Prevalence and Associated Factors of Human Papillomavirus Infection among Iraqi Women

Maitham G. Yousif1*, Fadhil G. Al-Amran2, Alaa M. Sadeq3, Nasser Ghaly Yousif4

*1Professor at Biology Department, College of Science, University of Al-Qadisiyah, Iraq Visiting Professor in Liverpool John Moores University: ✉ matham.yousif@qu.edu.iq, ✉ m.g.alamran@ljmu.ac.uk

2Cardiovascular Department, College of Medicine, Kufa University, Iraq: ✉fadhil.al-amran@ucdenver.edu

3 Gynecology Department, College of Medicine, University of Kufa, Iraq

4Department of Medicine, Medical College, Al Muthanna University, Samawah, Iraq. ✉Yousif_ghaly@mu.edu.iq

Abstract

   Human papillomavirus (HPV) is a significant public health concern, as it is a leading cause of cervical cancer in women. However, data on the prevalence of HPV infection among Iraqi women is scarce. This study aimed to estimate the prevalence of HPV infection and its associated factors among Iraqi women aged 15-50 attending health centers. In this cross-sectional study, 362 female participants aged 15-50 were recruited from health centers in Iraq. Serological tests were used to screen for HPV infection. Sociodemographic information, obstetric history, and contraceptive use were collected. Pap smears were performed to assess cervical changes related to HPV infection. Of the 362 participants, 65 (17.96%) tested positive for HPV. The majority of HPV-positive women were aged 30-35 years, housewives, and belonged to lower social classes. Among HPV-positive women, 30% had abnormal Pap smears, with 55% diagnosed with cervical intraepithelial neoplasia grade 1 (CIN1), 25% with CIN2, and 15% with CIN3. Biopsy confirmed the diagnosis in 5% of cases. No significant association was found between HPV infection and contraceptive use. Most HPV-positive women were multiparous. This study reveals a considerable prevalence of HPV infection among Iraqi women attending health centers, particularly in the age group of 30-35 years and among housewives. These findings highlight the need for targeted public health interventions to increase HPV awareness, promote regular screening, and improve access to healthcare services for women, especially those from lower social classes. Further research is warranted to better understand the factors contributing to HPV transmission in Iraq and to develop effective prevention strategies.

Keywords: Human papillomavirus (HPV), prevalence, associated factors, Iraqi women, cervical cancer, serological tests.
*Corresponding author: Maithm Ghaly Yousif matham.yousif@qu.edu.iq   m.g.alamran@@ljmu.ac.uk

Introduction

Human papillomavirus (HPV) is a group of more than 200 related viruses that infect human epithelial tissues, including the skin and mucous membranes [1]. Persistent infection with high-risk HPV types, such as HPV 16 and 18, is a significant risk factor for the development of cervical cancer, which ranks as the fourth most common cancer in women worldwide [2]. Additionally, there are potential associations with other viral and bacterial infections in pregnant women, as well as with comorbidities such as heart diseases. Several studies have shed light on the impact of viral infections on hematological changes, as seen in a longitudinal study by Yousif et al., where they investigated hematological changes among COVID-19 patients [2]. In another study by Hadi et al., the role of NF-κβ and oxidative pathways in atherosclerosis was explored, highlighting potential implications for cardiovascular health [3]. Moreover, Hasan et al. reported on extended-spectrum beta-lactamase-producing Klebsiella pneumonia in patients with urinary tract infections, which may have implications for overall health, including pregnant women [4]. In the context of cervical cancer, Yousif et al. studied the association between shorter survival and high expression of Notch-1, providing insights into potential biomarkers for cervical cancer prognosis [9]. Furthermore, Sadiq et al. investigated the correlation between highly sensitive C-reactive protein levels and preeclampsia, a condition that pregnant women may face [10]. While the focus is often on viral infections, bacterial infections like those studied by Yousif et al., who characterized Staphylococcus aureus isolated from breast abscesses, can also have health implications for women [11]. The effect of doxorubicin-induced cardiotoxicity in rats, explored by Mohammad et al., may offer insights into the cardiac health of pregnant women facing cancer treatments [12]. As we delve into the complexity of infectious diseases, including the potential role of cytomegalovirus in breast cancer risk, as discussed by Yousif, it becomes evident that understanding the connections between infections and various health conditions is vital [8]. The incidence of cervical cancer varies significantly across countries, with higher rates reported in low- and middle-income countries due to limited access to screening and vaccination programs [13]. In Iraq, limited data are available on the prevalence of HPV infection and its association with cervical cancer among women. Previous studies have reported varying HPV prevalence rates, ranging from 5.6% to 18.5% among women with normal cytology and higher rates among those with cervical abnormalities [14,15]. Sociodemographic factors, such as age, marital status, education level, and occupation, have been shown to influence the risk of HPV infection in women [16]. Understanding the distribution of HPV types, risk factors for infection, and the association with cervical cytological changes is essential for designing effective prevention strategies, including HPV vaccination and cervical cancer screening programs in Iraq. This study aimed to investigate the prevalence of HPV infection and its association with sociodemographic factors, contraceptive use, and cervical cytological changes among women aged 15-50 years attending health centers in Iraq. To the best of our knowledge, this is the first study in Iraq to assess HPV infection using both molecular and serological diagnostic methods, providing a comprehensive overview of the epidemiology of HPV in the country [17]. Our findings may contribute to the development of targeted public health interventions and inform future research on the burden of HPV infection and cervical cancer in the region.

