

RESEARCH ARTICLE

## Routine Screening of Adolescents for *Trichomonas vaginalis* in a Juvenile Detention Center

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### ABSTRACT

**Background:** Detained and incarcerated adolescents are at increased risk of sexually transmitted infections (STI), but limited information is currently available regarding the prevalence of *Trichomonas vaginalis* (TV) in detained youth.

**Methods:** A total of 144 detainees (75 males and 69 females) in the Franklin County Juvenile Detention Facility (FCJDF) in Columbus, Ohio, consented to STI screening between May 2016 and June 2017. Participants were screened for TV in addition to *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) using urine nucleic acid amplification tests (NAAT).

**Results:** Among detained youth who consented to testing, TV was identified in 7 of 69 (10.1%) females and 0 of 75 (0%) males ( $P < 0.01$ ). *Neisseria gonorrhoeae* was identified in 12 of 69 (17.4%) females and 3 of 75 (4.0%) males ( $P = 0.01$ ), and CT was identified in 16 of 69 (23.2%) female and 7 of 75 (9.3%) male detainees ( $P = 0.04$ ). Among females, positive TV screen was associated with prior history of STI.

**Conclusion:** Our data support routine screening of female detainees at FCJDF, based on our finding of 10% positivity among females who underwent testing.

**Keywords:** Detained and incarcerated youth, *Trichomonas vaginalis*, STI screening, Nucleic acid amplification test

### INTRODUCTION

*Trichomonas vaginalis* (TV) is a parasitic sexually transmitted infection (STI) with an estimated 276.4 million new cases per year worldwide, making it the most common nonviral STI.<sup>1</sup> The Centers for Disease Control and Prevention (CDC) estimates that 3.7 million people in the United States are currently infected with TV, compared to 1.6 million with *Chlamydia trachomatis* (CT) and 270,000 with *Neisseria gonorrhoeae* (NG).<sup>2</sup> In females, untreated *Trichomonas vaginalis* is associated with increased risk of low birth weight and preterm delivery,<sup>3</sup> increased susceptibility to human immunodeficiency virus (HIV),<sup>4</sup> and pelvic inflammatory disease in HIV-positive women.<sup>5</sup> In males, TV has been associated with nongonococcal urethritis.<sup>6</sup> Despite its high prevalence and associated morbidity, TV receives limited public health attention. *Trichomonas vaginalis* is not a reportable infection in the state of Ohio; information on rates of infection therefore are lacking.

Incarcerated and detained adolescents are at high risk for STIs.<sup>7</sup> Among arrested or detained adolescent females, prevalence estimates as high as 33% for CT and 13% for NG have been reported.<sup>8</sup>

Among males, prevalence estimates as high as 14% for CT and 7% for NG have been observed.<sup>9</sup> Given the high prevalence of CT and NG, many juvenile correctional facilities routinely screen youth for these infections.

Limited information is available regarding the prevalence of TV in incarcerated and detained youth. Prior studies, using older testing methodologies with lower sensitivity, found that TV prevalence was similar to or higher than that of CT among females.<sup>10</sup> A high-sensitivity nucleic acid amplification test (NAAT) is now approved by the Food and Drug Administration (FDA) for the diagnosis of TV infection in females, using urine or vaginal specimens. The NAATs have shown good performance when testing urine from males as well, and may be used by labs that have performed internal validation studies on these specimens.<sup>11-14</sup> The higher sensitivity of NAAT tests may lead to more accurate estimates of TV prevalence in a given population. A study in adolescent females found a 3-fold higher prevalence of TV when NAAT testing was used as compared to unstained microscopic evaluation of vaginal secretions.<sup>15</sup> Aalsma et al used NAAT testing to screen juvenile detainees for NG, CT, and TV, and found that 1% of males and 11% of females



were positive for TV infection.<sup>16</sup> Rates of infection in detained youth in Ohio have not previously been reported.

In 2015, the CDC stated that screening for TV may be considered for women in high prevalence settings, including correctional facilities. The CDC further advised that screening decisions should be based on the local epidemiology of TV.<sup>11</sup> Given the limited information currently available regarding TV prevalence among detained and incarcerated youth in Ohio, it is unclear whether routine screening for this infection is indicated in this setting. The purpose of the current study was to determine the prevalence of TV infection in youth detained at the Franklin County Juvenile Detention Facility (FCJDF) using NAAT and to compare this to the prevalence of CT and NG. A secondary objective was to explore characteristics associated with testing positive for TV.

