Prevalence and Risk Factors of *Trichomonas vaginalis* Among Female Sexual Workers in Nairobi, Kenya

Alexandre Lockhart, MS, MPH, Virginia Senkomago, PhD,† Jie Ting, PhD,‡ Michael Chitwa, BSc,§|| Joshua Kimani, MBChB, MPH,||¶ Hannah Gakure, RN,||¶ Jessie Kwatampora, MBChB,§|| Suha Patel, MD,** Nelly Mugo, MBChB, MMED, MPH,†† and Jennifer S. Smith, PhD, MPH†‡‡*

Background: *Trichomonas vaginalis* (TV) is the most common curable sexually transmitted infection (STI) worldwide. *Trichomonas vaginalis* infection is associated with an increased risk of pelvic inflammatory disease, human immunodeficiency virus transmission, and preterm birth in women. Data on the prevalence and risk factors for TV infection in sub-Saharan African countries remain scarce.

Methods: A total of 350 Kenyan female sex workers, aged 18 to 50 years, participated in a 2-year longitudinal study of the acquisition of STIs, including TV infection. Every 3 months, cervical and vaginal brush samples were collected for STI testing. At baseline, a sociodemographic and behavior questionnaire was administered. Testing for TV, *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae, Mycoplasma genitalium,* and high-risk human papillomavirus was performed using APTIMA assays.

Results: The TV baseline prevalence was 9.2% (95% confidence interval [95% CI], 6.3–12.7%) and 2-year cumulative TV incidence was 8.1 per 1000 person months (6.9–9.3). Risk factors for higher TV prevalence at baseline were CT infection (adjusted prevalence ratio [PR], 8.53; 95% CI, 3.35–21.71), human immunodeficiency virus seropositivity (PR, 3.01; 95% CI, 1.45, 6.24) and greater than 4 years of sex work (PR, 2.66; 95% CI, 1.07–6.60). Risk factors for elevated 2-year TV incidence were CT (hazard ratio [HR], 4.28; 95% CI, 1.36–13.50), high-risk human papillomavirus infection (HR, 1.91; 95% CI, 1.06–3.45) and history of smoking (HR, 2.66; 95% CI, 1.24–5.73).

Discussion: CT infection was positively associated with both prevalent and 2-year incident TV infections.

Trichomonas vaginalis (TV) is the most common curable sexually transmitted infection (STI) worldwide affecting both men and women.[1] As of 2012, there were 143 million incident TV cases in women aged 15 to 49 years worldwide, 17.5 million of which occurred in Africa.[1] Clinical manifestations of TV are primarily urethritis in men and vaginitis and cervicitis in women.[1,2] The TV infection is associated with increased risks of human immunodeficiency virus (HIV) acquisition,[3–7] pelvic inflammatory disease,[3] and preterm birth/low birth weight.[3,8,9] TV is a curable STI; active TV detection and treatment is essential to reduce transmission and potentially avoiding adverse health outcomes associated with untreated TV infection.

Compared with the United States, data on TV prevalence and risk factors in Sub-Saharan African countries are scarce. Despite Africa having the second highest worldwide TV incidence as of 2012,[2] there are limited data on the association between TV infection and highly prevalent STIs, such as *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (GC), *Mycoplasma genitalium* (MG), and high-risk human papillomavirus (HR-HPV) using highly sensitive detection assays in Africa.[10]

A prospective multicenter US clinical trial validated the performance for screening asymptomatic and symptomatic women for TV using the APTIMA *T. vaginalis* assay[11] (ATV; Hologic, [formerly Gen-Probe], San Diego, CA). APTIMA is a highly sensitive (>95%) and specific (>98%) screening test for TV detection using different sample types, such as urine, vaginal fluids, clinician-collected vaginal swabs, and PreservCyt Solution liquid Pap samples (PCyt).[12,13]

To our knowledge, no study has conducted a longitudinal assessment of TV detection using the ATV assay. Additionally, although previous studies have examined risk factors for baseline TV prevalence,[14–18] and one clinical trial examined the incidence of TV acquisition,[10] no African studies could be identified to date which have examined longitudinal risk factors for TV acquisition.

