

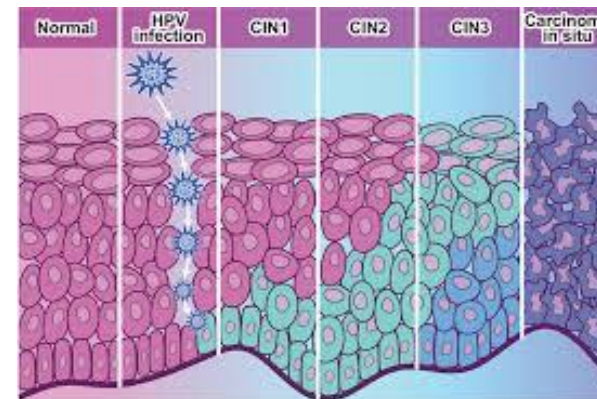
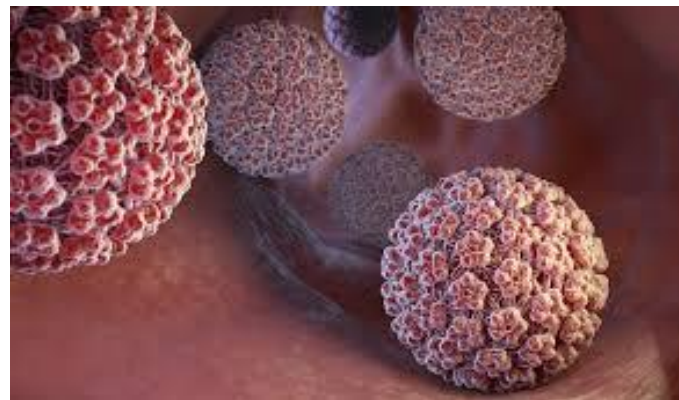


وزارتخانه علوم پزشکی
خدمات بهداشتی درمانی تبریز



HPV Transmission (sexual & nonsexual)

Dr. Vaezi Maryam
Fellowship of Gyn. & Oncology
Tabriz University Of Medical Sciences
Nov.2025



TOPICS

1. Occupational exposure to HPV 2025
2. Herd immunity and prevention in HPV transmission
3. potential non-sexual transmission routes in public environments
4. Non-sexual transmission of HPV 2024
5. Hematogenous spread of HPV 2025
6. 🧒 Early-Life HPV Infection 2025
7. Transmission of HPV via transvaginal ultrasound
8. Possible iatrogenic transmission via medical devices
9. Hand-to-genital transmission of alpha-HPV types-2019
10. Airborne HPV transmission risk during ablation procedures
11. Transmission & clearance of HPV infection in the oral cavity-2022
12. Non-sexual HPV transmission and role of vaccination
13. Waterborne Transmission
14. Vertically transmitted by breastfeeding
15. HPV Infection During Pregnancy

RESEARCH

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Healthcare providers' knowledge, attitude, and practice regarding occupational exposure to human papillomaviruses



Que Wu¹, Yongfang Li², Linying Chen² and Ling Shen^{2*}

Duan et al. BMC Public Health (2025) 25:1907
https://doi.org/10.1186/s12889-025-22319-w

BMC Public Health

RESEARCH

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Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk



Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Tao^{1*}

Kim et al. BMC Public Health (2025) 25:2686
https://doi.org/10.1186/s12889-025-23810-0

BMC Public Health

RESEARCH

Open Access

Qualitative assessment of sex-stratified human papillomavirus transmission dynamics in South Korea



Contents lists available at ScienceDirect

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Original article

Human Papillomavirus (HPV) prevalence in population younger than 12 years old: A meta-analysis and systematic review

Mona Sadat Larjani^a, Amir Javadi^{b,c}, Amirabbas Faridpour^c, Mohammad Banifazi^d, Fatemeh Ashrafi^a, Anahita Bavand^a, Ladan Moradi^a, Amitis Ramezani^{a,c}

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Review article

Airborne human papillomavirus (HPV) transmission risk during ablation procedures: A systematic review and meta-analysis

Stefano Palma^a, Timo Gnams^{b,c}, Richard Crevenna^a, Galateja Jordakieva^{b,c}

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The Lancet Infectious Diseases

Volume 19, Issue 3, March 2019, Pages 317-326



Articles

Hand-to-genital and genital-to-genital transmission of human papillomaviruses between male and female sexual partners (HITCH): a prospective cohort study

Talía Malagón PhD^{a†}, Karolina Louvanto PhD^{d†}, Michel Wissing PhD^a, Ann N Burchell PhD^{e,f}, Pierre-Paul Tellier MD^c, Mariam El-Zein PhD^a, Prof François Coutlée MD^{g,h}, Prof Eduardo L Franco DrPH^{a,b}

Home > [Virology Journal](#) > Article

Prevalence of oral HPV infection and genotype distribution in Iranian children during the early ages of life

Research | [Open access](#) | Published: 19 May 2025

Volume 22, article number 148, (2025) [Cite this article](#)

BMC

Virology Journal

Springer Nature

Prophylactic HPV vaccination in HPV-related gynecologic cancers: European Society of Gynecological Oncology (ESGO) prevention committee opinion

Nicolò Bizzarri¹ | Maria Kyrgiou^{2,3} | Rosa De Vincenzo^{1,4} | Ignacio Zapardiel⁵ | Zoia Razumova⁶ | Nadja Taumberger^{7,8} | Ico Toth⁹ | Charalampos Theofanakis¹⁰ | Murat Gultekin¹¹ | Elmar A. Joura¹²

HPV and Male Cancer: Pathogenesis, Prevention and Impact

by Soumendu Patra¹, Harshita Shand¹, Sayan Ghosal¹ and Suvankar Ghoral^{1,2,*}

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Published: 27 February 2025



Human papillomavirus: An update

Manik Kohli, MB ChB, MSc, MRCP^{a,b}, Christopher B. Bunker, MA, MD, FRCP^c, Georgios Kravvas, BSc, MB BS, MRCP^{c,*}

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Men's role in women's health: Engaging male partners in cervical cancer prevention efforts in low-to-middle-income countries

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Received 14 November 2024, Accepted 17 November 2024; Available online 17 December 2024

Principles Part 3- The Enduring Guidelines

Principles are enduring guidelines for human conduct.

The Leadership Boost podcast

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A proposal to reduce the risk of transmission of human papilloma virus via transvaginal ultrasound

C. Andrew Combs, MD, PhD | Alan Fishman, MD

Affiliations & Notes | Article Info

The Prevalence of Human Papillomavirus in Iranian Women's: A Comprehensive Systematic Review and Meta-Analysis

Original Article | Published: 03 January 2024

Volume 22, article number 8, (2024) | [Cite this article](#)

Mahsa Hojjati, Masoume Reshadati, Mahshid Rashidi, Alireza Ghasemi Moghadam, Nader Salari, Amir Abdolmaleki, Ahmad Abdullahi, Ali Asghar Khaleghi & Masoud Mohammadi

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Abstract

Background

Cervical cancer (CC) is one of the most common women's malignancies in the world. Besides, the Human Papillomavirus (HPV) is considered the main cause of CC incidence.



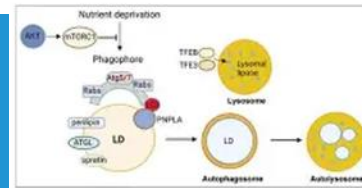
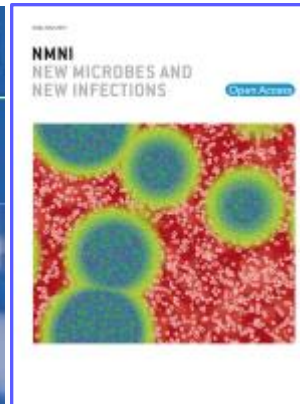
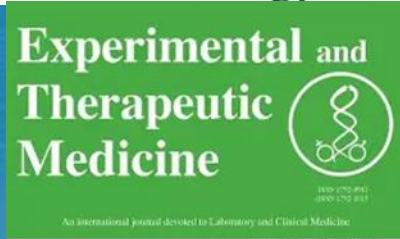
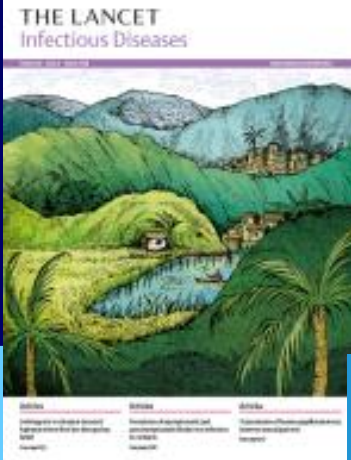
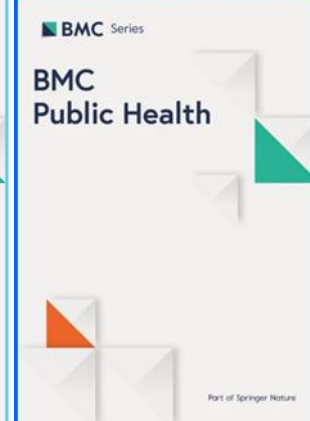
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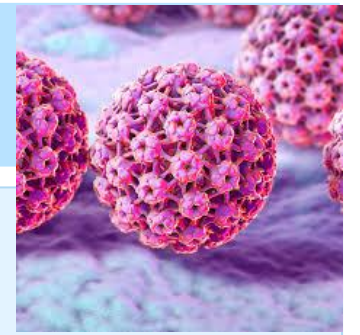
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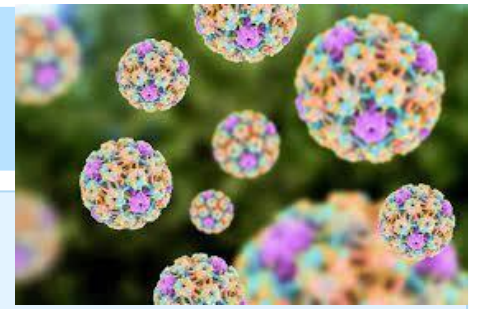
Introduction



➤ Overview

- **Papillomaviruses** are **double-stranded DNA viruses** from the *Papillomaviridae* family.
- They are **species-specific**: **HPVs** infect only humans.
- There are **over 200 HPV types**, classified as:
 - **Cutaneous** (affecting skin)
 - **Mucosal** (affecting mucous membranes)
 - Virions are released when infected cells **desquamate**.

