



# Uptake of and factors associated with testing for sexually transmitted infections in community-based settings among youth in Zimbabwe: a mixed-methods study



Kevin Martin, Ioana D Olaru, Nyasha Buwu, Tsitsi Bandason, Michael Marks, Ethel Dauya, Joice Muzangwa, David Mabey, Chido Dziva Chikwari, Suzanna C Francis, Mandikudza Tembo, Constanca Mavodza, Victoria Simms, Constance R S Mackworth-Young, Anna Machiha, Katharina Kranzer, Rashida A Ferrand

*Lancet Child Adolesc Health*  
2021; 5: 122–32

Published Online  
January 5, 2021

[https://doi.org/10.1016/S2352-4642\(20\)30335-7](https://doi.org/10.1016/S2352-4642(20)30335-7)

See [Comment](#) page 93

Department of Global Health and Infection, Brighton and Sussex Medical School, Brighton, UK (K Martin MBBS); Clinical Research Department (K Martin, I D Olaru MBBS, M Marks PhD, Prof D Mabey DM, C Dziva Chikwari MSc, M Tembo MSc, C R S Mackworth-Young PhD, K Kranzer PhD, Prof R A Ferrand PhD), Department of Infectious Disease Epidemiology (S C Francis PhD, M Tembo, C Mavodza MPH, V Simms PhD), and Department of Public Health and Policy (C Mavodza), London School of Hygiene & Tropical Medicine, London, UK; Biomedical Research and Training Institute, Harare, Zimbabwe (I D Olaru, N Buwu BSc, T Bandason MSc, E Dauya MPH, J Muzangwa MSc, C Dziva Chikwari, V Simms, K Kranzer, Prof R A Ferrand); AIDS and TB Unit, Ministry of Health and Child Care, Zimbabwe (A Machiha BSc); Division of Infectious and Tropical Medicine, Medical Centre of the University of Munich, Munich, Germany (K Kranzer)

Correspondence to: Dr Kevin Martin, Department of Global Health and Infection, Brighton and Sussex Medical School, Brighton BN1 9PX, UK [kevinmartin@doctors.org.uk](mailto:kevinmartin@doctors.org.uk)

## Summary

**Background** The prevalence of sexually transmitted infections (STIs) among youth is high in sub-Saharan Africa. We investigated the uptake of testing for and prevalence of *Chlamydia trachomatis* (chlamydia) and *Neisseria gonorrhoeae* (gonorrhoea) infections among youth in community-based settings in Zimbabwe, and explored the facilitators and barriers to testing.

**Methods** This study was nested within a cluster randomised trial of community-based delivery of integrated HIV and sexual and reproductive health services for youth aged 16–24 years. Chlamydia and gonorrhoea testing via urine samples using the Xpert CT/NG test was offered in the four intervention clusters in Harare, Zimbabwe. Factors associated with testing uptake were investigated in a subset of participants (n=257) using hierarchical multivariate logistic regression. In-depth interviews with a separate purposively selected sample (n=26) explored facilitators and barriers to STI testing and partner notification and were analysed using thematic analysis.

**Findings** Between June 1, 2019, and Jan 31, 2020, there were 6200 attendances by 4440 participants (78.2% women, 21.8% men) median age 20.3 (IQR 17.9–22.8) years. 1478 participants had 1501 tests done, and 248 tests were positive and 1253 tests were negative for chlamydia or gonorrhoea, or both. STI test uptake was 33.3% (95% CI 31.9–34.7), increasing from 11.7% in June, 2019, to 37.1% in January, 2020. The prevalence of chlamydia or gonorrhoea, or both, was 16.5% (95% CI 14.7–18.5; 248 of 1501), with only seven participants (3%) showing symptoms. The overall yield of testing was 4.0% (95% CI 3.5–4.5; 248 of 6200). Uptake was associated with having symptoms (adjusted odds ratio [OR] 14.8, 95% CI 1.66–132.07) and negatively associated with being single (adjusted OR 0.33, 95% CI 0.13–0.84) or having a boyfriend or girlfriend (adjusted OR 0.19, 95% CI 0.087–0.43) compared with being married, and being a student compared with being employed (adjusted OR 0.26, 95% CI 0.10–0.68). Perceived risk and symptoms of STIs were motivators for testing whereas misinformation, anticipated stigma, and concern about confidentiality were barriers.

**Interpretation** The prevalence of chlamydia or gonorrhoea, or both, was high among youth but only a minority were symptomatic. Therefore most infections would remain untreated without access to STI testing. Provision of education, counselling, and confidentiality are essential to improve uptake and acceptability of STI testing.

**Funding** Wellcome Trust.

**Copyright** © 2020 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

## Introduction

Globally, 376 million curable sexually transmitted infections (STIs) were recorded in 2016 among people aged 15–49 years.<sup>1</sup> Although the concerted focus on HIV infection has led to a substantial decline in HIV incidence in many countries, STI programmes have not been effective and the prevalence of STIs globally is increasing.<sup>2</sup> Adolescents and young people, especially young women, are at particularly high risk of STIs, with higher prevalence than that in older age groups observed in east and southern Africa.<sup>3</sup>

Over the past three decades, syndromic management of STIs has been implemented in resource-limited settings

due to lack of laboratory capacity. However, syndromic management has consistently been shown to have very poor sensitivity and specificity, leading to considerable levels of both underdiagnosis and overtreatment.<sup>4</sup> Crucially, many curable STIs are asymptomatic, but syndromic management requires the presence of symptoms. Therefore, in settings where diagnostic testing is not available, participants with asymptomatic STIs will not receive treatment. The WHO 2016–21 strategy on STIs notes that “investment in point-of-care test development will generate future savings by lowering STI diagnostic and screening costs, and improving case management and detection of asymptomatic STI, thus contributing to lower

## Research in context

### Evidence before this study

We searched MEDLINE for articles published before July 30, 2020, with no language restrictions, with the search terms (variations on and synonyms of) “sexually transmitted infections” AND “testing” AND “uptake” AND “youth” AND “sub-Saharan Africa”. Of the 619 articles identified by this search, there were no studies that assessed uptake of sexually transmitted infection (STI) testing among youth when offered universally in a community-based setting in sub-Saharan Africa. A study published in 2020, investigated self-reported “lifetime STI testing” among urban refugee and displaced youth living in informal settlements in Kampala, Uganda. Among young women, predictors of lifetime STI testing were older age, lower sexual activity and pregnancy stigma, and lower food insecurity. Except for older age, predictors were different for young men including higher self-efficacy in condom use, and increased sexual activity and pregnancy stigma. However, lifetime STI testing was self-reported and thus subject to bias and misclassification.

