

## **HIV burden and correlates of infection among transfeminine persons and cisgender men who have sex with men in Nairobi: an observational study**

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## 1 Summary

## 2 Background

3 Globally transgender persons are disproportionately affected by HIV and other sexually transmitted  
4 infections (STIs), and culturally competent prevention and treatment services are often unavailable or  
5 inaccessible. Despite recent improvements in national HIV responses for many key populations in East  
6 Africa, evidence of transgender sexual health needs to inform effective responses is sparse. We aimed  
7 to assess gender identity among men and transgender persons who have sex with men in Nairobi and  
8 explore associations with sexual health related outcomes, risk behaviour and uptake of HIV  
9 interventions

## 10 Methods

11 We recruited adult men and transgender persons who reported sex with men through respondent  
12 driven sampling during 2017 in Nairobi. We assessed gender identity, sociodemographics, sexual  
13 behaviour and HIV prevention and care uptake by self-completed survey. Participants tested for HIV,  
14 syphilis, rectal and urethral gonorrhoea and chlamydia. We compared prevalence of sexual health  
15 outcomes, risk behaviour and service uptake among transfeminine and cisgender participants using  
16 multivariable robust Poisson regression models with gender identity as the independent variable.

## 17 Findings

18 Among 618 recruits, 522 (86.1%) identified as cisgender, 70 (11.5%) transfeminine and 3 (0.7%)  
19 transmasculine. Compared to cisgender participants, transfeminine persons were more likely to be  
20 HIV positive (41.4% (28/70) v 24.6% (151/521)  $p=0.00087$ ) and report rectal symptoms consistent with  
21 a current STI (16.3% (88/67) v 7.0% (38/518)  $p=0.014$ ). Transfeminine persons reported higher recent  
22 male partner counts and were more likely to report recent condomless anal intercourse (62.1%  
23 (43/70) v 38.6% (208/522)  $p=0.00085$ ), receptive anal intercourse (76.5% (54/70) v 45.5% (252/522)  
24  $p<0.0001$ ), transactional sex with men (57.5% (42/69) v 41.7% (240/518)  $p=0.023$ ) and experience of  
25 sexual assault during the last year (23.1% (16/69) v 11.3% (65/520)  $p=0.019$ ). Utilisation of pre- and  
26 post-exposure prophylaxis was low.

## 27 Interpretation

28 Transfeminine persons who have sex with men have a higher burden of HIV and associated risk  
29 behaviours compared to cisgender MSM in the same context, yet uptake of prevention and care  
30 services is poor. Policies should acknowledge the specific needs of transfeminine persons as distinct  
31 from men who have sex with men, and support providers to address these.

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34

## 35 Introduction

36 The term 'transgender' is often used to describe those whose internal sense of their gender (their  
37 gender identity) is different from the sex they were assigned at birth<sup>1</sup>. UNAIDS identify transgender  
38 people, in particular transgender women, as a priority population in the global response to the HIV  
39 epidemic. Yet, as of 2014, only 39% of countries reported national AIDS strategies that specifically  
40 addressed transgender persons<sup>2</sup>. Where evidence is available, transgender women are often  
41 disproportionately affected by HIV and other STIs but reviews highlight the paucity of HIV surveillance  
42 for this population generally<sup>3</sup>. Proximal origins of elevated HIV risk among transfeminine persons  
43 include high rates of receptive anal intercourse, multiple sexual partnerships and engagement in  
44 transactional sex<sup>4</sup>. Vulnerability is compounded by high rates of depression and substance use, and  
45 degrees of social exclusion and economic marginalisation that impede access to prevention and  
46 treatment options<sup>3,5</sup>. Comparable research with transgender men is limited to a few small studies  
47 predominantly in the US<sup>6</sup>.

48 Despite a recent increase in research focussed on transgender populations, policy-informative  
49 research on the sexual health burden and needs of transgender individuals remains particularly scant  
50 in sub-Saharan Africa<sup>3,7,8</sup>. However, studies of gay, bisexual and other men who have sex with men  
51 (GBMSM) increasingly elicit gender identity measures from participants or are inclusive of  
52 transfeminine participants. A synthesis of studies between 2011-2015 in Western and Southern Africa  
53 consisting participants assigned male sex at birth and reporting recent sexual activity with men found  
54 that 26% currently identified as female or transgender<sup>9</sup>, they were almost twice as likely to be living  
55 with HIV and more often reported condomless receptive anal intercourse than cisgender GBMSM (cis-  
56 MSM). Recent cohort studies with similar eligibility in South Africa<sup>10</sup>, Nigeria<sup>11</sup> and Kenya<sup>12</sup> also report  
57 significantly higher HIV incidence among transfeminine participants but have yet to clarify correlates  
58 of risk specific to this group.

59 Kenya has a declining generalised HIV epidemic and an aggressive HIV prevention and control strategy  
60 that aims to be inclusive of key populations most affected by HIV<sup>13</sup>. Yet Kenya's most recent HIV  
61 Prevention and Treatment Strategic Plan does not include responses for transgender or other gender  
62 diverse people<sup>7,13</sup>. National evidence is limited to two small studies including transgender participants:  
63 baseline prevalence was 25% among 32 participants in the Kisumu arm of HTPN075<sup>14</sup> whilst annual  
64 incidence of 21% was recorded among fourteen participants in a self-testing study in Malindi<sup>12</sup>. The  
65 first National Transgender Discrimination Survey also reported high levels of gender-related mental  
66 health diagnoses and suicidality, economic hardship, refusal of medical care and widespread gender-  
67 related discrimination in public, educational, workplace and health care settings<sup>15</sup>. In the absence of  
68 specific services for gender diverse persons, transgender and other gender diverse people seek care  
69 from key population services, specifically those catering for cis-MSM<sup>15</sup>.

70 We sought to examine self-assessed gender identity among a population-based study of men and  
71 transgender persons who have sex with men in Nairobi, and where possible to document sexual health  
72 related outcomes, associated risk behaviour and prevention knowledge and uptake among  
73 transgender people and cis-MSM.

## 74 *Methods*

75 **Study design and participants** Between May-December 2017, respondent driven sampling (RDS) was  
76 employed to recruit 618 participants to a cross-sectional study in Nairobi. Seed participants were  
77 identified by three community organisations who provide targeted health care services to GBMSM  
78 communities in Nairobi. Following formative qualitative research, ten seeds were selected to optimise

79 diversity in personal characteristics (age, marital status, gender identity, socioeconomic status and  
80 location of residence within Nairobi County).

