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ORIGINAL ARTICLE

Prevalence and Genotype Distribution of HPV Infection Among 16,516 Women in Chaohu, China: a Retrospective Study

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SUMMARY

Background: **Prevalence and genotype distribution of human papillomavirus (HPV) infection among 16,516 women in Chaohu City from May 2023 to May 2025 were not well established. A retrospective study was conducted to analyze the clinical situations and laboratory data of 16,516 women tested for HPV. It might provide valuable information for the epidemiological characteristics of regional differences in infection rate and dominant genotype of HPV.**
Methods: **A total of 16,516 women from outpatients, inpatients, and physical examinations were randomly selected from May 2023 to May 2025. Exfoliated cells from the cervical orifice were collected with a cervical cytobrush and HPV genotypes were detected. Data of all tests were acquired from the hospital's laboratory information system, and statistical analysis was performed with SPSS 27.0 software.**
Results: **Among 16,516 women, 3,608 were positive and the positive rate was 21.85%. High-risk genotype infection and single infection were respectively more than low-risk genotype infection and multiple infection ($p < 0.05$). The highest positive rate of HPV infection was found in the ≥ 20 age group, and the ≥ 60 and 51 - 60 age groups had higher positive rate. The positive rate was not significantly different among each age group ($p > 0.05$). Among 23 genotypes, HPV 52, 53, and 58 were the most common genotypes which were all high-risk genotypes, and HPV 52 was the most dominant in all different age groups.**
Conclusions: **The retrospective study showed a high prevalence of HPV infection in Chaohu City in the past two years. More high-risk genotype infection and single infection than low-risk genotype infection and multiple infection, and high-risk genotype infection and single infection mainly occurring in the middle and old age were the characteristics of HPV infection in Chaohu. HPV 52, 53, and 58 were the dominant HPV genotypes, suggesting that vaccine which contained HPV 52, 53, and 58 genotypes might be a better choice for this region.**
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KEYWORDS

human papilloma virus (HPV), prevalence, genotype distribution, retrospective study

INTRODUCTION

Among gynecological malignant tumors in China, cervical cancer was one of the most common and its incidence ranked second, only less than breast cancer. HPV is a type of small-molecular-weight, unenveloped double stranded cyclic DNA virus that specifically infects and parasitizes human reproductive organs and epithelial cells of other tissues and organs [1,2]. In clinical practice, HPV could be classified into low-risk and high-risk genotypes based on the pathogenicity or carcinogenic risk of different subtypes. Low-risk HPV mainly causes exophytic warts and low-grade lesions on the skin of the anus, male external genitalia, female labia minora and urethral orifices, and low-grade cervical intraepithelial neoplasia. High-risk HPV could even cause external genital cancer, cervical cancer and high-grade cervical intraepithelial neoplasia. Just because of this, HPV was found as the leading cause of cervical cancer and also related with oropharynx cancer and anal cancer [3-5]. At present, it has been confirmed that high-risk HPV persistent infection is a necessary factor for the occurrence of precancerous lesions and cervical cancer and HPV infection has a particularly important link with the process of cervical cancer carcinogenesis. HPV has a huge viral family and more than 200 genotypes have been found and identified. However, the carcinogenicity of different HPV genotypes varies greatly. Therefore, the effective premise of cervical cancer prevention was to fully understand the carcinogenicity of different high-risk HPV genotypes and the proportion of cervical cancer patients that might be caused by different HPV genotypes [6,7].

In the last two decades, in spite of an enhanced awareness of cervical cancer prevention and effective HPV genotypes screening, the morbidity and mortality of cervical cancer in many countries have still increased [8,9]. In China, hundreds of thousands of new cases of cervical cancer have been diagnosed every year, especially for young women during the first few years after sexual debuts [10,11]. Prevalence and genotype distribution of HPV infection show regional differences and the positive rate shows considerable volatility from year to year. It did not present an obvious downward trend, all of which indicates a relatively heavy burden of HPV infection in China [12-15].

MATERIALS AND METHODS

Study population

All 16,516 women were randomly selected from outpatients, inpatients, and physical examiners in Department of Gynaecology, Department of Physical Examination and Department of Obstetrics from May 2023 to May 2025. All data were collected from the hospital's laboratory information system.