### Added value of this study

This study is an important addition to a very sparse literature. To our knowledge, it is the first study to implement testing for *Chlamydia trachomatis* (chlamydia) and *Neisseria gonorrhoeae*

(gonorrhoea) infections in adolescents in a community-based setting in sub-Saharan Africa and to investigate the cascade from testing to treatment including partner notification. Crucially, uptake of testing and associated factors was assessed after testing was actually offered to youth. Additionally, we found a high prevalence of chlamydia and gonorrhoea yet only a small minority reported the presence of symptoms. The qualitative data from in-depth interviews further contextualised the barriers that youth face in accessing services for STIs including stigma, misinformation, and concerns surrounding confidentiality. We have also showed the difficulties associated with partner notification, and further research is needed to optimise this process.

### Implications of all the available evidence

This study contributes towards the mounting evidence regarding the limitations of syndromic management and the need to further develop and implement point-of-care diagnostics in resource-limited settings. We have demonstrated the feasibility of a community-based model for STI testing for youth in resource-limited settings. Further innovative strategies for the delivery of STI testing and care will need to be developed to ensure high levels of uptake as point-of-care tests for STIs become more widely available.

STI burdens”.<sup>5</sup> Over the past decade, simpler diagnostic platforms for STIs that do not require sophisticated laboratory infrastructure have been developed. However, data on uptake and acceptability of testing if offered to asymptomatic individuals, particularly among youth, are sparse.

Young people experience multiple barriers to accessing sexual and reproductive health (SRH) services. In addition to a lack of availability or knowledge of services, costs and long waiting times as a barrier to access, perceived judgmental attitudes of health-care providers, and concerns surrounding confidentiality result in low uptake of services.<sup>6,7</sup> Therefore, STI testing strategies will need to account for and address these factors to facilitate optimum uptake and acceptability.

The aims of this study were to investigate the prevalence of *Chlamydia trachomatis* (chlamydia) and *Neisseria gonorrhoeae* (gonorrhoea), and uptake and yield of testing offered as part of an integrated package of SRH and HIV services in community-based settings to youth aged 16–24 years in Harare, Zimbabwe, and to explore facilitators and barriers to uptake of chlamydia and gonorrhoea testing.

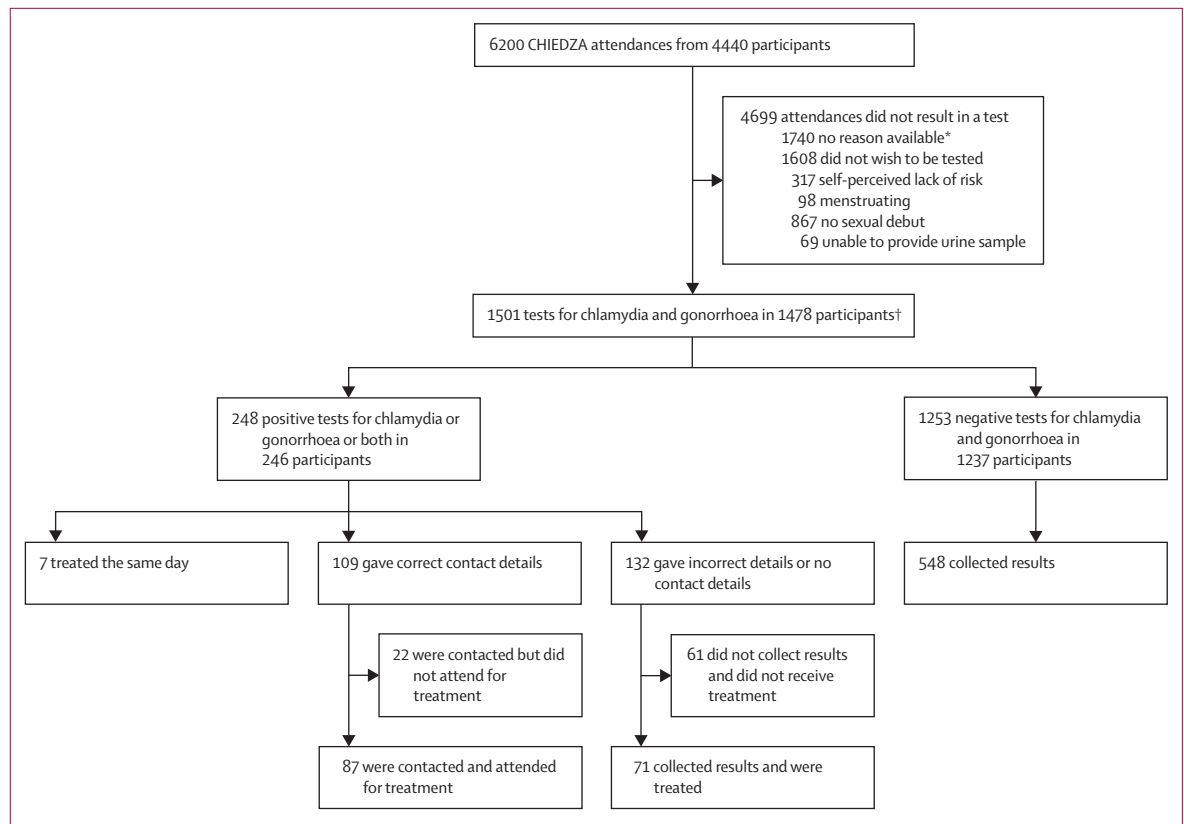
## Methods

### Study design and participants

This study was nested within the CHIEDZA trial (Community based interventions to improve HIV outcomes in youth: a cluster randomised trial in

Zimbabwe; NCT03719521), a cluster randomised trial investigating the effect of an integrated package of HIV and SRH services for youth in community-based settings on population level HIV prevalence and other health outcomes. The two-arm trial is being done in 24 clusters in three provinces (Harare, Mashonaland East, and Bulawayo), with each province randomised to four intervention and four standard of care (routine, existing services) clusters (1:1). A cluster is a geographically demarcated area containing a primary health-care clinic and a community centre from which services are delivered.

Individuals aged 16–24 years living within an intervention cluster are eligible to receive a package of services including HIV testing, HIV treatment and adherence support, contraception, pregnancy testing, syndromic management of STIs, menstrual health information and products, condoms, and general health counselling. Treatment of STIs and HIV is delivered according to national guidelines. In each cluster, services are delivered once weekly (on the same day each week) by a team of nurses, community health workers, youth workers, and a counsellor, and all services are offered free of cost. The services are configured to be youth-friendly and to ensure confidentiality. The services are provided from 1100 h to 1900 h and operate on an open access basis with no previous appointments required. There is no limit to the number of times an individual can access the service over time. The present study was done in the four intervention clusters in Harare.



**Figure 1: Study profile**

\*Reasons for lack of uptake documented from Sept 3, 2019, onwards. †23 participants tested twice during the study period.