Introduction



➔ 🌐 Epidemiology & Disease Associations

- HPV infections are widespread and linked to various diseases.
- Their role in **epithelial cancers** is covered in other resources.


➔ 📖 Clinical Aspects

- **Symptoms, diagnosis, and treatment** of HPV-related conditions are discussed in dedicated clinical reviews.

➔ 💉 Prevention

- **HPV vaccination** is available to prevent infection and related diseases, with details covered elsewhere.

Introduction

- ➔  Most HPV infections, even carcinogenic types, resolve within 12 months.
- Persistent infections (>12 months) raise the risk of **precancerous or cancerous lesions**.
- In the U.S., **precancerous cervical lesions** typically appear **~10 years after sexual debut**.
- HPV can become **latent** and later **reactivate**, especially in:
 - **HIV-positive individuals**
 - **Older women**
 - **Women with prior cervical dysplasia**
- The cancer risk from reactivation remains **uncertain**.

Introduction

→ 🌐 Global Prevalence

- **Worldwide HPV prevalence** among females with **normal cervical cytology** is approximately **10%**.
- **Africa** has the **highest** regional rate at **22%**.
- **HPV types 16 and 18** are the most common globally and are **preventable** by vaccination.
- **Vaccination uptake remains low**: In 2020, **only 13% of eligible girls worldwide received two doses.**

Introduction

→ 🌐 Global Prevalence

- **Worldwide HPV prevalence** among females with **normal cervical cytology** is approximately **10%**.
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- **Vaccination uptake remains low**: In 2020, **only 13% of eligible girls worldwide received two doses.**

Introduction

➤ 🌐 Geographic Variation

- HPV genotype distribution varies by region:
 - **In Europe**, HPV 16 is more prevalent than in Sub-Saharan Africa (OR 2.6).
- **In Uganda**, among females aged 12–24:
 - HPV prevalence: 75%
 - HIV prevalence: 9%
 - Most common high-risk types: **HPV 52, 51, 18, and 16**
- **In the UK**, among university students:
 - High-risk HPV prevalence: 19%
 - **HPV 16** was most common, but many had non-16/18 types.

HPV in World:

- It has been estimated that more than 80% of sexually active women and men will acquire at least one HPV infection by the age of 45 years
- Most of them will be transient infections **without any clinical impact.**
- In women, 90% of incident HPV genital infections clear within 2 years.

Role of HPV

- ➔ The average duration of a newly diagnosed HPV infection is 8-13 months.
- ➔ The age distribution of HPV : 14-59 years ;
- ➔ The overall prevalence was 26.8%.
- ➔ At least 75- 80 % of sexually active patients will have acquired a genital HPV infection by age 50.

Reactivation in Older Females

- ▶ HPV detection in older women may result from **reactivation of prior infections** rather than new exposure.
- Among women aged **35–60**:
 - **History of >5 sexual partners** had a stronger link to HPV than recent partners (87% vs. 8% in those >50).
 - In women aged **35–49**, both lifetime and recent partners contributed equally (28%).
- **Reactivation** is also a key factor in **HIV-positive women**:
 - **Over half of newly detected HPV cases occurred without new sexual partners.**

Role of HPV

- ▶ **Age and persistence** : Most cervical HPV infections are transient and occur in young patients.
- ▶ **Persistent infection** with **oncogenic HPV subtypes** is a **key factor in development of high-grade cervical lesions and cervical cancer**, while **clearance of HPV infection predicts regression of CIN.**
- ▶ **Over 50 % of new HPV infections are cleared in 6- 18 months**, and **80-90%** will **have resolved within 2-5 years.**

Introduction

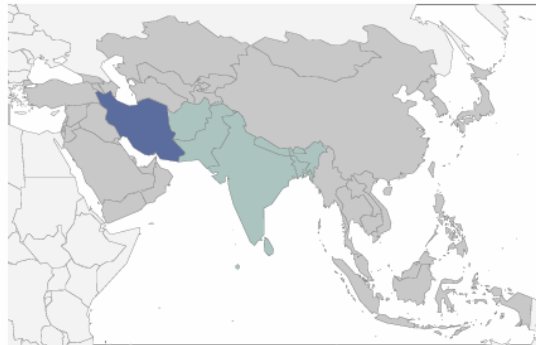
➔ 👤 Age-Related Trends

- In unvaccinated populations, HPV prevalence **declines after age 25.**
- A **secondary peak** may occur **post-menopause** in some regions.
- In **China and Africa**, HPV prevalence remains **consistently high across all ages.**

Iran

Human Papillomavirus and Related Cancers, F

I. Key data on HPV and HPV-related cancers



Iran has a population of 33.5 million women ages 15 years and older who are at risk of developing cervical cancer. Current estimates indicate that every year 1056 women are diagnosed with cervical cancer and 644 die from the disease. Cervical cancer ranks as the 14th

most frequent cancer among women in Iran and the 10th most frequent cancer among women between 15 and 44 years of age. About 2.8% of women in the general population are estimated to harbour cervical HPV-16/18 infection at a given time, and 58.6% of invasive cervical cancers are attributed to HPVs 16 or 18.

Figure
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HPV in IRAN:

- Following the assessment of **26 eligible studies** with a sample size of 5.560, the overall prevalence of HPV in Iranian women was detected 23% (95%CI: 14.3–34.9%). The highest (95%CI: 88.8–99.2%) and the lowest (95%CI: 1–4.8%) prevalence of HPV were detected in Tehran and Isfahan provinces with 97% and 2.2%, respectively.

Home > Indian Journal of Gynecologic Oncology > Article

The Prevalence of Human Papillomavirus in Iranian Women's: A Comprehensive Systematic Review and Meta-Analysis

Original Article | Published: 03 January 2024
Volume 22, article number 8, (2024) [Cite this article](#)



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Mahsa Hojjati, Masoume Reshadati, Mahshid Rashidi, Alireza Ghasemi Moghadam, Nader Salari, Amir Abdolmaleki, Ahmad Abdullahi, Ali Asghar Khaleghi & Masoud Mohammadi ✉

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Occupational exposure to HPV, BMC Med Educ 2025

📄 Study Overview

- **Objective:** Assess healthcare providers' knowledge, attitude, and practice (KAP) regarding occupational exposure to HPV.
- **Setting:** First Affiliated Hospital of Shantou University (Oct 2023–Feb 2024).
- **Participants:** 1,059 providers from gynecology, dermatology, and coloproctology departments.

📌 Conclusion

- Providers showed moderate awareness and behavior toward HPV exposure risks.
- **Educational and training programs are recommended to improve KAP levels.**

Wu et al. BMC Medical Education (2025) 25:1511
<https://doi.org/10.1186/s12909-025-08059-w>

BMC Medical Education

RESEARCH

Open Access

Healthcare providers' knowledge, attitude, and practice regarding occupational exposure to human papillomaviruses



Que Wu¹, Yongfang Li², Linying Chen² and Ling Shen^{2*}

Herd immunity and prevention in HPV transmission

📌 Study Focus

- Developed a **deterministic model** to explore **HPV transmission dynamics**, emphasizing the role of **exogenous reinfection**.
- Found evidence of **backward bifurcation**, indicating that **targeting only primary infections is insufficient** for eradication.

🔍 Key Insights

- **Effective control** requires addressing both **primary and secondary (reinfection) pathways**.
- **Vaccination gaps**, especially in countries like **Bangladesh**, make **community education and targeted prevention** essential.
- **Optimal control strategies** must be:
 - **Multifaceted**
 - **Precisely implemented**
 - **Adapted to local resource constraints**

PLOS ONE

RESEARCH ARTICLE

Herd immunity and prevention in HPV transmission with exogenous reinfection

Md Mehedi Hasan[✉], Md Hamidul Islam^{✉*}

Department of Applied Mathematics, University of Rajshahi, Rajshahi, Bangladesh

✉ These authors contributed equally to this work.

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Herd immunity and prevention in HPV transmission 2025

Consequences of Poor Implementation

- Imprecise interventions delay disease control.
- This leads to:
 - Surges in **new infections**
 - Increased **reinfection rates**
 - **Prolonged transmission cycles**

Conclusion

- **Well-calibrated, combined strategies**—including education, prevention, and treatment—are critical to reducing **HPV burden** and improving **public health outcomes**, especially in low-resource settings.

PLOS ONE

RESEARCH ARTICLE

Herd immunity and prevention in HPV transmission with exogenous reinfection

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Department of Applied Mathematics, University of Rajshahi, Rajshahi, Bangladesh

* These authors contributed equally to this work.

