Clinical epidemiology of sexually transmitted infections among transgender women in Brazil

DANIEL J. MCCARTNEY

Thesis submitted in accordance with the requirements for the degree of
Doctor of Public Health
of the
University of London

OCTOBER 2023

Department of Clinical Research
Faculty of Infectious and Tropical Diseases
LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE

No funding received

DECLARATION

I, **Daniel Jason McCartney**, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

ABSTRACT

Introduction

Sexually transmitted infections (STIs) disproportionately affect transgender women, who often lack access to healthcare due to stigma and discrimination. In Brazil, there is limited data on the prevalence of HIV, syphilis, viral hepatitis, and other STIs. This DrPH study aimed to detail the clinical epidemiology of *Neisseria gonorrhoeae* (NG), *Chlamydia trachomatis* (CT), and human papillomavirus (HPV) among transgender women in Brazil to better inform approaches for the control of STIs.

Methods

TransOdara was a multi-centric, cross-sectional STI prevalence study conducted in five capital cities representing all Brazilian regions, between December 2019 and July 2021. A total of 1,317 transgender women aged ≥18 years were recruited using respondent driven sampling, completed an interviewer-led questionnaire, offered a physical examination, and provided samples from multiple sites (anorectal, oropharyngeal, and urogenital) to detect *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), and human papillomavirus (HPV). Data analysis determined the uptake of physical examination, acceptability of sample collection methods, and comparability of self-sampling to provider-collection for the detection of STIs by transgender women in Brazil.

Results

This study found a high prevalence of anorectal NG (9.1%) and CT (8.9%) infections, with most being asymptomatic (87.6% and 88.9%, respectively). Anorectal prevalence of high-risk HPV types was also high (66.2%). Most participants consented to a general examination (65.4%), but less than half permitted a genital (42.3%) or anal (42.1%) examination. With regards to preferred sample collection for STI testing, most selected self-collection for anorectal (74.9%) and genital (72.7%) samples. Test positivity rates from self-collection were comparable to provider-collected samples.

Conclusion

This study highlights the need to integrate periodic multi-site NG/CT screening into sexual health services offered to transgender women, due to the high prevalence of asymptomatic infections. While molecular NG/CT testing should guide treatment for symptomatic cases, syndromic management suits resource-constrained settings due to high cost and limited diagnostic capacity, compounded by the absence of affordable point-of-care (POC) tests. For both STI screening and testing, offering the option of self-collected samples is essential. Self-sampling was found to be well-accepted and yielded comparable results to provider-collected samples. The study concludes that the choice of collection methods supports gender-affirmative care and has the potential to enhance accessibility of sexual health services for transgender women.

ACKNOWLEDGEMENTS

I would like to express my gratitude to my supervisor, Philippe Mayaud, for his invaluable guidance and support throughout my studies at LSHTM. I am deeply appreciative of the opportunities he has provided me and his dedication to my growth and development. I am also grateful to Maria Amelia Veras for the opportunity to work with her and the inspiring team at NUDHES. Without their support, this research project would not have been possible.

I am grateful for the support received from the International Planned Parenthood Federation (IPPF) for enabling me to pursue this DrPH programme as a part-time student. I would also like to acknowledge LSHTM for their financial support, including the Doctoral Project Travelling Scholarship, the COVID-19 Support Scheme, and the Public Engagement Small Grants Scheme.

I would also like to thank my husband, Michael, for his patience and unwavering support throughout this process. His love and understanding have been a constant source of strength and motivation for me.

Lastly, I would like to acknowledge the participants of this study and recognise the resilience of the trans community in Brazil. Their contributions and willingness to participate in this study are greatly appreciated. Thank you all for your support.

Mural in São Paulo, Brazil (*Photo: McCartney/2018*)

"This mural is a celebration of the daily resistance of the Trans community to build a free society where anyone and everyone can be who they are. RESIST TO BE ABLE TO EXIST."

CONTENTS

LIST OF TABLES & FIGURES

LIST OF ACRONYMS & ABBREVIATIONS

AIDS	acquired immune deficiency syndrome
AMR	antimicrobial resistance
ANRS	French National Agency for Research on AIDS
ANVISA	*Agência Nacional de Vigilância Sanitária* (Brazil)
AOR	adjusted odds ratio
ART	antiretroviral therapy
BRL	Brazilian reals (R$)
CDC	US Centers for Disease Control and Prevention
CI	confidence interval
COVID-19	coronavirus disease 2019
CRT	*Centro de Referência e Treinamento DST/Aids* (Brazil)
CT	*Chlamydia trachomatis* (chlamydia)
DrPH	Doctor of Public Health (LSHTM)
HAV	hepatitis A virus
HBV	hepatitis B virus
HCV	hepatitis C virus
HIV	human immunodeficiency virus
HPV	human papillomavirus
HR	high-risk (HPV)
HSV	herpes simplex virus
ICD	International Classification of Diseases
IPPF	International Planned Parenthood Federation
IQR	interquartile range
ISO	International Organization for Standardization
IUSTI	International Union of Sexually Transmitted Infections
LGV	lymphogranuloma venereum
LR	low-risk (HPV)
LSHTM	London School of Hygiene & Tropical Medicine
MeSH	Medical Subject Heading
MG	*Mycoplasma genitalium*
MSM	men who have sex with men
MVA	multivariate analysis
NAAT	nucleic acid amplification test
NG	*Neisseria gonorrhoeae* (gonorrhoea)
NPV	negative predictive value
NUDHES	Núcleo de Pesquisa e Direitos Humanos em Saúde da População LGBT+
OR	odds ratio
PAHO	Pan American Health Organization
PEP	Post-Exposure Prophylaxis (for HIV)
PCS	provider-collected sample
POC	point-of-care
PPV	positive predictive value
PrEP	Pre-Exposure Prophylaxis (for HIV)
RAI	receptive anal intercourse
REDCap	Research Electronic Data Capture
RDS	respondent-driven sampling
RPR	rapid plasma reagin (test)
SCS	self-collected sample
SD	standard deviation
SRH	sexual and reproductive health
STI	sexually transmitted infection
SUS	*Sistema Único de Saúde* (Brazil)

TV	*Trichomonas vaginalis* (trichomoniasis)
UCSF	University of California, San Francisco
USD	US dollars (US$)
VDRL	venereal disease research laboratory (test)
WHO	World Health Organization

CHAPTER 1: INTRODUCTION & LITERATURE REVIEW

1.1 CONTEXT OF RESEARCH PROJECT

This Doctor of Public Health (DrPH) research project focussed on the clinical epidemiology of sexually transmitted infections (STIs) among transgender women in Brazil. Clinical epidemiology can be described as the application of epidemiology principles and methods to the clinical setting.[1] In the context of STIs, clinical epidemiology is concerned with the study of the frequency, distribution, and determinants of STIs in defined populations, as well as the development, implementation, and evaluation of clinical interventions to prevent and control these infections. This can include identifying populations at high risk for STIs and developing targeted prevention strategies for these groups.

Transgender women, who are assigned male sex at birth but identify as women or other trans-feminine identities, are known to be at higher risk of HIV and other STIs compared to the general population.[2] However, apart from HIV, there is limited epidemiological data available on other STIs affecting this population, particularly in lower- and middle-income countries, including Brazil. Additionally, there remains a significant lack of guidance for the prevention, diagnosis and treatment of STIs that is inclusive of transgender women.

Brazil is a country with progressive laws supporting transgender people. Transgender people can change gender and name without psychological or medical evaluation, but transgender women continue to face barriers accessing sexual health services and are vulnerable to transphobic violence.[3] The country's public healthcare system, *Sistema Único de Saúde* (SUS), is the largest government-run system in the world and provides free care for all.[4] It offers a wide range of services, including the diagnosis and treatment of STIs, including HIV, syphilis, viral hepatitis, and other STIs. In reality, diagnostic capacity beyond sero-prevalent STIs is extremely limited, with a focus on syndromic management.[5] For transgender people, this also includes access to hormones and gender affirmation surgery for transgender people in limited number of centres.[6] A growing number of private healthcare options are also available to those who can afford insurance or the direct costs.[7]

In collaboration with the *Faculdade de Ciências Médicas da Santa Casa de São Paulo*, this DrPH research project was embedded within a national prevalence study among transgender women across five cities in Brazil, called TransOdara. This was a cross-sectional study to determine the prevalence of HIV, hepatitis A, B and C, syphilis, *Neisseria gonorrhoeae* (NG), *Chlamydia trachomatis* (CT), and human papillomavirus (HPV). As a listed partner and study investigator in the TransOdara study, this DrPH research project had three main objectives:

1) To determine the prevalence of anorectal STIs (including NG, CT, and HPV), risk factors for infection and associated anorectal symptoms, and to assess the performance and costs of various clinical approaches for the diagnosis and management of anorectal STIs;
2) To assess the uptake and acceptability of physical examination (including general, genital, and anorectal examination) for the detection of STIs by a clinician, and frequency of symptom presentation; and
3) To evaluate the choice of sample collection method from potential infection sites (including anorectal, oropharyngeal, and genital sites) for STI testing, including the comparability of test results.

This research aimed to influence public health policy and practice by describing the epidemiology and clinical presentation of STIs among transgender women for the development of effective prevention and control strategies in Brazil and beyond.

1.2 BACKGROUND

STIs, including HIV, continue to be of major public health concern worldwide, affecting quality of life and causing serious morbidity and mortality. In 2020, the World Health Organization (WHO) estimated that there were 374 million new cases of curable STIs worldwide among adults aged 15-49 years: 129 million cases of chlamydia, 82 million cases of gonorrhoea, 7 million cases of syphilis, and 156 million cases of trichomoniasis.[8] This equates to more than one million cases acquired every day.

The prevalence of viral STIs is also high, with an estimated 491 million people infected with herpes simplex virus type 2 (HSV-2), and an estimated 24 million people infected annually.[9] HPV is the most common viral infection of the reproductive tract, and it is estimated that more than 290 million women are infected with HPV at any point in time.[10]

When left undiagnosed and untreated, STIs can result in serious complications such as pelvic inflammatory disease, infertility, ectopic pregnancy, miscarriage, foetal loss, and congenital infections. STIs have a direct impact on reproductive and child health through infertility, cancers, and pregnancy complications; and they have an indirect impact through their role in facilitating the sexual transmission of HIV. Antimicrobial resistance (AMR) for STIs including NG and *Mycoplasma genitalium* (MG) is also a global public health concern due to the possible emergence of untreatable infections.[11]

The presence of a STI, such as syphilis, HSV-2, or NG, significantly increases the risk of acquiring or transmitting HIV infection by two to three times in some populations.[12] STIs, especially ulcerative STIs, cause lesions and inflammation of the genital tract, which can facilitate the sexual transmission of HIV. This occurs by increasing both the susceptibility of HIV-negative individuals and the infectivity of people living with HIV, even while on effective antiretroviral therapy (ART).[13] For HIV-negative individuals effectively using pre-exposure prophylaxis (PrEP) to prevent HIV acquisition, the preventive benefit seemingly persists even in the presence of STIs, although PrEP use has been associated with an increase of STIs due to risk behaviours.[14] Synergies also exist between HIV and other STIs, such as HPV. HPV is known to facilitate acquisition of HIV, and people living with HIV are disproportionally affected by HPV, and would benefit from available HPV vaccination.[15]

STIs not only pose physical health risks but also lead to significant psychosocial morbidity, including shame, fear of relationship breakdown, stigma, discrimination, and depression which can impact an individuals' quality of life.[16,17] Therefore, the prevention and control of STIs are vital and integral components of comprehensive sexual and reproductive health (SRH) services. **Figure 1.1** summarises the beneficial impact of an effective STI response on wider health outcomes.

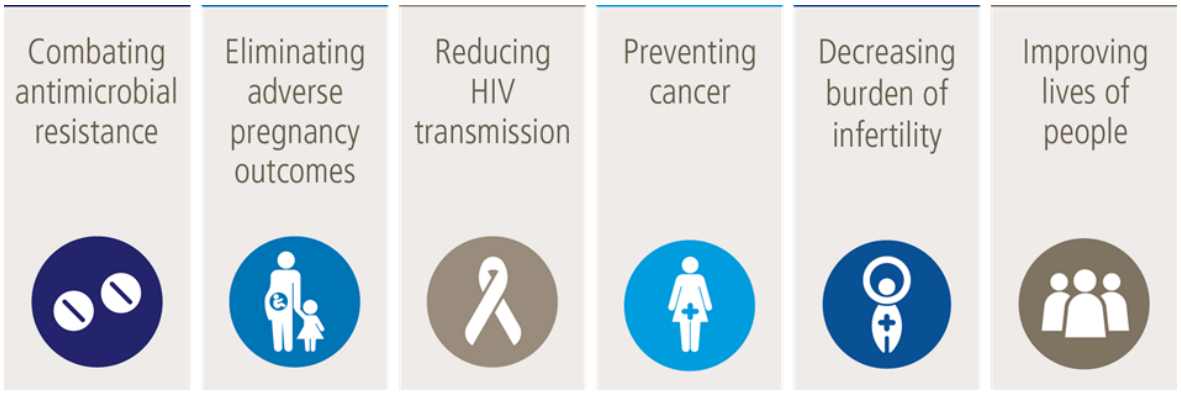


Figure 1.1 An effective STI response can have a significant global health impact (*Image: McCartney/IPPF*)

Certain groups can be identified whose behaviour or life circumstances place them at higher risk than others, such as young people, sex workers and their clients, gay men and other men who have sex with men (MSM), and transgender people. While transgender people are known to be disproportionately affected by HIV infection, they remain understudied and under-prioritised by researchers and policy makers.

In the past decade, a significant shift in attention has occurred in public health, from almost no mention of transgender health and rights to near global recognition of the importance of addressing transgender people as a key population independent of cis-gender MSM.[18,19,20] According to Wolf *et al* (2016), a critical shift occurred when the findings from the first HIV prevalence meta-analysis on transgender women became available at the 2012 International AIDS Conference in Washington, DC, which showed that transgender women were 49 times more likely to acquire HIV than the general population of adults of reproductive age.[18,21]

The high vulnerability and specific health needs of transgender people necessitate a distinct focus in the global response to HIV and other STIs. While an increased interest in inclusion, diversity, and representativeness in epidemiological and public health research aimed at promoting well-being among all communities and reducing health inequities, there remains misunderstanding and conflation of sex and gender, and related terminology.[22]

1.3 TRANSGENDER PEOPLE AND APPROPRIATE TERMINOLOGY

Terminology related to transgender people is constantly evolving and is influenced by language and cultural interpretations, and defined by the community themselves. While there is 'globally' accepted terminology, there are also locally acceptable terms that require consideration and understanding. In general, 'transgender' is defined as "denoting or relating to a person whose sense of personal identity and gender does not correspond with their birth sex."[23]

Transgender (or trans) is both an adjective and umbrella term for people whose gender identity differs from their sex assigned at birth.[22] Recently, the WHO provided an updated and expanded definition of 'trans and gender diverse people' expressing as "an umbrella term for those whose gender identity, roles and expression does not conform to the norms and expectations traditionally associated with the sex assigned to them at birth; it includes people who are transsexual, transgender, or otherwise gender non-conforming or gender incongruent."[2]

Trans and gender diverse people may self-identify with various gender identities, including transgender, female, male, trans woman, or trans man, as well as many other non-binary or non-conforming identities. This includes some culturally significant local identities such like *hijra* in India, *kathoey* in Thailand, and *waria* in Indonesia.[24] Individuals may also express their gender in a variety of masculine, feminine and/or androgynous ways, and some may choose gender-affirming procedures such as surgical interventions or hormone treatments. However, it is important to recognise that being transgender is distinct from one's sexual orientation, as one may have diverse sexual orientations, identities, and behaviours, and can be attracted to individuals of any gender.[20]

In epidemiology, two sub-populations are commonly described: transgender women and transgender men. When referring to 'transgender women' (or trans women), this includes individuals who were assigned male sex at birth but identify as women or have a trans-feminine identity; while 'transgender men' (or trans man) includes individuals assigned female sex at birth but identify as men or have a transmasculine identity. It is important to acknowledge the fluidity of identities and definitions among trans and gender diverse people, as well as the necessity for understanding the language and meanings of terms within specific settings to avoid imposing inappropriate labels.

While certain terms may have negative connotations, the local context should inform the appropriate terms that individuals use to define their diverse preferences and experiences. For example, in Brazil, the terms 'transsexual' and 'transvestite' (or '*travesti'* in Portuguese) are commonly embraced by the communities themselves. Similar to the *hijras* of India, *travestis* in Brazil hold a unique cultural significance that distinguishes them from those who identify as trans women. In general, *travesti* may undergo various gender affirmative procedures, but they often do not experience discomfort with their male genitalia nor seek legal recognition as women.[6,25]

The medical profession's perspective on gender identity is evolving away from considering it a negative mental or behavioural condition. A notable example of this progress is reflected in the latest edition of the WHO's disease manual, the eleventh edition of the International Classification of Diseases (ICD-11), which came into force on 1 January 2022, replacing the previous version from 1990 (ICD-10). In this updated edition, the term "transsexualism" has been replaced with "gender incongruence". This change marks a significant shift as it defines gender incongruence as a condition related to a person's sexual health, rather categorising it as a mental or behavioural disorder.[26]

1.4 EPIDEMIOLOGY OF STIs AMONG TRANSGENDER WOMEN

Transgender women have some of the highest rates of HIV reported for any population. A review by Baral *et al* (2013) included a meta-analysis of data from 15 countries and estimated that transgender women have a pooled HIV prevalence of 19.1% (95%CI: 17.4-20.7), which represented an estimated 49-fold (95%CI: 21.2-76.3) increased odds of HIV infection compared with other adults of reproductive age.[21] A more recent systematic review found HIV prevalence of up to 40% in some studies, with the lowest prevalence among young transgender individuals, and the highest among transgender sex workers and transgender women of colour.[27]

While research on HIV among transgender women is gradually advancing, the understanding of other STIs in this population remains even more limited.[19] A recent systematic review by Van Gerwen *et al* (2020) found a limited number of studies that included data on NG and CT, it was noted that most based on self-reported data, and only five studies reporting the anatomical site of NG and/or

CT infection.[28] No data was found for *Trichomonas vaginalis* (TV) or MG, and the review did not include HPV. The reported prevalence range of individual STIs among transgender women are outlined in **Table 1.1**.

Table 1.1 Prevalence of STIs among transgender women as reported by Van Gerwen *et al* (2020) systematic review

STI	# of studies	Prevalence range (%)
HIV	24	0 to 49.6
Syphilis	13	1.4 to 50.4
Gonorrhoea	10 (5 site-specific)	2.1 to 19.1
Chlamydia	10 (5 site-specific)	2.7 to 24.7
Hepatitis A (HAV)	1	0
Hepatitis B (HBV)	5	2 to 40.2
Hepatitis C (HCV)	6	3.2 to 15.7
Herpes Simplex Virus (HSV)	3 (2 HSV-2)	2.1 to 80.7

A limitation of the Van Gerwen *et al* (2020) review is that it was challenging to determine whether the studies were representative of the spectrum of transgender women due potential sampling biases.[29] This includes the focus on populations within metropolitan cities, which may not fully capture the diversity of transgender women across various settings, and the risk of conflation with sex work, where research might disproportionately involve transgender women who engage in sex work, potentially skewing the findings and generalisability to the broader transgender community.

The review also highlighted the limited number of studies with information on the anatomical site of infection for identified cases. Through further critical review, it was noted that of the five studies reporting the anatomical site of NG/CT infection, only four of these were unique studies and three reported consistent anatomical data for both NG and CT. By extracting data from these three studies,[30,31,32] the overall prevalence of NG and CT ranged from 2.1% to 19.1%, and 2.7% to 24.7%, respectively (**Table 1.2**). Two of these studies were conducted in Lima, Peru, and one in San Francisco, USA. Site specific prevalence of anorectal NG and CT ranged from 6.3% to 12.3% and 4.2% and 24.7%; whilst oropharyngeal NG and CT ranged from 3.5% to 9.5% and 2.1% to 11.2%, respectively. Only one study reported urogenital NG prevalence of 2.0% and no CT.[32]

Table 1.2 Extracted site-specific prevalence of NG and CT among transgender women as reported by three studies in Van Gerwen *et al* (2020) systematic review

STI	Overall prevalence range (%)	Anorectal prevalence range (%)	Oropharyngeal prevalence range (%)	Urogenital prevalence (%)
Gonorrhoea	2.1-19.1	6.3-12.3	3.5-9.6	2.0
Chlamydia	2.7-24.7	4.2-20.2	2.1-11.2	0

Many of the same determinants of HIV acquisition and transmission among transgender people and other key populations also increase the risk for other STIs, including the frequency of condomless anal intercourse, in particular receptive condomless anal intercourse.[13] Another risk factor for HIV infection among transgender women is psychological and physical abuse as a result of gender non-conformity.[33] Other reported associated risk factors include low levels of education and high levels of substance use, including use of unsterile injecting equipment for drugs or body modifications.[2,34] **Figure 1.2** provides a framework published by WHO (2022) that outlines the social, legal, structural and other contextual factors that increase the vulnerability of key populations (including transgender people) to HIV, viral hepatitis, and other STIs among key populations, and obstruct access to health and other essential services.[2]

Anorectal STIs are mostly acquired through receptive anal intercourse, although transmission is also possible through oral-anal or digital-anal sexual contact, and may also be due to contiguous spread from a genital infection.[35] People at highest risk of anorectal STIs include gay men and other MSM, transgender people, sex workers, and cis-gender women who engage in anal intercourse.[2,36] Anorectal infections are often asymptomatic, although precise data are scarce, and can include proctitis (rectal inflammation) caused by NG, CT, lymphogranuloma venereum (LGV) caused by a specific CT serovar, HSV, syphilis, and MG.[35] HPV can also cause anorectal warts (*condylomata acuminata*; caused by HPV types 6 and 11), and anal cancer (predominantly by HPV 16).[37] Other infections, such as *Shigella*, can sometimes be associated with anorectal STIs due to transmission through faecal-oral contact.[38] Anorectal infections often go unrecognised and untreated due to a combination of low levels of clinical suspicion and stigmatisation of anal intercourse.[39]

Stigma and discrimination pose additional barriers to the utilisation of health services leading to poorer health outcomes among transgender people.[40,41] Some structural barriers are common among other key populations, including criminalisation, but are often compounded by a lack of gender recognition.[2] Transgender people frequently report negative experiences in healthcare settings, ranging from insensitive language to refusal of care, in addition to healthcare providers often feeling ill-prepared to provide adequate care.[41] This lack of appropriate gender-affirming care and the lack of knowledge among healthcare providers on how to provide it can also make it difficult for transgender individuals to seek testing, diagnosis, and treatment for STIs, as well as other necessary healthcare.

For Brazil, the meta-analysis conducted by Baral *et al* (2013) reported a pooled HIV prevalence from three studies of 31.1% (95%CI: 26.7-39.4) among transgender women, with an estimated 85-fold (95%CI: 72.3-100.6) increased odds of HIV infection compared to other adults.[21] A study conducted in 2016 with transgender women in Rio de Janeiro reported an HIV prevalence of 31.2% (95%CI: not reported),[3] while a study in São Paulo from 2016 to 2017 reported an HIV prevalence of 38% (95%CI: 30.9-45.6) among transgender women.[42] In addition, a systematic review by Zoni *et al* (2013) estimating the prevalence of syphilis among most at-risk populations in Latin America and the Caribbean found one study reporting the prevalence of active syphilis among transgender women in São Paulo as 43.3% (95%CI: not reported),[43] however further review of the individual study found likely sampling bias as study focussed on MSM and sex workers.[44] A separate study suggested that *travestis* are likely at greater risk for HIV, syphilis, and other STIs compared to other transgender women in Brazil.[25]

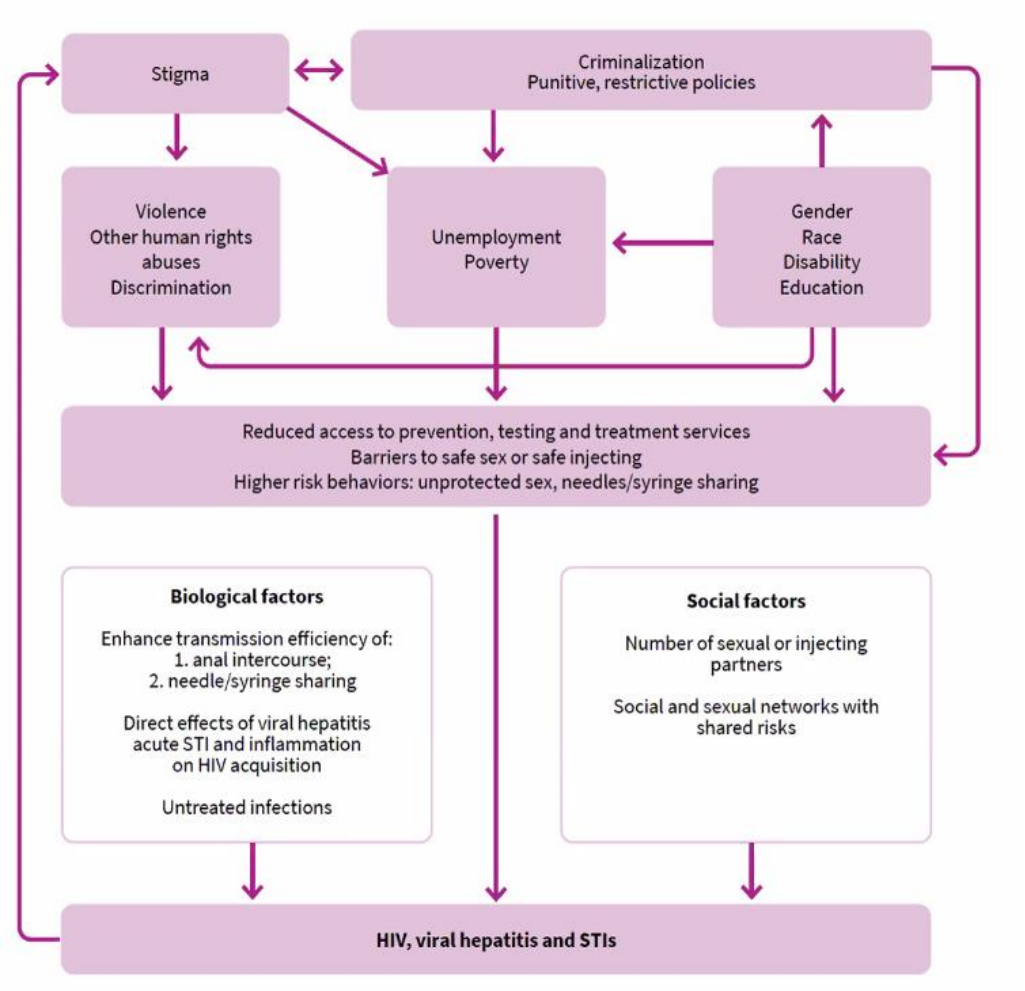


Figure 1.2 Factors contributing to HIV, viral hepatitis, and other STIs in key populations (WHO 2022)

1.5 STI SCREENING AND SPECIMEN COLLECTION

STI screening and testing play a critical role in the prevention and control of STIs. Screening helps identify asymptomatic infections, and testing enables more precise pathogen detection for targeted treatment, thereby interrupting the spread of the infection. Moreover, STI screening and testing offers an opportunity for individuals to access other preventive services, including PrEP for HIV, vaccinations (such as HPV and HBV), and relevant SRH services.

Typically, the diagnosis of STIs requires samples of blood, urine, or specimens collected from potential infection sites, such as the endocervix, vagina, or urethra for cis-gender women and the urethra for cis-gender men. Additionally, anorectal and oropharyngeal sites may also be sample, though less frequently. In most cases, except for urine collection, specimens are collected by a healthcare provider. Molecular testing of samples is the preferred approach for diagnosing many STIs, such as NG and CT, due to its high specificity and sensitivity.[39] However, this method requires expensive laboratory equipment, which is often not readily available in low-resource settings or countries with limited healthcare infrastructure. Additionally, many available tests have also not been adequately validated for anorectal diagnosis.[45]

A study by Pitasi *et al* (2019) conducted in the United States found that a significant number of transgender individuals are not routinely tested for anorectal or oropharyngeal NG/CT infections. Where STI testing if available, this lack of comprehensive testing is likely similar in Brazil. Interestingly, this study found that the majority of transgender women with anorectal or oropharyngeal NG/CT infections had concurrent negative urogenital test results, indicating that solely relying on urogenital screening could miss these anorectal or oropharyngeal infections.[46] A related finding was noted in the systematic review by Van Gerwan *et al* (2020), which found that more than half of the STI prevalence among transgender people did not perform testing beyond the urogenital tract.[28]

For transgender women who have undergone vaginoplasty, while mucosal infections such as chlamydia or gonorrhoea are possible, there is currently no evidence to guide routine screening in asymptomatic transgender women who have undergone vaginoplasty, and the role of neovaginal specimens, as opposed to urine testing only, is unknown.[47,48]

In practice, transgender individuals may avoid screening procedures and clinical examinations due to fears of discrimination, encountering inadequately trained healthcare providers, or personal discomfort with the visit or exam. Consequently, some transgender patients may prefer to collect their own specimens to have greater control over the screening process. However, the acceptability and preferences for self-collected versus provider-collected STI specimens among transgender women remain relatively unknown and require further research.

Self-sampling or self-collected samples (SCS), including urine collection and self-collected swabs, has increased the acceptance of STI screening among patients and providers, as it allows routine specimen collection without a clinical examination or provider-collected sample (PCS). Pooled results from a systematic review by Paudyal *et al* (2015) found that self-sampling was a highly acceptable method with 85% of patients reporting the method to be well received and acceptable.[49]

With studies (among non-transgender populations) showing that NAAT for CT, NG, and TV using SCS and urine specimens have equivalent sensitivity and specificity to PCS, self-sampling has become an important tool for routine screening, especially among patients who would otherwise be reluctant to undergo examination.[50,51,52] Despite the adoption of SCS as the standard of care in certain high-income settings, Brazil appears to have not followed suit.

Past studies to evaluate the acceptability and performance of SCS have focused primarily on vaginal swabs among cis-gender females and rectal swabs for MSM. Among MSM who collected their own anorectal and oropharyngeal samples, detection rates were found to be of equal or better accuracy than those of clinical providers.[52] However, few studies have included sampling among transgender people.

For transgender people, there is currently insufficient evidence specific to SCS. One study by Reisner *et* al (2017) conducted in Boston, USA, compared the acceptability and performance of SCS and PCS for detecting high-risk strains of HPV among transgender men. The study found that over 90% of participants preferred SCS, indicating that self-collected vaginal swabs are highly acceptable for HPV testing in this population.[53]

In Papua New Guinea, a small qualitative study explored the acceptability of anorectal STI testing and self-collection procedures among key populations, including transgender women. The study found positive support for anorectal STI testing and SCS in this context.[54] Another linked study focussed on developing a culturally appropriate illustrated tool for self-collecting anorectal specimens.[55] However, there remains a notable lack of available information, including self-guided diagrams with gender-inclusive or gender-neutral instructions, to enable self-collection among anatomically diverse populations, including transgender individuals. The visual aids currently available seem designed primarily for use by cis-gender males and females.[56,57]

1.6 EXISTING RECOMMENDATIONS

With limited epidemiological data on STIs among transgender people, there remains a significant gap in guidance specifically tailored to the prevention, diagnosis and treatment of STIs for this population. In many instances, existing guidance is combined with that for MSM due to presumed similar risk profiles. However, this approach may not adequately address the unique needs and experiences of transgender individuals, including sexual and gender-affirming practices.

Fortunately, some organisations and health agencies have taken the steps to provide specific guidance on STIs related to transgender people. For instance, the WHO, the US Centers for Disease Control and Prevention (CDC), and other organisations focussed on transgender health have developed resources and recommendations. In 2022, the WHO published the first consolidated guidelines on HIV, viral hepatitis and STI prevention, diagnosis, treatment and care for key populations, including transgender people.[2] These guidelines stress the importance of screening and diagnosing STIs, recognising that targeted efforts for key populations are a crucial part of a comprehensive response to HIV and STIs. The specific recommendations are outlined in **Box 1.1**. Interestingly, testing for oropharyngeal NG/CT infections is not included.

The updated recommendations emphasise that syndromic management for STIs should not be limited solely to urethral discharge and genital ulcers, but also include anorectal-related syndromes, including ulcers and discharge.[39] Notably, anorectal infections or syndromes were not

previously included in the 2003 WHO STI Treatment Guidelines.[58] However, in the absence of published evidence, expert consensus led to the development of an unvalidated management algorithm for anorectal infections in the 2011 WHO guidelines, specifically for MSM and transgender people.[20] Additionally, regional STI management guidelines for the WHO South-East Asia region also offered guidance in this area.[59]

Box 1.1 WHO (2022) recommendations for key populations related to screening and diagnosis of STIs

- Offering periodic testing for asymptomatic urethral and rectal *N. gonorrhoeae* and *C. trachomatis* infections using nucleic acid amplification tests (NAAT) is suggested over not offering such testing for men who have sex with men and trans and gender diverse people (*conditional recommendation, low certainty of evidence*).

- Offering periodic serological testing for asymptomatic syphilis infection to men who have sex with men and trans and gender diverse people is strongly recommended over not offering such screening (*strong recommendation, moderate certainty of evidence*).

- WHO suggests offering periodic screening for asymptomatic sexually transmitted infections (chlamydia, gonorrhoea and syphilis) to sex workers (*conditional recommendation, low certainty of evidence*).

- Self-collection of samples for *N. gonorrhoeae* and *C. trachomatis* should be made available as an additional approach to deliver STI testing services (*strong recommendation, moderate certainty of evidence*).

- For people with symptoms of: 1) urethral discharge from the penis or 2) anorectal discharge and report receptive anal sex, management is recommended to be based on the results of quality-assured molecular assays. However, in settings with limited or no molecular tests or laboratory capacity, WHO recommends syndromic treatment to ensure treatment on the same day of the visit (*strong recommendation, moderate certainty of evidence*).

- For people who present with genital ulcers (including anorectal ulcers), WHO recommends treatment based on quality-assured molecular assays of the ulcer. However, in settings with limited or no molecular tests or laboratory capacity, WHO recommends syndromic treatment to ensure treatment on the same day of the visit (*strong recommendation, moderate certainty of evidence*).

Additional guidance on STI management for transgender individuals has been provided by organisations focussed on transgender health, such as the University of California, San Francisco (UCSF) Transgender Care, which published the Guidelines for the Primary and Gender-Affirming Care of Transgender and Gender Nonbinary People. These guidelines emphasise that while

recommendations for serologic screening (HIV, HBV, HCV, syphilis) and management of confirmed STIs are similar to those for cis-gender people, specific considerations are necessary when screening for other STIs. Transgender individuals have distinct hormone use, history of gender-affirming surgical procedures, and patterns of sexual behaviours and practices, necessitating tailored screening approaches.[48]

Some national STI guidelines have incorporated transgender people, such as the US CDC 2021 STI Treatment Guidelines which have included transgender men and women in a section for the 'detection of STIs in special populations'.[60] However, in many cases, transgender people are rarely included in national guidelines or receive only limited guidance. For instance, the national STI guidelines published in Brazil in 2022 provide only minimal mention of transgender people or guidance on anorectal infections.[61] Nevertheless, it does recommend bi-annual screening for the detection of anorectal NG and CT for all individuals engaging in "receptive anal practice without barrier protection" (i.e., condoms).[61] However, due to limited access to diagnostic testing, these management guidelines do not offer specific management guidance for anorectal symptoms. Instead, the guidelines provide a generic flowchart for the presumptive diagnosis of sexually transmitted enteric and intestinal infections among individuals who engage in receptive anal intercourse (**Figure 1.3**). However, there is currently little evidence regarding the performance and cost-effectiveness of this algorithm, particularly among marginalised populations such as transgender women in the country.

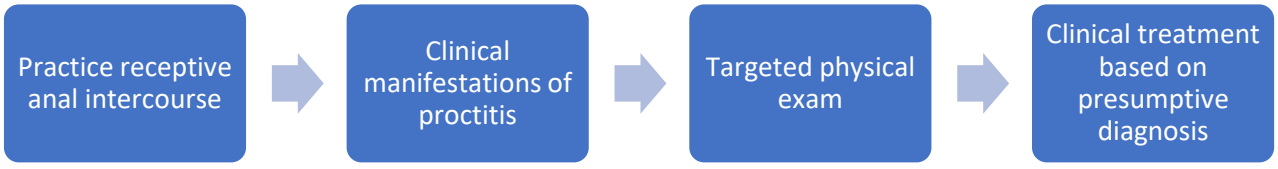


Figure 1.3 Translated flowchart based on the presumptive diagnosis of sexually transmitted enteric and intestinal infections from the Ministry of Health, Brazil (2022)

1.7 KEY RESEARCH GAPS

The literature review highlights that while transgender women are known to be at high risk of HIV infection, most existing epidemiological studies on HIV and other STIs group transgender people within MSM, which obscures the different degrees of vulnerability, health needs, and barriers they face when accessing services. Therefore, there remains a need to disaggregate data specifically for transgender populations.[62] Moreover, there is a notable scarcity of few research studies from low-income and middle-income countries.

While HIV prevalence among transgender women is relatively well-studied, there is very limited information in the literature regarding other STIs, especially those that present as extragenital infections or cannot be measured by serology. Among the available data, it is difficult to determine whether studies accurately represent the entire spectrum of transgender women due to the focus on populations within metropolitan cities, potential conflation with sex work, and limited information on the anatomical site of infection.[29] Further research is needed to better understand the STI burden and specific risk factors among transgender people.

Both Pitasi *et al* (2019) and Van Gerwen *et al* (2020) highlighted the lack of screening and other clinical guidance tailored specifically to transgender populations, emphasising the need for further research to determine optimal screening and testing practices.[28,46] Additionally, it was observed that clinical protocols for STIs often lack specific considerations for transgender individuals. Johnson *et al* (2018) suggest that future mixed-methods research is necessary to gather acceptability and feasibility data for extragenital STI testing while implementing self-collected versus provider-collection methods.[63]

Other research gaps include a lack of data about the performance of vaginal swab tests among transgender individuals who have undergone vaginoplasty. Additionally, studies that include detailed information on the anatomy of transgender people are limited. For instance, MacCarthy *et al* (2017) emphasised the need for research comparing the risk of STIs among transgender women with penile-inversion vaginoplasty versus sigmoid colon vaginoplasty (or colovaginoplasty).[19] In contrast, even less is known about STIs among transgender men. While available research indicates that STIs

appear to be more prevalent in transgender women than transgender men, there is a marked lack of data including transgender men.[64]

Overall, as transgender women remain an understudied population, there is a lack of evidence-based interventions tailored to their specific needs. There is a critical need to document and understand the disparities among transgender individuals to develop appropriate and effective STI prevention and management strategies, aimed at reducing their risk of STI acquisition and transmission.

The gaps in the literature offer multiple opportunities for research, especially concerning the epidemiology of STIs among transgender people, encompassing bacterial, parasitic, and non-HIV viral STIs. In Brazil, the focus has largely been on sero-prevalent STIs, with little to no know research on the most common STIs such as NG, CT, and HPV. This limitation hinders the availability of evidence-based guidance and services for transgender individuals.

Methodological note:

This literature review was supported by a literature search of electronic databases (Ovid MEDLINE and Ovid Embase) conducted on 4 July 2020. The search strategy included all literature which contained both MeSH (Medical Subject Heading) terms for transgender people (Transgender Persons) and STIs (Sexually Transmitted Diseases), which elicited a total of 206 studies. The investigator reviewed the title and abstracts of all and selected a further 46 to review the full text, with a total of 34 relevant studies that include epidemiological aspects of STIs (excluding sole focus on HIV) among transgender people.

CHAPTER 2: FORMATIVE RESEARCH

2.1 INTRODUCTION

In 2018, a formative research study was conducted to assess the acceptability of introducing STI screening, specifically for CT and NG, among transgender women, as part of a future epidemiological study. This formative study was conducted with a small sample of transgender women who were participating in the São Paulo arm of the TransNational cohort study, coordinated by the *Faculdade de Ciências Médicas da Santa Casa de São Paulo*. The larger TransNational study, led by UCSF, aimed to measure HIV incidence and investigate causal factors for infection among trans women in San Francisco and São Paulo. Within this cohort study, the formative study aimed to assess the acceptability among participants of introducing self-collected or provider-collected sampling for the screening of other STIs within this specific study population.

While blood samples for serological testing of HIV, syphilis, and viral hepatitis (A, B, C) were already being collected as part of the cohort study, detecting other STIs like NG and CT would require urine samples and specimen collection from potential infection sites, including anorectal, oropharyngeal and neovaginal sites. This formative study aimed to prepare for a larger national STI prevalence study and determine the feasibility and preferences for specimen collection methods. The primary objective was to prepare for a larger national STI prevalence study and determine the feasibility and preferences for specimen collection. The study population consisted of participants already enrolled in the cohort study, making it suitable for understanding the acceptability of requesting samples from anatomical sites.

To achieve these objectives, the formative study employed a mixed-methods approach, combining qualitative and quantitative methodologies through convenience sampling of participants during their scheduled study visit. Data collection was conducted using a concise interviewer-led questionnaire in Portuguese. The protocol and questionnaire are shown in **Annex 1**, which included the presentation of investigator-designed instructional diagrams for self-sampling, encompassing oropharyngeal, anorectal, and vaginal sites, as well as self-collection of urine samples. The

investigator ensured anatomical and gender diversity when developing these diagrams by reviewing existing visual instructions (see **Annex 2**).

The results from this formative study were presented in a manuscript submitted to and accepted by the *Brazilian Journal of Infectious Diseases*, included as **Research Paper 1**. The study involved focus group discussions and thematic analysis of transcripts, conducted by the second author.

2.2 RESEARCH PAPER 1: Acceptability of self-sampling for etiological diagnosis of mucosal sexually transmitted infections (STIs) among transgender women in a longitudinal cohort study in Sao Paulo, Brazil

RESEARCH PAPER COVER SHEET

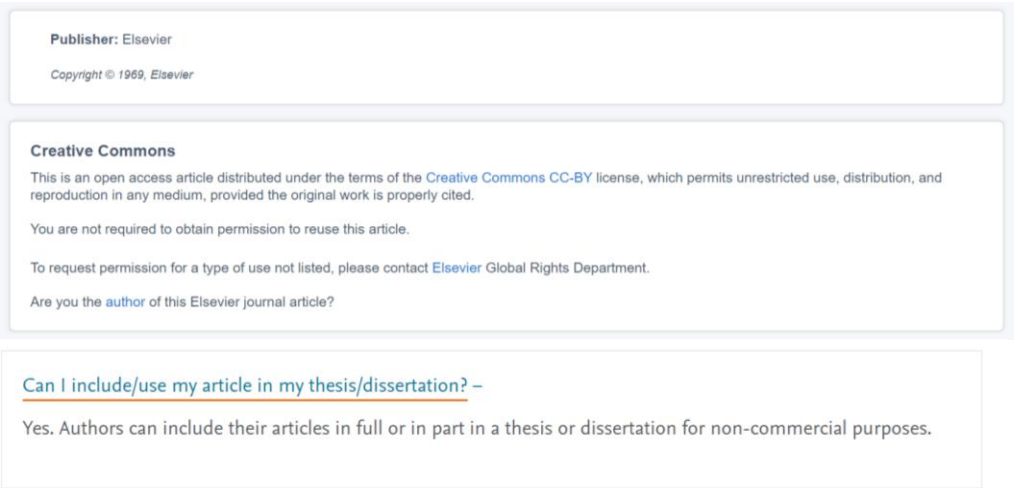
Please note that a cover sheet must be completed <u>for each</u> research paper included within a thesis.

<u>SECTION A – Student Details</u>

Student ID Number	155857	**Title**	
First Name(s)	Daniel		
Surname/Family Name	McCartney		
Thesis Title	Clinical epidemiology of STIs among transgender women in Brazil		
Primary Supervisor	Philippe Mayaud		

<u>SECTION B – Paper already published</u>

Where was the work published?	The Brazilian Journal of Infectious Diseases		
When was the work published?	18 May 2022		
If the work was published prior to registration for your research degree, give a brief rationale for its inclusion	N/A		
Have you retained the copyright for the work?*	**No**	Was the work subject to academic peer review?	**Yes**



Publisher: Elsevier

Copyright © 1969, Elsevier

Creative Commons

This is an open access article distributed under the terms of the Creative Commons CC-BY license, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

You are not required to obtain permission to reuse this article.

To request permission for a type of use not listed, please contact Elsevier Global Rights Department.

