ORIGINAL RESEARCH

Prevalence and incidence of *Mycoplasma genitalium* in a cohort of HIV-infected and HIV-uninfected pregnant women in Cape Town, South Africa

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ABSTRACT

Objective *Mycoplasma genitalium* (MG) is a sexually transmitted organism associated with cervicitis and pelvic inflammatory disease in women and has been shown to increase the risk of HIV acquisition and transmission. Little is known about the prevalence and incidence of MG in pregnant women. Our study sought to evaluate the prevalence and incidence of MG infection in HIV-infected and HIV-uninfected pregnant women.

Methods We conducted a cohort study of 197 women ≥18 years receiving antenatal care in South Africa from November 2017 to February 2019. We over-recruited HIV-infected pregnant women to compare MG by HIV infection status. Self-collected vaginal swabs, performed at the first antenatal visit, third trimester and within 1 week post partum, were tested for MG using the Aptima assay (Hologic, USA). We report on the prevalence and incidence of MG and used multivariable logistic regression to describe correlates of MG and adverse pregnancy and birth outcomes (preterm delivery, miscarriage and vertical HIV transmission), adjusting for maternal age and HIV infection status.

Results At first antenatal visit, the median age was 29 years (IQR=24–34) and the gestational age was 19 weeks (IQR=14–23); 47% of women enrolled in the study were HIV-infected. MG prevalence was 24% (95% CI 16% to 34%, n=22) in HIV-infected and 12% (95% CI 6.8% to 20%, n=13) in HIV-uninfected pregnant women. MG incidence during pregnancy and early post partum was 4.7 infections per 100 woman-years (95% CI 1.2 to 12.9) or 3.9 per 1000 woman-months (95% CI 1.0 to 10.7). Adjusting for maternal age, HIV-infected women had over three times the odds of being infected with MG (adjusted OR=3.09, 95% CI 1.36 to 7.06).

Conclusion We found a high prevalence and incidence of MG in pregnant women. Younger maternal age and HIV infection were associated with MG infection in pregnancy. Further research into birth outcomes of women infected with MG, including vertical transmission of HIV infection, is needed.

INTRODUCTION

STIs, including *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG) and *Trichomonas vaginalis* (TV), have been shown to increase the risk of HIV acquisition in women.[1 2] In pregnancy, STIs have been shown to nearly double the risk of mother-to-child transmission of HIV in utero and intrapartum.[3]

The bacterium *Mycoplasma genitalium* (MG) is a sexually transmitted organism that was first isolated in 1981 from the urethral specimens of two men with non-gonococcal urethritis (NGU).[4] MG is now a recognised cause of NGU in men and is associated with cervicitis and pelvic inflammatory disease in women.[5] In South Africa, a study of men and women living with and without HIV presenting with male urethral syndrome and vaginal discharge syndrome found that MG prevalence was 8.9% and 10.6%, respectively, and another found that prevalence was inversely correlated with age in women.[6 7]

Prior studies have reported an association between MG infection and HIV acquisition and transmission. In a mechanism similar to other STIs, MG elicits secretion of chronic inflammatory cytokines that reduce the epithelial barrier integrity and increase susceptibility to HIV.[8 9] This mechanism was supported by a meta-analysis in 2009 that showed that participants infected with MG had two times the odds of being HIV-infected, an association which was even stronger in sub-Saharan African studies.[10] In a study of heterosexual HIV discordant and concordant couples in the USA, the odds of partners being concordant HIV-infected were greater when both partners were infected with MG, after adjusting for MG serology, herpes simplex 2 status and stage of HIV disease.[11]

There is limited consensus on the association between MG infection and adverse pregnancy outcomes. A 2015 meta-analysis of MG infection in pregnant women reported an approximately twofold increase in the odds of preterm delivery or spontaneous abortion.[12] However, several studies have shown no association.[13–18] Furthermore, only one study to date has measured the association between MG and adverse pregnancy outcomes in HIV-infected pregnant women.[19] Therefore, many of these prior studies have omitted a potential risk factor for MG infection and a mechanism by which MG may affect pregnancy outcomes.