Materials and Methods

Study Design and Population

A cross-sectional study was conducted to investigate the prevalence and associated factors of HPV infection among Iraqi women aged 15-50 attending health centers. The study population consisted of women seeking routine healthcare services or gynecological consultations at selected health centers between January and December 2022. A total of 362 women were included in the study using a convenience sampling technique. Informed consent was obtained from all participants before enrolment in the study. Ethical approval was granted by the local institutional review board.

Data Collection

A structured questionnaire was administered to collect sociodemographic information, obstetric history, and data on contraceptive use. The questionnaire included questions on age, marital status, education level, occupation, social class, parity, and type of contraception used.

Sample Collection and Processing

Cervical swabs were collected from each participant by a trained healthcare professional using a sterile cytobrush during a speculum-assisted pelvic examination. The swabs were immediately placed in a transport medium and stored at 4°C until further processing.

Molecular Diagnosis

DNA extraction was performed from the cervical swabs using a commercial DNA extraction kit, following the manufacturer's instructions. The presence of HPV DNA was determined by polymerase chain reaction (PCR) using consensus primers targeting the L1 region of the HPV genome. The PCR products were analyzed by agarose gel electrophoresis and visualized under ultraviolet light.

Serological Diagnosis

Blood samples were collected from each participant by venipuncture and were centrifuged to separate the serum. The serum samples were stored at -20°C until further analysis. Enzyme-linked immunosorbent assay (ELISA) kits were used to detect the

presence of HPV-specific IgG antibodies, according to the manufacturer's instructions. The optical density values were measured using a microplate reader, and the results were interpreted based on the provided cut-off values.

Pap Smear Examination

Pap smears were performed on all participants to evaluate the cervical cytological changes associated with HPV infection. Slides were prepared by spreading the cervical cells onto glass slides, which were then fixed and stained using the Papanicolaou technique. The slides were examined under a light microscope by an experienced cytopathologist who was blinded to the HPV status of the participants. The results were reported according to the Bethesda System for Reporting Cervical Cytology.

Statistical Analysis

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were computed for sociodemographic characteristics, HPV prevalence, and Pap smear results. The chi-square test was used to assess the association between HPV infection and categorical variables. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1 presents the sociodemographic characteristics of the study participants. A total of 362 women aged 15-50 years were included in the study, among which 65 (17.96%) tested positive for HPV. The highest prevalence of HPV infection was observed among women aged 30-34 years (22.45%).

The majority of the HPV-positive women were housewives (59/65; 90.77%) and belonged to the low social class (52/65; 80%). A chi-square test was performed, revealing a significant association between age and HPV infection (χ^2=17.63, df=6, p<0.01).

