

Prevalence of High-Risk Human Papillomavirus Infection in Pregnant Women and Its Association with Adverse Pregnancy Outcomes: A Cross-Sectional Study

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Abstract

Background

High-risk human papillomavirus (HPV) infection is common among women of reproductive age, but data on HPV infection during pregnancy in South-East Asia remain limited. This study aimed to determine the prevalence of high-risk HPV infection and abnormal cervical cytology among pregnant women in Thailand, identify factors associated with high-risk HPV infection, and explore its association with adverse pregnancy outcomes.

Methods

This cross-sectional study included pregnant women aged ≥ 18 years attending antenatal care at a tertiary referral hospital in Bangkok, Thailand, between June 2024 and May 2025. Cervical samples were tested for 14 high-risk HPV genotypes using real-time polymerase chain reaction and assessed by liquid-based cytology. Demographic, reproductive, and epidemiological characteristics were collected using questionnaires and electronic medical records. Pregnancy outcomes were recorded after delivery. Logistic regression was used to identify factors associated with high-risk HPV infection.

Results

Among 255 participants, 40 tested positive for high-risk HPV, giving a prevalence of 15.7% (95% CI 11.5–20.7). Other high-risk HPV genotypes were most common (12.2%), followed by HPV 16 (3.9%) and HPV 18 (1.6%). Abnormal cervical cytology was detected in 2.0% of participants (four ASC-US and one HSIL). Younger age and having three or more lifetime sexual partners were independently associated with high-risk HPV infection. Pregnancy outcome data were available for 216 participants. No statistically significant associations were observed between high-risk HPV infection and abortion, preterm delivery, preterm premature rupture of membranes, fetal growth restriction, low birth weight, gestational hypertension, or pre-eclampsia.

Conclusions

High-risk HPV infection was identified in 15.7% of pregnant women, while abnormal cervical cytology was uncommon and most high-risk HPV infections occurred in women with normal cytology. Antenatal care may provide an opportunity to improve cervical cancer screening coverage. No significant association between high-risk HPV infection and adverse pregnancy outcomes was observed, although the study was not powered primarily to assess these outcomes.

Background

Human papillomaviruses (HPVs) are epitheliotropic DNA viruses comprising more than 200 genotypes, approximately 40 of which are known to cause genital infection. High-risk HPV genotypes, including HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, and 68, are oncogenic and are associated with premalignant lesions of the anogenital tract. Most HPV infections are transient and resolve within 1–2 years, and clinical presentation ranges from asymptomatic infection to clinically apparent lesions [1, 2].

Pregnancy may influence HPV acquisition and clearance through physiological changes in the cervix and alterations in maternal immunity. Previous studies have reported a higher prevalence of HPV infection among pregnant than non-pregnant women [2–6]. Maternal HPV infection has also been investigated in relation to adverse pregnancy outcomes, including preterm delivery, preterm premature rupture of membranes, fetal growth restriction, low birth weight, and intrauterine fetal death; however, reported associations remain inconsistent [1, 2, 7].

A recent systematic review and meta-analysis estimated the worldwide prevalence of HPV infection among pregnant women at approximately 30.38%, with substantial geographic variation and limited data from South-East Asia [8]. In Thailand, available evidence is limited. Previous studies have included pregnant women living with HIV and, more recently, pregnant women recruited up to 28 weeks of gestation [9, 10]. Evidence regarding high-risk HPV infection across all gestational ages in a general pregnant population and its association with pregnancy outcomes remains limited.

This study aimed to determine the prevalence and genotype distribution of high-risk HPV infection among pregnant women in Thailand, determine the prevalence of abnormal cervical cytology, identify factors associated with high-risk HPV infection, and explore the association between high-risk HPV infection and adverse pregnancy outcomes.

Methods

Study design and setting

This was a cross-sectional study conducted at the antenatal care unit of King Chulalongkorn Memorial Hospital (KCMH), a tertiary referral centre in Bangkok, Thailand, between June 2024 and May 2025. Recruitment commenced following approval of the study protocol by the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University (IRB No. 0936/2566).

