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Correlates of Cervical *Mycoplasma genitalium* and Risk of Preterm Birth Among Peruvian Women

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Abstract

Background—*Mycoplasma genitalium* is associated with cervicitis and pelvic inflammatory disease in nonpregnant women. We investigated associations between cervical *M. genitalium*, demographic and behavioral risk factors for sexually transmitted infection and preterm birth among low-income Peruvian women.

Methods—This case-control study, conducted at the Instituto Nacional Materno Perinatal, Lima, Peru, included 661 cases with a spontaneous preterm birth at <37 weeks and 667 controls who delivered at ≥37 weeks. Within 48 hours after delivery, subjects underwent interviews, medical record review, and collection of cervicovaginal specimens for *M. genitalium*, *Chlamydia trachomatis*, and *Neisseria gonorrhoeae* by nucleic acid amplification testing, and *Trichomonas vaginalis* by culture. Odds ratios and 95% confidence intervals were calculated for associations between *M. genitalium*, other genital infections and risk factors, and preterm birth. Multivariable logistic regression was used to adjust for potential confounders.

Results—Cervical *M. genitalium* was detected in 3% of subjects and was significantly associated with *C. trachomatis* infection ($P < 0.001$) and preterm birth (4% vs. 2%; adjusted odds ratio: 2.5, 95% confidence interval: 1.2–5.0, $P = 0.014$), and marginally associated with *T. vaginalis* ($P = 0.05$). *M. genitalium* detection was also associated with younger maternal age ($P = 0.003$) but not with other risk factors for preterm birth. The association between cervical *M. genitalium* detection and preterm birth remained significant after adjustment for maternal age and coinfection with *C. trachomatis* or *T. vaginalis*.

Conclusions—Cervical *M. genitalium* detection was independently associated with younger maternal age and preterm birth, suggesting that this organism may be an infectious correlate of spontaneous preterm birth.

Mycoplasma genitalium is a fastidious sexually transmitted microorganism first isolated in 1981 from urethral specimens of men with urethritis¹ and more recently identified from cervical² specimens using polymerase chain reaction (PCR) technology. This organism seems to infect the cervix^{2–5} and is capable of invading the upper reproductive tract in

nonpregnant women.^{6,7} However, as yet little is known about reproductive consequences of *M. genitalium* infection during pregnancy.

Epidemiologic evidence points to several other lower genital tract infections including bacterial vaginosis, *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, and *Trichomonas vaginalis* as important antecedents of preterm birth.^{8–13} These vaginal and cervical infections probably result in subclinical ascending infection of the upper genital tract before or in early pregnancy, thus increasing risk for preterm birth. The micro-organisms most frequently isolated by culture from the amniotic fluid of women with preterm deliveries include anaerobic bacteria, mycoplasmas, and ureaplasmas.^{14–16} To date there is little information about potential associations between *M. genitalium* and preterm birth. We therefore conducted a case-control study of microbial and behavioral correlates of preterm birth among postpartum women in Lima, Peru, to test the hypothesis that *M. genitalium* detection in the endocervix immediately postpartum would be associated with spontaneous preterm birth, independent of demographic, behavioral and other infectious factors.

MATERIALS AND METHODS

This case-control study was conducted at the Instituto Nacional Materno Perinatal in Lima, Peru between October 2002 and June 2004. This large maternity hospital averages 20,000 deliveries per year. Approximately 7% (1400) of births occur at <37 weeks' gestation with 20% (280) of these having maternal or fetal indications for preterm delivery, leaving approximately 1120 spontaneous preterm births annually. Potential subjects were screened for eligibility immediately after delivery. Preterm cases included women with a spontaneous preterm delivery at 20 to 36 weeks' gestation. Term controls included the next consecutive spontaneous term delivery (at ≥37 weeks' gestation) after each preterm case, with a case: control ratio of 1:1. Gestational age was determined by newborn physical examination; 6 stillborn infants did not have a physical exam performed, and for these infants, gestational age was determined by last menstrual period (n = 4) or ultrasound if available and >2 weeks discordance between menstrual dating and ultrasound (n = 2). Both cases and controls included women ≥12 years of age who had presented with spontaneous labor. Women who required labor induction or had a maternal or fetal indication for delivery were not eligible. Women with ruptured membranes or who required labor augmentation were eligible, as long as they had initially presented in spontaneous labor. Women with twin gestations were eligible to participate. Women who had received oral or vaginal antibiotics in the past 2 weeks were excluded, however, women who had received intrapartum antibiotics (including intravenous antibiotic prophylaxis at cesarean delivery) were eligible to participate. All subjects provided written informed consent, and the study was approved by the Instituto Nacional Materno Perinatal and University of Washington Institutional Review Boards.