Despite strong evidence that MG increases the risk of HIV acquisition and transmission, few studies have evaluated the prevalence and incidence of MG infection in pregnant women living with HIV. Our study evaluates the prevalence and incidence of MG infection in pregnant women living with and without HIV, as well as correlates of MG infection.

METHODS

From November 2017 to February 2019, we conducted a cohort study of pregnant women in antenatal care in a public health facility in Cape Town, South Africa to evaluate the prevalence, incidence and correlates of STIs in HIV-infected and HIV-uninfected pregnant women. The setting, eligibility criteria, data collection, and specimen collection and testing have been described elsewhere.[20] Briefly, women ≥18 years of age and currently pregnant (<34 weeks) were invited to participate in the study at their first antenatal care visit. We trained research staff to recruit a purposeful sample of pregnant women from antenatal care. We did not collect information on the number of women eligible for enrolment or response rate in the study because of the nature of the purposeful recruitment from a busy antenatal clinic. The study enrolled a total of 242 women. Women participated in three visits over the course of their pregnancy: at first antenatal visit, third trimester and immediate post partum (7–10 days after delivery). Women self-collected vulvovaginal swab specimens at each visit. Trained staff tested swabs for CT, NG and TV using Xpert assays (Cepheid, Sunnyvale, California). Women who reported symptoms or were infected with an STI were treated in accordance with South Africa National Guidelines.[21] CT infections were treated with 1 g azithromycin orally, NG with ceftriaxone 250 mg intramuscular injection plus 1 g azithromycin orally (2 g azithromycin if significant penicillin allergy), and TV with metronidazole 400 mg orally two times per day for 7 days. For the 12 women who delivered soon after their first antenatal visit, data were not available from the third trimester; however, these women were still included in the study.

Women self-collected a second vaginal swab at each visit which was frozen and stored for future use. A batch analysis in 198 women was conducted for detection of MG using an Aptima assay (Hologic, San Diego, California). Because the analysis was done after the end of the study, the participants were tested and treated for other STIs but not for MG infection.

Trained staff administered questionnaires investigating women's sociodemographic background, sexual history during pregnancy and partner history. Data on HIV status were determined using Toyo Anti-HIV-1/2 (TurkLab, İzmir, Turkey) and confirmed using Determine HIV-1/2 Ag/Ab Combo (Alere, Scarborough, Maine) administered at each study visit if the participant was HIV-negative at the prior visit. Trained staff collected self-reported pregnancy and birth outcomes at the postpartum visit. Adverse pregnancy or birth outcomes included preterm delivery (defined as delivery at <37 weeks' gestation), miscarriage (defined as fetal death at any gestational age prior to delivery) and vertical transmission of HIV infection.

Statistical analysis

We used univariate and bivariate analyses to describe participant characteristics. Categorical variables are reported as frequencies and percentages. Continuous variables are reported as medians and IQRs. We calculated incidence rate as the number of new MG infections per 100 woman-years (or 1000 woman-months) of follow-up in participants with a negative MG test at first antenatal visit. We used logistic regression models to evaluate the association between baseline HIV status and MG infection. In addition, we evaluated secondary outcomes including sociodemographic and health factors associated with MG infection. We also used logistic regression to evaluate the association between MG infection and adverse pregnancy or birth outcome, defined as miscarriage, preterm delivery at fewer than 37 weeks' gestation and/or vertical transmission of HIV. We developed directed acyclic graphs (DAGs) for each of our models following published guidelines to understand the relationship between the variables in our study and associations.[22] We chose variables which described our prediction needs best based on a priori knowledge. Additionally, we included variables which were significant in univariate analysis ($p<0.5$) and excluded variables that accounted for little variation seen. The relationship between variables and outcomes was considered using the DAG model. Variables were excluded if they were found to be mediating or associated with only the exposure or outcome; only confounding variables were included in the final regression model. Statistical analyses were performed using SAS V.9.4 software.Ethics

RESULTS

Demographic and clinical characteristics of pregnant women attending first antenatal visit