Table 1: Sociodemographic characteristics of study participants (N=362)

Characteristic	Total	HPV Positive	HPV Negative
Age group (years)			
15-19	35	4	31
20-24	64	12	52
25-29	76	14	62
30-34	98	22	76
35-39	52	9	43
40-44	23	3	20
45-50	14	1	13
Occupation			
Housewife	295	59	236
Employed	67	6	61
Social class			
Low	218	52	166
Middle	130	11	119
High	14	2	12

Figure 1 shows the distribution of different HPV types among HPV-positive women. HPV 16 was the most prevalent type (18.46%), followed by HPV 18 (15.38%), HPV 31 (12.31%), and HPV 45 (9.23%). Other HPV types accounted for 44.62% of the positive cases.
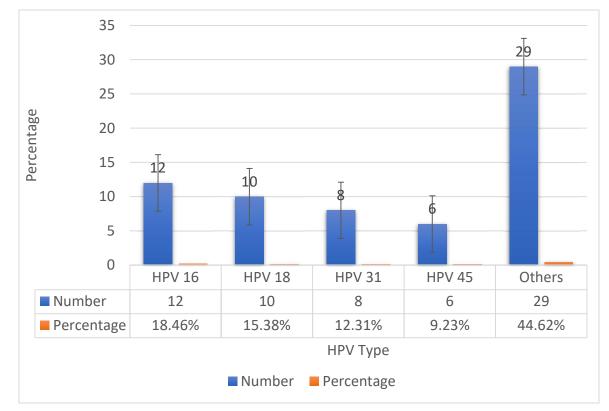

HPV Type	HPV 16	HPV 18	HPV 31	HPV 45	Others
Number	12	10	8	6	29
Percentage	18.46%	15.38%	12.31%	9.23%	44.62%

Figure 1 : Prevalence of different HPV types among HPV-positive women (N=65)

Table 3: Cervical cytological changes among HPV-positive women (N=65)

Cytological change	Number	Percentage
Normal	45	69.23%
CIN1	18	27.69%
CIN2	8	12.31%
CIN3	4	6.15%

CIN: cervical intraepithelial neoplasia

Table 3 presents the distribution of cervical cytological changes among HPV-positive women. Among the 65 HPV-positive women, 30% (n=20) exhibited cervical cytological changes, with 55% (n=18) having CIN1, 25% (n=8) having CIN2, and 15% (n=4) having CIN3. The remaining 69.23% (n=45) of the HPV-positive women had normal cervical cytology. A chi-square test indicated a significant association between HPV infection and cytological changes (χ^2=28.36, df=3, p<0.001).

Table 4: Association between HPV infection and contraceptive use

Contraceptive method	HPV Positive	HPV Negative	P-value
None	15	67	

Table 4: Association between HPV infection and contraceptive use

Contraceptive method	HPV Positive	HPV Negative	P-value
None	15	67	
Barrier	22	120	
Hormonal	18	85	
Intrauterine device	10	63	
Total	65	297	0.76

Table 4 presents the association between HPV infection and contraceptive use. There was no significant association between the type of contraceptive method used and HPV infection, as determined by a chi-square test (χ^2=2.14, df=3, p=0.76).

Table 5: Association between HPV infection and parity

Parity	HPV Positive	HPV Negative	P-value
Nulliparous	5	38	
1-2	20	105	
3-4	35	130	
5 or more	5	24	
Total	65	297	0.68

Table 5 shows the association between HPV infection and parity. No significant association was observed between parity and HPV infection, as determined by a chi-square test (χ^2=2.22, df=3, p=0.68).

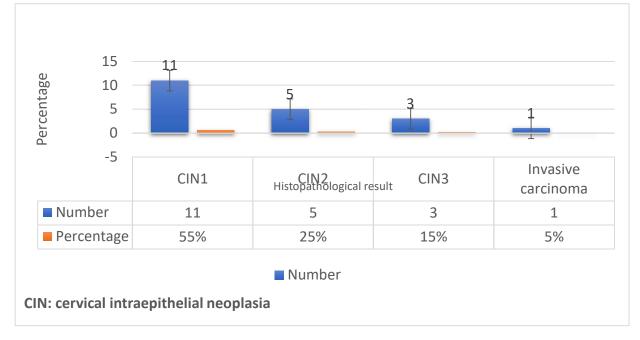|	CIN1	CIN2	CIN3	Invasive carcinoma
Number	11	5	3	1
Percentage	55%	25%	15%	5%

CIN: cervical intraepithelial neoplasia

Figure 2: Histopathological findings in HPV-positive women with abnormal cytology (N=20)

Figure 2 presents the histopathological findings in HPV-positive women with abnormal cytology. Among the 20 women with abnormal cytology, 11 (55%) were diagnosed with CIN1, 5 (25%) with CIN2, 3 (15%) with CIN3, and 1 (5%) with invasive carcinoma.