Within 48 hours after delivery, subjects had a structured interview with collection of demographic, reproductive, medical and behavioral data. A pelvic examination was performed using a sterile, unlubricated speculum. The cervix was visualized and lochia removed using large cotton-tipped swabs. Two Dacron swabs were obtained from the endocervix for detection of *M. genitalium*, and of *C. trachomatis* and *N. gonorrhoeae*, respectively; these swabs were placed in sterile cryovials containing 1 mL of 2SP transport

medium (0.2 mol/L sucrose and 0.02 mol/L phosphate buffer), immediately placed on dry ice, and then stored at -70°C until assayed. Fluid was collected from the vaginal sidewall with a cotton-tipped swab and inserted into culture medium for *T. vaginalis* (InPouch; Biomed Diagnostics, White City, OR). Maternal and neonatal medical records were abstracted after hospital discharge to collect information about prenatal care, pregnancy and labor complications, and maternal and neonatal outcomes.

M. genitalium was detected using an *M. genitalium*-specific research-use only transcription-mediated amplification assay (Gen-Probe Incorporated; San Diego, CA) performed in Seattle, as previously described.¹⁷ *C. trachomatis* and *N. gonorrhoeae* testing was conducted in Lima (1086 subjects) and Seattle (248 subjects) using a commercial assay with internal controls for PCR inhibition (COBAS AMPLICOR CT/NG PCR test; Roche Diagnostics, Indianapolis, IN). Before initiating this study, laboratory performance for this assay was validated in Peru, both by assessing positive and negative Seattle specimens in Peru and positive and negative Peruvian specimens in Seattle. Of 1086 samples tested in Lima, 40 (4%) were indeterminate for *C. trachomatis* and 4 (0.003%) were indeterminate for *N. gonorrhoeae*, and these results were excluded from analysis. In addition, 3 samples tested in Seattle that were positive for *C. trachomatis* showed assay inhibition for *N. gonorrhoeae*; these were reexamined using a transcription-mediated amplification assay for *N. gonorrhoeae* only (AP-TIMA GC ID T-TMA; Gen-Probe Incorporated, San Diego, CA) and all were found to be negative for *N. gonorrhoeae*.

Assuming a prevalence of *M. genitalium* of 2% to 4% in the study population and using a 2-sided χ^2 with $\alpha = 0.05$, we estimated that a total sample size of 1500 subjects (750 cases and controls) would provide over 85% power to detect an association between *M. genitalium* and preterm birth with an odds ratio of 2.5. Characteristics of preterm cases and term controls were compared using the χ^2 or Fisher exact test for categorical variables and a 2-sample T test for continuous variables. Associations with preterm birth and/or cervical *M. genitalium* detection were estimated by odds ratios with 95% confidence intervals. Multivariable logistic regression was used to adjust for potential confounding variables, as needed. Two additional sensitivity analyses were performed to evaluate potential confounding factors, as follows: the first excluded subjects with twin gestation, and the second limited the analysis to women with vaginal delivery to eliminate the potential effect of antibiotic prophylaxis at cesarean delivery on *M. genitalium* carriage.