81 After completion of study procedures, each participant received two coupons and instruction in  
82 recruiting from their social network. Inclusion criteria for recruits were: possession of a valid study  
83 coupon; age 18 or over; male gender assignment at birth or identification currently; residence within  
84 50km of Nairobi, and consensual anal or oral sexual activity with a man in the previous twelve months.  
85 Coupons detailed the location and contact details for the study site but disclosed no information about  
86 the purpose of the study or target population. To ensure legitimacy and avoid duplication, coupons  
87 were uniquely numbered, used non-standard grade watermarked paper and date stamped. The two-  
88 week period of coupon validity was temporarily extended to allow coupon holders to avoid election-  
89 related demonstrations near the study site in October 2017. Participants were reimbursed 300 Kenya  
90 shillings (~USD \$3) for each recruit they referred to the study who subsequently participated.

91 The study was approved by the Kenya Medical Research Institute Scientific and Ethics Review Unit  
92 (KERMI/SERU/CGMR-C/CSC 044/3334), the University of Oxford, Oxford Tropical Research Ethics  
93 Committee (OxTREC 47-16) and London School of Hygiene & Tropical Medicine Human Research Ethics  
94 Committee (REF: 14144). All participants provided separate written informed consent to the  
95 questionnaire, sample collection and sample storage, and were able to withdraw from any portion of  
96 the study.

97 **Procedures** Valid coupon recipients who satisfied eligibility criteria underwent informed consent  
98 procedures. Prior participation was established using a commercially available digital fingerprint  
99 scanner. Clinic visitors who were ineligible for the study were provided details of other testing and  
100 care services. Links between participant details and study identifiers were held securely off-site.  
101 Clinical and laboratory reports were stored in secure premises and online surveys did not record  
102 identifying characteristics.

103 Personal behaviours were collected via a tablet-administered, self-completed questionnaire in English  
104 or Kiswahili on SurveyGizmo™. Participants had access to an interviewer for clarification of questions  
105 or assisted completion. The questionnaire collected demographic characteristics; measures of sexual  
106 behaviour; alcohol and other substance use; knowledge of HIV transmission risks; awareness and use  
107 of HIV/STI prevention methods; recent anogenital STI symptoms; experiences of sexuality-related  
108 stigma, discrimination or violence; HIV testing history; measures of engagement with HIV care  
109 continuum; and pre-validated measures of alcohol use and dependence (AUDIT). Individual network  
110 degree was elicited from a sequence of questions yielding the number of Nairobi resident adult  
111 GBMSM they had met in person in the last fortnight. Participants were compensated 500 Kenya  
112 shillings (~USD \$5), according with Kenyan research remuneration guidelines.

113 Gender identity was assessed using what at the time was considered best practice via a two-step  
114 approach<sup>16</sup>, comprising assessment of sex assignment at birth (male, female or prefer not to say) and  
115 current gender identity (male, female, transgender or none of these). In line with expert  
116 recommendations<sup>5</sup>, we coded participants as 'cisgender' where birth assignment and currently  
117 identification was male, 'transmasculine' where birth assignment was female but currently  
118 identification was male or transgender, and 'transfeminine' where birth assignment was male sex but  
119 currently identification was female or transgender. Participants who did not currently identify as male,  
120 female or transgender could chose to specify that none of these terms applied.

121 Participants were offered HIV counselling and rapid testing following Kenya National Guidelines using  
122 two commercial rapid HIV testing kits (Determine Alere HIV 1/2 and First Response HIV 1–2.0). Blood

123 specimens were tested for syphilis (TPHA/RPR) and qualitative or quantitative HIV-1 PCR conditional  
124 on rapid test results (GeneXpert® HIV-1 Qual or VL). Urine and either self- or clinical collected rectal  
125 swabs were tested for *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) using PCR  
126 (GeneXpert® CT/NG).

127 HIV positive participants not receiving care were referred to government services for initiation of  
128 antiretroviral therapy. HIV negative participants were informed of government and community clinics  
129 offering pre-exposure prophylaxis (PrEP) eligibility assessment and referred directly if requested. Free  
130 treatment for STIs and active syphilis infections was provided according to national guidelines.  
131 Condoms, lubricants, sexual health information and details of local sexual services were freely  
132 available in the study clinic.

133 **Statistical analysis** RDS diagnostics including visualisation of recruitment chains, convergence and  
134 seed dependence, and statistical assessment of recruitment homophily were analysed using the *rds*  
135 library for R version 3.4.0<sup>17</sup>. Prevalence of cisgender, transfeminine and transmasculine identities, as  
136 well as those who used none of these identity labels, were reported as crude and weighted estimates  
137 in accordance with good practice. In univariate and multivariable analyses, point estimates and  
138 prevalence ratios were sample weighted by the inverse of the individual network degree measure  
139 (RDS-II method)<sup>18</sup>. Seeds were excluded from RDS-II analyses.

140 Associations between gender identity and STI outcomes, sexual behaviour, sexual health knowledge  
141 and intervention access were only explored for transfeminine and cis-MSM participants, given the  
142 small sample size of other gender identities. Differences in sociodemographic characteristics of  
143 transfeminine and cis-MSM were compared using Pearson's  $X^2$  with second-order correction<sup>19</sup>. We  
144 used Poisson regression models with robust variance estimation (non-clustered sandwich estimator<sup>20</sup>)  
145 to estimate prevalence ratios of sexual health outcomes, behaviours and prevention and care uptake  
146 by gender identity as the independent variable. Multivariable models were confounder-adjusted for  
147 age and sociodemographic covariates in bivariate association with gender identity at  $p < 0.200$  (Wald  
148 test). Models assessing sexual behaviour associations were also adjusted for awareness of HIV status.  
149 Models of PrEP and post-exposure prophylaxis (PEP) knowledge and use were limited to participants  
150 who were HIV negative or status unaware, whilst associations with care engagement were restricted  
151 to participants living with HIV irrespective of awareness of status. Model specification and results were  
152 compared using unweighted and RDS-II weighted approaches and no marked differences were noted.  
153 Missing covariates were coded as dummy variables in models. Analyses were performed in Stata  
154 version 16.

155 **Role of the funding source** The funder of the study had no role in study design, data collection, data  
156 analysis, data interpretation, or writing of the report. The corresponding author had full access to all  
157 the data in the study and had final responsibility for the decision to submit for publication.

## 158 **Results**

159 761 individuals presented to the study site with the intention of participation. 124 were ineligible due  
160 to fake or missing coupons (31), repeat attendance (2), intoxication (6), ineligible by other inclusion  
161 criteria (85)). Of the 637 individuals with confirmed eligibility, 29 declined participation during consent  
162 procedures (refused biometrics (2), insufficient reimbursement (5), process too long (22)). Of 608  
163 recruits and 10 seeds completing informed consent, one participant declined blood testing and six  
164 declined rectal swabs. Four seeds accounted for 516 (84.9%) recruits. Depth of recruitment ranged  
165 from 1 to 19 waves per seed (median 7) (Appendix page 1).