* hamidul.islam@ru.ac.bd

Potential non-sexual transmission 2025

- To assess **HPV positivity and genotype distribution in female public restrooms.**
- Investigates **potential non-sexual transmission routes in public environments.**

Duan et al. *BMC Public Health* (2025) 25:1907
<https://doi.org/10.1186/s12889-025-22319-w> BMC Public Health

RESEARCH Open Access

Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk

Check for updates

Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Tao^{1*}

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As of 2023

Potential non-sexual transmission 2025

- **Cervical cancer** is the **4th most common cancer** and cause of cancer-related death in women globally.
- In **2022**, there were **~660,000 new cases**, with **94% of deaths in low- and middle-income countries**.
- **High-risk HPV infection** is the leading cause, responsible for **~95% of cases**.
- **Major risk factors include:**
 - **Persistent HPV infection**
 - **Smoking**
 - **Multiple sexual partners**
 - **Early sexual debut**
 - **Long-term oral contraceptive use**

- Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk XiuZhi Duan1†, Jinmei Pan2†, Xuchu Wang1, Weiwei Liu1, Ying Ping1, Pan Yu1, Zhenli Wei1, Yiyi Xie1* and Zhihua Ta , Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>



Prevention Challenges

- Most cervical cancers are **preventable** through:
 - **HPV vaccination**
 - **Screening and treatment** of precancerous lesions
- As of **end of 2023**, global **HPV vaccine coverage** for girls (first dose) was only **27%**, underscoring the need for expanded prevention efforts.
- ➔ Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk
Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta , Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Transmission Insights

- HPV is primarily **sexually transmitted**, but **non-sexual routes** are increasingly recognized:
 - **Vertical transmission (mother to child)**
 - **Hand contact**
 - **Autoinoculation**
 - **Contaminated surfaces**
- Supporting evidence:
 - HPV-positive children with **anal-genital and oropharyngeal infections**
 - **12% prevalence** of subclinical high-risk HPV in **boys under 15 with no sexual history**
 - Case of a **9-year-old girl with genital warts and no history of sexual contact or abuse**
- ▶ Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk XiuZhi Duan1†, Jinmei Pan2†, Xuchu Wang1, Weiwei Liu1, Ying Ping1, Pan Yu1, Zhenli Wei1, Yiyi Xie1* and Zhihua Ta , Duan et al. BMC Public Health **(2025)** 25:1907
<https://doi.org/10.1186/s12889-025-22319-w>

Sample Collection

- ▶ **Study Sites:** Female restrooms in four public settings:
 - General hospitals
 - Obstetrics and gynecology hospitals
 - Community health centers
 - Public restrooms
- **Sampling Period:** 30 weekdays (May 15 – July 1, 2024)
- **Sampling Time:** Daily at 15:00
- **Sample Locations:** **Door handles, washbasins, squat toilets**
- **Total Samples:** 360 (12 samples/day × 30 days)
- **Additional Sampling:** 36 hourly samples from the highest HPV-positive site to assess viral persistence

Potential non-sexual transmission 2025

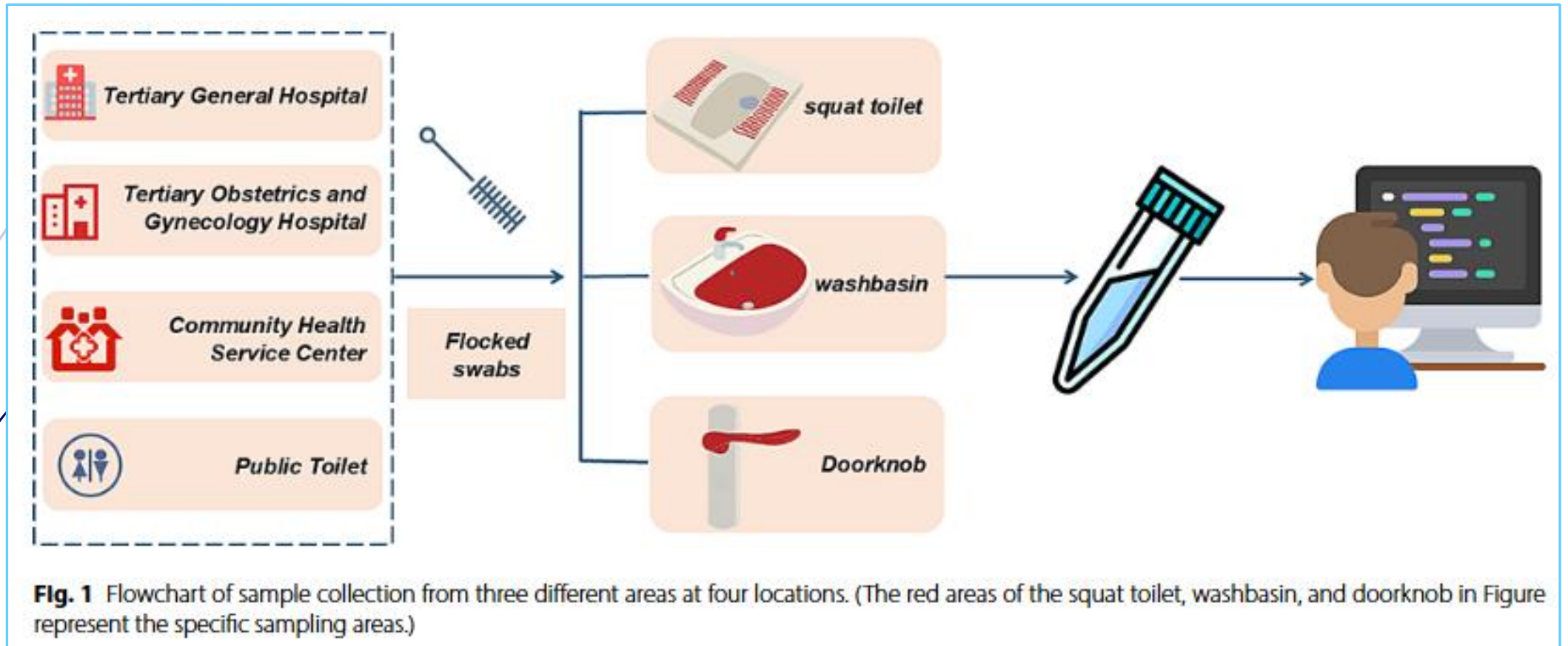


Fig. 1 Flowchart of sample collection from three different areas at four locations. (The red areas of the squat toilet, washbasin, and doorknob in Figure represent the specific sampling areas.)

- Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk. XiuZhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta, Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Results

HPV Genotype Distribution


- **Total genotypes identified:** 19 across four types of locations: (Public restrooms, Community health centers, Obstetrics and gynecology hospitals, General hospitals)
- **Top 5 high-risk genotypes:** HPV-51 (18.99%), HPV-16 (14.56%), HPV-52 (11.39%), HPV-58 (8.23%), HPV-56 (6.96%)
- **Most common low-risk types:** HPV-42 (4.23%), HPV-43 (2.53%), HPV-81 (2.53%)
- **Overall distribution:** High-risk types: 88.61%, Low-risk types: 11.39%

- Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk XiuZhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta , Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

□ HPV Positivity in Environmental Samples

- Total samples collected: 360 Positive samples: 87 Overall positivity rate: 24.17%
- **Positivity by Location (HPV-positive days):**
 - General hospitals: 23 days (38.89% positivity)
 - Obstetrics & gynecology hospitals: 22 days (30.00%)
 - Community health centers: 13 days
 - Public restrooms: 11 days
- **Positivity by Surface Type:**
 - Squat toilets: 53.33%
 - Washbasins: 14.17%
 - Door handles: 5.00%
- Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk. Xiuuzhi Duan1†, Jinmei Pan2†, Xuchu Wang1, Weiwei Liu1, Ying Ping1, Pan Yu1, Zhenli Wei1, Yiyi Xie1* and Zhihua Ta, Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Viral Load (Ct Value Categories)

- High concentration (Ct ≤ 30): 12.82%
 - Medium concentration (30 < Ct < 35): 41.03%
 - Low concentration (Ct ≥ 35): 46.15%
 - ➔  Observations:
 - High concentrations were most common in:
 - **General hospitals**
 - **Obstetrics & gynecology hospitals**
 - **Squat toilets showed the highest viral loads.**
 - Washbasins and door handles mostly had **low concentrations.** (hand-mediated transmission)
 - Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk
- Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta , Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Discussion

➔ ? HPV Transmission and Genotype Trends

- **HPV** is the primary cause of **cervical cancer**, typically transmitted through **sexual contact**.
- Increasing reports of **genital warts in children without sexual history** highlight the possibility of **non-sexual transmission routes**.
- In **China**, the most prevalent genotypes are **HPV-16, HPV-58, and HPV-52**, consistent with findings from this study.
- From 360 samples, **19 genotypes** were identified, with **HPV-51** being the most frequent—suggesting environmental persistence and potential need for a **targeted HPV-51 vaccine**, as it is **not covered** by current vaccines approved in China.
- Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk. Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta, Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Discussion

➔ ? ? Persistence and Disinfection

- **Low-concentration contamination** lasted ≤ 3 hours
- **High-concentration contamination** persisted for up to 7 hours
- **HPV is resistant** to many disinfectants but **sensitive to hypochlorite-based solutions**
- **Post-cleaning with 500 mg/L chlorine disinfectant, all samples tested negative, confirming its effectiveness**
- Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk
Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta , Duan et al. BMC Public Health **(2025)** 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Discussion

✦ Implications

- Environmental contamination is a plausible route for **non-sexual HPV transmission**
 - **Hospital hygiene protocols** must prioritize:
 - **Frequent disinfection**
 - **Targeted cleaning of high-risk surfaces**
 - **Vaccine development** should consider **emerging genotypes** like HPV-51
 - These findings support **broader public health strategies** to reduce HPV transmission in both clinical and community settings
 - Monitoring the presence of human papillomavirus in public areas indicates non-sexual transmission of the virus and environmental risk
- Xiuzhi Duan^{1†}, Jinmei Pan^{2†}, Xuchu Wang¹, Weiwei Liu¹, Ying Ping¹, Pan Yu¹, Zhenli Wei¹, Yiyi Xie^{1*} and Zhihua Ta , Duan et al. BMC Public Health (2025) 25:1907 <https://doi.org/10.1186/s12889-025-22319-w>

Non-sexual transmission of STD in women-2024

Medicinal Research Reviews 2024

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REVIEW ARTICLE

Open Access

Non-sexual transmission of sexually transmitted diseases in women

Aya Kawssan^{1,2}, Chirine Chawiche^{2,3}, Zahraa Mohammad Shamas^{1,2}, Hiba Hamdar²

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ABSTRACT

Non-sexual transmission routes contribute significantly to the prevalence of sexually transmitted infections (STIs) in women, STIs are often associated with sexual activity. This comprehensive review acknowledges the impact of different non-sexual STI transmission modes on different populations, emphasizing the need for a deeper understanding of transmission dynamics. Evidence suggests that several STIs, such as gonorrhoea, chlamydia, herpes genitalis, and Trichomonas vaginalis, can be spread non-sexually. Research challenges preconceived notions by highlighting the significance of identifying these alternate pathways. For instance, intravenous drug users who share needles run a higher risk of contracting bloodborne infections. Moreover, the review identifies non-sexual routes of human papillomavirus transmission, such as skin-to-skin contact, further broadening the scope of STI prevention strategies. Understanding non-sexual transmission is crucial for developing comprehensive preventive measures that extend beyond conventional sexual health programs. This shift in perspective underscores the complexity of STI transmission and the need for inclusive treatment strategies to mitigate the impact of these infections on various communities.