Are you the author of this Elsevier journal article?

Can I include/use my article in my thesis/dissertation? –

Yes. Authors can include their articles in full or in part in a thesis or dissertation for non-commercial purposes.

SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	
Please list the paper's authors in the intended authorship order:	
Stage of publication	Choose an item.

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Conception and design of sub-study, including survey instrument, analysis, interpretation of results, and primary author of paper

SECTION E

Student Signature	[redacted]
Date	8 February 2023

Supervisor Signature	[redacted]
Date	8 February 2023

Sociedade Brasileira de Infectologia

The Brazilian Journal of
INFECTIOUS DISEASES

www.elsevier.com/locate/bjid

Original Article

Acceptability of self-sampling for etiological diagnosis of mucosal sexually transmitted infections (STIs) among transgender women in a longitudinal cohort study in São Paulo, Brazil

Daniel Jason McCartney [a,*], *Thiago Félix Pinheiro* [b], *José Luis Gomez* [b], *Paula Galdino Cardin de Carvalho* [b], *Maria Amélia Veras* [b], *Philippe Mayaud* [a]

[a] *London School of Hygiene & Tropical Medicine, Keppel Street, London WC1E 7HT, United Kingdom*
[b] *Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo, SP, Brazil*

ARTICLE INFO

Article history:
Received 10 January 2022
Accepted 3 April 2022
Available online 2 May 2022

Keywords:
Transgender women
Sexually transmitted infections (STIs)
Self-sampling
Chlamydia trachomatis
Neisseria gonorrhoeae

ABSTRACT

This study conducted among transgender women in São Paulo, Brazil assessed the acceptability and suitability of screening sexually transmitted infections (STIs), such as *Chlamydia trachomatis* and *Neisseria gonorrhoeae*, by sampling multiple anatomical sites (i.e. urethral, anorectal, oropharyngeal, and neovaginal), and utilizing self- or provider-collection methods. First, a convenience sample of 23 cohort participants were recruited during a scheduled study visit between October and November 2018. Data collection was through a short investigator-led quantitative survey in Portuguese, and included presentation of investigator-designed, gender-neutral instructional diagrams to guide self-sampling. Three supplemental focus group discussions (FGDs) with a total of 30 participants guided by semi-structured script were conducted in Portuguese between September and October 2019. All participants reported being assigned male sex at birth and self-identified with a feminine gender identity at time of study. All survey respondents (100%; n = 23) indicated willingness to provide samples for STI screening during a future study visit. Preference was for self-collection of urine samples (83%; n = 19), urethral swabs (82%; n = 18), and anorectal swabs (77%; n = 17). A lower preference for self-collection of oropharyngeal swabs (48%; n = 11) was observed. Most respondents (78%; n = 18) indicated that they would not prefer specimens to be collected by a health professional, mainly due to 'more privacy' (72%; n = 13). All respondents indicated that they would feel comfortable to provide a self-collected sample based on instructional diagrams shown. In FGDs, although the collection by a health professional was described as a technically safer option for some participants, there was a preference for self-collection to avoid discomfort and embarrassment in exposing the body. Overall, this sub-study suggested acceptability among transgender women of introducing self-sampling for etiological diagnosis of STIs from potential infection sites. Uptake

* Corresponding author.
E-mail address: daniel.mccartney@lshtm.ac.uk (D.J. McCartney).

https://doi.org/10.1016/j.bjid.2022.102356

and usability will be explored further in a cross-sectional STI prevalence study of transgender women in Brazil.

Introduction

Transgender women are known to be at high risk of HIV and other sexually transmitted infections (STIs). While HIV prevalence among transgender women is relatively well-studied, very little is known about other STIs, in particular bacterial STIs such as chlamydia and gonorrhoea.[1,2] A recent systematic review found a limited number of studies that included data on syphilis, gonorrhoea, and chlamydia among transgender women, and estimated prevalence ranging from 1.4 to 50.4%, 2.1 to 19.1%, and 2.7 to 24.7%, respectively.[2] Despite high prevalence of STIs in populations of transgender people, there remains limited clinical guidance tailored to STI screening, with most national protocols for STIs not providing any specific considerations.[2,3]

While syndromic management of STIs refers to the diagnosis and treatment based on common STI syndromes, etiological diagnosis of STIs provides a more definitive diagnosis by testing a sample of blood, urine, or swab-based specimen collection at relevant anatomical sites. This allows for better targeted treatment and improves antibiotic stewardship. For cis-gender women, sampling commonly includes urine collection and specimens collected by a health professional at endocervical and vaginal sites, while sampling urethral site by health professional or urine collection is common for cis-gender men. However, STI screening is often not routinely conducted at anorectal or oropharyngeal sites, leaving the possibility of undiagnosed infections, especially among certain populations with high prevalence of STIs. There is little evidence to guide routine screening in asymptomatic transgender women who have undergone vaginoplasty, and the role of vaginal specimens is currently unknown.[4]

In practice, transgender people may avoid screening procedures and physical examinations due to fear of discrimination, encountering health professionals who are inadequately trained, or personal discomfort with the visit or exam, and may prefer to collect their own specimens to allow for greater control over the screening process.[4]

Self-sampling, including urine collection and self-collected swabs (SCS), allows routine specimen collection without the need for a physical examination or provider-collected swabs (PCS). This provides a benefit both for efficiency of health professionals with limited time and capacity, as well as enabling those who may not access service due to actual or perceived requirement of a clinician needing to complete a physical examination.

Many studies have demonstrated that SCS have equivalent sensitivity and specificity to PCS for nucleic acid amplification testing (NAAT) for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*,[5,6] and self-sampling has become an important tool for expanding STI testing. With the potential to address common barriers including inaccessibility, inconvenience, embarrassment, and discomfort,[7,8] self-sampling for STI diagnosis has been found to be a highly acceptable method among patients.[9] A recent review found self-collection of samples increased uptake of STI testing services when compared to samples collected by a health professional.[10]

Past studies evaluating the validity, feasibility, and acceptability of SCS have focused primarily on vaginal swabs among cis-gender females and rectal swabs for MSM. Among MSM who collected their own rectal and pharyngeal samples, detection rates were found to be of equal or better accuracy than those of health professionals.[11]

For transgender people, there is insufficient evidence specific to SCS, with only one study identified from Boston, USA comparing the performance and acceptability of SCS and PCS for detection of high-risk genotypes of the human papillomavirus (HPV) among transgender men (self-identified as men, assigned female at birth).[12] No relevant studies with transgender women were found at the time of study.

Visual aids are commonly used to help support SCS, including instructional diagrams or videos, often designed for cis-gender males and females.[9,13-15] These illustrative tools can be modified for different settings and co-developed with target populations for increased understanding and acceptability.[16] However, no published examples were found of self-guided diagrams with gender inclusive or gender-neutral instructions to enable self-collection of anatomically diverse populations.

The objective of this study was to assess the acceptability and suitability of screening STIs, such as *C. trachomatis* and *N. gonorrhoeae*, among transgender women by sampling multiple anatomical sites (i.e. urethral, anorectal, oropharyngeal and neovaginal), and utilizing SCS or PCS.

Methods

Study population

The study was conducted among transgender women participating in a longitudinal cohort study aiming to determine HIV, syphilis, and viral hepatitis seroprevalence in São Paulo, Brazil. Briefly, the TransNational Study aimed to enroll 550 transgender women aged 18 years and over in the metropolitan area of the city of São Paulo following a respondent-driven sampling (RDS) methodology.[17] The opportunity was afforded to interview a sample of volunteers to determine the acceptability and practicability of mucosal STI screening in addition to blood samples collected for serological testing.

This sub-study included mixed quantitative and qualitative methodologies through convenience sampling. Consecutive potential participants from the existing cohort study were invited during a scheduled study visit over a two-week period with a target enrolment of 20 participants to complete

a quantitative survey. Following the initial results from the survey, additional focus group discussions were arranged with cohort participants. Written informed consent was obtained from all participants.

Quantitative survey

Data was collected using a short investigator-led questionnaire in Portuguese. This included the presentation of investigator-designed, gender-neutral instructional diagrams for self-sampling utilizing oropharyngeal, anorectal, and vaginal swabs, and provision of urine samples. Participants received information about the proposed addition of STI screening to the cohort study, and the investigator received informed consent to conduct the additional survey. No samples were provided in this sub-study.

Focus group discussions

Focus group discussions (FGDs) were conducted in Portuguese and guided by a semi-structured script to discuss the acceptability of self-sampling versus collection by a health professional of oropharyngeal, urethral, and anorectal samples for the diagnosis of STIs. Thematic analysis of transcripts was conducted in Portuguese, with key quotes translated to English by the investigators.

Results

Study participants

A total of 23 participants from the cohort study were invited to this sub-study between 29 October to 13 November 2018, during one of their scheduled study visits (ranging from first to fifth visit), and none declined. Participant characteristics are presented in Table 1. Participants' ages ranged from 18 to 45 years, with a median age of 27 years. All reported residing in the city of São Paulo, except one participant residing elsewhere in the state of São Paulo. They reported being assigned male sex at birth and identified with a feminine gender identity at the time of study. Of the 23 participants, one confirmed having had genital or lower surgery (gender-affirmative surgery) to remove their male genitalia.

Three FGDs with a total of 30 participants were conducted at the study clinic in São Paulo between 24 September and 1 October 2019. The first group was composed of transgender women who completed high school education; the second group was composed of transgender women sex workers without completed high school education; and the third group was composed of transgender women with different professional activities and different levels of education.

Previous experience of STI sampling

Most survey respondents (70%; n = 16) stated that they had never had an STI test that required a urine sample or swab, while one respondent (4%) was uncertain. Over a quarter (26%; n = 6) indicated that they had tested in the past, with five (22%) indicating experience of oral swabs, two (9%) of urethral swabs, and one (4%) of rectal swabs, while one (4%) did not provide response of anatomical site. In total, three (13%) responded that these were self-collected, two (9%) collected by professional, and one (4%) reported collection both by self and professional.

Table 1 – Participant characteristics of the quantitative survey respondents (N = 23).

Characteristics	Summary statistics [*n* (%)]
Age (years)	
Mean (SD)	27.8 (7.6)
Median (range)	27 (18-45)
Gender identity	
Woman (*mulher*)	7 (30.4)
Transsexual woman	11 (47.8)
Travesti	4 (17.4)
Other female gender identity	1 (4.3)
Residence	
São Paulo city	22 (95.7)
Sorocaba	1 (4.3)
Study visit	
First	1 (4.3)
Second	3 (13.0)
Third	8 (34.8)
Fourth	5 (21.7)
Fifth	6 (26.1)
Gender-affirmation surgery	
Yes	1 (4.3)
No	22 (95.7)

Sampling preference

All survey respondents were asked to indicate their preference of method for providing samples if they were to visit a clinic for STI testing. For all sample methods (excluding vaginal), an overall preference was for these samples to be self-collected (Table 2). In order of preference for self-collection, this was greatest for urine sample (83%; n = 19), urethral swab (82%; n = 18); and rectal swab (77%; n = 17). Only two sampling methods had preference for provider-collected: oral swab (13%; n = 3) and oral rinse (9%; n = 2). While some indicated no preference for each of the sampling methods, none expressed being uncertain.

FGD participants considered that urine collection and oral (oropharyngeal) swab collection were acceptable and straightforward procedures. Participants' preferences for self-collected or provider-collected oral swabs diverged:

"I'd rather I do it myself."

"I prefer the professional, I feel safer."

"If you're a professional, I'd rather not risk [self-collecting]."

(Participants from FGD3)

"That depends on who the professional is."

(Participant from FGD2)

The collection of specimen samples from the penile urethra or vagina generated much divergence in the focus groups, although no participant stated that they would refuse to do so. The preference of some participants for self-collection was related to their discomfort of exposing their naked body and having their genitalia handled by a medical professional:

Table 2 – Preference for self-collected versus provider-collected samples for STI testing (N = 23).

Sample type	Self-collected	Provider-collected	No preference	Unsure	Total responses
Urethral swab	18 (82%)	0	4 (18%)	0	22
Oral swab	11 (48%)	3 (13%)	9 (39%)	0	23
Oral rinse	11 (50%)	2 (9%)	9 (41%)	0	22
Rectal swab	17 (77%)	0	5 (23%)	0	22
Vaginal swab	0	0	1 (100%)	0	1
Urine sample	19 (83%)	0	4 (17%)	0	23

"I already find it very embarrassing the person [professional] is doing this down there on you."

"I think it's a boring exam."

"I think it would be a very intimate thing of the person, it would have to be you could do it yourself."

"It gives shame."

(Participants from FGD2)

"I, in my uniqueness... he [the professional] never saw my [genitals]. And then, I'll get there... I can't do it."

(Participant from FGD1)

The collection of anorectal samples also generated divergence, although it seemed less controversial than collection from genitals (penile urethra or vagina). In the third FGD, some participants stated that they would refuse to perform this collection:

"I'd stop doing it because I wouldn't feel comfortable."

(Participant from FGD3)

However, the preference for self-collection was more expressive, although some participants stated that they would not have resistance to let the professional perform the collection:

"I think it's unnecessary for a professional to do this kind of action. Why couldn't you do it yourself, walk into a small room and do it?"

(Participant from FGD2)

"Everything is an option. If [the professional] gives me the option to go there and collect, fine. If I don't have [that] option, I will let [the professional] collect."

(Participant from FGD1)

Acceptability of sampling

All survey respondents were asked if they would be willing to provide samples for screening of other STIs during a future study visit. All provided a positive response (100%; n = 23) and indicated that they would feel comfortable collecting samples by themselves if received information on how to collect (n = 21; 2 missing).

When asked if they would prefer samples to be collected by a health professional, two (9%) indicated that they would prefer, while three (13%) indicated no preference. For the two respondents who indicated that they would prefer samples to be collected by a health professional, they explained that this was due to 'preference by trained professionals', and 'afraid to take the wrong exam'.

Most respondents (78%; n = 18) indicated that they would not prefer specimens to be collected by a health professional. The reasons for preferring self-collection are illustrated in Figure 1. The main reason provided was for 'more privacy' (72%; n = 13). Other reasons were for 'greater physical comfort' (39%; n = 7), 'easy to execute' (33%; n = 6); and 'knowledge about one's own body' (17%; n = 3). Of respondents who indicated 'other' reason (17%; n = 3), all explained due to 'shame'.

During the FGDs, one participant told of an experience in which she was satisfied with the possibility of self-collection offered:

"I went to take an exam, and he [the professional] said: If you see that you will be embarrassed to show your organ to me, I close the curtain and give you a cotton swab for you to do. Then I said, I prefer it that way. Did you understand?? He was a gentleman, but I wasn't going to make it because he also had a girl in his office who stays with him. Then he pulled the curtain, then I took the cotton swab."

(Participant from FGD2)

The participants who showed preference for the collection by a health professional stated that they felt more confident because it was perceived that the professional would have more technical knowledge and a greater ability to perform the procedure correctly:

"I prefer with the professional, I feel safer."

(Participant from FGD3)

"It's just that sometimes you can do it one way and the doctor does it another."

(Participant from FGD2)

"He's the doctor, he'll know where to go."

(Participant from FGD1)

Faced with the argument that the professional has more technical knowledge to perform the collection, one participant proposes that guidance material for self-collection be offered:

"Just show a little video like that running [the swab] in the little head [of the penis]."

(Participant from FGD1)

Although the gender of the health professional did not seem to be a relevant issue for some participants, others indicated that they would have different reactions to men or women:

"I feel uncomfortable whether [the health professional] is a woman or a man."

(Participant from FGD1)

"I think I would let [the health professional collect sample] if it was a professional woman, but if it was a man, I'd be ashamed."

"I prefer a woman, because it's better than a professional man, you know? It's because there are some doctors who even have a prejudice, you understand? And also he won't say 'I'm prejudiced or not' [because] he's a professional. (...) You have to take the exam, you have to feel good. So I prefer a professional woman."

"I like being served by a man, my private parts are man's, not a woman's."

(Participants from FGD2)

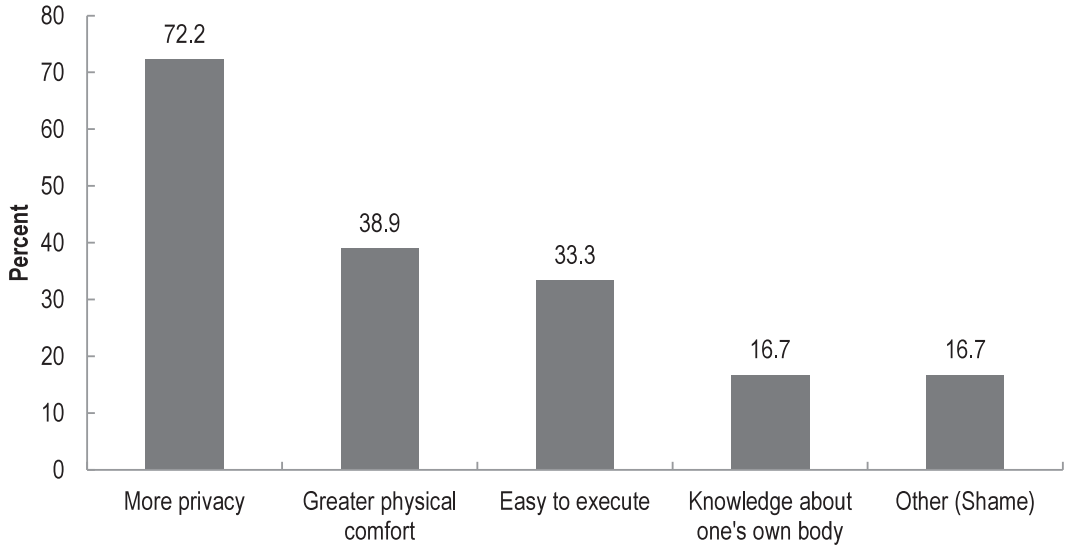


Figure 1 – Reasons for preferring self-collected samples for STI testing (N = 18).

One participant suggested that the ideal would be for a transgender professional to perform the collection and received great agreement from the group.

In the second FGD composed of transgender women sex workers, there was a discussion about the different relationships between the exposure of the body in the context of sex work and in the context of health care:

"It's because, for people who lose their aesthetics, who feel ashamed, being naked in front of a [client] is different from being naked in front of a professional. (...) [For] people who work at night it is different to be naked with a [client] and be at ease than the professional who is a doctor."

"I lost this fear [of showing my naked body] through the customers, because (...) when I go into the room, I have to take off my clothes with the guy I don't even know, you know? I think I'd easily let [the health professional] use the swab, because I think it breaks all the taboos, we work with the body at night, and we don't have to be ashamed to expose ourselves to the client. So why are you going to be ashamed to exposure yourself to a man who is going to give you the cure for what you're looking for?"

(Participants from FGD2)

Self-sampling instructional diagrams

A total of 20 survey respondents were shown the instructional diagrams for self-sampling and asked to indicate their level of understanding. Overall, the majority of respondents provided positive responses of understanding (Table 3).

All respondents indicated that the oral swab was *easy* (55%; n = 11) or *very easy* (45%; n = 9) to understand. For the urine sample, most respondents indicated that it was *very easy* (50%; n = 10) or *easy* (45%; n = 9) to understand, while one (5%) indicated that it was *difficult* to understand. For the rectal swab, most respondents indicated that it was *easy* (50%; n = 10) or *very easy* (40%; n = 8) to understand, while two (10%) indicated that it was *difficult* to understand. Only one participant was eligible to review the vaginal swab diagram and indicated that it was *very easy* to understand.

All participants were asked whether, based on the instructional diagrams shown, they would feel comfortable to self-collect the sample. All provided an affirmative response, with one explaining that they would feel less comfortable with the rectal samples as they felt '[it] would be difficult to collect'.

Discussion

With accuracy and acceptability of self-collected samples for STI testing demonstrated more generally in other studies,[5-8] this study provided much needed additional evidence of acceptability and suitability of self-sampling specifically among transgender women, and from different potential infection sites.

Table 3 – Stated level of understanding of instructional diagrams for self-sampling (N = 20).

Sample type	Very easy	Easy	Difficult	Very difficult	Total responses
Oral swab	9 (45%)	11 (55%)	0	0	20
Rectal swab	8 (40%)	10 (50%)	2 (10%)	0	20
Vaginal swab	1 (100%)	0	0	0	1
Urine sample	10 (50%)	9 (45%)	1 (5%)	0	20

As stigma and discrimination may pose additional barriers to the utilization of health services among transgender people,[18] this study provided an indication that self-collection of samples may help to alleviate some discomfort when encountering health professionals. Further research is needed to better understand the reasons for avoidance of testing among transgender women, and to understand whether self-collection helps increase the utilization of STI testing.

However, there was limited evidence to suggest a perception that specimen collection by a health professional was the norm for cis-gender women and was therefore the sampling method some participants stated they would prefer. This could be a powerful part of gender affirmation, whereby transgender women are not wanting to be treated differently from cis-gender women.

Visual aids are important to guide effective self-collection, with imagery co-created with the target population critical to ensure suitability and acceptability.[16] The novel gender-neutral instructional diagrams that were piloted in this study received positive responses of understanding to enable self-collection of samples, with further development and testing warranted.

Overall, transgender people remain an understudied population with a paucity of evidence-based interventions tailored to their unique needs. There remains an expressed lack of screening and other clinical guidance specifically tailored to transgender populations, with more research needed to inform appropriate and effective strategies/interventions to reduce risk of STI acquisition and transmission.[2,3]

One limitation of this study was that it did not include actual sample collection. With more data needed on acceptability of self-sampling in real-life settings, uptake and usability will be explored further in a large cross-sectional STI prevalence study of transgender women in Brazil (TransOdara). The research findings will have important policy and public health implications in Brazil and internationally by informing specific STI-related recommendations for transgender women including etiological screening and management of urethral, anorectal, oropharyngeal and neovaginal infections.

Ethical aspects

The TransNational Study protocol was reviewed and approved by the Brazilian National Commission on Research Ethics (CONEP-CNS, #1880217), the Ethical Review Committee of the Centro de Referência e Treinamento em DST/AIDS (CRT DST/AIDS), and the Internal Review Board of the University of California San Francisco. The protocol for this sub-study was reviewed and approved by the London School of Hygiene & Tropical Medicine (LSHTM) Ethics Committee. Informed consent was obtained from all individual participants included in the study. All procedures were carried out in accordance with the Declaration of Helsinki.

Conflicts of interest

All authors declare no conflicts of interest.

Acknowledgements

The TransNational Study was supported by the US National Institute on Minority and Health Disparities (R01MD010678). In Brazil, additional support was provided by the Centro de Referência e Treinamento DST/AIDS (CRT DST/AIDS) and the Instituto Adolfo Lutz of the State of São Paulo Health Department.

REFERENCES

1. MacCarthy S, Poteat T, Xia Z, Roque NL, Baral S, Reisner SL. Current research gaps: a global systematic review of HIV and sexually transmissible infections among transgender populations. Sex Health. 2017;14:456–68.
2. Van Gerwen OT, Jani A, Long DM, Austin EL, Musgrove K, Muzny CA. Prevalence of sexually transmitted infections and human immunodeficiency virus in transgender persons: a systematic review. Transgender Health. 2020;5:90–103.
3. Pitasi MA, Kerani RP, Kohn R, et al. Chlamydia, gonorrhea, and human immunodeficiency virus infection among transgender women and transgender men attending clinics that provide sexually transmitted disease services in six US cities: results from the Sexually Transmitted Disease Surveillance Network. Sex Transm Dis. 2019;46:112–7.
4. UCSF Transgender Care. Guidelines for the Primary and Gender-Affirming Care of Transgender and Gender Nonbinary People. 2nd edition Department of Family and Community Medicine, University of California San Francisco; 2016.
5. Lunny C, Taylor D, Hoang L, et al. Self-collected versus clinician-collected sampling for chlamydia and gonorrhea screening: a systemic review and meta-analysis. PLOS One. 2015;10:e0132776.
6. van der Helm JJ, Hoebe CJ, van Rooijen MS, et al. High performance and acceptability of self-collected rectal swabs for diagnosis of Chlamydia trachomatis and Neisseria gonorrhoeae in men who have sex with men and women. Sex Transm Dis. 2009;36:493–7.
7. Fielder RL, Carey KB, Carey MP. Acceptability of sexually transmitted infection testing using self-collected vaginal swabs among college women. J Am Coll Health. 2013;61:46–53.
8. Paudyal P, Llewellyn C, Lau J, Mahmud M, Smith H. Obtaining self-samples to diagnose curable sexually transmitted infections: a systematic review of patients' experiences. PLOS One. 2015;10:e0124310.
9. Barbee LA, Tat S, Dhanireddy S, Marrazzo JM. Implementation and operational research: effectiveness and patient acceptability of a sexually transmitted infection self-testing program in an HIV care setting. JAIDS-J Acq Imm Def. 2016;72:e26–31.
10. Ogale Y, Yeh PT, Kennedy CE, Toskin I, Narasimhan M. Self-collection of samples as an additional approach to deliver testing services for sexually transmitted infections: a systematic review and meta-analysis. BMJ Glob Health. 2019;4:e001349.
11. Sexton ME, Baker JJ, Nakagawa K, et al. How reliable is self-testing for gonorrhea and chlamydia among men who have sex with men. J Fam Practice. 2013;62:70–8.
12. Reisner SL, Deutsch MB, Peitzmeier SM, et al. Comparing self- and provider-collected swabbing for HPV DNA testing in female-to-male transgender adult patients: a mixed-methods biobehavioral study protocol. BMC Infect Dis. 2017;17:1.
13. Hickson DA, Truong NL, Smith-Bankhead N, et al. Rationale, design and methods of the ecological study of sexual behaviors and HIV/STI among African American men who

have sex with men in the Southeastern United States (The MARI Study). PLOS One. 2015;10(12):e0143823.
14. Hologic. Instructions for Using the Aptima™ Multitest Swab Specimen Collection Kit for Patient-Collected Specimens. San Diego, CA: Hologic; 2017.
15. Lampinen TM, LaTulippe L, Van Niekerk D, et al. Illustrated instructions for self-collection of anorectal swab specimens and their adequacy for cytological examination. Sex Transm Dis. 2006;33:386–8.
16. Kelly-Hanku A, Bell S, Ase S, et al. Developing a culturally appropriate illustrated tool for the self-collection of anorectal specimens for the testing of sexually transmitted infections: lessons from Papua New Guinea. BMC Public Health. 2019;19:1.
17. Amelia de Sousa Mascena Veras M, Roza Saggese G, Gomez Junior J, et al. Brief report: young age and sex work are associated with HIV seroconversion among transgender women in São Paulo, Brazil. JAIDS-J Acq Imm Def. 2021;88: e1–4.
18. Poteat T, German D, Kerrigan D. Managing uncertainty: a grounded theory of stigma in transgender health care encounters. Soc Sci Med. 2013;84:22–9.

2.3 SUMMARY OF KEY FINDINGS

- This formative study indicated a high level of acceptability among participants for the introduction of sample collection, including self-sampling, from potential infection sites for the detection of STIs in a future study.
- All participants expressed willingness to provide samples for STI screening during a future study visit and reported feeling comfortable with providing self-collected samples using instructional diagrams.
- There was a preference for self-collection of urethral and anorectal specimens, while participants preferred provider-collection of oropharyngeal specimens.
- Most respondents favoured self-collection due to increased privacy and to avoid discomfort and embarrassment when interacting with healthcare professionals.
- Qualitative evidence revealed that some participants perceived that sample collection by a healthcare professional to be the norm for cis-gender women, leading to a preference for provider-collection among these individuals.

2.4 FURTHER REFLECTION

In summary, the formative study indicated a positive response from study participants regarding the introduction of sample collection for the screening of other STIs, with a preference for self-collection. The study revealed that few participants had prior experience with STI tests requiring urine samples or other specimens, likely due to the limited availability of such STI testing. Furthermore, the lower preference for self-collection of oropharyngeal swabs observed in this study may have been influenced by the pre-COVID-19 context, during which participants may have had more experience with such sample collection.

Despite the small sample size, these findings provided valuable insights and increased the confidence of the Brazilian investigators in developing a comprehensive research proposal for the

TransOdara STI prevalence study. However, it was important to acknowledge that this formative study was hypothetical in nature and did not involve actual sample collection. As a result, the approach of offering participants the choice between self-collection and provider-collection for each sample in the TransOdara study was deemed essential. This true choice would allow the future study participants to express their preferences, share their experiences, and provide input on their preferred collection method, ensuring that the study design is more attuned to the needs and preferences of transgender women.

CHAPTER 3: RESEARCH AIMS

This DrPH research project was conducted in collaboration with the *Faculdade de Ciências Médicas da Santa Casa de São Paulo* (Santa Casa de São Paulo School of Medical Sciences), a centre of excellence for teaching, research and health care contributing to improving health care and life conditions of the Brazilian population. As a listed partner and study investigator, this DrPH research project was integrated into the national STI prevalence study conducted in five locations in Brazil, titled: *Syphilis prevalence study and other sexually transmitted infections between travesti and trans women in Brazil: care and prevention* (TransOdara). Involvement spanned across various aspects of the study, including study design, development of data collection tools, implementation considerations, data analysis, and interpretation of results.

TransOdara was a mixed-methods cross-sectional study among transgender women in five cities located in five cities across the five macro-regions of Brazil: São Paulo (Southeast), Porto Alegre (South), Salvador (Northeast), Campo Grande (Midwest) and Manaus (North). The primary objectives of TransOdara were to estimate the prevalence of STIs, specifically HIV, syphilis, NG, CT, HPV, HAV, HBV, and HCV, and to gain insights into the meanings and representations attributed to these infections among transgender women in Brazil.

As TransOdara was a large research study involving multiple partners and investigators with diverse research interests and priorities, the DrPH research project focussed on three complementary areas of investigation within study, each with specific aims and objectives. These areas were identified and agreed upon with the principal investigator to address under-researched aspects and offer valuable insights with the potential to influence public health policy and practice in Brazil and beyond.

Objective 1: Prevalence of anorectal STIs, symptoms, signs and syndromes

As the research protocol for TransOdara included sampling and examination of anorectal sites, the DrPH study focussed on determining the prevalence of anorectal NG and CT, along with associated risk factors among transgender women in Brazil. While the overall prevalence of NG and

CT was investigated by others, anorectal infections remained under-researched, with potential implications beyond transgender women. Consequently, the study also aimed to assess the performance and costs of different clinical approaches for the diagnosis and management of anorectal STIs. It was hypothesised that the prevalence of NG and CT will be higher at anorectal sites (5 to 10%) than oropharyngeal (2 to 5%) or urogenital (0 to 2%) sites.[28,62] In addition, it was hypothesised that the anorectal syndromic management approach (based on specific anorectal symptoms for presumptive treatment of NG and CT) would have a low sensitivity due to frequent asymptomatic infections, but maintain high specificity without distinguishing between NG and CT.[36] Additional analysis to determine the prevalence of anorectal HPV was also included. The study aimed to provide evidence to inform policy and recommendations for the management of anorectal STIs, including syndromic management, specifically targeting transgender people and other populations at high risk of anorectal infections.

Objective 2: Uptake of physical examination for detection of STIs

The TransOdara research protocol offered participants the option of physical examination by a study clinician to assess for any clinical signs of STIs, regardless of whether they reported symptoms. The DrPH study aimed to investigate the uptake and acceptability of examining each anatomical site separately (general, genital, and anorectal) among study participants. It was hypothesised that many participants might be reluctant to undergo an examination, particularly of genital and anogenital sites, due to possible discomfort when encountering healthcare professionals. This objective of the study was to determine the acceptability of physical examination and identify the factors that influenced its uptake for the detection of symptomatic STIs among transgender women in Brazil.

Objective 3: Acceptability and usability of self-collected samples for diagnosis of STIs

In the TransOdara research protocol, samples were collected from potential anatomical infection sites, including anorectal, oropharyngeal, genital, and urine samples, for the diagnosis of NG, CT, and HPV. The formative research had an impact on the study design, resulting in participants being offered the choice of self-collection or provider collection. The primary objective of this DrPH study was to assess the acceptability and usability of self-collected samples from potential infection sites for STI testing among transgender women in Brazil. Despite some sampling methods being perceived as more invasive, such as anorectal samples, it was hypothesised that the majority of participants would prefer and opt for self-collection. The study aimed to contribute valuable evidence on the acceptability and usability of self-collection and inform guidance for appropriate sample collection strategies in STI testing interventions for transgender women.

CHAPTER 4: METHODS

4.1 STUDY DESIGN

TransOdara was a multi-centric, cross-sectional STI prevalence study among transgender women 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). The study was conducted from December 2019 to July 2021, with the aim of recruiting a minimum of 1280 transgender women using respondent-driven sampling (RDS) across the five study locations. RDS was considered an appropriate approach for reaching this often hard-to-reach population,[65] based on the principal investigator's previous experience with this sampling method.

To achieve an accurate estimate, the minimum calculated sample size was defined *a priori*, and a standard error for each location was calculated using a method that does not assume a known population size.[66,67] The sample size for each study location was calculated by the principal investigator to estimate the prevalence of active syphilis (considering titres >1:8 on the VDRL), and the sample was proportionally stratified in each of the five study locations, as shown in **Table 4.1**.

Table 4.1 Sample size for each site and its respective standard error

Study location	Sample size	Standard error (%)
Manaus	300	3.7
Salvador	200	4.7
Campo Grande	180	5.0
Porto Alegre	200	4.8
São Paulo	400	3.1

To recruit participants, potential 'seeds' were selected in each study location who were deemed to have strong links to large networks of potential participants. These 'seeds' received six coupons that were distributed to these potential participants, a number established based on previous studies with transgender women in Brazil.[68,69] In addition to leading the recruitment of participants,

the study actively involved individuals who identified with a trans-feminine identity in the design and implementation of the study.

Eligibility criteria included (1) age 18 years or over, (2) assigned male sex at birth and self-reported a feminine gender identity (including *travesti*, woman, trans woman, agender or other female identification), (3) resided in the metropolitan area of one of the five cities, and (4) received a valid study coupon. Those who met these criteria were invited to provide informed consent to participate in the study. Participants were reimbursed for food and transportation expenses. All completed a standard interviewer-led questionnaire for sociodemographic information and responded to numerous questions including gender-affirming procedures, sexual behaviour, STI symptoms in the past six months and at study visit. An additional interviewer-led questionnaire was developed to ask a series of questions before and after sample collection, including open-ended questions about reasons for refusal, choice of sample collection method, and experience of difficulty or discomfort using chosen method (**Annex 3**).

4.2 CLINICAL & LABORATORY PROCEDURES

As part of the study, each participant was asked permission to undergo a physical examination by a study clinician to observe signs of infection, irrespective of any reported symptoms, and could opt-out of all or any examinations. This included (i) general examination of the skin, oropharynx, and axillary and groin lymph nodes (to detect possible signs of syphilis, warts, ulcers, inflammation, and enlarged glands); (ii) genital examination (to detect presence of genital discharge, warts, and ulcers); and (iii) anal examination (to detect presence of anal discharge, warts, and ulcers). Genital examination was based on the genitalia present (penis and scrotum, or a neovagina following surgery).

All participants were asked to provide biological samples voluntarily for STI screening, with the option to refuse any of the tests. Participants were given the choice whether oropharyngeal, anorectal, and genital samples were self-collected or provider-collected. To aid self-collection, instructional diagrams developed specifically for this study, offering guidance on using oropharyngeal,

anorectal, and genital swabs (one diagram for individuals with a penis and another for those with a neovagina), as well as providing urine samples.

CT and NG testing were performed using Abbott RealTime CT/NG assay (Des Plaines, IL, USA) on urine, anorectal, and oropharyngeal samples. Prior research has demonstrated the assay's accuracy for detecting these pathogens at each anatomical site.[45,70] Remaining samples are stored in a freezer at -20ºC degrees in screw cap microtubes and/or in Eppendorf tubes. Neovaginal swabs were not collected for CT and NG testing in this study.

For HPV testing, the Seegene Anyplex II HPV28 Detection assay (Seoul, Republic of Korea) was utilised to detect HPV DNA and identify specific genotypes in swabs from the perianal region and the external genitals. Although the assay's performance has been primarily demonstrated for cervical samples in cis-gender females,[71] it has shown acceptable accuracy in detecting HPV genotypes in the anal canal.[72] This study considered 12 high-risk types (16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59) with sufficient evidence to cause cancer at multiple anatomical sites, as well as 16 other types classified as low-risk.[73]

While outside the scope for this DrPH research project, study participants were also asked to voluntarily provide blood samples for the detection of HIV, syphilis, and hepatitis (A, B, C) viruses. The serological screening procedures and products varied by study location but were performed following the standards set by the Brazilian Ministry of Health and utilising products registered with and regulated by the *Agência Nacional de Vigilância Sanitária* (ANVISA). At all study locations, initial rapid tests were conducted during the study visit. Any reactive results from the rapid test required confirmation with a second immunochromatographic assay and samples were sent to designated laboratory to differentiate a recent infection, where applicable.

Where necessary, participants were referred for treatment based on test results or clinical examinations. Vaccination status was assessed, and participants were referred to receive vaccines as indicated. A flowchart outlining the steps for participation was developed to guide the operationalisation, and standard operational procedures (SOPs) were developed to ensure

homogeneity across the five study locations. For reference, an operational flow diagram developed by the DrPH investigator for the study location in São Paulo is included as **Annex 4**.

4.3 DATA ANALYSIS

All study data, including information from interviewer-led questionnaires and standardised case report forms, were collected as a single entry managed through REDCap electronic data capture tools hosted at the *Faculdade de Ciências Médicas da Santa Casa de São Paulo*.[74,75] Statistical analyses within the DrPH study were conducted using IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA).

The specific analyses differed and are reported separately within each of the three research papers included in this thesis. Demographic and other participant characteristics, such as gender identity, gender-affirmation, experiences of discrimination and violence, recency of sexual partnerships and behaviours, and various health-related characteristics, were ordered from distal to more proximal factors and examined against the respective study variables.

Bivariate comparisons were conducted by calculating odds ratios (OR) and 95% confidence intervals (CI). Factors associated with the variables at *p*-values less than 0.1 in the bivariate analyses were included in a multivariate analysis (MVA) using logistic regression to calculate adjusted odds ratios (AOR) and 95% CI for all included variables. Statistical significance was considered for *p*-values less than 0.05 in the MVA.

For the analysis of valid, open-ended responses to relevant survey questions, the short interviewer-inputted responses were exported into a spreadsheet (Google Sheets) and auto-translated from Portuguese into English using the syntax: GOOGLETRANSLATE(text, “pt”,”en”) in adjacent cell).[76] Thematic coding of individual responses was completed by reviewing the translated responses. In cases where the sentiment of the response was unclear, a native Portuguese speaker was consulted for review. Recurrent themes were assessed by reviewing the thematic codes.

4.4 CONCEPTUAL FRAMEWORK

A conceptual framework was developed to assess the acceptability and usability of SCS from potential infection sites for STI testing among transgender women. This framework was based on the definitions of ‘acceptability’ as related to healthcare interventions and ‘usability’ as described by the International Organization for Standardization (ISO) in relation to systems, products, or services (ISO 9241-11:2018).

Acceptability, in the context of this study, refers to “a multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention.”[77] The ‘multi-faceted’ construct includes seven components: affective attitude, burden, perceived effectiveness, ethicality, intervention coherence, opportunity costs, and self-efficacy. Ensuring that an intervention is acceptable to all intended beneficiaries, respectful of ethics and confidentiality, and sensitive to gender and equity is crucial.

Usability is defined as “the extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.”[78] Within this definition, ‘efficiency’ refers to the “resources used in relation to the results achieved”, ‘satisfaction’ relates to the “extent to which the user's physical, cognitive and emotional responses that result from the use of a system, product or service meet the user’s needs and expectations”, and ‘effectiveness’ pertains to the “accuracy and completeness with which users achieve specified goals”.

Combining ‘accessibility’ and ‘usability’, this comprehensive framework aims to be more encompassing than commonly used constructs like ‘patient preferences’ or ‘user-friendliness’. An intervention deemed accessible and usable can lead to benefits such as improved productivity, enhanced user well-being, and reduced risk of harm or user error, whereas poor accessibility and usability can increase the risk of unintended outcomes.

This study focussed transgender women as the specified users of SCS for STI testing, aiming to provide suitable specimens for accurate test results for CT, NG, and HPV. Three study objectives

were designed to assess the accessibility and usability of SCS: (1) to determine participants' preferred choice of sampling options (SCS or PCS) for anorectal, oropharyngeal, and genital sites, both independently and overall; (2) to determine participants' satisfaction with their chosen sampling option and their preference for future collection; and (3) to assess the accuracy of SCS compared to PCS by analysing the comparability of individual STI results (positivity rate) at the various anatomical sites.

In summary, 'acceptability' was determined by considering participants' choice and satisfaction with their choice, while 'usability' was assessed by considering user satisfaction and the comparability of results. A schematic representation of these three components within the conceptual framework is provided in **Figure 4.1**.

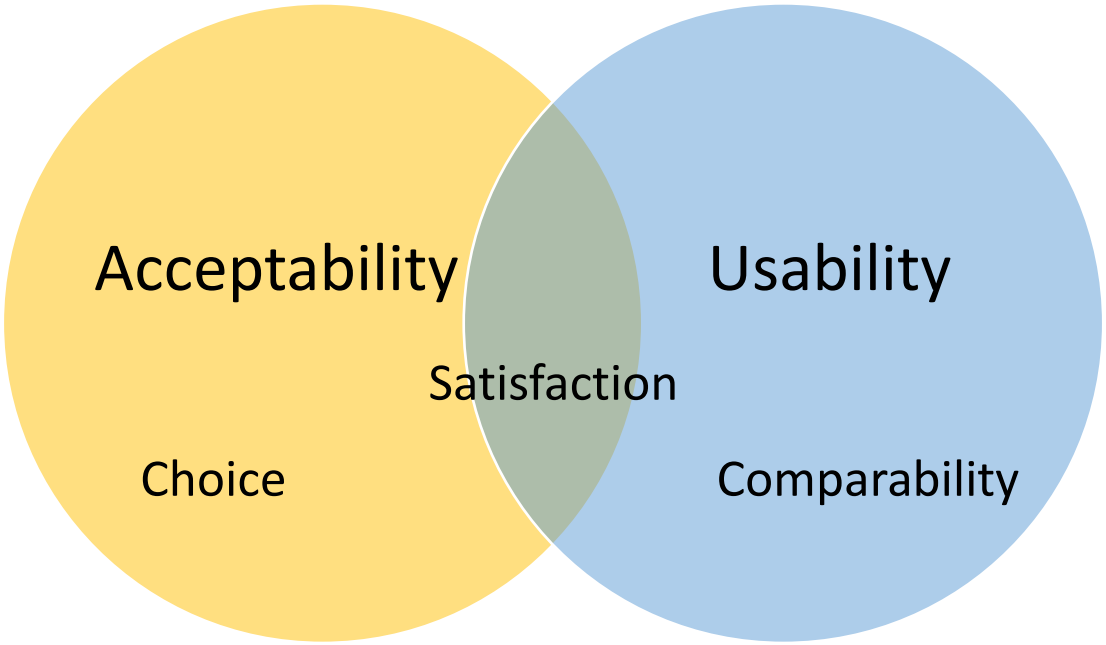


Figure 4.1 Schematic representation of the developed conceptual framework

4.5 ETHICAL ASPECTS

The TransOdara study was approved by the Research Ethics Committee (CEP) of the Santa Casa de Misericórdia de São Paulo, Brazil (CAAE 05585518.7.0000.5479; opinion n°: 3.126.815; 30/01/2019), as well as by the other participating institutions. Secondary data analysis for the DrPH research project was approved by the London School of Hygiene & Tropical Medicine, UK (Ref: 26700; 14/12/2021). Written informed consent was obtained from all individual participants included in the study.

CHAPTER 5: GENERAL FINDINGS

5.1 SOCIO-DEMOGRAPHIC CHARACTERISTICS

A total of 1,345 participants were recruited for the study, with 1,317 meeting the eligibility criteria and included in the analysis. The participants were distributed across five study locations in Brazil: 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 geographic distribution of participants in the five study locations is depicted on a map of Brazil in **Figure 5.1**. The key demographic variables collected in this study are outlined in **Table 5.1**, showing variations observed between the different study locations. Below is an overview of the total study population.