Instruments and reagents

HPV Genotypes Detection kits (PCR-fluorescence probe method) were purchased from Changsha Shengxiang Biotechnology Co. LTD (Production batch number: 20223401003) and a Shanghai Hongshi Real-time fluorescence quantitative PCR instrument (Instrument type: SLAN-96S) was used. Twenty-three genotypes were tested and mainly fell into two categories: low-risk and high-risk genotypes. Five low-risk genotypes included HPV 6, 11, 42, 43, and 81, and eighteen high-risk genotypes included HPV 16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73, and 82.

Specimen collection

The sample should not be collected during the menstrual period and women before collection should not have had sexual behavior within 48 hours. Vaginal irrigation or the use of contraceptive ointments and other vaginal medications should not be performed 3 days prior to collection. For women with suspected cervical infection, exfoliated cells were collected from the cervical orifice. Before sampling, the excessive secretions need to be wiped from the cervical opening with a sterile cotton swab and the cervical cytobrush is placed at the cervical opening. The cervical cytobrush should be rubbed and rotated clockwise for 3 to 4 turns and then removed and placed in the sample collection tube containing the cell preservation solution. The excess cytobrush handle was broken off at the pipe opening, sealed and sent for inspection.

If the sample could not be tested immediately, it was stored at room temperature (20°C) for no more than 24 hours, 2 - 8°C for no more than 120 hours, -20 ± 5°C for no more than 7 months, and -70°C for no more than 24 months. It was recommended to freeze and thaw repeatedly for no more than 7 times. Sample transportation was carried out using sealed foam boxes with ice (no more than 5 days).

Detection methods and criteria of positive result

The basic procedure consisted of two steps: nucleic acid extraction and PCR amplification. The criteria of positive result should have both the typical S-shaped amplification curves and the detected Ct values which were between 24 and 30.

Statistical analysis

All statistical analysis was performed using SPSS 27.0 software. The chi-squared test was used to analyze the data of categorical variables which were expressed as rate (%). p-value less than 0.05 was considered statistically significant.

RESULTS

Clinical characteristics of study population

A total of 16,516 women were chosen and the average age of study population was 45.67 years, with an age range of 15 - 91 years. Women were mainly from the Department of Gynaecology, Department of Physical Examination, and Department of Obstetrics.

Overall prevalence and genotype distribution of HPV

From May 2023 to May 2025, 16,516 eligible women who conducted the test for 23 HPV genotypes were en-

Table 1. Overall prevalence and genotype distribution of HPV in the last two years.

Genotype	Number of HPV positive women	HPV positive rate of low or high-risk genotypes (%)	HPV positive rate in all women (%)
Low risk			
6	117	10.35	0.71
11	38	3.37	0.23
42	425	37.61	2.57
43	180	15.93	1.09
81	370	32.74	2.24
Total	1,130	100	6.84
High risk			
16	400	9.46	2.42
18	131	3.10	0.79
26	17	0.40	0.10
31	124	2.93	0.75
33	185	4.38	1.12
35	84	1.99	0.51
39	287	6.79	1.74
45	26	0.62	0.16
51	295	6.98	1.79
52	891	21.08	5.39
53	433	10.24	2.62
56	237	5.61	1.43
58	427	10.10	2.59
59	167	3.95	1.01
66	161	3.81	0.97
68	269	6.36	1.63
73	54	1.28	0.33
82	39	0.92	0.24
Total	4,227	100	25.59

Table 2. Age-specific distribution of HPV infection.

Age group	Number of HPV detected women	Number of HPV positive women	Positive rate (%)
≤ 20	35	16	45.71
21 - 30	1,204	232	19.27
31 - 40	4,164	774	18.59
41 - 50	5,479	1,066	19.46
51 - 60	4,515	1,183	26.20
≥ 60	1,119	337	30.12
Total	16,516	3,608	21.85

rolled for final statistical analysis in this study. In all, 3,608 women were positive and the positive rate was 21.85%. The positive rate of low-risk and high-risk genotypes was respectively 6.84% (1,130/16,516) and 25.59% (4,227/16,516), which had a significant difference ($p < 0.05$). Among low-risk genotypes, HPV 42,

Table 3. Detailed analysis of age-specific distribution of HPV positive genotypes.