166 612 participants completed both two-step questions on sex assignment at birth and current gender  
167 identification (table 1). Six participants indicated that they preferred not to answer these questions,  
168 and were excluded. 85.3% (RDS-II 86.1%; 95%CI 82.6-88.9) identified as cisgender male. Seventy  
169 participants (11.4%; RDS-II 11.4%, 95%CI 8.8-14.7) identified as transfeminine, with approximately  
170 equal proportions currently identify as female and transgender. Only three participants identified as  
171 transmasculine. A total of 17 participants (2.8%; RDS-II 2.2%; 95%CI 1.2-3.8), the majority of whom  
172 had been assigned male sex at birth, did not self-identify as male, female or transgender.

173 Sampling proportions of gender categories did not converge by the end of recruitment (Appendix page  
174 2). Diagnostic plots indicated a degree of seed dependence and suggested that the sampling  
175 proportion of transfeminine participants may have further increased if recruitment had continued.  
176 We found no evidence for recruitment homophily by gender identity ( $1.003 \chi^2 p=0.376$ ).

177 The median age of both transfeminine and cisgender participants was 24 years with no significant  
178 differences in age-distribution (table 2). The vast majority of both transfeminine and cis-MSM  
179 participants identified as gay or homosexual, and there were no significant differences in sexuality by  
180 gender identity. HIV prevalence was significantly higher among transfeminine participants (41.4%)  
181 compared to cis-MSM (24.6%, table 3). Transfeminine participants were more likely than cis-MSM to  
182 report symptoms suggestive of a rectal STI at the time of participation (16.3%) or at some point during  
183 the previous year (34.3%), and more likely to report rectal symptoms than urethral symptoms at both  
184 points. Overall prevalence of NG and CT by anatomical site did not differ significantly different by  
185 gender identity, although prevalence of rectal NG was high among transfeminine participants. The  
186 proportion of confirmed infections that were asymptomatic did not differ by site (rectal: 83.9% (73.4-  
187 90.8%) urethral: 83.0% (68.6-91.6)), however symptoms were more often indicative of confirmed  
188 rectal infection when reported by transfeminine than cis-MSM participants (36.7% versus 12.5%,  
189  $p=0.045$ ) while the reverse was true of urethral symptoms (3.3% versus 18.3%,  $p=0.069$ ).

190 Transfeminine participants reported higher numbers of male partners within the last three months  
191 and were more likely to report having sold sex to men in the last year (Table 4). There were no  
192 significant differences in the reported number of transactional and non-transactional female contacts  
193 in the last year. Transfeminine participants were much more likely to report receptive anal intercourse  
194 during the last three months than cis-MSM, and twice as likely to report condomless receptive anal  
195 intercourse during that period. Conversely, transfeminine participants were significantly less likely to  
196 report insertive anal intercourse with male partners, but were no less likely to report condomless  
197 insertive anal intercourse than cis-MSM. Almost one in four transfeminine participants reported being  
198 the victim of non-consensual sex in the previous year. No associations were apparent between gender  
199 identity and alcohol or substance use.

200 Table 5 reports measures of knowledge, access and uptake of sexual health resources, and HIV care  
201 and prevention services available in Kenya. Transfeminine participants were less likely than cis-MSM  
202 to have ever taken an HIV test and more likely to cite difficulties accessing lubricants. Among  
203 participants living with HIV, the HIV care cascade for both transfeminine and cisgender participants  
204 were significantly short of UNAIDS 90-90-90 targets (transfeminine: 72-85-71; cis-MSM: 78-86-80).  
205 Differences between transfeminine and cisgender participants were not statistically significant in this  
206 restricted sample, but were suggestive of lower status awareness and virological suppression in care  
207 among transfeminine participants. Among HIV negative and undiagnosed HIV positive participants,  
208 less than half of transfeminine participants demonstrated accurate understanding of pre- and post-  
209 exposure prophylaxis, and very few reported ever using either form of biomedical prevention (PrEP  
210 3.7%; PEP 4.8%).

211 **Discussion**

212 This population-based study highlights the startlingly high burden of HIV and STIs among this hitherto  
213 unrecognised population within the national HIV/AIDS response in Kenya. Our findings suggest that  
214 transfeminine persons who have sex with men in Nairobi have over 80% higher prevalence of HIV than  
215 cisgender GBMSM who themselves bear a high burden of infection. Our estimates concur with those  
216 from similar populations in different African contexts over the last decade among which the pooled  
217 odds of HIV was 1.8 times that of cis-MSM in the same context<sup>9</sup>. The high prevalence of symptomatic  
218 rectal STIs among transfeminine persons, principally rectal gonorrhoea, is consistent with findings  
219 elsewhere and may both reflect high levels of sexual exposure through receptive anal intercourse as  
220 well as lack of access to prompt diagnosis or care<sup>8</sup>. The high prevalence of asymptomatic STIs is  
221 consistent with findings elsewhere in the region<sup>11</sup> and calls into question the adequacy of existing  
222 national syndromic management guidance for key populations<sup>21</sup>.

223 In keeping with similar studies of transfeminine persons in other contexts<sup>5,8,9</sup>, we found higher levels  
224 of sexual risk behaviours that may in part explain the higher observed burden of HIV and rectal STIs in  
225 this population. Transfeminine persons were more likely to report condomless receptive anal  
226 intercourse, transactional sex with male partners and higher male partner counts compared to cis-  
227 MSM. These findings are of particular concern juxtaposed with the extremely low usage of pre-  
228 exposure and post-exposure prophylaxis in both populations, despite public provision in Kenya<sup>22</sup>, and  
229 widespread self-reports of problems accessing lubricants and condoms for transfeminine persons  
230 specifically.

231 Occupational, housing and income instability, experience of stigma and discrimination and poor  
232 mental health also contribute to socio-ecological vulnerability to HIV acquisition among transgender  
233 populations in other settings<sup>4,23,24</sup>. Recent evidence suggests these wider issues affect the lives of  
234 transgender Kenyans too<sup>15</sup>, and our observation that 1 in 4 transfeminine people in Nairobi have been  
235 recent victims of non-consensual sex alludes to the need for urgent action to reduce the social  
236 vulnerability of this group.

237 The behavioural exclusion criteria and network sampling methods employed likely accounts for the  
238 low representation of transmasculine persons in this study, but signals the need for further research  
239 into the full spectrum of gender diversity in Kenya and the implications for sexual health responses<sup>25</sup>.  
240 A sizeable minority of study participants did not identify with any of the gender options presented by  
241 our two-step survey questions suggesting this common approach fails to capture the complexity of  
242 gender in this context. There is increasing recognition in other regions that such approaches may be  
243 too simplistic in not allowing individuals to affirm other specific gender identities (e.g. gender non-  
244 binary, gender fluid, gender queer)<sup>16</sup> and hence fail to capture distinct identities with specific  
245 sociodemographic and health needs<sup>26</sup>. Our observation that self-identified sexuality was not markedly  
246 different between transfeminine and cisgender participants might reflect the need for transgender  
247 persons to 'pass' as cis-MSM to access services<sup>15</sup>. However previous work documents the complex  
248 intersectional nature of gender role, gender expression, anal intercourse role preference and  
249 relational power dynamics among Kenyan GBMSM that challenges simplistic and common  
250 categorisation of gender or sexuality<sup>27</sup>. There is a pressing need for culturally acceptable and  
251 meaningful gender identity measures to be validated and adopted to enable providers and  
252 programmes to tailor services to meet the needs of gender diverse users.