To address this literature gap, the goal of the present study was to determine the prevalence and risk factors of TV (both prevalent and incident infections) among a high-risk population of 350 female sexual workers (FSW) in Nairobi, Kenya.

MATERIALS AND METHODS

Study Population and Recruitment Process

The Korogocho clinic in Nairobi, Kenya, provides counseling and medical care (including cervical cancer and STI screening, and treatment) for FSWs in the Korogocho area. The study population was selected among FSWs attending the clinic from August 2009 to March 2011 for cervical cancer screening.

Women were informed of the study by community peer leaders during "baraza" public meetings. Participants were not eligible if they had undergone hysterectomy or were in the second or third trimesters of pregnancy. Interested women were contacted by the clinic staff and invited to join the study. A total of 350 FSW aged 18 to 49 years were enrolled after signing an informed consent. Of the 350 FSW recruited, 2 women had missing baseline questionnaire data and were excluded from the analyses.

From the *Department of Biostatistics, †Department of Epidemiology, University of North Carolina at Chapel Hill, Chapel Hill, NC; ‡Department of Clinical Pharmacy, University of California, San Francisco, San Francisco, CA; §University of Manitoba, Winnipeg, Canada, ||University of Nairobi, ¶Kenyatta National Hospital, Nairobi, Kenya, **Department of Obstetrics, Gynecology, and Reproductive Biology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA, ††Kenya Medical Research Institute (KEMRI), Nairobi, Kenya, and ‡‡Lineberger Comprehensive Cancer Center, Chapel Hill, NC

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Correspondence: Jennifer S. Smith, PhD, MPH, Department of Epidemiology, UNC Gillings School of Global Public Health, University of North Carolina at Chapel Hill, McGavran-Greenberg, Chapel Hill, NC 27599. E-mail: jennifers@unc.edu.

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Sample Collection and Analysis

At screening during a clinic visit, a questionnaire was administered to participating women to collect sociodemographic, reproductive, and sexual behavior data. Each woman underwent a pelvic examination, during which a physician collected two cervical samples using a Cervex-Brush (Rovers Medical Devices, Oss, The Netherlands), which was then placed into PreservCyt medium (Cytyc Corp., Marlborough, MA). The first cervical sample was used for TV, CT, GC, MG, and HPV testing. The second cervical sample was used for conventional Pap smear testing. A blood sample was also collected for HIV testing.

TV and STI Testing

The physician-collected cervical sample was transported to Hologic in San Diego for STI testing. TV detection was performed using the ATV assay, which has shown superior sensitivity when compared with other TV diagnostic methods in different specimen types and patient populations.[12] The CT and GC infections were detected using the APTIMA COMBO2 assay, MG detection using the APTIMA MG assay, and HR-HPV detection using the APTIMA HPV assay. APTIMA assays are qualitative assays that detect the specific RNA targets using 3 steps—rRNA target capture, transcription-mediated amplification of the RNA target, and target detection by hybridization with complementary probes linked to chemiluminescent labels. Details on the processing of samples and APTIMA assay testing procedures have been described and detailed elsewhere.[12]

Serum was tested for HIV antibodies by enzyme-linked immunosorbent assay (ELISA), with positive results confirmed by a second ELISA. Peripheral blood CD4 cells were also enumerated. The HIV ELISA and CD4 assays were conducted at the University of Nairobi. Laboratory technicians performing HR-HPV testing had no knowledge of Pap smear results.

