Anorectal gonorrhoea and chlamydia among transgender women in Brazil: prevalence and assessment of performance and cost of anorectal infection detection and management approaches

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ABSTRACT

Objectives We aimed to determine the prevalence of anorectal *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) among transgender women in Brazil, and to assess the performance and costs of various approaches for the diagnosis and management of anorectal NG/CT.

Methods TransOdara was a multicentric, cross-sectional STI prevalence study among 1317 transgender women conducted in five capital cities representing all Brazilian regions. Participants aged ≥18 years were recruited using respondent-driven sampling (RDS), completed an interviewer-led questionnaire, offered an optional physical examination and given choice between self-collected or provider-collected samples for NG/CT testing. Performance and cost indicators of predetermined management algorithms based on the WHO recommendations for anorectal symptoms were calculated.

Results Screening uptake was high (94.3%) and the estimated prevalence of anorectal NG, CT and NG and/or CT was 9.1%, 8.9% and 15.2%, respectively. Most detected anorectal NG/CT infections were asymptomatic (NG: 87.6%, CT: 88.9%), with a limited number of participants reporting any anorectal symptoms (9.1%). Of those who permitted anal examination, few had clinical signs of infection (13.6%). Sensitivity of the tested algorithms ranged from 1.4% to 5.1% (highest for treatment based on the reported anorectal discharge or ulcer and receptive anal intercourse (RAI) in the past 6 months) and specificity from 98.0% to 99.3% (highest for treatment based on the reported anorectal discharge with clinical confirmation or report of RAI). The estimated cost-per-true case of anorectal NG/CT infection treated varied from lowest providing treatment for anorectal discharge syndrome based on the reported RAI ($2.70–4.28), with algorithms including clinical examinations decreasing cost-effectiveness.

Conclusions High prevalence of mostly asymptomatic anorectal NG and CT was observed among Brazilian transgender women. Multi-site NG/CT screening should be offered to transgender women. Where diagnostic testing capacity is limited, syndromic management for those presenting with anorectal symptoms is recommended.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Sexually transmitted infections disproportionately affect key populations including transgender women, who often lack access to healthcare due to stigma and discrimination.
⇒ Commonly acquired through receptive anal intercourse, anorectal infections with *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) may go unrecognised and untreated due to a combination of low levels of clinical suspicion and stigmatisation of anal intercourse.
⇒ The WHO advocates use of anorectal syndromic management of symptomatic cases, but this approach and others have not been specifically evaluated in transgender women populations.

WHAT THIS STUDY ADDS

⇒ Overall NG/CT infections in multi-anatomical sites, in particular anorectal, are common among Brazilian transgender women.
⇒ Syndromic management for anorectal symptoms is a low-cost approach for the treatment of anorectal NG and CT infections, although it will have limited value in reducing infection burden owing to the high proportion of asymptomatic infections.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Periodic, multi-anatomical site screening for asymptomatic NG/CT is needed to reduce the infection burden among transgender women, with syndromic management used for people with anorectal symptoms in the absence of diagnostic capacity to provide specific treatment on same-day visit.
⇒ There is an urgent need for affordable and high-performance point-of-care tests suitable for anorectal specimens to enhance accessibility to NG/CT diagnostic testing and treatment.

INTRODUCTION

People at highest risk of anorectal sexually transmitted infections (STIs) include gay men and other men who have sex with men, transgender people, sex workers and cis-gender women who engage in anal sexual intercourse.[1] *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) are among the most common pathogens that cause sexually transmitted anorectal infections.[2] Some of

these infections may lead to symptoms, such as pain, bleeding, discharge, inflammation or ulceration. Most anorectal infections are asymptomatic and can only be detected by laboratory tests.

