The demographic, sexual health and behavioural correlates of *Mycoplasma genitalium* infection among women with clinically suspected pelvic inflammatory disease

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**ABSTRACT**

**Objective** *Mycoplasma genitalium* has been identified as a cause of pelvic inflammatory disease (PID), a clinic syndrome associated with inflammation of the female upper genital tract and serious reproductive sequelae. As the demographic, behavioural and sexual risk profile of women with *M genitalium*-associated PID is not well understood, the characteristics of *M genitalium*-infected women presenting with clinically suspected PID were investigated.

**Methods** Data from 586 participants in the PID Evaluation and Clinical Health Study were analysed. Demographic, sexual history and behavioural characteristics, including age, race, marital status, education level, sexual activity, number of sexual partners, history of sexually transmitted infection (STI), bacterial vaginosis and PID, contraception use, oral and anal sex, age at sexual debut, douching practices and drug, alcohol and tobacco use, were compared between 88 women testing positive and 498 women testing negative for *M genitalium* by PCR in the cervix and/or endometrium. Twenty-two women with *M genitalium* mono-infections were compared with 172 women who tested positive for *Neisseria gonorrhoeae* by culture and/or *Chlamydia trachomatis* by PCR.

**Results** Age under 25 years (odds ratio (OR) 2.3, 95% CI 1.3 to 4.1), douching two or more times per month (OR 1.9, 95% CI 1.2 to 3.3) and smoking (OR 1.9, 95% CI 1.2 to 3.3) were significantly associated with women with *M genitalium* infection. As results for *N gonorrhoeae* infection and/or *C trachomatis* were similar, only results for combined cervical and/or endometrial infections were presented. The *χ²* test was used to compare the risk profile of women with *M genitalium* mono-infection with women with *C trachomatis* and/or *N gonorrhoeae* infection. As results for lower and upper genital tract *M genitalium* infection were similar, only results for combined cervical and/or endometrial *M genitalium* are presented. The *χ²* test was used to compare the risk profile of women with *M genitalium* mono-infection with women with *C trachomatis* and/or *N gonorrhoeae* infection.

**RESULTS** Age under 25 years (odds ratio (OR) 2.3, 95% CI 1.3 to 4.1), douching two or more times per month (OR 1.9, 95% CI 1.2 to 3.3) and smoking (OR 1.9, 95% CI 1.2 to 3.3) were significantly associated with *M genitalium* infection among women with PID.

**Conclusion** *Mycoplasma genitalium* has recently been cited as a possible cause of pelvic inflammatory disease (PID), the inflammation of the female upper genital tract caused by the ascension of organisms from the lower genital tract. As serious sequelae, including tubal factor infertility and chronic pelvic pain frequently follow an episode of PID, it is important to identify correlates associated with PID-causing pathogens. As the risk factors associated with *M genitalium* infection among women with PID have not been studied, we sought to describe the demographic, sexual health and behavioural correlates for *M genitalium* in a population of women with clinically suspected PID. We hypothesise that the risk profile of *M genitalium* will be similar to that for *Chlamydia trachomatis* and *Neisseria gonorrhoeae*.
Table 1  Characteristics of study participants and association with *M* genitalium cervical and/or endometrial infection