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KEYWORDS

Non-sexual transmission;
STIs, intravenous drug use;
contaminated objects;
skin-to-skin contact;
public health; prevention
strategies; women's health

Non-sexual transmission of HPV-2024

- In terms of medical procedures, the risk of infection from different pathogens such as N. gonorrhoea, HIV, syphilis, HPV, CMV, chlamydia, and HIV **cannot be completely eliminated by using condoms, probe covers, and disinfecting.**
- The risk of HIV transmission from an infected patient to an uninfected patient ranges from **4% to over 6% for HPV** and CMV, according to a large study conducted in France with a sample size of **4 million patients.**
- Non-sexual transmission of sexually transmitted diseases in women

Non-sexual transmission of HPV-2024

- In a distinct cultural setting, researchers in rural Maharashtra state, India, hypothesized that **HPV might be passed nonsexually from mother to daughter through the sharing of reusable sanitary pads or clothing, a habit that is typical among low-income women.**
- The results of the population-based study, however, did not support the hypothesis because none of the participating mothers and daughters shared their wardrobes. Rather, the study identified **underlying risk factors for HPV infection, such as not washing your hands often enough or using an old cloth as a sanitary pad. According to research, these circumstances are perfect for HPV survival on surfaces.**
- **Non-sexual transmission of sexually transmitted diseases in women**

Non-sexual transmission of HPV-2024

- ▶ In relation to the HPV virus, there is still **controversy and uncertainty surrounding the process of HPV transmission horizontally among young girls and people who are not sexually active.**
- ▶ Researchers have discovered a **link between the risk of cervicovaginal HPV infection in sexually active individuals compared to non-sexually active individuals and a family history of skin HPV (not genital warts).**
- ▶ Additionally, **changing diapers or having close contact with an infected mother increases the risk of infection.**
- ▶ Investigations are currently underway into **peri natal transmission, auto- and hetero-inoculation from the anogenital area to hands, through lip and hand contact**, and possible indirect transmission through contaminated objects .
- **Non-sexual transmission of sexually transmitted diseases in women**

Non-sexual transmission of HPV

- Animals can act as STI hosts, affecting the dynamics of the disease and how it spreads among different species.
- It is critical to comprehend these interactions for the health of humans and animals alike.

Maryam Vaezi

- **Non-sexual transmission of sexually transmitted diseases in women**

JOURNAL OF MEDICAL RESEARCH AND REVIEWS 2024; 17 -22. 10.5455/JMRR.20240702073007

HPV and Bloodstream Presence-2025

Transmission Pathways

- **Primary route:** Sexual contact.
- **Other routes:**
 - Fomites
 - Skin-to-skin and skin-to-mucous contact
 - Vertical transmission (mother-to-child)
 - **Autoinoculation:** Found in children without sexual exposure.

HPV and Bloodstream Presence

- HPV DNA found in blood of **cancer and non-cancer patients.**
- **Suggests possible dissemination via blood during asymptomatic phases.**
- Raises concern about **access to distant tissues beyond the cervix.**

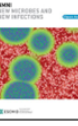


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New Microbes and New Infections

journal homepage: www.journals.elsevier.com/new-microbes-and-new-infections



Original Article

Prevalence and genotyping of human papillomavirus DNA in peripheral blood mononuclear cells from blood donors in Iran

Shahab Falahi^a, Katayoun Arvaneh^a, Hassan Nourmohammadi^b, Amir Abdoli^c, Arezoo Bozorgomid^d, Azra Kenarkoobi^{a,e,f,*}

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^b Department of Hematology & Oncology, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran

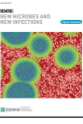
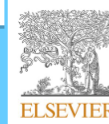
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^e Department of Laboratory Sciences, School of Allied Medical Sciences, Ilam University of Medical Sciences, Ilam, Iran

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Hematogenous spread of HPV 2025



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^f Department of Microbiology, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran

📍 HPV and Cancer Associations

- Proven link to:
 - Cervical, vaginal, vulvar, anal, penile, head & neck cancers.
 - Investigated in:
 - Breast, prostate, gastric, skin, and lung cancers.
 - **Bloodborne spread** remains a key research question??????
- ➡ **📄 Study Objective in Iran**
- Investigate HPV DNA in blood donors in Ilam, western Iran.
 - Aim: Inform **public health strategies** and HPV control programs.

Maryam Vaezi

Hematogenous spread of HPV

➤ ? Implications of Hematogenous HPV Spread

➤ 🔍 Research Significance

- Emphasizes the need to study **bloodborne transmission** of HPV.

➤ 🛡️ ? Policy and Safety Considerations

- If proven, **vaccine strategies** must be revised.
- Greater focus on **blood safety and transfusion protocols** is essential.

➤ ? Viral Dissemination

- HPV genome found in multiple body tissues.
- Critical to understand **how HPV reaches distant sites** via blood or other mechanisms.
- **10.18%** of blood donors in this study tested positive for HPV DNA.

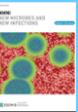


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^e Department of Laboratory Sciences, School of Allied Medical Sciences, Ilam University of Medical Sciences, Ilam, Iran

^f Department of Microbiology, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran

Early-Life HPV Infection

- HPV infection is **relatively common in early childhood**.
- **Nonsexual transmission** possible, especially via **maternal routes through the oral cavity**.
- **🔍 Viral Persistence**
 - Studies show **HPV can persist** in children.
 - Highlights the need for **early screening programs** to prevent future malignancies.
- **🔍 🚨 High-Risk HPV Alert**
 - **HPV16** is the dominant high-risk type in children.
 - Urges development of **targeted health policies** for this age group.
- **🔍 Research Recommendations**
 - Further studies needed in **unvaccinated populations**.
 - **Longitudinal monitoring** of HPV persistence in infants is recommended.

Contents lists available at [ScienceDirect](#)

 **Journal of Infection and Public Health**


journal homepage: www.elsevier.com/locate/jiph

Original article

Human Papillomavirus (HPV) prevalence in population younger than 12 years old: A meta-analysis and systematic review

Mona Sadat Larijani ^a, Amir Javadi ^{b,c}, Amirabbas Faridpour ^c, Mohammad Banifazl ^d, Fatemeh Ashrafi ^a, Anahita Bavand ^a, Ladan Moradi ^a, Amitis Ramezani ^{a*}

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^b Department of Community Medicine, School of Medicine, Qazvin University of Medical Sciences, Qazvin, Iran
^c Arak University of Medical Science, Arak, Iran
^d Iranian Society for Support of Patients with Infectious Disease, Tehran, Iran




Early-Life HPV Infection


Background HPV prevalence in children has been studied across different populations, but results vary widely, leaving overall prevalence unclear.

- **Methods** A systematic review and meta-analysis examined studies on children under 12 years old (1994–2021). Included studies tested HPV in oropharyngeal, nasopharyngeal, and anogenital samples.
- **Results**
 - **Sample size:** 15 studies, 2,638 children (ages 1 day–12 years).
 - **Overall prevalence: 14.7%.**

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^b Department of Community Medicine, School of Medicine, Qazvin University of Medical Sciences, Qazvin, Iran
^c Arak University of Medical Science, Arak, Iran
^d Iranian Society for Support of Patients with Infectious Disease, Tehran, Iran



Early-Life HPV Infection 2025

- ➔ **Age effect:** Highest prevalence in children >1 year old (25.4%).
- **Sample type:** Buccal swabs showed the highest infection rates.
- **Maternal status:**
 - HPV-positive mothers → 3–55% of children infected (median 17.5%).
 - HPV-negative mothers → 0–19.7% of children infected (median 5.55%).
- **Conclusion:** HPV prevalence in children is relatively high. More prospective studies are needed to monitor transmission, persistence beyond infancy, and implications for vaccination strategies and public health policy.

Maryam Vaezi

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Check for updates

Early-Life HPV Infection

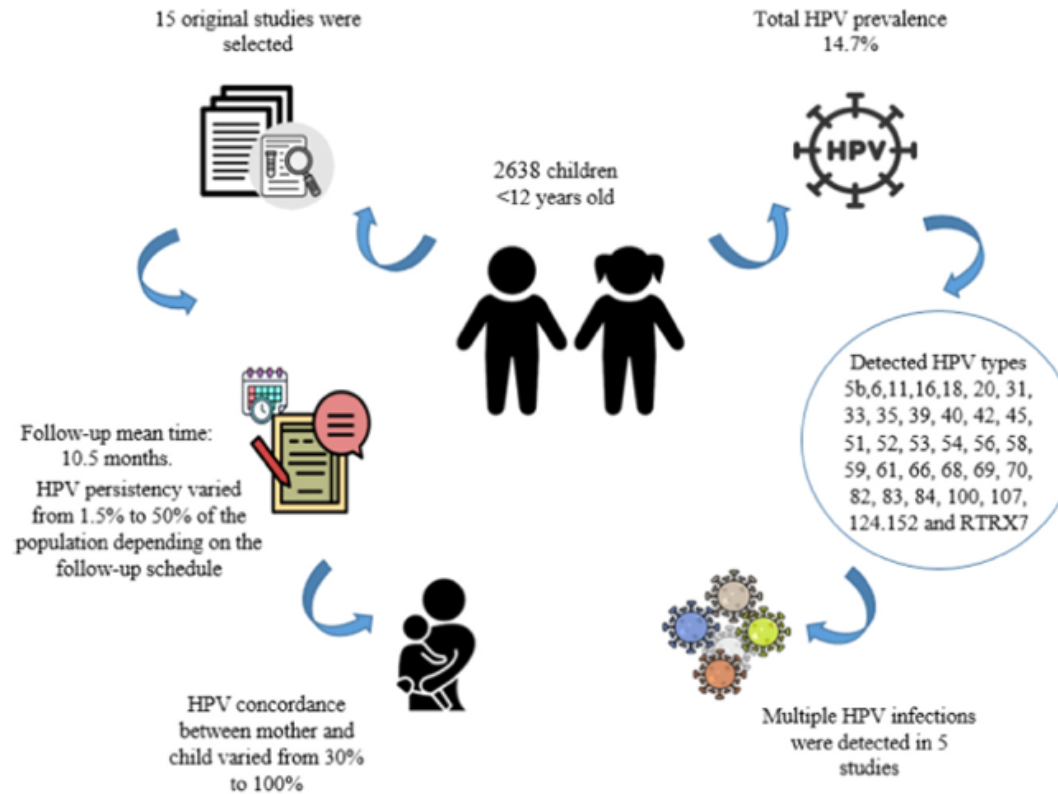


Fig. 2. A summary of important findings from the investigated studies. Totally 2368 children < 12 years old were studied in 15 original articles in whom different HPV types were detected. The HPV infection persistence was estimated in 7 studies. HPV concordance between mothers and children varied in 8 studies from 3% to 100%.