We enrolled 197 pregnant women at their first antenatal visit: 92 (47%) were HIV-infected and 105 (53%) were HIV-uninfected. The median age of women living with HIV was 32 years (IQR=28–36) and the median gestational age was 19 weeks (IQR=15–23). Among women living without HIV, the median age was 26 years (IQR=22–32) and the median gestational age was 19 weeks (IQR=13–24). Fewer than half of all participants reported being married to or cohabiting with the father of their child (48%, n=94). Nearly all participants reported having vaginal sex during pregnancy (92%, n=181), and very few reported having oral or anal sex (3.1% and 2.5%, respectively). Reports of having more than one sexual partner were found only in women living with HIV (100%, n=2). The majority of women participating in the study did not report STI-related symptoms (77%, n=151). However, women living with HIV were significantly more likely to report vaginal bleeding compared with their uninfected counterparts (80% vs 20%, p=0.008) (table 1).

Prevalence and incidence of MG

At first antenatal visit, 24% (95% CI 16% to 34%, n=22) of women living with HIV and 12% (95% CI 6.8% to 20%, n=13) of women living without HIV were infected with MG. Of the total 35 MG infections at baseline, 51% (n=18) were MG monoinfections. There was no difference in the proportion of MG monoinfections among women living with HIV (9.8%, n=9) and without HIV (8.6%, n=9) (p=0.105). Among women living with HIV, TV was the most common coinfection with MG (8.7%, n=8), whereas CT was more common among women living without HIV (12%, n=3) (figure 1 and online supplementary table 1). Among 162 women who were MG-negative at first antenatal visit, there were three incident infections during 760 woman-months of follow-up (median=5 months, IQR=3–6). Two of the three incident infections occurred in women living with HIV. There was no difference in follow-up time among women living with HIV (321 woman-months total, median=5, n=71) and without HIV (439 woman-months total, median=5, n=92) (p=0.106). The incidence rate was 4.7 per 100 woman-years (95% CI 1.2 to 12.9) or 3.9 per 1000 woman-months (95% CI 1.0 to 10.7).

Correlates of MG infection at first antenatal visit

Characteristics were compared for pregnant women with and without MG infection. Being unmarried, not cohabiting with or having no relationship with the father of their child was associated with increased risk of MG in crude analysis but was attenuated after adjusting for age and HIV status (adjusted OR (aOR)=1.55, 95% CI 0.69 to 3.49). Reporting intimate partner

Table 1 Demographic and clinical characteristics of pregnant women attending first antenatal visit in MG study by HIV infection status, Cape Town, South Africa, 2017–2019 (N=197)

	Total, n	%	HIV-positive, n	%	HIV-negative, n	%
Total	197	100	92	47	105	53
Maternal age in years, median (IQR)	29 (24–34)		32 (28–36)		26 (22–32)	
Gestational age in weeks, median (IQR)	19 (14–23)		19 (15–23)		19 (13–24)	
Relationship with father of child						
Married/cohabiting	94	48	42	46	52	50
Unmarried/not cohabiting/no relationship	103	52	50	54	53	50
Ever experienced intimate partner violence	4	2	2	2.2	2	1.9
Sexual behaviour during pregnancy						
Vaginal sex	181	92	82	89	99	94
Oral sex	6	3.1	3	3.3	3	2.9
Anal sex	5	2.5	3	3.3	2	1.9
Sex partners in the past 3 months						
1	195	99	90	98	105	100
2	2	1	2	2.2	0	0
Suspect partner of having other sex partners						
No	103	52	44	48	59	56
Yes	63	32	36	39	27	26
Don't have a partner	5	2.5	4	4.4	1	1
Don't know	26	13	8	8.7	18	17
STI status						
Current STI (CT, NG, TV and/or MG)	83	42	46	50	37	35
CT	40	20	18	20	22	21
NG	13	6.6	10	11	3	2.9
TV	30	15	20	22	10	9.5
MG	35	18	22	24	13	12
STI symptoms during pregnancy						
Any	46	23	22	24	24	23
Vaginal discharge	27	14	11	12	16	15
Pain during intercourse	12	6.1	6	6.5	6	5.7
Pain during urination	9	4.6	4	4.4	5	4.8
Vaginal bleeding	5	2.5	4	4.4	1	1
Genital sores	6	3.1	3	3.3	3	2.9
CD4 count () (cells x 10^9/L) (n=6 missing)						
<0.5	44	51	44	51	–	–
≥0.5	42	49	42	49	–	–
Viral load (copies/mL) (n=3 missing)						
<1000	74	83	74	83	–	–
≥1000	15	17	15	17	–	–
Couple serostatus						
Concordant HIV-uninfected	70	36	–	–	70	67
Concordant HIV-infected	28	14	28	30	–	–
Discordant	22	11	18	20	4	3.8
Don't know	77	39	46	50	31	30
Partner serostatus						
Partner HIV-uninfected	88	45	18	20	70	67
Partner HIV-infected	32	16	28	30	4	3.8
Don't know	77	39	46	50	31	30