Ethical approval for the CHIEDZA trial including the STI study was obtained from the Medical Research Council of Zimbabwe and The London School of Hygiene & Tropical Medicine Ethics Committee. Regarding services offered through the CHIEDZA intervention, verbal consent was sought for chlamydia and gonorrhoea testing. Written informed consent in Shona or English was obtained from participants who were enrolled for the questionnaire and for qualitative interviews. The protocol for the CHIEDZA trial has been previously published.

### Procedures

All individuals accessing CHIEDZA services were non-selectively offered confidential testing for chlamydia and gonorrhoea, regardless of whether they had symptoms. Those who accepted testing provided a first-catch urine sample which was tested within 48 h of collection using the GeneXpert platform (Cepheid, Sunnyvale, CA, USA). Participants were eligible for repeat testing after 6 months. To maintain confidentiality, participants provided a pseudonym and samples were processed using an identification number.

All participants were given the option to pick up their result the following week, and those with a positive result were actively followed up by telephone. If uncontactable, repeat phone calls were made weekly for up to 2 months,

after which a participant was considered lost to follow-up. Individuals who reported STI symptoms at presentation were treated according to national guidelines for syndromic management. If treatment was given on the day of presentation, they were not actively contacted about a subsequent positive chlamydia and gonorrhoea test result. Given that the intervention team delivered services to a cluster once weekly, the shortest possible duration between testing and treatment for asymptomatic participants was 7 days. Partner notification slips were given to those who were treated for an STI, and all partners were offered presumptive treatment regardless of age and whether they resided in the intervention cluster.

Chlamydia and gonorrhoea testing uptake data were regularly reviewed in real-time and discussed at the intervention team's monthly debrief meetings. During the course of the study, the intervention team underwent further training on STIs and written Information, Education and Communication material for participants was developed to enhance uptake of chlamydia and gonorrhoea testing.

Participants accessing CHIEDZA services at the four intervention sites in Harare between June 10 and July 16, 2019, were consecutively enrolled to complete an interviewer-administered questionnaire to understand

factors associated with uptake of chlamydia and gonorrhoea testing. The questionnaire recorded socio-demographic and sexual behaviour data, and included a mixture of open-ended and closed-ended questions to assess knowledge of STIs and to solicit opinions about STI service delivery including partner notification.

A separate purposively selected sample was also recruited to participate in in-depth interviews to explore understanding of STIs and perceived facilitators and barriers to chlamydia and gonorrhoea testing. Participants were selected to provide roughly equal representation of men and women and those who accepted and declined chlamydia and gonorrhoea testing. Interviews were done by a trained interviewer (not involved in service delivery) at a secluded spot outside the community centre, in either Shona or English depending on participant preference. Interviews were done after a participant had completed their consultation with a health worker and were continued until data saturation was achieved. All interviews were audio-recorded and translated and transcribed by the interviewer.

The primary outcome of this study was uptake of STI testing. Secondary outcomes included prevalence of chlamydia and gonorrhoea, and yield of testing.

### Statistical analysis

Sample size calculations to investigate chlamydia and gonorrhoea testing uptake assumed a ratio of 1:2 between those accepting and declining STI testing. Given the dearth of data on uptake of chlamydia and gonorrhoea testing in similar settings, this ratio was informed by the range of uptake reported in high-income countries<sup>8</sup> together with the fact that testing was offered within a package of youth-friendly services. Assuming a prevalence of a risk factor of 20% among those declining testing and a type I error rate of 5%, a sample size of 204 (68 accepting testing) would provide 80% power to detect an odds ratio (OR) of 2.5.

The prevalence of chlamydia and gonorrhoea and uptake and yield of testing were recorded, and the proportion of participants with positive tests who received treatment, and time to treatment were calculated.

Factors associated with uptake of STI testing were investigated using multivariate logistic regression. We used a hierarchical conceptual approach with three levels: (1) sociodemographic, (2) behavioural, and (3) other more proximal factors (appendix p 1).<sup>9,10</sup> Age and sex were considered a priori confounders for each model. For level 1, all age-adjusted and sex-adjusted socio-demographic factors that met a p value cutoff of less than 0.10 were included in the multivariate model for level 1. Those factors that remained associated at less than 0.10 became the core level 1 factors. For level 2, all core level 1-adjusted behavioural factors that met a p value cutoff of less than 0.10 were included in the multivariate model

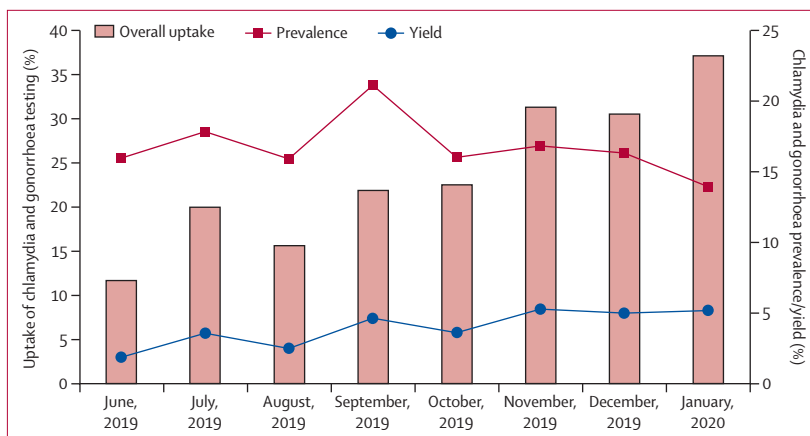


Figure 2: Prevalence of chlamydia and gonorrhoea, and uptake and yield of testing

for level 2, together with the core level 1 factors. Associations with level 3 factors were determined in a similar way. If factors that were restricted by reported penile–vaginal sex or sex met the p value cutoff and we wanted to use the factor to adjust other variables, a reference category was added to the variable so that there would be an unrestricted adjusted model. For example, for factors restricted to participants who reported having had penile–vaginal sex, a reference category of no penile–vaginal sex was added to the variable when included in the adjusted model.

Qualitative data were analysed using thematic analysis on the basis of the following themes: facilitators and barriers to chlamydia and gonorrhoea testing uptake and facilitators and barriers to partner notification. Following familiarisation with data, codes were generated on the basis of these themes and subthemes emerging from the transcripts. NVivo 12 (QSR International) was used to assist with coding transcripts. Themes and coding were iteratively reviewed and refined. Data analysis was done with STATA version 15.0.

### Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to all the data in the study and accept responsibility for the decision to submit for publication.

### Results

Between June 1, 2019, and Jan 31, 2020, there were 6200 attendances to CHIEDZA services by 4440 young people who met the eligibility criteria for chlamydia and gonorrhoea testing. 3473 (78.2%) were women and 967 (21.8%) were men, and the median age was 20.3 years (IQR 17.9–22.8). Of the 6200 attendances, 4699 (76%) were not tested for reasons including refusal, self-perceived lack of risk, menstruation, not yet sexually active, or unable to provide a urine sample (figure 1).