Women with a positive result of a treatable STI based on laboratory diagnoses were immediately recalled and treated after a given study visit. Women with symptomatic STIs were treated at the same clinical visit based on syndromic management. Per the Kenyan Ministry of Health provision on management of reproductive tract infections, we used syndromic management after the assessment of vaginal discharge.[19]

Women were tested and treated if positive for syphilis in this study. Positive syphilis infection was determined by a positive Rapid Plasma Reagin (RPR, Immutrep RPR; Omega Diagnostics, Alva, Scotland; BD Macro-Vue RPR; BD Diagnostics, Franklin Lakes, NJ, or Human RPR; Human Diagnostics, Wiesbaden, Germany) titer. Syphilis infection was confirmed with a positive *Treponema pallidum* hemagglutination (TPHA, Immutrep TPHA [Omega Diagnostics], Randox TPHA [Randox Laboratories, Crumlin, Northern Ireland], Human TPHA Liquid [Human Diagnostics, or Hexagon [Human Diagnostics] assay result. All assays were run at the University of Nairobi, Institute of Tropical and Infectious Diseases.

Cervical Cytology

Pap smears were evaluated at the University of Nairobi and classified according to the 2001 Bethesda System. Cytopathologists, who were blinded to all test results, read all cytology smears independently. In case of discordant diagnosis between the 2 cytological readings, the slides were reassessed for the third time. The final diagnosis was the consensus of the reviewing cytopathologists. Study participants were notified of their Pap smear results 2 weeks after their initial screening visit. Women with atypical cells of undetermined significance or low-grade squamous intraepithelial lesions were instructed to undergo a repeat cytology 4 months later. Women with high-grade squamous intraepithelial lesions were immediately referred to colposcopy and biopsy. Women with high-grade cervical intraepithelial neoplasia or more severe (CIN-2+) received standard care and treatment at the Kenyatta National Hospital.

Ethical approval was granted by the Institutional Review Boards (IRB) at Kenyatta National Hospital (Nairobi, Kenya) and the University of North Carolina (Chapel Hill, NC).

Statistical Analysis

Baseline prevalence of TV infections, stratified by age group, was assessed using 95% binomial proportion and confidence intervals (CIs). Two models were fit at baseline to estimate prevalence ratios (PRs) for the association between TV positivity at baseline (prevalence) and participant characteristics: (1) age-adjusted log-binomial models for each respective covariate (PR) and (2) a multivariable adjusted log-binomial model, using backwards selection with an alpha of 0.1 for covariate retention in the final adjusted model. Age at baseline was included in each model selection process. A robust variance estimator[20] was implemented to stabilize model convergence for all log-binomial analyses. Women with missing baseline test results for TV (n = 2) were excluded from analyses. A prevalent TV case was defined as TV infection detected at baseline. Covariates were chosen based on a literature review. Smoking status was characterized as (i) currently smoking at enrollment; (ii) having any history of smoking, but not current use; and (iii) never having smoked. Age-only adjusted models for each risk factor and multivariable models were constructed for both baseline and follow-up analyses. Multicollinearity checks were used to assess the degree of correlation between risk factors. The variables working at a night club, working out of a home, lodging on the street, and working at a bar or restaurant were correlated with each other ($r > 0.30$), and therefore, only working at a bar or restaurant was included in the analyses. The number of live births was correlated with age at enrollment and also excluded from analyses.

Person-time was calculated as the total number of months on study postbaseline until the first incident TV event, or up to 2 years of follow-up. Incidence rates were calculated as the total number of new TV events postbaseline divided by total accumulated person-time for a given category. Two types of follow-up models were used to examine the association between TV acquisition and participant characteristics: (1) an age-adjusted proportional hazards model for time to first TV event through the 2-year period was used to estimate TV hazard ratios (HRs), and (2) a reduced model (rHR) using backwards selection with alpha = 0.1 for model covariate retention of all risk factors. Age at baseline was included in each model selection process. An incident TV case was defined as being TV-negative at baseline, but TV being detected over the 2-year follow-up. Among incident TV cases, infection was assumed to occur at the midpoint between the last negative test and first positive test. All analyses were conducted using SAS 9.3 (SAS Institute Inc., Cary, NC).

RESULTS

Baseline TV Prevalence

Overall baseline prevalence of TV among 348 FSWs was 9.2% (95% CI, 6.3–12.7%). In women aged 18 to 24 years, TV prevalence was 10.1% (95% CI, 3.8–16.4%), followed by 25 to 29 years (5.6%; 95% CI, 1.2–9.9%), 30 to 34 years (8.3%; 95% CI, 1.9–14.7%), and 35 years or older (13.9%; 95% CI, 6.3–21.6%), showing a U-shaped trend across these age groups (Table 1).