## METHODS

### Setting and Design

The FCJDF in Columbus, Ohio, is a 132-bed maximum security facility, housing detained males and females between the ages of 10-22 years. It is the main booking center for juveniles in Franklin County. The average length of stay is 12.5 days. The population averages 90% males and 10% females with a median age of 16 years. The center averages 79% African American and 21% white juveniles.

This was a cross-sectional survey of incoming detainees. The study protocol was approved by the FCJDF Lead Juvenile Judge. In addition, the protocol was reviewed by Nationwide Children's Hospital's Institutional Review Board (IRB) and deemed a quality improvement project and IRB exempt.

### Participants

Adolescents and young adults detained at the FCJDF between April 2016 and June 2017 who consented to STI testing were included in the analysis. Due to the much higher census of males versus females, specimens from males were obtained at a faster rate. In order to attempt to get an equal sample of male and female participants, males were enrolled until June 2016, whereas female participants were enrolled through June 2017.

### Procedures

As standard of care, a health assessment is completed by a nurse within 48 hours of an adolescent being admitted to the facility. A standardized medical history collection form is used to record demographic data and medical history, including sexual history. Detainees are offered testing for NG, CT, and HIV. For youth who give verbal consent, a urine sample is collected and tested for NG and CT. During the study period, urine samples were additionally tested for TV.

Testing for TV was performed at the Center of Disease Detection (CDD) or the Nationwide Children's Hospital (NCH) clinical laboratory. Specimens were delivered on the day of collection to NCH via courier. Specimens were delivered to CDD by next day air mail

delivery. Both labs utilized the APTIMA *Trichomonas vaginalis* Assay NAAT (GenProbe, San Diego, CA). All NG and CT testing was completed at CDD utilizing the Cobas 4800 CT/GC NAAT (Roche, Pleasanton, CA).

### Measures

The primary study outcome was prevalence of positive TV tests among male and female detainees who consented to STI testing. Secondary outcomes were prevalence of positive NG and CT tests, and patient characteristics associated with a positive TV test.

For detainees who consented to STI screening, medical history forms were reviewed for the following: demographic characteristics; substance use history (reported tobacco, alcohol, and drug use and history of prior drug treatment), mental health history (current mental health conditions, history of suicidal ideation/self-injury, and family history of suicide), and sexual history (reported sexually activity, condom use, history of anal/oral/vaginal sex, age at sexual debut, number of sexual partners in a year, prior pregnancy, and prior STI).

### Statistical Analysis

Descriptive statistics included count (percentage) for categorical variables and mean (standard deviation) for continuous variables. Male and female detainees were compared on demographic, substance use, mental health, and sexual activity characteristics utilizing chi-square, Fisher exact, and *t* tests, as appropriate. Fisher exact tests were used to compare the proportion of males and females positive for TV, NG, and CT.

Since no positive TV results were found in male detainees, exploration of characteristics associated with positive TV screening result was limited to females. Chi-square and *t* tests were used to examine associations between demographic, substance use, mental health, and sexual characteristics with positive TV screening results. Variables associated with positive TV screen at  $P < 0.1$  in bivariate analyses were eligible for multivariable modeling. Stepwise logistic regression was utilized to determine characteristics independently associated with positive TV result. Data analyses were performed using SAS Enterprise Guide 7.1.

## RESULTS

Testing was completed on 75 male urine specimens and 69 female urine specimens of detainees who consented to STI testing during the study period. Mean age of the study sample was 16.5 years, and the majority was African American (**Table 1**). Female detainees were significantly more likely than males to report tobacco use (56.5% vs 39.0%,  $P = 0.01$ ) and alcohol use (18.8% vs 5.3%,  $P = 0.02$ ). Marijuana use was similar in both sexes. Female detainees had significantly ( $P < 0.01$ ) higher rates of reported suicidal ideation (18.8% vs 4.0% in males), self-injury (17.4% vs 1.3% in males), and family history of suicide (27.5% vs 2.7% in males). Approximately one-third of participants reported 2-3 sexual partners in the past year (37.1% in females vs 30.1% in males). Although reported rates of sexual activity (85.5% in fe-



Table 1. Demographic, Substance Use, Mental Health, and Sexual Activity Characteristics of Juvenile Detainees, by Sex