	Total (n=1501)		Men				Women							
	Number of participants	95% CI	16–20 years (n=187)		21–24 years (n=113)		Total for age 16–24 (n=300)		16–20 years (n=420)		21–24 years (n=781)		Total for age 16–24 (n=1201)	
			Number of participants	95% CI	Number of participants	95% CI	Number of participants	95% CI	Number of participants	95% CI	Number of participants	95% CI	Number of participants	95% CI
Chlamydia	200 (13.32%)	11.64–15.15	8 (4.28%)	1.86–8.26	14 (12.39%)	6.94–19.91	22 (7.33%)	4.65–10.89	68 (16.19%)	12.80–20.06	110 (14.08%)	11.72–16.72	178 (14.82%)	12.80–16.96
Gonorrhoea	34 (2.27%)	1.57–3.15	4 (2.14%)	0.59–5.39	3 (2.65%)	0.55–7.56	7 (2.33%)	0.94–4.75	13 (3.10%)	1.66–5.23	14 (1.79%)	0.98–2.99	27 (2.25%)	1.49–3.25
Chlamydia and gonorrhoea	14 (0.93%)	0.51–1.56	0	..	1 (0.88%)	0.02–4.83	1 (0.33%)	0.00–1.84	4 (0.95%)	0.26–2.42	9 (1.15%)	0.53–2.18	13 (1.08%)	0.58–1.84

Data are n (%) unless otherwise specified. All 95% CIs presented are for percentages.

**Table 1: Prevalence of chlamydia and gonorrhoea by age group and sex**

In total, 1501 STI tests (24.2%) were done of the 6200 attendances, in 1478 people, with 23 people tested twice over the study period at an interval of at least 6 months, equating to an uptake of at least one chlamydia and gonorrhoea test of 33.3% (95% CI 31.9%–34.7%; figure 1). The uptake in men was 30.4% (294 of 967) and in women was 34.1% (1184 of 3473). The uptake of testing among eligible attendees increased over time from 11.7% (94 of 806) in the first month to 37.1% (287 of 773) in month eight (figure 2). The chlamydia and gonorrhoea prevalence among those tested was 16.5% (95% CI 14.7–18.5; 248 of 1501). The prevalence of these STIs was lower in men than in women (30 [10%] of 300 vs 218 [18.2%] of 1201, p=0.0010; table 1). Of the 23 participants who underwent testing at two timepoints, two tested positive on both occasions and 16 tested negative both times. The overall yield of testing was 4.0% (95% CI 3.5–4.5; 248 of 6200).

Of 248 participants with a positive STI test, 165 (67%) were treated. Seven (3%) participants were symptomatic on presentation and following examinations were treated on the same day using syndromic treatment guidelines. Five (2%) were female participants with vaginal discharge syndrome (three with gonorrhoea only, one with chlamydia only, and one with both infections), and two (<1%) were male participants with urethral discharge syndrome (one with gonorrhoea only and one with chlamydia only). Correct traceable contact details had only been provided by 109 (44%) of the 248 participants, and of these 87 (80%) attended for treatment. Of the 132 participants who were uncontactable, 71 (54%) presented to collect results and were treated. The median time between testing and treatment in the 158 participants who were not treated at presentation was 7 days (IQR 7–21). Of the 1253 participants who had negative test results (and were therefore not contacted), 548 (43.7%) attended to collect their results within two months of testing. Overall, 22 partners were treated through the partner notification process.

A total of 257 participants were recruited between June 10, and July 16, 2019, to investigate factors associated with uptake of chlamydia and gonorrhoea testing. Participants were broadly representative of those in the CHIEDZA study; the median age was 20 years (IQR 18–22) and 161 (63%) were women (table 2). 84 (33%) participants used condoms regularly and 80 (31%) used condoms at last sexual intercourse. Being a woman, older (age 21–24 years compared with age 16–20 years), married (compared with being single or having a girlfriend or boyfriend), employed (compared with being a student), having at least one sexual partner in the previous 12 months, having current STI symptoms, not using a condom at last sexual intercourse and lower levels of reported condom use, higher levels of perceived risk of an STI, and having had at least one pregnancy were associated with uptake of testing in the unadjusted analysis. After adjusting for age, sex, occupation and marital status,

current STI symptoms remained strongly associated with accepting chlamydia and gonorrhoea testing (adjusted OR 14.79, 95% CI 1.66–132.07). Having a boyfriend or girlfriend (adjusted OR 0.19, 95% CI 0.087–0.43) or being single (adjusted OR 0.33, 95% CI 0.13–0.84) compared with being married, and being a student

	STI testing uptake	Unadjusted OR (95% CI)	p value	Adjusted OR* (95% CI)	p value
<b>Sociodemographic factors (level 1)</b>					
Age, years					
16–20	37/148 (25%)	1 (ref)	0.0003	1 (ref)	0.34
21–24	51/109 (47%)	2.64 (1.55–4.48)		1.37 (0.72–2.59)	
Sex					
Male	24/96 (25%)	1 (ref)	0.017	1 (ref)	0.79
Female	64/161 (40%)	1.98 (1.13–3.46)		0.92 (0.47–1.78)	
Occupation					
Employed	18/35 (51%)	1 (ref)	0.0001	1 (ref)	0.019
Unemployed	54/127 (43%)	0.70 (0.33–1.48)		0.53 (0.22–1.26)	
Student	16/95 (17%)	0.19 (0.08–0.45)		0.26 (0.10–0.68)	
Education					
Post-secondary	5/20 (25%)	1 (ref)	0.50	1 (ref)	0.98
Secondary	76/221 (34%)	1.57 (0.55–4.49)		0.90 (0.26–3.12)	
Primary	7/16 (44%)	2.33 (0.57–9.60)		0.84 (0.16–4.45)	
Marital status					
Married	41/63 (65%)	1 (ref)	<0.0001	1 (ref)	0.0003
Partner	30/135 (22%)	0.15 (0.08–0.30)		0.19 (0.087–0.43)	
Single	17/59 (29%)	0.22 (0.10–0.47)		0.33 (0.13–0.84)	
<b>Sexual behaviour factors (level 2)</b>					
Ever had oral sex†					
No	54/176 (31%)	1 (ref)	0.077	1 (ref)	0.52
Yes	34/81 (42%)	1.63 (0.95–2.82)		1.24 (0.64–2.41)	
Ever had anal sex†					
No	86/248 (35%)	1 (ref)	0.45	1 (ref)	0.47
Yes	2/9 (22%)	0.54 (0.11–2.65)		0.54 (0.10–2.92)	
Ever had penile–vaginal sex					
No	11/77 (14%)	1 (ref)	<0.0001	1 (ref)	0.099
Yes	77/180 (43%)	4.49 (2.22–9.06)		2.17 (0.86–5.45)	
Age at sexual debut‡, years					
>16	57/129 (44%)	1 (ref)	0.54	1 (ref)	0.32
≤16	20/51 (39%)	0.81 (0.42–1.58)		1.49 (0.67–3.31)	
Number of sexual partners in past 12 months§					
0	12/83 (14%)	1 (ref)	<0.0001	1 (ref)	0.13
1	54/106 (51%)	6.14 (2.99–12.63)		2.50 (0.91–6.87)	
≥2	22/68 (32%)	2.83 (1.28–6.27)		2.79 (0.97–8.03)	
New sexual partner in past 3 months					
No	75/208 (36%)	1 (ref)	0.21	1 (ref)	0.19
Yes	13/49 (27%)	0.64 (0.32–1.28)		0.57 (0.24–1.31)	
Condom use at last sex‡					
Yes	25/80 (31%)	1 (ref)	0.0056	1 (ref)	0.37
No	52/100 (52%)	2.38 (1.29–4.41)		0.66 (0.26–1.66)	
Condom use‡					
Always or mostly	27/84 (32%)	1 (ref)	0.0074	1 (ref)	0.37
Sometimes or rarely or never	50/96 (52%)	2.29 (1.25–4.21)		0.66 (0.27–1.64)	
Money or gifts for sex					
No	85/249 (34%)	1 (ref)	0.84	1 (ref)	0.89
Yes	3/8 (38%)	1.16 (0.27–4.96)		1.11 (0.23–5.37)	