RESULTS

We enrolled 1338 (670 cases and 668 controls) of the total planned sample size of 1500 subjects before closing study enrollment for logistical and funding reasons. Data were omitted for 5 cases with gestational age <20 weeks or no documentation of gestational age assessment, 2 cases with higher-order multiple gestations and 3 additional subjects who did not have cervical samples collected for *M. genitalium*, leaving 661 cases and 667 controls for these analyses. Of these 1328 subjects, *T. vaginalis* culture results were available for 1315 (99%), and *C. trachomatis* and *N. gonorrhoeae* results were available for 1286 (97%).

Table 1 summarizes demographic, reproductive, and behavioral characteristics as well as lower genital tract infections for preterm cases and term controls. As expected, spontaneous preterm birth was strongly associated with cigarette smoking ($P = 0.007$), second-trimester bleeding ($P < 0.001$), and twin gestation ($P < 0.001$). Preterm birth also occurred less frequently among primiparous women ($P < 0.001$) and more frequently among multiparous women with a previous preterm birth ($P = 0.001$). Notably, 873 (65%) of the study population received intrapartum antibiotics for prevention of group B streptococcal sepsis, prophylaxis at the time of cesarean delivery, intrapartum fever or other indication. Intrapartum antibiotics were received by 522 (79%) of preterm cases and 351 (53%) of term controls ($P < 0.001$).

Overall, *M. genitalium* was detected in 41 (3%) of subjects, *C. trachomatis* in 98 (8%), *T. vaginalis* in 33 (2%), and *N. gonorrhoeae* in 1 (<1%) of subjects. Cervical *M. genitalium* was significantly associated with *C. trachomatis* ($P < 0.001$) infection and marginally with *T. vaginalis* ($P = 0.05$). *M. genitalium* detection was significantly associated with spontaneous preterm birth (4% vs. 2%; OR: 2.5, 95% confidence interval: 1.3–5.0, $P = 0.007$) and this relationship persisted after adjustment for coinfection with *C. trachomatis* or *T. vaginalis*. Specifically, among 1148 women who did not have *C. trachomatis* or *T. vaginalis*, *M. genitalium* was detected among 21 (3.7%) of preterm cases and 9 (1.6%) of term controls (OR: 2.4, 95% confidence interval: 1.1–5.3, $P = 0.03$). *M. genitalium* was detected in cervical swabs from 5 (10%) of 49 women who delivered at 20 to 24 weeks' gestation, 3 (3%) of 94 deliveries at 25 to 28 weeks, 8 (4%) of 193 deliveries at 29 to 32 weeks, 13 (4%) of 325 deliveries at 33 to 36 weeks, and 12 (2%) of 667 deliveries at 37 weeks ($P < 0.01$).

As summarized in Table 1, *M. genitalium* detection occurred significantly more frequently at a younger maternal age ($P = 0.001$), but was not associated with other known risk factors for spontaneous preterm birth. Cervical *M. genitalium* infection was also significantly associated with younger age at coitarche (mean age for subjects with *M. genitalium* detected 16.6 vs. 17.8 years; $P = 0.03$), shorter time since coitarche (4.6 vs. 6.9 years; $P = 0.02$), low body mass index (12% vs. 4% of subjects; $P = 0.02$), and was nonsignificantly associated with low income (63% vs. 48% of subjects; $P = 0.08$); however, none of these factors were significantly associated with spontaneous preterm birth.

Table 2 summarizes the multivariable analysis of risk factors for cervical *M. genitalium*. Younger maternal age was the single most important correlate of *M. genitalium* detection. After adjustment for maternal age, only *C. trachomatis* coinfection remained significantly associated with *M. genitalium*. The addition of age at coitarche, years since coitarche, low income, low body mass index, or *C. trachomatis* to the model did not change the association of maternal age with risk of *M. genitalium* detection.