CT, *Chlamydia trachomatis*; MG, *Mycoplasma genitalium*; NG, *Neisseria gonorrhoeae*; TV, *Trichomonas vaginalis*.

violence was associated with increased odds of MG infection after adjusting for age, HIV and relationship status (aOR=7.66, 95% CI 0.92 to 63.87). Nearly all women reported having vaginal sex during pregnancy, but this was not associated with MG infection. Having more than one partner during pregnancy was not associated with MG infection, and neither was suspecting the partner of having more than one sexual partner. The majority of women infected with MG were asymptomatic (77%, n=27). The most frequently reported symptoms among MG-infected women were vaginal discharge (11%, n=4), followed by vaginal bleeding (9%, n=3). In crude analysis, women with MG monoinfections were more likely to report vaginal bleeding (OR=6.65, 95% CI 0.40 to 111.33) (online supplementary table 2). Coinfection with another STI (CT, NG and/or TV) was associated

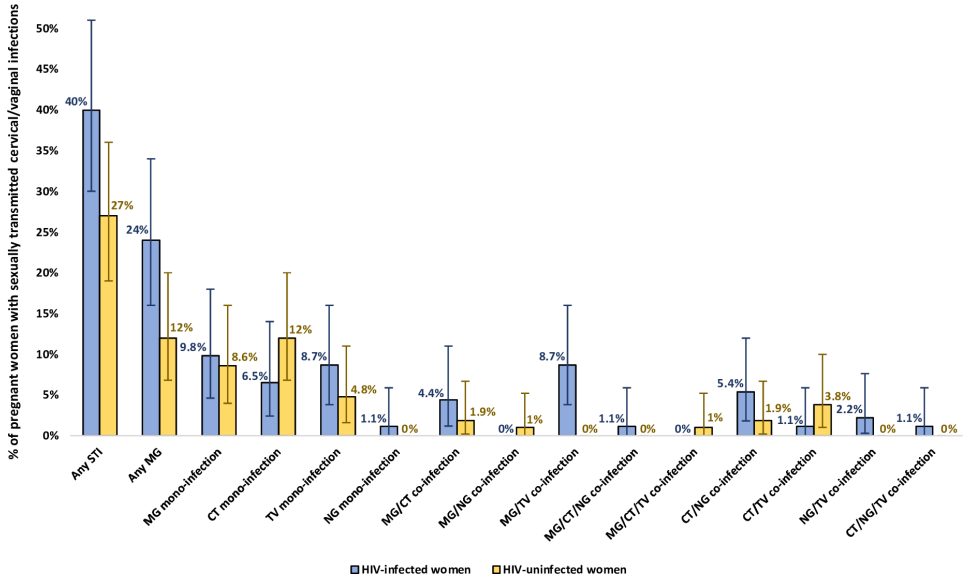

Figure 1 Prevalence of *Mycoplasma genitalium* (MG) and STI by type in pregnant women attending first antenatal visit in Cape Town, South Africa, 2017–2019 (N=197). STIs include *Chlamydia trachomatis* (CT), *Neisseria gonorrhoeae* (NG) and *Trichomonas vaginalis* (TV).

with MG infection in crude analysis (OR=2.24, 95% CI 1.07 to 4.72). This was driven primarily by coinfection with TV infection, which was associated with increased odds of MG infection after adjusting for age and HIV status (aOR=2.00, 95% CI 0.80 to 5.03).