Age group	≤ 20	21 - 30	31 - 40	41 - 50	51 - 60	≥ 60
Low risk genotypes						
6	2 (12.50%)	7 (3.02%)	23 (2.97%)	32 (3.00%)	36 (3.04%)	17 (5.04%)
11	1 (6.25%)	3 (1.29%)	8 (1.03%)	10 (0.94%)	14 (1.31%)	2 (0.59%)
42	0 (0.00%)	26 (11.21%)	72 (9.30%)	145 (13.60%)	140 (13.13%)	42 (12.46%)
43	0 (0.00%)	9 (3.88%)	49 (6.33%)	54 (5.07%)	57 (5.35%)	11 (3.26%)
81	0 (0.00%)	18 (7.76%)	72 (9.30%)	96 (9.01%)	144 (12.17%)	40 (11.87%)
High risk genotypes						
16	3 (18.75%)	19 (8.19%)	81 (10.47%)	123 (11.54%)	127 (10.74%)	46 (13.65%)
18	4 (25.00%)	15 (6.47%)	18 (2.33%)	42 (3.94%)	43 (4.03%)	9 (2.67%)
26	2 (12.50%)	1 (0.43%)	3 (0.39%)	5 (0.47%)	5 (0.42%)	1 (0.30%)
31	0 (0.00%)	9 (3.88%)	29 (3.75%)	33 (3.10%)	22 (1.86%)	31 (9.20%)
33	1 (6.25%)	14 (6.03%)	17 (2.20%)	47 (4.41%)	77 (6.51%)	29 (8.61%)
35	0 (0.00%)	4 (1.72%)	16 (2.07%)	10 (1.78%)	23 (1.94%)	22 (6.53%)
39	1 (6.25%)	29 (12.50%)	56 (7.24%)	76 (7.13%)	98 (8.28%)	27 (8.01%)
45	1 (6.25%)	1 (0.43%)	10 (1.29%)	2 (0.19%)	9 (0.76%)	3 (0.89%)
51	0 (0.00%)	21 (9.05%)	66 (8.53%)	72 (6.75%)	100 (8.45%)	36 (10.68%)
52	1 (6.25%)	52 (22.41%)	176 (22.74%)	257 (24.11%)	296 (25.02%)	109 (32.34%)
53	2 (12.50%)	21 (9.05%)	75 (9.69%)	118 (11.07%)	171 (14.45%)	46 (13.65%)
56	1 (6.25%)	12 (5.17%)	42 (5.43%)	52 (4.88%)	100 (8.45%)	30 (8.90%)
58	3 (18.75%)	34 (14.66%)	80 (10.34%)	120 (11.26%)	135 (11.41%)	55 (16.32%)
59	2 (12.50%)	14 (6.03%)	51 (6.59%)	33 (3.10%)	48 (4.06%)	19 (5.64%)
66	5 (31.25%)	13 (5.60%)	36 (4.65%)	34 (3.19%)	53 (4.48%)	20 (5.93%)
68	1 (6.25%)	12 (5.17%)	57 (7.36%)	77 (7.22%)	77 (6.51%)	45 (13.35%)
73	0 (0.00%)	0 (0.00%)	11 (1.42%)	19 (1.78%)	21 (1.76%)	3 (0.89%)
82	2 (12.50%)	1 (0.43%)	13 (1.68%)	5 (0.66%)	12 (1.01%)	4 (1.19%)

Table 4. Distribution of single and multiple HPV infection.

Kind	Single infection (%)	Double infection (%)	Triple infection (%)	Quadruple infection (%)	Quintuple infection (%)	≥ Sextuple infection (%)	Total (%)
	2,484 (68.85)	752 (20.84)	227 (6.29)	76 (2.11)	52 (1.44)	17 (0.47)	3,608 (100.00)

81, and 43 were 37.61%, 32.74%, and 15.93%, respectively. Among high-risk genotypes, HPV 52, 53, and 58 were in the top three (21.08%, 10.24% and 10.10%). To sum up, HPV 52, 53, and 58 were the most common genotypes, and three were all high-risk genotypes. All data were listed in Table 1.