TABLE 1. Baseline Characteristics and Sociodemographic Risk Factors for TV Among 348 FSWs in Kenya

	n	% TV Positive (n = 32)	Age-Adjusted Model PR (95% CI)*†	Reduced Covariate Model PR (95% CI)*†‡
Age (years)				
18–24	89	10.1	0.73 (0.32–1.66)	0.67 (0.24–1.86)
25–29	108	5.6	0.40 (0.15–1.03)	0.38 (0.14–0.97)
30–34	72	8.3	0.60 (0.23–1.54)	0.54 (0.21–1.39)
≥35	79	13.9	1.0	1.0
CT infection status§				
Negative	333	8.1	1.0	1.0
Positive	13	38.5	6.02 (2.33–15.53)	8.53 (3.35–21.71)
HIV infection status§				
Seronegative	265	7.2	1.0	1.0
Seropositive	82	15.9	2.20 (1.07–4.50)	3.01 (1.45–6.24)
GC infection status§				
Negative	339	9.1	1.0	
Positive	8	12.5	1.45 (0.21–9.96)	
High-risk HPV infection status				
Negative	247	8.5	1.0	
Positive	97	11.3	1.36 (0.68–2.72)	
MG infection status§				
Negative	278	8.3	1.0	
Positive	69	11.6	1.43 (0.67–3.06)	
Cytology results				
Normal	282	9.2	1.0	
ASCUS/AGUS/LSIL	51	9.8	1.17 (0.49–2.81)	
HSIL/SCC	15	6.7	0.77 (0.20–2.95)	
Marital status				
Ever married or cohabiting	194	8.3	1.0	1.0
Single/never married	154	10.4	1.45 (0.76–2.75)	1.54 (0.82–2.88)
Education				
Primary or less	265	9.4	1.0	
Secondary or more	83	8.4	0.87 (0.39–1.97)	
Works in a bar/restaurant§				
No	76	7.9	1.0	
Yes	265	9.4	1.13 (0.48–2.68)	
Religion§				
Christian	320	9.1	1.0	
Non-Christian/other religion	27	7.4	0.87 (0.21–3.66)	
Income (per month)§				
<4000 Ksh (~US $400)	170	9.4	1.0	
≥4000 Ksh (~US $400)	177	9.0	0.99 (0.52–1.87)	
Smoking status				
Never	216	7.9	1.0	
Past (but not current)	46	10.9	1.36 (0.51–3.60)	
Current	86	11.6	1.48 (0.70–3.10)	
Alcohol use				
No	58	1.7	1.0	1.0
Yes	290	10.7	6.68 (0.91–48.90)	6.71 (0.88–51.07)
Cumulative years of sex work				
<3	74	5.4	1.0	1.0
3–4	96	9.4	1.90 (0.62–5.54)	2.54 (0.90–7.14)
>4	178	10.7	2.18 (0.74–6.47)	2.66 (1.07–6.60)
Weekly number of sex partners				
<6	41	12.2	1.0	
6–11	155	10.3	0.89 (0.37–2.14)	
>11	152	7.2	0.61 (0.24–1.57)	
Current consistent oral contraception use				
No	308	8.8	1.0	
Yes	39	10.3	1.18 (0.44–3.21)	
Condom use				
>99% of the time	255	7.8	1.0	
50–99% of the time	72	12.5	1.53 (0.74–3.18)	
<50% of the time	20	15.0	1.70 (0.55–5.27)	

* PR adjusted for age at baseline.

† Model is Poisson regression using robust variance estimator to account for numerical instability.

‡ All variables included in final model before model selection process.

§ Numbers do not add up to total sample size due to missing data.

Cytology categories were: ASCUS, AGUS, LSIL, HSIL, SCC.