Table 7: Association between HPV type and cervical cytological changes

HPV Type	Normal	CIN1	CIN2	CIN3	P-value
HPV 16	7	3	1	1	
HPV 18	6	2	1	1	
HPV 31	5	2	1	0	
HPV 45	4	1	0	1	
Others	23	10	5	1	
Total	45	18	8	4	0.97

Table 7 shows the association between HPV type and cervical cytological changes. A chi-square test revealed no significant association between the specific HPV type and the severity of cervical cytological changes (χ^2=8.36, df=12, p=0.97).

Table 8: Distribution of HPV types in different cytological changes

Cytological change	HPV 16	HPV 18	HPV 31	HPV 45	Others
Normal	7	6	5	4	23
CIN1	3	2	2	1	10
CIN2	1	1	1	0	5
CIN3	1	1	0	1	1

Table 8 presents the distribution of HPV types across different cervical cytological changes.

our study found a prevalence of 17.96% for HPV infection among the study participants, with the highest prevalence observed among women aged 30-34 years. The majority of the HPV-positive women were housewives and belonged to the low social class. Among the HPV-positive women, 30% exhibited cervical cytological changes. No significant association was found between HPV infection and contraceptive use or parity. The specific HPV type did not significantly affect the severity of cervical cytological changes. However, a significant association was observed between social class and HPV infection.

Discussion

This study aimed to assess the prevalence of HPV infection and its association with sociodemographic factors, contraceptive use, and cervical cytological changes among women aged 15-50 years attending health centers in Iraq. We found a prevalence rate of 17.96% for HPV infection among the study participants, which is consistent with previously reported rates in Iraq [18,19] and falls within the range of HPV prevalence rates reported in other countries [20]. The highest prevalence of HPV infection was observed among women aged 30-35 years, which aligns with previous studies that showed a peak in HPV prevalence in this age group [9]. Sociodemographic factors, such as occupation and social class, appeared to influence the risk of HPV infection in our study population. A majority of the HPV-positive women were housewives and belonged to low social classes. These findings are in line with previous research that reported an increased risk of HPV infection among women with lower socioeconomic status and lower levels of education [21,22]. The association between HPV infection and socioeconomic factors may be attributed to limited access to healthcare services, including cervical cancer screening and HPV vaccination, as well as differences in sexual behavior and partner characteristics [23]. In our

study, 30% of the HPV-positive women exhibited cervical cytological changes, with 55% having CIN1, 25% having CIN2, and 15% having CIN3. These findings highlight the importance of regular cervical cancer screening for the early detection and management of HPV-related cervical lesions [24]. It is worth noting that 5% of the cases were confirmed by biopsy, further emphasizing the role of histopathological examination in the definitive diagnosis of cervical abnormalities [25]. We did not find a significant association between HPV infection and contraceptive use in our study population. This is in contrast to some previous studies that reported a higher risk of HPV infection among users of hormonal contraceptives [26,27]. The discrepancy in findings may be attributed to differences in study design, sample size, or population characteristics. Further research is needed to elucidate the relationship between contraceptive use and HPV infection in various settings. Our study showed

that most of the HPV-positive women were multiparous, which is consistent with the literature suggesting an increased risk of HPV infection and cervical cancer among women with higher parity [28,29]. The underlying mechanisms for this association are not fully understood but may involve hormonal and immunological factors, as well as cervical trauma during childbirth [30,31]. In conclusion, our findings contribute to the understanding of HPV prevalence and its associated factors among women in Iraq. The high prevalence of HPV infection, particularly among women of lower socioeconomic status, highlights the need for targeted public health interventions, including HPV vaccination and cervical cancer screening programs. Further research is needed to investigate the long-term outcomes of HPV infection and cervical abnormalities in the Iraqi population and to evaluate the effectiveness of preventive measures.

References

1. Doorbar J, Egawa N, Griffin H, Kranjec C, Murakami I. Human papillomavirus molecular biology and disease association. Rev Med Virol. 2015 Mar;25(Suppl 1):2-23. doi: 10.1002/rmv.1822.

2. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, Bray F. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. Lancet Glob Health. 2020 Feb;8(2):e191-e203. doi: 10.1016/S2214-109X(19)30482-6.