Age-specific distribution of HPV infection

All women were divided into six age groups, including ≤ 20, 21 - 30, 31 - 40, 41 - 50, 51 - 60 and ≥ 60 age group. In the age-specific distribution of HPV infection, the positive rate was 45.71%, 19.27%, 18.59%, 19.46%, 26.20%, and 30.12% in each age group. The highest positive rate was in the ≤ 20 age group, and it was 45.71%. There were no significant differences in the positive rate among different age groups ($p > 0.05$), as shown in Table 2.

Detailed analysis of age-specific distribution of HPV positive genotypes

In the detailed analysis of age-specific distribution, HPV 66, 18, and 16 were dominant in the ≤ 20 age group; HPV 52, 58, and 39 were common in the 21 - 30 age group; HPV 52, 16, and 58 were dominant in the 31

Table 5. Detailed analysis of single and multiple HPV infection in different age groups.

Age group	Single infection (%)	Double infection (%)	Triple infection (%)	Quadruple infection (%)	Quintuple infection (%)	≥ Sextuple infection (%)	Total (%)
≤ 20	9 (56.25)	1 (6.25)	3 (18.75)	2 (12.50)	1 (6.25)	0 (0.00)	16 (100.00)
21 - 30	169 (72.84)	40 (17.24)	13 (5.60)	2 (0.86)	5 (2.16)	3 (1.29)	232 (100.00)
31 - 40	560 (72.35)	160 (20.67)	41 (5.30)	8 (1.03)	4 (0.52)	1 (0.13)	774 (100.00)
41 - 50	778 (72.98)	214 (20.08)	47 (4.41)	16 (1.50)	8 (0.75)	3 (0.28)	1,066 (100.00)
51 - 60	797 (67.37)	248 (20.96)	84 (7.10)	30 (2.53)	21 (1.78)	3 (0.25)	1,183 (100.00)
≥ 60	171 (50.74)	89 (26.41)	40 (11.87)	18 (5.34)	13 (3.86)	6 (1.78)	337 (100.00)

- 40 age group; HPV 52, 42, and 16 were common in the 41 - 50 age group; HPV 52, 81, and 42 were dominant in the 51 - 60 age group; and HPV 52, 58, and 16 were common in the ≥ 60 age group. To summarize, HPV 52 was the most dominant in all different age groups, as listed in Table 3.

Detailed analysis of single and multiple infection in different age groups

There were 2,484 (68.85%) women with a single infection and 1,124 (31.15%) women with a multiple infection. The proportion of single infection was obviously higher than that of multiple infection, which had a significant difference (68.85% vs. 31.15%, $p < 0.05$). There were more than five different kinds of multiple infections with two or more genotypes of HPV (two to six or more than six different HPV genotypes) in each kind. In the multiple infections, double infection was the most common, which had a significant difference ($p < 0.05$). Single infection was the most detected in each age group. Multiple infection was the most detected in those aged ≤ 20, and the positive rate was 43.75%, as shown in Table 4 and Table 5.