| Characteristic                                      | M. genitalium positive N = 88 | M. genitalium negative N = 498 | OR (95% CI) | AOR (95% CI) |
|----------------------------------------------------|-------------------------------|-------------------------------|-------------|---------------|
| **Demographics**                                   |                               |                               |             |               |
| Age < 25 years                                     | 71 (18.2)                     | 319 (81.8)                    | 2.3 (1.3 to 4.1) | 2.7 (1.5 to 4.7) |
| ≥ 25 years                                         | 17 (8.7)                      | 179 (91.3)                    |             |               |
| Race/ethnicity                                      |                               |                               |             |               |
| African-American                                   | 69 (16.2)                     | 358 (83.8)                    | 1.4 (0.8 to 2.4) | –†            |
| White/Hispanic/other                               | 19 (11.9)                     | 140 (99.1)                    |             |               |
| Marital status                                     |                               |                               |             |               |
| Unmarried                                          | 71 (14.7)                     | 411 (85.3)                    | 1.4 (0.6 to 3.1) | –†            |
| Married                                            | 7 (11.3)                      | 55 (88.7)                     |             |               |
| Education                                          |                               |                               |             |               |
| < High school                                      | 38 (16.7)                     | 189 (83.3)                    | 1.2 (0.8 to 2.0) | –†            |
| ≥ High school                                      | 50 (13.9)                     | 308 (86.0)                    |             |               |
| Sexual health                                      |                               |                               |             |               |
| Sexually active                                    |                               |                               |             |               |
| Yes                                                | 78 (15.8)                     | 415 (84.2)                    | 1.6 (0.8 to 3.1) | –†            |
| No                                                 | 10 (10.7)                     | 83 (89.2)                     |             |               |
| Two or more lifetime sexual partners               |                               |                               |             |               |
| Yes                                                | 10 (17.9)                     | 46 (82.1)                     | 1.3 (0.6 to 2.6) | –†            |
| No                                                 | 78 (14.7)                     | 452 (85.3)                    |             |               |
| New sexual partner in past month                   |                               |                               |             |               |
| Yes                                                | 10 (17.5)                     | 47 (82.5)                     | 1.2 (0.6 to 2.5) | –†            |
| No                                                 | 78 (14.7)                     | 451 (85.3)                    |             |               |
| History of STIs                                    |                               |                               |             |               |
| Yes                                                | 52 (15.0)                     | 295 (85.0)                    | 1.0 (0.6 to 1.6) | –†            |
| No                                                 | 35 (15.0)                     | 198 (85.0)                    |             |               |
| History of bacterial vaginosis                     |                               |                               |             |               |
| Yes                                                | 13 (10.0)                     | 117 (90.0)                    | 0.6 (0.3 to 1.0) | –†            |
| No                                                 | 73 (16.7)                     | 365 (83.3)                    |             |               |
| History of PID                                     |                               |                               |             |               |
| Yes                                                | 23 (12.9)                     | 155 (87.1)                    | 0.8 (0.5 to 1.3) | –†            |
| No                                                 | 64 (15.9)                     | 338 (84.1)                    |             |               |
| Hormonal contraception use                         |                               |                               |             |               |
| Yes                                                | 17 (15.6)                     | 92 (84.4)                     | 0.9 (0.5 to 1.8) | –†            |
| No                                                 | 61 (15.9)                     | 323 (84.1)                    |             |               |
| Rare/occasional condom use¶                        |                               |                               |             |               |
| Yes                                                | 60 (17.2)                     | 289 (82.8)                    | 1.4 (0.8 to 2.6) | –†            |
| No                                                 | 18 (12.5)                     | 126 (87.5)                    |             |               |
| Consistent condom use**                            |                               |                               |             |               |
| Yes                                                | 7 (10.9)                      | 57 (89.1)                     | 1.2 (0.5 to 2.7) | –†            |
| No                                                 | 71 (16.5)                     | 358 (83.5)                    |             |               |
| Oral sex                                           |                               |                               |             |               |
| Yes                                                | 23 (17.6)                     | 108 (82.4)                    | 1.2 (0.7 to 2.0) | –†            |
| No                                                 | 63 (15.0)                     | 356 (85.0)                    |             |               |
| Anal sex                                           |                               |                               |             |               |
| Yes                                                | 4 (21.1)                      | 15 (78.9)                     | 1.5 (0.5 to 4.7) | –†            |
| No                                                 | 84 (14.8)                     | 489 (85.2)                    |             |               |
| Age at sexual debut                                |                               |                               |             |               |
| ≤ 15 years                                         | 48 (15.8)                     | 255 (84.2)                    | 1.1 (0.7 to 1.8) | –†            |
| > 15 years                                         | 40 (14.1)                     | 243 (85.9)                    |             |               |
| Behavioural                                        |                               |                               |             |               |
| Vaginal douche two or more times in past month     |                               |                               |             |               |
| Yes                                                | 26 (22.8)                     | 88 (77.8)                     | 1.9 (1.2 to 3.3) | 2.0 (1.2 to 3.4) |
| No                                                 | 62 (13.1)                     | 410 (86.9)                    |             |               |
| Illicit drug use                                   |                               |                               |             |               |
| Yes                                                | 32 (20.4)                     | 125 (79.6)                    | 1.7 (1.0 to 2.7) | –†            |
| No                                                 | 56 (13.1)                     | 370 (86.9)                    |             |               |
| Current smoker                                     |                               |                               |             |               |
| Yes                                                | 49 (20.2)                     | 194 (79.8)                    | 1.9 (1.2 to 3.1) | 2.0 (1.3 to 3.3) |
| Continued                                          |                               |                               |             |               |
these same women should also be screened for factors for these pathogens and screening efforts could help detect and treat uncomplicated lower C trachomatis. African-American (59.1% vs 86.0%, p<0.001) than women with N gonorrhoeae. Variables with a p value greater than 0.10 were not included in the multivariate analysis.

Women with M genitalium mono-infection (n=22) were generally similar to women with C trachomatis and/or N gonorrhoeae (n=172) (results not shown). The only characteristic that differed between these two groups was race. Women with M genitalium mono-infection were significantly less likely to be African-American (59.1% vs 86.0%, p=0.001) than women with C trachomatis and/or N gonorrhoeae.

DISCUSSION

Among women with clinically suspected PID, compared with women who tested negative, women positive for M genitalium in the cervix and/or endometrium were more likely to have some characteristics and behaviours that are commonly associated with other sexually transmitted infections (STI) and PID, including young age, smoking and douching. Furthermore, the characteristics of M genitalium were similar to those of N gonorrhoeae and C trachomatis. However, M genitalium infection was not associated with all traditional markers of STI, including sexual activity, number of sexual partners, new sexual partner, history of STI or PID, condom use, oral and anal sex and age at sexual debut. Our findings are not consistent with other studies that have examined the risk factors for M genitalium lower genital tract infection.6–7 However, all women enrolled in our study had clinically suspected PID. Therefore, they may have had a homogeneity of sexual risk behaviours, which probably biased these variables towards the null.

As patients infected with M genitalium may have mild symptoms,5–7 an understanding of risk factors may aid efforts to reduce the acquisition, spread and complications of infection. As clinicians may use certain risk factors to decide who to screen for STI, including N gonorrhoeae and C trachomatis, and the risk factors for these pathogens and M genitalium are largely the same, these same women should also be screened for M genitalium. Such screening efforts could help detect and treat uncomplicated lower genital tract M genitalium infections, which could ultimately prevent some PID cases.

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**Contributors**

VLS analysed the data and wrote the final draft; CLH conceived the paper and edited the manuscript; PAT, RBN, SFK and PM edited the manuscript; SGA and PAT assisted with laboratory analyses.

**Competing interests**

None.

**Ethics approval**

Ethics approval was obtained from the University of Pittsburgh.

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