In multivariable analyses, the association between cervical *M. genitalium* detection and spontaneous preterm birth remained significant after adjustment for maternal age, cigarette smoking, second trimester bleeding, and prior preterm birth (Table 3). The risk estimate for *M. genitalium* was similar to that for prior preterm birth and exceeded the risk estimate for cigarette smoking. A sensitivity analysis that excluded women with twin gestation resulted

in a similar risk estimate for *M. genitalium* and preterm birth (N = 1253 subjects with singleton pregnancy; adjusted odds ratio 2.4, 95% confidence interval, 1.2–5.0). Similarly, restriction to subjects who did not receive intrapartum antibiotics (N = 455) did not substantially change this risk estimate (adjusted odds ratio, 4.2, 95% confidence interval, 1.3–12.5).

DISCUSSION

Preterm birth remains a major public health problem worldwide, and a leading cause of infant mortality as well as serious neonatal morbidity. In this cohort, *M. genitalium* was strongly associated with spontaneous preterm birth as well as with risk factors for sexually transmitted infection such as younger maternal age, independent of other known infectious, demographic, and reproductive risk factors, suggesting that this organism may be an infectious correlate of preterm birth.

The overall prevalence of *M. genitalium* of 3% among low-income Peruvian women in this report is similar to other estimates worldwide. General population estimates for *M. genitalium* cervical infection have ranged from 1% to 2.3%.^{5,18} In sexually transmitted disease clinic populations, *M. genitalium* prevalence has ranged from 6% among women without cervicitis to 30% among women with mucopurulent cervicitis.^{2–4} These prevalence estimates approach those for *C. trachomatis* infection, and suggest that the potential public health burden of *M. genitalium* could approach that of chlamydial infection. Several reports suggest that *M. genitalium* may be sexually transmitted, as *M. genitalium* infection is associated with sexual activity^{3,5} and partners are likely to be infected with the same strain.¹⁹

The observed association between cervical *M. genitalium* detection and spontaneous preterm birth has biologic plausibility. *M. genitalium* is associated with mucopurulent cervicitis,^{2–4} acute endometritis,⁶ and clinical pelvic inflammatory disease.²⁰ Further, this organism was detected in the fallopian tubes of a woman with laparoscopically confirmed salpingitis,⁷ demonstrating that this organism can invade into the upper female genital tract. In this way, *M. genitalium* may behave in similar fashion to bacterial vaginosis-associated bacteria, *C. trachomatis* and *N. gonorrhoeae*. Other genital mycoplasmas such as *M. hominis* and *U. urealyticum*, commonly found in the vagina, are also relatively frequent isolates from amniotic fluid of women in preterm labor.^{14–16} If *M. genitalium* can invade the uterus in nonpregnant women, this organism might also plausibly infect the amniotic fluid and/or chorioamnion, resulting in pregnancy complications such as preterm birth.

The possibility of an association between *M. genitalium* and preterm birth has not been extensively examined. Of 4 published studies of the effect of *M. genitalium* on pregnancy outcome, only one—an observational cohort study of women presenting in preterm labor—found a significant association between *M. genitalium* and preterm birth.²¹ The prevalence of *M. genitalium* in that cohort was 20%, substantially higher than in our study population, and higher than in most other studies. Conversely, 2 large prospective series from England showed very low prevalences of *M. genitalium* in the first trimester (0.6%–0.7%) and no association with preterm birth.^{22,23} The smallest study, from sub-Saharan Africa, found a

6% prevalence of *M. genitalium* and no significant association with preterm birth or with other adverse pregnancy outcome,²⁴ but may have had low power to detect an association. Our study population is the largest reported to date that has systematically assessed the relationship between *M. genitalium* and preterm birth as the primary study outcome, with sufficient sample size to evaluate this association and examination of potential demographic, reproductive and behavioral confounding factors.