253 Limitations of the study include the cross-sectional design (precluding examination of causal direction  
254 of correlates) and the reliance on self-reported measures of behaviours and service uptake (subject

255 to memory error and social desirability bias). Furthermore, eligibility was limited to persons reporting  
256 sexual activity with men and we applied an RDS degree measure based on GBMSM network size. This  
257 reflects the primary focus of this and other such studies in the region upon GBMSM for whom  
258 advocacy, public health policy and research is well established. However gender diverse populations  
259 also comprise individuals who are not sexually active with men or do not share the same social  
260 networks<sup>28</sup>, and who therefore would not be represented in this study. Thus while our findings signal  
261 worrying patterns of sexual ill health, HIV acquisition risk and difficulties accessing resources and  
262 services among transfeminine persons who have sex with men that demand action in their own right,  
263 we caution against generalizing these findings to all transfeminine persons. Conversely, sampling  
264 within close sexual networks shared by participants may have resulted in some non-independence of  
265 observed sexually transmitted infections and may partially explain similarities seen in bacterial STI  
266 prevalence between groups. These design limitations perhaps explain why our sample failed to  
267 converge on measures of gender identity, despite satisfactory sample size and recruitment wave  
268 depth for other study measures. This underscores the need for research that is specific to gender  
269 diverse populations in Africa as distinct from GBMSM populations<sup>29</sup>.

270 Notwithstanding these limitations, our findings have clear implications for sexual health surveillance  
271 and responses in Kenya. Our study highlights the importance of routinely distinguishing between  
272 gender identity and sexual identity in surveillance, research and service interactions with key  
273 populations, where they may otherwise be conflated<sup>29</sup>. Failure to distinguish gender diverse persons  
274 who engage with research or services designed for GBMSM not only obscures the specific needs of  
275 gender diverse service users, it also threatens to compromise our understanding of cisgender men's  
276 burden and needs.

277 It is crucial that Kenyan HIV/AIDS policy-makers now acknowledge and respond to the sexual health  
278 needs of transfeminine populations as distinct from GBMSM in accordance with UNAIDS/WHO  
279 guidance<sup>30</sup>. In 2015 WHO recommended essential health sector HIV interventions for transgender  
280 persons, including comprehensive condom and lubrication programming, provision of pre-exposure  
281 prophylaxis, and access to STI and community-based HIV testing, to be delivered by health-care  
282 providers sensitive to and knowledgeable of specific health needs of transgender people<sup>1</sup>. Our findings  
283 suggest these aspirations are yet to be realised for transfeminine persons in Nairobi.

284 Developing an acceptable HIV prevention and care response for transgender persons will also require  
285 better understanding of wider priorities and needs of gender diverse Kenyans beyond sexual health.  
286 Holistic transgender-specific service models have been developed in other settings<sup>31</sup>, and limited  
287 evidence suggests that sexual health services delivered in conjunction with gender affirming services  
288 such as gender counselling and hormone therapy may improve acceptability, uptake and retention in  
289 HIV services<sup>32</sup>. Specialist services may be an unrealistic prospect outside major cities, and given half of  
290 the transfeminine persons in our study identified as women rather than transgender suggests that no  
291 single service model is likely to be universally accepted or accessible. Rather we suggest that  
292 sensitisation and gender-inclusion training across a range of service types is required, including  
293 mainstream health services and those catering to sexual minorities, as well as law enforcement  
294 agencies or other social care providers, especially in support of post-rape care<sup>1,33</sup>

295 In summary, gender diverse persons exist in Kenya and have sexual health needs that remain largely  
296 unrecognised and unmet. Transfeminine persons who have sex with men in Nairobi have a higher  
297 burden of HIV and report greater sexual HIV acquisition risks than cis-MSM in the same context, yet  
298 uptake of available sexual health interventions is poor. National HIV/AIDS strategies should recognise  
299 this key population in the Kenyan HIV response and articulate effective and acceptable approaches to



300 surveillance, prevention and care. Sexual health services and programmes, particularly those targeting  
301 key populations, should routinely assess gender identity to better identify the needs of individual  
302 service users and to understand the health disparities between them. Future research must aim to  
303 understand and address obstacles to the uptake of existing sexual health programs and services for  
304 this population, and should seek to describe wider health, social and gender-affirming needs. Action  
305 to increase the cultural competence of community organisations, health and social care providers and  
306 other public authorities already serving gender diverse Kenyans should be prioritised.

307

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317

318 **Conflicts of Interest**

319 No author has conflicts of interest to declare.

320

321 **Author contributions**

322 ADS contributed to designing the study and data collection instruments, carried out quantitative  
323 analyses and wrote the first draft of the manuscript; AB contributed to conceiving and designing the  
324 study and data collection instruments and drafting of the manuscript; JK and RK contributed to  
325 designing the study and data collection instruments, implementation of study procedures, and  
326 commented on the manuscript. PW and EF contributed to conceiving and designing the study and data  
327 collection instruments and commented on the manuscript. All authors approved the final draft.

328 **Data sharing**

329 Data from this study has not been deposited publicly because of the potential risk of deductive  
330 disclosure that may arise from individual data needed for valid analysis of the data, and the potential  
331 individual and social harms that may arise from such disclosure in a context of criminalisation and  
332 stigmatisation. However all authors aim to make the data underlying the findings of the study available  
333 for legitimate research purposes, and requests will be considered by the London School of Hygiene  
334 and Tropical Medicine Research Operations Office Data Management lead  
335 ([alex.hollander@lshtm.ac.uk](mailto:alex.hollander@lshtm.ac.uk)). The request must specify the purpose of research, the list of required  
336 variables, and if personally identifiers or sensitive data are sought, specify measures to maintain  
337 information security and governance that will be applied in storage, handling and reporting the data.