Transmission of HPV via transvaginal ultrasound

Ineffective Disinfectants: Commonly used disinfectants (glutaraldehyde and orthophthalaldehyde) are ineffective against the HPV.

➤ **Leaky Probe Covers:** Commercial probe covers have a **high leakage rate (8-81%)**, making them **unreliable**.

➤ To address this, the authors recommend:

➤ **Replacing aldehyde disinfectants with a sonicated hydrogen peroxide system**.

➤ **Using a condom** instead of a commercial probe cover, as condoms have a **much lower leakage rate (0.9-2%)**.

➤ These 2 changes, along with **standard cleaning**, are estimated to drastically **reduce the HPV viral load**, significantly **improving patient safety**.

➤ A proposal to reduce the risk of transmission of human papilloma virus via transvaginal ultrasound, C. Andrew Combs, MD, PhD andrewcombs@me.com · Alan Fishman, MD, AmericanJournalofObstetrics&GynecologyMONTH2016



Transmission of HPV via transvaginal ultrasound

Recommended protocol:

1. Clean the probe after each use
2. Perform high-level disinfection
3. Use a single-use barrier during exams

• Current issues:

- Common disinfectants (glutaraldehyde, orthophthalaldehyde) are ineffective against HPV types 16 and 18
- Commercial probe covers leak frequently (8–81%), unlike condoms (0.9–2%)

• Improved practices:

- Use **sonicated hydrogen peroxide** for disinfection
- Cover probes with **condoms** instead of standard probe covers

- **Impact:** These changes, along with cleaning, could reduce HPV viral load by up to 250 billion-fold, significantly improving patient safety.



Transmission of HPV via transvaginal ultrasound

TABLE

Reduction of human papilloma virus viral load by method of disinfection and type of probe covering

Variable	GTA or OPA plus commercial cover	GTA or OPA plus condom	Sonicated peroxide plus commercial cover	Sonicated peroxide plus condom
Reduction in viral load from cleaning (\log_{10})	2	2	2	2
Reduction in viral load from disinfectant (\log_{10})	0–0.5	0–0.5	5.2–7.4	5.2–7.4
Reduction in viral load from cover (\log_{10})	0.1–1.1	1.7–2.0	0.1–1.1	1.7–2.0
Combined reduction in viral load (\log_{10})	2.1–3.6	3.7–4.5	7.3–10.5	8.9–11.4
Combined reduction in viral load (\log_{10})	130–4000	5000–32,000	20 million to 32 billion	800 million to 250 billion

GTA, glutaraldehyde; OPA, orthophthalaldehyde.

Combs and Fishman. HPV on ultrasound probes. *Am J Obstet Gynecol* 2016.



AJOG American Journal of Obstetrics & Gynecology

CALL TO ACTION · Volume 215, Issue 1, P63-67, July 2016

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A proposal to reduce the risk of transmission of human papilloma virus via transvaginal ultrasound

[C. Andrew Combs, MD, PhD](#)   · [Alan Fishman, MD](#)

[Affiliations & Notes](#)  [Article Info](#) 



Assessing nonsexual transmission of the HPV

- Background: HPV is mainly sexually transmitted, but possible iatrogenic transmission via medical devices has been suggested.
- Objective: To evaluate whether cleaning methods for flexible endoscopes in an otolaryngology clinic effectively remove HPV.
- Methods: **24 patients with head and neck cancer** (2 excluded as outliers). 9 had HPV-associated cancer.
- PCR used to detect and quantify HPV DNA before and after cleaning.
- Findings: In HPV+ cases, some cleaned endoscopes showed reduced DNA, but not consistently.
- In non-HPV cases, some endoscopes had more DNA after cleaning, indicating possible contamination from cleaning solutions.
- No statistically significant difference ($p > 0.05$) between pre- and post-cleaning samples.
- **Conclusion: Current cleaning methods for reusable endoscopes may not reliably eliminate HPV DNA, raising concerns about infection control.**

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RESEARCH ARTICLE

JOURNAL OF
MEDICAL VIROLOGY WILEY

Assessing nonsexual transmission of the human papillomavirus (HPV): Do our current cleaning methods work?

Jacqueline Tucker¹ | Janice Milici² | Samina Alam² |
Ashley P. O'Connell Ferster³ | David Goldenberg^{1,4} | Craig Meyers² | Neerav Goyal^{1,4}

Hand-to-genital transmission of alpha-HPV types-Lancet 2019

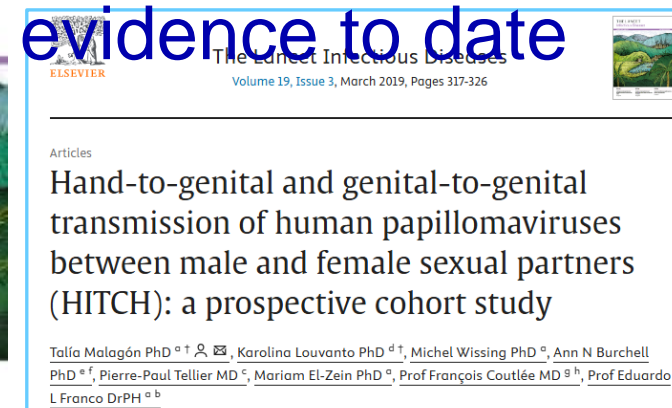
Evidence Before This Study:

A literature review found the existing evidence on hand-to-genital HPV transmission to be limited and conflicting.

Previous studies had small sample sizes and could not definitively determine the direction of transmission, leaving it **unclear if the virus moves from hand-to-genital or genital-to-hand.**

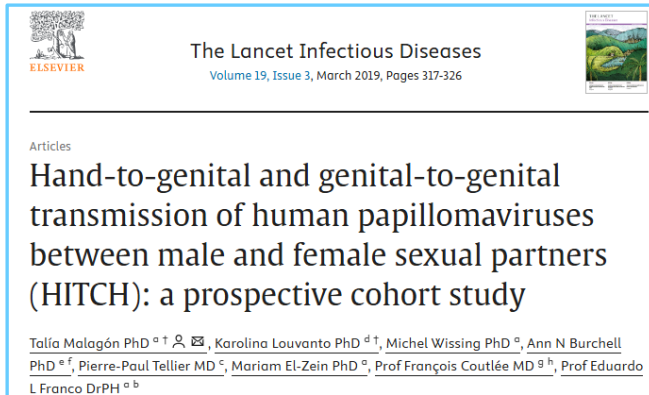
Added Value of This Study:

This is the largest study to date on this topic. By controlling for confounding factors, it provides the **evidence to date** that:



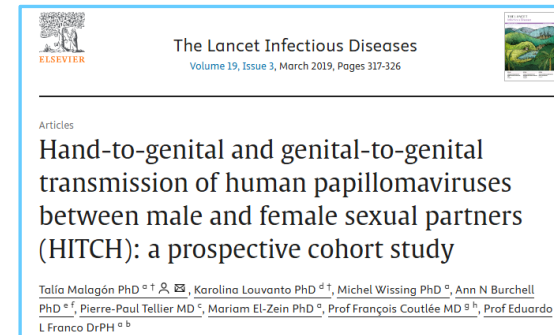
Hand-to-genital transmission of alpha-HPV types-Lancet 2019

- Genital HPV acquisition is unlikely to be due to hand-to-genital transmission.
- Transmission occurs mostly through **genital-to-genital contact**.
- Most HPV DNA found on the hands is likely the result of **self-inoculation from the person's own genitals**.
- **Implications:**
This evidence allows clinicians to reassure patients that HPV is very **unlikely** to be transmitted through hand contact. This can help alleviate anxiety for women who test positive for HPV and have questions about how they contracted the virus and the risks of transmission to their partners.



Hand-to-genital transmission of alpha-HPV types-2019

- **Conclusion on Transmission Risk:** The high concordance of HPV types between hands and genitals is a result of **genital-to-hand transmission**, not the other way around. Therefore, the hand is unlikely to be an important reservoir for spreading HPV to the genitals.
- **Limitations and Nuances:**
The study acknowledges it cannot completely rule out rare hand-to-genital transmission, but if it does occur, it is not a major mode of spread. It also notes that a positive HPV test on the hand may often detect deposited virus rather than an active infection of the hand itself.



Hand-to-genital transmission of alpha-HPV types-Lancet 2019

- **Deposition vs. Infection:**
- Regardless of whether HPV DNA on the hand represents a **true infection or just temporary viral deposition**, the key finding is that **it does not lead to new genital infections.**

Maryam Vaezi





The Lancet Infectious Diseases

Volume 19, Issue 3, March 2019, Pages 317-326



Articles

Hand-to-genital and genital-to-genital transmission of human papillomaviruses between male and female sexual partners (HITCH): a prospective cohort study

Talía Malagón PhD ^{a†}  , Karolina Louvanto PhD ^{d†}, Michel Wissing PhD ^a, Ann N Burchell PhD ^{e f}, Pierre-Paul Tellier MD ^c, Mariam El-Zein PhD ^a, Prof François Coutlée MD ^{g h}, Prof Eduardo L Franco DrPH ^{a b}

Hand-to-genital transmission of alpha-HPV types-Lancet 2019

- **Key Implications for Patient Counseling:**

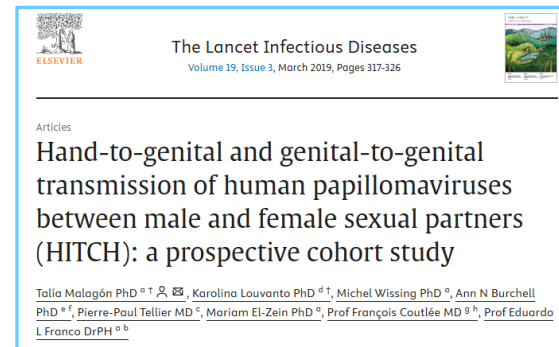
- **Reassurance:** Clinicians can reassure women who test positive for HPV that they are unlikely to have acquired it from, or transmitted it through, hand contact. This can help reduce unnecessary anxiety and stigma.
- **Addressing Stigma:** While HPV is a sexually transmitted infection, emphasizing its extreme commonality can help reduce feelings of shame.
- **Accurate Prevention Advice:** The findings allow health workers to confidently emphasize that using **condoms** is an effective strategy to reduce genital-to-genital transmission, which is the main risk.