Study participants

Pregnant women attending antenatal care at KCMH were eligible if they were aged ≥ 18 years and willing to undergo routine cervical cancer screening (Pap smear), which is offered as part of standard antenatal care at the clinic. Study information was provided by attending nurses or physicians, and women who expressed interest received written study information, a structured questionnaire, and an informed consent form. Written informed consent was obtained prior to enrolment and specimen collection.

Women were excluded if they had contraindications to pelvic examination, including active vaginal bleeding, vasa previa, placenta previa, or preterm premature rupture of membranes; were in labour or had ruptured membranes; had anatomical conditions precluding pelvic examination (e.g. large vulvar mass); or withdrew from the study.

Participants who tested positive for high-risk HPV were counselled and managed according to the 2019 American Society for Colposcopy and Cervical Pathology (ASCCP) guidelines [11].

Data collection

Demographic, reproductive, and epidemiological characteristics were collected using a participant-completed questionnaire and electronic medical records. Cervical cytology results, HPV DNA testing results, and pregnancy outcomes were obtained from electronic medical records. Pregnancy complications and outcomes were recorded after delivery.

Cervical specimen collection and laboratory procedures

Cervical samples were collected as part of routine Pap smear screening using an Ayre spatula from the ectocervical area. Specimens were preserved in PreservCyt® solution, allowing simultaneous fixation for liquid-based cytology and HPV DNA testing.

Liquid-based cytology was performed and interpreted according to the 2014 Bethesda System by a board-certified pathologist, with secondary review by a gynaecologic pathologist to ensure diagnostic accuracy [12].

High-risk HPV DNA testing was performed using real-time polymerase chain reaction (RT-PCR) on the Cobas® 5800 system (Roche Diagnostics). The assay detects 14 high-risk HPV genotypes and reports results as HPV 16, HPV 18, or other high-risk HPV types (31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, and 68).

Study outcomes

The primary outcome was the prevalence of high-risk HPV infection. Secondary outcomes included the prevalence of abnormal cervical cytology and the association between high-risk HPV infection and adverse pregnancy outcomes, including abortion, preterm delivery, preterm premature rupture of membranes, fetal growth restriction, low birth weight, gestational hypertension, and pre-eclampsia.

Sample size

The required sample size was calculated using a formula for descriptive studies with an infinite population proportion. Assuming a prevalence of high-risk HPV infection of 39.4%, based on a

prospective study of HPV infection in early pregnancy conducted in India, a sample size of 255 participants was required to achieve a 95% confidence level ($Z = 1.96$) with a margin of error of 0.06 [13].

Statistical analysis

Continuous variables were summarised as medians with interquartile ranges (IQRs), and categorical variables as frequencies and percentages. Comparisons between women with and without high-risk HPV infection were performed using the Wilcoxon rank-sum test for continuous variables and the chi-square or Fisher's exact test for categorical variables, as appropriate.

The prevalence of high-risk HPV infection was estimated using the binomial distribution with 95% confidence intervals (CIs). Logistic regression analysis was used to identify factors associated with high-risk HPV infection. Variables with $P < 0.1$ in univariable analyses were included in multivariable models. All tests were two-sided, and $P < 0.05$ was considered statistically significant. No imputation was performed, and analyses were conducted using available-case data. Statistical analyses were performed using Stata version 19.5 (StataCorp, College Station, TX, USA).

Results

A total of 255 cervical samples were collected and all were sent for HPV DNA testing. Of these, 253 samples were examined for cervical cytology; two samples were not submitted for cytological analysis because of an error in the specimen submission process. Some participant characteristics were missing because of incomplete questionnaire responses. Pregnancy outcome and pregnancy-related complication data were available for 216 of 255 participants (84.7%); 39 women discontinued antenatal care at the study site or delivered at another hospital (Fig. 1).

Forty of 255 participants tested positive for high-risk HPV, corresponding to a prevalence of 15.7% (95% CI 11.5–20.7). Other high-risk HPV types were most frequent (12.2%, 95% CI 8.4–16.8), followed by HPV 16 (3.9%, 95% CI 1.9–7.1) and HPV 18 (1.6%, 95% CI 0.4–3.9). Prevalence was highest among women aged <25 years (48.0%, 95% CI 27.8–68.7) and was 13.5% (95% CI 8.8–19.6) among women aged 25–35 years and 8.3% (95% CI 2.8–18.4) among those aged >35 years. By trimester, high-risk HPV prevalence was 10.3% (95% CI 6.9–16.5) in the first trimester, 30.6% (95% CI 18.2–45.4) in the second trimester, and 16.4% (95% CI 8.2–28.1) in the third trimester (Table 1).