For those with anorectal symptoms, syndromic management can provide treatment for pathogens most commonly responsible for infection, including NG and CT. In 2021, the WHO published guidelines recommending syndromic management of anorectal discharge when diagnostic testing is unavailable,[3] based on earlier experience of managing anogenital syndromes in various settings since at least 2011.[4 5] The 2021 guidelines recommend separate clinical flowcharts for the management of anorectal discharge (to include treatment for NG and CT) and anogenital ulcers (to include management for herpes simplex virus, syphilis and/or lymphogranuloma venereum (LGV)).

In Brazil, the national STI guidelines published in 2022 recommend biannual screening for the detection of anorectal NG and CT for all people with 'receptive anal practice without barrier protection' (ie, condoms). However, with limited access to diagnostic testing, these guidelines do not include guidance specifically for the management of anorectal symptoms, but provide a generic flowchart for the presumptive diagnosis of sexually transmitted enteric and intestinal infections among those who engage in receptive anal intercourse.[6] For those who present with anorectal discharge, the algorithm is most closely aligned to the 2021 WHO guidelines. No evidence was found on the performance and cost-effectiveness of this algorithm, in particular among marginalised populations such as transgender women in the country.

While the prevalence of HIV and syphilis among transgender women is relatively well studied, very little is known about other STIs.[7 8] A recent systematic review found a limited number of studies that included data on NG and CT, with only five studies reporting anatomical site of NG/CT infection.[9] Further investigation noted only four of these were unique studies and three reported consistent anatomical data for both NG and CT. From these three studies (from Lima, Peru and San Francisco, USA), the prevalence of anorectal NG and CT ranged from 6.3% to 12.3% and from 4.2 to 20.2%, respectively.[10–12] More recent studies found similarly high anorectal NG/CT prevalence among transgender women in the USA (NG: 11.8%, CT: 15.4%) and in Thailand (NG: 9.6%, CT: 19.5%).[13 14]

To address these gaps in the literature, this study among transgender women aimed to determine the prevalence of anorectal NG and CT. With this evidence, the study additionally aimed to evaluate the performance and costs of various algorithms for syndromic management and screening approaches.

METHODS

Study design

TransOdara was a multicentric, cross-sectional STI prevalence study among transgender women conducted in the capital cities representing the five main regions of Brazil: Campo Grande (Midwest), Manaus (North), Porto Alegre (South), Salvador (Northeast) and São Paulo (Southeast). Participants were recruited from December 2019 to July 2021 using respondent-driven sampling (RDS), deemed an appropriate approach for recruiting this often hard-to-reach population.[15] Based on previous studies with transgender women in Brazil,[16 17] five 'seeds' were selected in each study location and given six coupons to distribute to potential participants within their social network. Minimum sample size calculations were estimated for each study location, with a total minimum sample size of 1280.

Eligibility criteria included (1) age ≥18 years, (2) assigned male sex at birth and self-reported feminine gender identity and (3) resided in the metropolitan area of one of the five capital cities. The project provided reimbursement for food and transportation expenses. All completed a standard interviewer-led questionnaire for sociodemographic information and responded to questions related to gender-affirming procedures, sexual behaviour and about STI symptoms in the past 6 months. Study data were collected as single entry and managed using REDCap electronic data capture tools hosted at the Faculdade de Ciências Médicas da Santa Casa de São Paulo.[18 19]

Clinical procedures, sample collection and laboratory testing

Each participant was asked if they had any specific STI symptoms at the time of study visit and were offered a physical examination by a study clinician, irrespective of any reported symptoms. This included independently asking permission to conduct (1) general examination, (2) genital examination and (3) anal examination to observe signs of infection and could opt-out of all or any examinations. Genital examination was based on the genitalia present (penis and scrotum, or neovagina following surgery). All participants were asked to voluntarily provide biological samples from multiple sites for STI screening. This included testing urine, anorectal and oropharyngeal samples for NG and CT using Abbott RealTime CT/NG assay (Des Plaines, Illinois, USA), with demonstrated high diagnostic accuracy for those anatomical sites.[20 21] Participants could choose whether anorectal and oropharyngeal samples were self-collected or provider-collected. Instructional diagrams developed for the study were provided to guide participants with self-collection using anorectal and oropharyngeal swabs, and the provision of urine samples.