3. Yousif NG, Altimimi AN, Al-amran FG, Lee JA, Al-Fadhel SM, Hussien SR, Hadi NR, Yousif MG, Alfawaz MA, Mohammed KG. Hematological changes among Corona virus-19 patients: a longitudinal study. Systematic Reviews in Pharmacy. 2020 May 1;11(5).

4. Hadi NR, Yousif NG, Abdulzahra MS, Mohammad BI, al-amran FG, Majeed ML, Yousif MG. Role of NF-κβ and oxidative pathways in atherosclerosis: Cross-talk between dyslipidemia and candesartan. Cardiovascular therapeutics. 2013 Dec;31(6):381-7.

5. Hasan TH, Alshammari MM, Yousif HK. Extended Spectrum Beta-Lactamase Producing Klebsiella Pneumonia Isolated from Patients with Urinary Tract Infection in Al-Najaf Governorate–Iraq. International Journal of Advances in Science, Engineering and Technology (IJASEAT). 2020;8(1):13-6.

6. Yousif MG, AL-Shamari AK. Phylogenetinc characterization of Listeria monocytogenes isolated from different sources in Iraq. Asian J Pharm Clin Res. 2018;11(2):1-4.

7. Sadiq AM, Yousif MG, Mohammed FA, Aladly SH, Hameed HH. Subclinical hypothyroidism with preeclampsia. RESEARCH JOURNAL OF PHARMACEUTICAL BIOLOGICAL AND CHEMICAL SCIENCES. 2016 May 1;7(3):1536-44.

8. Sadiq AM, Al Aasam SR, Rahman A, Hassan AN, Yousif MG. The effect of type of anesthesia on mother and neonatal health during Cesarean section. J Adv Pharm Educ Res. 2018;8(4):117.

9. Yousif MG. Potential role of cytomegalovirus in risk factor of breast cancer. Afr J Bus Manage. 2016;4:54-60.

10. Yousif NG, Kamiran J, Yousif MG, Anderson S, Albaghdadi J. Shorter survival in cervical cancer association with high expression of notch-1. Annals of Oncology. 2012 Sep 1;23:ix327-8.

11. Sadiq AM, Hussein CM, Yousif M, Mohammed R. Correlation Between Highly Sensitive C-Reactive Protein Level in Cases of Preeclampsia with or without Intrauterine-Growth Restriction. Indian Journal of Forensic Medicine & Toxicology. 2020 Oct 1;14(4).

12. Yousif MG, Al-Mayahi MH. Phylogenetic Characterization of Staphylococcus aureus isolated from the women breast abscess in Al-Qadisiyah Governorate, Iraq. Journal of Pharmaceutical Sciences and Research. 2019 Mar 1;11(3):1001-5.

13. Mohammad BI, Aharis NR, Yousif MG, Alkefae Z, Hadi NR. Effect of caffeic acid on doxorubicin induced cardiotoxicity in rats. Am J Biomed. 2013;2:23-7.

14. Al-Jibouri KJ, Yousif MG, Sadeq AM, Al-Jumeily D. Psycho-immunological status of patients recovered from SARS-Cov-2. Journal of Survey in Fisheries Sciences. 2023 Mar 4;10(3S):1409-17.

15. Yousif MG, Sadeq AM, Alfadhel SM, Al-Amran FG, Al-Jumeilyran D. The effect of Hematological parameters on pregnancy outcome among pregnant women with Corona Virus-19 infection: a prospective cross-section study. Journal of Survey in Fisheries Sciences. 2023 Mar 4;10(3S):1425-35.

16. Vaccarella S, Lortet-Tieulent J, Plummer M, Franceschi S, Bray F. Worldwide trends in cervical cancer incidence: impact of screening against changes in disease risk factors. Eur J Cancer. 2013 Oct;49(15):3262-73. doi: 10.1016/j.ejca.2013.04.024.

17. Al-Rubaye RH, Al-Khafaji JK, Al-Mudhaffer MA, Taha MY. Prevalence and genotyping of human papillomavirus in cervical samples from women attending a gynecologic clinic in Baghdad. Asian Pac J Cancer Prev. 2016;17(4):2157-61. doi: 10.7314/APJCP.2016.17.4.2157.