Abnormal cervical cytology was detected in 2.0% of samples (5/253; 95% CI 0.6–4.6), including four cases of atypical squamous cells of undetermined significance (ASC-US) and one case of high-grade squamous intraepithelial lesion (HSIL) (Table 2). Among 39 participants with high-risk HPV infection and available cytology results, three had abnormal cytology and 36 had normal cytology (negative for intraepithelial lesion or malignancy), corresponding to a prevalence of 14.5% (95% CI 10.4–19.5) for high-risk HPV infection with normal cervical cytology.

In univariable analyses, factors associated with high-risk HPV infection included age <25 years, monthly income $\leq 20,000$ baht, earlier age at first sexual intercourse, having three or more lifetime sexual partners,

current sexually transmitted infection, and a history of oral contraceptive use. In multivariable logistic regression, age <25 years (adjusted OR 9.45, 95% CI 1.77–50.62; $P = 0.009$) and having three or more lifetime sexual partners (adjusted OR 2.01, 95% CI 1.04–3.90; $P = 0.039$) remained significantly associated with high-risk HPV infection (Table 3).

No statistically significant differences in adverse pregnancy outcomes were observed between women with and without high-risk HPV infection. Rates of abortion were 3.0% versus 7.1% ($P = 0.700$), preterm delivery 12.5% versus 13.5% ($P = 0.875$), preterm premature rupture of membranes 3.0% versus 0% ($P = 0.153$), fetal growth restriction 0% versus 1.1% ($P = 0.546$), low birth weight 9.1% versus 11.0% ($P = 0.746$), gestational hypertension 3.0% versus 4.9% ($P = 0.635$), pre-eclampsia without severe features 0% versus 1.6% ($P = 0.459$), and severe pre-eclampsia 3.0% versus 2.7% ($P = 0.924$). Eclampsia and intrauterine fetal death were not observed in either group (Table 4).

Discussion

In this study, high-risk HPV infection was identified in 15.7% of pregnant women attending antenatal care at a tertiary referral hospital in Thailand. Abnormal cervical cytology was uncommon (2.0%), and most women with high-risk HPV infection and available cytology results had normal cytology. Younger maternal age and having three or more lifetime sexual partners were independently associated with high-risk HPV infection. We found no statistically significant association between high-risk HPV infection and the adverse pregnancy outcomes evaluated in this cohort.

The prevalence observed in our study was higher than the approximately 5.6% previously reported in the general Thai population and was also higher than estimates of 8–10% among women of reproductive age in the general population [14]. Previous studies have similarly reported a higher prevalence of HPV infection among pregnant than non-pregnant women [2–6]. However, our prevalence was substantially lower than the 39.4% reported by Pandey et al. in India [13]. Differences between studies may reflect geographic variation, population characteristics, socioeconomic conditions, vaccination policies, gestational age at recruitment, and laboratory methods.

Evidence from Thailand remains limited. Bollen et al. reported a high-risk HPV prevalence of 23.4% among pregnant Thai women living with HIV [9], a population with a higher expected susceptibility to persistent HPV infection. More recently, Kulpomsirikul et al. reported a prevalence of 12.7% among pregnant women recruited up to 28 weeks of gestation [10]. Our study included women across all gestational ages and additionally evaluated pregnancy complications and outcomes.

Younger age and a greater number of lifetime sexual partners were independently associated with high-risk HPV infection. These findings are consistent with the sexual transmission of HPV and support the importance of sexual health and risk-reduction counselling. The high prevalence among women aged < 25 years should be interpreted cautiously because this subgroup was relatively small, as reflected by the wide confidence interval around the estimate.

Among participants with high-risk HPV infection and available cytology results, 92.3% had normal cytology. Pregnancy may therefore represent an opportunity to identify women with high-risk HPV infection who would not be detected by cytology alone. Antenatal care may also provide an opportunity to improve cervical cancer screening coverage among women who have limited contact with healthcare services outside pregnancy. However, the present study was not designed to compare screening strategies or determine the clinical effectiveness or cost-effectiveness of HPV-based screening during pregnancy.