Figure 5.1 Number of participants recruited at each TransOdara study location in Brazil

The age of participants ranged from 18 to 67 years, with a mean age of 32 years and a standard deviation (SD) of 9.86. The median age was 30 years, with an interquartile range (IQR) of 24-38.5. The majority of participants reported a ‘mixed’ ethnicity (44.1%), while similar proportions reported ‘black’ or ‘white’ ethnicity (26.7% and 25.7%, respectively). Over one-third of participants reported no religion (36.3%), with Catholicism being the most report religion (26.4%) followed by Afro-

Brazilian religions (21.8%). The majority reported receiving a secondary-level education (54.2%) or higher (20.8%), with one-quarter reported having no education or only completed primary-level education (25.0%).

Reported in Brazilian Reals (BRL), the mean monthly income of the participants was R1499.32 (approximately US$290), with the median reporting a monthly income of R1045.00 (approx. US$202), and a quarter reporting R600.00 (approx. US$116) or less per month. Employment status varied, with the highest number reporting being unemployed (22.4%), followed by sex workers (21.4%) and self-employed individuals (16.2%). Only a small number reported being employed with a work permit (8.5%).

The majority of participants identified as trans women (56.4%) or *travesti* (29.9%), while very few identified as women (6.5%) or other gender identities (6.3%). Less than one-third (29.1%) reported changing their name on any official document. Over one-quarter (27.4%) reported undergoing some transition-related surgery or procedure, while a very small proportion (1.7%) reported having a neovagina after undergoing surgery to remove their penis and scrotum. Commonly reported procedures included breast augmentation (19.1%), laser hair removal (12.7%), and facial feminisation (4.1%). Almost half of all participants (47.6%) were using gender-affirming hormones.

High levels of discrimination and violence were observed, with the majority reporting that they have ever experienced discrimination (85.5%) or forced sex (51.0%). Almost one-quarter (23.1%) reported ever being arrested. In the past twelve months, participants reported experiencing verbal assault (47.7%), physical assault (16.0%), and discrimination within a health service (30.6%).

Regarding sexual orientation, the majority reported being heterosexual (79.3%), and their partnership status as single (70.1%). In the past six months, less than half reported any regular sex partners (48.8%) or casual sex partners (44.3%). While two-fifths (40.0%) indicated having at least one commercial sex partner in the past six months, most participants reported ever having engaged in transactional sex (64.4%). Almost all (90.7%) reported receptive anal intercourse (RAI) in the past six months, and approximately one-quarter (24.5%) reported any condomless intercourse in the past 72 hours.

Among those who had ever heard about PrEP or post-exposure prophylaxis (PEP) to prevent HIV infection (65.5% and 55.2%, respectively), only a limited number of participants reported ever using PrEP (n=97, 11.9%) or PEP (n=140, 20.2%). Almost half (48.2%) reported ever receiving the vaccine to prevent hepatitis B. Over one-quarter (28.0%) self-reported being HIV-positive, with almost half (47.9%) having ever been diagnosed with syphilis. In the past six months, less than one-quarter reported any STI symptoms (21.2%) or STI diagnosis (18.8%).

Table 5.1 Characteristics of 1,317 transgender women in the TransOdara study

Variable	Campo Grande	Manaus	Porto Alegre	Salvador	São Paulo	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	**n (%)**
Socio-demographic						
Age, years						
<20	7 (3.9)	31 (9.1)	5 (2.6)	14 (6.9)	7 (1.7)	**64 (4.9)**
20-24	39 (21.5)	85 (25.1)	48 (25.0)	57 (28.2)	57 (14.1)	**286 (21.7)**
25-29	56 (30.9)	55 (16.2)	34 (17.7)	54 (26.7)	96 (23.8)	**295 (22.4)**
30-34	20 (11.0)	57 (16.8)	31 (16.1)	24 (11.9)	71 (17.6)	**203 (15.4)**
35-39	21 (11.6)	50 (14.7)	26 (13.5)	22 (10.9)	55 (13.6)	**174 (13.2)**
40-49	17 (9.4)	46 (13.6)	34 (17.7)	18 (8.9)	92 (22.8)	**207 (15.7)**
50+	21 (11.6)	15 (4.4)	14 (7.3)	13 (6.4)	25 (6.2)	**88 (6.7)**
Ethnicity (missing 12)						
Black	38 (22.1)	53 (15.7)	61 (31.8)	107 (53.0)	90 (22.4)	**349 (26.7)**
East Asian	2 (1.2)	12 (3.6)	3 (1.6)	4 (2.0)	5 (1.2)	**16 (2.0)**
Indigenous	1 (0.6)	8 (2.4)	1 (0.5)	2 (1.0)	7 (1.7)	**19 (1.5)**
Mixed	76 (44.2)	204 (60.5)	36 (18.8)	67 (33.2)	192 (47.8)	**575 (44.1)**
White	55 (32.0)	60 (17.8)	91 (47.4)	22 (10.9)	108 (26.9)	**336 (25.7)**
Religion (missing 8)						
Afro-Brazilian	24 (13.6)	38 (11.2)	83 (43.5)	73 (36.1)	68 (17.0)	**286 (21.8)**
Catholic	49 (27.7)	150 (44.4)	26 (13.6)	30 (14.9)	91 (22.7)	**346 (26.4)**
Evangelical/Protestant	18 (10.2)	33 (9.8)	7 (3.7)	6 (3.0)	52 (13.0)	**116 (8.9)**
Judaism	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.5)	**2 (0.2)**
Oriental/Asian	1 (0.6)	1 (0.3)	2 (1.0)	1 (0.5)	4 (1.0)	**9 (0.7)**
Spiritism	14 (7.9)	12 (3.6)	10 (5.2)	4 (2.0)	35 (8.7)	**75 (5.7)**
No religion	71 (40.1)	104 (30.8)	63 (33.0)	88 (43.6)	149 (36.2)	**475 (36.3)**
Education (missing 4)						
None or primary-level	48 (26.8)	77 (22.8)	52 (27.1)	54 (26.9)	97 (24.1)	**328 (25.0)**
Secondary-level	89 (49.7)	196 (58.0)	87 (45.3)	107 (53.2)	233 (57.8)	**712 (54.2)**
Higher-level	42 (23.5)	65 (19.2)	53 (27.6)	40 (19.9)	73 (18.1)	**273 (20.8)**
Monthly income (BRL) (missing 120)						
0-499	16 (9.4)	62 (23.0)	28 (15.3)	34 (18.4)	44 (11.3)	**184 (15.4)**
500-999	21 (12.4)	73 (27.1)	34 (18.6)	63 (34.1)	90 (23.1)	**281 (23.5)**
1000-1499	50 (29.4)	67 (24.9)	52 (28.4)	36 (19.5)	120 (30.8)	**325 (27.2)**
1500-1999	24 (14.1)	25 (9.3)	17 (9.3)	14 (7.6)	54 (13.8)	**134 (11.2)**

2000-2499	18 (10.6)	23 (8.6)	17 (9.3)	15 (8.1)	39 (10.0)	**112 (9.4)**
2500-4999	30 (17.6)	13 (4.8)	28 (15.3)	17 (9.2)	32 (8.2)	**120 (10.0)**
5000+	11 (6.5)	6 (2.2)	7 (3.8)	6 (3.2)	11 (2.8)	**41 (3.4)**
Occupation (missing 7)						
Employed with work permit	9 (5.0)	15 (4.5)	17 (8.9)	10 (5.0)	60 (14.9)	**111 (8.5)**
Employed without work permit	23 (12.8)	56 (16.8)	10 (5.2)	21 (10.4)	40 (9.9)	**150 (11.5)**
Self-employed	19 (10.6)	40 (12.0)	45 (23.6)	54 (26.7)	54 (13.4)	**212 (16.2)**
Irregular work	5 (2.8)	38 (11.4)	7 (3.7)	21 (10.4)	39 (9.7)	**110 (8.4)**
Retired / on benefits	6 (3.3)	7 (2.1)	9 (4.7)	0 (0.0)	8 (2.0)	**30 (2.3)**
Sex worker	55 (30.6)	42 (12.6)	38 (19.9)	58 (28.7)	87 (21.6)	**280 (21.4)**
Student	4 (2.2)	3 (0.9)	10 (5.2)	4 (2.0)	29 (7.2)	**50 (3.8)**
Unemployed	27 (15.0)	117 (35.0)	49 (25.7)	32 (15.8)	69 (17.1)	**294 (22.4)**
Other occupation	32 (17.8)	16 (4.8)	6 (3.1)	2 (1.0)	17 (4.2)	**73 (5.6)**
Housing (missing 2)						
Owns house or apartment	45 (25.0)	51 (15.1)	64 (32.8)	71 (35.1)	113 (28.0)	**343 (26.1)**
Rents house or apartment	60 (33.3)	83 (24.6)	66 (34.4)	93 (46.)	178 (44.2)	**480 (36.5)**
Temporarily with friends or family	61 (33.9)	162 (47.9)	50 (26.0)	28 (13.9)	42 (10.4)	**343 (26.1)**
Other housing arrangement	14 (7.8)	42 (12.4)	13 (6.8)	10 (5.0)	70 (17.4)	**149 (11.3)**
Gender-affirmation						
Gender identity (missing 3)						
Trans woman	78 (43.3)	175 (51.6)	97 (50.8)	128 (63.7)	263 (65.3)	**741 (56.4)**
Travesti	60 (33.3)	151 (44.5)	48 (25.1)	39 (19.4)	95 (23.6)	**393 (29.9)**
Woman	12 (6.7)	4 (1.2)	21 (11.0)	22 (10.9)	39 (9.7)	**98 (7.5)**
Transsexual	9 (5.0)	0 (0.0)	18 (9.4)	7 (3.5)	4 (1.0)	**38 (2.9)**
Non-binary	20 (11.1)	6 (1.8)	6 (3.1)	5 (2.5)	1 (0.2)	**38 (2.9)**
Other identity	1 (0.6)	3 (0.9)	1 (0.5)	0 (0.0)	1 (0.2)	**6 (0.5)**
Name changed on any official document (missing 2)						
No	136 (75.6)	310 (91.4)	109 (56.8)	149 (73.8)	228 (56.7)	**932 (70.9)**
Yes	44 (24.4)	29 (8.6)	83 (43.2)	53 (26.2)	174 (43.3)	**383 (29.1)**
Any gender-affirming transition procedure (missing 8)						
No	139 (77.2)	320 (95.8)	98 (51.3)	161 (80.1)	232 (57.6)	**950 (72.6)**
Yes	41 (22.8)	14 (4.2)	93 (48.7)	40 (19.9)	171 (42.4)	**359 (27.4)**
Reported lower surgery (missing 5)						
No	180 (100.0)	333 (99.4)	187 (97.4)	200 (99.0)	390 (96.8)	**1290 (98.3)**
Yes	0 (0.0)	2 (0.6)	5 (2.6)	2 (1.0)	13 (3.2)	**22 (1.7)**
Use of gender-affirming hormones (current) (missing 190)						
No	88 (61.5)	160 (62.3)	82 (51.6)	76 (40.9)	185 (48.4)	**591 (52.4)**
Yes	55 (38.5)	97 (37.7)	77 (48.4)	110 (59.1)	197 (51.6)	**536 (47.6)**

Discrimination & violence						
Ever experienced discrimination (missing 7)						
No	33 (18.4)	51 (15.1)	23 (12.0)	35 (17.3)	48 (12.0)	**190 (14.5)**
Yes	146 (81.6)	286 (84.9)	169 (88.0)	167 (82.7)	352 (88.0)	**1120 (85.5)**
Ever experienced forced sex (missing 8)						
No	98 (54.4)	178 (53.3)	88 (46.1)	88 (43.8)	190 (47.1)	**642 (49.0)**
Yes	82 (45.6)	156 (46.7)	103 (53.9)	113 (56.2)	213 (52.9)	**667 (51.0)**
Ever arrested (missing 9)						
No	129 (72.1)	252 (74.6)	152 (80.0)	161 (80.1)	312 (78.0)	**1006 (76.9)**
Yes	50 (27.9)	86 (25.4)	38 (20.0)	40 (19.9)	88 (22.0)	**302 (23.1)**
Experienced verbal assault (past 12 months) (missing 13)						
No	91 (50.8)	201 (60.7)	82 (42.7)	107 (53.2)	201 (50.1)	**682 (52.3)**
Yes	88 (49.2)	130 (39.3)	110 (57.3)	94 (46.8)	200 (49.9)	**622 (47.7)**
Experienced physical assault (past 12 months) (missing 9)						
No	145 (80.6)	278 (83.5)	161 (83.9)	175 (87.5)	340 (84.4)	**1099 (84.0)**
Yes	35 (19.4)	55 (16.5)	31 (16.1)	25 (12.5)	63 (15.6)	**209 (16.0)**
Experienced discrimination in health service (past 12 months) (missing 8)						
No	123 (69.1)	236 (70.2)	129 (67.5)	152 (75.2)	269 (66.9)	**909 (69.4)**
Yes	55 (30.9)	100 (29.8)	62 (32.5)	50 (24.8)	133 (33.1)	**400 (30.6)**
Sexuality & partnerships						
Sexual orientation (missing 10)						
Asexual	1 (0.6)	0 (0.0)	1 (0.5)	0 (0.0)	1 (0.2)	**3 (0.2)**
Bisexual	20 (11.2)	15 (4.4)	18 (9.5)	10 (5.0)	22 (5.5)	**85 (6.5)**
Heterosexual	107 (59.8)	293 (86.7)	127 (66.8)	164 (82.4)	345 (86.0)	**1036 (79.3)**
Homosexual	34 (19.0)	23 (6.8)	17 (8.9)	7 (3.5)	16 (4.0)	**97 (7.4)**
Pansexual	15 (8.4)	6 (1.8)	26 (13.7)	18 (9.0)	16 (4.0)	**81 (6.2)**
Other	2 (1.1)	1 (0.3)	1 (0.5)	0 (0.0)	1 (0.2)	**5 (0.4)**
Partnership status (missing 4)						
Single	132 (73.7)	259 (76.6)	127 (66.5)	143 (70.8)	259 (64.3)	**920 (70.1)**
Dating	20 (11.2)	42 (12.4)	35 (18.3)	27 (13.4)	58 (14.4)	**182 (13.9)**
Married or co-habitat	19 (10.6)	35 (10.4)	23 (12.0)	30 (14.9)	82 (20.3)	**189 (14.4)**
Separate, divorced or widowed	8 (4.5)	2 (0.6)	6 (3.1)	2 (1.0)	4 (1.0)	**22 (1.7)**
Ever engaged in transactional sex (missing 361)						
No	48 (42.9)	96 (33.9)	52 (40.0)	54 (38.8)	90 (30.8)	**340 (35.6)**
Yes	64 (57.1)	187 (66.1)	78 (60.0)	85 (61.2)	202 (69.2)	**616 (64.4)**
Any commercial sex partner (past 6 months) (missing 9)						
No	89 (49.4)	261 (77.7)	89 (46.8)	102 (50.7)	244 (60.8)	**785 (60.0)**
Yes	91 (50.6)	75 (22.3)	101 (53.2)	99 (49.3)	157 (39.2)	**523 (40.0)**
Any regular sex partner (past 6 months) (missing 5)						
No	91 (50.8)	233 (69.1)	83 (43.2)	82 (40.8)	183 (45.4)	**672 (51.2)**
Yes	88 (49.2)	104 (30.9)	109 (56.8)	119 (59.2)	220 (54.6)	**640 (48.8)**

Any casual sex partner (past 6 months) (missing 10)						
No	94 (52.2)	228 (68.1)	77 (40.3)	99 (49.0)	230 (57.6)	**728 (55.7)**
Yes	86 (47.8)	107 (31.9)	114 (59.7)	103 (51.0)	169 (42.4)	**579 (44.3)**
Any receptive anal intercourse (past 6 months) (missing 247)						
No	14 (8.9)	14 (6.6)	20 (11.2)	20 (11.0)	31 (9.1)	**99 (9.3)**
Yes	143 (91.1)	198 (93.4)	158 (88.8)	162 (89.0)	310 (90.9)	**971 (90.7)**
Any condomless intercourse (last 72 hours) (missing 9)						
No	141 (80.1)	238 (70.4)	149 (78.4)	153 (75.7)	306 (76.1)	**987 (75.5)**
Yes	35 (19.9)	100 (29.6)	41 (21.6)	49 (24.3)	96 (23.9)	**321 (24.5)**
Health & STIs						
Reported HIV status (at study visit) (missing 166)						
Negative	117 (73.6)	194 (75.2)	84 (48.0)	135 (81.3)	299 (76.1)	**829 (72.0)**
Positive	42 (26.4)	64 (24.8)	91 (52.0)	31 (18.7)	94 (23.9)	**322 (28.0)**
Ever used HIV pre-exposure prophylaxis (PrEP) (missing 41)						
No	96 (86.5)	106 (88.3)	101 (87.1)	127 (90.7)	288 (87.8)	**718 (88.1)**
Yes	15 (13.5)	14 (11.7)	15 (12.9)	13 (9.3)	40 (12.2)	**97 (11.9)**
Ever used HIV post-exposure prophylaxis (PEP) (missing 27)						
No	83 (80.6)	73 (89.0)	87 (81.3)	80 (83.3)	231 (75.5)	**554 (79.8)**
Yes	20 (19.4)	9 (11.0)	20 (18.7)	16 (16.7)	75 (24.5)	**140 (20.2)**
Ever received HBV vaccine (missing 235)						
No	52 (43.3)	239 (75.6)	60 (40.8)	71 (46.4)	139 (40.2)	**561 (51.8)**
Yes	68 (56.7)	77 (24.4)	87 (59.2)	82 (53.6)	207 (59.8)	**521 (48.2)**
Ever diagnosed with syphilis (missing 60)						
No	93 (52.8)	189 (63.9)	82 (43.2)	117 (58.8)	174 (43.9)	**655 (52.1)**
Yes	83 (47.2)	107 (36.1)	108 (56.8)	82 (41.2)	222 (56.1)	**602 (47.9)**
Any STI diagnosis (past 6 months) (missing 39)						
No	141 (81.0)	285 (88.8)	146 (77.2)	165 (84.2)	301 (75.6)	**1038 (81.2)**
Yes	33 (19.0)	36 (11.2)	43 (22.8)	31 (15.8)	97 (24.4)	**240 (18.8)**
Any STI symptoms (past 6 months) (missing 18)						
No	135 (76.7)	306 (93.6)	124 (64.9)	150 (74.3)	308 (76.4)	**1023 (78.8)**
Yes	41 (23.3)	21 (6.4)	67 (35.1)	52 (25.7)	95 (23.6)	**276 (21.2)**
Any STI symptoms (at study visit) (missing 18)						
No	164 (94.3)	283 (83.5)	167 (88.4)	178 (89.4)	337 (84.7)	**1129 (82.6)**
Yes	10 (5.7)	56 (16.5)	22 (11.6)	21 (10.6)	61 (15.3)	**170 (13.1)**

5.2 STI SYMPTOMS AND CLINICAL SIGNS

During the interviewer-led questionnaire, participants were asked about any STI-related symptoms they have experienced in the past six months from a list of potential symptoms. Overall, approximately one-fifth (19.5%) reported having any STI symptoms in the past six months, with the most common symptoms being painful urination (7.0%), itching (6.9%), anogenital ulcers (4.8%), and anogenital warts (4.7%) (**Table 5.2, A**). This question did not explicitly differentiate between anorectal and genital discharge, ulcers or warts.

Participants were also asked about any symptoms they were experiencing during the study visit, with 13.1% reporting some form of STI symptom. Among the individual symptoms reported, anorectal warts (6.5%) and extragenital lesions (2.1%) were the most frequent. Combined, anorectal symptoms (9.1%) and anogenital warts (7.9%) were the most commonly reported symptoms at the study visit (**Table 5.2, B**).

Among participants who consented to a genital (42.3%) or anorectal (42.1%) examination during the study visit, clinicians detected signs of infection in 17.6% of participants. The most frequently observed sign was anorectal or genital warts (12.6% and 3.0%, respectively), with anogenital warts being identified in 15.6% of the examined participants. However, extragenital lesions were not included in the clinical reporting form. Overall, only a small number of other signs were identified among the examined participants (**Table 5.2, C**).

Concordance of the self-reported symptoms at the study visit with the noted clinical signs is presented in **Table 5.3**. With the exception of anogenital warts, confirmation by a clinician during examination was observed for fewer than half of the self-reported symptoms at the study visit, with no additional signs being identified.

Table 5.2 Self-reported symptoms in past six months (A) and at study visit (B) by participants, and identified signs by clinician (C) at study visit

A. Self-reported symptoms in past 6 months	
Symptom	n/N (%)
Genital discharge	31/1299 (2.4)
Anogenital ulcers	63/1299 (4.8)
Anogenital warts	61/1299 (4.7)
Small bubbles/vesicles	35/1299 (2.7)
Itching	91/1299 (6.9)
Pain urinating	94/1299 (7.0)
Other symptoms	39/1299 (3.0)
Any of listed above (exc. Other)	253/1299 (19.5)
Any symptom (inc. Other)	276/1299 (21.2)

B. Self-reported symptoms at study visit	
Symptom	n/N (%)
Anorectal discharge	18/1309 (1.4)
Anorectal ulcer	26/1308 (2.0)
Anorectal wart	85/1309 (6.5)
Extragenital lesion	27/1301 (2.1)
Genital ulcer	13/1310 (1.0)
Genital wart	26/1310 (2.0)
Urethral discharge	9/1309 (0.7)
Any anogenital discharge	24/1309 (1.8)
Any anogenital ulcer	37/1308 (2.8)
Any anogenital wart	103/1310 (7.9)
Any anogenital ulcer or extragenital lesion	61/1299 (4.7)
Any anorectal symptom	119/1307 (9.1)
Any symptom	170/1299 (13.1)

C. Identified signs by clinician at study visit	
Clinical sign	n/N (%)
Anorectal discharge	5/547 (0.9)
Anorectal ulcer	3/546 (0.5)
Anorectal wart	69/547 (12.6)
Genital ulcer	4/533 (0.8)
Genital wart	16/540 (3.0)
Urethral discharge	2/540 (0.4)
Any anogenital discharge	7/519 (1.3)
Any anogenital ulcer	7/514 (1.4)
Any anogenital wart	83/533 (15.6)
Any anorectal sign	74/546 (13.6)
Any clinical sign	93/529 (17.6)

Table 5.3 Concordance of self-reported symptoms by participants and identified signs by clinician at study visit

	Self-reported symptom at study visit	
Identified sign by clinician at study visit	**Yes**	**No**
	n/N (%)	n/N (%)
Anorectal discharge	5/12 (41.7)	0/534 (0.0)
Anorectal ulcer	3/17 (17.6)	0/529 (0.0)
Anorectal wart	50/60 (83.3)	19/486 (3.9)
Genital ulcer	4/11 (36.4)	0/534 (0.0)
Genital wart	11/17 (64.7)	5/535 (0.9)
Urethral discharge	2/5 (40.0)	0/539 (0.0)

5.3 PREVALENCE OF NG AND CT

The overall prevalence of NG and CT at any anatomical site was 13.6% (95%CI: 11.8-15.7) and 11.9% (95%CI: 10.2-13.9), respectively. The combined prevalence of NG and/or CT infection was 21.6% (95%CI: 19.3-24.0). Prevalence varied across the five study locations, with the highest NG prevalence (19.5%) found in Manaus and the highest CT prevalence (17.0%) found in Salvador (**Table 5.4**). This same table appears in **Research Paper 2**.

Table 5.4 Prevalence of NG and CT by infection 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)**

In anatomical site-specific analysis, the highest prevalence was observed for anorectal NG (9.1%, 95%CI: 7.6-10.8) and anorectal CT (8.9%, 95%CI: 7.3-10.6), followed by oropharyngeal NG (8.1%, 95%CI: 6.6-9.7) and oropharyngeal CT (3.2%, 95%CI: 2.3-4.4), and lowest for urogenital CT (0.7%, 95%CI: 0.3-1.3) and urogenital NG (0.2%, 95%CI: 0.0-0.6). The proportion of cases with multi-site infections was higher for NG (25.7%, n=43) compared to CT (7.5%, n=11). Most participants with NG/CT infection did not report any symptoms at the study visit (85.2%, n=225/264), with asymptomatic infections slightly more prevalent for NG (85.6%, n=143/167) than CT (84.0%, n=121/144). Further analysis of anorectal NG/CT is detailed in **Research Paper 2**.

5.4 PREVALENCE OF HPV

The prevalence of HPV at anorectal and genital (penile or neovaginal) sites was 86.5% (95%CI: 84.4-88.4) and 53.8% (95%CI: 50.9-56.7) respectively (**Table 5.5**). This encompassed the detection of 12 high-risk HPV types at anorectal (66.2%, 95%CI: 63.4-68.8) and genital (32.2%, 95%CI: 29.5-34.9) sites, along with 16 low-risk HPV types at anorectal (72.9%, 95%CI: 78.2-82.8) and genital (44.7%, 95%CI: 41.8-47.6) sites.

Among individuals with a neovagina who underwent HPV testing, the prevalence was 60.0% (n=9/15), encompassing both high-risk (33.3%, n=5/15) and low-risk (53.3%, n=8/15) HPV types detected.

Little variation in HPV prevalence was observed across the five study locations (**Table 5.5**). The overall anorectal HPV prevalence ranged from the lowest in Salvador (83.5%) to the highest in Porto Alegre (87.7%), while overall genital HPV ranged from the lowest in Campo Grande (52.0%) to the highest in Salvador (57.0%). A comprehensive risk-factor analysis for HPV infection was not included as part of this DrPH research project.

Among those reporting symptoms of anorectal warts, both low-risk HPV (92.7%, n=76/82) and high-risk types (73.2%, n=60/82) were detected. Similarly, among those with clinically observed anorectal warts, both low-risk HPV (94.1%, n=64/68) and high-risk types (75.0%, n=51/68) were identified.

For anorectal HPV, the identified HPV types are outlined in **Table 5.6**. The most frequently detected oncogenic type in anal lesions (HPV 16) was found in 19.8% (n=236/1191) of the tested participants. Among those who were tested, 42.4% (n=505/1191) and 63.1% (n=752/1191) exhibited any of the HPV types that are preventable through available quadrivalent or nonavalent vaccination, respectively.

Table 5.5 Prevalence of HPV (high-risk [**HR**] and low-risk [**LR**]) by anatomical site and study location among transgender women in Brazil

	Anorectal			**Genital**		
	HR	**LR**	**Any**	**HR**	**LR**	**Any**
Study location	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)	n/N (%)
Campo Grande	79/148 (53.4)	118/148 (79.7)	126/148 (85.1)	47/152 (30.9)	60/152 (39.5)	79/152 (52.0)
Manaus	221/330 (67.0)	261/330 (79.1)	287/330 (87.0)	109/329 (33.1)	156/329 (47.4)	184/329 (55.9)
Porto Alegre	118/171 (69.0)	142/171 (83.0)	150/171 (87.7)	52/169 (30.8)	83/169 (49.1)	93/169 (55.0)
Salvador	112/164 (68.3)	128/164 (78.0)	137/164 (83.5)	42/158 (26.6)	80/158 (50.6)	90/158 (57.0)
São Paulo	258/378 (68.3)	311/378 (82.3)	330/378 (87.3)	128/367 (34.9)	146/367 (39.8)	186/367 (50.7)
Total	**788/1191 (66.2)**	**960/1191 (80.6)**	**1030/1191 (86.5)**	**378/1175 (32.2)**	**525/1175 (44.7)**	**632/1175 (53.8)**

Table 5.6 Detected HPV types at anorectal site among 1,191 tested participants

HPV type	**n/N**	**%**
HPV6	261/1191	21.9
HPV11	91/1191	7.6
HPV16	236/1191	19.8
HPV18	142/1191	11.9
HPV6/11	318/1191	26.7
HPV16/18	313/1191	26.3
HPV6/11/16/18 (*quadrivalent*)	505/1191	42.4
HPV6/11/16/18/31/33/45/52/58 (*nonavalent*)	752/1191	63.1

5.5 SUMMARY OF KEY FINDINGS

- Approximately one-fifth (19.5%) of participants reported experiencing any STI symptom in the past six months, while 13.1% reported such symptoms during the study visit, with anorectal symptoms being the most commonly reported (9.1%).
- Clinicians observed signs of infection in 17.6% of examined participants, with anogenital warts being the most frequently observed (15.6%).
- Prevalence of NG, CT, and either NG/CT at any anatomical site was 13.6%, 11.9%, and 21.6%, respectively.
- The highest observed prevalence was anorectal NG (9.1%), anorectal CT (8.9%), and oropharyngeal NG (8.1%), followed by oropharyngeal CT (3.2%), urogenital CT (0.7%), and urogenital NG (0.2%).
- Most participants with either NG or CT infection did not report any symptoms during the study visit (85.2%), with asymptomatic infections slightly higher for NG (85.6%) than CT (84.0%).
- The prevalence of HPV at anorectal and genital sites was 86.5% and 53.8% respectively, with high-risk HPV types detected at anorectal (66.2%) and genital (32.2%) sites.
- At the anorectal site, HPV-16 was detected in approximately one-fifth (19.8%) of tested participants, known for its association with anal cancer yet vaccine-preventable.

CHAPTER 6: Prevalence of anorectal STIs, symptoms, signs and syndromes

6.1 INTRODUCTION

Recognising the significance of anorectal STIs among transgender women, as highlighted earlier, a comprehensive analysis was conducted with a specific focus on anorectal NG and CT. This analysis included the examination of associated risk factors, as well as the prevalence of anorectal symptoms and clinical signs.

Considering that syndromic management offers a treatment approach targeting the pathogens most commonly responsible for anorectal symptoms, including NG and CT, a theoretical assessment of various management approaches for anorectal discharge or syndromes previously published by the WHO (refer to **Annex 5**) was completed.

These results of this analysis are presented in a manuscript submitted to the journal *Sexually Transmitted Infections*, and are included as **Research Paper 2**.

6.2 RESEARCH PAPER 2: Anorectal gonorrhoea and chlamydia among transgender women in Brazil: prevalence and assessment of performance and cost of anorectal infection detection and management approaches

RESEARCH PAPER COVER SHEET

Please note that a cover sheet must be completed for each research paper included within a thesis.

SECTION A – Student Details

Student ID Number	155857	**Title**	
First Name(s)	Daniel		
Surname/Family Name	McCartney		
Thesis Title	Clinical epidemiology of STIs among transgender women in Brazil		
Primary Supervisor	Philippe Mayaud		

If the Research Paper has previously been published please complete Section B, if not please move to Section C.

SECTION B – Paper already published

Where was the work published?			
When was the work published?			
If the work was published prior to registration for your research degree, give a brief rationale for its inclusion			
Have you retained the copyright for the work?*	Choose an item.	Was the work subject to academic peer review?	Choose an item.

SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	Sexually Transmitted Infections
Please list the paper's authors in the intended authorship order:	Daniel Jason McCartney, Carla Gianna Luppi, Roberto José Carvalho da Silva, Sandra de Araújo, Katia Cristina Bassichetto, Philippe Mayaud, Maria Amélia Veras
Stage of publication	**Undergoing revision**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Planning, analysis, interpretation of results, and primary author of paper

SECTION E

Student Signature	[redacted]
Date	14 August 2023

Supervisor Signature	[redacted]
Date	14 August 2023

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

Word count: 2,955

Authors: **Daniel Jason McCartney** (0000-0002-4557-2358) [1], **Carla Gianna Luppi** (0000-0001-9183-8594)[2], **Roberto José Carvalho da Silva** (0000-0001-9186-0206)[2], **Sandra de Araújo** (0000-0003-3546-6372)[2], **Katia Cristina Bassichetto** (0000-0003-3645-025X)[3,4], **Philippe Mayaud** (0000-0001-5730-947X)[1], **Maria Amélia Veras** (0000-0002-1159-5762)[3,4], for the TransOdara Research Group*

[1] Department of Clinical Research, Faculty of Infectious & Tropical Diseases, London School of Hygiene & Tropical Medicine, London, United Kingdom

[2] Centro de Referência e Treinamento em DST/Aids – Secretaria de Estado da Saúde de São Paulo, São Paulo, Brazil

[3] Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo, Brazil

[4] Núcleo de Pesquisa e Direitos Humanos em Saúde da População LGBT+, São Paulo, Brazil

*Membership of the TransOdara Research Group is provided in the Acknowledgements.

Corresponding Author:

Daniel Jason McCartney (http://orcid.org/0000-0002-4557-2358)

Department of Clinical Research, Faculty of Infectious & Tropical Diseases

London School of Hygiene & Tropical Medicine

Keppel Street, London WC1E 7HT, United Kingdom

daniel.mccartney@lshtm.ac.uk

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 multi-centric, cross-sectional STI prevalence study among 1,317 transgender women conducted in five capital cities representing all Brazilian regions. Participants aged ≥18y 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 pre-determined management algorithms based on 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 tested algorithms ranged from 1.4-5.1% (highest for treatment based on reported anorectal discharge or ulcer and receptive anal intercourse (RAI) in past 6 months) and specificity from 98.0-99.3% (highest for treatment based on 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 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.

Key words: *Neisseria gonorrhoeae* (NG), *Chlamydia trachomatis* (CT), anorectal infections, transgender women, treatment algorithms, Brazil

KEY MESSAGES

What is already known on this topic:

STIs 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 World Health Organization (WHO) advocates use of anorectal syndromic management of symptomatic cases, but this approach and others have not been evaluated in trans 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 expand access 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 (MSM), 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 World Health Organization (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 [HSV], syphilis, and/or lymphogranuloma venereum [LGV]).

In Brazil, the national STI guidelines published in 2022 recommend bi-annual screening for the detection of anorectal NG and CT for all people with “receptive anal practice without barrier protection” (i.e., 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 6.3-12.3% and 4.2-20.2%, 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 multi-centric, 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 1,280.

Eligibility criteria included (1) age $\geq$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 six 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 (i) general examination, (ii) genital examination, and (iii) 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, IL, 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 utilising 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 odds ratios (OR), 95% confidence intervals (CI), 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 significance over statistical significance. Any reported estimates are descriptive and should be interpreted with caution to avoid 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 to confirmed anorectal NG/CT infection by calculating OR. We used IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA) for statistical analyses. Reporting was informed by the recommendations within the STROBE-RDS guidelines.[26]

Algorithms performance and costs

The validity and cost-effectiveness of seven management algorithms (**Box 1**) and presumptive treatment of the entire 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 over-treatment rate (proportion of non-infected patients who received treatment, which is equal to 1 - specificity) were also estimated.

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:

1. **S1 + R1**: Patient reports anorectal discharge (S1) **and** RAI in past 6 months (R1)
2. **S1 + E1**: Patient reports anorectal discharge (S1) **and** treated only if anorectal discharge is seen.
3. **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]
4. **S2 + R1**: Patient reports anorectal symptom (S2) **and** RAI in past 6 months (R1)
5. **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]
6. **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.
7. **(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]

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 **Supplemental Table 1**.

RESULTS

Study population

A total of 1,317 participants aged 18 to 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] 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 six 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 *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (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: 11.8-15.7), 11.9% (95%CI: 10.2-13.9), and 21.6% (95%CI: 19.3-24.0), respectively.

In anatomical site-specific analysis, the most observed infections were anorectal NG (9.1%, 95%CI: 7.6-10.8) and anorectal CT (8.9%, 95%CI: 7.3-10.6), followed by oropharyngeal NG (8.1%, 95%CI: 6.6-9.7) and oropharyngeal CT (3.2%, 95%CI: 2.3-4.4), and lowest for urogenital CT (0.7%,

95%CI: 0.3-1.3) and urogenital NG (0.2%, 95%CI: 0.0-0.6). 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: 19.3-33.1) rather than CT (7.5%, 95%CI: 3.8-13.1) infections.

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

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*

Prevalence of 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: 1.4-9.6) or anorectal ulcer

(OR=2.5, 95%CI: 1.0-6.2) had higher odds of anorectal NG/CT infection, and this was more likely for CT rather than NG (**Supplemental Table 2, A**).

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: 1.2-46.2) or anorectal warts (OR=2.2, 95%CI: 1.0-4.7) had higher odds of anorectal NG infection, but not CT (**Supplemental Table 2, B**). 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 risk-based algorithms (R1: RAI in past 6 months; R2: any STI symptoms in 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 algorithm (E1: confirmed anorectal discharge), and two of the combined algorithms (S1+E1: reports anorectal discharge and confirmed by exam; 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 over-treatment rate of non-infected patients (100.0%). Presumptive treatment based on reporting RAI in the past six months (R1) had a slightly lower sensitivity (95.5%) with low specificity (9.7%) and moderate PPV (16.3%), leading to the second highest over-treatment rate (90.3%).

Presumptive treatment based on reporting any STI symptoms in the past six months (R2) had a much lower sensitivity (30.1%) but higher specificity (80.1%) and PPV (21.4%) for a lower over-treatment 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 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 2, B**), 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 six 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.

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

A. Algorithms	Total (N)	% exam	NG/CT infections (n)	Cases positive by algorithm	Sensitivity/ Specificity (%)	PPV/NPV (%)	Accuracy/ Over-treatment (%)	Cost range per true case treated ($)[1]
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 anorectal discharge (AD)	1236	0	7	18	3.7/99.0	38.9/85.2	84.5/1.0	2.78-4.40
S2: Reports anorectal discharge or ulcer (ADU)	1234	0	11	37	5.9/97.5	29.7/85.3	83.6/2.5	3.63-5.75
Risk-based								
R1: Reports receptive anal intercourse (RAI) 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 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								
E1: Confirms anorectal discharge (AD)	535	100	2	5	2.4/99.3	40.0/84.7	84.3/0.7	537.70-1341.78
E2: Confirms anorectal discharge or ulcer (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 ($)[2]
A1: All transgender women (presumptive screening)	1241	100	15.2	0				67.04-133.62
Risk-based screening approaches								
R1: Reports receptive anal intercourse (RAI) past 6 months	1009	91.1	16.3	0.7				62.35-124.24
R2: Reports any STI symptoms past 6 months	1223	21.4	21.4	10.6				47.87-95.28

NPV: negative predictive value; **PPV**: positive predictive value

[1] Lower cost estimate: $2.00 for each exam, 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 exam, and $1.71 treatment for each case positive by algorithm based on anticipated change to NG/CT treatment recommendation.
[2] 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.
* Performance measures for screening approaches are not indicated as the data reflects the actual positivity rate of the sample.

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 of anorectal STIs among transgender women conducted by Van Gerwen *et al* (2020),[9] and other recent studies.[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 not suitable, which aligns with study by Pitasi *et al* (2019) that suggested anorectal or oropharyngeal infections be missed by urogenital screening alone.[14] 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.[30] While a number of other rapid POC tests for NG and CT are in development,[31] 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.

STATEMENTS

Acknowledgements

The TransOdara study was coordinated by the Faculdade de Ciências Médicas da Santa Casa de São Paulo, in collaboration with the Centro de Referência e Treinamento em DST/Aids (CRT DST/AIDS), Universidade Federal do Rio Grande do Sul (UFRGS), Universidade Federal da Bahia (UFBA), Universidade Federal do Mato Grosso do Sul (UFMS), Fundação Leônidas e Maria Deane (Fiocruz – Manaus), Secretaria Municipal e de Saúde de Porto Alegre (SMS- POA), Instituto Adolfo Lutz (IAL), and the Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA). The authors would like to thank the TransOdara study participants and the TransOdara Research Group. Contributing members of the TransOdara Research Group included the following: Maria Amélia de S.M. Veras, Maria Inês Costa Dourado, Thiago Pinheiro, Ana Rita C. Motta Castro, Andrea Fachel Leal, Bruno Puccinelli, Carla Gianna Luppi, Claudia Renata dos Santos Barros, Daniela Knauth, Daniel McCartney, Philippe Mayaud, Roberto Carvalho, Katia Cristina Bassichetto, Maria Aparecida da Silva, Rita Bacuri, Thiago Pestana, Laio Magno, Sandra Brasil, Luisa Lina Villa, Willi McFarland, Erin Wilson, Mariana Veloso, Alícia Kruger, Ana Roberta Patti Pascon, Adele Benzaken, Maria Luíza Bazzo, Gwenda Hughes, Carmem Freitas Oliveira, Luis Fernando Brígido, Regina Célia Moreira, Adriana Parise Compri, Edilene Peres Real da Silveira, Elaine Lopes de Oliveira, Marcia Jorge Castejon, Neuza Satomi Sato, Rosemeire Yamashiro; Sandra Araújo, Mara Cristina Scheffer, Lisléia Golfetto, Dariana Pimentel Gomes Hübner, Patrícia Puccinelli Orlandi Nogueira, Leonardo Soares Bastos, Francisco Inácio Bastos, Sandro Leonardo Martins Sperandei, Camila Mattos dos Santos. Preliminary results from this manuscript were presented as an oral presentation at the 23rd IUSTI World Congress in Victoria Falls, Zimbabwe (4-7 Sep 2022).

Contributors

Daniel Jason McCartney: planning, analysis, interpretation of results, and writer of the paper; Carla Gianna Luppi: study conception, planning and execution, interpretation of results, and reviewing of the paper; Roberto José Carvalho da Silva: data collection, interpretation of results, and writing of the paper; Sandra de Araújo: data collection, interpretation of results, and reviewing of the paper; Katia

Cristina Bassichetto: monitoring and evaluating quality of data collected, interpretation of results, and writing of the paper; Philippe Mayaud: study conception, analysis, interpretation of results, and writing of the paper; Maria Amélia Veras: study conception, planning and execution, interpretation of results, and writing of the paper. All authors approved the final submitted manuscript.

Funding

The TransOdara study was funded by the Pan American Health Organization (PAHO) and the Ministry of Health of Brazil – Department of Chronic Conditions and Sexually Transmitted Infections (DCCI) (Agreement n°: SCON2019-00162). The first author (DJM) received a Doctoral Project Travelling Scholarship from the London School of Hygiene & Tropical Medicine, UK.

Competing interests

None declared.

Ethics approval

The TransOdara study was approved by the Research Ethics Committee (CEP) of the Santa Casa de Misericórdia de São Paulo, Brazil (CAAE 05585518.7.0000.5479; opinion n°: 3.126.815; 30/01/2019), as well as by other participating institutions. Secondary data analysis (by first author) was approved by the London School of Hygiene & Tropical Medicine, UK (Ref: 26700; 14/12/2021). Written consent was obtained from all individuals who participated in the study. Individuals who identified with a trans-feminine identity were involved in the design and implementation of the study, and led the recruitment of participants using respondent-driven sampling (RDS).

Data availability statement

Extracted data are available on request to the corresponding author.

REFERENCES

1. World Health Organization (WHO). Consolidated guidelines on HIV, viral hepatitis and STI prevention, diagnosis, treatment and care for key populations. Geneva: WHO, 2022. Available: https://apps.who.int/iris/handle/10665/360601.

2. de Vries HJC, Nori AV, Kiellberg Larsen H, *et al*. 2021 European Guideline on the management of proctitis, proctocolitis and enteritis caused by sexually transmissible pathogens. *J Eur Acad Dermatol* 2021;35:1434–43.

3. World Health Organization (WHO). Guidelines for the management of symptomatic sexually transmitted infections. Geneva: WHO, 2021. Available: https://apps.who.int/iris/handle/10665/342523.

4. World Health Organization, Regional Office for South-East Asia (WHO-SEAR). Management of Sexually Transmitted Infections - Regional Guidelines. New Delhi: WHO-SEAR, 2011. Available: https://apps.who.int/iris/handle/10665/205471.

5. World Health Organization (WHO). Guidelines: prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender populations: recommendations for a public health approach 2011. Geneva: WHO, 2011. Available: https://apps.who.int/iris/handle/10665/44619.

6. Ministério da Saúde (Brasil). Protocolo Clínico e Diretrizes Terapêuticas para Atenção Integral às Pessoas com Infecções Sexualmente Transmissíveis [Clinical Protocol and Therapeutic Guidelines for Comprehensive Care for People with Sexually Transmitted Infections]. Brasília: Ministério da Saúde, 2022. Available: http://bvsms.saude.gov.br/bvs/publicacoes/protocolo_clinico_atecao_integral_ist.pdf

7. Poteat T, Scheim A, Xavier J, *et al*. Global epidemiology of HIV infection and related syndemics affecting transgender people. *J Acquir Immune Defic Syndr* 2016;72(Suppl 3):S210–9.

8. MacCarthy S, Poteat T, Xia Z, *et al*. Current research gaps: A global systematic review of HIV and sexually transmissible infections among transgender populations. *Sex Health* 2017;14(5):456–68.

9. Van Gerwen OT, Jani A, Long DM, *et al*. Prevalence of Sexually Transmitted Infections and Human Immunodeficiency Virus in Transgender Persons: A Systematic Review. *Transgend Health* 2020;5(2):90–103.