Data analysis and reporting

Due to the complex sample design using RDS at five distinct study locations, the resulting study population does not represent a random sample and is prone to biases stemming from the non-random selection of participants.[22] Although published estimation methods can theoretically mitigate these biases,[23] there is ongoing debate as some literature suggests that unweighted logistic regression offers the best approach for RDS samples.[24 25] In light of this, we opted to present unweighted estimates, including OR, 95% CIs and p values, acknowledging that this approach is also subject to dispute. Nevertheless, our primary focus was to provide useful evidence to support clinical practice recommendations for this marginalised and under-researched population. Consequently, we prioritised clinical relevance over statistical significance. Any reported estimates are descriptive and should be interpreted with caution to avoid potentially misleading conclusions.

The analysis estimated NG and CT prevalence by study location and by anatomical site (anorectal, oropharyngeal, urogenital). Self-reported symptoms and clinician-observed signs at study visit were compared with confirmed anorectal NG/CT infection by calculating OR.

We used IBM SPSS Statistics for Windows, V.26 (IBM, Armonk, New York, USA) for statistical analyses. Reporting was informed by the recommendations within the STROBE-RDS (Strengthening the Reporting of Observational Studies in Epidemiology–respondent-driven sampling) guidelines.[26]

Algorithms performance and costs

The validity and cost-effectiveness of seven management algorithms (box 1) and presumptive treatment of the entire

Box 1 Components and algorithms evaluated for the syndromic management of anorectal NG/CT infections

Symptom
⇒ **S1**: Patient reports anorectal discharge
⇒ **S2**: Patient reports anorectal symptom (discharge or ulcer)

Risk
⇒ **R1**: Patients report receptive anal intercourse (RAI) in past 6 months
⇒ **R2**: Patients report any STI symptoms in past 6 months

Exam
⇒ **E1**: Clinician confirms anorectal discharge
⇒ **E2**: Clinician confirms anorectal discharge or ulcer

Algorithms
⇒ **S1+R1**: Patient reports anorectal discharge (S1) **and** RAI in past 6 months (R1)
⇒ **S1+E1**: Patient reports anorectal discharge (S1) **and** treated only if anorectal discharge is seen.
⇒ **S1+R1+E1**: Patient reports anorectal discharge (S1) **and** RAI in past 6 months (R1), treated only if anorectal discharge is seen (*based on WHO 2021 recommendation*)[3]
⇒ **S2+R1**: Patient reports anorectal symptom (S2) **and** RAI in past 6 months (R1)
⇒ **S2+E2**: Patient reports anorectal symptom (S2) **and** treated only if anorectal discharge and/or ulcer is seen (*based on WHO-SEAR 2011 recommendation*)[4]
⇒ **S2+R1+E2**: Patient reports anorectal symptom (S1) **and** RAI in past 6 months (R1) **and** treated only if anorectal discharge and/or ulcer is seen.
⇒ (**S2 or R1)+E2**: Patient reports anorectal symptom (S2) **or** RAI in past 6 months (R1) **and** treated only if anorectal discharge and/or ulcer is seen (*based on WHO 2011 recommendation*)[5]

CT, Chlamydia trachomatis; NG, Neisseria gonorrhoeae; STI, sexually transmitted infection.

population were assessed by comparing the treatment given against treatment that should have been given using detection of anorectal NG and/or CT by molecular assay as the 'gold standard' outcome. Standard performance indicators (sensitivity, specificity and positive and negative predictive values (PPV, NPV)) were calculated from two-by-two tables. Correct treatment rate or accuracy (proportion of patients correctly identified as requiring treatment or not) and the overtreatment rate (proportion of non-infected patients who received treatment, which is equal to 1−specificity) were also estimated.