We found no statistically significant differences in pregnancy complications or outcomes between women with and without high-risk HPV infection. Previous literature has reported inconsistent associations between maternal HPV infection and adverse pregnancy outcomes [1, 2, 7]. A recent meta-analysis restricted to studies using HPV DNA testing found an association between HPV infection overall and preterm delivery; however, the association was not statistically significant when the analysis was restricted to high-risk HPV infection [15]. The absence of an association in our cohort may reflect the predominantly transient nature of HPV infection and limited systemic effects. Importantly, the sample size was calculated to estimate HPV prevalence rather than to detect differences in individual pregnancy outcomes; the analyses of pregnancy outcomes should therefore be considered exploratory.

This study has several strengths. It included pregnant women across all gestational ages, used molecular testing for 14 high-risk HPV genotypes, and included secondary review of cytology by a gynaecologic pathologist. It also provides data from Thailand, where evidence on HPV infection in pregnancy remains limited. Several limitations should be acknowledged. This was a single-centre study at a tertiary referral hospital, which may limit generalisability. The relatively small sample size and low number of individual adverse pregnancy outcomes limited statistical power. Pregnancy outcome data were unavailable for 39 participants who discontinued antenatal care at the study site or delivered elsewhere. Some questionnaire variables were also missing and were analysed using available cases. Larger multicentre prospective studies with complete longitudinal follow-up are needed to clarify the relationship between high-risk HPV infection and pregnancy outcomes and to evaluate the role of antenatal care in cervical cancer screening.

Conclusions

High-risk HPV infection was identified in 15.7% of pregnant women in this Thai tertiary-care cohort. Abnormal cervical cytology was uncommon, and most high-risk HPV infections occurred in women with normal cytology. Younger age and having three or more lifetime sexual partners were independently associated with high-risk HPV infection. Antenatal care may provide an opportunity to improve cervical cancer screening coverage; however, further studies are required to determine the most appropriate screening strategy during pregnancy. No significant association was observed between high-risk HPV infection and adverse pregnancy outcomes, although these analyses were limited by sample size and should be interpreted as exploratory.

Abbreviations

ANC, antenatal care; ASC-US, atypical squamous cells of undetermined significance; ASCCP, American Society for Colposcopy and Cervical Pathology; BMI, body mass index; CI, confidence interval; GA, gestational age; HPV, human papillomavirus; HSIL, high-grade squamous intraepithelial lesion; IQR, interquartile range; KCMH, King Chulalongkorn Memorial Hospital; NILM, negative for intraepithelial lesion or malignancy; OCP, oral contraceptive pill; OR, odds ratio; PPROM, preterm premature rupture of membranes; RT-PCR, real-time polymerase chain reaction; STD, sexually transmitted disease.

Declarations

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Authors' contributions

TP conceived and designed the study, recruited participants, collected and analysed the data, and drafted the initial manuscript. PP supervised the research process, reviewed data interpretation, and finalised the manuscript. NPh contributed to study planning, clinical oversight, data interpretation, and manuscript revision. NPo performed pathological review of all cytology specimens and contributed to data interpretation. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request, subject to applicable institutional and ethical requirements.

Ethics approval and consent to participate

This study involved human participants and was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board of the Faculty of Medicine, Chulalongkorn University, Bangkok, Thailand, on 22 December 2023 (IRB No. 0936/2566). Written informed consent was obtained from all participants prior to study enrolment.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