10. Kojima N, Park H, Konda KA, *et al*. The PICASSO Cohort: baseline characteristics of a cohort of men who have sex with men and male-to-female transgender women at high risk for syphilis infection in Lima, Peru. *BMC Infect Dis* 2017;17:255.

11. Leon SR, Segura ER, Konda KA, *et al*. High prevalence of Chlamydia trachomatis and Neisseria gonorrhoeae infections in anal and pharyngeal sites among a community-based sample of men who have sex with men and transgender women in Lima, Peru. *BMJ Open* 2016;6:e008245.

12. Stephens SC, Bernstein KT, Philip SS. Male to female and female to male transgender persons have different sexual risk behaviors yet similar rates of STDs and HIV. *AIDS Behav* 2011;15:683–6.

13. Hiransuthikul A, Janamnuaysook R, Sungsing T, et al. High burden of chlamydia and gonorrhoea in pharyngeal, rectal and urethral sites among Thai transgender women: implications for anatomical site selection for the screening of STI. *Sex Transm Infect* 2019;95:534-539.

14. Pitasi MA, Kerani RP, Kohn R, et al. Chlamydia, Gonorrhea, and Human Immunodeficiency Virus Infection Among Transgender Women and Transgender Men Attending Clinics that Provide Sexually Transmitted Disease Services in Six US Cities: Results From the Sexually Transmitted Disease Surveillance Network. *Sex Transm Dis* 2019;46(2):112-117.

15. Heckathorn DD. Respondent-driven sampling: a new approach to the study of hidden populations. *Soc Probl* 1997;44(2):174-99.

16. Dourado I, da Silva LAV, Magno L, *et al*. Building bridges: the practice of interdisciplinarity. PopTrans Study: a study with transvestites and transgender women in Salvador, Bahia, Brazil. *Cad Saude Publica* 2016;32(9):1–11.

17. Bastos FI, Bastos LS, Coutinho C, *et al*. HIV, HCV, HBV, and syphilis among transgender women from Brazil. *Medicine (Baltimore)* 2018;97(1S Suppl 1):S16–24.

18. Harris PA, Taylor R, Thielke R, *et al*. Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42(2):377–81.

19. Harris PA, Taylor R, Minor BL, *et al*. The REDCap consortium: Building an international community of software partners. *J Biomed Inform* 2019;95:103208.

20. Gaydos CA, Cartwright CP, Colaninno P, *et al*. Performance of the Abbott RealTime CT/NG for Detection of Chlamydia trachomatis and Neisseria gonorrhoeae. *J Clin Microbiol* 2010;48:3236–43.

21. Adamson PC, Pandori MW, Doernberg SB, *et al*. Analytical Evaluation of the Abbott RealTime CT/NG Assay for Detection of Chlamydia trachomatis and Neisseria gonorrhoeae in Rectal and Pharyngeal Swabs. *J Mol Diagn* 2020;22:811–16.

22. Johnston LG, Hakim AJ, Dittrich S, et al. A Systematic Review of Published Respondent-Driven Sampling Surveys Collecting Behavioral and Biologic Data. *AIDS Behav* 2016;20(8):1754-76.

23. Salganik MJ, Heckathorn DD. Sampling and estimation in hidden populations using respondent-driven sampling. *Sociol Methodol* 2004;34(1):193-240.

24. Avery L, Rotondi N, Mcknight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: results from a simulation study. *BMC Med Res Methodol* 2019;19.

25. Sperandei S, Bastos LS, Ribeiro-Alves M, Reis A, Bastos FI. Assessing logistic regression applied to respondent-driven sampling studies: a simulation study with an application to empirical data. *Int J Soc Res Methodol* 2023;26:319–33.

26. White RG, Hakim AJ, Salganik MJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology for respondent-driven sampling studies: “STROBE-RDS” statement. *J Clin Epidemiol* 2015;68:1463-71.

27. Korenromp EL, Wi T, Resch S, *et al*. Costing of National STI Program Implementation for the Global STI Control Strategy for the Health Sector, 2016-2021. *PLoS One* 2017;12:e0170773.

28. UNICEF. Supply catalogue [online]. 2022. Available: https://supply.unicef.org/ [Accessed 02 Dec 2022].

29. Santos PMRD, Santos KCD, Magalhães LS, *et al*. Travestis and transsexual women: who are at higher risk for sexually transmitted infections? *Rev Bras Epidemiol* 2021;24:e210017.

30. Carrara S, Hernandez JDG, Uziel AP, *et al*. Body construction and health itineraries: a survey among travestis and trans people in Rio de Janeiro, Brazil. *Cad Saude Publica* 2019;35(4):e00110618.

31. Wi TE, Ndowa FJ, Ferreyra C, *et al*. Diagnosing sexually transmitted infections in resource-constrained settings: challenges and ways forward. *J Int AIDS Soc* 2019;22(Suppl 6):e25343.

32. Adamson PC, Loeffelholz MJ, Klausner JD. Point-of-Care Testing for Sexually Transmitted Infections: A Review of Recent Developments. *Arch Pathol Lab Med* 2020;144:1344–51.

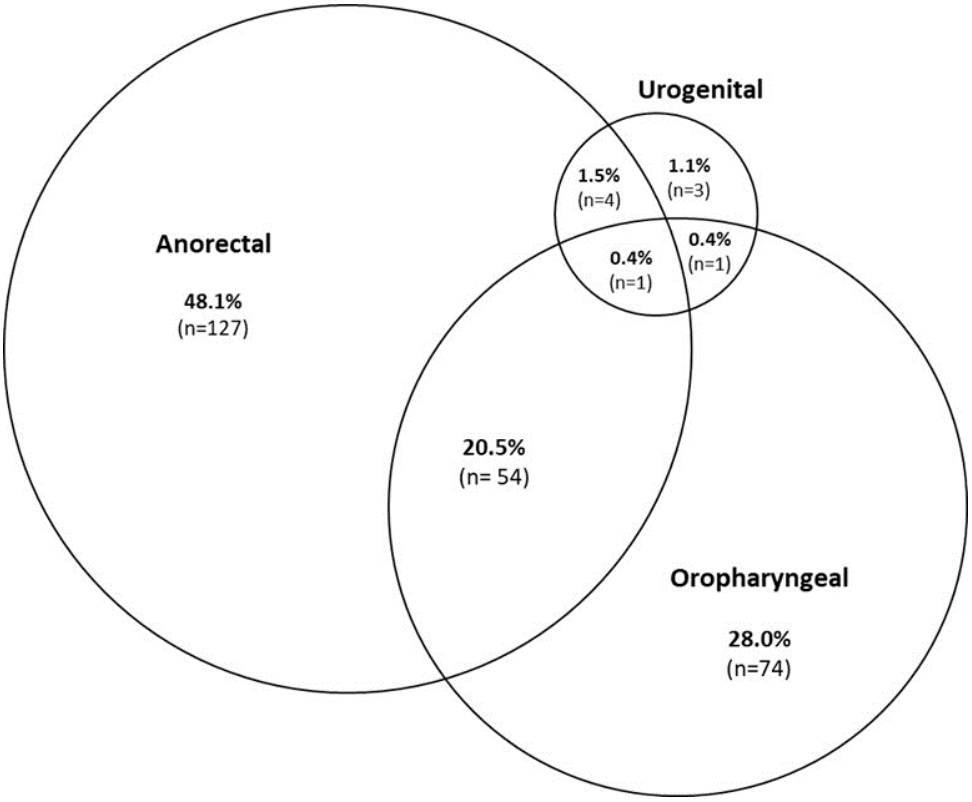


Figure 1. NG/CT infection by anatomical sites among study participants with results from all three sites (N=264)

Supplemental Table 1. Unit costs (2022 US$) of treatment and diagnostic commodities for anorectal discharge (NG+CT)

A. Treatment (Tx)	Dose	Tx duration (days)	Cost per dose*	Cost per Tx	25% procurement	Total cost of Tx	Exam cost	Cost of Tx +exam
(1) Lower cost scenario:								
Ceftriaxone 250 mg, IM +	1	1	0.67	0.86	0.22	1.08	2.00	3.08
Azithromycin 1 g, orally	1	1	0.19					
(2) Upper cost scenario:								
Ceftriaxone 1 g, IM +	1	1	0.81	1.37	0.34	1.71	5.00	6.71
Doxycycline 100 mg, orally	2	7	0.04					
B. Diagnostics						**Tx cost**	**Test cost**	**Cost of Tx + test**
(3) Lower cost scenario:								
NAAT + Tx scenario 1						1.08	10.00	11.08
(4) Upper cost scenario:								
NAAT + Tx scenario 2						1.71	20.00	21.71

CT: *Chlamydia trachomatis*; **IM**: intramuscular injection; **NAAT**: nucleic acid amplification test; **NG**: *Neisseria gonorrhoeae*

[1] Lower cost estimate: $2.00 for each exam, and $1.08 treatment for each case positive by algorithm based on current WHO (2021) NG/CT treatment recommendations.
[2] Upper cost estimate: $5.00 for each exam, and $1.71 treatment for each case positive by algorithm based on anticipated change to NG/CT treatment recommendation.
[3] Lower cost estimate: $10.00 for each test (NAAT) and $1.08 treatment for each positive test based on current WHO (2021) NG/CT treatment recommendations.
[4] Upper cost estimate: $20.00 for each test (NAAT) and $1.71 treatment for each positive test based on anticipated change to NG/CT treatment recommendation.

*Unit costs obtained from UNICEF (US$ in 2022),[1] using the combination of drugs recommended for first line treatment by WHO in 2021, with consideration on anticipated changes in the forthcoming guidelines.[2]

References

1. UNICEF. Supply catalogue [online]. 2022. Available: https://supply.unicef.org/ [Accessed 02 Dec 2022].
2. World Health Organization (WHO). Guidelines for the management of symptomatic sexually transmitted infections. Geneva: WHO, 2021. Available: https://apps.who.int/iris/handle/10665/342523

Supplemental Table 2. Self-reported symptoms (A) and observed signs by clinician (B) at study visit and associated anorectal NG/CT infection

A. Symptoms		NG			CT			NG/CT		
		n/N (%)	OR (95%CI)	*p*-value	n/N (%)	OR (95%CI)	*p*-value	n/N (%)	OR (95%CI)	*p*-value
Anorectal discharge	No	109/1220 (8.9)	1.00 (-)	-	104/1218 (8.5)	1.00 (-)	-	180/1218 (14.8)	1.00 (-)	-
	Yes	4/18 (22.2)	2.91 (0.94-9.00)	0.063	5/18 (27.8)	**4.12 (1.44-11.8)**	**0.008**	7/18 (38.9)	**3.67 (1.40-9.59)**	**0.008**
Anorectal ulcer	No	110/1214 (9.1)	1.00 (-)	-	104/1212 (8.6)	1.00 (-)	-	180/1212 (14.9)	1.00 (-)	-
	Yes	3/23 (13.0)	1.51 (0.44-5.15)	0.514	5/23 (21.7)	**2.96 (1.08-8.13)**	**0.035**	7/23 (30.4)	**2.51 (1.02-6.18)**	**0.046**
Anorectal wart	No	103/1156 (8.9)	1.00 (-)	-	103/1154 (8.9)	1.00 (-)	-	173/1154 (15.0)	1.00 (-)	-
	Yes	10/82 (12.2)	1.42 (0.71-2.84)	0.321	6/82 (7.3)	0.81 (0.34-1.90)	0.620	14/82 (17.1)	1.17 (0.64-2.12)	0.612
Anorectal discharge or ulcer	No	108/1199 (9.0)	1.00 (-)	-	101/1197 (8.4)	1.00 (-)	-	176/1197 (14.7)	1.00 (-)	-
	Yes	5/37 (13.5)	1.58 (0.60-4.14)	0.353	8/37 (21.6)	**2.99 (1.33-6.72)**	**0.008**	11/37 (29.7)	**2.45 (1.19-5.06)**	**0.015**
Any anorectal symptom	No	99/1123 (8.8)	1.00 (-)	-	97/1121 (8.7)	1.00 (-)	-	165/1121 (14.7)	1.00 (-)	-
	Yes	14/113 (12.4)	1.46 (0.81-2.66)	0.211	12/113 (10.6)	1.25 (0.67-2.36)	0.483	22/113 (19.5)	1.40 (0.86-2.30)	0.181
B. Clinical signs		**NG**			**CT**			**NG/CT**		
		n/N (%)	OR (95%CI)	*p*-value	n/N (%)	OR (95%CI)	*p*-value	n/N (%)	OR (95%CI)	*p*-value
Anorectal discharge	No	43/530 (8.1)	1.00 (-)	-	54/530 (10.2)	1.00 (-)	-	81/530 (15.3)	1.00 (-)	-
	Yes	2/5 (40.0)	**7.55 (1.23-46.42)**	**0.029**	1/5 (20.0)	2.20 (0.24-20.07)	0.483	2/5 (40.0)	3.70 (0.61-22.46)	0.156
Anorectal ulcer	No	45/531 (8.5)	-	-	54/531 (10.2)	1.00 (-)	-	82/531 (15.4)	1.00 (-)	-
	Yes	0/3 (0.0)	-	-	1/3 (33.3)	4.42 (0.39-49.52)	0.228	1/3 (33.3)	2.74 (0.25-30.54)	0.413
Anorectal wart	No	35/469 (7.5)	1.00 (-)	-	51/469 (10.9)	1.00 (-)	-	71/469 (15.1)	1.00 (-)	-
	Yes	10/66 (15.2)	**2.21 (1.04-4.72)**	**0.039**	4/66 (6.1)	0.53 (0.19-1.51)	0.235	12/66 (18.2)	1.25 (0.64-2.45)	0.523
Anorectal discharge or ulcer	No	43/526 (8.2)	1.00 (-)	-	53/473 (10.1)	1.00 (-)	-	80/526 (15.2)	1.00 (-)	-
	Yes	2/8 (25.0)	3.74 (0.73-19.12)	0.113	2/8 (25.0)	2.98 (0.59-15.11)	0.189	3/8 (37.5)	3.35 (0.78-14.27)	0.103
Any anorectal sign	No	34/463 (7.3)	1.00 (-)	-	49/463 (10.6)	1.00 (-)	-	69/463 (14.9)	1.00 (-)	-
	Yes	11/71 (15.5)	**2.31 (1.11-4.81)**	**0.025**	6/71 (8.5)	0.78 (0.32-1.89)	0.583	14/71 (19.7)	1.40 (0.74-2.66)	0.299

CT: *Chlamydia trachomatis*; **CI**: Confidence Interval; **NG**: *Neisseria gonorrhoeae*; **OR**: Odds Ratio

6.3 RISK FACTOR ANALYSIS

Further analysis explored the potential factors associated with anorectal NG/CT infections, including demographic and other characteristics. This included gender identity and gender-affirmation, experiences of discrimination and violence, recency of sexual partnerships and behaviours, and other health-related characteristics considered important from the literation and in Brazil. The findings are summarised in **Table 6.1**.

Bivariate analysis identified variables potentially associated with a higher odds of anorectal NG/CT infection. These included individuals aged 18-24 years compared to those aged ≥25 years (OR=2.2, 95%CI: 1.6-3.0), engagement in transactional sex (OR=1.8, 95%CI: 1.2-2.8), commercial sex partner in past 6 months (OR=1.5, 95%CI: 1.1-2.0), receptive anal intercourse in past 6 months (OR=2.3, 95%CI: 1.1-5.1), condomless intercourse in past 72 hours (OR=2.1, 95%CI: 1.5-2.9), and any STI symptoms in the past 6 months (OR=1.7, 95%CI: 1.2-2.5). A potential protective effect emerged among those who reported changing their name in official documents for gender affirmation (OR=0.6, 95%CI: 0.4-0.9), undergoing any gender-affirming transition procedure (OR=0.7, 95%CI: 0.5-1.0), and using of gender-affirming hormones (OR=0.7, 95%CI: 0.5-1.0). Notably, variables not associated with NG/CT infection in this analysis included reported gender identity and HIV status.

Multivariate analysis included variables with a *p*-value <0.1 from the bivariate analysis. The findings revealed two variables that sustained an association with anorectal NG/CT infection: age 18-24 vs. ≥25 years (AOR=3.1, 95%CI: 1.7-5.5, $p<0.001$), and recent condomless intercourse (AOR=2.5, 95%CI: 1.4-4.3, $p=0.001$). Moreover, the potentially protective effect persisted for those who changed their name in official documents for gender-affirmation (AOR=0.4, 95%CI: 0.2-0.9, $p=0.051$).

Anorectal infections shared similar risk factors with HIV and other STIs, including condomless receptive anal intercourse and commercial sex partnerships.[19,27,35] Unlike HIV, the highest prevalence was among young transgender individuals,[27] with no observed difference based on gender identity (i.e. '*travesti*' were not at higher risk).[25]

Table 6.1 Risk factors associated with anorectal NG/CT infection among transgender women in Brazil

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Study location			***0.009***		
São Paulo	49/392 (12.5)	1.00 (-)	-	1.00 (-)	-
Campo Grande	15/172 (8.7)	0.67 (0.36-1.23)	0.195	0.47 (0.15-1.47)	0.195
Manaus	63/334 (18.9)	1.63 (1.08-2.44)	**0.019**	1.78 (0.87-3.65)	0.113
Porto Alegre	29/179 (16.2)	1.35 (0.82-2.23)	0.233	1.13 (0.49-2.62)	0.773
Salvador	32/163 (19.6)	1.71 (1.05-2.79)	**0.031**	1.04 (0.46-2.37)	0.926
Age, years					
18-24	77/329 (23.4)	2.20 (1.59-3.04)	**<0.001**	3.08 (1.72-5.53)	**<0.001**
≥25	111/911 (12.2)	1.00 (-)	-	1.00 (-)	-
Ethnicity			*0.368*		
Black	57/321 (17.8)	1.00 (-)	-		
Mixed	79/545 (14.5)	0.79 (0.54-1.14)	0.203		
White	42/321 (13.1)	0.70 (0.45-1.08)	0.102		
Other[1]	8/42 (19.0)	1.09 (0.48-2.48)	0.837		
Religion			*0.104*		
No religion	74/446 (16.6)	1.00 (-)	-		
Afro-Brazilian	46/263 (17.5)	1.07 (0.71-1.60)	0.758		
Catholic	48/333 (14.4)	0.85 (0.57-1.26)	0.408		
Other[2]	19/191 (9.9)	0.56 (0.33-0.95)	0.031		
Education			*0.146*		
None or primary	54/302 (17.9)	1.57 (0.98-2.51)	0.063		
Secondary	101/672 (15.0)	1.27 (0.83-1.95)	0.269		
Higher-level	32/262 (12.2)	1.00 (-)	-		
Housing			*0.378*		
Owns house or apartment	41/318 (12.9)	1.00 (-)	-		
Rents house or apartment	70/450 (15.6)	1.25 (0.82-1.89)	0.302		
Temporarily with friends or family	58/333 (17.4)	1.43 (0.92-2.20)	0.109		
Other[3]	19/137 (13.9)	1.09 (0.61-1.95)	0.778		
Gender identity			*0.554*		
Trans woman	112/724 (15.5)	1.00 (-)	0.291		
Travesti	60/377 (15.9)	1.03 (0.74-1.46)	0.847		
Woman	11/96 (11.5)	0.71 (0.37-1.37)	0.353		
Other identity	4/40 (10.0)	0.61 (0.21-1.74)	0.353		
Name changed in any official document					
No	148/871 (17.0)	1.00 (-)	-	1.00 (-)	-
Yes	39/367 (10.6)	0.58 (0.40-0.85)	**0.005**	0.51 (0.26-1.00)	0.051
Any gender-affirming transition procedure					
No	148/892 (16.6)	1.00 (-)	-	1.00 (-)	-
Yes	39/340 (11.5)	0.66 (0.45-0.95)	**0.026**	1.33 (0.65-2.72)	0.703
Use of gender-affirming hormones (current)					
No	92/560 (16.4)	1.00 (-)	-	1.00 (-)	-
Yes	59/502 (11.8)	0.68 (0.48-0.96)	**0.030**	0.70 (0.40-1.22)	0.204
Experienced physical assault (past 12 months)					
No	150/1036 (14.5)	1.00 (-)	-		
Yes	37/196 (18.9)	1.38 (0.92-2.05)	0.117		

Ever engaged in transactional sex					
No	31/322 (9.6)	1.00 (-)	-	1.00 (-)	-
Yes	94/577 (16.3)	1.83 (1.19-2.81)	**0.006**	1.20 (0.62-2.34)	0.584
Any commercial sex partner (past 6 months)					
No	97/736 (13.2)	1.00 (-)	-	1.00 (-)	-
Yes	91/495 (18.4)	1.48 (1.09-2.03)	**0.013**	1.50 (0.81-2.78)	0.198
Any casual sex partner (past 6 months)					
No	98/682 (14.4)	1.00 (-)	-		
Yes	89/548 (16.2)	1.16 (0.85-1.58)	0.364		
Any regular sex partner (past 6 months)					
No	95/639 (14.9)	1.00 (-)	-		
Yes	91/596 (15.3)	1.03 (0.76-1.41)	0.844		
Any receptive anal intercourse (past 6 months)					
No	7/90 (7.8)	1.00 (-)	-	1.00 (-)	-
Yes	150/919 (16.3)	2.31 (1.05-5.10)	**0.038**	2.06 (0.58-7.29)	0.263
Any condomless intercourse (past 72 hours)					
No	116/931 (12.5)	1.00 (-)	-	1.00 (-)	-
Yes	70/304 (23.0)	2.10 (1.51-2.92)	**<0.001**	2.47 (1.44-4.25)	**0.001**
Received hepatitis B vaccine					
No	88/526 (16.7)	1.00 (-)	-		
Yes	65/491 (13.2)	0.76 (0.54-1.08)	0.120		
Reported HIV status					
Negative	108/784 (13.8)	1.00 (-)	-		
Positive	44/301 (14.6)	1.07 (0.73-1.57)	0.720		
Any STI symptoms (past 6 months)					
No	130/961 (13.5)	1.00 (-)	-	1.00 (-)	-
Yes	56/262 (21.4)	1.74 (1.23-2.46)	**0.002**	1.66 (0.89-3.10)	0.111

AOR: Adjusted Odds Ratio; **CI**: Confidence Interval; **OR**: Odds Ratio

*Variables with ***p*-value** (in bold) were <0.1 in bivariate analysis and included in MVA, where statistical significance was considered $p<0.05$.

[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

6.4 ADDITIONAL COST SCENARIO

An additional cost scenario was estimated for the screening and treatment of anorectal NG/CT utilising a theoretical rapid, point-of-care (POC) test. This scenario operated under the assumption of the WHO's recommended minimum sensitivity (80%) and specificity (90%) for a quality-assured rapid test (**Table 6.2**).[39] Using rapid POC tests, the cost per true case of anorectal NG/CT infection treated varied across screening strategies: from targeting solely those who reported any STI symptom in the past six months ($18.89-31.36) to screening all transgender women ($26.47-43.96). In contrast to the projected cost scenarios presented earlier in **Research Paper 2**, these speculative screening scenarios using rapid POC tests exhibited a similarity to most syndromic approaches that incorporate clinical examination.

Table 6.2 Performance of management approaches using rapid, point-of-care (POC) test for the detection and treatment of anorectal NG/CT infections

Screening approaches using rapid POC test	Total (N)	% exam	Cases positive by algorithm	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	Over-treatment (%)	Cost per true case treated ($)[1]	Cost per true case treated ($)[2]
A1: All transgender women (presumptive screening)	1240	100	256	80.3	90.0	59.0	96.2	88.5	10.0	26.47	43.96
Risk-based screening approaches											
R1: Reports receptive anal intercourse (RAI) past 6 months	1009	91.1	197	80.0	90.0	60.9	95.8	88.4	10.0	24.75	41.10
R2: Reports any STI symptoms past 6 months	1223	21.4	65	80.4	90.2	69.2	94.4	88.1	9.8	18.89	31.36

NPV: negative predictive value; **PPV**: positive predictive value

1 Lower cost estimate: $3.00 for each test (rapid POC) and $1.08 for each positive test based on current WHO (2021) NG/CT treatment recommendations

2 Upper cost estimate: $5.00 for each test (rapid POC) and $1.71 treatment for each positive test based on anticipated change to CT treatment recommendation

6.4 SUMMARY OF KEY FINDINGS

- High prevalence of anorectal NG (9.1%), CT (8.9%), and combined NG and/or CT (15.2%) infections was observed among study participants.
- An increased likelihood of anorectal infections was observed among younger transgender women (18-24 years) in comparison to those aged 25 years and older.
- Anorectal NG and CT infections were largely asymptomatic, with a minimal number of participants reporting related symptoms or observed to have any clinical signs (87.6% and 88.9%, respectively).
- Accurate diagnosis requires multi-site anatomical sampling and testing due to the predominance of asymptomatic infections. Relying solely on urine samples alone is inadequate for this population.
- Syndromic management remains an option for symptomatic patients, however, it has lower sensitivity (ranging from 1.4 to 5.1%) and does not apply to asymptomatic individuals.
- The cost per true case treated for most syndromic management approaches involving clinical examination ($18.32-53.49) showed similarities to screening and treatment based on a hypothetical rapid POC test ($18.89-43.96), with laboratory-based screening and treatment approaches ($47.87-133.62) slightly exceeding.
- There is an urgent need for affordable and high-performance POC tests suitable for anorectal specimens to enhance accessibility to NG/CT diagnostic testing and treatment.

CHAPTER 7: Uptake of physical examination for detection of STIs

7.1 INTRODUCTION

While the findings in **Research Paper 2** suggested the removal of clinical examination to confirm anorectal discharge for improved performance and cost-effectiveness, clinical examination continues to be a fundamental aspect of global guidelines for the syndromic management of STIs. Usually, it is conducted simultaneously with the collection of samples for STI testing by healthcare providers. As such, it was important to assess the acceptability and factors associated with the uptake of physical examination among transgender women. In the TransOdara study, the opportunity for physical examination (comprising general, genital, and anorectal examination) by a study clinician was offered to identify any clinical signs and symptoms of STIs.

The uptake and acceptability of examining each anatomical site are outlined in a manuscript submitted for inclusion in a Supplement for the TransOdara study, which is under review by the *Revista Brasileira de Epidemiologia (Brazilian Journal of Epidemiology*), and included as **Research Paper 3**.

7.2 RESEARCH PAPER 3: Uptake of physical examination for the detection of sexually transmitted infections among transgender women in Brazil

RESEARCH PAPER COVER SHEET

Please note that a cover sheet must be completed <u>for each</u> research paper included within a thesis.

<u>SECTION A – Student Details</u>

Student ID Number	155857	**Title**	
First Name(s)	Daniel		
Surname/Family Name	McCartney		
Thesis Title	Clinical epidemiology of STIs among transgender women in Brazil		
Primary Supervisor	Philippe Mayaud		

If the Research Paper has previously been published please complete Section B, if not please move to Section C.

<u>SECTION B – Paper already published</u>

Where was the work published?			
When was the work published?			
If the work was published prior to registration for your research degree, give a brief rationale for its inclusion			
Have you retained the copyright for the work?	Choose an item.	Was the work subject to academic peer review?	Choose an item.

<u>SECTION C – Prepared for publication, but not yet published</u>

Where is the work intended to be published?	Revista Brasileira de Epidemiologia (Brazilian Journal of Epidemiology) – Supplement for TransOdara Study
Please list the paper's authors in the intended authorship order:	Daniel Jason McCartney, Layana Guedes Carvalhal, Camila de Albuquerque Moraes, Philippe Mayaud, Maria Amélia Veras
Stage of publication	**Submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Planning, analysis, interpretation of results, and primary author of paper

SECTION E

Student Signature	[redacted]
Date	14 August 2023

Supervisor Signature	[redacted]
Date	14 August 2023

Title: Uptake of physical examination for the detection of sexually transmitted infections among transgender women in Brazil

Short Title: Uptake of physical examination among trans women in Brazil

Word count: 2,892

Authors: Daniel Jason McCartney (0000-0002-4557-2358)[1], Layana Guedes Carvalhal (0000-0002-9498-5917)[2], Camila de Albuquerque Moraes (0000-0003-0424-7249)[2], Philippe Mayaud (0000-0001-5730-947X)[1], Maria Amélia Veras (0000-0002-1159-5762)[3,4]

[1] Faculty of Infectious & Tropical Diseases, London School of Hygiene & Tropical Medicine, London, United Kingdom

[2] Centro de Referência e Treinamento em DST/Aids – Secretaria de Estado da Saúde de São Paulo, São Paulo, Brazil

[3] Núcleo de Pesquisa e Direitos Humanos em Saúde da População LGBT+, São Paulo, Brazil

[4] Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo, Brazil

Acknowledgments:

The TransOdara study was coordinated by the Faculdade de Ciências Médicas da Santa Casa de São Paulo, in collaboration with the Centro de Referência e Treinamento em DST/Aids (CRT DST/AIDS) and the Instituto Adolfo Lutz at the Secretaria de Estado da Saúde de São Paulo, São Paulo, Brazil.

Conflicts of Interest:

Nothing to declare.

Financial Support:

This study was funded by the Pan American Health Organization (PAHO) and the Ministry of Health of Brazil – Department of Chronic Conditions and Sexually Transmitted Infections (DCCI) (Agreement

n°: SCON2019-00162). The first author (DJM) received a Doctoral Project Travelling Scholarship from the London School of Hygiene & Tropical Medicine, UK.

Authors' contribution:

Daniel Jason McCartney: planning, analysis, interpretation of results, and writer of the paper; Layana Guedes Carvalhal: data collection, interpretation of results, and writing of the paper; Camila de Albuquerque Moraes: data collection, interpretation of results, and writing of the paper; Philippe Mayaud: study conception, analysis, interpretation of results, and writing of the paper; Maria Amélia Veras: study conception, planning and execution, interpretation of results, and writing of the paper. All authors approved the final submitted manuscript.

ABSTRACT

Objective: Physical examination remains key to the management of symptomatic sexually transmitted infections (STIs). Transgender women often lack access to STI care due to stigma and discrimination and may be reluctant to undergo examination. This study aimed to determine the acceptability and the factors associated with uptake of physical examination for the detection of symptomatic STIs by transgender women in Brazil.

Methods: TransOdara was a multi-centric, cross-sectional STI prevalence study conducted among transgender women in five capital cities representing all Brazilian regions. Self-identified transgender women aged ≥18 years were recruited using respondent driven sampling, completed a standard questionnaire, were offered a physical examination, and blood, oropharyngeal, anorectal and genital samples were collected and tested for various STIs. Factors enabling examination uptake were investigated by reviewing demographic characteristics of participants who gave permission for physical examination (general, genital, and anorectal), with qualitative analysis of data collected on participant experience of examination.

Results: Most participants (65.4%, 95%CI:62.7-68.0) gave permission for a general examination (including oropharyngeal), with fewer permitting genital (42.3%, 95%CI:39.6-46.0) or anorectal (42.1%, 95%CI:39.4-44.9) examinations. Overall, 34% of participants refused all examinations. Factors associated with the uptake of examination included study location, older age, religion, and higher education. Participants with STI symptoms were significantly more likely to give permission for examination (OR=3.60, 95%CI:2.4-5.5) than asymptomatic participants.

Conclusion: In the context of STI management, the decision to conduct focused anatomical examination should be based on history taking, presenting symptoms, and current anatomy. In addition, individuals accessing STI services may benefit from the option of self-collecting samples, where not yet established as the standard of care.

Key words:

Transgender, Physical Examination, Sexually Transmitted Infections (STI), Patient Preferences and Values, Quality of Health Care, Brazil

Introduction

Physical examination remains key to the management of sexually transmitted infections (STIs), along with sexual history taking, to help determine the general status of a patient's sexual health, to confirm symptoms described by the patient, to identify signs of infection, and to guide any further investigations or treatment required.

STI syndromic management is based on identifying consistent groups of symptoms and easily recognized signs (i.e., syndromes), and providing treatment that will take care of the most serious pathogens responsible for producing the specific syndrome.[1] Following medical and sexual history taking, the examination typically focuses on the anogenital region and includes a general examination aimed to detect potential manifestations of STIs. Anogenital examinations are inherently intrusive and can be particularly intimidating or unsettling, especially for patients who experience dysphoria with their bodies, experienced past mistreatment from health care providers, or experienced violence, including sexual violence, in other contexts.[2,3]

Research conducted in Brazil affirms a high level of exposure to violence, stigma, and discrimination by transgender women, which significantly constrains access to public health and social services.[4,5] Findings from a large survey in São Paulo have indicated that 94% of transgender women have experienced violence due to their gender identity, including 43% citing discrimination by health care providers.[6,7] The efficacy of physical examination might be compromised if the healthcare provider avoids specific areas when examining transgender patients due to uncertainty or concerns about causing discomfort, especially given the limited extent of relevant training often provided.[8]

It is recommended that examination focus on the current anatomy of the patient and the potential for infection based on the sexual history. Sensitive medical history taking helps to understand individual characteristics in the context of hormone administration and surgical intervention.[9] Consideration should also be given to the detection of other health issues that may not have been previously identified due to limited engagement with health care. For some transgender women, the offer of examination may be welcomed under certain circumstances, as this may be seen as a gender-affirming experience within the healthcare setting.[2]

As transgender women are considered a population at increased risk for STIs and may be reluctant to undergo examination to detect STIs, the objective of this study was to determine the acceptability and the factors enabling uptake of physical examination for the detection of STIs among participants of the TransOdara study in Brazil.

Methods

Study design and procedures

TransOdara was a multi-centric cross-sectional STI prevalence study conducted among transgender women in five capital cities representing all Brazilian regions from December 2019 to July 2021. Self-identified transgender women aged 18 years and over were recruited using respondent driven sampling in each city, completed a standard interviewer-led questionnaire, and provided biological samples from multiple sites for testing multiple STIs. Participants could choose whether anorectal, oropharyngeal, or genital samples were self- or provider-collected. Questionnaire collected data included sociodemographic information and responses to questions related to gender-affirming procedures, sexual behaviors, and STI symptoms (including anogenital discharge, ulcers or warts) in the past six months and at study visit (see Veras [methodological article]).

As part of the study, each participant was asked permission to undergo a physical examination by a study clinician, irrespective of any reported symptoms. This included independently asking permission to conduct (i) general examination of the skin, oropharynx, and axillary and groin lymph nodes (to detect possible signs of syphilis, warts, ulcers, inflammation, and adenomegaly); (ii) genital examination (to detect presence of genital discharge, warts, and ulcers); and (iii) anal examination (to detect presence of anal discharge, warts, and ulcers). Genital examination was based on the genitalia present.

Data analysis

Study data were collected on standardized case report forms and managed using REDCap electronic data capture tools hosted at the Faculdade de Ciências Médicas da Santa Casa de São Paulo.[10,11] IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA) was used for statistical analyses. Demographic and other characteristics of participants who gave permission for each level of examination (general, genital, and anal), and those who permitted examination of all three sites (full examination) were examined. Bivariate comparisons were conducted by calculating odds ratios (OR) and 95% confidence intervals (CI) between permission responses and several variables. Variables associated with permission for examination at *p*-values less than 0.1 in the

bivariate analyses were included in a multivariate analysis (MVA) using logistic regression to calculate adjusted odds ratios (AOR) and 95% CI for all included variables. Statistical significance was considered for *p*-values less than 0.05 in the MVA.

Valid, open-ended responses to a survey question addressing participants' experience of examination were analyzed. Interviewer-inputted responses were exported into a spreadsheet using Google Sheets, and auto-translated from Portuguese into English. Coding individual responses was completed by reviewing the translated responses, and recurrent themes were identified by reviewing the thematic codes.

Ethical aspects

The TransOdara study was approved by the Research Ethics Committee (CEP) of the Santa Casa de Misericórdia de São Paulo, Brazil (CAAE 05585518.7.0000.5479; opinion n°: 3.126.815; 30/01/2019), as well as by other participating institutions (see Veras [methodological article]). Secondary data analysis (by first author) was approved by the London School of Hygiene & Tropical Medicine, UK (Ref: 26700; 14/12/2021). Informed consent was obtained from all individual participants included in the study.

Results

Study population

A total of 1,317 participants, aged 18 to 67 years (mean 31.96 years, ±SD 9.86), were recruited from five distinct study locations: 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 majority of participants identified as transgender women (56.4%) or '*travesti*' (29.9%), while a smaller proportion identified as women (6.5%) or other gender identities (6.3%). Over one-quarter (27.4%) reported undergoing some transition-related surgeries or procedures, with a minority (1.7%) reported undergoing neovaginal construction following removal of the penis and scrotum; nearly half (47.6%) were utilizing gender-affirming hormones. Concerning STI symptoms, 21.2% (n=276) reported experiencing symptoms in the past six months, while 13.1% (n=170) reported symptoms at the study visit, including anogenital warts (n=103), ulcers (n=61), and discharge (n=24).

Uptake of physical examination

A total of 1307 records containing examination data (99.2%) were obtained, with 1297 of these records having complete data for all three anatomical sites. Most study participants (65.4%, 95%CI: 62.7-68) granted permission for a general examination, while a smaller proportion allowed genital examination (42.3%, 95%CI: 39.6-46.0) and anal examination (42.1%, 95%CI: 39.4-44.9). Overall, less than half (40.6%, 95%CI: 37.9-43.4) consented to a comprehensive physical examination (encompassing all three levels). **Table 1** presents the uptake for each level of examination according to study location, demonstrating considerable variation. Notably, participants recruited from São Paulo exhibited significantly higher acceptance rates for all examination levels, while those from Manaus displayed the lowest likelihood to give permission. For instance, participants in São Paulo were 2.9 times (95%CI: 2.1-3.9) more likely than those in Manaus to consent to genital examination and 3.2 times (95%CI: 2.3-4.3) more likely to consent to anal examination.

Over one-third (34.4%, 95%CI: 31.8-37.0) of participants declined all examinations. Fewer refused genital and anal examinations exclusively (22.4%, n=290), or any other combinations of refusal: anal only (1.2%, n=15); genital only (1.2%, n=15); general and genital only (0.1%, n=1);

general and anal only (0.0%, n=0). **Figure 1** illustrates the permissions granted across the three levels of examination. Participants who consented to all three examinations were slightly older (mean 33.12 years, SD ±9.94) comparted to those who granted permission to some or no examination (mean 31.12 years, SD ±9.67). Individuals who reported current STI symptoms at the study visit were most likely to agree to full examinations (64.3%) than those without symptoms (37.4%), with symptomatic participants being less likely to refuse all examinations (13.7%) compared to asymptomatic participants (37.5%).

Factors associated with uptake at each examination level

General examination

Individual-level variables associated with uptake of physical examination are presented in **Supplemental Table 1**. Apart from study location, the MVA revealed associations with stated religion, education level, use of gender-affirming hormones, and any STI symptoms at study visit. Participants identifying with Afro-Brazilian religion were 1.7 times (95%CI: 1.1-2.5) more likely, and those with other stated religions were 1.9 times (95%CI: 1.2-3.0) more likely to grant permission compared to those with no stated religion. Higher education levels (post-secondary) were associated with a 2.2 times (95%CI: 1.4-3.5) higher likelihood of granting permission compared to lower education levels (none or primary). Participants reporting use of gender-affirming hormones were 1.4 times (95%CI: 1.0-1.9) more likely to grant permission than non-users, and those reporting any STI symptoms at the study visit were 4.2 times (95%CI: 2.4-7.1) more likely to grant permission than those without symptoms.

Genital examination

Individual-level variables associated with uptake of genital examination are presented in **Supplemental Table 2**. The MVA showed that uptake was associated with age, stated religion, education level, and STI symptoms at the study visit. Participants aged 25 years or older were 1.4 times (95%CI: 1.0-2.0) more likely to grant permission than those aged 18-24 years. Those identifying with Afro-Brazilian religion were 1.6 times (95%CI: 1.1-2.4) more likely, and other stated religions

were 1.7 times (95%CI: 1.2-2.6) more likely to grant permission than those with no stated religion. Higher education levels (post-secondary) were associated with a 1.8 times (95%CI: 1.2-2.8) higher likelihood of granting permission compared to those with lower education levels (none or primary). Participants reporting any STI symptoms at the study visit were 4.8 times (95%CI: 3.1-7.4) more likely to grant permission. Additionally, uptake of genital examination was less likely among participants identifying with a gender identity other than woman, trans woman, or *travesti*.

Anal examination

Individual-level variables associated with uptake of anal examination are presented in **Supplemental Table 3**. The MVA showed that uptake was associated with age, stated religion, education level, and STI symptoms at study visit. Participants aged 25 years or older were 1.4 times (95%CI: 1.0-1.9) more likely to grant permission than those aged 18-24 years. Those identifying with Afro-Brazilian and other stated religions were both 1.6 times (95%CI: 1.2-2.2; 1.1-2.3, respectively) more likely to grant permission than those with no stated religion. Higher education levels (post-secondary) were associated with a 2.1 times (95%CI: 1.4-3.0) higher likelihood of granting permission compared to lower education levels (none or primary). Participants reporting any STI symptoms at study visit were 3.7 times (95%CI: 2.5-5.5) more likely to grant permission.

Full physical examination

Individual-level variables associated with uptake of full physical examination (at all three levels) are presented in **Table 2** (all variable associations are presented in **Supplemental Table 4**). The MVA showed that uptake was associated with age, stated religion, education level, and any STI symptoms at study visit. Participants aged 25 years or older were 1.5 times (95%CI: 1.0-2.1) more likely to grant permission than those aged 18-24 years. Those identifying with Afro-Brazilian religion were 1.7 times (95%CI: 1.2-2.5) more likely, and other stated religions were 1.9 times (95%CI: 1.3-2.8) more likely to grant permission than those with no stated religion. Higher education levels (post-secondary) were associated with a 2.0 times (95%CI: 1.3-3.0) higher likelihood to grant permission compared to lower education levels (none or primary). Participants reporting any STI symptoms at

the study visit were 3.6 times (95%CI: 2.4-5.5) more likely to grant permission for a full examination. It was also observed that uptake of a full physical examination was less likely among participants identifying with a gender identity other than woman, trans woman, or *travesti*.

While not significantly associated in the MVA, participants who reported any level of gender-affirmation, including name change on any official documents (OR=1.7, 95%CI: 1.3-2.1), or any gender-affirming procedure or surgery (OR=1.5, 95%CI: 1.2-1.9), were more likely to grant permission. Among those who reported having a neovagina, over half (54.5%, n=12) permitted a full examination.

Examination experience

Overall, 13.0% (n=160/1230) of participants responding to questions on their examination experience reported feeling embarrassed during the examinations conducted by a study clinician. Thematic analysis of 146 valid, open-ended questionnaire responses from those 160 respondents highlighted that most of this embarrassment was due to shyness or discomfort with showing their naked body. Some participants expressed feelings of shame, finding the examination too intimate or exposing. Others mentioned their embarrassment due to the healthcare professional being a stranger or based on characteristics like gender or age.

Discussion

This study reports on the acceptability of physical examination aimed at identifying clinical signs of STIs within a highly vulnerable population of trans women in Brazil. The findings reveal a varying degree of willingness among participants to undergo specific examination types. While most participants permitted a general examination (65%), fewer permitted a genital (42%) or anal (42%) examination.

As physical examination remains a key component for comprehensive case management of STIs in global guidelines,[1] this lower uptake leaves potential challenges in achieving comprehensive identification of clinical signs of infection. However, notably, the acceptance of physical examination was greater among participants reporting STI symptoms at the study visit. Various factors, including study location, older age, religion, and education, were also found to influence uptake.

Considerable variation of uptake across study locations was evident, with participants in São Paulo being more likely to grant permission. This could be attributed to factors such as the trust built between the São Paulo research team and the transgender community through previous studies. The TransNational study was a longitudinal cohort study to measure HIV incidence of transgender women in São Paulo, [12] with study participants invited to participate in TransOdara. Additionally, as Latin America's largest city, São Paulo may serve as a hub for those seeking gender-affirming care and a greater sense of community.

Consistent with existing literature, younger participants (aged 18-24) were less likely to grant permission, particularly for genital or anal examinations.[13] In addition, participants with higher education levels demonstrated increased acceptance across all levels of examination. The observation that individuals identifying with an Afro-Brazilian religion were more likely to grant permission, especially compared to those identifying with the Catholic religion, could potentially be explained as religions with Afro-Brazilian origins tend to be more inclusive of people from sexual and gender minorities.[14] These findings highlight the need for employing approaches with clear, uncomplicated explanations to emphasize the importance of examinations, and those that alleviate potential feelings of shame or embarrassment before or during an examination.