(Table 2 continues on next page)



	STI testing uptake	Unadjusted OR (95% CI)	p value	Adjusted OR* (95% CI)	p value
(Continued from previous page)					
Current contraception use (barrier methods excluded)‡¶					
None	19/43 (44%)	1 (ref)	0.31	1 (ref)	0.94
Oral contraceptive pill	27/42 (64%)	2.27 (0.95–5.44)		0.95 (0.31–2.90)	
Depot injection	3/6 (50%)	1.26 (0.23–6.98)		0.55 (0.084–3.61)	
Implant	10/17 (59%)	1.80 (0.58–5.63)		0.94 (0.26–3.37)	
Intrauterine contraceptive device	0/1	..		..	
Circumcised					
Yes	8/32 (25%)	1 (ref)	0.48	1 (ref)	0.61
No	8/44 (18%)	0.67 (0.22–2.02)		0.74 (0.22–2.43)	
<b>Proximal factors (level 3)</b>					
Number of pregnancies¶					
0	17/85 (20%)	1 (ref)	<0.0001	1 (ref)	0.64
1	25/42 (60%)	5.88 (2.61–13.27)		1.41 (0.41–4.79)	
≥2	22/34 (65%)	7.33 (3.04–17.71)		0.89 (0.19–4.10)	
Current STI symptoms‡					
No	66/168 (39%)	1 (ref)	0.0073	1 (ref)	0.016
Yes	11/12 (92%)	17.00 (2.14–134.78)		14.79 (1.66–132.07)	
Perceived STI risk					
Unlikely or no risk	65/214 (30%)	1 (ref)	0.0015	1 (ref)	0.45
Very likely or likely	22/36 (61%)	3.60 (1.73–7.48)		1.33 (0.55–3.23)	
Unsure	1/7 (14%)	0.38 (0.045–3.24)		0.30 (0.031–2.87)	
Self-reported HIV status					
Negative	85/253 (34%)	1 (ref)	0.13	1 (ref)	0.67
Positive	3/4 (75%)	5.93 (0.61–57.86)		1.68 (0.16–17.60)	
Data are n/N (%), unless otherwise specified. STI=sexually transmitted infection. OR=odds ratio. *Sociodemographic factors adjusted for age, sex, occupation, and marital status (sociodemographic core set); sexual behavioural factors adjusted for sociodemographic core set and if ever had penile–vaginal sex; proximal factors were adjusted for sociodemographic core set, if ever had penile–vaginal sex, and presence of current symptoms. ‡Combined giving or receiving. †Question restricted to participants who reported having ever had penile–vaginal sex (n=180). §Because of evidence of collinearity "number of sexual partners in past 12 months" was not adjusted for "ever had penile–vaginal sex". ¶Question restricted to female participants (n=161).   Question restricted to male participants (n=76).					

**Table 2: Multivariate analysis of factors affecting uptake of STI testing**

compared with being employed (adjusted OR 0.26, 95% CI 0.10–0.68) were negatively associated with chlamydia and gonorrhoea testing uptake.

Knowledge about STIs was highly variable. Of the 257 participants who completed the questionnaire, 231 (90%) knew that STIs could be prevented by condom use, and 217 (84%) knew that these infections could facilitate HIV transmission. However, 141 participants (55%) could not name any complications of STIs (table 3). Furthermore, 26 (10%) participants thought that insect bites and 25 (10%) thought that sharing clothes or towels could transmit STIs.

Regarding testing procedures, all 96 male participants and 154 (96%) of 161 female participants stated that they would prefer urine samples to a genital swab. The most preferred option for provision of STI testing services was in a community-based, non-clinical setting and only a minority identified schools as a venue where STI services should be offered (table 3). Additionally, 233 (91%) participants preferred to receive STI test results in person; 58 (23%) selected telephone and 43 (17%) selected text as options for receiving test results.

Although 166 (92%) of 180 participants said they would be able to contact sexual partners from the past 3 months, only 142 (79%) said that they would inform them about a positive STI test result. Notably, 92% (100 of 109) of female participants versus only 59% (42 of 71) of male participants said they would inform a partner about a positive STI result. The need to treat the partner for the partner's sake (151 [84%]) and to prevent reinfection (65 [36%]) were the most common reasons noted for notifying partners. Reasons for not telling a partner about a positive STI result were fear of the partner leaving (92 [51%]), being blamed for the STI (27 [15%]), and risk of violence (22 [12%]). Regarding the referral process itself, 126 (70%) participants preferred notifying partners themselves (patient referral). However, 65 (36%) selected provider referral, whereby a health-care worker informs the contact directly, as an appropriate option for partner notification.