References

1. Chilaka VN, Navti OB, Al Beloushi M, Ahmed B, Konje JC. Human papillomavirus (HPV) in pregnancy - An update. *Eur J Obstet Gynecol Reprod Biol.* 2021;264:340–8.
2. Condrat CE, Filip L, Gherghel M, Cretoiu D, Suciu N. Maternal HPV Infection: Effects on Pregnancy Outcome. *Viruses* 2021, 13(12).
3. Liu P, Xu L, Sun Y, Wang Z. The prevalence and risk of human papillomavirus infection in pregnant women. *Epidemiol Infect.* 2014;142(8):1567–78.
4. Luo D, Peng M, Wei X, Pan D, Xue H, Xu Y, Dong B. Prevalence of Human Papillomavirus and Genotype Distribution in Pregnant and Non-Pregnant Women in China. *Risk Manag Healthc Policy.* 2021;14:3147–57.
5. Salcedo MM, Damin AP, Agnes G, Pessini SA, Beitune PE, Alexandre CO, Schmeller KM, da Silveira GP. Prevalence of human papillomavirus infection in pregnant versus non-pregnant women in Brazil. *Arch Gynecol Obstet.* 2015;292(6):1273–8.
6. Schneider A, Hotz M, Gissmann L. Increased prevalence of human papillomaviruses in the lower genital tract of pregnant women. *Int J Cancer.* 1987;40(2):198–201.
7. Niyibizi J, Zanre N, Mayrand MH, Trottier H. Association Between Maternal Human Papillomavirus Infection and Adverse Pregnancy Outcomes: Systematic Review and Meta-Analysis. *J Infect Dis.* 2020;221(12):1925–37.
8. Ardekani A, Sepidarkish M, Mollalo A, Afradiasbagharani P, Rouholamin S, Rezaeinejad M, Farid-Mojtahedi M, Mahjour S, Almukhtar M, Nourollahpour Shiadeh M, et al. Worldwide prevalence of human papillomavirus among pregnant women: A systematic review and meta-analysis. *Rev Med Virol.* 2023;33(1):e2374.

9. Bollen LJ, Chuachoowong R, Kilmarx PH, Mock PA, Culnane M, Skunodom N, Chaowanachan T, Jetswang B, Neeyapun K, Asavapiriyant S, et al. Human papillomavirus (HPV) detection among human immunodeficiency virus-infected pregnant Thai women: implications for future HPV immunization. *Sex Transm Dis*. 2006;33(4):259–64.

10. Kulpomsirikul M, Srison U, Laosooksathit W, Tantitamit T. Prevalence of Cervical High-risk Human Papilloma Viral Infection in Pregnant Women at HRH Maha Chakri Sirindhorn Medical Center, Thailand. *Thai J Obstet Gynecol*. 2024;32:128–36.

11. Perkins RB, Guido RS, Castle PE, Chelmow D, Einstein MH, Garcia F, Huh WK, Kim JJ, Moscicki AB, Nayar R, et al. : 2019 ASCCP Risk-Based Management Consensus Guidelines for Abnormal Cervical Cancer Screening Tests and Cancer Precursors. *J Low Genit Tract Dis*. 2020;24(2):102–31.

12. Nayar R, Wilbur DC. The Pap Test and Bethesda 2014. The reports of my demise have been greatly exaggerated. (after a quotation from Mark Twain). *Acta Cytol*. 2015;59(2):121–32.

13. Pandey D, Solleti V, Jain G, Das A, Shama Prasada K, Acharya S, Satyamoorthy K. Human Papillomavirus (HPV) Infection in Early Pregnancy: Prevalence and Implications. *Infect Dis Obstet Gynecol* 2019, 2019:4376902.

14. Phoolcharoen N, Kantathavorn N, Sricharunrat T, Saeloo S, Krongthong W. A population-based study of cervical cytology findings and human papillomavirus infection in a suburban area of Thailand. *Gynecol Oncol Rep*. 2017;21:73–7.

15. Kovacs D, Szabo A, Hegyi P, Acs N, Keszthelyi M, Sara L, Csirzo A, Matrai P, Munnoch K, Nagy R, et al. Association between human papillomavirus and preterm delivery: A systematic review and meta-analysis. *Acta Obstet Gynecol Scand*. 2024;103(10):1933–42.

Tables

Table 1. Prevalence of high-risk HPV infection

Characteristic	N	HPV positive, n	% (95% CI)
All	255	40	15.7 (11.5–20.7)
HPV 16	255	10	3.9 (1.9–7.1)
HPV 18	255	4	1.6 (0.4–3.9)
Other high-risk HPV	255	31	12.2 (8.4–16.8)
Age <25 years	25	12	48.0 (27.8–68.7)
Age 25–35 years	170	23	13.5 (8.8–19.6)
Age >35 years	60	5	8.3 (2.8–18.4)
First trimester (GA ≤13 weeks 6 days)	145	15	10.3 (6.9–16.5)
Second trimester (GA 14–27 weeks 6 days)	49	15	30.6 (18.2–45.4)
Third trimester (GA ≥28 weeks)	61	10	16.4 (8.2–28.1)

* Four participants had HPV co-infection: three had HPV 16 and other high-risk HPV types, and one had HPV 16, HPV 18, and other high-risk HPV types.