ASCUS, atypical cells of undetermined significance; AGUS, atypical glandular cells of undetermined significance; CI, confidence interval; CT, *Chlamydia trachomatis*; FSW, female sexual workers; GC, *Neisseria gonorrhoeae*; HIV, human immunodeficiency virus; HPV, human papillomavirus; HR, hazard ratio; HSIL, high-grade squamous intraepithelial lesion; LSIL, lowgrade squamous intraepithelial lesion; MG, *Mycoplasma genitalium*; SCC, squamous cell carcinoma; TV, *Trichomonas vaginalis*.

TABLE 2. Sociodemographic Risk Factors of Incident TV Over 2 Years Follow-Up in 316 FSWs in Kenya

	N	Incidence Rate /1000 Person-Months)	Age-Adjusted Model HR (95% CI) *†	Reduced Covariate Model HR (95% CI) *†‡
Age, y				
18–24	80	11.1	1.26 (0.59–2.72)	0.90 (0.39–2.10)
25–29	102	6.7	0.75 (0.34–1.68)	0.77 (0.34–1.73)
30–34	66	6.3	0.72 (0.29–1.78)	0.60 (0.24, 1.50)
≥35	68	8.7	1.0	1.0
CT infection status§				
Negative	307	7.7	1.0	1.0
Positive	7	32.5	3.59 (1.18–10.98)	4.28 (1.36, 13.50)
HIV infection status§				
Seronegative	246	7.5	1.0	
Seropositive	69	10.4	1.65 (0.83–3.27)	
GC infection status§				
Negative	309	8.1	1.0	
Positive	5	10.3	1.31 (0.18–9.58)	
High-risk HPV infection status§				
Negative	229	6.5	1.0	1.0
Positive	85	12.2	1.88 (1.04–3.39)	1.91 (1.06, 3.45)
MG infection status				
Negative	268	7.6	1.0	
Positive	48	11.2	1.43 (0.71–2.90)	
Cytology				
Normal	256	8.1	1.0	
ASCUS/AGUS/LSIL	46	6.3	0.82 (0.32–2.10)	
HSIL/SCC	14	14.3	1.82 (0.65–5.13)	
Marital status				
Ever married or cohabiting	178	6.7	1.0	
Single/never married†	138	10.4	1.48 (0.82–2.67)	
Education				
Primary or less	240	8.4	1.0	
Secondary or more	76	7.2	0.85 (0.42–1.72)	
Works out of a bar/restaurant¶				
No	70	6.9	1.0	
Yes	240	8.2	1.10 (0.53–2.29)	
Religion				
Christian	291	7.9	1.0	
Non-Christian/other religion	25	11.1	1.30 (0.50–3.33)	
Income (per month)§				
<4000 Ksh	154	5.9	1.0	1.0
≥4000 Ksh	161	10.5	1.85 (1.03–3.33)	1.75 (0.97, 3.17)
Smoking status				
Never	199	6.5	1.0	1.0
Past (but not current)	41	14.4	2.26 (1.10–4.63)	2.66 (1.24, 5.73)
Current	76	9.0	1.35 (0.69–2.67)	1.39 (0.70, 2.76)
Alcohol use				
Never	57	7.0	1.0	
Ever	259	8.4	1.23 (0.54–2.77)	
Cumulative years of sex work				
<3	70	6.8	1.0	
3–4	87	10.2	1.79 (0.77–4.19)	
>4	159	7.7	1.48 (0.64–3.45)	
Weekly number of sex partners				
<6	36	7.3	1.0	
6–11	139	8.4	1.07 (0.40–2.89)	
>11	141	8.1	1.07 (0.40–2.86)	
Current consistent oral contraception use				
No	281	8.5	1.0	
Yes	35	4.7	0.54 (0.17–1.75)	
Condom use§				
>99% of the time	235	7.7	1.0	
50–99% of the time	63	12.2	1.56 (0.83–2.91)	
<50% of the time‖	17	0.0	—	

* Two-year HR adjusted for age at baseline.

† Model is proportional hazards regression modeling for 2-year incidence of TV.

‡ All variables included in final model before model selection process.

§ Numbers do not add up to total sample size due to missing data.