The strategies were compared in terms of cost per true case of NG/CT infection treated. In this analysis, we developed two cost scenarios with updated and modified cost estimates,[27] by allocating a treatment cost for each case treated and a service delivery cost for each patient examined. For comparison, we included cost estimates of laboratory testing (nucleic acid amplification test, NAAT) for anorectal NG/CT, but to simplify estimation we assumed same treatment costs regardless of infection. Unit costs for treatment were obtained from UNICEF (US$ in 2022),[28] using the combination of drugs recommended for first-line treatment by WHO in 2021,[3] and consideration of anticipated changes in forthcoming guidelines. Cost scenarios are detailed in online supplemental table 1.

RESULTS

Study population

A total of 1317 participants aged 18–67 years (mean 31.96 years, ±SD 9.86) were enrolled in the study from Campo Grande (n=181, 13.7%), Manaus (n=339, 25.7%), Porto Alegre (n=192, 14.6%), Salvador (n=202, 15.3%) and São Paulo (n=403, 30.6%). The final number of seeds, waves of recruitment and average length of referral chains varied by study location, with recruitment interrupted by national and regional COVID-19 restrictions.

As a combined study population, the majority identified as trans women (56.4%) or '*travesti*' (29.9%), a distinct identity with cultural significance in Brazil,[29 30] while fewer identified as women (7.5%) or other gender identities (6.2%). While over one-quarter (27.4%) reported undergoing some gender-affirming transition-related surgery or procedure, a very small proportion (1.7%) reported having a neovagina after undergoing surgery to remove their penis and scrotum. Almost half (47.6%) were using gender-affirming hormones. Almost all (90.7%) reported receptive anal intercourse (RAI) and two-fifths (40.0%) indicated at least one commercial sex partner in the past 6 months. More than one-quarter (28.0%) of participants self-reported a HIV-positive status. Uptake of sampling and testing was high but varied by anorectal (n=1242, 94.3%), oropharyngeal (n=1266, 96.1%) and urogenital (n=1280, 97.2%) sites.

Prevalence of NG and CT by anatomical site and study location

Prevalence of each pathogen varied across the five study locations, with highest NG prevalence (19.5%) found in Manaus and highest CT prevalence (17.0%) found in Salvador (table 1). The estimated prevalence of NG, CT and NG and/or CT at any anatomical site among the combined study population were 13.6% (95% CI 11.8% to 15.7%), 11.9% (95% CI 10.2% to 13.9%) and 21.6% (95% CI 19.3% to 24.0%), respectively.

Table 1 Prevalence of NG and CT infection by anatomical site and study location among transgender women in Brazil

	Anorectal		Oropharyngeal		Urogenital		Any site		Overall
	NG	CT	NG	CT	NG	CT	NG	CT	NG/CT
Study location	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)
Campo Grande	8/173 (4.6)	11/172 (6.3)	13/177 (7.3)	5/177 (2.8)	0/176 (0.0)	1/176 (0.6)	17/168 (10.1)	15/167 (9.0)	27/167 (16.2)
Manaus	44/334 (13.2)	28/334 (8.4)	40/332 (12.0)	14/333 (4.2)	2/333 (0.6)	2/333 (0.6)	64/329 (19.5)	41/330 (12.4)	88/329 (26.7)
Porto Alegre	18/180 (10.0)	16/179 (8.9)	11/187 (5.9)	6/187 (3.2)	0/183 (0.0)	3/184 (1.6)	22/176 (12.5)	22/176 (12.5)	39/175 (22.3)
Salvador	21/163 (12.9)	18/163 (11.0)	17/171 (9.9)	11/170 (6.5)	0/187 (0.0)	1/187 (0.5)	30/160 (18.8)	27/159 (17.0)	45/159 (28.3)
São Paulo	22/392 (5.6)	37/392 (9.4)	21/399 (5.3)	5/399 (1.3)	0/400 (0.0)	2/400 (0.5)	34/391 (8.7)	41/391 (10.5)	65/391 (16.6)
Total	**113/1242 (9.1)**	**110/1240 (8.9)**	**102/1266 (8.1)**	**41/1266 (3.2)**	**2/1279 (0.2)**	**9/1280 (0.7)**	**167/1224 (13.6)**	**146/1223 (11.9)**	**264/1221 (21.6)**

CT, *Chlamydia trachomatis*; NG, *Neisseria gonorrhoeae*.