Abbreviations: CI, confidence interval; GA, gestational age; HPV, human papillomavirus.

Table 2. Prevalence of abnormal cervical cytology

Cervical cytology	N (total = 253*)	% (95% CI)
Abnormal cytology	5	2.0 (0.6–4.6)
ASC-US	4	1.6 (0.4–4.0)
HSIL	1	0.4 (0.01–2.12)
Normal cytology	248	98.0 (95.4–99.4)
High-risk HPV positive	36	14.5 (10.4–19.5)

* Two cervical cytology results were missing; one participant tested positive and one tested negative for high-risk HPV DNA.

Abbreviations: ASC-US, atypical squamous cells of undetermined significance; CI, confidence interval; HPV, human papillomavirus; HSIL, high-grade squamous intraepithelial lesion.

Table 3. Factors associated with high-risk HPV infection

Characteristic	Univariable OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Age <25 years	10.15 (3.04–33.91)	<0.001	9.45 (1.77–50.62)	0.009
Age 25–35 years	1.72 (0.62–4.75)	0.295	1.65 (0.41–6.57)	0.480
Age >35 years	1 (Ref)		1 (Ref)	
BMI ≥ 30 kg/m ²	1.82 (0.76–4.37)	0.182		
Gravida ≥ 2	0.68 (0.34–1.33)	0.258		
Parity ≥ 1	0.66 (0.33–1.33)	0.249		
Below bachelor's degree	1.49 (0.76–2.95)	0.244		
Bachelor's degree or above	1 (Ref)			
Lifetime sexual partners ≥ 3	2.45 (1.14–5.24)	0.021	2.01 (1.04–3.90)	0.039
Income $\leq 20,000$ vs $>20,000$ baht	2.53 (1.23–5.25)	0.012	2.43 (0.95–6.22)	0.064
Age at first intercourse <15 years	6.63 (1.39–31.56)	0.018	0.38 (0.03–5.23)	0.473
Age at first intercourse 15–20 years	3.83 (1.65–8.87)	0.002	1.46 (0.52–4.06)	0.471
Age at first intercourse >20 years	1 (Ref)		1 (Ref)	
History of STD	5.71 (0.78–41.91)	0.086	4.65 (0.39–55.3)	0.224
Current STD	4.86 (1.67–14.02)	0.003	2.33 (0.56–9.78)	0.248
Smoking	2.12 (0.83–5.45)	0.118		
History of OCP use	2.35 (1.06–5.24)	0.036	1.39 (0.52–3.71)	0.505

Variables with $P < 0.1$ in univariable logistic regression were included in the multivariable model.

Abbreviations: BMI, body mass index; CI, confidence interval; OCP, oral contraceptive pill; OR, odds ratio; Ref, reference category; STD, sexually transmitted disease.

Table 4. High-risk HPV infection and adverse pregnancy outcomes

Adverse pregnancy outcome	Total (N = 216)	HPV negative (N = 183)	HPV positive (N = 33)	P value
Abortion	14 (6.5)	13 (7.1)	1 (3.0)	0.700
Term delivery	175 (86.6)	147 (86.5)	28 (87.5)	
Preterm delivery	27 (13.4)	23 (13.5)	4 (12.5)	0.875
Preterm premature rupture of membranes	1 (0.5)	0 (0)	1 (3.0)	0.153
Intrauterine fetal growth restriction	2 (1.0)	2 (1.1)	0 (0)	0.546
Low birth weight	23 (10.7)	20 (11.0)	3 (9.1)	0.746
Gestational hypertension	10 (4.6)	9 (4.9)	1 (3.0)	0.635
Pre-eclampsia without severe features	3 (1.4)	3 (1.6)	0 (0)	0.459
Severe pre-eclampsia	6 (2.8)	5 (2.7)	1 (3.0)	0.924
Eclampsia	0 (0)	0 (0)	0 (0)	NA
Intrauterine fetal death	0 (0)	0 (0)	0 (0)	NA

Values are n (%).