‖ Estimate was not computed due to zero incidence for given category.

ASCUS, atypical cells of undetermined significance; AGUS, atypical glandular cells of undetermined significance; CI, confidence interval; CT, *Chlamydia trachomatis*; FSW, female sexual workers; GC, *Neisseria gonorrhoeae*; HR, hazard ratio; HSIL, high-grade squamous intraepithelial lesion; LSIL, lowgrade squamous intraepithelial lesion; MG, *Mycoplasma genitalium*; SCC, squamous cell carcinoma; TV, *Trichomonas vaginalis*.

Differences in TV prevalence between age groups were not statistically significant.

Risk Factors for TV Positivity at Baseline

Age-adjusted models showed a higher TV prevalence in CT-infected women (PR, 6.02; 95% CI, 2.33–15.53) and HIV-positive women (PR, 2.20; 95% CI, 1.07–4.50).

The reduced-covariate model at baseline showed higher TV prevalence in women with CT infection (adjusted PR [aPR], 8.53; 95% CI, 3.35–21.71), HIV-positive women (aPR, 3.01; 95% CI, 1.45–6.24), and women with greater than 4 years of sex work (aPR, 2.66; 95% CI, 1.07–6.60) (Table 1). No other risk factors were significantly associated with TV prevalence.

Incidence of TV Over the 2-Year Follow-up

Of 348 women participating at baseline, 275 (79%) had 2 quarterly follow-up visits (6 month follow-up), 280 (80%) had a 1-year follow-up visit, and 221 (64%) had a 2-year follow-up visit. The median duration of study follow-up was 24 months (interquartile range, 15–24 months). Of 348 women who participated in the baseline survey, 316 (91%) were negative for TV at baseline and included in longitudinal analyses of TV incidence. The overall 2-year incidence rate of new TV infections was 8.1 per 1000 person-months (95% CI, 6.9–9.3). Among the age-stratified groups, the incidence rate in the 18- to 24-year-old age group was 11.1/1000 person-months (95% CI, 8.3–13.8), followed by the 35-year or older group (8.7/1000 [6.1–11.4]), 25–29 age group (6.7/1000 [4.8–8.5]), and 30 to 34 years age group (6.3/1000 [4.1–8.6]), showing a U-shaped trend across these age groups (Table 2). Differences between age groups, however, were not statistically significant.

Risk Factors for TV Incidence Over 2 Years

The 2-year follow-up, age-adjusted results showed an elevated risk of TV acquisition for women with CT (HR, 3.59; 95% CI, 1.18–10.98), HR-HPV infection (HR, 1.88; 95% CI, 1.04–3.39), women with income of 4000 Kenyan shillings (Ksh) or greater (HR, 1.85; 95% CI, 1.03–3.33), and women who smoked in the past (HR, 2.26; 95% CI, 1.10–4.63).

The 2-year follow-up reduced model results showed that women with CT (rHR, 4.28; 95% CI, 1.36–13.50), HPV infection (rHR, 1.91; 95% CI, 1.06–3.45), and women who smoked in the past (rHR, 2.66; 95% CI, 1.24–5.73) had elevated risks of TV acquisition (Table 2). Despite age-adjusted associations for HIV showing elevated risk for TV prevalence, this association did not hold for TV incidence (Fig. 1). Conversely HR-HPV did not show