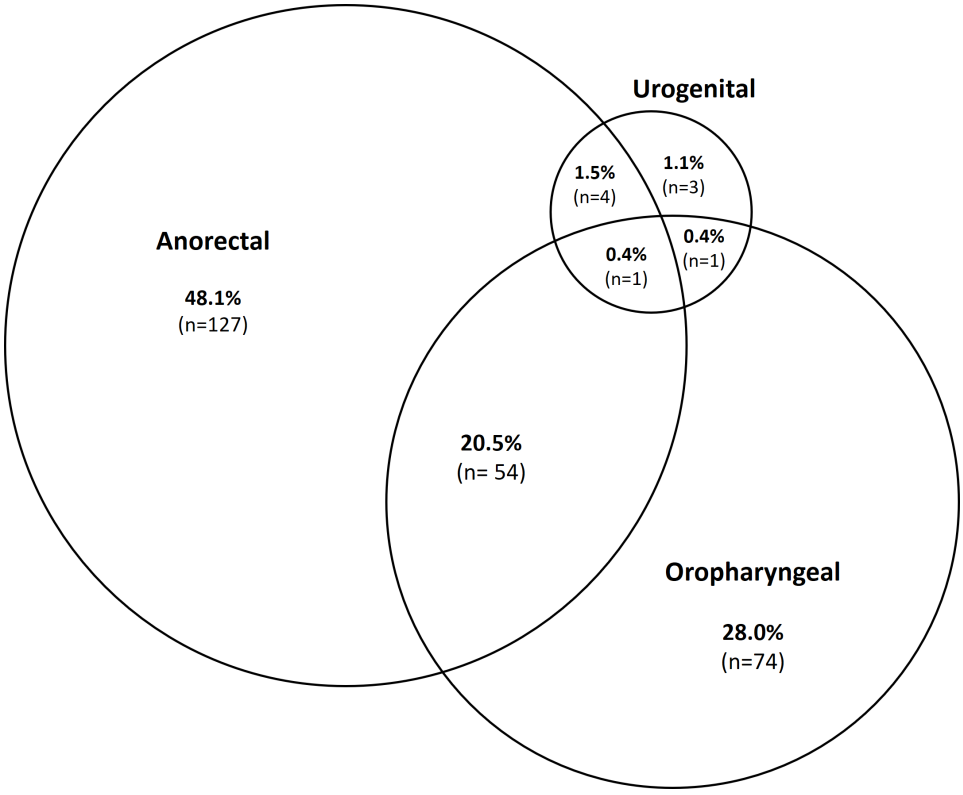

Figure 1 *Neisseria gonorrhoeae* / *Chlamydia trachomatis* infection by anatomical site among study participants with results from all three sites (N=264).

In anatomical site-specific analysis, the most observed infections were anorectal NG (9.1%, 95% CI 7.6% to 10.8%) and anorectal CT (8.9%, 95% CI 7.3% to 10.6%), followed by oropharyngeal NG (8.1%, 95% CI 6.6% to 9.7%) and oropharyngeal CT (3.2%, 95% CI 2.3% to 4.4%) and lowest for urogenital CT (0.7%, 95% CI 0.3% to 1.3%) and urogenital NG (0.2%, 95% CI 0.0% to 0.6%). Total numbers of infections (NG/CT) by anatomical site are presented in figure 1, with most being single-site and anorectal infections. Although relatively few cases of multi-site infections, the majority were NG (25.7%, 95% CI 19.3% to 33.1%) rather than CT (7.5%, 95% CI 3.8% to 13.1%) infections.