DISCUSSION

Cervical cancer is one of the most common malignancies and the leading cause of cancer related death in women all over the world. A global goal of reducing the rate of incidence and expanding vaccination program every year had been set by WHO. Epidemiological research showed that more than ninety-five percent of cervical cancer females who had a persistent high-risk HPV infection were fifty times more likely to get cervical cancer than those without HPV infection [16,17]. It is suggested that women should undergo screening with HPV tests more than once during 35 to 45 years old for prevention. HPV infection always has significant regional and demographic differences and the prevalence and genotype distribution of HPV infection also vary greatly in the different areas of China. In a general way, HPV 16, 52, and 58 were the most common high-risk HPV genotypes [18,19]. In our study, among all of the 16,516 women, 3,608 were detected as positive, and the positive rate was 21.85%. It was near to the global statistic of 2 - 20%, which was revealed in the previous studies. The reason might be that the number of women included in the study population in the research was large and the research results obtained were authentic. Previous studies had showed that the majority of HPV positive women was in the ≤ 20 age group in Chengdu City and in the ≤ 30 age group in Zhoupu District, Shanghai City [20,21]. In our study, the positive rate was high in the ≤ 20 and ≥ 60 age groups in Chaohu City, and it presented that HPV infection was more common in younger and older women, which revealed that it was urgent to increase the coverage of HPV screening and strengthen the HPV vaccination in these two age groups. In the Chaohu area, high-risk genotype infection and single infection were both obviously dominant and accounted for 25.59% and 68.85%. It was consistent with the results of Luo et al., who reported that high-risk genotype infection and single infection were more prevalent than low-risk genotype infection and multiple infection in Southern China [22]. More high-risk genotype infection and single infection than low-risk genotype infection and multiple infection, and high-risk genotype infection and single infection mainly occurring in middle and old age were the characteristics of HPV infection in Chaohu. The reason might be that Chaohu City is a traditional conservative city and people's sexual attitudes are not open. Up to now, the main way of HPV infection is sexual transmission and close transmission and people with middle-age are a group with more frequent sexual activities and the probability of infection is also increasing. In old age, although the female sex life is reduced, the defense function of the vagina declines and women become more susceptible to pathogenic microorganism with the decline of ovarian function and the decrease of estrogen levels. More studies found that the incidence of bacterial vaginitis and mycotic vaginitis in women with HPV infection was also high [23]. With the increase in age, due to the increased incidence of metabolic diseases and reduced immunity, HPV infection becomes more likely. For women, regular HPV screening and vaccination are effective measures of preventing infection [24,25]. Among 23 genotypes, HPV 52, 53, and 58 are the most common genotypes which are all high-risk genotypes. High-risk HPV genotypes are usually related to cervical cancer, and it suggests that we should pay more attention to HPV screening in order to prevent cancer. In the detailed analysis of age-specific distribution of HPV positive genotypes, HPV 52 is among the most dominant in all different age groups except in the ≤ 20 age group, which suggests that special attention should be paid to the detection and prevention of HPV52. In previous reports, there have been some simultaneous infections with eight HPV genotypes which was rare, and it was concluded that multiple infections simultaneously with six HPV genotypes is uncommon [26]. In our study, the number of equal or more than sextuple infections was so small and it was in line with the conclusion. In the multiple infection, double infection was the most common and equal or more than sextuple infection was the least, which showed a significant difference ($p < 0.05$).

CONCLUSION

The prevalence and genotype distribution of HPV in Chaohu were different from those of other regions in China. More high-risk genotype infection and single infection than low-risk genotype infection and multiple infection, and high-risk genotype infection and single infection mainly occurring in the middle and old age were the characteristics of HPV infection in Chaohu. HPV 52, 53, and 58 were the predominant HPV genotypes, suggesting that vaccines which contained HPV 52, 53, and 58 genotypes might be a better choice for this region.

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Ethical Approval:
This research was reviewed and approved by the Ethics Committee of the Fourth Affiliated Hospital of Anhui Medical University (Number: KYXM-202205-008).

Data Availability Statement:
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Interest:
The authors have no conflicts of interest to declare.

References:

1. Gusho E, Laimins AL. Human papillomaviruses sensitize cells to DNA damage induced apoptosis by targeting the innate immune sensor cGAS. PLoS Pathog 2022;18(7):e1010725. (PMID: 35877778)

2. Li MZ, Zhao C, Zhao Y, et al. Immunogenicity, efficacy, and safety of human papillomavirus vaccine: Data from China. Front Immunol 2023;14:1112750. (PMID: 36993948)

3. Gholamzad A, Khakpour N, Hashemi M, Gholamzad M. Prevalence of high and low risk HPV genotypes among vaccinated and non-vaccinated people in Tehran. Virol J 2024;21(1):9. (PMID: 38183101)

4. Bettampadi D, Dickey B, Abrahamsen M, et al. Differences in Factors Associated With High- and Low-Risk Oral Human Papillomavirus Genotypes in Men. J Infect Dis 2021;223(12):2099-107. (PMID: 33151300)

5. Clarke AM, Deshmukh AA, Suk R, et al. A systematic review and meta-analysis of cytology and HPV-related biomarkers for anal cancer screening among different risk groups. Int J Cancer 2022;151(11):1889-901. (PMID: 35793241)

6. Oyouni AAA. Human papillomavirus in cancer: Infection, disease transmission, and progress in vaccines. EJ Infect Public Health 2023;16(4):626-31. (PMID: 36868166)

7. Viveros-Carreno D, Fernandes A, Pareja R. Updates on cervical cancer prevention. Int J Gynecol Cancer 2023;33(3):394-402. (PMID: 36878567)

8. Sahasrabuddhe VV. Cervical Cancer: Precursors and Prevention. Hematol Oncol Clin North Am 2024;38(4):771-81. (PMID: 38760198)