Our data have several limitations. First, a large proportion of study subjects received intrapartum antibiotics, and cases were more likely than controls to have received antibiotics, consistent with clinical guidelines to prevent early onset neonatal group B streptococcal sepsis. However, we do not believe that intrapartum antibiotics would substantially influence detection of *M. genitalium* and other microorganisms by nucleic acid testing. If intrapartum antibiotic use had introduced bias, it would probably have been in the direction to not detect an association between *M. genitalium* and preterm birth. Second, as evaluation for endocervical *M. genitalium* occurred after delivery, we cannot determine the timing of *M. genitalium* acquisition relative to delivery, and also cannot distinguish colonization from endocervical infection. Since the validity of vaginal gram stain interpretation for diagnosis of bacterial vaginosis has not been established in the early postpartum period, we could not examine the potential overlap between *M. genitalium* and bacterial vaginosis (although the 2 conditions have not been associated with each other in other studies). *M. genitalium* assays were performed from cervical swabs (not from the uterus), so we do not have evidence of upper genital tract invasion. Finally, results from urban low-income women in Peru may not be generalizable to other populations, although our risk estimates for cigarette smoking, prior preterm birth and other recognized risk factors for preterm birth are very similar to those in the published literature.

In summary, *M. genitalium* was detected immediately postpartum in 3% of our study population and was significantly associated with preterm birth as well as with younger maternal age, low body mass index (a possible measure of socioeconomic deprivation), and *C. trachomatis* infection. The association between *M. genitalium* and preterm birth was robust, remaining stable after adjustment for *C. trachomatis* as well as other recognized risk factors for prematurity. These data suggest that *M. genitalium* should be included in the growing list of lower genital tract microorganisms that are associated with preterm birth. The association that we have observed between *M. genitalium* and preterm birth deserves further investigation in large prospective cohorts and in other populations, ideally with assessment of upper genital tract invasion.

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References

1. Tully JG, Taylor-Robinson D, Cole RM, et al. A newly discovered mycoplasma in the human urogenital tract. *Lancet*. 1981; 1:1288–1291. [PubMed: 6112607]
2. Manhart LE, Crichtlow CW, Holmes KK, et al. Mucopurulent cervicitis and *Mycoplasma genitalium*. *J Infect Dis*. 2003; 187:650–657. [PubMed: 12599082]
3. Falk L, Fredlund H, Jensen JS. Signs and symptoms of urethritis and cervicitis among women with or without *Mycoplasma genitalium* or *Chlamydia trachomatis* infection. *Sex Transm Infect*. 2005; 81:73–78. [PubMed: 15681728]
4. Pepin J, Labbe AC, Khonde N, et al. *Mycoplasma genitalium*: An organism commonly associated with cervicitis among west African sex workers. *Sex Transm Infect*. 2005; 81:67–72. [PubMed: 15681727]