In the bivariate analysis, participants who reported some level of gender-affirmation, such as changing their name on official documents or undergoing gender-affirming procedures or surgery, exhibited a higher likelihood of granting permission for examination. Gender identity also played a role, with those who identify as ‘women’ more likely to permit examination. As reported in the literature, it is possible that a physical examination may be an affirming experience for some transgender woman.[2]

Overall, a modest uptake of anogenital examinations was observed. This highlights the importance of building patient trust and avoiding unnecessary examinations. In the context of STI case management, the decision to conduct specific examinations should be guided by history taking, presenting symptoms, and anatomical relevance for potential infections. In cases where examinations are unnecessary, self-collection of samples for STI screening may prove more appropriate and acceptable to transgender women.[15]

The World Health Organization (WHO) provides guidelines for the management of symptomatic STIs that include simplified flowcharts which involve some level of physical examination.[1] While these guidelines strive to be gender-inclusive (for example, they describe ‘urethral discharge from the penis’ rather than ‘urethral discharge in men’), more specific guidance tailored to and inclusive of transgender and other gender-diverse individuals would be beneficial.

The STI guidelines published by the US Centers for Disease Control and Prevention (CDC) provide specific considerations for transgender and gender diverse persons, including recommendations for creating a welcoming clinical environment and STI screening recommendations.[16,17] Similar gender-affirming guidance is essential within Brazilian clinical settings.

As recommended by the University of California San Francisco (UCSF) Gender Affirming Health Program, a gender-affirming approach to physical examinations is essential. This includes using the correct name and pronouns for patients and employing preferred terms for body parts.[9] Avoiding assumptions about patients’ sexual partners, activities, or risks contributes to a more sensitive approach.[3]

In summary, this study reveals that while physical examinations are not universally accepted among transgender women, higher acceptance among those with STI symptoms supports potential use within the context of symptomatic case management. Given the likelihood of asymptomatic STIs, granting individuals accessing STI services greater autonomy through self-collection and potential self-testing is crucial. Improving examination uptake requires increasing transgender-specific literacy of health professionals and creating a sensitive, gender-affirming approach in clinical guidelines.

TABLES & FIGURES

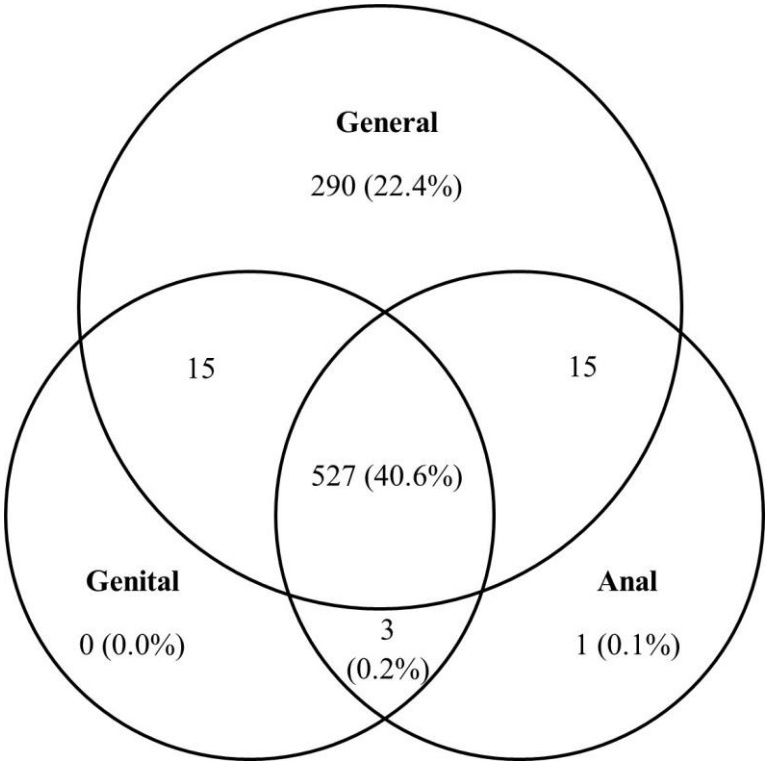


Figure 1. Uptake of general, genital, and anal examinations among study participants with a recorded response at all three levels (N=851)

Table 1. Uptake of physical examination by level and study location among 1,317 transgender women in Brazil

	General		**Genital**		**Anal**		**Full (all levels)**	
Study location	n/N (%)	OR (95%CI)	n/N (%)	OR (95%CI)	n/N (%)	OR (95%CI)	n/N (%)	OR (95%CI)
Manaus	163/338 (48.2)	1.00 (-)	102/338 (30.2)	1.00 (-)	96/333 (28.8)	1.00 (-)	90/333 (27.0)	1.00 (-)
Campo Grande	121/176 (68.8)	2.36 (1.61-3.47)	55/174 (31.6)	1.07 (0.72-1.59)	54/174 (31.0)	1.11 (0.75-1.66)	53/174 (30.5)	1.18 (0.79-1.77)
Salvador	109/202 (54.0)	1.26 (0.89-1.79)	80/202 (39.6)	1.52 (1.05-2.19)	81/202 (40.1)	1.65 (1.14-2.39)	77/202 (38.1)	1.66 (1.15-2.42)
Porto Alegre	115/190 (60.5)	1.65 (1.15-2.36)	93/190 (48.9)	2.22 (1.54-3.20)	91/188 (48.4)	2.32 (1.60-3.36)	90/188 (47.0)	2.48 (1.71-3.61)
São Paulo	346/400 (86.5)	6.88 (4.81-9.84)	222/401 (55.4)	2.87 (2.12-3.89)	225/401 (56.1)	3.16 (2.32-4.30)	217/400 (54.3)	3.20 (2.34-4.37)
Total	854/1306 (65.4)	-	552/1305 (42.3)	-	547/1298 (42.1)	-	527/1297 (40.6)	-

OR: Odds Ratio; **CI**: Confidence Interval

Table 2. Factors significantly associated with uptake of full physical examination (at all three levels) among 1,317 transgender women in Brazil

Variable	n/N (%)	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Study location					
Manaus	90/333 (27.0)	1.00 (-)	-	1.00 (-)	-
Campo Grande	53/174 (30.5)	1.18 (0.79-1.77)	0.415	1.72 (1.03-2.88)	**0.040**
Salvador	77/202 (38.1)	1.66 (1.15-2.42)	**0.008**	2.10 (1.28-3.45)	**0.003**
Porto Alegre	90/188 (47.0)	2.48 (1.71-3.61)	**<0.001**	3.22 (1.91-5.43)	**<0.001**
São Paulo	217/400 (54.3)	3.20 (2.34-4.37)	**<0.001**	3.90 (2.52-6.03)	**<0.001**
Age, years					
18-24	110/344 (32.0)	1.00 (-)	-	1.00 (-)	-
≥25	417/953 (40.9)	1.66 (1.28-2.15)	**<0.001**	1.47 (1.04-2.08)	**0.031**
Religion					
No religion	169/470 (36.0)	1.00 (-)	-	1.00 (-)	-
Catholic	118/338 (34.9)	0.96 (0.71-1.28)	0.759	1.26 (0.88-1.80)	0.213
Afro-Brazilian	139/282 (49.3)	1.73 (1.28-2.34)	**<0.001**	1.72 (1.20-2.49)	**0.004**
Other[1]	99/199 (49.7)	1.76 (1.26-2.47)	**0.001**	1.87 (1.26-2.79)	**0.002**
Education					
None or primary	121/322 (37.6)	1.00 (-)	-	1.00 (-)	-
Secondary	269/702 (38.3)	1.03 (0.79-1.36)	0.821	1.20 (0.87-1.65)	0.272
Higher-level	135/269 (50.2)	1.67 (1.21-2.33)	**0.002**	1.98 (1.32-2.97)	**0.001**
Gender identity					
Travesti	150/386 (38.9)	1.00 (-)	-	1.00 (-)	-
Trans woman	316/767 (41.2)	1.10 (0.86-1.42)	0.445	0.88 (0.64-1.19)	0.396
Woman	49/97 (50.5)	1.61 (1.03-2.51)	**0.038**	0.99 (0.58-1.67)	0.961
Other identity	11/44 (25.0)	0.52 (0.26-1.07)	**0.076**	0.13 (0.03-0.67)	**0.014**
Any STI symptoms at study visit					
No	418/1118 (37.4)	1.00 (-)	-	1.00 (-)	-
Yes	108/168 (64.3)	3.01 (2.15-4.23)	**<0.001**	3.60 (2.37-5.49)	**<0.001**

OR: Odds Ratio; **CI**: Confidence Interval; **AOR**: Adjusted Odds Ratio
[1]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism

REFERENCES

1. World Health Organization. Guidelines for the management of symptomatic sexually transmitted infections. Geneva: World Health Organization; 2021.

2. Gelman M, Van Wagenen A, Potter J. Principles for taking an LGBTQ-inclusive health history and conducting a culturally competent physical exam. In: Makadon HJ, Mayer KH, Potter J, Goldhammer H, ed. The Fenway guide to lesbian, gay, bisexual, and transgender health. Philadelphia: American College of Physicians; 2015. p. 159-92.

3. Poteat T. Transgender people and sexually transmitted infections (STIs). In: Deutsch MB, ed. Guidelines for the primary and gender-affirming care of transgender and gender nonbinary people. 2nd ed. San Francisco: Center of Excellence for Transgender Health, Department of Family and Community Medicine, University of California San Francisco; 2016. p. 90-2.

4. Sevelius J, Murray LR, Martinez Fernandes N, Veras MA, Grinsztejn B, Lippman SA. Optimising HIV programming for transgender women in Brazil. Cult Health Sex 2019; 21: 543-58. https://doi.org/10.1080/13691058.2018.1496277.

5. Santos PM, Santos KC, Magalhães LS, Oliveira BR, Carneiro MA, Souza MM, et al. Travestis and transsexual women: who are at higher risk for sexually transmitted infections? Rev Bras Epidemiol 2021; 24. https://doi.org/10.1590/1980-549720210017.

6. Zucchi EM, Barros CR, Redoschi BR, Deus LF, Veras MA. Bem-estar psicológico entre travestis e mulheres transexuais no Estado de São Paulo, Brasil. Cad Saude Publica 2019; 35. https://doin.org/10.1590/0102-311x00064618.

7. Pinto TP, Teixeira F, Barros CR, Martins RB, Saggese G, Barros DD, et al. Silicone líquido industrial para transformar o corpo: prevalência e fatores associados ao seu uso entre travestis e mulheres transexuais em São Paulo, Brasil. Cad Saude Publica 2017; 33. https://doi.org/10.1590/0102-311x00113316.

8. Obedin-Maliver J, Goldsmith ES, Stewart L, White W, Tran E, Brenman S, et al. Lesbian, gay, bisexual, and transgender-related content in undergraduate medical education. JAMA 2011; 306. https://doi.org/10.1001/jama.2011.1255.

9. Wesp L. Transgender patients and the physical examination. In: Deutsch MB, ed. Guidelines for the primary and gender-affirming care of transgender and gender nonbinary people. 2nd ed. San Francisco: Center of Excellence for Transgender Health, Department of Family and Community Medicine, University of California San Francisco; 2016. p. 20-2.

10. Harris PA, Taylor R, Thielke T, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support, J Biomed Inform 2009; 42(2): 377-81. https://doi.org/10.1016/j.jbi.2008.08.010.

11. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software partners, J Biomed Inform 2019; 95. https://doi.org/10.1016/j.jbi.2019.103208.

12. Veras MA, Saggese GS, Gomez JL, Silveira P, Paiatto B, Ferreira D, et al. Brief Report: Young Age and Sex Work Are Associated With HIV Seroconversion Among Transgender Women in São Paulo, Brazil. J Acquir Immune Defic Syndr 2021; 88(1): e1-e4. https://doi.org/10.1097/QAI.0000000000002737.

13. Gayles TA, Garofalo R. Caring for LGBTQ youth. In: Makadon HJ, Mayer KH, Potter J, Goldhammer H, ed. The Fenway guide to lesbian, gay, bisexual, and transgender health. Philadelphia: American College of Physicians; 2015. p. 79-104.

14. Da Silva Dias C. Vivências de gênero dissidentes em religiosidades de matrizes africanas: alguns aspectos sobre as transexualidades na religião. Veredas Hist 2019;12. https://doi.org/10.9771/rvh.v12i2.47829.

15. McCartney DJ, Pinheiro TF, Gomez JL, Carvalho PGC, Veras MA, Mayaud P. Acceptability of self-sampling for etiological diagnosis of mucosal sexually transmitted infections (STIs) among transgender women in a longitudinal cohort study in São Paulo, Brazil. Braz J Infect Dis 2022; 26(3): 102356. https://doi.org/10.1016/J.BJID.2022.102356.

16. Ministry of Health (Brazil). [Clinical protocol and therapeutic guidelines for comprehensive care for people with sexually transmitted infections (STIs)] Protocolo clínico e diretrizes terapêuticas para atenção integral às pessoas com infecções sexualmente transmissíveis (IST). Brasilia: Ministry of Health; 2022.

17. Workowski KA, Bachmann LH, Chan PA, Johnston CM, Muzny CA, Park I, et al. Sexually transmitted infections treatment guidelines, 2021. MMWR Recomm Rep 2021; 70: 1-187. http://dx.doi.org/10.15585/mmwr.rr7004a1.

SUPPLEMENTAL MATERIAL

Supplemental Table 1. Factors associated with uptake of general examination among 1,317 transgender women in Brazil

Variable	n/N (%)	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Study location					
Manaus	163/338 (48.2)	1.00 (-)	-	1.00 (-)	-
Campo Grande	121/176 (68.8)	2.36 (1.61-3.47)	**<0.001**	3.07 (1.86-5.07)	**<0.001**
Salvador	109/202 (54.0)	1.26 (0.89-1.79)	0.197	1.76 (1.09-2.82)	**0.020**
Porto Alegre	115/190 (60.5)	1.65 (1.15-2.36)	**0.007**	2.33 (1.37-3.99)	**0.002**
São Paulo	346/400 (86.5)	6.88 (4.81-9.84)	**<0.001**	9.69 (6.11-15.39)	**<0.001**
Age, years					
18-24	206/348 (59.2)	1.00 (-)	-	1.00 (-)	-
≥25	648/958 (67.6)	1.44 (1.12-1.86)	**0.005**	1.35 (0.95-1.93)	0.091
Ethnicity					
Black	221/347 (63.7)	1.00 (-)	-	1.00 (-)	-
Mixed	374/570 (65.6)	1.01 (0.82-1.44)	0.554	1.22 (0.85-1.76)	0.273
White	228/332 (68.7)	1.25 (0.91-1.72)	0.170	1.16 (0.77-1.74)	0.479
Other[1]	22/45 (48.9)	0.55 (0.29-1.02)	**0.057**	0.54 (0.25-1.18)	0.122
Religion					
No religion	295/471 (62.6)	1.00 (-)	-	1.00 (-)	-
Catholic	201/344 (58.4)	0.84 (0.63-1.11)	0.225	1.15 (0.80-1.68)	0.450
Afro-Brazilian	199/282 (70.6)	1.43 (1.04-1.96)	**0.027**	1.68 (1.13-2.51)	**0.011**
Other[2]	155/201 (77.1)	2.01 (1.38-2.94)	**<0.001**	1.87 (1.17-2.98)	**0.009**
Education					
None or primary	203/325 (62.5)	1.00 (-)	-	1.00 (-)	-
Secondary	450/706 (38.3)	1.06 (0.81-1.38)	0.692	1.23 (0.88-1.72)	0.220
Higher-level	199/271 (73.4)	1.66 (1.17-2.36)	**0.005**	2.22 (1.41-3.50)	**0.001**
Housing					
Temporarily with friends or family	213/341 (62.5)	1.00 (-)	-		
Rents house or apartment	318/476 (66.8)	1.21 (0.90-1.62)	0.200		
Owns house or apartment	227/339 (67.0)	1.22 (0.89-1.67)	0.220		
Other[3]	96/148 (64.9)	1.11 (0.74-1.66)	0.613		
Gender identity					
Travesti	246/390 (63.1)	1.00 (-)	-	1.00 (-)	-
Trans woman	511/772 (66.2)	1.15 (0.89-1.48)	0.293	0.97 (0.69-1.34)	0.834
Woman	70/97 (72.2)	1.52 (0.93-2.48)	**0.095**	1.01 (0.55-1.84)	0.981
Other identity	26/44 (59.1)	0.85 (0.45-1.60)	0.605	0.38 (0.13-1.13)	0.082
Name changed on any official document					
No	574/923 (62.2)	1.00 (-)	-	1.00 (-)	-
Yes	279/381 (73.2)	1.66 (1.28-2.16)	**<0.001**	1.04 (0.74-1.47)	0.822
Any gender-affirming procedure					
No	594/941 (63.1)	1.00 (-)	-	1.00 (-)	-
Yes	257/357 (72.0)	1.50 (1.15-1.96)	**0.003**	0.85 (0.59-1.22)	0.369
Use of gender-affirming hormones (current)					
No	363/583 (62.3)	1.00 (-)	-	1.00 (-)	-
Yes	375/534 (70.2)	1.43 (1.11-1.84)	**0.005**	1.41 (1.04-1.92)	**0.027**

Any STI symptoms in past 6 months					
No	643/1013 (63.5)	1.00 (-)	-	1.00 (-)	-
Yes	199/275 (72.4)	1.51 (1.12-2.02)	**0.006**	0.96 (0.67-1.39)	0.832
Any STI symptoms at study visit					
No	702/1126 (62.3)	1.00 (-)	-	1.00 (-)	-
Yes	146/169 (86.4)	3.83 (2.43-6.05)	**<0.001**	4.15 (2.44-7.05)	**<0.001**

OR: Odds Ratio; **CI**: Confidence Interval; **AOR**: Adjusted Odds Ratio
[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

Supplemental Table 2. Factors associated with uptake of genital examination among 1,317 transgender women in Brazil

Variable	n/N (%)	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Study location					
Manaus	102/338 (30.2)	1.00 (-)	-	1.00 (-)	-
Campo Grande	55/174 (31.6)	1.07 (0.72-1.59)	0.739	1.64 (0.98-2.72)	0.058
Salvador	80/202 (39.6)	1.52 (1.05-2.19)	**0.025**	1.89 (1.16-3.09)	**0.011**
Porto Alegre	93/190 (48.9)	2.22 (1.54-3.20)	**<0.001**	2.94 (1.75-4.92)	**<0.001**
São Paulo	222/401 (55.4)	2.87 (2.12-3.89)	**<0.001**	3.41 (2.21-5.25)	**<0.001**
Age, years)					
18-24	117/347 (33.7)	1.00 (-)	-	1.00 (-)	-
≥25	435/958 (45.4)	1.64 (1.27-2.11)	**<0.001**	1.41 (1.00-1.99)	**0.050**
Ethnicity					
Black	143/347 (41.2)	1.00 (-)	-		
Mixed	239/570 (41.9)	1.03 (0.79-1.35)	0.830		
White	150/331 (45.3)	1.18 (0.87-1.60)	0.281		
Other[1]	15/45 (33.3)	0.71 (0.37-1.37)	0.312		
Religion					
No religion	179/472 (37.9)	1.00 (-)	-	1.00 (-)	-
Catholic	127/343 (37.0)	0.96 (0.72-1.28)	0.794	1.20 (0.84-1.72)	0.310
Afro-Brazilian	143/282 (50.7)	1.68 (1.25-2.27)	**0.001**	1.63 (1.13-2.35)	**0.009**
Other[2]	101/200 (50.5)	1.67 (1.20-2.33)	**0.003**	1.73 (1.17-2.58)	**0.007**
Education					
None or primary	129/324 (39.8)	1.00 (-)	-	1.00 (-)	-
Secondary	280/706 (39.7)	0.96 (0.76-1.30)	0.962	1.15 (0.84-1.58)	0.382
Higher-level	141/271 (52.0)	1.64 (1.18-2.27)	**0.003**	1.84 (1.23-2.76)	**0.003**
Housing					
Temporarily with friends or family	123/341 (36.1)	1.00 (-)	-	1.00 (-)	-
Rents house or apartment	205/477 (43.0)	1.34 (1.00-1.78)	**0.047**	1.17 (0.81-1.70)	0.399
Owns house or apartment	162/338 (47.9)	1.63 (1.20-2.22)	**0.002**	1.27 (0.86-1.87)	0.234
Other[3]	62/147 (42.2)	1.29 (0.87-1.92)	0.203	0.94 (0.57-1.57)	0.816
Gender identity					
Travesti	163/389 (41.9)	1.00 (-)	-	1.00 (-)	-
Trans woman	327/772 (42.4)	1.02 (0.80-1.30)	0.882	0.83 (0.61-1.13)	0.242
Woman	49/97 (50.5)	1.42 (0.91-2.21)	0.127	0.89 (0.52-1.51)	0.887
Other identity	12/44 (27.3)	0.52 (0.26-1.04)	**0.064**	0.12 (0.02-0.61)	**0.011**
Name changed on any official document					
No	356/922 (38.6)	1.00 (-)	-	1.00 (-)	-
Yes	195/381 (51.2)	1.67 (1.31-2.12)	**<0.001**	1.23 (0.91-1.66)	0.175
Any gender-affirming procedure					
No	374/941 (39.7)	1.00 (-)	-	1.00 (-)	-
Yes	177/356 (49.7)	1.50 (1.17-1.92)	**0.001**	0.91 (0.67-1.25)	0.557
Use of gender-affirming hormones (current)					
No	237/582 (40.7)	1.00 (-)	-	1.00 (-)	-
Yes	244/534 (45.7)	1.23 (0.97-1.55)	**0.094**	1.19 (0.89-1.58)	0.240
Any STI symptoms in past 6 months					
No	405/1012 (40.0)	1.00 (-)	-	1.00 (-)	-

Yes	142/275 (51.6)	1.60 (1.22-2.09)	**0.001**	0.95 (0.68-1.32)	0.768
Any STI symptoms at study visit					
No	432/1124 (38.4)	1.00 (-)	-	1.00 (-)	-
Yes	119/170 (70.0)	3.74 (2.64-5.30)	**<0.001**	4.76 (3.09-7.35)	**<0.001**

OR: Odds Ratio; **CI**: Confidence Interval; **AOR**: Adjusted Odds Ratio
[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

Supplemental Table 3. Factors associated with uptake of anal examination among 1,317 transgender women in Brazil

Variable	n/N (%)	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Study location					
Manaus	96/333 (28.8)	1.00 (-)	-	1.00 (-)	-
Campo Grande	54/174 (31.0)	1.11 (0.75-1.66)	0.605	1.30 (0.83-2.05)	0.250
Salvador	81/202 (40.1)	1.65 (1.14-2.39)	**0.007**	1.73 (1.11-2.70)	**0.015**
Porto Alegre	91/188 (48.4)	2.32 (1.60-3.36)	**<0.001**	2.24 (1.42-3.55)	**0.001**
São Paulo	225/401 (56.1)	3.16 (2.32-4.30)	**<0.001**	3.22 (2.18-4.75)	**<0.001**
Age, years					
18-24	112/344 (32.6)	1.00 (-)	-	1.00 (-)	-
≥25	435/954 (45.6)	1.74 (1.34-2.25)	**<0.001**	1.39 (1.03-1.88)	**0.032**
Ethnicity					
Black	141/345 (40.9)	1.00 (-)	-		
Mixed	232/566 (41.0)	1.01 (0.77-1.32)	0.972		
White	154/330 (46.7)	1.27 (0.93-1.72)	0.129		
Other[1]	15/45 (33.3)	0.72 (0.38-1.39)	0.333		
Religion					
No religion	176/471 (37.4)	1.00 (-)	-	1.00 (-)	-
Catholic	125/338 (37.0)	0.98 (0.74-1.31)	0.911	1.13 (0.81-1.58)	0.460
Afro-Brazilian	143/282 (50.7)	1.72 (1.28-2.33)	**<0.001**	1.61 (1.15-2.23)	**0.005**
Other[2]	101/199 (50.8)	1.73 (1.24-2.41)	**0.001**	1.60 (1.10-2.31)	**0.013**
Education					
None or primary	127/323 (39.3)	1.00 (-)	-	1.00 (-)	-
Secondary	278/702 (39.6)	1.01 (0.77-1.33)	0.932	1.17 (0.86-1.57)	0.315
Higher-level	140/269 (52.0)	1.68 (1.21-2.32)	**0.002**	2.07 (1.43-2.98)	**<0.001**
Housing					
Temporarily with friends or family	126/340 (37.1)	1.00 (-)	-	1.00 (-)	-
Rents house or apartment	201/476 (42.2)	1.24 (0.93-1.65)	0.138	0.92 (0.66-1.28)	0.616
Owns house or apartment	161/335 (48.1)	1.57 (1.16-2.14)	**0.004**	1.10 (0.77-1.57)	0.596
Other[3]	59/145 (40.7)	1.17 (0.78-1.73)	0.451	0.77 (0.49-1.22)	0.260
Gender identity					
Travesti	159/386 (41.2)	1.00 (-)	-	1.00 (-)	-
Trans woman	326/768 (42.4)	1.05 (0.82-1.35)	0.683	0.91 (0.69-1.20)	0.505
Woman	50/97 (51.5)	1.52 (0.97-2.37)	**0.067**	1.02 (0.62-1.67)	0.950
Other identity	11/44 (25.0)	0.48 (0.23-0.97)	**0.041**	0.50 (0.23-1.10)	0.086
Name changed on any official document					
No	353/917 (38.5)	1.00 (-)	-	1.00 (-)	-
Yes	193/379 (50.9)	1.66 (1.30-2.11)	**<0.001**	1.23 (0.93-1.64)	0.152
Any gender-affirming procedure					
No	369/935 (39.5)	1.00 (-)	-	1.00 (-)	-
Yes	177/355 (49.9)	1.53 (1.19-1.95)	**0.001**	0.90 (0.67-1.21)	0.477
Use of gender-affirming hormones (current)					
No	238/581 (41.0)	1.00 (-)	-		
Yes	241/531 (45.4)	1.20 (0.94-1.52)	0.137		
Any STI symptoms in past 6 months					
No	398/1006 (39.6)	1.00 (-)	-	1.00 (-)	-

Yes	143/274 (52.2)	1.67 (1.28-2.18)	**<0.001**	1.06 (0.78-1.44)	0.717
Any STI symptoms at study visit					
No	429/1118 (38.4)	1.00 (-)	-	1.00 (-)	-
Yes	116/169 (68.6)	3.52 (2.49-4.97)	**<0.001**	3.73 (2.53-5.49)	**<0.001**

OR: Odds Ratio; **CI**: Confidence Interval; **AOR**: Adjusted Odds Ratio
[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

Supplemental Table 4. Factors associated with uptake of full physical examination (at all three levels) among 1,317 transgender women in Brazil

Variable	n/N (%)	OR (95% CI)	*p*-value	AOR (95% CI)	*p*-value
Study location					
Manaus	90/333 (27.0)	1.00 (-)	-	1.00 (-)	-
Campo Grande	53/174 (30.5)	1.18 (0.79-1.77)	0.415	1.72 (1.03-2.88)	**0.040**
Salvador	77/202 (38.1)	1.66 (1.15-2.42)	**0.008**	2.10 (1.28-3.45)	**0.003**
Porto Alegre	90/188 (47.0)	2.48 (1.71-3.61)	**<0.001**	3.22 (1.91-5.43)	**<0.001**
São Paulo	217/400 (54.3)	3.20 (2.34-4.37)	**<0.001**	3.90 (2.52-6.03)	**<0.001**
Age. years					
18-24	110/344 (32.0)	1.00 (-)	-	1.00 (-)	-
≥25	417/953 (40.9)	1.66 (1.28-2.15)	**<0.001**	1.47 (1.04-2.08)	**0.031**
Ethnicity					
Black	135/345 (39.4)	1.00 (-)	-		
Mixed	223/565 (39.5)	1.00 (0.76-1.32)	0.988		
White	148/330 (44.8)	1.25 (0.92-1.70)	0.154		
Other[1]	15/45 (33.3)	0.77 (0.40-1.48)	0.431		
Religion					
No religion	169/470 (36.0)	1.00 (-)	-	1.00 (-)	-
Catholic	118/338 (34.9)	0.96 (0.71-1.28)	0.759	1.26 (0.88-1.80)	0.213
Afro-Brazilian	139/282 (49.3)	1.73 (1.28-2.34)	**<0.001**	1.72 (1.20-2.49)	**0.004**
Other[2]	99/199 (49.7)	1.76 (1.26-2.47)	**0.001**	1.87 (1.26-2.79)	**0.002**
Education					
None or primary	121/322 (37.6)	1.00 (-)	-	1.00 (-)	-
Secondary	269/702 (38.3)	1.03 (0.79-1.36)	0.821	1.20 (0.87-1.65)	0.272
Higher-level	135/269 (50.2)	1.67 (1.21-2.33)	**0.002**	1.98 (1.32-2.97)	**0.001**
Housing					
Temporarily with friends or family	122/340 (35.9)	1.00 (-)	-	1.00 (-)	-
Rents house or apartment	195/475 (41.1)	1.24 (0.93-1.66)	0.136	1.04 (0.72-1.50)	0.851
Owns house or apartment	154/335 (46.0)	1.52 (1.12-2.07)	**0.008**	1.12 (0.76-1.65)	0.582
Other[3]	56/145 (38.6)	1.12 (0.75-1.68)	0.567	0.80 (0.48-1.33)	0.381
Gender identity					
Travesti	150/386 (38.9)	1.00 (-)	-	1.00 (-)	-
Trans woman	316/767 (41.2)	1.10 (0.86-1.42)	0.445	0.88 (0.64-1.19)	0.396
Woman	49/97 (50.5)	1.61 (1.03-2.51)	**0.038**	0.99 (0.58-1.67)	0.961
Other identity	11/44 (25.0)	0.52 (0.26-1.07)	**0.076**	0.13 (0.03-0.67)	**0.014**
Name changed on any official document					
No	339/916 (37.0)	1.00 (-)	-	1.00 (-)	-
Yes	187/379 (49.3)	1.66 (1.30-2.11)	**<0.001**	1.19 (0.88-1.61)	0.250
Any gender-affirming procedure					
No	356/934 (38.1)	1.00 (-)	-	1.00 (-)	-
Yes	170/355 (47.9)	1.49 (1.17-1.91)	**0.001**	0.87 (0.63-1.19)	0.371
Use of gender-affirming hormones (current)					
No	227/580 (39.1)	1.00 (-)	-	1.00 (-)	-
Yes	236/531 (44.4)	1.24 (0.98-1.58)	**0.073**	1.15 (0.86-1.53)	0.345
Any STI symptoms in past 6 months					
No	385/1005 (38.3)	1.00 (-)	-	1.00 (-)	-

Yes	138/274 (50.4)	1.63 (1.25-2.14)	**<0.001**	1.00 (0.72-1.39)	0.991
Any STI symptoms at study visit					
No	418/1118 (37.4)	1.00 (-)	-	1.00 (-)	-
Yes	108/168 (64.3)	3.01 (2.15-4.23)	**<0.001**	3.60 (2.37-5.49)	**<0.001**

OR: Odds Ratio; **CI**: Confidence Interval; **AOR**: Adjusted Odds Ratio
[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

7.3 SUMMARY OF KEY FINDINGS

- Majority of participants consented to a general examination (65.4%), but fewer permitted genital (42.3%) or anal (42.1%) examinations, potentially leading to incomplete STI detection.
- Less than half (40.6%) consented to a full physical examination, with uptake higher among participants reporting STI symptoms. Factors such as age, religion, and education also influenced acceptance.
- Greater acceptability among individuals with symptoms supports the consideration of clinical examination for the management of symptomatic STIs, including the syndromic approach.
- Establishing patient trust and avoiding unnecessary examinations are essential to improving the acceptance of anogenital examinations.
- When examination is unnecessary or refused, self-collection of samples for STI screening and diagnosis may offer a more suitable and acceptable alternative in specific instances.

CHAPTER 8: Acceptability of self-collected samples for diagnosis of STIs

8.1 INTRODUCTION

With a low level of acceptability for physical examination among transgender women for the purpose of STI screening, especially among asymptomatic individuals, the self-collection of samples may offer a more acceptable choice for STI testing. In TransOdara, participants could choose whether samples for the screening of NG/CT (from anorectal and oropharyngeal sites) and HPV (from anorectal and genital sites) were self-collected or collected by a provider. This study aimed to assess the acceptability and usability of self-collected samples from potential infection sites for STI testing among transgender women in Brazil.

These results are presented in a manuscript prepared for submission to *Sexually Transmitted Diseases (STD)*, included as **Research Paper 4**.

8.2 RESEARCH PAPER 4: Acceptability and usability of self-sampling for the detection of sexually transmitted infections among transgender women: the TransOdara multi-centric study in Brazil

RESEARCH PAPER COVER SHEET

Please note that a cover sheet must be completed for each research paper included within a thesis.

SECTION A – Student Details

Student ID Number	155857	**Title**	
First Name(s)	Daniel		
Surname/Family Name	McCartney		
Thesis Title	Clinical epidemiology of STIs among transgender women in Brazil		
Primary Supervisor	Philippe Mayaud		

If the Research Paper has previously been published please complete Section B, if not please move to Section C.

SECTION B – Paper already published

Where was the work published?			
When was the work published?			
If the work was published prior to registration for your research degree, give a brief rationale for its inclusion			
Have you retained the copyright for the work?*	Choose an item.	Was the work subject to academic peer review?	Choose an item.

SECTION C – Prepared for publication, but not yet published

Where is the work intended to be published?	Sexually Transmitted Diseases
Please list the paper's authors in the intended authorship order:	Daniel Jason McCartney, Katia Cristina Bassichetto, Andrea Fachel Leal, Daniela Knauth, Inês Dourado, Laio Magno, Roberto José Carvalho da Silva, Philippe Mayaud, Maria Amélia Veras
Stage of publication	**Submitted**

SECTION D – Multi-authored work

For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)	Conception of sub-study, analysis, interpretation of results, and primary author of paper

SECTION E

Student Signature	[redacted]
Date	14 August 2023

Supervisor Signature	[redacted]
Date	14 August 2023

Acceptability and usability of self-sampling for the detection of sexually transmitted infections among transgender women: the TransOdara multi-centric study in Brazil

Daniel Jason McCartney[1], Katia Cristina Bassichetto[2,3], Andrea Fachel Leal[4], Daniela Knauth[4], Inês Dourado[5], Laio Magno[6], Roberto José Carvalho da Silva[7], Philippe Mayaud[1], Maria Amélia Veras[2,3], for the TransOdara Research Group*

1. Department of Clinical Research, Faculty of Infectious & Tropical Diseases, London School of Hygiene & Tropical Medicine, London, United Kingdom
2. Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo, Brazil
3. Núcleo de Pesquisa e Direitos Humanos em Saúde da População LGBT+, São Paulo, Brazil
4. Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
5. Instituto de Saúde Coletiva - Universidade Federal da Bahia, Salvador, Brazil
6. Departamento de Ciências da Vida, Universidade do Estado da Bahia, Salvador, Brazil
7. Centro de Referência e Treinamento em DST/Aids – Secretaria de Estado da Saúde de São Paulo, São Paulo, Brazil

*Membership of the TransOdara Research Group is provided in the Acknowledgements.

Corresponding author:

Daniel J. McCartney

Department of Clinical Research, Faculty of Infectious & Tropical Diseases

London School of Hygiene & Tropical Medicine

Keppel Street, London, WC1E 7HT, United Kingdom

Phone: +44 7587025322

Email: daniel.mccartney@lshtm.ac.uk

Conflicts of Interest and Source of Funding: This study was funded by the Pan American Health Organization (PAHO) and the Ministry of Health of Brazil – Department of Chronic Conditions and Sexually Transmitted Infections (DCCI) (Agreement no.: SCON2019-00162). The authors declare that they have no conflicts of interest.

Short Summary

A study among transgender women in Brazil showed high acceptability for self-collected STI samples from anorectal and genital sites, with comparable results to provider-collected samples.

Abstract

Background: Effective testing of sexually transmitted infections (STIs) requires samples from potential infection sites. This study aimed to evaluate the choice, satisfaction, and performance of self-collected samples (SCS) from potential infection sites for STI testing among transgender women in Brazil.

Methods: Between December 2019 and July 2021, TransOdara was a multi-centric, cross-sectional STI prevalence study conducted in five Brazilian cities. Using respondent-driven sampling, 1,317 transgender women aged ≥18 years were recruited. Participants completed interviewer-led questionnaires and provided swab samples from multiple sites (anorectal, oropharyngeal, and genital) for *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), and human papillomavirus (HPV) testing. Participants were given a choice of SCS or provider-collected samples (PCS) for each site.

Results: Most participants selected SCS for anorectal (74.9%, 95%CI:72.4-77.3) and genital (72.7%, 95%CI:70.2-75.1) sites, while slightly fewer chose SCS for the oropharyngeal site (49.8%, 95%CI:47.0-52.6). Those who opted for SCS reported ‘easy’ sample collection for genital (97.2%, 95%CI:95.9-98.2), anorectal (93.2%, 95%CI:91.4-94.8), and oropharyngeal (92.5%, 95%CI:90.1-94.4) sites. For future testing, most participants expressed a preference for SCS for genital (72.2%,

95%CI:69.5-74.7) and anorectal (70.2%, 95%CI:67.6-72.7) sites, while approximately half favored SCS for the oropharyngeal (47.2%, 95%CI:44.4-50.0) site. There was no significant difference in positive test results for CT and NG between SCS and PCS at anorectal and oropharyngeal sites, as well as for HPV at anorectal and genital (penile or neovaginal) sites.

Conclusions: This study showed a high level of acceptability and usability of self-sampling for STI testing among transgender women. A preference for SCS was evident for anorectal and genital sites, and the results of SCS were comparable to those of PCS. The findings suggest that multisite STI testing, utilizing self-collection methods as an option, can be effectively integrated into sexual health services for transgender women.

Keywords: Transgender, Specimen Collection, Sexually Transmitted Infections, Patient Preference, Patient Satisfaction

Introduction

Transgender women are disproportionately affected by HIV and other sexually transmitted infections (STIs), including chlamydia, gonorrhea, and syphilis [1,2]. STI testing services are crucial components of a comprehensive response to HIV and STIs [3]. Like other key populations, transgender women often do not have access to adequate STI testing services or are prevented from seeking STI-related care due to concerns about autonomy, inconvenience, stigma, discrimination, and lack of privacy [3,4]. Gender-insensitive healthcare has also been associated with a lower likelihood of STI testing among transgender women [5].

STI testing requires a sample of blood, urine, or specimens collected at relevant anatomical sites (i.e., anorectal, oropharyngeal) to provide accurate pathogen detection for targeted treatment. Specimen collection is often not routinely conducted at anorectal or oropharyngeal sites, leaving the possibility of undiagnosed infections, especially among specific populations with a high prevalence of STIs at these infection sites [6].

Provider-collected samples (PCS) from the anogenital area can be considered intrinsically intrusive and an unsettling experience for any individual. Transgender and other gender-diverse people may experience additional distress due to fear of discrimination, encountering inadequately trained health professionals, or personal discomfort by exposing their bodies [7]. In such instances, individuals may prefer to collect their own specimens to enable greater control. Self-collected samples (SCS) taken either at a healthcare facility or elsewhere (i.e., at home) can be provided to their healthcare provider or sent to a laboratory for testing [8,9]. SCS methods can include first-void urine, oropharyngeal, anorectal, urethral, and (neo)vaginal swabs. This provides benefits for both the efficiency of healthcare providers with limited time and capacity, as well as enabling those who may not access service due to the actual or perceived requirement of a clinician needing to conduct a physical examination.

A series of systematic reviews including both men and women from the general population have shown that SCS for STI testing is as diagnostically accurate as PCS [10], is highly acceptable by patients [11], and programs offering SCS increased the overall uptake of STI testing and cervical

cancer screening services [12,13]. The World Health Organization (WHO) recommends that SCS for *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) be made available as an additional approach to deliver STI testing services and human papillomavirus (HPV) in cervical cancer screening services [8]. Previous studies have primarily focused on the self-collection of vaginal samples from cis-gender women and anorectal samples from men who have sex with men (MSM) in high-income countries [14]. For transgender people, there is limited evidence specific to the acceptability and usability of SCS [15,16,17]. This study aimed to assess the choice of method, satisfaction, and comparability of test results of SCS and PCS for the detection of STIs from potential infection sites in a study of transgender women in Brazil.

Methods

Study design and procedures

TransOdara was a multi-centric cross-sectional STI prevalence study conducted among transgender women in five capital cities (Campo Grande, Manaus, Porto Alegre, Salvador, and São Paulo), representing all Brazilian regions. Participants were recruited from December 2019 to July 2021 using respondent-driven sampling (RDS) in each of the five study locations. Eligible participants were (1) aged $\geq$18 years, (2) assigned male sex at birth and self-identified with a feminine gender identity, and (3) lived in the metropolitan area of one of the five capital cities. Participants completed an interviewer-led questionnaire for sociodemographic information and responded to questions related to gender-affirming procedures, sexual behavior, and STI symptoms in the past six months.

All the participants were asked to voluntarily provide samples or allow sampling from multiple anatomical sites for STI testing. This included testing urine, anorectal, and oropharyngeal samples for CT and NG using the Abbott RealTime CT/NG assay (Des Plaines, IL, USA), and testing anorectal and external genital (penile or neovaginal) samples for HPV using the Seegene Anyplex II HPV28 Detection assay (Seoul, Republic of Korea), which also enables identification of HPV types, including 12 high-risk oncogenic types (16 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59) [18]. Participants could individually choose either SCS or PCS for the oropharyngeal, anorectal, and genital samples.

Instructional diagrams developed for the study were provided to guide participants with self-collection, including the neovagina. An additional interviewer-led questionnaire was developed to ask a series of questions before and after sample collection, including open-ended questions about the reasons for refusal, choice of sample collection method, and experience of difficulty or discomfort using the chosen method. Study data were collected as a single entry and managed using REDCap electronic data capture tools hosted at the Faculdade de Ciências Médicas da Santa Casa de São Paulo [19,20].

Conceptual framework

To achieve the overall study aim, a conceptual framework was developed based on the definitions of 'acceptability' as related to healthcare interventions and 'usability, ' as described by the International Organization for Standardization (ISO) as related to systems, products, or services (ISO 9241-11:2018). Acceptability is defined as "a multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention" [21]. Usability is defined as "the extent to which a system, product, or service can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [22].

This study considered transgender women as specified users of SCS for STI testing with the goal of providing suitable specimens for accurate test results for CT, NG, and HPV, with the following three study objectives: (1) to determine the participants' preferred choice of sampling options (SCS or PCS) for anorectal, oropharyngeal, and genital sites; (2) to determine participants' satisfaction with the chosen sampling option and preference for future collection; and (3) to assess the accuracy of SCS compared to PCS by analyzing the comparability of individual STI results (positivity rate) at various anatomical sites.

Data analysis and reporting

Due to the complex sample design utilizing 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.[23] Although published estimation methods can theoretically mitigate these biases,[24] there is ongoing debate as some literature suggests that unweighted logistic regression offers the best approach for RDS samples.[25,26] In light of this, we opted to present unweighted estimates, including odds ratios (OR), 95% confidence intervals (CI), 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 marginalized and under-researched population. Consequently, we prioritized clinical significance over statistical significance. Any reported estimates are descriptive and should be interpreted with caution to avoid misleading conclusions. Reporting was informed by the recommendations within the STROBE-RDS guidelines [27].

The analysis determined the choice of SCS or PCS for each of the anorectal, oropharyngeal, and genital sites, including refusal rates; participant satisfaction with the chosen sampling option by analyzing reported ease of SCS and comfort of PCS at each of the sites; and participant preference for future sample collection from each of the sites. Positivity rates of CT, NG, and HPV test results (including void results) were calculated at a 95%CI for each site by comparing SCS and PCS by calculating *p*-values to determine if there were significant differences.

Additional analysis was conducted to assess whether any characteristics were associated with the choice of SCS compared with PCS at each sampling site, excluding participants who refused to provide the corresponding sample. Bivariate comparisons were conducted by calculating the OR and 95%CI between the sample collection methods and several variables. Variables associated with self-collection at each sampling site (*p* value less than 0.1) in the bivariate analysis were included in a multivariate analysis (MVA) using logistic regression to calculate adjusted odds ratios (AOR) and 95%CI for all included variables. Statistical significance was considered for *p*-values less than 0.05.

IBM SPSS Statistics for Windows, version 26 (IBM Corp., Armonk, NY, USA) was used for the statistical analyses. Valid, open-ended responses to relevant survey questions were analyzed by exporting interviewer-inputted responses into a spreadsheet (Google Sheets), auto-translating individual responses from Portuguese to English, coding individual responses, and assessing recurrent themes.