9. Jensen EJ, Becker LG, Jackson JB, Rysavy MB. Human Papillomavirus and Associated Cancers: A Review. Viruses 2024;16(5): 680. (PMID: 38793561)

10. Shi JF, Canfell K, Lew JB, Qiao YL. The burden of cervical cancer in China: synthesis of the evidence. Int J Cancer 2012;130(3): 641-52. (PMID: 21387308)

11. Wu SY, Jiao J, Yue XY, Wang Y. Cervical cancer incidence, mortality, and burden in China: a time-trend analysis and comparison with England and India based on the global burden of disease study 2019. Front Public Health 2024;12:1358433. (PMID: 38510348)

12. Song Q, Wang XX. Prevalence and Genotype Distribution of HPV in Hangzhou, China. Clin Lab 2024;70(6). (PMID: 38868876)

13. Xu XX, Feng T, Li D, Lou H, Lan H. Prevalent distribution and survival outcome of HPV infection in patients with early-stage cervical cancer in Hangzhou, China. BMC Infect Dis 2022;22(1): 32(4):e12970. (PMID: 36522614)

14. Wang R, Guo XL, Wisman GBA, et al. Nationwide prevalence of human papillomavirus infection and viral genotype distribution in 37 cities in China. BMC Infect Dis 2015;15:257. (PMID: 26142044)

15. Liu MM, Zhang XG, Guo LL, Sun W, Jiang X. HPV prevalence and genotype distribution among 38056 women in Weifang, China: a cross-sectional study. BMJ Open 2023;13(9):e073332. (PMID: 37669845)

16. Wolf J, Kist LF, Pereira SB, et al. Human papillomavirus infection: Epidemiology, biology, host interactions, cancer development, prevention, and therapeutics. Rev Med Virol 2024;34(3): e2537. (PMID: 38666757)

17. Okunade KS. Human papillomavirus and cervical cancer. J Obstet Gynaecol 2020;40(5):602-8. (PMID: 31500479)

18. Zhao C, Zhao Y, Li JR, Li M, Shi Y, Wei L. Opportunities and challenges for human papillomavirus vaccination in China. Hum Vaccin Immunother 2024;20(1):2329450. (PMID: 38575524)

19. Li KM, Li QL, Song L, et al. The distribution and prevalence of human papillomavirus in women in mainland China. Cancer 2019;125(7):1030-7. (PMID: 30748006)

20. Zhang JY, Zha TZ, Wang XM, He W. Prevalence and genotype distribution of HPV infections among women in Chengdu, China. Virol J 2024;21(1):52. (PMID: 38429823)

21. Li HP, Xiao ZG, Xing BL, et al. Association between common vaginal and HPV infections and results of cytology test in the Zhoupu District, Shanghai City, China, from 2014 to 2019. Virol J 2022;19(1):127. (PMID: 35906702)

22. Luo LP, He P, Liu QT, et al. Prevalence and genotype distribution of HPV infection among 214,715 women from Southern China, 2012 - 2018: baseline measures prior to mass HPV vaccination. BMC Infect Dis 2021;21(1):328. (PMID: 33827456)

23. Rosa DN, Santangelo F, Todisco C, Dequerquis F, Santangelo C. Collagen-Based Ovule Therapy Reduces Inflammation and Improve Cervical Epithelialization in Patients with Fungal, Viral, and Bacterial Cervico-Vaginitis. Medicina (Kaunas) 2023;59(8): 1490. (PMID: 37629780)

24. Paaso A, Jaakola A, Syrjanen S, Louvanto K. From HPV Infection to Lesion Progression: The Role of HLA Alleles and Host Immunity. Acta Cytol 2019;63(2):148-58. (PMID: 30783048)

25. Fuzzell NL, Perkins BR, Christy MS, Lake PW, Vadaparampil ST. Cervical cancer screening in the United States: Challenges and potential solutions for underscreened groups. Prev Med 2021; 144:106400. (PMID: 33388330)

26. Rio-Ospina DL, Leon SS, Camargo M, et al. Multiple high-risk HPV genotypes are grouped by type and are associated with viral load and risk factors. Epidemiol Infect 2017;145(7):1479-90. (PMID: 28185605)