26 young people participated in in-depth interviews. Participants were aged 16–24 years (median 19), 16 (62%) were women, and ten (38%) were men. Of these, 12 had agreed to testing, 12 had declined testing,

	Number of participants (n=257)		Number of participants (n=257)
<b>Knowledge of STIs</b>		(Continued from previous column)	
STI symptoms*		Preferred STI testing location*	
Genital ulcers	164 (64%)	Community-based non-clinic setting	190 (74%)
Genital discharge	99 (39%)	Clinic	168 (65%)
Rash	99 (39%)	School or college	30 (12%)
Groin swelling	46 (18%)	Private doctor	13 (5%)
Dysuria	45 (18%)	Other§	5 (2%)
Itch	42 (16%)	Preferred methods for receiving STI test results†	
Abdominal pain	24 (9%)	In person	233 (91%)
Warts	15 (6%)	Phone call	58 (23%)
Weight loss	9 (4%)	Short messaging service (SMS)	43 (17%)
Hair loss	9 (4%)	Post	1 (<1%)
Haematuria	8 (3%)	<b>Partner notification</b>	
Fever	7 (3%)	Reasons for not notifying partner if diagnosed with STI*‡	
Red lips	5 (2%)	Partner might leave	92/180 (51%)
Erectile dysfunction	1 (<1%)	Accusation of infidelity	27/180 (15%)
Unsure	18 (7%)	Violence from partner	22/180 (12%)
Complications of STIs*		Others might find out	18/180 (10%)
Infertility	72 (28%)	Embarrassment	16/180 (9%)
Cancer	22 (9%)	Not the index's responsibility	5/180 (3%)
HIV or AIDS	19 (7%)	Other¶	8/180 (4%)
Blindness	7 (3%)	Preferred methods for partner notification†‡	
Testicular pain or swelling	11 (4%)	Referral by index	126/180 (70%)
Miscarriage or ectopic pregnancy	5 (2%)	Referral by provider	65/180 (36%)
Death	3 (1%)	Direct delivery of medication to partner by index	1/180 (1%)
Pelvic inflammatory disease	2 (1%)	Would not contact	15/180 (8%)
Loss of genitalia	3 (1%)	If diagnosed with STI, would inform partner‡	
Neonatal disabilities	1 (<1%)	Yes	142/180 (79%)
Unsure	141 (55%)	No	36/180 (20%)
Modes of transmission of STIs†		Unsure	2/180 (1%)
Sex	256 (100%)	Never had sex	77/180 (43%)
Infected blood	189 (74%)	Able to contact all sexual partners of past 3 months‡	
Vertical	151 (59%)	Yes	166/180 (92%)
Kissing	47 (18%)	No	11/180 (6%)
Insect bite	26 (10%)	Unsure	3/180 (2%)
Sharing clothes or towels	25 (10%)	Never had sex	77/180 (43%)
Shaking hands	0		
<b>Preferences for service delivery</b>			
Treatment-seeking behaviour for STI symptoms*‡			
Attend clinic	170/180 (94%)		
Attend pharmacy	10/180 (6%)		
Wait for symptoms to resolve	2/180 (1%)		
Get advice from family or friends	13/180 (7%)		
Attend a traditional healer	1/180 (1%)		
Consult a private doctor	2/180 (1%)		

(Table 3 continues in next column)

Data are n (%), or n/N (%) and include all answers given by participants. STI=sexually transmitted infection. \*Open-ended question with no options provided. †Closed-ended question, but responses could be elicited in more than one category. ‡Question restricted to participants who said they had penile-vaginal sex (n=180). §Home-based testing, n=2; church, n=1; pharmacy, n=1; workplace, n=1. ¶||Not able to contact partner, n=3; would not see partner again, n=2; might be accused of testing positive for HIV, n=1; partner might worry, n=2. ||Closed-ended question for which response was confined to a single category.

**Table 3: Knowledge of STIs and preferences for STI testing**

and two were unaware of testing being available. Emergent themes and supporting quotes are presented in the appendix (p 2).

STI testing uptake was motivated by presence of symptoms and potential treatment if they tested positive.

Additionally, participants' decision to be tested was driven by their perceived risk, based on their own and their partner's sexual behaviour.

Stigma was a key barrier factor to uptake of STI testing. Many feared family and community members finding out and were worried "about what other people might say about you" and being ostracised by their families if found

See Online for appendix



to be sexually active. Anticipated stigma alongside perceived lack of confidentiality among health-care workers was not only a barrier to uptake of testing, but influenced young people's choice of health-care providers. Participants stated they would choose either "the furthest" hospital from them or a private clinic, so they wouldn't "be recognised". There were also misconceptions that impeded uptake of STI testing, including the belief that circumcision conferred complete protection from STIs, that menstruation precluded STI testing, and that HIV testing covered other STIs. Notably, there was much less concern about curable STIs than about HIV and absence of symptoms deterred participants from testing.

Participants were aware that if they had an STI, their partner might also have an STI and should be treated to protect them and to prevent reinfection. Although participants acknowledged a general need for honesty, telling partners was perceived to be a particular challenge.

### Discussion

We found a high prevalence of chlamydia and a moderate prevalence of gonorrhoea among youth offered testing in community-based settings, only a minority of whom had symptoms. One in six youth who took up testing tested positive for chlamydia or gonorrhoea, or both. Importantly, testing was not targeted at those with high risk behaviours or symptoms. The uptake of testing improved over time, and uptake and prevalence of the STIs was higher in female participants than in male participants. The prevalence of chlamydia and gonorrhoea was high in comparison to that reported in two previous systematic reviews of STI prevalence among women in sub-Saharan Africa.<sup>3,11</sup> These findings emphasise the substantial STI epidemic in southern Africa and the unmet need for STI services, particularly among youth who consistently have a higher prevalence of STIs than do older age groups.<sup>4,12,13</sup> Chlamydia was more prevalent than gonorrhoea in this group of mostly asymptomatic youth. However, in previous studies in Zimbabwe, gonorrhoea was more common than chlamydia among men and women presenting with urethral and vaginal discharge.<sup>14,15</sup>

The availability of simple diagnostic platforms provides an opportunity to move away from syndromic management.<sup>16</sup> The GeneXpert platform is a closed cartridge system that does not require sophisticated laboratory infrastructure or expert skills and is widely available in sub-Saharan Africa. Given that a single dose treatment is available for STIs such as chlamydia and gonorrhoea, point-of-care STI diagnostics paired with immediate treatment would have an impact on STI control.<sup>17</sup> However, in addition to the high cost, the need for a continuous power supply and the time to result (90 min) preclude the use of the Xpert CT/NG platform as a true point-of-care test.<sup>18</sup> In our study, the earliest available results were 1 week post-testing, which might have resulted in lower treatment rates of those diagnosed with an STI.

Diagnostic testing will only be effective in curbing the STI epidemic if accessible, acceptable delivery strategies are developed. Youth face particular sociocultural and structural barriers to accessing sexual and reproductive health services including poor health literacy, stigma, shame, judgmental attitudes of health-care providers, and the need for guardian consent. Globally health facility usage rates among youth remain low.<sup>6</sup> Most participants stated they would access a clinic if they developed STI symptoms, but this may reflect their familiarity with a clinic setting. Only a minority favoured educational institutions for STI service delivery due to concerns about confidentiality, a finding also raised previously in a study of Kenyan female adolescents.<sup>19</sup> STI testing in a community-based setting was the most commonly chosen option by participants. This might be because chlamydia or gonorrhoea testing was offered as part of an integrated package of youth-friendly HIV and sexual and reproductive services codesigned with youth to optimise accessibility and acceptability. However, given that participants were recruited while accessing a community-based sexual and reproductive service, these results might not be representative of youth in the wider community and desirability bias may have influenced responses.