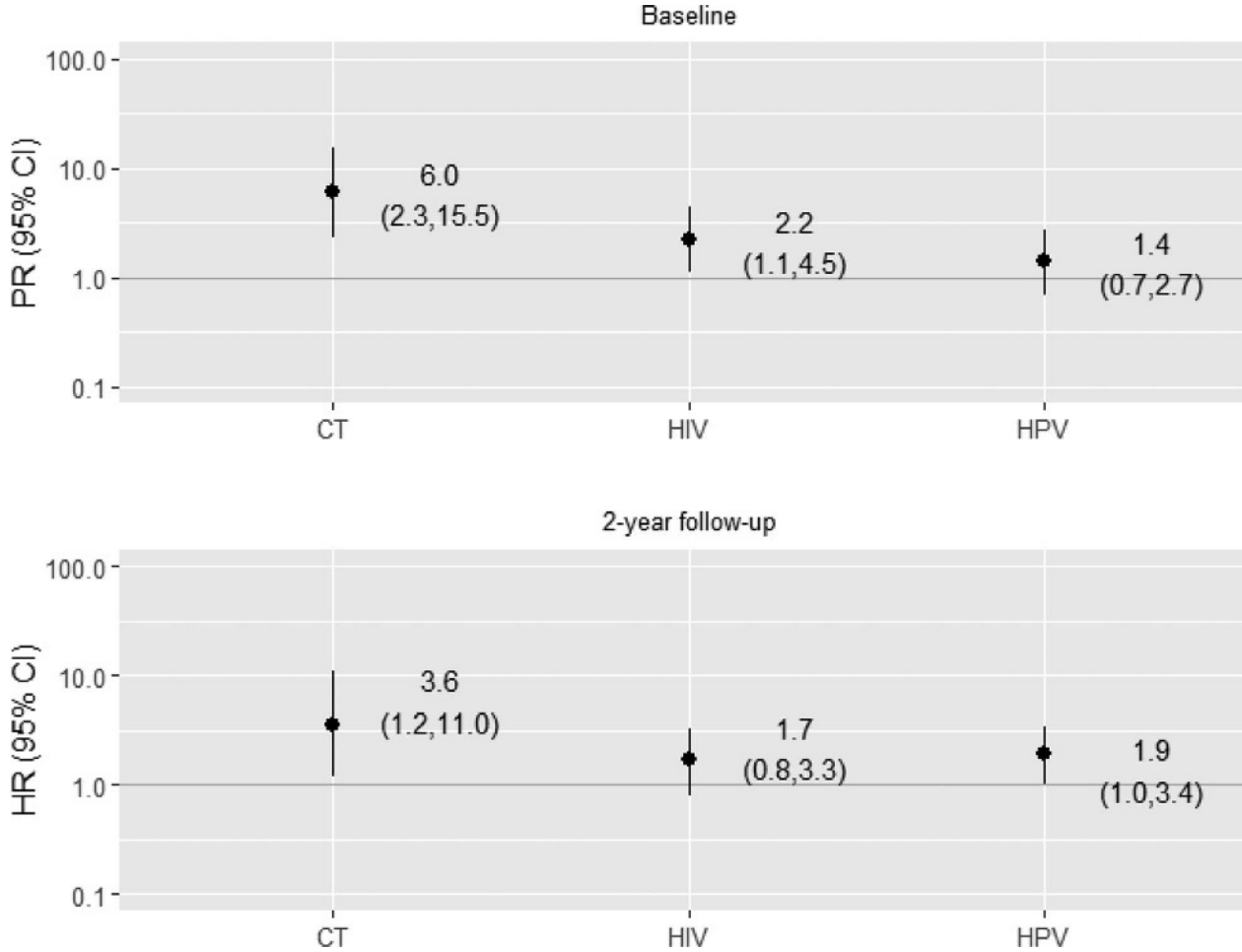

Figure 1. HIV, CT, and HR-HPV as risk factors for TV at baseline and 2-year follow-up. *Baseline PR and 95% CI are based on age-adjusted log-binomial model. Two-year follow-up HR and 95% CI are based on age-adjusted proportional hazards model. Horizontal line is the reference for the null effect estimate value. CI, confidence interval; CT, *Chlamydia trachomatis*; HR-HPV, high-risk human papillomavirus; PR, prevalence ratio.

an age-adjusted association for TV prevalence, although HR-HPV did show an elevated association for TV incidence (Fig. 1). No other risk factor showed a significant relationship with risk of TV acquisition.

DISCUSSION

In this population of ~350 Kenyan FSWs, baseline TV prevalence was slightly under 10%, and a high acquisition of TV was observed over a 2-year follow-up period. *Chlamydia trachomatis* infection, HIV seropositivity, and greater than 4 years of sex work were associated with increased TV prevalence at baseline. Over the 2-year follow-up, greater TV acquisition was positively associated with CT infection, HR-HPV positivity, and past smoking status.