338

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Table 1: Current gender identity and gender assignment at birth, TRANSFORM participants 2017

|  |                     | Sex assignment at birth                   |                                   |   |
|--|---------------------|---|-----------------------------------|---|
|  |                     | Male                                      | Female                            | Total                                   |
| Current gender identity  | Male                | 522<br>85.3%<br><b>86.1 (82.6-88.9)</b>   | 3<br>0.5%<br><b>0.4 (0.1-1.2)</b> | 525<br>85.8%<br><b>86.4 (83.0-89.2)</b> |
|  | Female              | 33<br>5.4%<br><b>5.5 (3.7-8.0)</b>        | -                                 | 33<br>5.4<br><b>5.5 (3.7-8.0)</b>       |
|  | Transgender         | 37<br>6.1%<br><b>6.0 (4.2-8.5)</b>        | -                                 | 37<br>6.1%<br><b>6.0 (4.2-8.5)</b>      |
|  | None of these terms | 16<br>2.6%<br><b>1.9 (1.0-3.4)</b>        | 1<br>0.2%<br><b>0.3 (0.0-2.0)</b> | 17<br>2.8%<br><b>2.2 (1.2-3.8)</b>      |
|  | Total               | 608<br>99.4%<br><b>99.4 (98.1 – 99.8)</b> | 4<br>0.7%<br><b>0.6 (0.2-1.9)</b> | 612                                     |
| Cell content: number of participants, unweighted proportion and (in bold) RDS-II weighted proportion and 95% confidence interval<br>Table excludes 6 persons who preferred not to answer |                     |   |                                   |   |

Table 2: Sociodemographic characteristics of transfeminine persons and cisgender GBMSM in Nairobi, 2017

|  | N   | Transfeminine |                         | Cisgender GBMSM |                         | p‡    |
|--|-----|---------------|-------------------------|-----------------|-------------------------|-------|
|  |     | n             | % (95% CI) <sup>†</sup> | n               | % (95% CI) <sup>†</sup> |       |
| <b>Age (years)</b>                             |     |               |                         |                 |                         |       |
| 18-23  | 214 | 22            | 32.3 (21.0-46.2)        | 192             | 38.6 (33.8-43.6)        | 0.324 |
| 23-29  | 242 | 33            | 49.2 (36.0-62.4)        | 209             | 38.5 (33.8-43.5)        |       |
| 30+  | 136 | 15            | 22.9 (19.0-27.4)        | 121             | 22.6 (19.0-27.4)        |       |
| <b>Employment (current)</b>                    |     |               |                         |                 |                         |       |
| Salaried                                       | 171 | 21            | 26.2 (16.3-39.5)        | 150             | 28.4 (24.1-33.2)        | 0.861 |
| Self employed                                  | 153 | 14            | 24.1 (14.2-37.9)        | 139             | 28.3 (23.9-33.1)        |       |
| Unemployed                                     | 237 | 32            | 46.8 (33.7-60.3)        | 205             | 40.6 (35.7-45.6)        |       |
| Other  | 21  | 2             | 2.8 (0.5-15.2)          | 19              | 2.8 (1.6-4.8)           |       |
| <b>Education (highest level of attendance)</b> |     |               |                         |                 |                         |       |
| Primary  | 108 | 13            | 21.0 (11.9-34.5)        | 95              | 18.1 (14.6-22.2)        | 0.792 |
| Secondary                                      | 312 | 37            | 55.1 (41.5-68.0)        | 275             | 54.3 (49.2-59.2)        |       |
| Higher   | 165 | 19            | 23.9 (14.5-36.8)        | 146             | 27.7 (23.4-32.4)        |       |
| <b>Income (1000s KES last month)</b>           |     |               |                         |                 |                         |       |
| <5   | 214 | 28            | 46.7 (33.0-60.9)        | 186             | 39.6 (34.6-44.8)        | 0.162 |
| 5 < 10   | 162 | 18            | 28.0 (16.9-42.7)        | 144             | 27.9 (23.5-32.7)        |       |
| 10 < 20  | 123 | 15            | 23.9 (13.9-37.8)        | 108             | 22.0 (18.0-26.6)        |       |
| 20+  | 53  | 2             | 1.4 (0.3-6.1)           | 51              | 10.6 (7.7-14.2)         |       |
| <b>Country of birth</b>                        |     |               |                         |                 |                         |       |
| Kenya  | 465 | 50            | 75.3 (61.7-85.2)        | 415             | 79.5 (75.1-83.3)        | 0.400 |
| Other Africa                                   | 107 | 18            | 24.7 (14.8-38.3)        | 89              | 18.8 (15.1-23.2)        |       |
| Outside Africa                                 | 11  | 0             | -                       | 11              | 1.7 (0.8-3.4)           |       |
| <b>Self-identified sexual identity</b>         |     |               |                         |                 |                         |       |
| Gay/Homosexual                                 | 429 | 56            | 78.9 (65.1-76.6)        | 373             | 72.3 (67.6-76.6)        | 0.649 |
| Bisexual                                       | 139 | 11            | 18.5 (10.0-31.8)        | 128             | 24.6 (20.5-29.2)        |       |
| Other  | 15  | 1             | 2.6 (0.4-16.4)          | 14              | 3.1 (1.7-5.6)           |       |

†: RDS-II weighted & seeds excluded ‡: Pearson  $\chi^2$  with second-order survey design correction

Table 3: Sexually transmitted infections and engagement with HIV care among transfeminine persons and cisgender GBMSM in Nairobi, 2017