Ethical Aspects

This study was approved by the Research Ethics Committee (CEP) of Santa Casa de Misericórdia de São Paulo, Brazil (CAAE 05585518.7.0000.5479; opinion n°:3.126.815; 30/01/2019) and by other participating institutions. Secondary data analysis (by the first author) was approved by the London School of Hygiene and Tropical Medicine, UK (Ref:26700; 14/12/2021). Written informed consent was obtained from all the participants.

Community involvement

Individuals who identified with a trans-feminine identity (including transgender women) were involved in the design and implementation of the study, led the recruitment of participants using RDS, and supported the dissemination of preliminary results and informative videos among the trans community. A feasibility study was first conducted among a sample of transgender women enrolled in a cohort study in São Paulo, which suggested the acceptability of inclusion into a study design the sampling from potential infection sites (either self- or provider-collected) for the testing of STIs [17].

Results

Study population

A total of 1,317 participants aged 18 to 67 years (mean 31.96 years, ±SD 9.86) were recruited 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 [28,29], while fewer identified as women (7.5%) or other gender identities (6.2%). While over one-quarter (27.4%) reported undergoing some transition-related surgery or procedure, only a small proportion (1.7%) reported having a neovagina

after undergoing surgery to remove their penis and scrotum; almost half (47.6%) used gender-affirming hormones. Almost all participants (90.7%) reported receptive anal intercourse, and two-fifths (40.0%) indicated at least one commercial sex partner in the past six months. More than one-quarter (28.0%) of the participants self-reported an HIV-positive status. STI symptoms were reported by 21.2% (n=276) of patients in the past six months, while 13.1% (n=170) reported symptoms at the study visit.

Choice of sample collection at three anatomical sties

Most participants opted for SCS from both anorectal and genital sites (75% and 73%, respectively), with a significantly lower preference (50%) for SCS compared to PCS from the oropharyngeal site (Table 1). Among the few participants who provided neovaginal samples (n=15), most chose PCS (60.0%) over SCS, with no refusal. Overall, a low refusal rate to provide samples was observed; this was lower for anorectal or oropharyngeal samples (0.8% and 0.6%, respectively) compared to urine samples (2.2%), with a higher refusal rate for penile samples (5.1%). The main reasons for refusal included participants being in a hurry or not feeling comfortable with the collection.

Of the 1,250 participants who provided samples from all three anatomical sites (anorectal, genital, and oropharyngeal), half of the participants self-collected all samples (50.3%, 95%CI:46.5-53.1) with slightly over one-quarter opting to self-collect some samples (26.3%, 95%CI:23.9-28.9) and almost one-quarter opting for all samples to be provider-collected (23.4%, 95%CI:21.0-25.8). The reasons for choosing SCS included feelings of shame, shyness, embarrassment, or discomfort of exposing their bodies in front of the doctor and self-collection being more practical, easier, faster, or enabling greater privacy. For PCS, reasons for choice included being afraid of collecting incorrectly, and preferring an experienced professional to collect correctly. Other reasons for choosing PCS, but similar to SCS, provider collection was described as more practical, easier, faster, and safer or secure. Minimal variation was observed between anatomical sample sites.

In addition to observed variations between the study locations, the MVA revealed that the choice of SCS over PCS for all three anatomical sites was most likely among participants who reported no STI symptoms in the past six months (p=0.001) or were not currently using gender-

affirming hormones (p=0.023). For instance, participants who reported no STI symptoms in the past six months were 2.5 times more likely to opt for SCS for genital (95%CI:1.5-4.2) and anorectal samples (95%CI:1.4-4.2) compared to those who reported symptoms in the past six months. Overall, there was limited variability observed between the various characteristics of study participants. The full results of the analysis for each anatomical site are provided (see Tables, Supplemental Digital Content 1-3).

Experience of sample collection and future collection preferences

Most participants considered self-collection easy, with similar results (over 90%) for all anatomical collection sites, except for collection from the neovagina (80.0%) (Figure 1, A). For those who were guided by instructional diagrams, almost all indicated that each diagram was 'easy' to follow (97-100%). The main reasons participants reported that collection was 'difficult' included feeling uncomfortable, with nausea reported for oropharyngeal sample collection, and pain or discomfort reported for anorectal sample collection.

Among the participants who opted for PCS, most reported feeling 'comfortable' with collection from all anatomical sites (Figure 1, B), although satisfaction was slightly lower than SCS at each site, except for sample collection from neovagina (100%). Similar reasons were reported for difficulty or discomfort of sample collection, including nausea for oropharyngeal sample collection and pain or discomfort for anorectal sample collection.

Overall, most participants (over 70%) would choose SCS in the future for genital and anorectal samples, whereas about half would choose SCS for oropharyngeal samples. A small proportion of respondents indicated no future preferences. For all anatomical sites, most participants who provided a self-collected sample would choose SCS in the future, while most who initially opted for provider collection would still choose PCS in the future.

Comparability of results of sample collection

Urine, anorectal, and oropharyngeal samples were tested for CT and NG. Positivity rates for both CT and NG at each anatomical site compared to the collection method are presented in Figure

2. There was no statistically significant difference between the choice of sample collection (SCS vs. PCS) for positive test results for CT and NG at anorectal and oropharyngeal sites. In addition, there was no significant difference between the proportion of collected samples providing void results, which was very low overall.

Anorectal and genital samples were tested for HPV and classified into high- and low-risk types. There were no statistically significant differences in the choice of sample collection for overall positive test results and the frequency of high-risk/low-risk types at anorectal and genital (penile or neovaginal) sites (Figure 3). Similarly, there was no significant difference between the collection methods for the proportion of samples that provided a void result.

Discussion

This study showed a high level of preference and acceptability of self-collection for STI testing by transgender women in Brazil, with a high level of comparability of test results with provider-collected samples, suggesting that self-sampling should be offered as a choice for STI testing among transgender women. When given this choice, most participants chose self-collection, reported a high level of satisfaction, and would choose it again in the future. This aligns with a study of transgender women in Bangkok, which also found high acceptance and satisfaction [16].

While the choice of sample collection method varied by sampling site, with most choosing self-collection for anorectal (75%) and genital (73%) samples but less for oropharyngeal (50%) samples, the factors that were found to be associated with the choice of SCS potentially characterized individuals in a more vulnerable position (i.e., poorer, less resources to support gender affirmation, and lower access to health services or health literacy). In addition, a greater preference for SCS was observed among participants who had not reported any recent STI symptoms, suggesting that SCS is likely to be more appropriate for testing approaches with asymptomatic individuals.

Importantly, the test positivity rates from SCS for each STI were found to be comparable to PCS, and both had a low level of void results. This comparability indicates a similar level of accuracy, suggesting that few cases would be missed by one collection method compared with the other, which

is in line with the existing literature [10]. However, a limitation of this study is that the collection methods were not directly compared for performance, as participants only provided each requested sample using a single collection method.

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 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.

Although the use of self-sampling is demonstrated to be effective and could potentially reduce human resource costs, it is important to note that most participants who chose provider collection would choose to do so again in the future. This indicates the need for healthcare providers to be open to patient preferences, as some value and prefer provider collection. As reported elsewhere, there is a perception among some transgender women that specimen collection by a health-care provider was the norm for cis-gender women and was therefore the preferred sampling method among individuals identified as women [17]. Offering the choice of collection method would support gender-affirmative care in settings that provide sexual health services to transgender women.

These results aim to inform policies and appropriate guidance for sample collection for STI testing interventions among transgender women. This includes possibilities for the integration of STI testing into gender-affirming care services or services for pre-exposure prophylaxis (PrEP) for HIV [3,30]. This study also provides additional evidence specifically for transgender women in relation to SCS-related recommendations within the 2022 WHO guidelines on self-care interventions for health and well-being [8]. While the WHO recommendation related to HPV testing focuses solely on self-sampling in relation to cervical cancer screening, this study provides supportive evidence for a future amendment inclusive of transgender women regarding self-sampling as an additional approach to HPV testing in other cancer screening services (i.e., anorectal or oropharyngeal cancer screening). For the two WHO recommendations related to SCS, we would suggest the inclusion of a key

implementation consideration regarding the importance of illustrated instructions (with inclusive imagery) to support effectiveness and increase accessibility and accuracy of self-sampling.

Conclusions

The offer and choice of sample collection methods will likely enhance STI testing for transgender women and other marginalized populations facing greater stigma and discrimination, often with the highest rates of STIs. Self-collection has the potential to expand accessibility and overcome barriers that often dissuade individuals from seeking STI testing through traditional healthcare channels. In summary, this study indicates that the feasibility of integrating multisite STI testing into sexual health services for transgender women, facilitated by self-collection methods. Ideally, individuals should be afforded the choice for their preferred sample collection approach, aligning with the principles of gender-affirmative care.

References

1. MacCarthy S, Poteat T, Xia Z, et al. Current research gaps: a global systematic review of HIV and sexually transmissible infections among transgender populations. Sex Health 2017; 14(5): 456-68.

2. Van Gerwen OT, Jani A, Long DM, et al. Prevalence of sexually transmitted infections and human immunodeficiency virus in transgender persons: a systematic review. Transgend Health 2020; 5(2): 90-103.

3. World Health Organization (WHO). Consolidated guidelines on HIV, viral hepatitis and STI prevention, diagnosis, treatment and care for key populations. Geneva: WHO; 2022.

4. Magno L, Pereira M, De Castro CT, et al. HIV Testing Strategies, Types of Tests, and Uptake by Men Who have Sex with Men and Transgender Women: A Systematic Review and Meta-analysis. AIDS Behav 2023; 27: 678-707.

5. Rosenberg S, Callander D, Holt M, et al. Cisgenderism and transphobia in sexual health care and associations with testing for HIV and other sexually transmitted infections: Findings from the Australian Trans & Gender Diverse Sexual Health Survey. PLoS One 2021; 16: e0253589.

6. Salgado V, Oliveira C, Marques L, et al. Bacterial STI rates by pharyngeal, urethral and rectal sites among adolescents' men who have sex with men in Northeast Brazil: the importance of comprehensive sample collection sites. Presented at: 11th IAS Conference on HIV Science [1280]; 2021; Berlin, Germany.

7. UCSF Gender Affirming Health Program, Department of Family and Community Medicine. Guidelines for the Primary and Gender-Affirming Care of Transgender and Gender Nonbinary People; 2nd edition. San Francisco: University of California San Francisco (UCSF); 2016.

8. World Health Organization (WHO). WHO guideline on self-care interventions for health and well-being, 2022 revision. Geneva: WHO; 2022.

9. Harding-Esch EM, Hollis E, Mohammed H, et al. Self-sampling and self-testing for STIs and HIV: the case for consistent nomenclature. Sex Transm Infect 2017;93:445-8.

10. Lunny C, Taylor D, Hoang L, et al. Self-collected versus clinician-collected sampling for chlamydia and gonorrhea screening: a systemic review and meta-analysis. PLoS One 2015; 10(7): e0132776.

11. Paudyal P, Llewellyn C, Lau J, et al. Obtaining self-samples to diagnose curable sexually transmitted infections: a systematic review of patients' experiences. PLoS One 2015; 10(4): e0124310.

12. Ogale Y, Yeh PT, Kennedy CE, et al. Self-collection of samples as an additional approach to deliver testing services for sexually transmitted infections: a systematic review and meta-analysis. BMJ Glob Health 2019; 4(2): e001349.

13. Yeh PT, Kennedy CE, De Vuyst H, et al. Self-sampling for human papillomavirus (HPV) testing: a systematic review and meta-analysis. BMJ Glob Health 2019; 4: e001351.

14. Vialard F, Anand A, Leung Soo C, et al. Self-sampling strategies (with/without digital innovations) in populations at risk of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*: a systematic review and meta-analyses. Sex Transm Infect 2023; sextrans-2022-0.

15. Reisner SL, Deutsch MB, Peitzmeier SM, et al. Test performance and acceptability of self- versus provider-collected swabs for high-risk HPV DNA testing in female-to-male trans masculine patients. PLoS One 2018; 13(3): e0190172.

16. Hiransuthikul A, Janamnuaysook R, Himma L, et al. Acceptability and satisfaction towards self-collection for chlamydia and gonorrhoea testing among transgender women in Tangerine Clinic, Thailand: shifting towards the new normal. J Int AIDS Soc 2021; 24(9): e25801.

17. McCartney DJ, Pinheiro TF, Gomez JL, et al. Acceptability of self-sampling for etiological diagnosis of mucosal sexually transmitted infections (STIs) among transgender women in a longitudinal cohort study in São Paulo, Brazil. Braz J Infect Dis 2022; 26(3): 102356.

18. Bouvard V, Baan R, Straif K, et al. A review of human carcinogens—Part B: biological agents. Lancet Oncol 2009; 10: 321-2.

19. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009; 42(2): 377-81.

20. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software partners. J Biomed Inform. 2019; 95: 103208.

21. Sekhon M, Cartwright M, Francis JJ. Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. BMC Health Serv Res 2017; 17.

22. International Organization for Standardization (ISO). ISO 9241-11:2018 Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts. Available at: https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en. Accessed December 23, 2022.

23. Johnston LG, Hakim AJ, Dittrich S, et al. A Systematic Review of Published Respondent-Driven Sampling Surveys Collecting Behavioral and Biologic Data. AIDS Behav 2016; 20(8): 1754-76.

24. Salganik MJ, Heckathorn DD. Sampling and estimation in hidden populations using respondent-driven sampling. Sociol Methodol 2004; 34(1): 193-240.

25. Avery L, Rotondi N, Mcknight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: results from a simulation study. BMC Med Res Methodol 2019; 19.

26. Sperandei S, Bastos LS, Ribeiro-Alves M, Reis A, Bastos FI. Assessing logistic regression applied to respondent-driven sampling studies: a simulation study with an application to empirical data. Int J Soc Res Methodol 2023; 26: 319-33.

27. White RG, Hakim AJ, Salganik MJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology for respondent-driven sampling studies: “STROBE-RDS” statement. J Clin Epidemiol 2015; 68:1463-71.

28. dos Santos PMR, dos Santos KC, Magalhães LS, et al. Travestis and transsexual women: who are at higher risk for sexually transmitted infections? Rev Bras Epidemiol 2021; 24.

29. Carrara S, Hernandez JDG, Uziel AP, et al. Body construction and health itineraries: a survey among travestis and trans people in Rio de Janeiro, Brazil. Cad Saude Publica 2019; 35.

30. World Health Organization (WHO). WHO implementation tool for pre-exposure prophylaxis (PrEP) of HIV infection. Module 13. Integrating STI services. Geneva: WHO; 2022.

STATEMENTS

Acknowledgements

The TransOdara study was coordinated by the Faculdade de Ciências Médicas da Santa Casa de São Paulo, in collaboration with the Centro de Referência e Treinamento em DST/Aids (CRT DST/AIDS), Universidade Federal do Rio Grande do Sul (UFRGS), Universidade Federal da Bahia (UFBA), Universidade Federal do Mato Grosso do Sul (UFMS), Fundação Leônidas e Maria Deane (Fiocruz – Manaus), Secretaria Municipal e de Saúde de Porto Alegre (SMS- POA), Instituto Adolfo Lutz (IAL), and the Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA). The authors would like to thank the TransOdara study participants and TransOdara Research Group. Contributing members of the TransOdara Research Group included the following: Maria Amélia de S.M. Veras, Maria Inês Costa Dourado, Thiago Pinheiro, Ana Rita C. Motta Castro, Andrea Fachel Leal, Bruno Puccinelli, Carla Gianna Luppi, Claudia Renata dos Santos Barros, Daniela Knauth, Daniel McCartney, Philippe Mayaud, Roberto Carvalho, Katia Cristina Bassichetto, Maria Aparecida da Silva, Rita Bacuri, Thiago Pestana, Laio Magno, Sandra Brasil, Luisa Lina Villa, Willi McFarland, Erin Wilson, Mariana Veloso, Alícia Kruger, Ana Roberta Patti Pascon, Adele Benzaken, Maria Luíza Bazzo, Gwenda Hughes, Carmem Freitas Oliveira, Luis Fernando Brígido, Regina Célia Moreira, Adriana Parise Compri, Edilene Peres Real da Silveira, Elaine Lopes de Oliveira, Marcia Jorge Castejon, Neuza Satomi Sato, Rosemeire Yamashiro; Sandra Araújo, Mara Cristina Scheffer, Lisléia Golfetto, Dariana Pimentel Gomes Hübner, Patrícia Puccinelli Orlandi Nogueira, Leonardo Soares Bastos, Francisco Inácio Bastos, Sandro Leonardo Martins Sperandei, Camila Mattos dos Santos. Preliminary results from this manuscript were presented as a poster presentation at the 24th International AIDS Conference in Montreal, Canada (29 Jul-2 Aug 2022).

Figures and Tables

Table 1. Overall uptake and choice of sample collection for all anatomical sites among transgender women in Brazil

	Total	**Self-collected**	**Provider-collected**	**Refused**
Sample site	N (missing)	% (95%CI)	% (95%CI)	% (95% CI)
Oropharyngeal	1271 (46)	49.8 (47.0-52.6)	49.6 (46.8-52.4)	0.6 (0.3-1.2)
Anorectal	1256 (61)	74.9 (72.4-77.3)	24.3 (21.9-26.8)	0.8 (0.4-1.5)
Genital	1312 (5)	72.7 (70.2-75.1)	22.3 (20.0-24.6)	5.0 (3.9-6.4)
Penile	1297 (4)	73.1 (70.6-75.5)	21.8 (19.6-24.2)	5.1 (4.0-6.4)
Neovaginal	15 (1)	40.0 (16.3-67.7)	60.0 (32.3-83.7)	0.0 (0.0-21.8)
Urine	1311 (6)	97.8 (96.8-98.5)	-	2.2 (1.5-3.2)

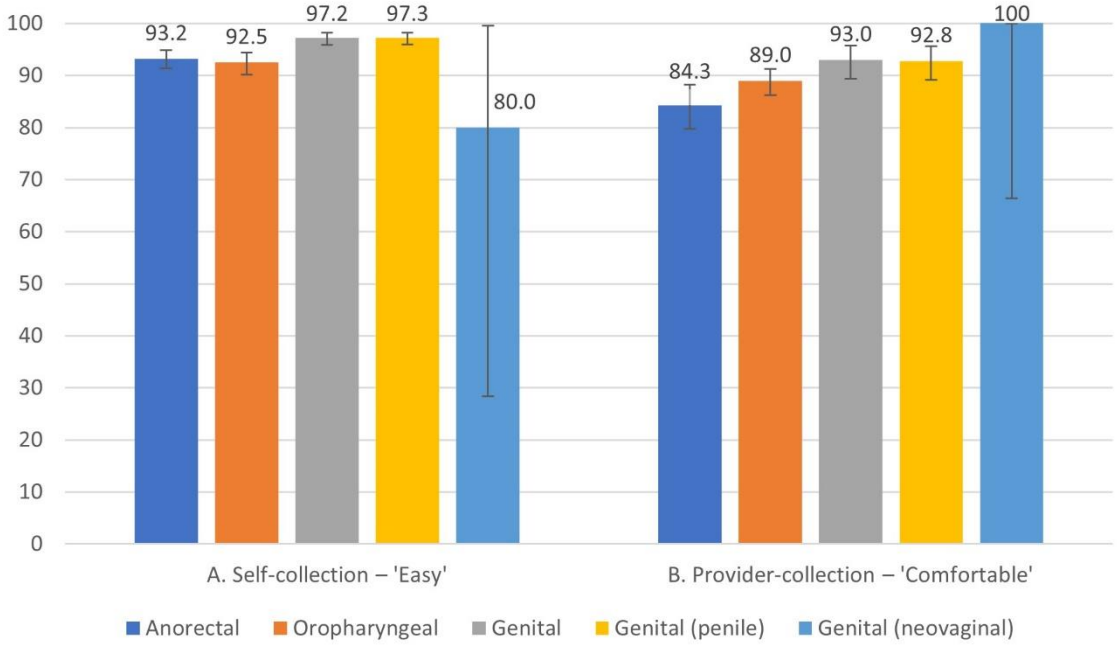


Figure 1. Participant experience of sample collection (A. self-collection and B. provider-collection) by anatomical site among transgender women in Brazil

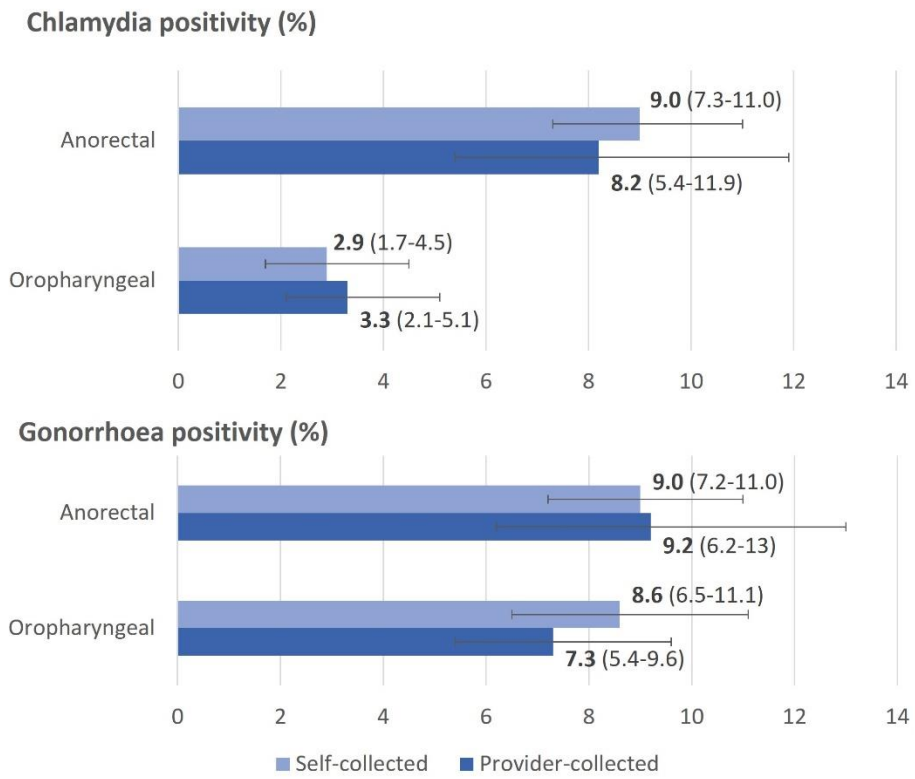


Figure 2. Test positivity rate (%) (with 95% CI) for *C. trachomatis* and *N. gonorrhoeae* by anatomical site and choice of sample collection method

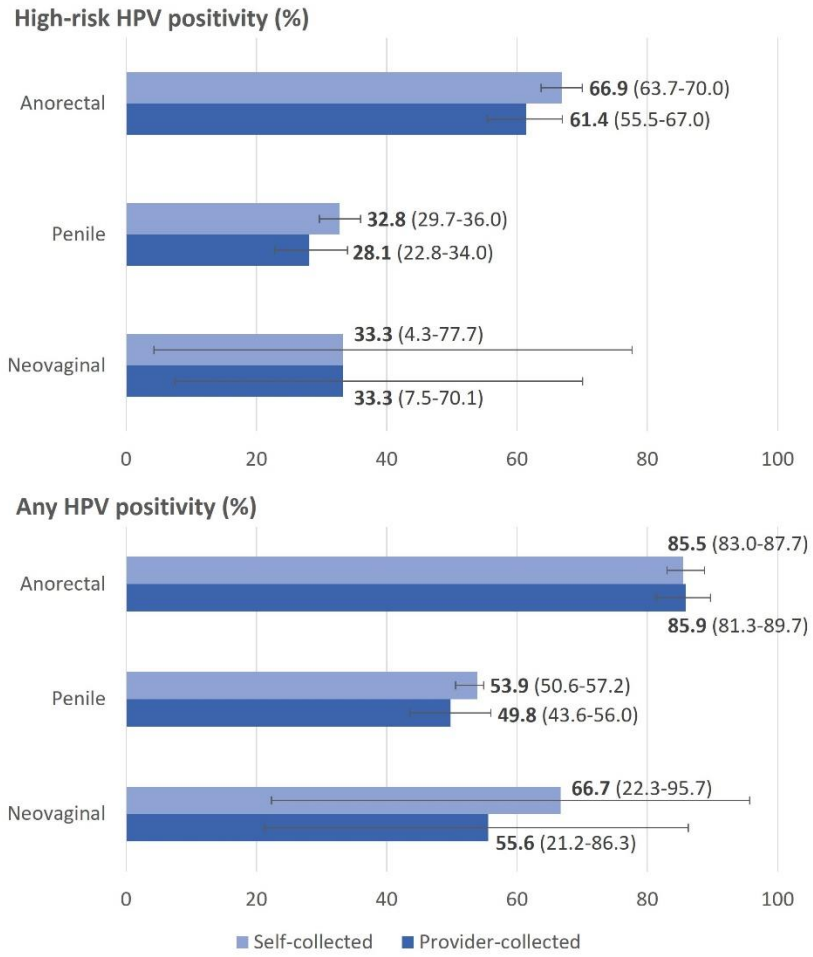


Figure 3. Test positivity rate (%) for high-risk and any HPV by anatomical site and choice of sample collection method

Supplemental Table 1. Factors associated with choice of anorectal self-collected over provider-collected samples (excluding refusal)

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Study location					
São Paulo	273/396 (68.9)	1.00 (-)	-	1.00 (-)	-
Salvador	100/161 (62.1)	0.74 (0.50-1.08)	0.121	0.40 (0.21-0.76)	**0.005**
Campo Grande	115/173 (66.5)	0.89 (0.61-1.31)	0.561	0.63 (0.30-1.30)	0.209
Porto Alegre	149/179 (83.2)	2.24 (1.43-3.50)	**<0.001**	1.88 (0.87-4.08)	0.111
Manaus	304/337 (90.2)	4.15 (2.73-6.30)	**<0.001**	1.93 (0.92-4.04)	0.083
Age, years					
18-24	263/331 (79.5)	1.35 (1.00-1.83)	**0.053**	0.88 (0.50-1.55)	0.656
≥25	678/915 (74.1)	1.00 (-)	-	1.00 (-)	-
Ethnicity					
Black	244/323 (75.5)	1.00 (-)	-		
Mixed	416/547 (76.1)	1.03 (0.75-1.42)	0.865		
White	242/324 (74.7)	0.96 (0.67-1.37)	0.802		
Other[1]	32/40 (80.0)	1.30 (0.57-2.93)	0.534		
Religion					
No religion	338/446 (75.6)	1.00 (-)	-		
Afro-Brazilian	192/265 (72.5)	0.84 (0.60-1.19)	0.324		
Catholic	267/334 (79.9)	1.27 (0.90-1.80)	0.169		
Other[2]	138/193 (71.5)	0.80 (0.55-1.17)	0.255		
Education					
None or primary	238/307 (77.5)	1.28 (0.87-1.87)	0.212		
Secondary	508/672 (75.6)	1.15 (0.83-1.58)	0.412		
Higher-level	192/263 (73.0)	1.00 (-)	-		
Housing					
Owns house or apartment	215/321 (67.0)	1.00 (-)	-	1.00 (-)	-
Rents house or apartment	342/449 (76.2)	1.58 (1.15-2.17)	**0.005**	1.66 (0.98-2.82)	0.059
Temporarily with friends or family	274/333 (82.3)	2.30 (1.60-3.30)	**<0.001**	1.46 (0.78-2.74)	0.242
Other[3]	108/141 (76.6)	1.61 (1.03-2.54)	**0.039**	1.13 (0.53-2.38)	0.756
Gender identity			0.076		0.934
Woman	66/96 (68.8)	1.00 (-)	-	1.00 (-)	-
Trans woman	541/726 (74.5)	1.33 (0.84-2.11)	0.228	1.15 (0.56-2.40)	0.702
Travesti	303/380 (79.7)	1.79 (1.09-2.95)	**0.022**	1.29 (0.55-2.99)	0.560
Other identity	29/41 (70.7)	1.10 (0.49-2.44)	0.818	1.40 (0.23-8.47)	0.718
Name changed on any official document					
Yes	250/365 (68.5)	1.00 (-)	-	1.00 (-)	-
No	689/879 (78.4)	1.67 (1.27-2.19)	**<0.001**	1.57 (0.96-2.56)	0.074
Any gender-affirming transition procedure					
Yes	240/339 (70.8)	1.00 (-)	-	1.00 (-)	-
No	693/899 (77.1)	1.39 (1.05-1.84)	**0.022**	1.19 (0.70-2.02)	0.517
Use of gender-affirming hormones (current)					
Yes	365/506 (72.1)	1.00 (-)	-	1.00 (-)	-
No	436/562 (77.6)	1.34 (1.01-1.76)	**0.040**	1.74 (1.08-2.79)	**0.023**

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Experienced physical assault (past 12 months)					
No	782/1040(75.2)	1.00 (-)	-		
Yes	152/198 (76.8)	1.09 (0.76-1.56)	0.637		
Ever exchanged in transactional sex					
No	236/324 (72.8)	1.00 (-)	-	1.00 (-)	-
Yes	450/577 (78.0)	1.32 (0.97-1.81)	**0.082**	0.83 (0.50-1.37)	0.456
Any commercial sex partner (past 6 months)					
Yes	361/495 (72.9)	1.00 (-)	-	1.00 (-)	-
No	574/742 (77.4)	1.27 (0.98-1.65)	**0.076**	1.23 (0.69-2.17)	0.487
Any casual sex partner (past 6 months)					
Yes	407/544 (74.8)	1.00 (-)	-		
No	527/692 (76.2)	1.08 (0.83-1.40)	0.586		
Any regular sex partner (past 6 months)					
Yes	438/601 (72.9)	1.00 (-)	-	1.00 (-)	-
No	499/640 (78.0)	1.32 (1.02-1.71)	**0.037**	0.90 (0.58-1.40)	0.632
Received hepatitis B vaccine					
Yes	351/492 (71.3)	1.00 (-)	-	1.00 (-)	-
No	432/530 (81.5)	1.77 (1.32-2.38)	**<0.001**	1.49 (0.95-2.34)	0.894
Reported HIV status					
Positive	218/305 (71.5)	1.00 (-)	-		
Negative	590/787 (75.0)	1.20 (0.89-1.61)	0.238		
Any STI diagnosis (past 6 months)					
Yes	151/227 (66.5)	1.00 (-)	-	1.00 (-)	-
No	764/982 (77.8)	1.76 (1.29-2.42)	**<0.001**	1.44 (0.89-2.71)	0.125
Any STI symptoms (past 6 months)					
Yes	166/264 (62.9)	1.00 (-)	-	1.00 (-)	-
No	762/965 (79.0)	2.22 (1.65-2.97)	**<0.001**	2.47 (1.46-4.19)	**0.001**
Any STI symptoms (at study visit)					
Yes	111/166 (66.9)	1.00 (-)	-	1.00 (-)	-
No	818/1067 (76.7)	1.63 (1.14-2.32)	**0.007**	1.69 (0.90-3.19)	0.105

AOR: Adjusted Odds Ratio; **CI**: Confidence Interval; **OR**: Odds Ratio

Variables with ***p*-value** (in bold) were <0.1 in bivariate analysis and included in MVA, where statistical significance was considered $p<0.05$.

[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

Supplemental Table 2. Factors associated with choice of genital (penile or neovaginal) self-collected over provider-collected samples (excluding refusal)

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Study location					
São Paulo	275/396 (69.4)	1.00 (-)	-	1.00 (-)	-
Salvador	103/163 (63.2)	0.76 (0.52-1.11)	0.152	0.44 (0.24-0.83)	**0.011**
Campo Grande	118/172 (68.6)	0.96 (0.65-1.42)	0.841	0.61 (0.30-1.28)	0.192
Porto Alegre	152/178 (85.4)	2.57 (1.61-4.11)	**<0.001**	3.10 (1.27-7.56)	**0.013**
Manaus	306/337 (90.8)	4.34 (2.83-6.66)	**<0.001**	2.10 (0.99-4.46)	0.053
Age, years					
18-24	271/332 (81.6)	1.50 (1.10-2.06)	**0.011**	0.94 (0.53-1.68)	0.830
≥25	683/914 (74.7)	1.00 (-)	-	1.00 (-)	-
Ethnicity					
Black	248/324 (76.5)	1.00 (-)	-		
Mixed	421/547 (77.0)	1.02 (0.74-1.42)	0.887		
White	247/324 (76.2)	0.98 (0.68-1.41)	0.926		
Other[1]	31/39 (79.5)	1.19 (0.52-2.69)	0.681		
Religion					
No religion	346/447 (77.4)	1.00 (-)	-		
Afro-Brazilian	195/263 (74.1)	0.84 (0.59-1.19)	0.325		
Catholic	268/335 (80.0)	1.17 (0.83-1.65)	0.382		
Other[2]	139/193 (72.0)	0.75 (0.51-1.10)	0.145		
Education					
None or primary	242/307 (78.8)	1.37 (0.93-2.02)	0.110		
Secondary	516/671 (76.9)	1.23 (0.88-1.70)	0.223		
Higher-level	193/264 (73.1)	1.00 (-)	-		
Housing					
Owns house or apartment	221/320 (69.1)	1.00 (-)	-	1.00 (-)	-
Rents house or apartment	345/447 (77.2)	1.52 (1.10-2.10)	**0.012**	1.49 (0.87-2.54)	0.150
Temporarily with friends or family	276/334 (82.6)	2.13 (1.47-3.08)	**<0.001**	1.42 (0.74-2.70)	0.292
Other[3]	110/143 (76.9)	1.49 (0.95-2.36)	**0.085**	1.03 (0.49-2.19)	0.936
Gender identity					
Woman	65/96 (67.7)	1.00 (-)	-	1.00 (-)	-
Trans woman	545/725 (75.2)	1.44 (0.91-2.29)	0.117	1.24 (0.59-2.59)	0.567
Travesti	311/381 (81.6)	2.12 (1.29-3.49)	**0.003**	1.49 (0.63-3.52)	0.360
Other identity	31/41 (75.6)	1.48 (0.64-3.40)	0.357	1.48 (0.25-8.91)	0.669
Name changed on any official document					
Yes	252/364 (69.2)	1.00 (-)	-	1.00 (-)	-
No	700/880 (79.5)	1.73 (1.31-2.28)	**<0.001**	1.43 (0.87-2.36)	0.157
Any gender-affirming transition procedure					
Yes	242/337 (71.8)	1.00 (-)	-	1.00 (-)	-
No	704/901 (78.1)	1.40 (1.06-1.87)	**0.020**	1.10 (0.64-1.88)	0.730
Use of gender-affirming hormones (current)					
Yes	368/507 (72.6)	1.00 (-)	-	1.00 (-)	-
No	441/561 (78.6)	1.39 (1.05-1.84)	**0.022**	1.89 (1.17-3.06)	**0.010**

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Experienced physical assault (past 12 months)					
No	792/1041(76.1)	1.00 (-)	-		
Yes	155/197 (78.7)	1.16 (0.80-1.68)	0.430		
Ever engaged in transactional sex					
No	240/325 (73.8)	1.00 (-)	-	1.00 (-)	-
Yes	457/578 (79.1)	1.34 (0.97-1.84)	**0.073**	0.83 (0.50-1.38)	0.478
Any commercial sex partner (past 6 months)					
Yes	365/494 (73.9)	1.00 (-)	-	1.00 (-)	-
No	583/743 (78.5)	1.29 (0.99-1.68)	**0.063**	1.16 (0.65-2.09)	0.614
Any casual sex partner (past 6 months)					
Yes	413/544 (75.9)	1.00 (-)	-		
No	534/692 (77.2)	1.07 0.82-1.40	0.607		
Any regular sex partner (past 6 months)					
Yes	445/601 (74.0)	1.00 (-)	-	1.00 (-)	-
No	504/540 (78.8)	1.30 (1.00-1.69)	**0.051**	0.88 (0.56-1.37)	0.561
Received hepatitis B vaccine					
Yes	357/493 (72.4)	1.00 (-)	-	1.00 (-)	-
No	438/528 (83.0)	1.85 (1.37-2.51)	**<0.001**	1.53 (0.97-2.43)	0.070
Reported HIV status					
Positive	220/303 (72.6)	1.00 (-)	-		
Negative	600/788 (76.1)	1.20 (0.89-1.63)	0.227		
Any STI diagnosis (past 6 months)					
Yes	156/227 (68.7)	1.00 (-)	-	1.00 (-)	-
No	772/982 (78.6)	1.67 (1.22-2.30)	**0.002**	1.44 (0.82-2.54)	0.206
Any STI symptoms (past 6 months)					
Yes	169/264 (64.0)	1.00 (-)	-	1.00 (-)	-
No	772/965 (80.0)	2.22 (1.65-2.97)	**<0.001**	2.45 (1.44-4.17)	**0.001**
Any STI symptoms (at study visit)					
Yes	111/164 (67.7)	1.00 (-)	-	1.00 (-)	-
No	831/1069 (77.7)	1.67 (1.17-2.38)	**0.005**	1.72 (0.90-3.27)	0.098

AOR: Adjusted Odds Ratio; **CI**: Confidence Interval; **OR**: Odds Ratio

*Variables with ***p*-value** (in bold) were <0.1 in bivariate analysis and included in MVA, where statistical significance was considered $p<0.05$.

[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

Supplemental Table 3. Factors associated with choice of oropharyngeal self-collected over provider-collected samples (excluding refusal)

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Study location					
São Paulo	225/399 (56.4)	1.00 (-)	-	1.00 (-)	-
Salvador	52/165 (31.5)	0.37 (0.24-0.52)	**<0.001**	0.29 (0.15-0.58)	**<0.001**
Campo Grande	30/176 (17.0)	0.16 (0.10-0.25)	**<0.001**	0.24 (0.12-0.50)	**<0.001**
Porto Alegre	33/186 (17.7)	0.17 (0.11-0.26)	**<0.001**	0.12 (0.05-0.25)	**<0.001**
Manaus	293/337 (86.9)	5.15 (3.54-7.48)	**<0.001**	4.13 (2.07-8.22)	**<0.001**
Age, years					
18-24	167/170 (49.6)	0.97 (0.76-1.24)	0.809		
≥25	466/926 (50.3)	1.00 (-)	-		
Ethnicity					
Black	144/329 (43.8)	1.00 (-)	-	1.00 (-)	-
Mixed	326/555 (58.7)	1.83 (1.39-2.41)	**<0.001**	0.59 (0.34-1.01)	0.053
White	136/327 (41.6)	0.92 (0.67-1.25)	0.573	0.59 (0.32-1.08)	0.088
Other[1]	25/40 (62.5)	2.14 (1.09-4.21)	**0.027**	1.84 (0.40-8.39)	0.431
Religion					
No religion	215/455 (47.3)	1.00 (-)	-	1.00 (-)	-
Afro-Brazilian	104/268 (38.8)	0.71 (0.52-0.96)	**0.027**	1.04 (0.58-1.88)	0.885
Catholic	209/337 (62.0)	1.82 (1.37-2.43)	**<0.001**	1.10 (0.63-1.94)	0.734
Other[2]	101/195 (51.8)	1.20 (0.86-1.68)	0.289	1.12 (0.63-1.99)	0.691
Education					
None or primary	155/313 (49.5)	1.26 (0.91-1.75)	0.168	1.19 (0.63-2.25)	0.589
Secondary	360/681 (52.9)	1.44 (1.08-1.92)	**0.012**	1.37 (0.81-2.31)	0.240
Higher-level	116/265 (43.8)	1.00 (-)	-	1.00 (-)	-
Housing					
Owns house or apartment	137/325 (42.2)	1.00 (-)	-	1.00 (-)	-
Rents house or apartment	217/454 (47.8)	1.26 (0.94-1.67)	0.119	1.45 (0.87-2.39)	0.151
Temporarily with friends or family	191/337 (56.7)	1.80 (1.32-2.44)	**<0.001**	1.56 (0.85-2.87)	0.152
Other[3]	86/145 (59.3)	2.00 (1.34-2.98)	**0.001**	1.79 (0.85-3.74)	0.124
Gender identity					
Woman	39/95 (41.1)	1.00 (-)	-	1.00 (-)	-
Trans woman	360/740 (48.6)	1.36 (0.88-2.10)	0.164	0.88 (0.43-1.83)	0.741
Travesti	216/381 (56.7)	1.88 (1.19-2.97)	**0.007**	0.93 (0.41-2.11)	0.857
Other identity	17/44 (38.6)	0.90 (0.44-1.88)	0.787	1.21 (0.27-5.35)	0.801
Name changed on any official document					
Yes	140/368 (38.0)	1.00 (-)	-	1.00 (-)	-
No	492/893 (55.1)	2.00 (1.56-2.56)	**<0.001**	1.59 (0.99-2.53)	0.055
Any gender-affirming transition procedure					
Yes	143/343 (41.7)	1.00 (-)	-	1.00 (-)	-
No	483/912 (53.0)	1.58 (1.23-2.02)	**<0.001**	0.59 (0.35-0.98)	**0.042**
Use of gender-affirming hormones (current)					
Yes	231/513 (45.0)	1.00 (-)	-	1.00 (-)	-
No	310/568 (54.6)	1.47 (1.15-1.86)	**0.002**	1.53 (0.99-2.37)	0.056

Variable	n/N (%)	OR (95% CI)	*p*-value*	AOR (95% CI)	*p*-value*
Experienced physical assault (past 12 months)					
No	529/1053(50.2)	1.00 (-)	-		
Yes	98/202 (48.5)	0.93 (0.69-1.26)	0.654		
Ever engaged in transactional sex					
No	158/331 (47.7)	1.00 (-)	-	1.00 (-)	-
Yes	324/587 (55.2)	1.35 (1.03-1.77)	**0.030**	0.90 (0.56-1.47)	0.683
Any commercial sex partner (past 6 months)					
Yes	205/497 (41.2)	1.00 (-)	-	1.00 (-)	-
No	424/757 (56.0)	1.81 (1.44-2.28)	**<0.001**	1.13 (0.65-1.95)	0.673
Any causal sex partner (past 6 months)					
Yes	244/550 (44.4)	1.00 (-)	-	1.00 (-)	-
No	382/703 (54.3)	1.49 (1.19-1.87)	**<0.001**	0.99 (0.64-1.52)	0.952
Any regular sex partner (past 6 months)					
Yes	263/607 (43.3)	1.00 (-)	-	1.00 (-)	-
No	367/651 (56.4)	1.69 (1.35-2.11)	**<0.001**	1.05 (0.68-1.62)	0.833
Received HBV vaccine					
Yes	223/498 (44.8)	1.00 (-)	-	1.00 (-)	-
No	329/539 (61.0)	1.93 (1.51-2.47)	**<0.001**	1.29 (0.84-1.98)	0.247
Reported HIV status					
Positive	142/308 (46.1)	1.00 (-)	-		
Negative	403/797 (50.6)	1.20 (0.92-1.56)	0.184		
Any STI diagnosis (past 6 months)					
Yes	97/231 (42.0)	1.00 (-)	-	1.00 (-)	-
No	519/995 (52.2)	1.51 (1.13-2.01)	**0.006**	1.10 (0.63-1.92)	0.728
Any STI symptoms (past 6 months)					
Yes	82/268 (30.6)	1.00 (-)	-	1.00 (-)	-
No	545/978 (55.7)	2.86 (2.14-3.81)	**<0.001**	2.18 (1.26-3.77)	**0.006**
Any STI symptoms (at study visit)					
Yes	83/166 (50.0)	1.00 (-)	-		
No	542/1084 (50.0)	1.00 (0.72-1.39)	1.000		

AOR: Adjusted Odds Ratio; **CI**: Confidence Interval; **OR**: Odds Ratio

*Variables with ***p*-value** (in bold) were <0.1 in bivariate analysis and included in MVA, where statistical significance was considered $p<0.05$.

[1]Other ethnicity: East Asian; Indigenous
[2]Other religion: Evangelical; Judaism; Oriental/Asian; Protestant; Spiritism
[3]Other housing: Any other housing arrangement

8.3 USE OF DIAGRAMS

Most participants who self-collected samples were guided by instructional diagrams tailored for this study, with **Table 8.1** providing further details on the comprehension of the various diagrams. To ensure effective self-collection, it is important to offer clear and straightforward guidance including the use of illustrated instructions, as inaccuracies during collection could yield unreliable test results. Notably, the diagrams utilized in this study differ from those piloted during the formative research (**Annex 2**) and were designed for research purposes, and potentially are unsuitable for clinical settings. It is recommended to further develop to create inclusive and/or trans-specific diagrams to enhance accessibility for transgender individuals.