- **Conclusion on Transmission Risk:**

The study **strongly concludes** that **detecting HPV on the hands is common, but it is a consequence of genital infection**

(via self-inoculation or partner contact) and **should not be a**

- **cause for concern, as it is unlikely to lead to new genital infections in oneself or one's partners.**



Airborne HPV transmission risk during ablation procedures

- **Evidence of Airborne HPV:** HPV DNA has been detected in the **surgical smoke generated during ablation procedures.**
- **Genotype Matching:** In some cases, the same "**high-risk**" HPV types found on patient lesions were also found in the airways of the medical staff after the procedure.
- **Animal Model Evidence:** Studies in animals confirm that papillomaviruses in ablation smoke can be infectious.
- **Increased Disease Risk:** Medical staff using **CO₂ lasers** have a significantly higher odds (5.75 times higher) of having warts in their nasal, oral, or pharyngeal mucosa compared to controls.

Discipline Environment... + **Language** English
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ISO 4 Environ. Res. **ISSN** 0013-9351 (print)... +



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Review article

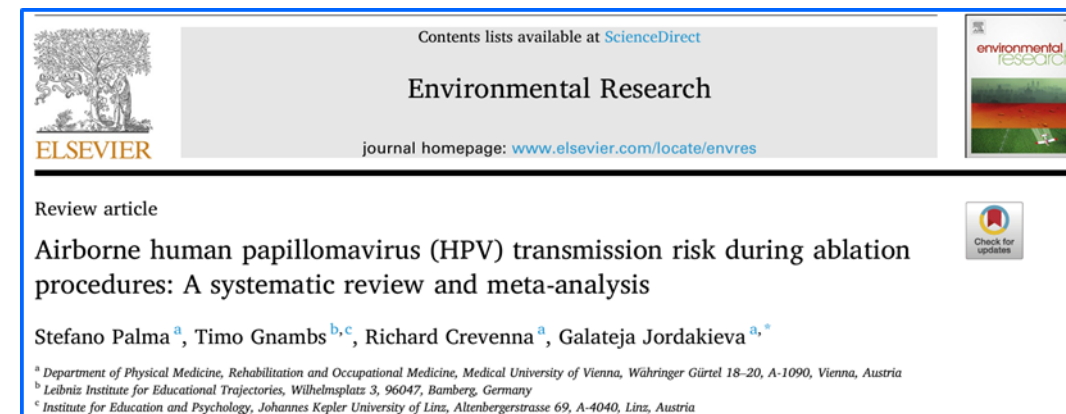
Airborne human papillomavirus (HPV) transmission risk during ablation procedures: A systematic review and meta-analysis

Stefano Palma^a, Timo Gnams^{b,c}, Richard Crevenna^a, Galateja Jordakieva^{a,*}

^a Department of Physical Medicine, Rehabilitation and Occupational Medicine, Medical University of Vienna, Währinger Gürtel 18-20, A-1090, Vienna, Austria
^b Leibniz Institute for Educational Trajectories, Wilhelmsplatz 3, 96047, Bamberg, Germany
^c Institute for Education and Psychology, Johannes Kepler University of Linz, Altenbergerstrasse 69, A-4040, Linz, Austria

Airborne HPV transmission risk during ablation procedures

- ▶ Case Reports: There are documented cases of medical staff developing HPV-associated upper airway neoplasms linked to exposure to laser and LEEP smoke.
- ▶ Conclusion and Implication:
- ▶ The review concludes that there is a documented occupational risk of airborne HPV transmission for medical staff performing ablation procedures like laser and LEEP. However, it also states that **simple safety measures can greatly reduce this contamination and transmission risk.**
- ▶ Simple protective measures (e.g., smoke evacuation, masks) can **significantly reduce contamination and infection risk.**



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^b Leibniz Institute for Educational Trajectories, Wilhelmplatz 3, 96047, Bamberg, Germany
^c Institute for Education and Psychology, Johannes Kepler University of Linz, Altenbergerstrasse 69, A-4040, Linz, Austria

Transmission & clearance of HPV infection in the oral cavity-2022

- ➔ ✦ **Prevalence:** Most sexually active individuals will encounter HPV at some point in their lives.
- **Transmission Pathways:**
 - **Autoinoculation:** Self-transfer of the virus between anatomical sites.
 - **Direct person-to-person:** Includes **sexual contact** and **perinatal transmission**.
 - **Indirect transmission:** Possible via hands, though less significant.
- ➔ ? **Oral & Oropharyngeal HPV Transmission**
 - **Primary Route:** Sexual contact is the main pathway for HPV reaching the oral cavity and oropharynx.
 - **Not Supported:** No evidence that saliva or everyday non-sexual activities transmit HPV.
 - **Minor Role:**
 - Autoinoculation to the mouth.
 - **Deep kissing (sometimes suspected, but evidence shows minimal contribution).**

Transmission & clearance of HPV infection in the oral cavity-2022

➤ Risk for Partners of Cancer Survivors

- Partners of individuals who survived **oropharyngeal HPV-related cancer** do **not** face a higher risk of infection through sexual intercourse.

➤ Key Takeaway

- HPV is widespread, but **oral and oropharyngeal transmission is overwhelmingly linked to sexual contact**. Everyday activities, saliva, and deep kissing play little to no role, and partners of cancer survivors are not at increased risk.




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REVIEW

WILEY

Transmission and clearance of human papillomavirus infection in the oral cavity and its role in oropharyngeal carcinoma – A review

Małgorzata Wierzbicka¹  | Michel R. M. San Giorgi²  | Frederik G. Dikkers³ 

Non-sexual HPV transmission and role of vaccination

- **Transmission:** The main route is **skin-to-skin** or **skin-to-mucosa contact**. While sexual transmission is most common, non-sexual routes are also possible, including:

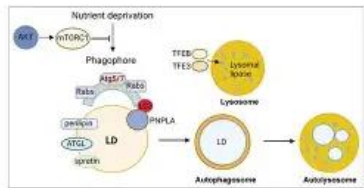
1. **Horizontal transfer via fomites (contaminated objects), fingers, and mouth.**
2. **Self-inoculation.**
3. **Vertical transmission from mother to child during pregnancy or birth.**

Ineffective Prevention: Routine hygiene and standard disinfection of medical equipment are often insufficient to prevent HPV transmission, as the virus can persist on contaminated surfaces.

Economic Impact: HPV-related diseases cost approximately **\$4 billion** annually in morbidity and mortality.

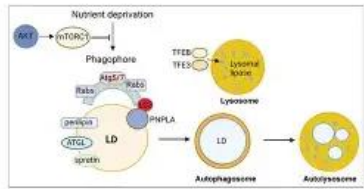
- **Vaccination Success:** Vaccination programs have proven **highly effective**, with examples like **Australia** showing a **decrease in cervical abnormalities** and the **elimination of new genital warts** cases in young women. **Promoting public understanding of these benefits is crucial for overcoming vaccine hesitancy.**
- ➔ Non-sexual HPV transmission and role of vaccination for a better future (Review)

Authors: Aida PetcaAndreea BorislavschiiMona Elena ZvancaRazvan-Cosmin PetcaFlorica SandruMihai Cristian Dumitrascu, Published online on: October 13, 2020
<https://doi.org/10.3892/etm.2020.9316>



Non-sexual HPV transmission and role of vaccination

- Annually, **14 million persons are infected and 79 million persons have a ubiquitous infection.**
- The virus can remain latent or inactive for months or years (the mechanism may be immunological). **Hormones are presumed to participate in the carcinogenic mechanism.**
- Most HPV infections are asymptomatic and/or they **resolve spontaneously**. The clearance time is ~6-24 months: Cervical HPV in 9.4 months and genital HPV in men 7.5 months (oncogenic and non-oncogenic types). Warts develop in ~6-10 months after initial infection.
- The International Agency for Research on Cancer (IARC) listed 7 viruses as 'carcinogenic to humans': Human T-lympho-trophic virus 1 (HTLV-1), EBV, human herpes virus 8 (HHV-8), HBV, HCV, HIV-1 and HPV (types: 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58 and 59).
- It is estimated that 15-20% of cancers are attributed to viruses, but only a small percentage of viral infections progress to cancer with a long evolution (years or decades). Over 30 HPV genotypes spread among the anogenital mucosa, 15 of those are liable for cervix malignancies .



Non-sexual HPV transmission

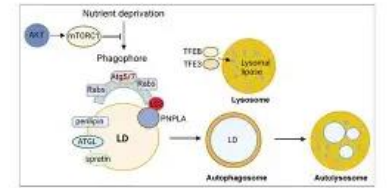
HPV Transmission Routes Beyond Sexual Contact

◆ Primary Transmission

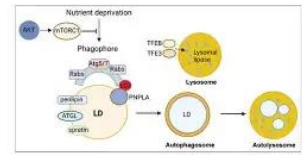
- HPV spreads mainly through **skin-to-skin or skin-to-mucosa contact**.
- **Sexual transmission** is the most documented, but **non-sexual routes** increasingly recognized.

◆ Horizontal Transmission

- Includes **fomites, fingers, mouth, and non-sexual skin contact**.
- HPV is **resistant to heat and drying**, retaining **~30% infectivity after 7 days of dehydration**.
- Can survive for days on **surfaces, clothing, and medical equipment**.
- Studies found:
 - **17.9% of gynecological equipment samples were HPV DNA-positive**.
 - Contamination was **2.7× higher in private clinics than hospitals**.
 - **9.4% of gloves and colposcopy rooms** showed notable **contamination risks**.