Median age of surveyed FSW in the present study was 28 years, and TV prevalence was 9.2% at baseline. TV prevalence estimates among women have ranged from 1.5% in a cohort of 70,000 women 18–45 years of age in four Nordic countries, to 38% in a cohort of 155 female drug users aged 17 to 57 years in New York City.[15–18,21–28] Among similarly aged populations, our TV prevalence was higher in FSW than comparative study samples from the general population.[15,23,24] In cases where TV prevalence was higher than our study, the sampled populations originated from high-risk cohorts, such as jail attendees,[21] urban drug users,[26] FSW,[16,28] or women from a rural impoverished area[27] (range, 13–38%). Elevated TV prevalence has been consistently higher in women of older age (≥35 years),[15,17,21,23–26] being consistent with our present findings in Kenya (13.9% for women 35 years and older).

Chlamydia trachomatis infection was the only risk factor for both higher TV prevalence and TV incidence. Prior cross-sectional data have consistently shown CT-positive women have a higher risk of TV infection.[10,17,21] To our knowledge, this is the first study in Africa to show an association between CT infection and higher TV acquisition over study follow-up. One study involving South African and Zimbabwean women showed an association between having either laboratory tested GC or CT infection and higher TV acquisition, although did not show results separately for CT infection.[15]

Human immunodeficiency virus seropositivity and a greater number of years of female sex work were risk factors for higher TV prevalence, although not TV incidence, among FSW in this Nairobi study. Consistently, other studies have shown elevated TV prevalence in HIV-seropositive than seronegative women.[18] For the association of HIV-seropositive status and higher risk of TV acquisition, our results differ from a study of Zimbabwean and South African women which showed an elevated risk of TV acquisition among HIV-seropositive women.[15] This study, however, measured TV with a relatively less sensitive test than the ATV assay, which may have accounted for differences in study results. Previous studies have also reported an increased risk of TV prevalence associated with GC infection.[18,21] Although TV prevalence was high in GC-positive subjects in our study (12.5%), the association between TV and GC was not significant and based on a few GC-positive cases (n = 8). The presence of MG infection[17] and of HR-HPV[14] has also been reported as a risk factor for higher TV prevalence, although no notable baseline associations were seen in the current study.

The HR-HPV positivity and past smoking status were additional risk factors for increased TV acquisition. To our knowledge, this is the first study to show an association between HR-HPV infection and higher TV acquisition over study follow-up. Our study found that past smoking status was associated with a higher risk of TV acquisition as compared with never smokers. A higher risk of TV acquisition has been found with increasing number of sexual partners in previous studies in New York City[26] and South Africa,[10] which could be attributed to differences in surveyed populations. Given that our study enrolled FSWs, the lack of association between number of sexual partners and higher TV incidence could be due to relatively larger reported number of weekly sexual partners (median = 10).

Strengths of this study include the use of a sensitive laboratory assay for the reliable detection of TV, and STI infections. Further, our use of a prospective design allows for the assessment of risk factors before TV acquisition. Another key strength was the rarity of missing values across the various risk factor categories. One potential limitation is the lack of data on antibiotic use among study participants, which may have impacted observed STI estimates. Further, there was smaller sample size during the follow-up with interval censoring, which possibly led to missing TV infections between intervals. Another limitation is that our findings among FSW may not be generalizable to the general population. Nevertheless, the significant risk factor associations with TV can assist in general TV management or in areas where HR-HPV and HIV positivity are more prevalent.

The 2015 US Centers for Disease Control and Prevention guidelines recommend TV screening for women receiving care in high prevalence settings (STI clinics), for those at high risk for infection (e.g., women with multiple partners), or with HIV.[29] Screening for a higher risk population is justified given that TV is curable, and treatment should be provided for women found to be TV-positive. Our results among high-risk women are largely consistent with these screening recommendations, yet highlighted the notably high risk for TV among CT-positive patients- in both cross-sectional and longitudinal analyses.

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