Characteristic	Male (N=75)	Female (N=69)	P value
Age (years), mean±SD	16.5±1.14	16.5±1.34	0.88
BMI (kg/m <sup>2</sup> ), mean±SD	23.0±4.95	26.0±6.72	<0.01
Race, n (%)			
African American	66 (88.0)	50 (72.5)	<0.01
White	5 (6.7)	17 (24.6)	
Other	4 (5.3)	2 (2.9)	
Grade, n (%)			
≤ 9 <sup>th</sup> grade	22 (29.3)	27 (39.1)	0.34
10 <sup>th</sup> grade	19 (25.3)	13 (18.8)	
≥11 <sup>th</sup> grade	28 (37.3)	27 (39.1)	
Unknown	6 (8.0)	2 (2.9)	
<b>Substance Use Characteristics</b>			
Reported Tobacco Use, n (%)	27 (36.0)	39 (56.5)	0.01
Reported Alcohol Use, n (%)	4 (5.3)	13 (18.8)	0.02
Reported Marijuana Use, n (%)	35 (46.7)	31 (44.9)	0.83
Prior Drug Treatment, n (%)	10 (13.3)	11 (15.9)	0.66
<b>Mental Health Characteristics</b>			
Current Mental Health Condition, n (%)	14 (18.7)	23 (33.3)	0.04
History of Suicidal Ideation, n (%)	3 (4.0)	13 (18.8)	<0.01
History of Self Injury, n (%)	1 (1.3)	12 (17.4)	<0.01
Family History of Suicide, n (%)	2 (2.7)	19 (27.5)	<0.01
<b>Sexual Activity Characteristics</b>			
Reported Sexual Activity, n (%)	64 (85.3)	59 (85.5)	0.98
Reported Condom Use, n (%)	51 (68.0)	42 (60.1)	0.37
History of Anal Sex, n (%)	4 (5.3)	0 (0.0)	0.12
History of Oral Sex, n (%)	26 (34.7)	32 (46.3)	0.17
History of Vaginal Sex, n (%)	66 (88.0)	60 (86.1)	0.14
Age (years) at Sexual Debut, n (%)			
≤ 11	10 (13.3)	3 (4.4)	0.01
12	12 (16.0)	6 (8.7)	
13	25 (33.3)	17 (24.6)	
14	10 (13.3)	12 (17.4)	
≥15	6 (8.0)	21 (30.4)	
unknown	3 (4.0)	2 (2.9)	
n/a	9 (12.0)	8 (11.6)	
Sexual Partners in Past Year, n (%)			
0-1	11 (14.1)	19 (27.5)	0.13
2-3	23 (30.1)	26 (37.1)	
4-6	11 (14.1)	9 (13.1)	
≥ 7	11 (14.7)	3 (4.4)	
unknown	9 (12.0)	5 (7.3)	
n/a	10 (13.3)	7 (10.1)	
Current or Prior STI, n (%)	9 (12.0)	23 (33.3)	<0.01
Prior Pregnancy, n (%)	n/a	26 (37.7)	--

males vs 85.3% in males) and condom use (60.1% in females vs 68% in males) were similar, the rate of current or past STI was significantly higher in the female detainees (33.3% in females vs 12.0% in males,  $P < 0.01$ ). A prior pregnancy was reported by 37.7% of the female detainees.

Prevalence of each STI among tested detainees are reported in **Table 2**. Females had higher rates of all infections than males. *Trichomonas vaginalis* was identified in 7 of 69 (10.1%) female and 0 of 75 (0.0%) male detainees. *Neisseria gonorrhoeae* was identified in 12 of 69 (17.4%) female and 3 of 75 (4.0%) male detainees,

Table 2. Sexually Transmitted Infection (STI) Screening Results in Juvenile Detainees, by Sex

Sexually Transmitted Infection n (%), 95% CI)	Male (N=75)	Female (N=69)	P value
<i>Neisseria gonorrhoeae</i>	3 (4.0, 95% CI: 0.0-8.4)	12 (17.4, 95% CI: 8.5-26.3)	0.01
<i>Chlamydia trachomatis</i>	7 (9.3, 95% CI: 2.8-15.9)	16 (23.2, 95% CI: 13.2-33.2)	0.04
<i>Trichomonas vaginalis</i>	0 (0.0, 95% CI: 0.0-4.8)	7 (10.1, 95% CI: 4.2-19.8)	<0.01



and CT was identified in 16 of 69 (23.2%) female and 7 of 75 (9.3%) of male detainees.

As TV was identified only in female detainees, associative analyses were limited to this sex group. In unadjusted bivariate analyses, two variables were associated with positive TV screen result in females at significance level adequate for inclusion in multivariable modeling: prior history of STI ( $P = 0.03$ ) and number of sexual partners ( $P = 0.01$ ). In stepwise logistic regression, only prior history of STI was independently associated with presence of positive TV screen in female detainees (odds ratio 6.1, 95% CI 1.1 – 34.4).