The combined prevalence of anorectal NG/CT within the study population was 15.2% (95% CI 13.2% to 17.3%). Among those who reported RAI in the past 6 months, the prevalence was 16.3% (n=150/919), and among those who reported any STI symptoms in the past 6 months, it was 21.4% (n=56/262).

Anorectal symptoms and signs

Overall, 9.1% (n=119/1307) of participants reported some anorectal symptoms at the study visit, including warts (6.5%), ulcer (2.0%) or discharge (1.4%). Most participants with anorectal NG/CT infection did not report any anorectal symptoms at study visit (88.2%; 165/187), similarly for CT (88.9%, 97/109) and NG (87.6%, 99/113). While few participants had anorectal symptoms, presenting at the study visit with anorectal discharge (OR=3.7, 95% CI 1.4 to 9.6) or anorectal ulcer (OR=2.5, 95% CI 1.0 to 6.2) had higher odds of anorectal NG/CT infection, and this was more likely for CT rather than NG (online supplemental table 2A).

Only 41.9% (546/1307) of participants permitted clinical examination, as they were entitled. Of those, anorectal signs were observed in 13.6% (74/546). The most frequently observed sign was anorectal warts (12.6%, 69/547), followed by anorectal discharge (0.9%, 5/547), and anorectal ulcer (0.5%, 3/546). While few observations, the confirmed presence of anorectal discharge (OR=7.6, 95% CI 1.2 to 46.2) or anorectal warts (OR=2.2, 95%CI 1.0 to 4.7) had higher odds of anorectal NG infection, but not CT (online supplemental table 2B). Most participants allowing examination with NG/CT infection did not have any clinical signs (83.1%, 69/83), and this was least likely for CT (89.1%, 49/55) than for NG (75.6%, 34/45).

Performance of syndromic approach and presumptive treatment for the management of anorectal NG/CT

Table 2 summarises the performance of the different algorithms for detection (and management) of anorectal NG/CT. While the risk-based components (R1: RAI in the past 6 months; R2: any STI symptoms in the past 6 months) produced the highest sensitivities (95.5% and 30.1%, respectively), the highest sensitivity among the combined algorithms was 5.1% (S2+R1: reported anorectal discharge or ulcer and reported RAI in the past 6 months). The highest specificity of 99.3% was observed in one exam-based component (E1: confirmed anorectal discharge), and two of the combined algorithms (S1+E1: reports anorectal discharge and confirmed by examination; S1+R1: reports anorectal discharge and RAI in the past 6 months), which also produced the highest PPVs (40.0%). All algorithms had similar NPVs. Overall, poor performance was observed for the three existing WHO algorithms for anorectal discharge or symptoms (sensitivity: 1.4%–4.2%; specificity: 98.7%–99.2%).

In comparison, presumptive treatment of all transgender women for anorectal NG/CT (A1) would provide the highest sensitivity (100.0%), but with specificity of zero (0.0%), leading to the highest overtreatment rate of non-infected patients

Table 2 Performance of management approaches for the detection and treatment of anorectal NG/CT infections