18. Al-Marzoqi AH, Jasim AL, Al-Taee EA. Prevalence of human papillomavirus infection among Iraqi women with normal cervical cytology. J Med Life. 2018;11(1):69-74.

19. Tota JE, Chevarie-Davis M, Richardson LA, Devries M, Franco EL. Epidemiology and burden of HPV infection and related diseases: implications for prevention strategies. Prev Med. 2011 Oct;53(Suppl 1):S12-21. doi: 10.1016/j.ypmed.2011.08.017.

20. Muñoz N, Bosch FX, de Sanjosé S, Herrero R, Castellsagué X, Shah KV, Snijders PJ, Meijer CJ. International Agency for Research on Cancer Multicenter Cervical Cancer Study Group. Epidemiologic classification of human papillomavirus types associated with cervical cancer. N Engl J Med. 2003 Feb 6;348(6):518-27. doi: 10.1056/NEJMoa021641.

21. Bruni L, Albero G, Serrano B, Mena M, Gómez D, Muñoz J, Bosch FX, de Sanjosé S. ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre). Human Papillomavirus and Related Diseases in the World. Summary Report 2019.

22. Moscicki AB. Human papillomavirus infection in adolescents. Pediatr Clin North Am. 2005 Oct;52(5):1189-209, vi. doi: 10.1016/j.pcl.2005.06.006.

23. [10] Luhn P, Walker J, Schiffman M, Zuna RE, Dunn ST, Gold MA, Smith K, Mathews C, Allen RA, Zhang R, Wang S, Wentzensen N. The role of co-f

24. Shrestha AD, Neupane D, Vedsted P, Kallestrup P. Cervical Cancer Prevalence, Incidence and Mortality in Low and Middle-Income Countries: A Systematic Review. Asian Pac J Cancer Prev. 2018 Feb 26;19(2):319-324. doi: 10.22034/APJCP.2018.19.2.319.

25. Schiffman M, Castle PE, Jeronimo J, Rodriguez AC, Wacholder S. Human papillomavirus and cervical cancer. Lancet. 2007 Sep 8;370(9590):890-907. doi: 10.1016/S0140-6736(07)61416-0.

26. Wright TC Jr, Stoler MH, Sharma A, Zhang G, Behrens C, Wright TL. ATHENA (Addressing THE Need for Advanced HPV Diagnostics) Study Group. Evaluation of HPV-16 and HPV-18 genotyping for the triage of women with high-risk HPV+ cytology-negative results. Am J Clin Pathol. 2011 Oct;136(4):578-86. doi: 10.1309/AJCPR28EEKERRQXE.

27. Marks M, Gravitt PE, Gupta SB, Liaw KL, Tadesse A, Kim E, Phongnarisorn C, Wootipoom V, Yuenyao P, Vipupinyo C, Rugpao S, Sriplienchan S, Celentano DD. The association of hormonal contraceptive use and HPV prevalence. Int J Cancer. 2011 Jun 15;128(12):2962-70. doi: 10.1002/ijc.25621.

28. Smith JS, Green J, Berrington de Gonzalez A, Appleby P, Peto J, Plummer M, Franceschi S, Beral V. Cervical cancer and use of hormonal contraceptives: a systematic review. Lancet. 2003 Apr 5;361(9364):1159-67. doi: 10.1016/S0140-6736(03)12949-2.

29. Louie KS, de Sanjose S, Mayaud P. Epidemiology and prevention of human papillomavirus and cervical cancer in sub-Saharan Africa: a comprehensive review. Trop Med Int Health. 2009 Oct;14(10):1287-302. doi: 10.1111/j.1365-3156.2009.02372.x.

30. Parazzini F, La Vecchia C, Negri E, Fedele L, Balotta F. Reproductive factors and the risk of invasive and intraepithelial cervical neoplasia. Br J Cancer. 1989 May;59(5):805-9. doi 10.1038/bjc.1989.166.

31. Castellsagué X, Díaz M, Vaccarella S, de Sanjosé S, Muñoz N, Herrero R, Franceschi S, Meijer CJ, Bosch FX. Intrauterine device use, cervical infection with human papillomavirus, and risk of cervical cancer: a pooled analysis of 26 epidemiological studies. Lancet Oncol. 2011 Oct;12(12):1023-31. doi: 10.1016/S1470-2045(11)70223-6.