Abbreviations: HPV, human papillomavirus; NA, not applicable.

Figures

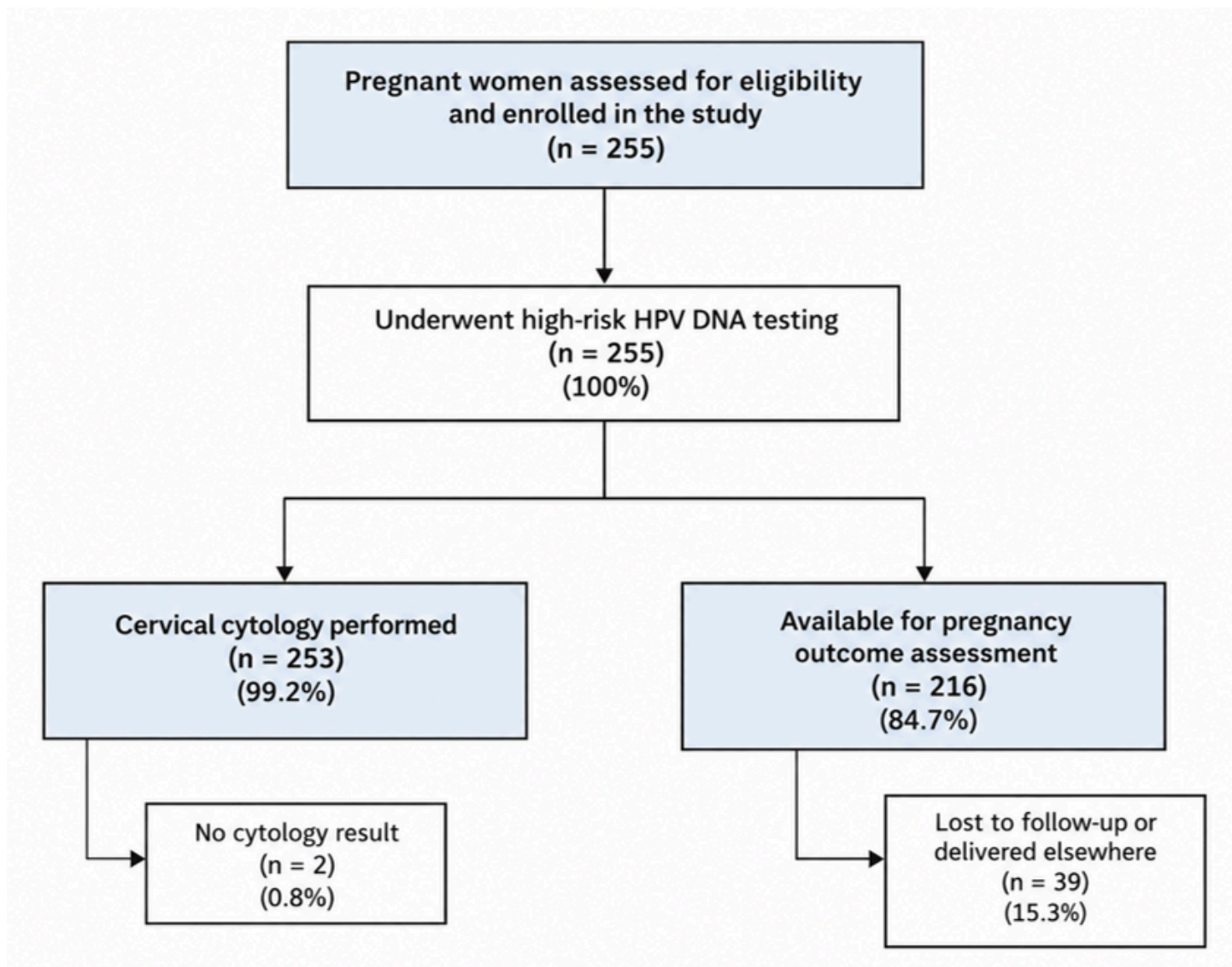


Figure 1

Flow chart of study participants.

A total of 255 pregnant women were enrolled and underwent high-risk HPV DNA testing, Cervical cytology was performed in 253 participants (two samples were not submitted for cytology). Pregnancy outcomes were available for 216 participants (39 were lost to follow-up or delivered elsewhere).