A. Management approaches	Total (N)	% exam	NG/CT infections (n)	Cases positive by algorithm	Sensitivity/ specificity (%)	PPV/NPV (%)	Accuracy/ overtreatment (%)	Cost range per true case treated ($)*
A1: All transgender women (presumptive treatment)	1240	0	188	1240	100.0/0.0	15.2/–	15.2/100.0	7.12–11.28
Syndromic treatment								
S1: Reports AD	1236	0	7	18	3.7/99.0	38.9/85.2	84.5/1.0	2.78–4.40
S2: Reports ADU	1234	0	11	37	5.9/97.5	29.7/85.3	83.6/2.5	3.63–5.75
Risk-based components								
R1: Reports RAI in the past 6 months	1009	0	150	919	95.5/9.7	16.3/92.2	23.1/90.3	6.62–10.48
R2: Reports any STI symptoms in the past 6 months	1223	0	56	262	30.1/80.1	21.4/86.5	72.5/19.9	5.05–8.00
Exam-based components								
E1: Confirms AD	535	100	2	5	2.4/99.3	40.0/84.7	84.3/0.7	537.70–1341.78
E2: Confirms ADU	534	100	3	8	3.6/98.9	37.5/84.8	84.1/1.1	358.88–894.56
Combined algorithms								
S1+E1: AD+confirm AD	534	2.2	2	5	2.4/99.3	40.0/84.7	84.3/0.7	14.70–34.28
S1+R1: AD+RAI	1005	0	4	10	2.6/99.3	40.0/84.7	84.3/0.7	2.70–4.28
S1+R1+E1: AD+RAI+confirm AD (WHO 2021)[3]	448	1.6	1	4	1.4/99.2	25.0/84.2	83.7/0.8	18.32–41.84
S2+E2: ADU+confirm ADU (WHO-SEAR 2011)[4]	533	4.9	3	8	3.6/98.9	37.5/84.8	84.1/1.1	20.21–47.89
S2+R1: ADU+RAI	1003	0	8	25	5.1/98.0	32.0/84.9	83.5/2.0	3.38–5.34
S2+R1+E2: ADU+RAI+confirm ADU	447	4.3	2	7	2.8/98.7	28.6/84.5	83.4/1.3	22.78–53.49
(S2 or R1)+E2: (RAI or ADU)+confirm ADU (WHO 2011)[5]	454	90.1	3	8	4.2/98.7	37.5/84.3	83.7/1.3	275.55–686.23

B. Screening approaches†	Total (N)	% tested	% positive	% missed	Cost range per true case treated ($)‡
A1: All transgender women (presumptive screening)	1241	100	15.2	0	67.04–133.62
Risk-based screening approaches					
R1: Reports RAI in the past 6 months	1009	91.1	16.3	0.7	62.35–124.24
R2: Reports any STI symptoms in the past 6 months	1223	21.4	21.4	10.6	47.87–95.28

*Lower cost estimate: $2.00 for each examination, and $1.08 treatment for each case positive by algorithm based on current WHO (2021) treatment recommendations for NG/CT; upper cost estimate: $5.00 for each examination, and $1.71 treatment for each case positive by algorithm based on anticipated change to NG/CT treatment recommendation.
†Performance measures for screening approaches are not indicated as the data reflect the actual positivity rate of the sample.
‡Lower cost estimate: $10.00 for each test, and $1.08 treatment for each positive test based on current WHO (2021) treatment recommendations for NG/CT; upper cost estimate: $20.00 for each test, and $1.71 treatment for each positive test based on anticipated change to NG/CT treatment recommendation.
AD, anorectal discharge; ADU, anorectal discharge or ulcer; CT, *Chlamydia trachomatis*; NG, *Neisseria gonorrhoeae*; NPV, negative predictive value; PPV, positive predictive value; RAI, receptive anal intercourse.

(100.0%). Presumptive treatment based on reporting RAI in the past 6 months (R1) had a slightly lower sensitivity (95.5%) with low specificity (9.7%) and moderate PPV (16.3%), leading to the second highest overtreatment rate (90.3%). Presumptive treatment based on reporting any STI symptoms in the past 6 months (R2) had a much lower sensitivity (30.1%) but higher specificity (80.1%) and PPV (21.4%) for a lower overtreatment rate (19.9%).

Cost analysis

Factoring in the estimated cost scenarios of examination and treatment, the cost per true case of anorectal NG/CT infection treated for each combined algorithm varied from the lowest ($2.70–4.28), providing treatment for anorectal discharge syndrome based on the reported RAI (S1+R1) to the highest ($275.55–686.23), providing treatment based on syndrome or risk and examination to confirm anorectal syndrome ((S2 or R1)+E). The highest estimated cost per case treated would be presumptive treatment based on examining all to confirm anorectal discharge (E1), owing to the cost of clinical examination.