In response, a project is underway to collaborative design self-collection diagrams with the transgender community in São Paulo, Brazil (described further in **Chapter 10**). Anticipated outcomes include the creation of imagery through active community participation, in an effort to foster greater user acceptance.

Table 8.1 Understanding of diagrams for self-collection by anatomical site

Sample site	Easy n/N (%)	Difficult n/N (%)	Indifferent n/N (%)
Oropharyngeal (missing 8)	599/616 (97.2)	1/616 (0.2)	16/616 (2.6)
Anorectal (missing 27)	884/905 (97.7)	1/905 (0.1)	20/905 (2.2)
Genital/penile (missing 23)	888/908 (97.8)	3/908 (0.3)	17/908 (1.9)
Genital/neovaginal (missing 0)	5/5 (100)	0/5 (0)	0/5 (0)
Urine (missing 211)	835/846 (98.7)	2/846 (0.2)	9/846 (1.1)

8.4 SUMMARY OF KEY FINDINGS

- When provided with an option, most participants favoured self-collection, expressing high satisfaction and a willingness to choose this method again in the future.
- Higher preference for self-collection evident for anorectal (75%) and genital (73%) samples, with somewhat reduced preference for oropharyngeal (50%) samples.
- Participants who did not reported any recent STI symptoms were more likely to select self-collection, suggesting that self-sampling may be more appropriate for asymptomatic screening.
- Among the participants who selected provider-collection, many indicated that they would prefer this method again in the future, underscoring the importance of offering a choice of sample collection methods.
- Test positivity rates from self-collected samples closely aligned with those from provider-collected samples, suggesting the efficacy of self-collection for STI testing among transgender women.
- To ensure effective self-collection, it is recommended to provide inclusive and/or trans-specific guidance through clear and simple illustrated instructions to mitigate errors that could compromise result accuracy.
- Offering the option of self-collection (with appropriate guidance) for STI testing aligns with gender-affirmative care, potentially enhancing acceptability of STI testing for transgender women in sexual health services to transgender women.

CHAPTER 9: FINAL DISCUSSION

9.1 SUMMARY & KEY IMPLICATIONS

This research project addressed critical gaps in evidence related to STI prevention and control strategies among transgender women in Brazil. The study revealed a high prevalence of anorectal and oropharyngeal NG and CT infections. Specifically, the prevalence of anorectal NG/CT was found to be 9.1% and 8.9%, respectively. These findings were consistent with a limited number of other studies involving transgender women, reporting prevalence of anorectal NG prevalence between 6.3% and 12.3%, and anorectal CT prevalence ranging from 4.2% to 20.2%.[28]

In the context of Brazil, where there is limited national surveillance data on CT and NG infections mainly due to their non-compulsory notification,[5,79] comparisons with other populations are challenging. However, recent studies have reported the prevalence of these infections among PrEP users (86% MSM) in São Paulo, showing CT prevalence of 2.6% (urethral), 6.4% (oropharyngeal), and 6.9% (anorectal), and NG prevalence of 0.7% (urethral), 6.4% (oropharyngeal), and 6.9% (anorectal).[80] A study among cis-gender women living with HIV across Brazil reported a CT prevalence of 2.1% and NG prevalence of 0.9%.[81] Another study in São Paulo found a CT prevalence of 2.2% among cis-gender women, with a higher prevalence of 6.0% observed among those aged 25 or younger.[82]

Similarly, the highest prevalence of NG/CT infections in this study were among young transgender people (aged 18-24 years). However, this contrasts with previous studies indicating higher HIV prevalence among older transgender people ($\geq$25 years)[27] Additionally, no significant differences based on gender identity were observed, which differs from research in Brazil which suggested that those who identify as *travesti* at higher risk of STIs.[25] Interestingly, this study found some evidence of a potential protective effect of gender-affirmation, including the medical affirmation of using gender-affirming hormones or the legal affirmation of changing name on official documents. This merits further investigation and could be partially explained by a published gender-affirmation framework, where those with unmet gender-affirmation needs are more likely to engage in behaviours that increased risk of adverse health outcomes.[83,84]

Regular multi-site NG/CT screening should be recommended to address these infections among transgender women. While bi-annual screening of anorectal NG and CT is already recommended in Brazil for individuals engaging in RAI without barrier protection,[61] this study suggests to expand this strategy to encompass multi-site screening among populations likely at higher risk of NG/CT infection (including transgender women) considering the predominant asymptomatic nature of anorectal and oropharyngeal NG/CT infections. An additional concern was the high prevalence of anorectal HPV-16, recognised for its role in anal cancer and its potential for vaccine-preventable control.[85] Expansion of current vaccination policy in Brazil to provide vaccination to adolescents (girls and boys aged 9 to 14 years) and in immunosuppressed people (up to 45 years) should be considered.[86]

Although most infections were asymptomatic, the study revealed that anorectal symptoms such as discharge or ulcers could predict the likelihood of anorectal NG/CT infection. In line with the WHO recommendation for syndromic diagnosis and management of anorectal infections in the absence of diagnostic tests,[39] these findings underscore the importance of employing syndromic management for individuals presenting with such symptoms. As such, it is advised that the national STI guidelines in Brazil incorporate a dedicated flowchart for managing anorectal discharge.

However, the study reaffirmed the low sensitivity of the syndromic management approach for anorectal symptoms,[36] emphasising the urgency for more affordable and accessible NG/CT testing solutions. While molecular testing remains costly and limited in many resource-constrained settings like Brazil, specific strategies have demonstrated cost-effectiveness, such as pooled multi-site specimen collection from one individual or pooled testing from multiple individuals.[87,88] Although pooled testing would not be suitable due to the high NG/CT prevalence in this population, pooling self-collected, multi-site specimens could yield cost reductions where molecular testing is available.

Developing accurate and affordable POC NG/CT tests, evaluated for use with anorectal and oropharyngeal specimens, have the potential to expand the accessibility of NG/CT testing in settings like Brazil with limited laboratory diagnostic capacity. Moreover, given Brazil's substantial population and geographic size, the implementation of suitable supply chains for POC tests could extend the reach of testing services to a much larger demographic.

Although physical examination remains an important component in management approaches for symptomatic STIs, this study found only 42% permitted a genital or anal examination, which could result in missed clinical signs of infection. Younger individuals and those with lower education levels were least likely to permit anogenital examinations. Unlike prior literature, no evidence of potential association was found between experience of violence or discrimination and uptake of examination.[89,90]

While it was expected that examination of anogenital area may be intimidating or unsettling for some participants, the study found that uptake of physical examination was highest among participants presenting STI symptoms during the study visit. Overall, these findings highlighted the need for fostering greater trust between healthcare professionals and transgender women, and more gender-affirming and supportive approaches during physical examinations. In instances where an examination is deemed unnecessary or declined, the self-collection of samples for STI testing may be a more suitable and acceptable alternative.

Although self-collected samples have exhibited diagnostic accuracy to provider-collected samples and have demonstrated high patient acceptance, transgender-specific evidence remains limited. This study, however, revealed that self-collection for STI testing is both highly preferred and accepted among transgender women in Brazil. When given the choice, most participants selected self-collection and expressed a high level of satisfaction with this method. However, the choice of sample collection method varied based on anatomical site, and some participants still indicated a preference for provider-collection. Importantly, the results showed a high level of comparability between self-collected and provider-collected samples, indicating a similar level of accuracy between the two methods, as found in other studies.

While self-collection might appear as the most logical choice, the results of this study indicate that patient choice is important. Additionally, allowing transgender women to decide whether they prefer self-collected or provider-collected samples may enhance accessibility in alignment with gender-affirming care principles.[48] In healthcare settings providing sexual health services to transgender women and other marginalised populations, the study also recommends the provision of inclusive and/or trans-specific self-sampling guidance to enhance both accessibility and accuracy.

Finally, to meet global health coverage targets,[91] this study highlights the necessity for national and global STI management guidelines to be more inclusive of transgender individuals. Such guidelines should create more opportunities for self-collection and self-testing. This inclusive approach is particularly relevant for Brazil's national STI guidelines,[61] which currently offers minimal references to transgender people or self-care approaches. Thie same holds true for current WHO recommendations, which could greatly benefit from being more inclusive of transgender and other gender-diverse people.

Box 9.1 provides a summary of key recommendations from this research collectively aimed to enhance STI prevention, diagnosis, and management for transgender women in Brazil.

Box 9.1 Summary of study recommendations to enhance STI prevention, diagnosis, and management for transgender women in Brazil

STI screening and prevention

- Recommend bi-annual multi-site NG/CT screening for transgender women and other high-risk populations to address asymptomatic anorectal and oropharyngeal infections.
- Focus targeted STI prevention efforts on younger transgender women and those engaged in sex work.
- Consider HPV vaccination for transgender women and other high-risk groups due to prevalent anorectal HPV, including HPV-16.

STI testing and management

- Expand STI diagnostic capacity for multi-site NG/CT testing among transgender women and other high-risk populations.
- Use syndromic management for anorectal symptoms when diagnostic capacity is limited, given its predictive value for NG/CT infections.
- Include a dedicated flowchart for the management of anorectal discharge in the national STI guidelines.

Examination and sample collection

- Enhance training of healthcare professionals in gender-affirming care for transgender individuals, including sensitive physical examinations.
- Provide a choice between self-collection and provider-collection of samples for STI screening and testing.
- Offer inclusive and trans-specific self-sampling guidance to improve accessibility and accuracy of STI screening and testing.

9.2 LIMITATIONS

A notable limitation of this cross-sectional study relates to the utilisation of RDS for participant recruitment across the five study locations. Commonly used to recruit hard-to-reach and marginalised populations, this method employs a snowball sampling technique whereby participants invite others from their social networks to participate in the study.[65] This can be an efficient and cost-effective way to recruit large numbers of participants in a relatively short period of time.

However, given the reliance on social networks for recruitment, the resulting sample lack representativeness and could exclude specific subgroups. Those who participate may possess certain characteristics, potentially introducing bias. For instance, in this study, the choice of initial 'seeds' for recruitment in each study location might have skewed participation towards those who engage in sex work, resulting in overrepresentation in one or all study locations. As such, the findings are not representative of all transgender women in Brazil, but rather indicative of the specific network within the sampled population at each study location.

Moreover, the implementation of RDS varied at each study location, introducing additional complexity when combining and comparing the resulting study populations. The final number of seeds, recruitment waves, and average referral chain length differed by study location, additionally affected by COVID-19 restrictions at national and regional levels. As a result, the study population cannot be deemed a random sample and is prone to biases stemming from non-random participant selection.[92]

While published estimation methods can theoretically mitigate these biases,[93] there is ongoing debate surrounding this issue, with some literature suggesting for unweighted logistic regression as the best approach for RDS samples.[94,95] Under the guidance of the lead statistician (also the author of one of these cited papers), the TransOdara Research Group decided to present unweighted estimates. Consequently, this approach necessitates careful interpretation of combined and unweighted estimates derived from the multiple study locations.

Nevertheless, the principal aim of this DrPH research project was to provide useful evidence supporting clinical practice recommendations for this marginalised and under-researched population.

Accordingly, clinical relevance was prioritised over statistical significance. All reported estimates and outlined associations are descriptive, warranting careful interpretation to avoid potentially misleading conclusions.

There were other limitations in the study design. The use of an interviewer-led questionnaire, with responses directly entered into data collection tool, introduced the possibility of minor data entry errors. For example, a refusal might have been incorrectly recorded a refusal as 'not applicable,' resulting in a slightly higher count of 'missing' data. However, given the substantial sample size, this was not expected to significantly impact the reported results. The open-ended responses, collected in Portuguese, were also subject to variability as inputted by the interviewers. For example, some interviewers aimed to provide verbatim participant quotes, while others summarised the essence of the response. Nevertheless, for the limited analysis of open-ended responses undertaken in this project, the information supplied was sufficient for the coding and thematic analysis.

Another important limitation pertains to the inability to directly determine the concordance of individual test results between sample collection methods. This was due to the choice afforded to participants to select either self-collected or provider-collected samples. Possible strategies to mitigate this were conceivable within the study design, such as incorporating a second provider-collected sample. However, financial constraints within the available budget rendered this approach impractical. Similarly, randomising sample collection methods was a possibility, however due to sensitivities of research with this population, it was decided that offering a choice was most important. This decision was likely appropriate, considering the relatively high instances of refusals for anogenital examinations. A similar financial decision was made not to collect neovaginal specimens for NG/CT testing. However, considering the small number of participants who indicated having a neovagina, the associated cost would have been relatively minor. Subsequent research efforts are warranted to establish the prevalence of neovaginal NG/CT infections.

Finally, the study suffered from the limitation of not differentiating chlamydial infection for LGV, which is caused by specific CT serovars/genovars (L1-L3). While prevalent in certain low-income settings, LGV infections are more invasive and prone to causing systemic infections, with outbreaks among MSM documented in high-income settings since 2003.[96] Data about the prevalence of LGV in

Brazil, especially among transgender women, remains limited. The possibility exists that some of the CT infections were LGV, particularly those causing anorectal ulcers. As such, further epidemiological investigation is planned, utilising stored specimens collected during this study (see further details in **Chapter 10**).

9.3 CONCLUSION

Overall, this research highlights the importance of integrating routine multi-site NG/CT screening into healthcare services for transgender women due to the high prevalence of asymptomatic anorectal and oropharyngeal infections. For those presenting with anorectal symptoms, molecular NG/CT testing should be prioritised to guide accurate treatment. However, in contexts where resources or laboratory capacity are limited, a syndromic management approach is appropriate. Although clinical examination continues to be a component of STI case management, this study revealed a substantial refusal of anogenital examinations among participants. Additionally, the value of clinical examination in improving the performance of syndromic management seems limited. For both screening and diagnostic testing purposes, the option for self-collected samples should be provided, particularly when an examination is either unnecessary or refused. Notably, the study highlights that self-sampling was not only well-accepted but also produced comparable results to provider-collected samples.

To effectively address the prevalence of these infections among transgender women, it is important to establish suitable screening and diagnostic strategies, especially in resource-constrained settings such as Brazil. Appropriate screening and diagnostic measures should be made available in resource-limited settings, including Brazil, to adequately address the burden of these infections among transgender women. Despite the increasing availability of NAAT-based tests suitable for multi-site specimens, their prohibitive cost remains a barrier, even with the implementation of proven cost-reducing strategies. There is an urgent need to develop affordable, high-performing POC tests suitable for anorectal and oropharyngeal specimens. This development is crucial to expand access to NG/CT diagnostics, enabling appropriate testing and treatment for effective STI management.

Additionally, the study notes the significance of offering a choice of sample collection methods. While self-sampling resonated more strongly with transgender women in this study, the research concludes that providing the option for either collection method is an important consideration for gender-affirmative care. This approach not only aligns with the principles of inclusive healthcare but has the potential to enhance accessibility to sexual health services for transgender women and other marginalised populations.

CHAPTER 10: DISSEMINATION & NEXT STEPS

10.1 DISSEMINATION

Preliminary results from this DrPH research project were presented at multiple international conferences to disseminate the research findings to a wider audience of STI and HIV experts, public health professionals, and policy makers. This included the following presentations:

- A poster presentation at the STI & HIV 2021 World Congress (held virtually due to COVID-19 travel restrictions);[97]
- A poster presentation at the 24th International AIDS Conference (AIDS 2022) in Montreal;[98]
- An oral presentation at the 23rd IUSTI World Congress in Victoria Falls, Zimbabwe,[99] which was awarded a "highly recommended oral presentation";[100] and
- A poster presentation at the STI & HIV 2023 World Congress in Chicago.[101]

In addition to the Research Papers published (**Research Paper 1**) or submitted for publication (**Research Paper 2** & **4**), a dedicated supplement for the *Revista Brasileira de Epidemiologia* (Brazilian Journal of Epidemiology) is in preparation to disseminate findings of the TransOdara study, including **Research Paper 3** and other articles (**Table 10.1**).

Table 10.1 Provisional titles of other research articles to be published in the TransOdara study supplement for the *Revista Brasileira de Epidemiologia*

Provisional titles
TransOdara study: integration protocol between qualitative and quantitative methods in an epidemiological study
Prevalence of syphilis and associated factors among trans women in Brazil
Experiences and meanings attributed to syphilis and other STIs by trans women in Brazil
HIV prevalence and associated factors among trans women in Brazil
Viral load and viral suppression of HIV among trans women in Brazil
Use of Pre-Exposure Prophylaxis (PrEP) and Post-Exposure to HIV (PEP) among trans women in Brazil
Prevalence of chlamydia and gonorrhea and associated factors among transvestites and trans women in Brazil
Prevalence of HPV and associated factors among trans women in Brazil
Prevalence of viral hepatitis and associated factors among trans women in Brazil
Sex work and exposure to syphilis and other STIs among trans women in Brazil
Gender transition and use of hormones without medical supervision among trans women in Brazil

In addition to the publication of the supplement, other dissemination opportunities are being explored with the TransOdara Research Group to ensure the collective research findings are disseminated to a wider audience of Brazilian healthcare professionals and policy makers. This includes in-person dissemination meetings and webinars. Opportunities at relevant international conferences are also being explored, including abstract submission or coordinated symposia.

10.2 FUTURE PROJECTS

Following this DrPH research project and the wider TransOdara study, additional research-related activities are planned with personal involvement:

1. **TransFormational Design:** Co-creation of instructional self-collection diagrams to support the testing of STIs through a participatory approach with transgender people in São Paulo, Brazil

Funded by the LSHTM Public Engagement Small Grants Scheme,[102] participatory research is being conducted to co-create instructional self-collection diagrams with trans-inclusive imagery and language to support a gender-affirming approach to STI-related care. In collaboration with *Núcleo de Pesquisa em Direitos Humanos e Saúde da População LGBT*+ (NUDHES) in São Paulo, this project aims to address the marked absence of trans-inclusive or gender-neutral instructions to support self-sampling among trans and other gender diverse individuals. This project follows the work initiated during the formative research stage and an initial focus group discussion conducted on 6 April 2022 with 13 peer-navigators from the transgender community in São Paulo. Workshop participants expressed a preference for ‘trans-specific’ imagery due to potential empowerment of seeing a trans body, but expressed the need to recognise the diversity that exists, and the importance of using language commonly used by the community (i.e., often use different terms for certain body parts). However, it was also noted that illustrations must be done in a sensitive manner as not to create further stigma among the general public towards the trans community.

The instructions will be based on the requirements for a common platform for detecting NG/CT,[57] but with imagery and written instructions co-created with a group of transgender people.

Imagery co-created with a diverse group of community members has the potential to ensure suitability and acceptability, and has been found to be more informative, contextualised, and understandable for users.[103] Within this project, transgender people will provide views and support the development of instructions and diagrams to help guide testing for STIs. The aim of the participatory design is to develop a set of instructional diagrams for self-specimen collection of each: oropharyngeal, anorectal, (neo)vaginal, urethral, and urine samples.

A sub-group of five trans women were selected to co-design instructional self-collection diagrams during three face-to-face meetings (April to June 2023) with the support of graphic designers. The initial result (**Annex 6**) was the work produced by a formation of ideas, dialogue, construction of figures, colours and characters developed by trans people and for trans people. These will be further developed in Portuguese and translated to English. It is expected that the final output will be circulated in Brazil to the further support STI services for transgender people in Brazil, and to share more widely outside Brazil as an example of enhancing the healthcare accessibility of transgender people. One opportunity being explored is to include as an example within the forthcoming WHO guidelines on the health of trans and gender diverse people.

2. MyTTrA: Molecular epidemiology of *Mycoplasma genitalium*, *Neisseria gonorrhoeae* and *Treponema pallidum* infections among the TransOdara study with focus on Antimicrobial resistance

Funded by ANRS, the French National Agency for Research on AIDS, further epidemiological research is planned to use stored specimens collected in the TransOdara study. This includes molecular methods to detect MG infection and the L-serovars associated with LGV infection in anal CT-positive specimens. Data will be used to determine prevalence and characterise the respective risk factors of infection. Importantly, with the emergence and concern of AMR of several STIs,[11] this study will also detect the associated molecular markers of AMR in positive specimens of NG, MG, and syphilis. In collaboration with multidisciplinary and multi-country teams in Brazil, France, and the United Kingdom, this study aims to improve the limited knowledge about the emergence, transmission, and impact of AMR in Brazil.

REFERENCES

1. Campbell DA. Clinical epidemiology reconstructed. Internal Medicine Journal. 2005 Feb;35(2):106–7.
2. World Health Organization (WHO). Consolidated guidelines on HIV, viral hepatitis and STI prevention, diagnosis, treatment and care for key populations. Geneva: WHO, 2022. Available from: https://apps.who.int/iris/handle/10665/360601.
3. Grinsztejn B, Jalil EM, Monteiro L, Velasque L, Moreira RI, Garcia ACF, et al. Unveiling of HIV dynamics among transgender women: a respondent-driven sampling study in Rio de Janeiro, Brazil. The Lancet HIV. 2017;4(4):e169–76.
4. Castro MC, Massuda A, Almeida G, Menezes-Filho NA, Andrade MV, de Souza Noronha KVM, et al. Brazil's unified health system: the first 30 years and prospects for the future. The Lancet. 2019;394(10195):345–56.
5. Machado HM, Martins JM, Schörner MA, Gaspar PC, Bigolin A, Ramos MC, et al. National surveillance of *Neisseria gonorrhoeae* antimicrobial susceptibility and epidemiological data of gonorrhoea patients across Brazil, 2018-20. JAC Antimicrobial Resistance. 2022;4(4):dlac076.
6. Carrara S, Hernandez J de G, Uziel AP, Conceição GMS da, Panjo H, Baldanzi AC de O, et al. Body construction and health itineraries: a survey among travestis and trans people in Rio de Janeiro, Brazil. Cadernos de Saúde Pública. 2019;35(4).
7. Cruz JAW, Da Cunha MAVC, De Moraes TP, Marques S, Tuon FF, Gomide AL, et al.. Brazilian private health system: history, scenarios, and trends. BMC Health Services Research. 2022;22.
8. World Health Organization (WHO). Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Accountability for the global health sector strategies 2016–2021: actions for impact. Geneva: WHO, 2021. Available from: https://www.who.int/publications/i/item/9789240027077
9. James C, Harfouche M, Welton NJ, Turner KM, Abu-Raddad LJ, Gottlieb SL, et al. Herpes simplex virus: global infection prevalence and incidence estimates, 2016. Bulletin of the World Health Organization. 2020;98(5):315–29.
10. de Sanjosé S, Diaz M, Castellsagué X, Clifford G, Bruni L, Muñoz N, et al. Worldwide prevalence and genotype distribution of cervical human papillomavirus DNA in women with normal cytology: a meta-analysis. The Lancet Infectious Diseases. 2007;7(7):453–9.
11. Unemo M, Jensen JS. Antimicrobial-resistant sexually transmitted infections: gonorrhoea and *Mycoplasma genitalium*. Nature Reviews Urology. 2017;14(3):139–52.
12. Johnson LF, Lewis DA. The Effect of Genital Tract Infections on HIV-1 Shedding in the Genital Tract: A Systematic Review and Meta-Analysis. Sexually Transmitted Diseases. 2008;35(11):946–59.
13. Ward H, Rönn M. The contribution of STIs to the sexual transmission of HIV. Current Opinion in HIV and AIDS. 2010;5(4):305.
14. Cohen MS, Council OD, Chen JS. Sexually transmitted infections and HIV in the era of antiretroviral treatment and prevention: the biologic basis for epidemiologic synergy. Journal of the International AIDS Society. 2019;22.
15. Looker KJ, Rönn MM, Brock PM, Brisson M, Drolet M, Mayaud P, et al. Evidence of synergistic relationships between HIV and Human Papillomavirus (HPV): systematic reviews and meta-analyses of longitudinal studies of HPV acquisition and clearance by HIV status, and of HIV acquisition by HPV status. Journal of the International AIDS Society. 2018;21(6).
16. Aggarwal S, Mahajan N, Singh T. Effect of Stigma on Quality of Life of People with Sexually Transmitted Infections. Journal of Quality in Health Care & Economics. 2020;3.
17. Singh S, Singh SK. Psychological health and well-being in patients with sexually transmitted infections: A prospective cross-sectional study. Indian Journal of Sexually Transmitted Diseases and AIDS. 2021;42(2):125–131.
18. Wolf RC, Adams D, Dayton R, Verster A, Wong J, Romero M, et al. Putting the t in tools: a roadmap for implementation of new global and regional transgender guidance. Journal of the International AIDS Society. 2016;19:20801.

19. MacCarthy S, Poteat T, Xia Z, Roque NL, Kim A, Baral S, et al. Current research gaps: a global systematic review of HIV and sexually transmissible infections among transgender populations. Sexual Health. 2017;14(5):456.

20. World Health Organization (WHO). Guidelines: prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender populations: recommendations for a public health approach 2011. Geneva: WHO, 2011. Available from: https://apps.who.int/iris/handle/10665/44619.

21. Baral SD, Poteat T, Strömdahl S, Wirtz AL, Guadamuz TE, Beyrer C. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. The Lancet Infectious Diseases. 2013;13(3):214–22.

22. Rioux C, Paré A, London-Nadeau K, Juster R-P, Weedon S, Levasseur-Puhach S, et al. Sex and gender terminology: a glossary for gender-inclusive epidemiology. Journal of Epidemiology and Community Health. 2022;76(8):764–8.

23. Oxford University Press. Oxford English Dictionary. Oxford: Oxford University Press; 2020.

24. Thomas R, Pega F, Kholsa R, Verster A, Hana T, Say L. Ensuring an inclusive global health agenda for transgender people. Bulletin of the World Health Organization. 2017;95(2):154–6.

25. dos Santos PMR, dos Santos KC, Magalhães LS, de Oliveira BR, Carneiro MA, de Souza MM, et al. Travestis and transsexual women: who are at higher risk for sexually transmitted infections? Revista Brasileira de Epidemiologia. 2021;24.

26. World Health Organization (WHO). International Classification of Diseases, Eleventh Revision (ICD-11). Geneva: WHO; 2019. Available from: https://icd.who.int/en.

27. Poteat T, Scheim A, Xavier J, Reisner S, Baral S. Global Epidemiology of HIV Infection and Related Syndemics Affecting Transgender People. JAIDS Journal of Acquired Immune Deficiency Syndromes. 2016;72:S210–9.

28. Van Gerwen OT, Jani A, Long DM, Austin EL, Musgrove K, Muzny CA. Prevalence of Sexually Transmitted Infections and Human Immunodeficiency Virus in Transgender Persons: A Systematic Review. Transgender Health. 2020;5(2):90–103.

29. Bauer GR, Scheim AI. Sampling bias in transgender studies. The Lancet Infectious Diseases. 2013;13(10):832.

30. Kojima N, Park H, Konda KA, Joseph Davey DL, Bristow CC, Brown B, et al. The PICASSO Cohort: baseline characteristics of a cohort of men who have sex with men and male-to-female transgender women at high risk for syphilis infection in Lima, Peru. BMC Infectious Diseases. 2017;17(1).

31. Leon SR, Segura ER, Konda KA, Flores JA, Silva-Santisteban A, Galea JT, et al. High prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* infections in anal and pharyngeal sites among a community-based sample of men who have sex with men and transgender women in Lima, Peru. BMJ Open 2016;6:e008245.

32. Stephens SC, Bernstein KT, Philip SS. Male to female and female to male transgender persons have different sexual risk behaviors yet similar rates of STDs and HIV. AIDS and Behavior. 2011;15:683–686.

33. Nuttbrock L, Bockting W, Rosenblum A, Hwahng S, Mason M, Macri M, et al. Gender Abuse, Depressive Symptoms, and HIV and Other Sexually Transmitted Infections Among Male-to-Female Transgender Persons: A Three-Year Prospective Study. American Journal of Public Health. 2013;103(2):300–7.

34. Pinto TP, Teixeira FD, Barros CR, Martins RB, Saggese GS, Barros DD, et al. Silicone líquido industrial para transformar o corpo: prevalência e fatores associados ao seu uso entre travestis e mulheres transexuais em São Paulo, Brasil. Cadernos de Saúde Pública. 2017;27(33):e00113316.

35. de Vries HJC, Nori AV, Kiellberg Larsen H, Kreuter A, Padovese V, Pallawela S, et al.. 2021 European Guideline on the management of proctitis, proctocolitis and enteritis caused by sexually transmissible pathogens. Journal of the European Academy of Dermatology and Venereology. 2021;35(7):1434–43.

36. World Health Organization (WHO). Guidelines for the management of symptomatic sexually transmitted infections: Web Annex F. Systematic review for syndromic management of the anorectal syndrome. Geneva: WHO, 2021. Available from: https://apps.who.int/iris/handle/10665/350463.

37. Lin C, Franceschi S, Clifford GM. Human papillomavirus types from infection to cancer in the anus, according to sex and HIV status: a systematic review and meta-analysis. The Lancet Infectious Diseases. 2018;18:198–206.

38. Mitchell H, Hughes G. Recent epidemiology of sexually transmissible enteric infections in men who have sex with men. Current Opinion in Infectious Diseases. 2018;31(1):50–6.

39. World Health Organization (WHO). Guidelines for the management of symptomatic sexually transmitted infections. Geneva: WHO, 2021. Available from: https://apps.who.int/iris/handle/10665/342523.

40. Magno L, Silva L, Veras MA, Pereira-Santos M, Dourado I. Stigma and discrimination related to gender identity and vulnerability to HIV/AIDS among transgender women: a systematic review. Cadernos de Saúde Pública. 2019;34(4):e00112718.

41. Poteat T, German D, Kerrigan D. Managing uncertainty: a grounded theory of stigma in transgender health care encounters. Social Science & Medicine. 2013;84:22–9.

42. da Rocha ABM, Barros C, Generoso IP, Bastos FI, Veras MA. HIV continuum of care among trans women and travestis living in São Paulo, Brazil. Revista De Saúde Pública. 2020;54:118.

43. Zoni AC, Gonzalez MA, Sjogren HW. Syphilis in the most at-risk populations in Latin America and the Caribbean: a systematic review. International Journal of Infectious Diseases. 2013;17(2):e84–92.

44. Grandi JL, Ueda M, Goihman S, Santos SA, Amorim AS. HIV and syphilis infection in Brazilian male sex workers. Folha médica. 2001:187–93.

45. Adamson PC, Pandori MW, Doernberg SB, Komarow L, Sund Z, Tran TTT, et al. Analytical Evaluation of the Abbott RealTime CT/NG Assay for Detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in Rectal and Pharyngeal Swabs. The Journal of Molecular Diagnostics. 2020;22:811–6.

46. Pitasi MA, Kerani RP, Kohn R, Murphy RD, Pathela P, Schumacher CM, et al. Chlamydia, Gonorrhea, and Human Immunodeficiency Virus Infection Among Transgender Women and Transgender Men Attending Clinics that Provide Sexually Transmitted Disease Services in Six US Cities: Results From the Sexually Transmitted Disease Surveillance Network. Sexually Transmitted Diseases. 2019;46(2):112–117.

47. Queensland Health. Queensland sexual health clinical management guidelines 2010. Brisbane: Queensland Government; 2010.

48. UCSF Gender Affirming Health Program, Department of Family and Community Medicine. Guidelines for the Primary and Gender-Affirming Care of Transgender and Gender Nonbinary People; 2nd edition. San Francisco: University of California San Francisco (UCSF), 2016. Available from: https://transcare.ucsf.edu/guidelines.

49. Paudyal P, Llewellyn C, Lau J, Mahmud M, Smith H. Obtaining Self-Samples to Diagnose Curable Sexually Transmitted Infections: A Systematic Review of Patients' Experiences. PLoS ONE. 2015;10(4):e0124310.

50. van der Helm JJ, Hoebe CJ, van Rooijen MS, Brouwers EE, Fennema HS, Thiesbrummel HF, et al. High performance and acceptability of self-collected rectal swabs for diagnosis of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* in men who have sex with men and women. Sexually Transmitted Diseases. 2009;36(8):493–7.

51. Fielder RL, Carey KB, Carey MP. Acceptability of Sexually Transmitted Infection Testing Using Self-collected Vaginal Swabs Among College Women. Journal of American College Health. 2013;61(1):46–53.

52. Sexton ME, Baker JJ, Nakagawa K, Li Y, Perkins R, Slack RS, et al. How reliable is self-testing for gonorrhea and chlamydia among men who have sex with men? The Journal of Family Practice. 2013;62(2):70–80.

53. Reisner SL, Deutsch MB, Peitzmeier SM, Hughto JM, Cavanaugh T, Pardee DJ, et al. Comparing self- and provider-collected swabbing for HPV DNA testing in female-to-male transgender adult patients: a mixed-methods biobehavioral study protocol. BMC Infectious Diseases. 2017;17(1):444.

54. Bell S, Wapling J, Ase S, Boli-Neo R, Vallely AJ, Kaldor JM, et al. Acceptability of testing for anorectal sexually transmitted infections and self-collected anal swabs in female sex workers, men who have sex with men and transgender women in Papua New Guinea. BMC Public Health. 2018;18(1):776.

55. Kelly-Hanku A, Bell S, Ase S, Boli-Neo R, Vallely AJ, Badman SG, et al. Developing a culturally appropriate illustrated tool for the self-collection of anorectal specimens for the testing of sexually transmitted infections: lessons from Papua New Guinea. BMC Public Health. 2019;19(1):214.

56. Lampinen TM, LaTulippe L, Van Niekerk D, Schilder AJ, Miller ML, Anema A, et al. Illustrated instructions for self-collection of anorectal swab specimens and their adequacy for cytological examination. Sexually Transmitted Diseases. 2006;33(6):386–8.

57. Hologic. Instructions for Using the Aptima™ Multitest Swab Specimen Collection Kit for Patient-Collected Specimens. San Diego, CA: Hologic; 2017.

58. World Health Organization (WHO). Guidelines for the management of sexually transmitted infections. Geneva: WHO; 2003. Available from: https://apps.who.int/iris/handle/10665/42782

59. World Health Organization, Regional Office for South-East Asia (WHO-SEAR). Management of Sexually Transmitted Infections - Regional Guidelines. New Delhi: WHO-SEAR, 2011. Available from: https://apps.who.int/iris/handle/10665/205471.

60. Workowski KA, Bachmann LH, Chan PA, Johnston CM, Muzny CA, Park I, et al. Sexually Transmitted Infections Treatment Guidelines, 2021. MMWR Recommendations and Reports. 2021;70:1–87.

61. Ministério da Saúde (Brasil). Protocolo Clínico e Diretrizes Terapêuticas para Atenção Integral às Pessoas com Infecções Sexualmente Transmissíveis [Clinical Protocol and Therapeutic Guidelines for Comprehensive Care for People with Sexually Transmitted Infections]. Brasília: Ministério da Saúde, 2022. Available from: https://www.gov.br/aids/pt-br/centrais-de-conteudo/pcdts/2022/ist/pcdt-ist-2022_isbn-1.pdf/view.

62. Ong JJ, Baggaley RC, Wi TE, Tucker JD, Fu H, Smith MK, et al. Global epidemiologic characteristics of sexually transmitted infections among individuals using preexposure prophylaxis for the prevention of HIV infection: a systematic review and meta-analysis. JAMA Network Open. 2019;2(12):e1917134.

63. Johnson AK, Reisner SL, Mimiaga MJ, Garofalo R, Kuhns LM. Prevalence and Perceived Acceptability of Nongenital Sexually Transmitted Infection Testing in a Cohort of Young Transgender Women. LGBT Health. 2018;5(6):381–86.

64. Callander D, Cook T, Read P, Hellard ME, Fairley CK, Kaldor JM, et al. Sexually transmissible infections among transgender men and women attending Australian sexual health clinics. Medical Journal of Australia. 2019;211(9):406–11.

65. Handcock MS, Gile KJ, Mar CM. Estimating hidden population size using Respondent-Driven Sampling data. Electronic Journal of Statistics. 2014;8:1491–521.

66. Rothman K, Greenland S. Planning Study Size Based on Precision Rather Than Power. Epidemiology. 2018;29(5):599–603.

67. Salganik MJ. Variance Estimation, Design Effects, and Sample Size Calculations for Respondent-Driven Sampling. Journal of Urban Health. 2006;83:98–112.

68. Dourado I, Silva LAV da, Magno L, Lopes M, Cerqueira C, Prates A, et al. Building bridges: the practice of interdisciplinarity. PopTrans Study: a study with transvestites and transgender women in Salvador, Bahia, Brazil. Cadernos de Saúde Pública. 2016;32(9):1–11.

69. Bastos FI, Bastos LS, Coutinho C, Toledo L, Mota JC, Velasco-de-Castro CA, et al. HIV, HCV, HBV, and syphilis among transgender women from Brazil. Medicine. 2018;97(1S):S16–24.

70. Gaydos CA, Cartwright CP, Colaninno P, Welsch J, Holden J, Ho SY, et al. Performance of the Abbott RealTime CT/NG for Detection of *Chlamydia trachomatis* and *Neisseria gonorrhoeae*. Journal of Clinical Microbiology. 2010;48:3236–43.

71. Latsuzbaia A, Tapp J, Nguyen T, Fischer M, Arbyn M, Weyers S, et al. Analytical performance evaluation of Anyplex II HPV28 and Euroarray HPV for genotyping of cervical samples. Diagnostic Microbiology and Infectious Disease. 2016;85(3):318–22.

72. Poynten IM, Jin F, Molano M, Machalek DA, Roberts JM, Hillman RJ, et al. Comparison of four assays for human papillomavirus detection in the anal canal. Clinical Microbiology and Infection. 2022;28(12):1652.e1–6.

73. Bouvard V, Baan R, Straif K, Grosse Y, Secretan B, Ghissassi FE, et al. A review of human carcinogens—Part B: biological agents. The Lancet Oncology. 2009;10(4):321–2.

74. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. Journal of Biomedical Informatics. 2009;42(2):377–81.

75. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. Journal of Biomedical Informatics. 2019;95:103208.

76. Google Docs Editors Help. GOOGLETRANSLATE [Internet]. Google. [cited 2023 Aug 8]. Available from: https://support.google.com/docs/answer/3093331?hl=en.

77. Sekhon M, Cartwright M, Francis JJ. Acceptability of healthcare interventions: an overview of reviews and development of a theoretical framework. BMC Health Services Research. 2017;17(1):88.

78. International Organization for Standardization (ISO). ISO 9241-11:2018 Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts [Internet]. ISO. [cited 2022 Dec 23]. Available from: https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en.

79. Miranda AE, Silveira MFD, Pinto VM, Alves GC, Carvalho NSD. Brazilian Protocol for Sexually Transmitted Infections, 2020: infections that cause cervicitis. Revista Da Sociedade Brasileira De Medicina Tropical. 2021;54.

80. Moreira JS, Vasconcelos R, Doi AM, Avelino-Silva VI. Real-life occurrence of bacterial sexually transmitted infections among PrEP users: improving the diagnosis of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* with multisite screening. Revista Do Instituto De Medicina Tropical De São Paulo. 2021;63.

81. Miranda AE, Silveira MF, Travassos AG, Tenório T, Val ICCD, Lannoy L, et al. Prevalence of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* and associated factors among women living with Human Immunodeficiency Virus in Brazil: a multicenter study. Brazilian Journal of Infectious Diseases. 2017;21(4):402–7.

82. Campaner AB, de Castro MA, Lucarelli AP. *Chlamydia trachomatis* prevalence in females in São Paulo, Brazil: 11 years' surveillance of the infection. Brazilian Journal of Microbiology. 2023;54(1):151–8.

83. Sevelius JM. Gender Affirmation: A framework for conceptualizing risk behavior among transgender women of color. Sex Roles. 2013;68(11-12):675–89.

84. King WM, Gamarel KE. A scoping review examining social and legal gender affirmation and health among transgender populations. Transgender Health. 2021;6(1):5–22.

85. Wieland U, Kreuter A. The importance of HPV16 in anal cancer prevention. The Lancet Infectious Diseases. 2018;18:131–2.

86. Filho DST, Rocha CMR, Bacha E, Andrade ÁNM, Pereira DDP, Nunes LM, et al. Current HPV Vaccination Strategies in Brazil. Health. 2023;15:107–21.

87. Wilson JD, Wallace HE, Loftus-Keeling M, Ward H, Davies B, Vargas-Palacios A, Hulme C, Wilcox MH. Swab-Yourself Trial With Economic Monitoring and Testing for Infections Collectively (SYSTEMATIC): Part 2. A Diagnostic Accuracy and Cost-effectiveness Study Comparing Rectal, Pharyngeal, and Urogenital Samples Analyzed Individually, Versus as a Pooled Specimen, for the Diagnosis of Gonorrhea and Chlamydia. Clinical Infectious Diseases. 2021; 73(9):e3183–93.

88. Xu Y, Aboud L, Chow EPF, Mello MB, Wi T, Baggaley R, et al. The diagnostic accuracy of pooled testing from multiple individuals for the detection of Chlamydia trachomatis and Neisseria gonorrhoeae: a systematic review. International Journal of Infectious Diseases. 2022;118:183–93.

89. Gelman M, Van Wagenen A, Potter J. Principles for taking an LGBTQ-inclusive health history and conducting a culturally competent physical exam. In: Makadon HJ, Mayer KH, Potter J, Goldhammer H, ed. The Fenway guide to lesbian, gay, bisexual, and transgender health. Philadelphia: American College of Physicians; 2015. p.159–92.

90. Poteat T. Transgender people and sexually transmitted infections (STIs). In: Deutsch MB, ed. Guidelines for the primary and gender-affirming care of transgender and gender nonbinary people. 2nd ed. San Francisco: Center of Excellence for Transgender Health, Department of Family and Community Medicine, University of California San Francisco; 2016. p.90–2.

91. World Health Organization (WHO). Global health sector strategies on, respectively, HIV, viral hepatitis and sexually transmitted infections for the period 2022-2030. Geneva: WHO, 2022. Available from: https://apps.who.int/iris/handle/10665/360348.

92. Johnston LG, Hakim AJ, Dittrich S, Burnett J, Kim E, White RGl. A Systematic Review of Published Respondent-Driven Sampling Surveys Collecting Behavioral and Biologic Data. AIDS and Behavior. 2016;20(8):1754–76.

93. Salganik MJ, Heckathorn DD. Sampling and estimation in hidden populations using respondent-driven sampling. Sociological Methodology. 2004;34(1):193–240.

94. Avery L, Rotondi N, Mcknight C, Firestone M, Smylie J, Rotondi M. Unweighted regression models perform better than weighted regression techniques for respondent-driven sampling data: results from a simulation study. BMC Medical Research Methodology. 2019;19.

95. Sperandei S, Bastos LS, Ribeiro-Alves M, Reis A, Bastos FI. Assessing logistic regression applied to respondent-driven sampling studies: a simulation study with an application to empirical data. International Journal of Social Research Methodology. 2023;26:319–33.

96. World Health Organization (WHO). Laboratory and point-of-care diagnostic testing for sexually transmitted infections, including HIV. Geneva: WHO; 2023 [in press].

97. McCartney D, Pinheiro T, Gomez J, Galdino P, De Sousa Mascena Veras M, Mayaud P. Acceptability of self-collected samples for diagnosis of sexually transmitted infections among transgender women in São Paulo cohort study [abstract]. In: STI & HIV World Congress 2021; 2021 Jul 14-17. Available from: https://sti.bmj.com/content/97/Suppl_1.

98. McCartney D, Bassichetto KC, Coimbra Motta Castro AR, et al. Acceptability and uptake of self-sampling for etiological diagnosis of sexually transmitted infections among transgender women in Brazil [abstract]. In: 24th International AIDS Conference (AIDS 2022); 2022 Jul 29-Aug 2; Montreal, Canada. Geneva: International AIDS Society (IAS). Available from: https://programme.aids2022.org/.

99. McCartney D, Luppi C, Carvalho da Silva R, et al. High prevalence of asymptomatic gonorrhoea and chlamydia among transgender women in Brazil [abstract]. In: 23rd IUSTI World Congress; 2022 Sep 4-7; Victoria Falls, Zimbabwe. Birmingham (UK): International Union Against Sexually Transmitted Infections (IUSTI). Available from: https://www.iusti2022zimbabwe.com/.

100. International Union of Sexually Transmitted Infections (IUSTI). STI Global Update: Newsletter of the International Union against Sexually Transmitted Infections; 2022 October. Available from: https://iusti.org/wp-content/uploads/2022/10/SexuallyTransmittedInfectionsGlobal-Update2022-10-v1.pdf

101. McCartney D, Faria R, Wanzeller M, et al. TransFormational Design: Co-creation of instructional self-collection diagrams to support the diagnosis of STIs through a participatory approach with transgender people in São Paulo, Brazil [Abstract]. In: STI & HIV 2023 World Congress; 2023 Jul 24-27; Chicago, USA. North Carolina: American Sexually Transmitted Diseases Association. Available from: https://stihiv2023.org/program/.