Among women living with HIV, there was twice the odds of having MG if the woman was infected with other STIs after adjusting for maternal age (aOR=2.88, 95% CI 1.04 to 7.96). Among women living without HIV, there was no association between MG infection and other STIs (aOR=1.08, 95% CI 0.29 to 4.02) after adjusting for maternal age. Finally, after adjusting for age, pregnant women living with HIV had three times the odds of MG infection (aOR=3.09, 95% CI 1.36 to 7.06). However, partners' HIV serostatus and concordance between partners were not associated with MG infection (table 2).

Clearance and persistence of MG

Of the 35 women who were infected with MG at first antenatal visit, 15 (43%) cleared MG infection by either the third trimester (n=8) or postpartum visit (n=7). Of the eight women who cleared at the third trimester visit, one was reinfected at the postpartum visit (figure 2). Coinfection with CT/NG and appropriate treatment with azithromycin were associated with increased odds of clearance after adjusting for age (aOR=29.05, 95% CI 2.95 to 285.89). Women who were treated with azithromycin cleared the MG infection (611 woman-days total, median=49, n=9) faster than those who were not treated (913 woman-days total, median=156, n=6) (p=0.002) (online supplementary figure 1). No association was found between clearance of MG infection and maternal age, gestational age, being married to or cohabiting with the father of their child, or HIV infection (online supplementary table 3).

Adverse pregnancy and birth outcomes in MG-infected women

We found that 27 of 185 women with a postpartum visit (15%) experienced an adverse pregnancy or birth outcome, defined as miscarriage, preterm delivery at fewer than 37 weeks' gestation and/or vertical transmission of HIV. In women living without HIV and with MG infection, there were no adverse pregnancy outcomes. Overall, 4 of 21 women living with HIV and MG infection had an adverse pregnancy outcome (19%) compared with 9 of 65 women living with HIV and without MG infection (14%) (online supplementary table 4). There were increased odds of having an adverse pregnancy outcome in women living with HIV and MG infection after controlling for maternal age, syphilis infection and partners' HIV status (aOR=4.87, 95% CI 0.71 to 33.32).

DISCUSSION

Our study measured the prevalence and incidence of MG infection among pregnant women living with and without HIV attending antenatal care in a community health centre in Cape Town, South Africa. We found a high prevalence and incidence of MG infection in the study. Women living with HIV had increased odds of MG infection. The majority of MG monoinfections were asymptomatic, but in crude analysis women with MG monoinfections were more likely to report vaginal bleeding. Coinfection with another STI (CT, NG and/or TV) was associated with MG infection in crude analysis but was attenuated after adjusting for age, HIV status and STI coinfection. The clearance of MG was associated with azithromycin treatment for CT and/or NG coinfection. Finally, our study was underpowered to detect any association between MG infection and adverse pregnancy outcomes, but women living with HIV had increased odds of having an adverse pregnancy outcome if they were also infected with MG.

The prevalence of MG among pregnant women living with and without HIV in our study is higher than that reported for non-pregnant women living with and without HIV in Johannesburg, South Africa, as well as for that estimated for women in the general population by Baumann *et al*.[6 23] However, the incidence of MG in our study is lower than that reported by three studies in sub-Saharan Africa, which ranged from 6.6 to 34.6 incident MG infections per 100 person-years.[24–26] Several differences exist between our study and those cited which may explain the variability. Our higher prevalence may be attributed to (1) inclusion of pregnant women, who have unique immune profiles and susceptibility to infection; (2) oversampling of HIV-infected women who represent a high-risk population for MG infection;

Table 2 Factors associated with MG infection in pregnant women attending first antenatal visit in MG study by HIV infection status, Cape Town, South Africa, 2017–2019 (N=197)*