Non-sexual HPV transmission-2020



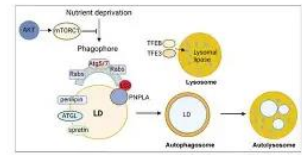
➔ Ultrasound Probe Contamination

- **Condoms** used as probe covers have a rupture risk of 0.9–5%.
- **Even after disinfection:**
 - 21% of probes tested positive for HPV DNA.
 - 3% post-exam and 1.9% pre-exam samples showed contamination.
 - Some probes contained **free virions**, not just DNA.

➔ ◆ Self-Inoculation

- Documented in **female virgins** and **children with genital warts** without sexual abuse history.
- One study: **51.1% of virgins** were HPV-positive vs. **69.1% of sexually active females**.
- **High-risk HPV remains primarily sexually transmitted.**
- ➔ Non-sexual HPV transmission and role of vaccination for a better future (Review)

Non-sexual HPV transmission -2020



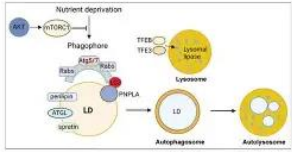
Vertical Transmission

- HPV can be passed from **mother to child** via:
 - **Amniotic fluid, placenta, or genital mucosa** during birth.
- Studies show:
 - **13.4% HPV prevalence in pregnant women.**
 - Most common types: **16 (29.6%), 18 (14.7%), 58 (14.2%).**
 - **23.6% DNA concordance** between mothers and newborns.
 - **Higher infection rates in female newborns.**
 - **Transplacental transmission** is possible.
 - Danish study: **200-fold increased risk of juvenile laryngeal papillomatosis** in children of mothers with warts.

➤ Non-sexual HPV transmission and role of vaccination for a better future (Review)

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Non-sexual HPV transmission



◆ Waterborne Transmission (Hypothetical)

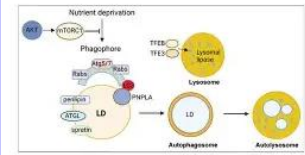
- No proven cases, but **HPV DNA found in water:**
 - Detected in **raw sewage, sewage sludge, rivers, and swimming water.**
 - HPV type 16 remains infectious for 7 days on wet surfaces.
 - Possible contamination from **skin shedding, urine, or feces.**

- Non-sexual HPV transmission and role of vaccination for a better future (Review)
- Authors: Aida PetcaAndreea BorislavskiMona Elena ZvancaRazvan-Cosmin PetcaFlorica SandruMihai Cristian Dumitrascu, Published online on: October 13, 2020 <https://doi.org/10.3892/etm.2020.9316>

Non-sexual HPV transmission

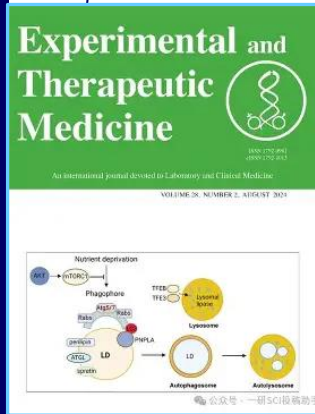
❓ Limitations of Everyday Hygiene in Preventing HPV Transmission

- **Conventional hygiene measures** (e.g., alcohol-based disinfectants) are **ineffective** against HPV, especially type 16.
- **HPV DNA** has been found on **medical equipment** even after **standard disinfection**, indicating persistent contamination.
- A key study showed:
 - **HPV 16 is resistant** to ethanol and isopropanol.
 - It is **susceptible** to **hypochlorite** and **high concentrations of peracetic acid-silver disinfectants**.
- These findings support the possibility of **self-inoculation** and **horizontal transmission** via **contaminated surfaces**.
- **Conclusion:** **Current disinfection protocols are inadequate**. **New, more effective methods** are urgently needed in healthcare settings.



Non-sexual HPV transmission

- ▶ Another benefit of vaccination could occur in people already infected with targeted types of HPV .
- ▶ There is little information on this topic, but the possibility that the **antibodies could break the cycle of reinfection exists**, thus **reducing the residence time of infection**, and also reducing the risk of transmission. Vaccinating the medical staff could have a real impact, as two laser gynecological surgeons with HPV-16 positive oropharyngeal SCC were reported .
- ▶ The **duration of protection after vaccination** is not entirely known, but some trials have suggested **8-9 years at the minimum**.
- ▶ **Seropositive persons** produce **higher antibodies in response** to the HPV vaccine, so **subsequent exposure after vaccination** could serve as a booster to **prolong the protection**.



Non-sexual HPV transmission

🔊 HPV Awareness Campaigns in Australia

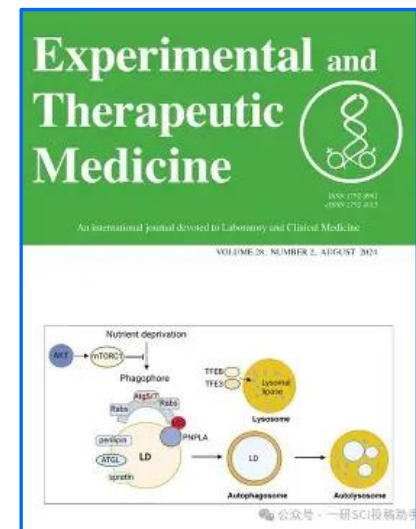
• Pre-campaign awareness:

- Only **51% of women** had heard of HPV.
- Just half of those knew its link to **cervical cancer**.

• Survey insights:

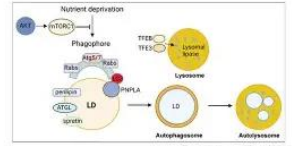
- **Middle-aged women** had the highest HPV knowledge, followed by men.
- **Teenagers** showed the **lowest awareness**.
- Many were unaware that:

- HPV causes **genital warts**.
- HPV is **sexually transmitted**.
- **Men** can be infected too.



Non-sexual HPV transmission

- **Media campaign focus:**
 - Emphasized **cervical cancer prevention**
 - Mentioned **anogenital warts** only as a side note
- **Parental concerns:**
 - Some feared vaccination might **encourage sexual activity**
 - Others lacked knowledge or felt **embarrassed** discussing STDs with their children
- **Recommendations:**
 - Improve **public understanding** of HPV and vaccination benefits
 - Address **misconceptions** about side effects
 - Integrate **health education** into youth programs in **engaging and accessible** ways



Maryam Vaeri

Vertically transmitted by breastfeeding-2025

- In this study which is **the first evaluation of oral HPV infection in Iranian children**, **the total HPV prevalence in oral samples was 7.9%** and high-risk HPV types; 16 and 18 were the most frequent ones.
- The analyzed data showed no significant association regarding children's HPV status and gender, birth order and underlying diseases.
- It has been suggested that **HPV could be vertically transmitted by breastfeeding.**

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Prevalence of oral HPV infection and genotype distribution in Iranian children during the early ages of life

Research | [Open access](#) | Published: 19 May 2025

Volume 22, article number 148, (2025) [Cite this article](#)

BMC

Virology
Journal

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Prevalence and genotyping in Iranian children- 2025

- The association between **mothers'oral HPV infection** and **positive HPV status in children** has been confirmed in the Finnish study.
- In addition, a meta-analysis including **3128 mothers** and children stated that children born to **HPV-positive mothers were 33% more likely to be HPV positive** than children born to HPV-negative mothers.
- We also observed that **83.3% of HPV-infected children** were born from **HPV-positive mothers** and the positive HPV status of mothers was significantly related to children's HPV positivity.

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Prevalence of oral HPV infection and genotype distribution in Iranian children during the early ages of life

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BMC

Virology
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Vertically transmitted by breastfeeding-2025

Multiple Routes: The study found strong evidence for **both vertical and horizontal transmission**.

1-Vertical: A significant association was found between vaginal delivery and an **increased risk of HPV transmission from mother to child**.

2-Horizontal: The lack of full HPV type concordance between most mother-child pairs strongly suggests transmission from other sources, such as **family members, caregivers, or the environment**.

HPV Types: **HPV16 and HPV18** were the most common high-risk types found in the children. A high rate (43.7%) of children had multiple HPV infections.

Clinical Significance and Conclusions:

Cancer Risk: **Detecting high-risk oral HPV, especially the persistent HPV 16,** is important due to its established link to **oropharyngeal cancers**.

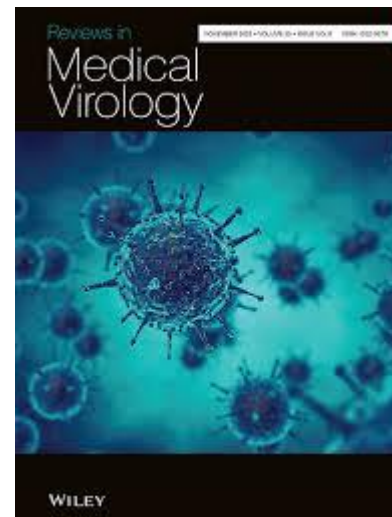
Need for Awareness and Screening: The study argues for the potential value of oral HPV screening in children to enable early diagnosis and inform preventive measures. It also highlights a gap, as most mothers, **Despite being educated, were not routinely screened or vaccinated.**

- **Introduction & Objective:** This study aimed to determine the prevalence of HPV in a young pregnant population at a single center in Turkey.
- **Methodology:** The researchers screened 312 pregnant women during their first prenatal visit, without an age limit, for HPV and cervical lesions.
- The **HPV prevalence was 8.04%** in the study's pregnant population, which is higher than the reported national average of 4.39% for the general population in Turkey. The authors suggest this is because their study group was younger.
- Among the 25 HPV-positive women, a variety of types were detected, with "other" types (not 16, 18, or 31) being the most common (64%).
- A small number of women (7) had abnormal cervical cytology (ASCUS or LSIL).
- **Crucially, HPV positivity did not statistically change pregnancy outcomes.**
- **Conclusion:** The study confirmed a higher HPV prevalence in its young pregnant cohort. The finding that HPV did not affect pregnancy outcomes.