102. 2022 Public Engagement Small Grants Scheme awardees announced [Internet]. LSHTM. [cited 2023 Feb 8]. Available from: https://www.lshtm.ac.uk/aboutus/public-engagement/stories-engagement/2022-public-engagement-small-grants-scheme-awardees-announced.

103. Arcia A, Suero-Tejeda N, Bales ME, Merrill JA, Yoon S, Woollen J, et al. Sometimes more is more: iterative participatory design of infographics for engagement of community members with varying levels of health literacy. Journal of the American Medical Informatics Association. 2015;23(1):174–83.

APPENDICES

Annex 1. Formative research protocol and questionnaire

QUESTIONNAIRE PROTOCOL

Acceptability of self-collected samples for diagnosis of sexually transmitted infections among transgender women in São Paulo cohort study

Summary

As a component of the ongoing cohort study of transgender women from the Santa Casa de São Paulo School of Medicine, it is proposed to assess the prevalence and incidence of sexually transmitted infections (STIs) including *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG), *Trichomonas vaginalis* (TV), and *Mycoplasma genitalium* (MG). Etiological diagnosis would require sampling of potential infection sites, including anorectal and oropharyngeal.

A preliminary study is required to assess the feasibility of this additional research component, including the acceptability of using self-collected swabs among a sample of transgender women enrolled in the cohort study. Ethical approval was obtained from the LSHTM Ethics Committee on 7 September 2018 (*LSHTM Ethics Ref: 14877*).

If this project confirms feasibility and acceptability, a follow-on study may be introduced to assess the prevalence and incidence of sexually transmitted infections among transgender women enrolled in the cohort study.

Data collection procedure
This study involves a short interviewer-led questionnaire of a sample of participants (n=20) within the existing cohort study during a scheduled visit. The questionnaire should take no longer than 5 minutes.

1. **Office: Participant intake**
    a. If NOT the first study visit, take a copy of the questionnaire
    b. Affix the '*Etiqueta RDS*' or write the participant code on questionnaire

2. **Consultation room: Participant interview**
    a. Interviewer to use questionnaire at appropriate time during visit
    b. Ensure the questionnaire has the '*Etiqueta RDS*' or participant code
    c. Confirm willingness to participate – should take no longer than 5 minutes
    d. Use the questionnaire as a guide and complete during interview with participant
    e. Keep the completed questionnaire in the participant file

3. **Office: Data entry**
    a. Copy/scan the completed questionnaire
    b. Keep the original questionnaire in the participant file
    c. At end of day, send all copies of questionnaires to lead investigator

ACCEPTABILITY QUESTIONNAIRE FOR STI STUDY

Date of visit: ____/____/_____

RDS CODE

Name of interviewer: _____

NOTE: This questionnaire is NOT to be completed during the FIRST study visit. The questionnaire is to be completed by the interviewer during a study visit.

READ TO PARTICIPANT:

I would like to ask additional questions which will take no more than 5 minutes. The questions are about screening tests for sexually transmitted infections (STIs) and to ask your views on whether additional tests would be acceptable by you and other participants at a future visit.

Confirm willing to participate:

( ) Yes
( ) No

READ TO PARTICIPANT:

During a future visit, we would like to ask study participants if they are willing to have additional tests to detect other sexually transmitted infections, such as chlamydia and gonorrhea. This would require you to provide a sample of urine and a swab of your throat (oropharyngeal), anus (anorectal), and (if present) neovagina. If an infection is detected, you will receive the appropriate treatment to cure the infection and to prevent transmission to sexual partners.

FOR INVESTIGATOR: Has the participant had genital or lower surgery (sex reassignment / gender-affirming surgery) to remove male genitalia?

( ) Yes
( ) No
( ) Unsure (Ask participant to determine)

1) Have you ever had any swabs taken for STI testing in the past?

( ) Yes
( ) No
( ) Unsure

1.1) If yes, which specific swabs have been taken for STI screening in the past?

	Yes	**No**	**Unsure**
a. Urethral			
b. Oral			
c. Rectal			
d. Neovaginal *(if applicable)*			

1.2) Were these collected by a health provider or by yourself?

( ) Self
( ) Provider
( ) Both (Self & Provider)
( ) Unsure

2) If you visit a health clinic, how would you prefer to give the following samples for screening STIs?

	Self-collected	**Provider-collected**	**No preference**	**Unsure**
a. Urethral *(urine or swab)*				
b. Oral *(saliva or swab)*				
c. Rectal *(swab)*				
d. Neovaginal *(swab, if applicable)*				

3) During a future visit to this study clinic, would you feel comfortable to provide samples for screening other STIs?

( ) Yes
( ) No

3.1) If no, ask why not?

( ) Uncomfortable with procedure
( ) Concerned about confidentiality
( ) I do not want to know if I have an STI
( ) I do not think I am at risk for an STI
( ) Other - Explain: _____

3.2) If yes, would you feel comfortable collecting the samples by yourself if given information on how to collect?

( ) Yes
( ) No
( ) Unsure

4) Would you prefer the swabs to be collected by a health professional?

( ) Yes
( ) No
( ) No preference

4.1) If Yes, why:

( ) Difficult to perform by self
( ) Dislike
( ) Other - Explain: _____

4.2) If No, why:

( ) More privacy
( ) Greater physical comfort
( ) Easy to perform
( ) Knowledge about own body
( ) Other - Explain: _____

OPTIONAL QUESTION

FOR INTERVIEWER: Show the instructional diagrams for self-collected swabs (if available) and ask the following question.

5) How easy was it to understand the instructional diagrams?

( ) Very easy
( ) Easy
( ) Difficult
( ) Very difficult
( ) Any comments: _____

Thank You!

Observations:

Annex 2. Piloted self-collection diagrams for (A) oral, (B) rectal, (C) vaginal, and (D) urine samples

A. How to collect an oral sample (Portuguese)

B. How to collect a rectal sample (Portuguese)

Como coletar uma amostra retal

1. Preparando-se
Certifique-se de que um tubo e um swab estão disponíveis.
Lave as mãos com sabão e água antes de coletara amostra.

2. Segurando o swab
Retire o swab do pacote e segure de 3 a 4 cm da ponta macia.
Não toque na ponta macia.

3. Encontre uma posição confortável
Fique em uma posição que permita o acesso ao seu ânus / reto.
Agache-se ou fique em pé no vaso sanitário para facilitar.
Abra um dos lados do bumbum.

4. Coletando a amostra
Segure bem o swab e insira a ponta macia de 2-3 cm no ânus / reto.
Gire o swab lentamente por 5-10 segundos.

5. Guardando o swab
Puxe para fora lentamente e coloque o swab (ponta macia primeiro) no tubo.
Não se sinta envergonhada se sair fezes na ponta - isso é normal. Lave suas mãos.

Versão 2 (31 de outubro de 2018) / D McCartney

SANTA CASA DE SÃO PAULO

C. How to collect a vaginal sample (Portuguese)

Como coletar uma amostra vaginal

1. Preparando-se

Certifique-se de que um tubo e um swab estão disponíveis.

Lave as mãos com sabão e água antes de coletar a amostra.

2. Segurando o swab

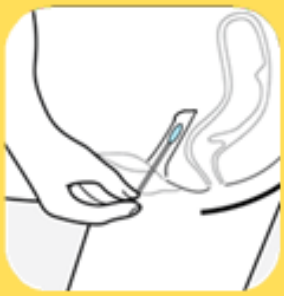
Retire o swab do pacote e segure de 3 a 4 cm da ponta macia.

Não toque na ponta macia.

3. Encontre uma posição confortável

Fique em uma posição que permita o acesso à sua vagina.

Sente ou apoie o pé no vaso sanitário para facilitar.



4. Coletando a amostra

Segure bem o swab e insira a ponta macia de 2-3 cm na sua vagina.

Gire o swab lentamente por 5-10 segundos.

5. Guardando o swab

Puxe para fora lentamente e coloque o swab (ponta macia primeiro) no tubo.

Lave as mãos com sabão e água.

Versão 2 (31 de outubro de 2018) / D McCartney

SANTA CASA DE SÃO PAULO

D. How to collect a urine sample (Portuguese)

Como coletar uma amostra de urina

1. Esperando por uma hora
Não urine por pelo menos uma hora antes de coletar a amostra.

2. Preparando-se
Certifique-se de que um pote de coleta e um saco plástico estejam disponíveis.
Lave as mãos com sabão e água antes de coletar uma amostra.

3. Encontre uma posição confortável
Abra o pote de coleta. Não toque no interior do pote ou da tampa.
Sentada no vaso sanitário pode ser mais confortável.

4. Coletando a amostra
Urine a primeira parte do fluxo diretamente no pote de coleta. Preencha a metode do pote.
Urine o resto no banheiro.

5. Guardando a amostra
Feche a tampa com força. Não se envergonhe se houver alguma urina no pote.
Coloque o pote de coleta no saco plástico.
Lave suas mãos com sabão e água.

Versão 2 (31 de outubro de 2018) / D McCartney

SANTA CASA DE SÃO PAULO

Annex 3. Interviewer-led acceptability questionnaire for specimen collection of STI diagnosis

*(*as proposed prior to translation to Portuguese and coded in REDCap)*

#	**Questions**	**Answer Categories**	**Logic**
	PART A - COLLECTION		
1	Read to the participant: I'd like to ask you additional questions that are about the screening tests for sexually transmitted infections (STIs). I would like to ask your opinion on whether you would like to collect the samples for these tests by yourself or by a health service provider (by a nurse or a doctor). The additional tests are to detect other sexually transmitted infections, including chlamydia, gonorrhea, and human papillomavirus (HPV). This would require you to provide a urine sample, and swabs of your throat (oropharyngeal), anus (anorectal), and your genitals (penis or vagina, as applicable). If an infection is detected, you will receive appropriate treatment to cure the infection and prevent transmission to sexual partners. I will also ask you questions with regards to treatment options/preferences.		
2	Have you already provided a urine sample today?	1 = Yes 2 = No	
3	Will you feel comfortable providing this today?	1 = Yes 2 = No	if Q2 = 2
4	Can I confirm that you have not urinated for at least two hours?	1 = Yes 2 = No	if Q3 = 1
5	When was the last time you urinated? [Suggest time when will be appropriate to provide sample.]	___ Hours ___ Minutes	if Q4 = 2
6	Today, how would you like to provide an ORAL sample/swab? This will enable us to test for chlamydia and gonorrhea in your throat. [If necessary, make reference to the self-collection diagrams. If participant uncertain, provide further information to enable a decision.]	1 = Auto 2 = Professional 3 = No preference 99 = Refuse	
7	Why did you make this choice?	[OPEN]	
8	Today, how would you like to provide a RECTAL sample/swab? This will enable us to test for chlamydia and gonorrhea in your anus/rectum. [If necessary, make reference to the self-collection diagrams. If participant uncertain, provide further information to enable a decision.]	1 = Auto 2 = Professional 3 = No preference 99 = Refuse	
9	Why did you make this choice?	[OPEN]	
10	Today, how would you like to provide a (neo)vaginal sample/swab? This will enable us to test for chlamydia and gonorrhea in your vagina. [If necessary, make reference to the self-collection diagrams. If participant uncertain, provide further information to enable a decision.]	1 = Auto 2 = Professional 3 = No preference 99 = Refuse	if Q1 = 2

11	Why did you make this choice?	[OPEN]	if Q1 = 2
12	Today, how would you like to provide a genital sample/swab? This will enable us to test for HPV infection. [If necessary, make reference to the self-collection diagrams. If participant uncertain, provide further information to enable a decision.]	1 = Auto 2 = Professional 3 = No preference 99 = Refuse	
13	Why did you make this choice?	[OPEN]	
	READ: I am now going to explain how the following tests will be obtained.		
14	ORAL: You have indicated that you would prefer to collect this sample by yourself. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable that you will be able to provide sample?	1 = Yes 2 = No	if Q6 = 1
15	ORAL: Would you prefer this to be collected by provider?	1 = Yes 2 = No	if Q14 = 2
16	ORAL: You have indicated that you would prefer to collect this by the service provider. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable for this to be collected by provider?	1 = Yes 2 = No	if Q6 = 2
17	ORAL: Would you prefer to collect this sample by yourself?	1 = Yes 2 = No	if Q16 = 2
18	RECTAL: You have indicated that you would prefer to collect this sample by yourself. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable that you will be able to provide this sample?	1 = Yes 2 = No	if Q8 = 1
19	RECTAL: Would you prefer this to be collected by provider?	1 = Yes 2 = No	if Q18 = 2
20	RECTAL: This sample will be collected by the doctor during an examination. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable for this?	1 = Yes 2 = No	if Q8 = 2
21	RECTAL: Would you prefer to collect this sample by yourself?	1 = Yes 2 = No	if Q20 = 2
22	(NEO)VAGINAL: You have indicated that you would prefer to collect this sample by yourself. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable that you will be able to collect this sample?	1 = Yes 2 = No	if Q1 = 2 AND if Q10 = 1
23	(NEO)VAGINAL: Would you prefer this to be collected by provider?	1 = Yes 2 = No	if Q1 = 2 AND if Q22 = 2
24	(NEO)VAGINAL: This sample will be collected by the doctor during an examination. [Explain by making reference to instruction diagram and show	1 = Yes 2 = No	if Q1 = 2 if Q10 = 2

	collection materials] Do you feel comfortable for this?		
25	(NEO)VAGINAL: Would you prefer to collect this sample by yourself?	1 = Yes 2 = No	if Q1 = 2 AND if Q24 = 2
26	GENITAL: You have indicated that you would prefer to collect this sample by yourself. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable that you will be able to collect this sample?	1 = Yes 2 = No	if Q12 = 1
27	GENITAL: Would you prefer this to be collected by provider?	1 = Yes 2 = No	if Q26 = 2
28	GENITAL: This sample will be collected by the doctor during an examination. [Explain by making reference to instruction diagram and show collection materials] Do you feel comfortable for this?	1 = Yes 2 = No	if Q12 = 2
29	GENITAL: Would you prefer this to collect this sample by yourself?	1 = Yes 2 = No	if Q28 = 2
	SELF-COLLECTION Provide the following samples:		
30	URINE	1 = Given 99 = Refused	if Q4 = 1
31	ORAL	1 = Given 99 = Refused	if Q14 = 1 OR if Q17 = 1
32	RECTAL	1 = Given 99 = Refused	if Q18 = 1 OR if Q21 = 1
33	(NEO)VAGINAL	1 = Given 99 = Refused	if Q22 = 1 OR if Q25 = 1
34	GENITAL	1 = Given 99 = Refused	if Q26 = 1 OR if Q29 = 1
	PROFESSIONAL Provide the following sample kits for medical collection:		
35	ORAL	1 = Given 99 = Refused	if Q15 = 1 OR if Q16 = 1
36	RECTAL	1 = Given 99 = Refused	if Q19 = 1 OR if Q20 = 1
37	(NEO)VAGINAL	1 = Given 99 = Refused	if Q23 = 1 OR if Q24 = 1
38	GENITAL	1 = Given 99 = Refused	if Q27 = 1 OR if Q28 = 1
	PART B - COLLECTION		
	[THE FOLLOWING TO BE INCLUDED FOR CONFIRMATION OF SAMPLE COLLECTION] Confirm receipt of the following samples:		

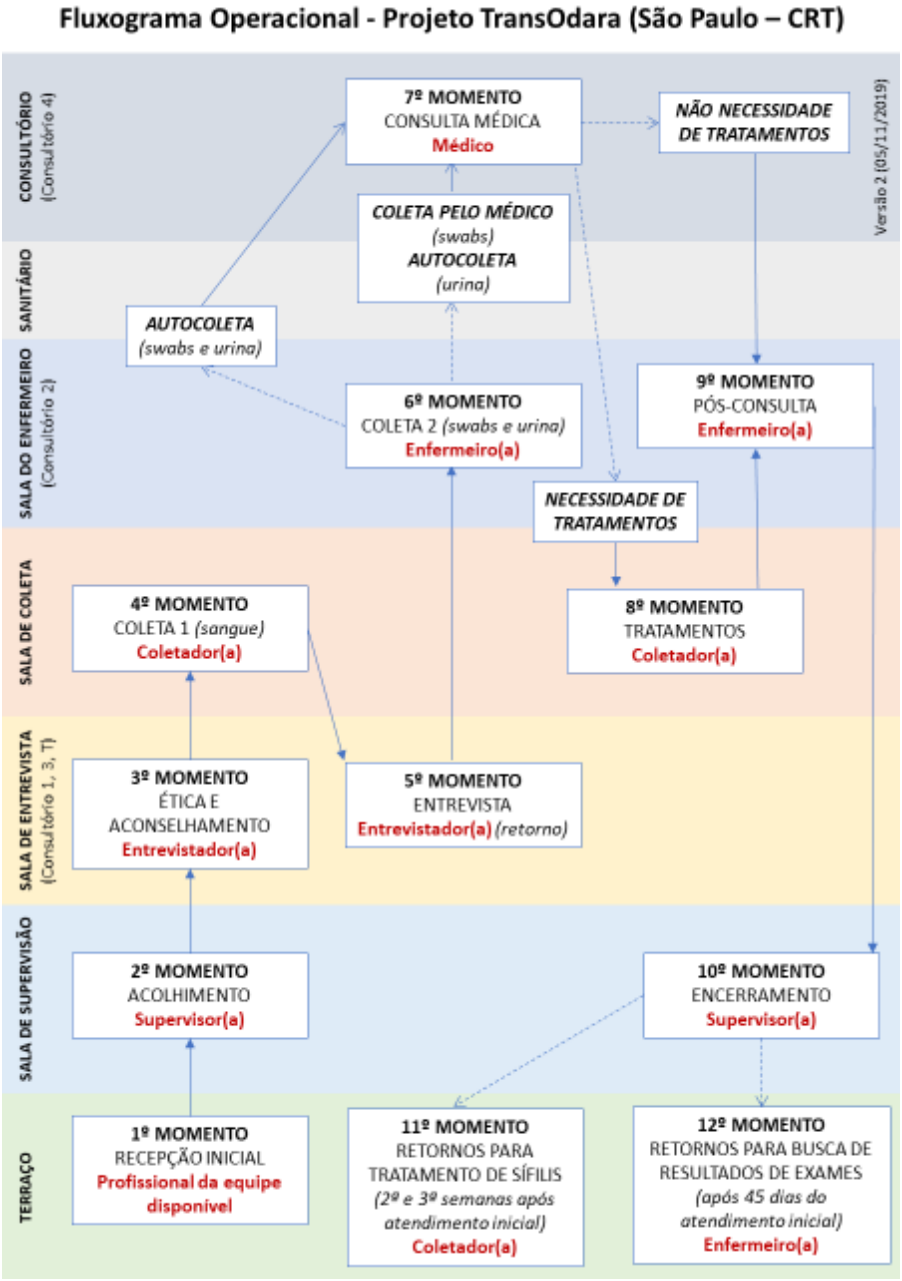
A	URINE	1 = Received 99 = Refused / Missing	if Q30 = 1
B	ORAL	1 = Received 99 = Refused / Missing	if Q31 = 1 OR if Q35 = 1
C	RECTAL	1 = Received 99 = Refused / Missing	if Q32 = 1 OR if Q36 = 1
D	(NEO)VAGINAL	1 = Received 99 = Refused / Missing	if Q33 = 1 OR if Q37 = 1
E	GENITAL	1 = Received 99 = Refused / Missing	if Q34 = 1 OR if Q38 = 1
	PART B - SELF-COLLECTION		
	To be filled by the project team with participants who chose the autocollection of anal/genital swab. [READ ALOUD] Now I would like to ask a few questions about your experience in collecting your sample yourself.		
39	URINE: For you, how easy or difficult was it to collect the sample by yourself?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not collect	if Q30 = 1 OR if A = 1
40	URINE: Was it easy or difficult to understand the instruction diagram?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not see or use diagram	if Q30 = 1 OR if A = 1
41	URINE: Why do you say it was difficult?	[OPEN]	if Q39 = 3 OR if Q40 = 3
42	ORAL: For you, how easy or difficult was it to collect the sample by yourself?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not collect	if Q31 = 1
43	ORAL: Was it easy or difficult to understand the instruction diagram?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not see or use diagram	if Q31 = 1
44	ORAL: Why do you say it was difficult?	[OPEN]	if Q42 = 3 OR if Q43 = 3
45	ORAL: Next time, would you prefer the healthcare professional to collect or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q31 = 1
46	RECTAL: For you, how easy or difficult was it to collect the sample by yourself?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not collect	if Q32 = 1
47	RECTAL: Was it easy or difficult to understand the instruction diagram?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not see or use diagram	if Q32 = 1

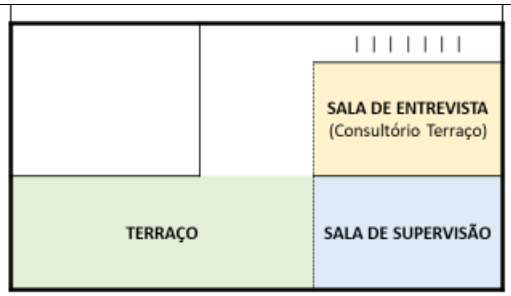
48	RECTAL: Why do you say it was difficult?	[OPEN]	if Q46 = 3 OR if Q47 = 3
49	RECTAL: Next time, would you prefer the healthcare professional to collect or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q32 = 1
50	(NEO)VAGINAL: For you, how easy or difficult was it to collect the sample by yourself?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not collect	if Q33 = 1
51	(NEO)VAGINAL: Was it easy or difficult to understand the instruction diagram?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not see or use diagram	if Q33 = 1
52	(NEO)VAGINAL: Why do you say it was difficult?	[OPEN]	if Q50 = 3 OR if Q51 = 3
53	(NEO)VAGINAL: Next time, would you prefer the healthcare professional to collect or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q33 = 1
54	GENITAL: For you, how easy or difficult was it to collect the sample by yourself?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not collect	if Q34 = 1
55	GENITAL: Was it easy or difficult to understand the instruction diagram?	1 = Easy 2 = Indifferent 3 = Difficult 99 = Did not see or use diagram	if Q34 = 1
56	GENITAL: Why do you say it was difficult?	[OPEN]	if Q54 = 3 OR if Q55 = 3
57	GENITAL: Next time, would you prefer the healthcare professional to collect or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q34 = 1
58	Overall, did you feel comfortable collecting your samples by yourself?	1 = Yes 2 = No 3 = Indifferent	if Q31 = 1 OR if Q32 = 1 OR if Q33 = 1 OR if Q34 = 1
59	Explain why you said this.	[OPEN]	if Q58 = 2
60	Next time, would you prefer to collect samples at home or in another health service?		if Q31 = 1 OR if Q32 = 1 OR if Q33 = 1 OR if Q34 = 1
	PART B - PROVIDER-COLLECTION		
	To be filled by the project team with participants who chose the collection of anal/genital swab performed by the health professional. [READ] Now I would like to ask a few questions about your experience in the examination and collection of samples by the healthcare professional.		

61	ORAL: For you, how easy or difficult was it to have the sample collected?	1 = Easy 2 = Indifferent 3 = Difficult	if Q35 = 1
62	ORAL: How comfortable did you feel with the health professional collecting this sample?	1 = Comfortable 2 = Indifferent 3 = Uncomfortable	if Q35 = 1
63	ORAL: Why do you say it was difficult or uncomfortable?	[OPEN]	if Q61 = 3 OR if Q62 = 3
64	ORAL: Next time, would you prefer the healthcare professional to collect sample or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q35 = 1
65	RECTAL: For you, how easy or difficult was it to have the sample collected?	1 = Easy 2 = Indifferent 3 = Difficult	if Q36 = 1
66	RECTAL: How comfortable did you feel with the health professional collecting this sample?	1 = Comfortable 2 = Indifferent 3 = Uncomfortable	if Q36 = 1
67	RECTAL: Why do you say it was difficult or uncomfortable?	[OPEN]	if Q65 = 3 OR if Q66 = 3
68	RECTAL: Next time, would you prefer the healthcare professional to collect sample or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q36 = 1
69	(NEO)VAGINAL: For you, how easy or difficult was it to have the sample collected?	1 = Easy 2 = Indifferent 3 = Difficult	if Q37 = 1
70	(NEO)VAGINAL: How comfortable did you feel with the health professional collecting this sample?	1 = Comfortable 2 = Indifferent 3 = Uncomfortable	if Q37 = 1
71	(NEO)VAGINAL: Why do you say it was difficult or uncomfortable?	[OPEN]	if Q71 = 3 OR if Q72 = 3
72	(NEO)VAGINAL: Next time, would you prefer the healthcare professional to collect sample or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q37 = 1
73	GENITAL: For you, how easy or difficult was it to have the sample collected?	1 = Easy 2 = Indifferent 3 = Difficult	if Q38 = 1
74	GENITAL: How comfortable did you feel with the health professional collecting this sample?	1 = Comfortable 2 = Indifferent 3 = Uncomfortable	if Q38 = 1
75	GENITAL: Why do you say it was difficult or uncomfortable?	[OPEN]	if Q73 = 3 OR if Q74 = 3
76	GENITAL: Next time, would you prefer the healthcare professional to collect sample or would you rather do it yourself?	1 = Auto 2 = Professional 3 = No preference	if Q38 = 1
77	Overall, did you feel comfortable with the health professional collecting your samples?	1 = Yes 2 = No 3 = Indifferent	if Q35 = 1 OR if Q36 = 1 OR if Q37 = 1 OR if Q38 = 1

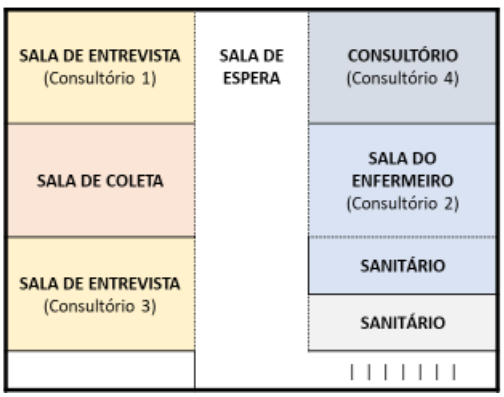
	PART B - COLLECTION - ALL		
78	Did you feel pain (or discomfort) at any point while collecting your samples today?	1 = Yes 2 = No	if Q31 = 1 OR if Q32 = 1 OR if Q33 = 1 OR if Q34 = 1 OR if Q35 = 1 OR if Q36 = 1 OR if Q37 = 1 OR if Q38 = 1
79	Please explain.	[OPEN]	if Q78 = 1
80	Did you feel embarrassed or ashamed during the exam by the healthcare professional?	1 = Yes 2 = No 3 = Indifferent	if Q31 = 1 OR if Q32 = 1 OR if Q33 = 1 OR if Q34 = 1 OR if Q35 = 1 OR if Q36 = 1 OR if Q37 = 1 OR if Q38 = 1
81	Please explain why?	[OPEN]	if Q80 = 1
82	Do you think the exam took a long time?	1 = Yes 2 = No 3 = Indifferent	if Q31 = 1 OR if Q32 = 1 OR if Q33 = 1 OR if Q34 = 1 OR if Q35 = 1 OR if Q36 = 1 OR if Q37 = 1 OR if Q38 = 1

Annex 4. Operational flow diagram for study site in São Paulo





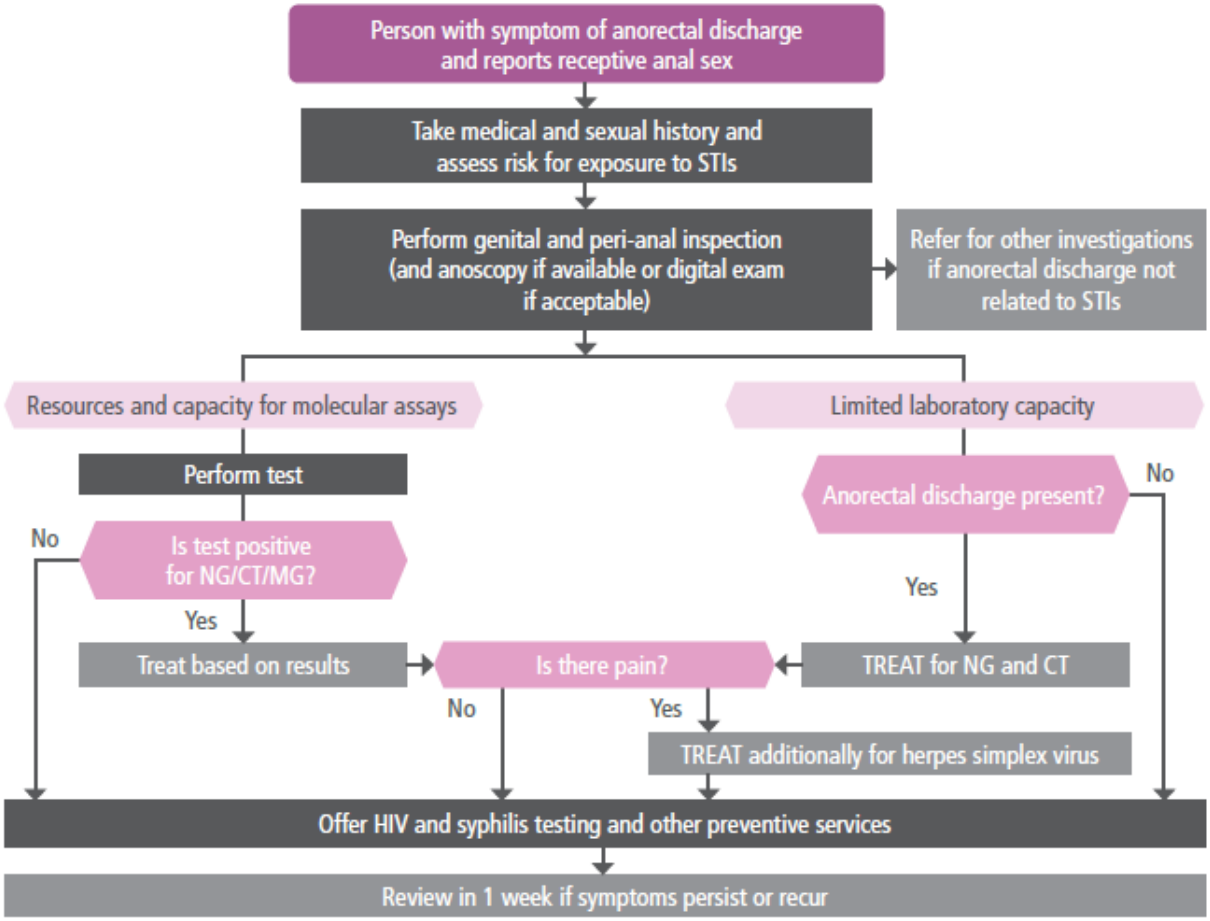
Ground Floor



1st Floor

Annex 5. Published WHO flowcharts for the management of anorectal discharge of symptoms

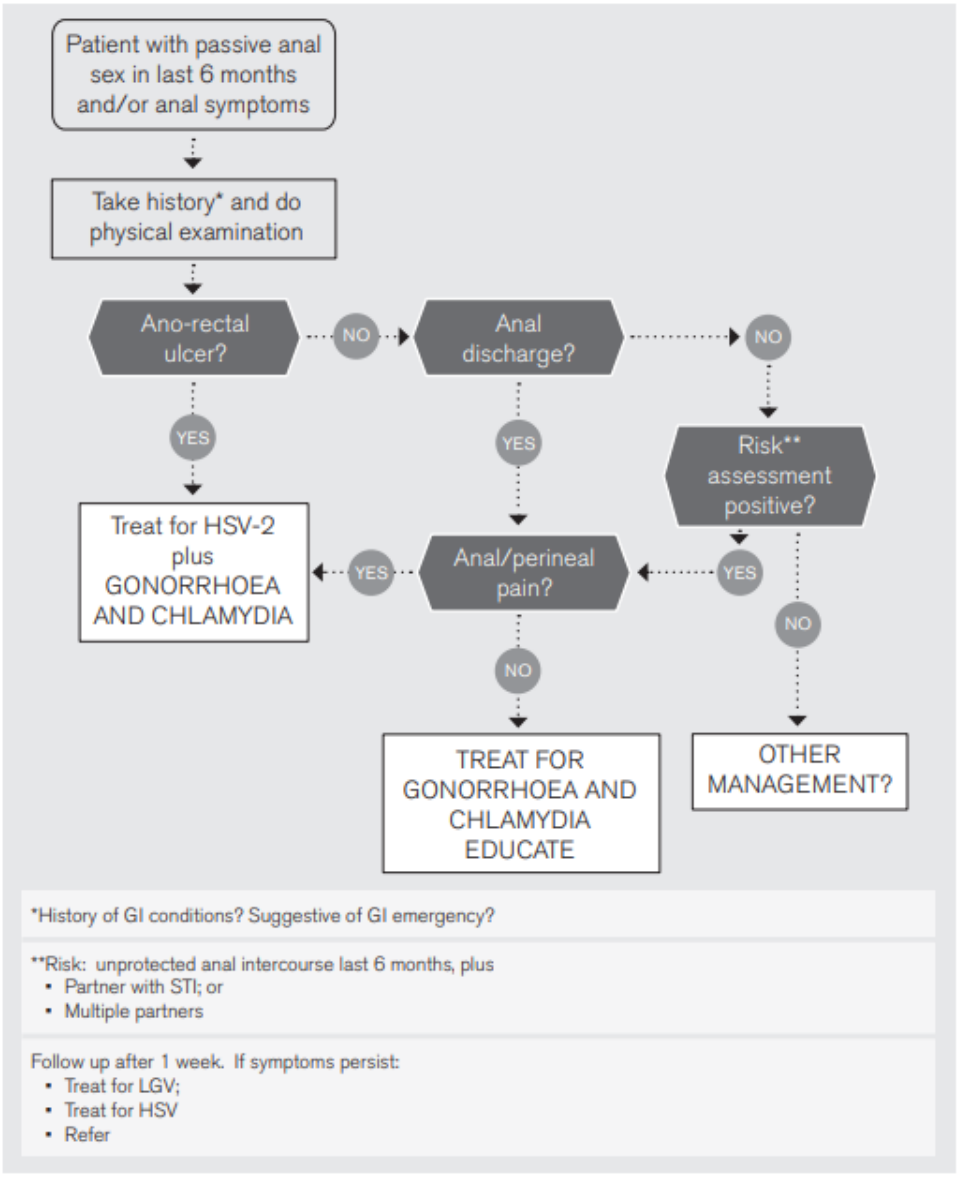
A. Flowchart for the management of anorectal discharge (WHO 2021)



NG, *N.gonorrhoeae*; CT, *C. trachomatis*; MG, *M. genitalium*.

Source: World Health Organization (WHO). Guidelines for the management of symptomatic sexually transmitted infections. Geneva: WHO, 2021. Available from: https://apps.who.int/iris/handle/10665/342523.

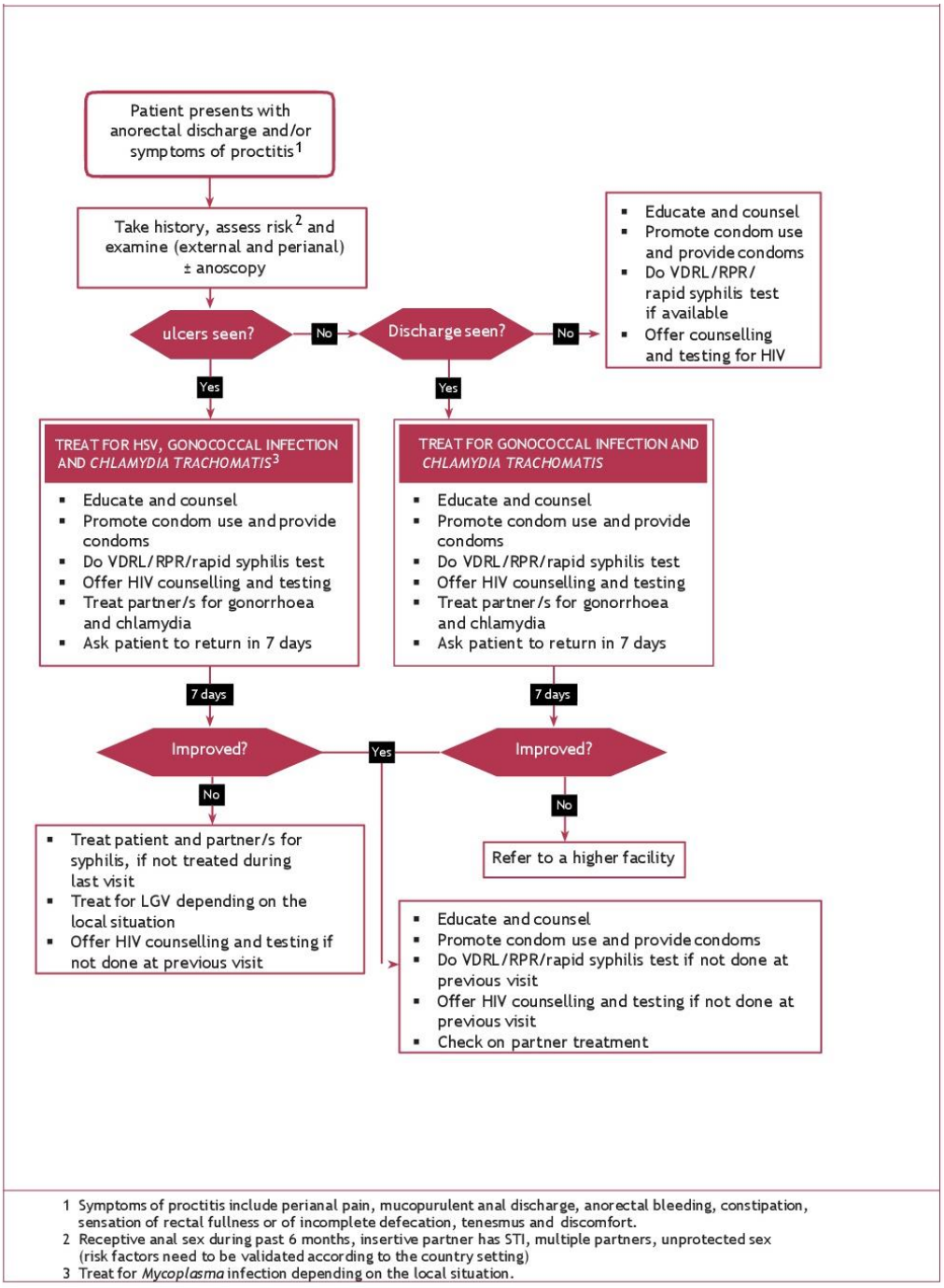
B. Flowchart for the management of anorectal infections (WHO 2011)



Due to its low sensitivity, microscopy is not recommended in the management of ano-rectal infections.

Source: World Health Organization (WHO). Guidelines: prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender populations: recommendations for a public health approach 2011. Geneva: WHO, 2011. Available from: https://apps.who.int/iris/handle/10665/44619

C. Flowchart for the management of anorectal discharge (WHO-SEAR 2011)

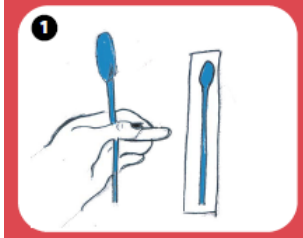


Source: World Health Organization, Regional Office for South-East Asia (WHO-SEAR). Management of Sexually Transmitted Infections - Regional Guidelines. New Delhi: WHO-SEAR, 2011. Available from: https://apps.who.int/iris/handle/10665/205471.

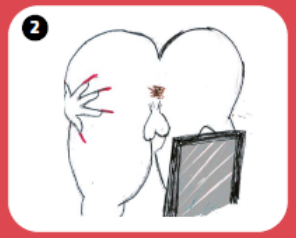
Annex 6. Co-designed ‘trans-specific’ instructional self-collection diagrams for STI testing

ANAL

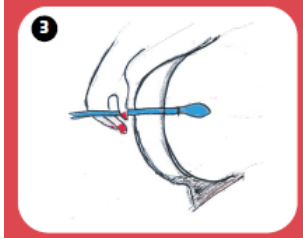
Amiga, é super fácil! Eu optei pela a coleta anal:



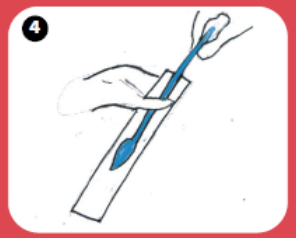
Eu lavei as mãos e verifiquei se estava tudo certinho no kit. Peguei o cotonete, segurando de 3 a 4 cm da ponta macia, com cuidado par não tocá-la.



Abri meu edy na frente do espelho, introduzi a ponta macia do cotonete e girei de 5 a 10 segundos.



Introduzi a ponta macia do cotonete e girei de 5 a 10 segundos.



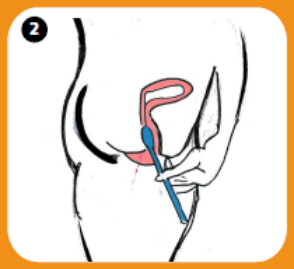
Tirei lentamente o cotonete, coloquei no tubo com cuidado e entreguei para o profissional de saúde.

VAGINAL

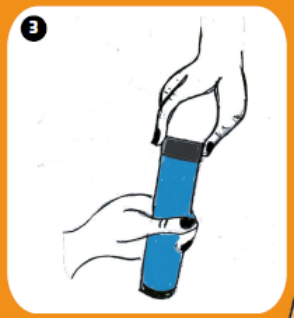
Eu me senti mais confortável fazendo a coleta vaginal:

A auto coleta vaginal também pode ser usada por mulheres cis e mulheres resignadas.

Comecei lavando bem as mãos com água e sabão, e então confirmei os produtos do kit. Procurei uma posição confortável e coloquei o cotonete dentro da minha vagina.



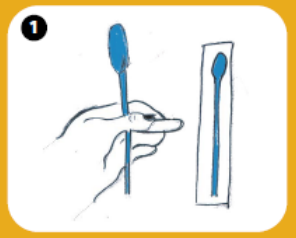
Girei de cinco a dez segundos e retirei o cotonete.



Coloquei o cotonete dentro do tubo com cuidado e levei a amostra ao posto de saúde.

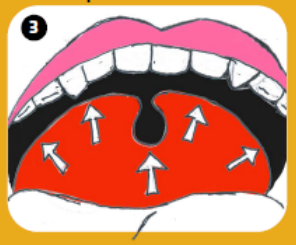
ORAL

Mana, eu escolhi fazer a coleta oral:

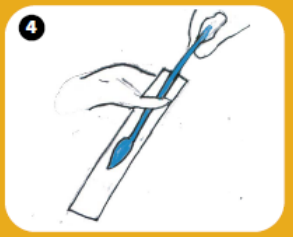


Comecei lavando as mãos e confirmando se os itens estavam corretos. Depois retirei o cotonete do pacote com cuidado para não tocar na parte macia

Abri bem a boca e coloquei o cotonete no fundo da garganta.



Passei o cotonete na parte de cima da garganta mais ou menos 5 vezes.

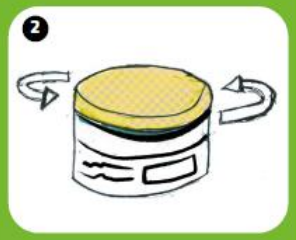


Coloquei o cotonete no tubo e levei ao posto de saúde.

URINA

Mana, eu escolhi fazer a coleta de urina:

Eu fiquei uma hora sem fazer xixi, e então higienizei as mãos com água e sabão e confirmei os produtos do kit.



Segurei o pote com cuidado para não tocar dentro dele e nem na tampa.

Sentei no vaso e fiz o primeiro fluxo de xixi dentro do potinho.

Guardei a amostra no saquinho e levei ao posto de saúde.

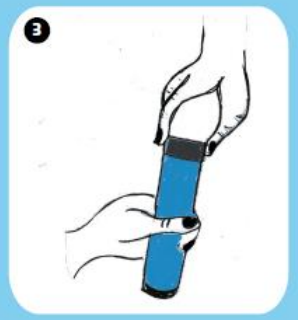
Priscila

PENIANO

Eu fiz o teste peniano e foi bem rápido!

Primeiro, higienizei as mãos com água e sabão e confirmei se estava tudo okay com o kit.

Peguei o cotonete e passei em volta da cabeça do pênis 5 vezes.



Coloquei o cotonete de volta no tubo e levei ao posto de saúde

Tainá

Guia: Como Fazer a sua Auto coleta

Feito por pessoas trans e travestis para pessoas trans e travestis.