Uptake of chlamydia and gonorrhoea testing in this study was initially low but increased three-fold from 12% to 37% over the 8 month study period. This increase is probably due to health-care providers gaining more experience and confidence in providing STI services, as well as the availability of Information, Education and Communication material for participants. Modelling studies indicate that uptake is the key factor in determining the effect of screening programmes on prevalence of chlamydia.<sup>20</sup> Therefore, increased uptake must be achieved and evidence from high-income countries has shown that large amounts of effort and changes to practice are often required to achieve high coverage.<sup>8</sup> Although young people are regularly exposed to information about HIV through school programmes and media campaigns, much less attention has been paid to curable STIs.<sup>21–23</sup> We found low levels of knowledge about STI risks, symptoms, and complications, a finding also reported by other studies from sub-Saharan Africa.<sup>24</sup> This has implications for uptake of STI testing as individuals who are asymptomatic might not realise they are infected and could decline testing. Additionally, only 44% of participants noted condom use at last sexual intercourse, showing the need to continue emphasising condom use. Having symptoms was significantly associated with uptake of STI testing on multivariate analysis. However, only a minority of participants had symptoms, and being symptomatic was a poor predictor for having chlamydia or gonorrhoea. Previous studies have shown similar findings, and support the use of an unselected approach to STI testing that is not dependent on symptoms.<sup>4</sup>

In addition to a lack of information, prevailing misinformation was a barrier to STI testing. A number

of participants were unaware of the difference between HIV and other STIs, and felt protected from other STIs if they had been tested for HIV. An additional barrier to uptake of testing was fear of a positive test result and consequent stigma. Similar results were reported in a study of adolescent girls from Kenya.<sup>19</sup> These findings underscore the importance of providing adequate and age-appropriate information to inform decision making and counselling to accompany testing.

Combining STI testing with effective follow-up strategies is crucial to ensure that those diagnosed are treated. Despite active and confidential follow-up, a third of participants with a positive test were lost to follow-up. Only 44% of participants provided correct traceable contact details, which might be related to concerns regarding confidentiality. However, about half of those with a positive test result who were uncontactable, and a similar proportion of those with a negative test result, returned to collect their result spontaneously, demonstrating their interest in their test results.

Partner notification is an important component of STI control as treatment of partners can prevent reinfection of the index patient, break the cycle of transmission, and reduce infection burden.<sup>5</sup> The yield of partner notification in our study was very low with less than 10% of partners attending for treatment. We cannot be certain that some partners did not attend alternative facilities for follow-up and treatment, but the low rates attending study sites indicate the challenges associated with partner notification.

A systematic review investigating the acceptability and efficacy of partner notifications in sub-Saharan Africa showed that 25% (range 0–77) of partners notified by direct patient referral attended services for evaluation or were treated. Provider referral (69%) and expedited partner treatment (84%) was more successful than direct patient referral.<sup>25</sup> Patient referral was the most popular method of partner notification in our study, but about a third of participants also selected provider referral as an option for partner notification. Providing multiple options could improve the success of partner notification, but is not the only consideration. Concerns about being accused of infidelity and fear of violence or the relationship ending impede individuals from informing their partners,<sup>26,27</sup> and emphasise the importance of counselling and support for both indexes and their partners.

The strengths of the study were the assessment of a large number of participants along the whole cascade of care from testing to treatment and partner notification, the moderate sample size for the regression analyses, the offer of unselected testing and inclusion of men, and the use of mixed research methods to investigate the facilitators and barriers to chlamydia and gonorrhoea testing. The study was done in four urban communities in Harare, Zimbabwe, which limits the generalisability of our findings. Given the stigma surrounding sex, under-reporting of sexual activity, particularly on reporting of

socially proscribed behaviours such as transactional sex, might have occurred. We used urine samples, which are slightly less sensitive than vaginal swabs.<sup>28</sup> Vaginal swabs were not available as an option for women who could not provide urine samples. Additionally, we did not offer testing for other common genital infections such as *Trichomonas vaginalis* or bacterial vaginosis. Finally, some questions on preferences for service delivery were based on hypothetical scenarios, which might have affected the validity of responses. For example, the majority of women preferred urine samples but they had no experience of vaginal swabs. Studies from sub-Saharan Africa show that vaginal swabs are highly acceptable and a systematic review from 2015 found that women found vaginal swabs marginally more acceptable than urine samples.<sup>29</sup>

Overall, our study found a high prevalence of chlamydia and gonorrhoea among youth who were offered unselective testing in a community-based setting. Potential areas for improvement include the inclusion of rapid tests for *T vaginalis* and bacterial vaginosis, allowing for a more comprehensive service. Increased regular testing might be required for young people at particularly high risk of STIs. Strategies to improve follow-up of participants and partner notification are vital to ensure treatment of STIs and the interruption of chains of transmission. Development of affordable point-of-care tests for STIs will help to improve rates of treatment following diagnosis. As availability of diagnostics increases, innovative strategies for delivery of STI testing and care that address the barriers to access and uptake will need to be developed. The lessons learned from HIV testing and treatment programmes such as provision of information and counselling and stigma reduction can serve as a template for designing STI service models. Importantly, given the wide availability of HIV services, meaningful integration of STI services, and more generally sexual and reproductive health services, can create synergies by capitalising on existing infrastructure, knowledge, and skills.

#### Contributors

RAF and KK conceptualised and designed the study. RAF, KK, and MM provided project supervision. KM and TB were responsible for data curation. KM, TB, VS, and RAF accessed and verified the data. KM, SCF, VS, and TB did the quantitative data analysis. KM and CRSM-Y did the qualitative data analysis. ED, CDC, CM, and MT were responsible for project administration. AM and DM provided guidance on community STI testing and treatment. KM wrote the first draft. KM, NB, and JM were responsible for data collection. IDO and KK oversaw laboratory testing procedures. All authors contributed to writing and review of the manuscript.

#### Declaration of interests

RAF reports grants from the Wellcome Trust, during the conduct of the study. MM reports grants from the National Institute for Health Research, The European & Developing Countries Clinical Trials Partnership, and UK Medical Research Council, outside of the submitted work. All other authors declare no competing interests.

#### Data sharing

Individual, anonymised participant data and a data dictionary will be available through The London School of Hygiene & Tropical Medicine repository (Data Compass) 12 months after publication of results.