|   | Transfeminine<br>N = 70 |                         | Cisgender GBMSM<br>n = 522 |                         | Crude                     |               | Adjusted                  |                |
|---|-------------------------|-------------------------|----------------------------|-------------------------|---------------------------|---------------|---------------------------|----------------|
|   | n/N                     | % (95% CI) <sup>†</sup> | n/N                        | % (95% CI) <sup>†</sup> | PR (95% CI) <sup>††</sup> | Wald p value  | aPR (95% CI) <sup>‡</sup> | Wald p value   |
| <b>HIV</b> [Determine <sup>®</sup> , First Response <sup>®</sup> & Xpert <sup>®</sup> HIV-Qual] |                         |                         |                            |                         |                           |               |                           |                |
| Positive  | 28/70                   | 41.4 (29.0-55.1)        | 151/521                    | 24.6 (20.7-29.0)        | <b>1.68 (1.17-2.42)</b>   | <b>0.0050</b> | <b>1.83 (1.28-2.62)</b>   | <b>0.00087</b> |
| <b>Syphilis</b> [TPHA/ RPR>3]   |                         |                         |                            |                         |                           |               |                           |                |
| Positive  | 1/70                    | 0.8 (0.1-5.8)           | 4/519                      | 1.2 (0.4-3.2)           | 0.71 (0.08-6.47)          | 0.763         | 0.65 (0.06- 6.61)         | 0.719          |
| <b>Neisseria Gonorrhoea</b> [Xpert <sup>®</sup> CTNG]   |                         |                         |                            |                         |                           |               |                           |                |
| Rectal  | 15/70                   | 20.7 (11.8-33.7)        | 57/516                     | 11.8 (8.8-15.5)         | 1.76 (0.97-3.20)          | 0.063         | 1.58 (0.84-2.97)          | 0.157          |
| Urine   | 3/70                    | 3.1 (1.0-9.8)           | 23/519                     | 4.6 (2.9-7.2)           | 0.68 (0.19-2.37)          | 0.540         | 0.66 (0.18-2.43)          | 0.537          |
| <b>Chlamydia Trachomatis</b> [Xpert <sup>®</sup> CTNG]  |                         |                         |                            |                         |                           |               |                           |                |
| Rectal  | 8/70                    | 7.2 (3.0-16.4)          | 44/516                     | 8.2 (5.9-11.4)          | 0.88 (0.35-2.20)          | 0.778         | 0.71 (0.32-1.56)          | 0.392          |
| Urine   | 5/70                    | 5.4 (1.3-19.9)          | 33/519                     | 10.9 (6.1-18.9)         | 0.57 (0.20-1.63)          | 0.296         | 0.57 (0.20-1.62)          | 0.291          |
| <b>Symptoms suggestive of an STI (current)</b>  |                         |                         |                            |                         |                           |               |                           |                |
| Rectal <sup>a</sup>   | 8/67                    | 16.3 (8.0-30.3)         | 38/518                     | 7.0 (4.8-10.0)          | <b>2.34 (1.09-5.00)</b>   | <b>0.029</b>  | <b>2.57 (1.21-5.48)</b>   | <b>0.014</b>   |
| Urethral <sup>b</sup>   | 3/66                    | 2.3 (0.6-8.3)           | 36/511                     | 6.2 (4.2-9.0)           | 0.38 (0.10-1.47)          | 0.160         | 0.43 (0.11-1.69)          | 0.227          |
| <b>Symptoms suggestive of an STI (last 12 months)</b>   |                         |                         |                            |                         |                           |               |                           |                |
| Rectal <sup>a</sup>   | 23/67                   | 34.3 (22.6-48.3)        | 99/519                     | 18.1 (14.6-22.3)        | <b>1.89 (1.22-2.92)</b>   | <b>0.0041</b> | <b>1.96 (1.26-3.03)</b>   | <b>0.0026</b>  |
| Urethral <sup>b</sup>   | 13/66                   | 16.9 (9.0-29.6)         | 98/512                     | 16.7 (13.4-20.7)        | 1.01 (0.53-1.92)          | 0.978         | 1.04 (0.55-1.96)          | 0.893          |

PR: prevalence ratio aPR: adjusted prevalence ratio

<sup>†</sup>: Seeds excluded & RDS-II weighted

<sup>††</sup>: Poisson regression with robust variance, seeds excluded & RDS-II weighting

<sup>‡</sup>: Poisson regression with robust variance, seeds excluded, RDS-II weighting and adjusted for age, income and country of birth

<sup>a</sup>: Participants were asked 'Have you had any discharge from your anus or severe pain during anal sex?'

<sup>b</sup>: Participants were asked 'Have you had any discharge from your penis or pain when you pass urine?'

Table 4: Sexual and substance use behaviour among transfeminine persons and cisgender GBMSM in Nairobi, 2017

|  | Transfeminine<br>N = 70 |                         | Cisgender GBMSM<br>N=522 |                         | Crude                     |                   | Adjusted <sup>‡</sup>     |                   |
|--|-------------------------|-------------------------|--------------------------|-------------------------|---------------------------|-------------------|---------------------------|-------------------|
|  | n/N                     | % (95% CI) <sup>†</sup> | n/N                      | % (95% CI) <sup>†</sup> | PR (95% CI) <sup>++</sup> | Wald p value      | aPR (95% CI) <sup>‡</sup> | Wald p value      |
| <b>Sexual behaviour – male partners</b>                                    |                         |                         |                          |                         |                           |                   |                           |                   |
| <i>Male sexual partners (last 3 months)</i>                                |                         |                         |                          |                         |                           |                   |                           |                   |
| None   | 7/70                    | 9.2 (3.8-20.5)          | 64/522                   | 12.9 (9.9-16.8)         | <b>0.71 (0.29-1.72)</b>   |                   | <b>0.81 (0.34-1.94)</b>   |                   |
| 1-3  | 41/70                   | 63.6 (50.1-75.2)        | 346/522                  | 73.8 (69.3-77.8)        | <b>0.86 (0.70-1.06)</b>   | <b>0.020</b>      | <b>0.68 (0.69-1.06)</b>   | <b>0.042</b>      |
| 4 or more  | 22/70                   | 27.3 (17.3-40.3)        | 112/522                  | 13.3 (10.6-16.7)        | <b>2.05 (1.26-3.32)</b>   |                   | <b>1.93 (1.19-3.14)</b>   |                   |
| <i>Transactional sex with male partners (last 12 months)</i>               |                         |                         |                          |                         |                           |                   |                           |                   |
| Once or more   | 42/69                   | 57.5 (43.7-70.2)        | 240/518                  | 41.7 (36.9-46.7)        | <b>1.38 (1.06-1.79)</b>   | <b>0.017</b>      | <b>1.36(1.04-1.76)</b>    | <b>0.023</b>      |
| <i>Sexual behaviour with male partners (last 3 months)</i>                 |                         |                         |                          |                         |                           |                   |                           |                   |
| Receptive AI   | 54/70                   | 76.5 (63.2-86.0)        | 252/522                  | 45.5 (40.6 – 50.5)      | <b>1.68 (1.40-2.02)</b>   | <b>&lt;0.0001</b> | <b>1.55 (1.28-1.87)</b>   | <b>&lt;0.0001</b> |
| Insertive AI   | 31/70                   | 42.8 (30.3-56.3)        | 333/522                  | 63.8 (58.9 – 68.5)      | <b>0.67 (0.49-0.92)</b>   | <b>0.014</b>      | <b>0.68 (0.49-0.93)</b>   | <b>0.017</b>      |
| <i>Condomless anal intercourse (AI) with male partners (last 3 months)</i> |                         |                         |                          |                         |                           |                   |                           |                   |
| Any AI   | 43/70                   | 62.1 (48.4-74.0)        | 208/522                  | 38.6 (33.8 – 43.5)      | <b>1.61 (1.26-2.06)</b>   | <b>0.00014</b>    | <b>1.57 (1.22-2.01)</b>   | <b>0.00085</b>    |
| Receptive AI   | 34/70                   | 48.1 (35.0-61.5)        | 133/522                  | 24.4 (20.4 – 28.9)      | <b>1.97 (1.42-2.75)</b>   | <b>&lt;0.0001</b> | <b>1.88 (1.34-2.65)</b>   | <b>0.00041</b>    |
| Insertive AI   | 18/70                   | 26.7 (16.5-40.2)        | 146/522                  | 26.5 (22.4 – 31.1)      | 1.01 (0.62-1.62)          | 0.982             | 0.99 (0.61-1.61)          | 0.975             |
| <b>Sexual behaviour – female partners</b>                                  |                         |                         |                          |                         |                           |                   |                           |                   |
| <i>Female sexual partners (last 3 months)</i>                              |                         |                         |                          |                         |                           |                   |                           |                   |
| One or more  | 11/70                   | 19.6 (10.8-32.9)        | 144/522                  | 27.5 (23.3-32.2)        | 0.64 (0.36-1.15)          | 0.133             | 0.69 (0.39-1.22)          | 0.202             |
| <i>Transactional sex with female partners (last 12 months)</i>             |                         |                         |                          |                         |                           |                   |                           |                   |
| Once or more   | 4/70                    | 7.7 (2.6-20.7)          | 52/519                   | 9.4 (6.9-12.8)          | 0.82 (0.28-2.45)          | 0.724             | 0.72 (0.25-2.08)          | 0.543             |
| <i>Condomless intercourse with female partners (last 3 months)</i>         |                         |                         |                          |                         |                           |                   |                           |                   |
| Any intercourse  | 8/70                    | 15.8 (7.9-29.3)         | 85/522                   | 16.6 (13.3 – 20.7)      | 0.95 (0.47-1.92)          | 0.889             | 1.09 (0.54-2.17)          | 0.814             |
| Vaginal intercourse  | 7/70                    | 13.3 (6.2-26.3)         | 79/522                   | 15.4 (12.2-19.4)        | 0.86 (0.40-1.85)          | 0.706             | 1.01 (0.47-2.16)          | 0.987             |
| Anal intercourse   | 2/70                    | 5.0 (1.3-17.8)          | 14/522                   | 2.8 (1.5-5.1)           | 1.77 (0.41-7.73)          | 0.447             | 1.96 (0.52-7.38)          | 0.318             |
| <b>Sexual violence</b>   |                         |                         |                          |                         |                           |                   |                           |                   |
| <i>Forced to have sex against will (last 12 months)</i>                    |                         |                         |                          |                         |                           |                   |                           |                   |
| Once or more   | 16/69                   | 23.1 (13.7-36.3)        | 65/520                   | 11.3 (8.5-14.9)         | <b>2.04 (1.16-3.58)</b>   | <b>0.013</b>      | <b>1.99 (1.12-3.53)</b>   | <b>0.019</b>      |
| <b>Substance Use Behaviour</b>   |                         |                         |                          |                         |                           |                   |                           |                   |
| <i>Alcohol use</i>   |                         |                         |                          |                         |                           |                   |                           |                   |
| Never  | 26/70                   | 37.1 (25.2-50.9)        | 222/522                  | 45.5 (40.5-50.5)        | 0.82 (0.56-1.18)          |                   | 0.78 (0.55-1.13)          |                   |
| Monthly  | 33/70                   | 47.9 (24.9-61.3)        | 228/522                  | 42.2 (37.5-47.4)        | 1.13 (0.83-1.53)          | 0.243             | 1.15 (0.85-1.55)          | 0.132             |
| Weekly   | 11/70                   | 14.9 (7.7-27.0)         | 72/522                   | 12.2 (9.3-15.8)         | 1.23 (0.62-2.44)          |                   | 1.35 (0.68-2.67)          |                   |
| <i>Substance use (last 3 months)<sup>a</sup></i>                           |                         |                         |                          |                         |                           |                   |                           |                   |
| Once or more   | 11/70                   | 13.4 (6.9-24.5)         | 37/522                   | 7.3 (5.0-10.5)          | 1.84 (0.88-3.86)          | 0.105             | 1.77 (0.79-3.93)          | 0.164             |