In comparison to the estimated cost scenarios of some form of laboratory screening and treatment based on result (table 2B), the cost per true case of anorectal NG/CT infection treated would range from a strategy to screen only those who report any STI symptoms in the past 6 months ($47.87–95.18) to screening all transgender women ($67.04–133.62). While the total estimated costs of these hypothetical screening scenarios were greater than all algorithms, the cost per true case treated was estimated to be relatively similar or even lower than the algorithms which rely on clinical examination.

DISCUSSION

As expected, transgender women recruited in this nationwide study in Brazil had a high prevalence of anorectal NG (9.1%) and CT (8.9%), which varied by study location. These findings align with the higher end of prevalence ranges presented in the recent systematic review conducted by Van Gerwen *et al*[9] and other recent studies of anorectal STIs among transgender women.[13 14] For people reporting symptoms, the study found those presenting with anorectal discharge or ulcer were more likely to have anorectal NG/CT infections. In the absence of accurate screening or diagnostic tests, syndromic management remains an option to manage symptomatic patients. This includes the flowchart for the management of anorectal discharge published in the 2021 WHO guidelines for symptomatic STIs.[3]

To improve on the existing flowchart, we recommend removing the need for 'reporting receptive anal sex' from the entry point to the algorithm, as we found removing slightly increased performance (with an increase in the specificity and PPV). Although most reported this sexual activity, stigma still remains surrounding anal sex, and some may feel uncomfortable discussing in healthcare settings. Instead, this could be included in the existing second step to 'assess risk for exposure to STIs', similar to other WHO management flowcharts. Our findings also suggest that a more significant improvement of performance and cost-effectiveness would be to remove the need for inspection or clinical examination to confirm anorectal discharge, which could also be refused by patients. For Brazil, a dedicated and more detailed flowchart for the management of anorectal discharge is recommended to be included in the national guidelines.

A high number of oropharyngeal NG/CT infections (10.9%) was also observed, but very few urogenital NG/CT infections

(0.8%) were detected. For this population, the sole use of urine samples for screening or diagnosis is likely inadequate. This aligns with the study by Pitasi *et al*[14] which suggested anorectal or oropharyngeal infections would be missed by urogenital screening alone. As expected, the vast majority of anorectal (and oropharyngeal) NG/CT infections were asymptomatic, which underscores the need to offer periodic screening to population, in line with current WHO recommendations.[1]

This cross-sectional study had a notable limitation regarding participant recruitment, as RDS was employed in each study location. This methodology introduces the potential for sample and selection bias, necessitating careful interpretation of the combined and unweighted estimates derived from multiple locations. It is important to note that the findings should not be regarded as representative of all transgender women in Brazil, but rather as indicative of the network within the sampled population at each study location. Additionally, it is essential to highlight that this study did not differentiate chlamydial infection specifically for LGV, particularly in cases where anogenital ulcers were present. However, further investigations are in progress to identify LGV and other infections, such as *Mycoplasma genitalium*, through the examination of stored specimens collected during this study.

Overall, our study findings suggest that regular multi-site anatomical sampling (either self-collected or provider-collected) and testing for NG/CT should be a preferred option to address the burden of these infections among transgender women and should be integrated into services for HIV and other sexual health services. The frequency of this screening needs to be determined by further modelling and economic analysis. Where laboratory capacity is limited, syndromic management for those presenting with anorectal symptoms such as discharge or ulcer is acceptable and cheap for treatment of anorectal NG and CT infections, although the approach will have limited value owing to its low sensitivity.

Despite the increasing availability of NAAT-based point-of-care (POC) tests suitable for multi-site specimens, the costs remain prohibitive in many resource-limited settings, including Brazil.[31] While a number of other rapid POC tests for NG and CT are in development,[32] few are achieving the ideal performance of high sensitivity and specificity, and have only been properly evaluated on urine and cervical specimens. It is important that high-performing and low-cost POC tests suitable for anorectal and oropharyngeal specimens are developed to expand access to NG/CT diagnostic testing and treatment for adequate STI control.

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