## DISCUSSION

This study assessed the prevalence of TV in detained youth in the FCJDF to determine whether routine screening may be indicated. We found a TV prevalence of approximately 10% among females. *Trichomonas vaginalis* was not identified in any male detainees. Our findings are similar to previously published data utilizing NAAT to screen for TV in detained adolescents.<sup>16</sup> In that study of 1181 detained adolescents, the prevalence of TV was 11% in females and 1% in males.

Several studies in adults have shown that TV infection disproportionately affects incarcerated populations.<sup>17</sup> A study in San Francisco County Jail inmates using urine NAAT found TV infections in 2.1% of men and 32.0% of women under the age of 25 years, which was a higher prevalence than we found in the current study.<sup>18,19</sup> It is known that TV infections are more prevalent with increasing age which may explain this discrepancy. Ginocchio et al evaluated 1215 women across the United States from multiple clinic sites, STD clinics, juvenile detention centers, and adult detention centers, and found that TV infections were more prevalent among women aged 40 years and older.<sup>20</sup>

In our study of adolescent detainees in Central Ohio, the presence of a current TV infection was associated with having history of a previous STI. *Trichomonas vaginalis* infection was not associated with age, grade, prior pregnancy, substance use, or having a current mental health condition. Of note, TV infections were only found in African American female detainees. Prior studies have demonstrated an increased prevalence of TV in African American female adolescents and young adults.<sup>15,21</sup>

This study does have limitations. STI testing at FCJDF is not mandatory; detainees may decline testing if they desire. Therefore, we are not able to determine a true prevalence of infection in the larger FCJDF population. It is possible that detainees with symptoms or concerns about prior sexual contacts would be more likely to consent to testing. In either case, several adolescents were identified and treated for TV who may have been missed if routine testing was not offered. An additional limitation of our study is the relatively small sample size, particularly for female detainees. Although we oversampled females, collecting data on them for approximately a year longer than males, we still were not able to achieve an equal sample size. The small sample size for females

likely further limited our ability to identify other characteristics associated with TV infection. Our findings are consistent with studies that show an increased prevalence of TV in African American females. In addition, the study population was limited in the number of Hispanic or Asian adolescents. Our findings are not necessarily generalizable to detained adolescents in other parts of the country.

## PUBLIC HEALTH IMPLICATIONS

The CDC now suggests that providers consider screening women for TV in high-prevalence settings such as correctional facilities, and that decisions regarding screening be based on the local epidemiology of TV.<sup>11</sup> Our data support routine screening of female detainees at FCJDF, based on our finding of 10% positivity among females who underwent testing. *Trichomonas vaginalis* infections in females are associated with an increased risk of HIV acquisition and adverse pregnancy outcomes.<sup>3,4</sup> To date, no studies have demonstrated that increased case identification and treatment would lead to a reduction in these outcomes, and further investigation in these areas is certainly needed. Nonetheless, adolescents in the juvenile justice system report high rates of unprotected sex, and may be less likely to obtain regular reproductive health care and STI screening because many do not identify a primary care provider.<sup>22,23</sup> The medical contact during detention provides an opportunity for such care, and STI testing should include the pathogens, including NG, CT, and TV, for which female detainees are at increased risk. Targeted education regarding STI risk reduction is also appropriate during these encounters. However, although such interventions may increase knowledge, they have not been shown to lead to significantly lower rates of STI or unprotected sex.<sup>24</sup> Therefore, such efforts do not diminish the need for STI testing.

Looking more broadly at this cohort of females detained at FCJDF, a number of health risks are apparent. Beyond their higher STI prevalence at the time of detention, they reported higher rates of tobacco and alcohol use, self-injurious thoughts and behaviors, and history of prior STI relative to males. A sizable minority (38%) reported a prior pregnancy. It may be that females detained at FCJDF represent a particularly high-risk group for a number of risky health behaviors, and risk-reduction interventions designed specifically for female detainees may be appropriate.

Our data does not support the routine screening of male detainees for TV at this time, as no TV infections were identified in males. It is not clear whether we would have identified more infections in males if our sample size was larger. Several previous studies have demonstrated higher prevalence of TV in females than males in various settings,<sup>12,16,18</sup> consistent with our findings. Furthermore, TV in males has not been demonstrated to be associated with increased HIV acquisition, or adverse pregnancy outcomes in female partners. The CDC does not recommend routine screening of males for TV in any setting at this time.



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**Editorial note regarding this article:**

**The title of this article was changed on May 18, 2020, to avoid confusion with a 2017 poster presentation given by the author. The original article title was: *Trichomonas vaginalis* in Detained Adolescents. Is Routine Screening Indicated? This pdf has been altered solely to reflect the new title and to add this editorial note.**