PR: prevalence ratio aPR: adjusted prevalence ratio

†: Seeds excluded & RDS-II weighted

++: Poisson regression with robust variance, seeds excluded & RDS-II weighting

‡: Poisson regression with robust variance, seeds excluded, RDS-II weighting and adjusted for age, income, awareness of HIV status and country of birth

<sup>a</sup> Ecstasy, amphetamines, mephamphetamine, mephedrone, heroin, GHB, rohypnol, cocaine, crack cocaine, benzene, amyl nitrite



Table 5: Access to HIV testing, prevention and care products and services

|  | Transfeminine<br>N = 70 |                         | Cisgender GBMSM<br>N=522 |                         | Crude                     | Adjusted <sup>‡</sup> |                  |              |
|--|-------------------------|-------------------------|--------------------------|-------------------------|---------------------------|-----------------------|------------------|--------------|
|  | n/N                     | % (95% CI) <sup>†</sup> | n/N                      | % (95% CI) <sup>†</sup> | PR (95% CI) <sup>††</sup> | Wald p value          | aPR (95% CI) ‡   | Wald p value |
| <b>Access to testing, condoms and lube [all participants]</b>  |                         |                         |                          |                         |                           |                       |                  |              |
| Ever tested for HIV  | 62/70                   | 85.0 (72.0-92.6)        | 490/522                  | 93.6 (90.6-95.6)        | 0.91 (0.80-1.03)          | 0.119                 | 0.90 (0.80-1.02) | 0.089        |
| Problems accessing condoms   | 36/64                   | 55.3 (41.1-68.6)        | 208/510                  | 41.9 (36.9-46.9)        | 1.32 (1.00-1.75)          | 0.053                 | 1.30 (0.98-1.74) | 0.072        |
| Problem accessing lubricants   | 43/66                   | 67.7 (53.8-79.0)        | 266/509                  | 52.1 (47.1-57.2)        | 1.30 (1.05-1.61)          | 0.017                 | 1.31 (1.06-1.61) | 0.012        |
| <b>HIV care [HIV positive participants]</b>  |                         |                         |                          |                         |                           |                       |                  |              |
| Aware of status  | 22/28                   | 71.9 (48.4-87.4)        | 122/151                  | 78.1 (68.9-85.1)        | 0.92 (0.68- 1.24)         | 0.586                 | 0.99 (0.74-1.32) | 0.923        |
| Currently on ART   | 18/28                   | 60.8 (39.2-78.8)        | 106/151                  | 67.0 (57.2-75.5)        | 0.91 (0.63- 1.31)         | 0.603                 | 1.00 (0.70-1.45) | 0.966        |
| Virological suppression  | 13/28                   | 42.9 (24.2-63.9)        | 84/151                   | 53.8 (44.1-63.2)        | 0.80 (0.48-1.34)          | 0.394                 | 0.94 (0.58-1.53) | 0.797        |
| <b>Biomedical HIV prevention knowledge and uptake [HIV negative &amp; undiagnosed HIV positive participants]</b> |                         |                         |                          |                         |                           |                       |                  |              |
| <i>Pre-exposure prophylaxis</i>  |                         |                         |                          |                         |                           |                       |                  |              |
| Correct knowledge <sup>a</sup>   | 17/44                   | 46.0 (30.0-62.9)        | 197/386                  | 46.6 (40.9-52.4)        | 0.99 (0.67-1.46)          | 0.949                 | 0.99 (0.67-1.45) | 0.945        |
| Previously or currently use  | 2/44                    | 3.9 (1.0-14.5)          | 37/394                   | 7.0 (4.7-10.4)          | 0.55 (0.13-2.30)          | 0.414                 | 0.58 (0.14-2.40) | 0.452        |
| <i>Post-exposure prophylaxis</i>   |                         |                         |                          |                         |                           |                       |                  |              |
| Correct knowledge <sup>b</sup>   | 16/44                   | 41.0 (25.5-58.6)        | 196/389                  | 48.6 (42.9-54.3)        | 0.84 (0.55-1.30)          | 0.446                 | 0.85 (0.56-1.31) | 0.462        |
| Previously or currently use  | 3/45                    | 5.0 (1.0-20.6)          | 30/388                   | 6.5 (4.1-10.0)          | 0.78 (0.16-3.72)          | 0.751                 | 0.81 (0.17-3.77) | 0.786        |