	Total, n	%	HIV-positive/ MG-positive, n	%	HIV-positive/ MG-negative, n	%	HIV-negative/ MG-positive, n	%	HIV-negative/ MG-negative, n	%	OR (95% CI)	Adjusted OR (95% CI)
Total	197	100	22	11	70	36	13	6.6	92	47		
Maternal age, median (IQR)	29 (24–34)		30 (24–33)		33 (28–36)		25 (22–28)		27 (22–32)		0.96 (0.90 to 1.02)	
18–24 years	50	25	6	27	6	8.6	4	31	34	37	2.38 (0.69 to 8.22)	
25–34 years	105	53	12	55	38	54	9	69	46	50	2.38 (0.76 to 7.40)	
35–45 years	42	21	4	18	26	37	0	0	12	13	Reference	
Gestational age, median weeks (IQR)	19 (14–23)		20 (15–21)		19 (14–23)		21 (18–26)		19 (13–24)		1.04 (0.98 to 1.10)	
Relationship with the father of the child												
Married/cohabiting	94	48	7	32	35	50	5	38	47	51	Reference	
Unmarried/not cohabiting/no relationship	103	52	15	68	35	50	8	62	45	49	1.97 (0.92 to 4.21)	1.55 (0.69 to 3.49)*
Ever experienced intimate partner violence	4	2	1	4.6	1	1.4	1	7.7	1	1.1	4.85 (0.66 to 35.66)	7.66 (0.92 to 63.87)†
Sexual behaviour during pregnancy												
Vaginal sex	181	92	19	86	63	90	13	100	86	93	0.93 (0.25 to 3.46)	
Oral sex	6	3.1	1	4.6	2	2.9	0	0	3	3.3	0.92 (0.11 to 8.16)	
Anal sex	5	2.5	0	0	3	4.3	0	0	2	2.2	–	
Sex partners during pregnancy												
≤1	195	99	21	95	69	99	13	100	92	100	Reference	
>1	2	1	1	4.6	1	1.4	0	0	0	0	4.74 (0.29 to 77.59)	
Suspect partner of having other sex partners												
No	103	52	11	50	33	47	8	62	51	55	Reference	
Yes	63	32	8	36	28	40	3	23	24	26	0.94 (0.41 to 2.12)	
Don't have a partner	5	2.5	1	4.6	3	4.3	0	0	1	1.1	1.11 (0.12 to 10.46)	
Don't know	26	13	2	9.1	6	8.6	2	15	16	17	0.80 (0.25 to 2.61)	
STI diagnosis in study												
Negative	132	67	9	41	46	66	9	69	68	74	Reference	
Positive (CT, NG and/or TV)	65	33	13	59	24	34	4	31	24	26	**2.24 (1.07 to 4.72)**	1.82 (0.85 to 3.93)†
CT	40	20	5	23	13	19	3	23	19	21	1.20 (0.50 to 2.90)	
NG	13	6.6	1	4.6	9	13	1	7.7	2	2.2	0.83 (0.18 to 3.93)	
TV	30	15	8	36	12	17	1	7.7	9	9.8	2.32 (0.96 to 5.64)	2.00 (0.80 to 5.03)†
STI symptoms during pregnancy												
Any	46	23	6	27	16	23	2	15	22	24	0.97 (0.41 to 2.31)	
Vaginal discharge	27	14	3	14	8	11	1	7.7	15	16	0.78 (0.25 to 2.42)	
Pain during intercourse	12	6.1	2	9.1	4	5.7	0	0	6	6.5	0.92 (0.19 to 4.40)	
Pain during urination	9	4.6	1	4.6	3	4.3	0	0	5	5.4	0.57 (0.07 to 4.68)	
Vaginal bleeding	5	2.5	3	14	1	1.4	0	0	1	1.1	**7.50 (1.20 to 46.71)**	6.17 (0.82 to 46.32)‡
Genital sores	6	3.1	0	0	3	4.3	1	7.7	2	2.2	0.92 (0.11 to 8.16)	
HIV status												