5. Manhart LE, Holmes KK, Hughes JP, et al. *Mycoplasma genitalium* among young adults in the United States: An emerging sexually transmitted infection. *Am J Public Health*. 2007; 97:1118–1125. [PubMed: 17463380]
6. Cohen CR, Manhart LE, Bukusi EA, et al. Association between *Mycoplasma genitalium* and acute endometritis. *Lancet*. 2002; 359:765–766. [PubMed: 11888591]
7. Cohen CR, Mugo NR, Astete SG, et al. Detection of *Mycoplasma genitalium* in women with laparoscopically diagnosed acute salpingitis. *Sex Transm Infect*. 2005; 81:463–466. [PubMed: 16326847]
8. Cotch MF, Pastorek JG II, Nugent RP, et al. *Trichomonas vaginalis* associated with low birth weight and preterm delivery. The Vaginal Infections and Prematurity Study Group. *Sex. Transm Dis*. 1997; 24:353–360.
9. Martin DH, Eschenbach DA, Cotch MF, et al. Double-blind placebo controlled treatment trial of *Chlamydia trachomatis* endocervical infections in pregnant women. *Infect Dis Obstet Gynecol*. 1997; 5:10–17. [PubMed: 18476128]
10. Elliott B, Brunham RC, Laga M, et al. Maternal gonococcal infection as a preventable risk factor for low birth weight. *J Infect Dis*. 1990; 161:531–536. [PubMed: 2313131]
11. Hay PE, Lamont RF, Taylor-Robinson D, et al. Abnormal bacterial colonisation of the genital tract and subsequent preterm delivery and late miscarriage. *BMJ*. 1994; 308:295–298. [PubMed: 8124116]
12. Hillier SL, Nugent RP, Eschenbach DA, et al. Association between bacterial vaginosis and preterm delivery of a low-birth-weight infant. The Vaginal Infections and Prematurity Study Group. *N Engl J Med*. 1995; 333:1737–1742. [PubMed: 7491137]
13. Gravett MG, Nelson HP, DeRouen T, et al. Independent associations of bacterial vaginosis and *Chlamydia trachomatis* infection with adverse pregnancy outcome. *JAMA*. 1986; 256:1899–1903. [PubMed: 3761496]
14. Goldenberg RL, Hauth JC, Andrews WW. Intrauterine infection and preterm delivery. *N Engl J Med*. 2000; 342:1500–1507. [PubMed: 10816189]
15. Hitti J, Hillier SL, Agnew KJ, et al. Vaginal indicators of amniotic fluid infection in preterm labor. *Obstet Gynecol*. 2001; 97:211–219. [PubMed: 11165584]
16. Watts DH, Krohn MA, Hillier SL, et al. The association of occult amniotic fluid infection with gestational age and neonatal outcome among women in preterm labor. *Obstet Gynecol*. 1992; 79:351–357. [PubMed: 1738513]
17. Wroblewski JK, Manhart LE, Dickey KA, et al. Comparison of transcription-mediated amplification and PCR assay results for various genital specimen types for detection of *Mycoplasma genitalium*. *J Clin Microbiol*. 2006; 44:3306–3312. [PubMed: 16954265]
18. Andersen B, Sokolowski I, Ostergaard L, et al. *Mycoplasma genitalium*: Prevalence and behavioral risk factors in the general population. *Sex Transm Infect*. 2007; 83:237–241. [PubMed: 17090566]
19. Hjorth SV, Bjornelius E, Lidbrink P, et al. Sequence-based typing of *Mycoplasma genitalium* reveals sexual transmission. *J Clin Microbiol*. 2006; 44:2078–2083. [PubMed: 16757601]
20. Simms I, Eastick K, Mallinson H, et al. Associations between *Mycoplasma genitalium*, *Chlamydia trachomatis*, and pelvic inflammatory disease. *Sex Transm Infect*. 2003; 79:154–156. [PubMed: 12690141]