### Acknowledgments

The study was funded by the Wellcome Trust (grant number, 206316\_Z\_17\_17). We would like to thank the Foundation for Innovative New Diagnostics and Cepheid for donation of Xpert CT/NG cartridges.

### References

- Rowley J, Vander Hoorn S, Korenromp E, et al. Chlamydia, gonorrhoea, trichomoniasis and syphilis: global prevalence and incidence estimates, 2016. *Bull World Health Organ* 2019; **97**: 548–62P.
- WHO. Progress report on HIV, viral hepatitis and sexually transmitted infections 2019. Accountability for the global health sector strategies, 2016–2021. Geneva: World Health Organization, 2019.
- Torrone EA, Morrison CS, Chen PL, et al. Prevalence of sexually transmitted infections and bacterial vaginosis among women in sub-Saharan Africa: an individual participant data meta-analysis of 18 HIV prevention studies. *PLoS Med* 2018; **15**: e1002511.
- Barnabas SL, Dabee S, Passmore JS, et al. Converging epidemics of sexually transmitted infections and bacterial vaginosis in southern African female adolescents at risk of HIV. *Int J STD AIDS* 2018; **29**: 531–39.
- Sarkodie F, Ullum H, Owusu-Dabo E, Owusu-Ofori S, Owusu-Ofori A, Hassall O. A novel strategy for screening blood donors for syphilis at Komfo Anokye Teaching Hospital, Ghana. *Transfus Med* 2016; **26**: 63–66.
- Newton-Levinson A, Leichliter JS, Chandra-Mouli V. Sexually transmitted infection services for adolescents and youth in low- and middle-income countries: perceived and experienced barriers to accessing care. *J Adolesc Health* 2016; **59**: 7–16.
- Logie CH, Okumu M, Mwima S, et al. Sexually transmitted infection testing awareness, uptake and diagnosis among urban refugee and displaced youth living in informal settlements in Kampala, Uganda: a cross-sectional study. *BMJ Sex Reprod Health* 2020; **46**: 192–99.
- Guy RJ, Ali H, Liu B, et al. Efficacy of interventions to increase the uptake of chlamydia screening in primary care: a systematic review. *BMC Infect Dis* 2011; **11**: 211.
- Victora CG, Huttly SR, Fuchs SC, Olinto MT. The role of conceptual frameworks in epidemiological analysis: a hierarchical approach. *Int J Epidemiol* 1997; **26**: 224–27.
- Baisley KJ, Andreasen A, Irani J, et al. HPV prevalence around the time of sexual debut in adolescent girls in Tanzania. *Sex Transm Infect* 2020; **96**: 211–19.
- Dubbink JH, Verweij SP, Struthers HE, et al. Genital Chlamydia trachomatis and *Neisseria gonorrhoeae* infections among women in sub-Saharan Africa: a structured review. *Int J STD AIDS* 2018; **29**: 806–24.
- Francis SC, Mthiyane TN, Baisley K, et al. Prevalence of sexually transmitted infections among young people in South Africa: a nested survey in a health and demographic surveillance site. *PLoS Med* 2018; **15**: e1002512-e.
- Peters RP, Dubbink JH, van der Eem L, et al. Cross-sectional study of genital, rectal, and pharyngeal chlamydia and gonorrhoea in women in rural South Africa. *Sex Transm Dis* 2014; **41**: 564–69.
- Chirenje ZM, Dhibi N, Handsfield HH, et al. The etiology of vaginal discharge syndrome in Zimbabwe: results from the Zimbabwe STI Etiology Study. *Sex Transm Dis* 2018; **45**: 422–28.
- Rietmeijer CA, Mungati M, Machiha A, et al. The etiology of male urethral discharge in Zimbabwe: results from the Zimbabwe STI Etiology Study. *Sex Transm Dis* 2018; **45**: 56–60.
- Garrett NJ, Osman F, Maharaj B, et al. Beyond syndromic management: opportunities for diagnosis-based treatment of sexually transmitted infections in low- and middle-income countries. *PLoS One* 2018; **13**: e0196209.
- Murtagh MM. The point-of-care diagnostic landscape for sexually transmitted infections (STIs). Geneva: World Health Organization, 2018.
- Peeling RW, Mabey D. Point-of-care tests for diagnosing infections in the developing world. *Clin Microbiol Infect* 2010; **16**: 1062–69.
- Avuvika E, Masese LN, Wanje G, et al. Barriers and facilitators of screening for sexually transmitted infections in adolescent girls and young women in Mombasa, Kenya: a qualitative study. *PLoS One* 2017; **12**: e0169388.
- Regan DG, Wilson DP, Hocking JS. Coverage is the key for effective screening of *Chlamydia trachomatis* in Australia. *J Infect Dis* 2008; **198**: 349–58.
- Badawi MM, SalahEldin MA, Idris AB, Hasabo EA, Osman ZH, Osman WM. Knowledge gaps of STIs in Africa; systematic review. *PLoS One* 2019; **14**: e0213224.
- Jung M, Arya M, Viswanath K. Effect of media use on HIV/AIDS-related knowledge and condom use in sub-Saharan Africa: a cross-sectional study. *PLoS One* 2013; **8**: e68359.
- Faust L, Yaya S. The effect of HIV educational interventions on HIV-related knowledge, condom use, and HIV incidence in sub-Saharan Africa: a systematic review and meta-analysis. *BMC Public Health* 2018; **18**: 1254.
- Abdul R, Gerritsen AAM, Mwangome M, Geubbels E. Prevalence of self-reported symptoms of sexually transmitted infections, knowledge and sexual behaviour among youth in semi-rural Tanzania in the period of adolescent friendly health services strategy implementation. *BMC Infect Dis* 2018; **18**: 229.
- Taleghani S, Joseph-Davey D, West SB, Klausner HJ, Wynn A, Klausner JD. acceptability and efficacy of partner notification for curable sexually transmitted infections in sub-Saharan Africa: a systematic review. *Int J STD AIDS* 2019; **30**: 292–303.
- Kalichman SC, Mathews C, Kalichman M, Lurie MN, Dewing S. Perceived barriers to partner notification among sexually transmitted infection clinic patients, Cape Town, South Africa. *J Public Health (Oxf)* 2017; **39**: 407–14.
- Alam N, Chamot E, Vermund SH, Streatfield K, Kristensen S. Partner notification for sexually transmitted infections in developing countries: a systematic review. *BMC Public Health* 2010; **10**: 19.
- Gaydos CA. Review of use of a new rapid real-time PCR, the Cepheid GeneXpert® (Xpert) CT/NG assay, for Chlamydia trachomatis and *Neisseria gonorrhoeae*: results for patients while in a clinical setting. *Expert Rev Mol Diagn* 2014; **14**: 135–37.
- 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.