Continued

Table 2 Continued

	Total, n	%	HIV-positive/ MG-positive, n	%	HIV-positive/ MG-negative, n	%	HIV-negative/ MG-positive, n	%	HIV-negative/ MG-negative, n	%	OR (95% CI)	Adjusted OR (95% CI)
Negative	105	53	–	–	–	–	13	100	92	100	Reference	
Positive	92	47	22	100	70	100	–	–	–	–	**2.22 (1.05 to 4.72)**	**3.09 (1.36 to 7.06)§**
CD4 count (cells x 10^9/L) (n=6 missing)												
<0.5	44	51	11	52	33	51	–	–	–	–	1.07 (0.40 to 2.86)	
≥0.5	42	49	10	48	32	49	–	–	–	–	Reference	
Viral load (copies/mL) (n=3 missing)												
<1000	74	83	16	76	58	85	–	–	–	–	Reference	
≥1000	15	17	5	24	10	15	–	–	–	–	1.81 (0.54 to 6.07)	
Couple serostatus												
Concordant HIV-uninfected	70	36	–	–	–	–	9	69	61	66	Reference	
Concordant HIV-infected	28	14	5	23	23	33	–	–	–	–	1.47 (0.45 to 4.86)	
Discordant	22	11	4	18	14	20	0	0	4	4.4	1.51 (0.42 to 5.47)	
Don't know	77	39	13	59	33	47	4	31	27	29	1.92 (0.79 to 4.64)	
Partner serostatus												
Partner HIV-uninfected	88	45	4	18	14	20	9	69	61	66	Reference	
Partner HIV-infected	32	16	5	23	23	33	0	0	4	4.4	1.07 (0.35 to 3.28)	
Don't know	77	39	13	59	33	47	4	31	27	29	1.64 (0.74 to 3.63)	

Confidence intervals in bold had sufficient evidence to conclude that the groups were statistically significantly different.
*Model adjusted for maternal age and HIV infection status.
†Model adjusted for maternal age, HIV infection status and partner relationship status.
‡Model adjusted for maternal age, HIV infection status and STI coinfection (CT, NG, and/or TV).
§Model adjusted for maternal age.
CT, *Chlamydia trachomatis*; MG, *Mycoplasma genitalium*; NG, *Neisseria gonorrhoeae*; TV, *Trichomonas vaginalis*.

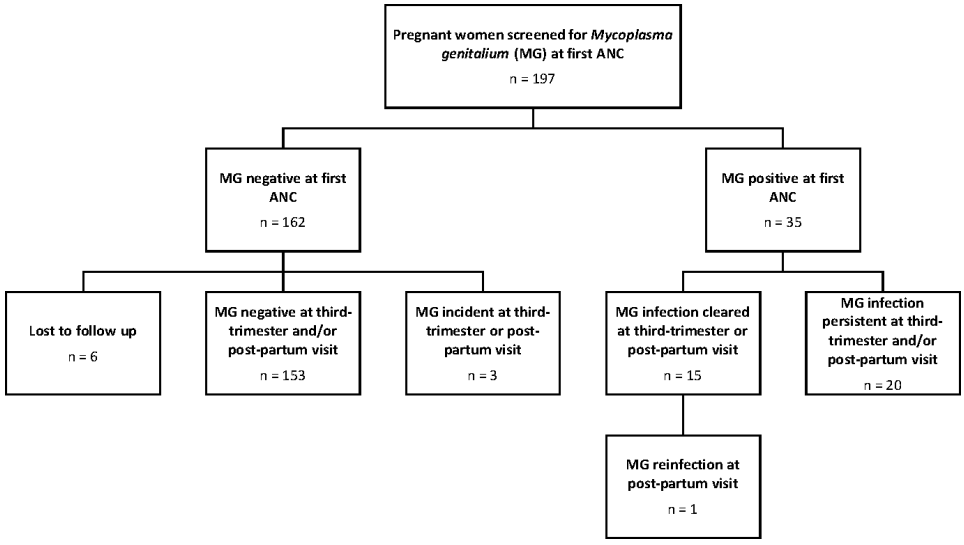

Figure 2 Clearance and persistence of *Mycoplasma genitalium* in pregnant women screened at first antenatal visit in Cape Town, South Africa, 2017–2019 (N=197). ANC, antenatal care.

and (3) setting in a country with a medium Human Development Index score as compared with high score. Finally, the three studies with higher incidence were conducted in populations of female sex workers, a population at greater risk for STIs than our population of pregnant women from the general population.