21. Edwards RK, Ferguson RJ, Reyes L, et al. Assessing the relationship between preterm delivery and various microorganisms recovered from the lower genital tract. *J Matern Fetal Neonatal Med.* 2006; 19:357–363. [PubMed: 16801313]
22. Oakeshott P, Hay P, Taylor-Robinson D, et al. Prevalence of *Mycoplasma genitalium* in early pregnancy and relationship between its presence and pregnancy outcome. *BJOG.* 2004; 111:1464–1467. [PubMed: 15663138]
23. Kataoka S, Yamada T, Chou K, et al. Association between preterm birth and vaginal colonization by mycoplasmas in early pregnancy. *J Clin Microbiol.* 2006; 44:51–55. [PubMed: 16390947]
24. Labbe AC, Frost E, Deslandes S, et al. *Mycoplasma genitalium* is not associated with adverse outcomes of pregnancy in Guinea-Bissau. *Sex Transm Infect.* 2002; 78:289–291. [PubMed: 12181470]

Characteristics and Coinfections Associated With Spontaneous Preterm Birth and Cervical *Mycoplasma genitalium* Detection

TABLE 1

	Gestational Age at Delivery			P	<i>Mycoplasma genitalium</i>		P
	Preterm (N = 661)	Term (N = 667)	n (%)		Present (N = 41)	Absent (N = 1287)	
Demographic							
Maternal age	25.0 ± 7.0	24.1 ± 6.7		0.02	21.2 ± 5.0	24.7 ± 6.9	0.001
Married/living together	499 (75)	503 (75)		1.0	26 (63)	976 (76)	0.07
Monthly income*	\$140 ± \$59	\$138 ± \$65		0.62	\$124 ± \$38	\$139 ± \$63	0.14
Low income [†]	301 (47)	328 (50)		0.27	25 (63)	604 (48)	0.08
Underweight [‡]	34 (5)	24 (4)		0.15	5 (12)	53 (4)	0.01
Smoker during pregnancy	55 (8)	31 (5)		0.01	5 (12)	81 (6)	0.13
Pregnancy							
Primiparous	343 (52)	418 (63)		<0.001	24 (58)	737 (57)	0.87
Interpregnancy interval (yr) [§]	4.4 ± 3.6	4.7 ± 3.2		0.31	3.3 ± 1.9	4.6 ± 3.4	0.09
Previous preterm birth [§]	78 (24)	33 (13)		0.001	6 (35)	105 (19)	0.10
Second trimester bleeding	136 (21)	44 (7)		<0.001	6 (15)	174 (14)	0.85
<3 prenatal visits	189 (29)	57 (8)		<0.001	12 (29)	234 (18)	0.07
Twin gestation	60 (9)	13 (2)		<0.001	3 (7)	70 (5)	0.60
Microorganisms							
<i>Trichomonas vaginalis</i>	14 (2)	19 (3)		0.38	3 (7)	30 (2)	0.05
<i>Neisseria gonorrhoeae</i>	1 (<1)	0 (0)		0.32	0 (0)	1 (<1)	0.86
<i>Chlamydia trachomatis</i>	50 (8)	48 (7)		0.77	9 (22)	89 (7)	<0.001
<i>Mycoplasma genitalium</i>	29 (4)	12 (2)		0.01	—	—	—

* Based on an average exchange rate over the study period of 3.45 nuevos soles per US dollar.

[†] Income less than median for study population (US \$130/mo).[‡] Mother's body mass index <18.5.[§] Among multiparous women only.

TABLE 2

Multivariable Analysis of Risk Factors for Cervical *M. genitalium* Detection

	Valid N	Unadjusted Odds Ratio	(95% Confidence Interval)	Adjusted* Odds Ratio	(95% Confidence Interval)
Age at coitarche	1327	0.9	(0.8–1.0)	1.0	(0.8–1.1)
Years since coitarche	1327	0.9	(0.9–1.0)	1.1	(0.9–1.2)
Low income [†]	1291	1.8	(0.9–3.4)	1.6	(0.8–3.1)
Underweight [‡]	1314	3.2	(1.2–8.5)	2.7	(1.0–7.2)
Lifetime sexual partners	1327	1.1	(0.8–1.6)	1.2	(0.9–1.8)
Cigarette smoking	1326	2.1	(0.8–5.4)	2.0	(0.8–5.2)
<i>C. trachomatis</i>	1286	3.6	(1.7–7.9)	3.2	(1.5–7.0)
<i>T. vaginalis</i>	1315	3.3	(1.0–11.2)	3.0	(0.9–10.4)

* Adjusted for maternal age.

[†] Income less than median for study population (US \$130/mo).

[‡] Body mass index <18.5.

TABLE 3

Multivariable Analysis of Risk Factors for Preterm Birth (n = 1326 With Complete Data for All Variables in Table)

	Unadjusted Odds Ratio	(95% Confidence Interval)	Adjusted* Odds Ratio	(95% Confidence Interval)
Cigarette smoking	1.9	(1.2–2.9)	2.0	(1.2–3.2)
Second trimester bleeding	3.7	(2.6–5.3)	3.9	(2.7–5.6)
Twin gestation	5.0	(2.7–9.2)	5.8	(3.1–10.8)
Prior preterm birth [†]	2.1	(1.4–3.3)	2.2	(1.4–3.4)
<i>M. genitalium</i>	2.5	(1.3–5.0)	2.5	(1.2–5.0)

* Adjusted for maternal age and all other co-variates in table.

[†] Among multiparous women only.