PR: prevalence ratio aPR: adjusted prevalence ratio

†: Seeds excluded & RDS-II weighted

††: Poisson regression with robust variance, seeds excluded & RDS-II weighting

‡: Poisson regression with robust variance, seeds excluded, RDS-II weighting and adjusted for age, income and country of birth

<sup>a</sup>: participants were asked if they knew the following information: "PrEP involves someone who does not have HIV taking a pill on an ongoing basis to prevent them from getting HIV. Most people who use PrEP take a pill everyday. PrEP needs to be taken before sex for it to be effective."

<sup>b</sup>: participants were asked if they knew the following information: "PEP is a one-month course of pills that may stop someone from becoming infected with HIV if they are exposed to the virus (such as by having sex without condoms. PEP needs to be started as soon as possible after an HIV risk."

### **Evidence before this study**

Globally, transfeminine persons bear a significantly higher burden of HIV and other sexually transmitted diseases. Systematic reviews highlight the lack of research attending to gender diversity in sub Saharan African countries with generalised HIV epidemics. We searched PubMed (search terms: trans\*, HIV and Africa; date range 2000-2019) and found nine population-based studies reporting HIV risk among transfeminine persons limited to Southern and Western Africa among which pooled odds of HIV was 1.6 times greater than cisgender men who have sex with men. We found no reports of HIV risk among transmasculine persons in the region.

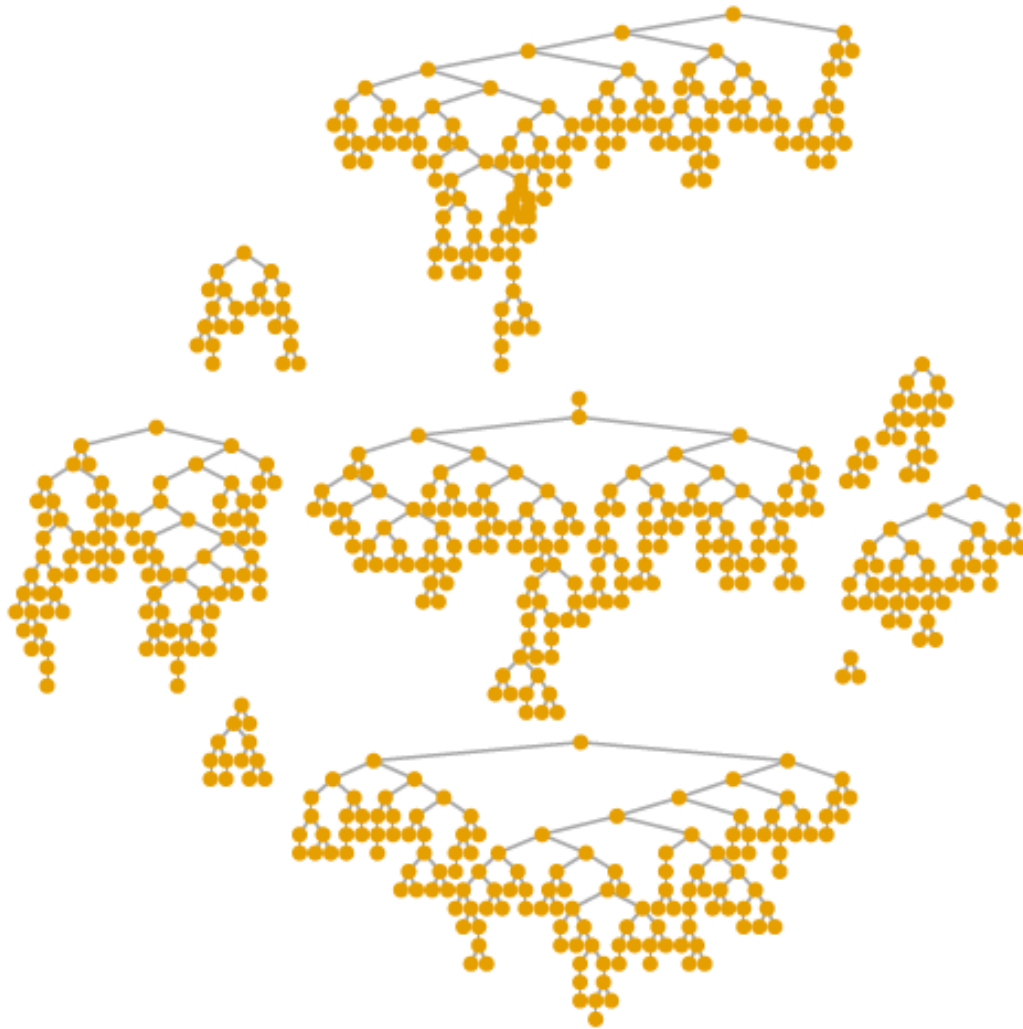
### **Added value of this study**

We report HIV and STI prevalence and related sexual risk behaviours among transfeminine persons who have sex with men in Nairobi, the first such data from East Africa. In this setting, HIV prevalence was 41% among transfeminine persons and considerably higher than among cisgender men who have sex with men. Higher reports of concurrent rectal STIs, recent condomless anal intercourse and transactional sex behaviours highlight unmet needs for accessible sexual health promotion and services, whilst the high frequency of sexual violence experience suggests wider vulnerabilities of transfeminine individuals in Kenya. Our study also documents the existence of wider gender diversity among social networks predominated by African men who have sex with men. Strengths of our approach include a representative sampling strategy and gender inclusive eligibility criteria.

### **Implications of all the available evidence**

Transfeminine individuals are an emerging key population in African generalised HIV epidemic settings whose sexual health needs are not specifically recognised or addressed in existing national key population policies and services. Existing key population service providers can routinely assess gender identity measures among clients, and address cultural competency of staff and clinics to improve acceptability to transgender clients. Holistic, integrated services capable of addressing sexual and mental health, harm reduction and gender affirmative needs are standard of care in many high-resource settings, and sustainable service models should be adapted.

Supplementary Figure 1: Recruitment network (Reingold Tilford algorithm), TRANSFORM 2017



Recruitment chains start at the top of each distinct network (10 seeds) and flow downward by recruitment wave.