Pregnant women living with HIV had three times the odds of MG infection, a finding consistent with that found in a prior meta-analysis which concluded that across 10 studies in sub-Saharan Africa, participants with MG had a greater than twofold increase in the odds of being HIV-infected.[10] The majority of women with MG infections in our study were asymptomatic, a finding consistent with the literature.[27–29] While vaginal bleeding was associated with MG infection in crude analysis, this association was attenuated after controlling for HIV status, a conclusion similarly made by Ong *et al*[30] between MG monoinfection and postcoital bleeding.

A meta-analysis by Lis *et al*[12] showed that MG infection in pregnant women was associated with an increased risk for preterm birth and spontaneous abortion. However, these studies excluded pregnant women with HIV. Our study was underpowered to detect any association between MG infection and adverse pregnancy outcomes. Furthermore, our study did not include other factors which may account for the adverse pregnancy outcomes experienced by these women, such as the use of tobacco, alcohol and elicit drugs and exposure to infectious organisms during pregnancy. To provide evidence for a targeted approach of testing pregnant women at high risk of MG infection as a strategy to reduce rates of adverse pregnancy outcomes, further investigation into the association between MG and adverse pregnancy outcomes in pregnant women living with HIV is necessary.

While our study provides important insight into this emerging pathogen, there are potential limitations. First, our results are limited by a small sample size, which made it difficult to identify significant relationships from the data. Therefore, our estimates may be conservative and underestimate correlates and outcomes of MG infection. Second, our data were collected from a single site, which limits the geographical scope of participants. However, the clinic offers a good representation of other clinics in the region.[20] Specifically, the clinic population has similar sociodemographics with the region considering race, gender, poverty distribution and health make-up, and with local health centres, including clinicians, staff, services offered and adherence to syndromic management guidelines. Finally, we collected self-reported data on partners' HIV infection status, sexual activity (including number of sex partners) and intimate partner violence, which may under-report the true prevalence of these behaviours. These limitations should be addressed in future research.

A review of the literature highlights how little is known about the impact of MG infection on HIV acquisition and transmission and birth outcomes. Our results suggest that there is a high prevalence of MG among pregnant women living with HIV in South Africa. While most MG infections were asymptomatic, vaginal bleeding may be associated with MG. Exploring the relationship between MG and HIV infection in pregnant women and measuring perinatal and postnatal outcomes will further our understanding of this emerging STI and of modifiable cofactors of HIV. Future quantitative studies on the importance and epidemiological determinants of MG are necessary in order to determine whether to include MG in existing STI and antimicrobial resistance monitoring strategies.

CONCLUSION

Our study demonstrates a high prevalence and incidence of MG infection in pregnant women. Correlates for MG include maternal HIV infection and maternal age. The majority of MG infections are asymptomatic. Further research into the correlates

Key messages

- The prevalence of urogenital *Mycoplasma genitalium* (MG) was 24% (n=22) in HIV-infected and 12% (n=13) in HIV-uninfected pregnant women in Cape Town.
- The incidence of MG during pregnancy and early post partum was 4.7 infections per 100 woman-years (95% CI 1.2 to 12.9) or 3.9 per 1000 woman-months (95% CI 1.0 to 10.7).
- After adjusting for age, women with HIV had three times the odds of being infected with MG compared with women without HIV (adjusted OR=3.09, 95% CI 1.36 to 7.06).

of MG infection and the reproductive sequela of MG in pregnant women living with HIV is needed.

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Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. Analyses were performed from data collected from women attending an antenatal care clinic. Data were maintained in a database using deidentified participant coding. Additional information can be made available on request.

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