HPV Infection 2024 Review a.

- Overall, **HPV-16 and HPV-18** are the most prevalent high-risk types worldwide and are responsible for the majority of HPV-related cancers.
- However, their distribution varies by region and gender.

Maryam Vaezi



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REVIEW WILEY

Human papillomavirus infection: Epidemiology, biology, host interactions, cancer development, prevention, and therapeutics

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Abstract
Human papillomavirus (HPV) infection is one of the most common sexually transmitted infections worldwide. It is caused by the HPV, a DNA virus that infects epithelial cells in various mucous membranes and skin surfaces. HPV can be categorised into high-risk and low-risk types based on their association with the

HPV Infection 2024 Review a.

➤ Regional Variations:

- **Sub-Saharan Africa:** Has some of the highest cervical cancer rates, predominantly caused by **HPV-16 and HPV-18**, with other types like HPV-31 and HPV-45 also common.
- **Asia:** **HPV-16 and HPV-18** are most prevalent, but some countries have higher rates of other types (e.g., HPV-58 in China, HPV-52 in Japan).
- **Europe & North America:** **HPV-16** is the most dominant type, followed by **HPV-18** and others like **HPV-31 and HPV-33**.
- **Latin America:** **HPV-16 and HPV-18** are most common, with regional variations in other high-risk types.
- **Australia & New Zealand:** Successful vaccination programs have led to a significant decrease in the prevalence of **HPV-16 and HPV-18**.



HPV Infection 2024 Review a.

- **Men:** The global prevalence of high-risk genital HPV in men is about 21% and remains stable throughout adult life. HPV causes substantial disease in men, most commonly as anogenital warts (caused by HPV-6 ,11), with the **highest prevalence in men aged 25–29.**
- **Women:** HPV prevalence in women **peaks around age 25**, decreases, and sometimes shows a smaller second peak around age 45.
- **Pregnancy:** HPV infection is more likely to be acquired and progress during pregnancy, with prevalence rates ranging from 16% to 82%.
- The most frequent types in pregnant women are HPV-16, HPV-6, HPV-18, and HPV-11.



HPV-host interactions: HPV Infection 2024 Review a.

➤ Infection Process:

HPV enters the body through tiny tears in the skin or mucous membranes. It attaches to specific receptors on the host cell surface (like heparan sulphate proteoglycans and alpha-6 integrin) to get inside.

➤ Mechanism of Cancer Development:

The primary drivers of cancer from high-risk HPV types (like 16 and 18) are two viral oncoproteins:

➤ **E6:** Binds to and degrades the host's p53 tumor suppressor protein, disrupting DNA repair and cell cycle arrest.

➤ **E7:** Inactivates the retinoblastoma (Rb) tumor suppressor protein, leading to uncontrolled cell division.

The combined action of E6 and E7 results in uncontrolled cell proliferation and tumor formation.



HPV prevention: HPV Infection 2024 Review a.

3. Regular Screening:

1. Essential for early detection of HPV-related cancers, especially cervical cancer.
2. Methods include **Pap smears and HPV DNA testing**.

➔ Key Public Health Benefits:

- **Herd Immunity**: Widespread vaccination of both genders can significantly reduce the overall transmission of the virus in the population, protecting even those who are unvaccinated.
- **Education**: Raising awareness about vaccination, safe practices, and screening is crucial for **reducing the burden of HPV-related diseases**.

▶ Key Co-infections and Their Impacts:

- **HIV:** This is the most significant co-infection. HIV **weakens the immune system**, making individuals more susceptible to persistent, high-risk HPV infections and ***accelerating the development of HPV-related cancers*** like cervical and anal cancer. In 2018, nearly 5% of all global cervical cancer cases were attributable to HIV.
- **Other Viruses:** Co-infections with Herpes Simplex Virus (HSV), Hepatitis B and C (HBV, HCV), Epstein-Barr Virus (EBV), Cytomegalovirus (CMV), and Human T-cell Lymphotropic Virus (HTLV-1) have also been observed. These can complicate diagnosis, management, and may increase the risk of certain cancers.

▶ Clinical Importance:

Co-infection can alter the clinical course of HPV, affect treatment outcomes, and influence transmission. Therefore, it is crucial to screen and manage individuals with HPV for other viral infections, especially if they have risk factors or belong to high-prevalence groups.

HPV coinfection with bacteria: HPV Infection 2024 Review a.

- ➔ **Chlamydia trachomatis and Mycoplasma genitalium:** Co-infection with these sexually transmitted bacteria may enhance the **persistence of HPV** and increase the risk of complications like **cervical dysplasia and cancer**.
- ➔ **Bacterial Vaginosis (BV):** This imbalance in vaginal flora is associated with high-risk HPV types. BV may create a **favorable environment for HPV to persist and progress**.
- ➔ **Other Bacteria:** Associations have also been noted with **Group B Streptococcus, Neisseria gonorrhoeae, and Haemophilus ducreyi**, though the clinical significance is less established.
- ➔ **Overall Implication:**
- ➔ **The presence of these bacterial infections can impact the clinical course, progression, and treatment outcomes of HPV-related diseases.**



HPV associated HNSCC: HPV Infection 2024 Review a.

- HPV is a major risk factor for a specific subset of HNSCC, primarily **oropharyngeal cancer** (tonsils, base of tongue, soft palate).
- **HPV16** is the dominant type responsible, and it's estimated that **70-80% of oropharyngeal cancers** are HPV-associated.
- ➔ **Key Characteristics:**
 - **Transmission:** Primarily linked to sexual transmission, especially through **oral-genital contact**.
 - **Mechanism:** The viral oncoproteins E6 and E7 drive cancer development by inactivating **tumor suppressor proteins (p53 and pRb)**, leading to **uncontrolled cell growth**.
 - **Prognosis:** Unlike other head and neck cancers, **HPV-positive HNSCC has a more favorable prognosis**. Patients are often younger, respond better to treatment, and have higher survival rates.
- ➔ **Clinical Impact:**
 - Determining **HPV status** (via DNA or p16 testing) is a critical prognostic factor and can influence treatment decisions, as HPV-positive tumors may require less aggressive therapy.

HPV anal cancers: HPV Infection 2024 Review a.

- Persistent infection with high-risk HPV types, particularly **HPV16 and HPV18**, is the primary cause of the majority of **anal cancers**.
- **Key Risk Factors:**
 - **Sexual Transmission:** Engaging in **anal sex** and having **multiple sexual partners** increases the risk.
 - **High-Risk Groups:** The risk is **elevated** for men who have **sex with men** (MSM), individuals with a history of receptive anal intercourse, and those with **weakened immune systems** (e.g., people living with HIV/AIDS).
- **Disease Progression and Management:**
 - **Precancerous Stage:** Anal cancer is often preceded by **precancerous lesions** known as **Anal Intraepithelial Neoplasia (AIN)**, which can progress to cancer if untreated.
 - **Diagnosis & Treatment:** Diagnosis involves **physical exams, anal Pap smears, and biopsies**. Treatment typically combines **surgery, radiation, and chemotherapy**.

Men's Role in HPV Transmission, 2025

- Men act as **significant reservoirs for HPV**, contributing to the **virus's persistence and spread**.
- Their infection **directly impacts women's health**, with studies showing a high **concordance of HPV types between sexual partners**.
- For instance, a **majority of male partners of women with CIN also have penile lesions**.

HPV and Male Cancer: Pathogenesis, Prevention and Impact

by Soumendu Patra ¹ , Harshita Shand ¹ , Sayan Ghosal ¹  and Suvankar Ghorai ^{1,2,*} 

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Key Transmission Dynamics, 2025

- **Sexual Transmission:** Sexual transmission is well-established. Certain male behaviors, like having multiple partners, increase the risk of cervical cancer in their female partners.
- **Direction of Transmission:** Evidence suggests women are more likely to transmit HPV to their male partners than vice versa.
- **Vertical Transmission:** HPV can be transmitted from mother to child during childbirth, with a high concordance between the mother's genital HPV and the child's oral HPV.
- **Breast Milk:** A potential new route of transmission is suggested, with HPV DNA found in breast milk. Interestingly, the HPV type in breast milk has been found to match the *spouse's oral* HPV type, hinting at a possible horizontal transmission between the spouse's mouth and the mother's breast, though this is not yet proven.

HPV and Male Cancer: Pathogenesis, Prevention and Impact

by Soumendu Patra¹✉, Harshita Shand¹✉, Sayan Ghosal¹✉ and Suvankar Ghorai^{1,2,*}✉

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Effects of HPV vaccination **BMC Public Health 2025**

- ▶ **Female-only HPV vaccination** in the national immunization program (NIP) inadvertently increased **HPV transmission to males**, raising male prevalence.
- **Treatment alone** is more **cost-effective** and can significantly reduce infections by **2030**.
- **Dual strategies** (treating both sexes) are more effective and cost-efficient than vaccination alone.
- **Male-targeted interventions** may yield greater reductions than female-targeted ones.
- **Triple strategies** (treatment for both sexes + vaccination for one sex) further improve outcomes and reduce costs.
- A **quadruple strategy** (treatment + vaccination for both sexes) could avert **~266,000 infections by 2030**.

Kim et al. *BMC Public Health* (2025) 25:2686
<https://doi.org/10.1186/s12889-025-23810-0>

BMC Public Health

RESEARCH

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Qualitative assessment of sex-stratified human papillomavirus transmission dynamics in South Korea



Introduction

➔ ? Conclusion

- **Treatment** offers **immediate impact** but needs sustained effort.
- **Vaccination** provides **long-term protection**, especially when coverage expands.
- **Combining strategies** enhances effectiveness, lowers costs, and maximizes infection reduction.
- These insights support **public health planning** in South Korea and may inform **global HPV prevention policies**.

Kim et al. *BMC Public Health* (2025) 25:2686
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RESEARCH

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Qualitative assessment of sex-stratified human papillomavirus transmission dynamics in South Korea



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Men's role in women's health 2024

- ▶ Despite being preventable, cervical cancer remains a major health issue for women in low-to-middle-income countries (LMICs). The text argues that effectively combating this disease requires actively engaging men, who are often the primary decision-makers in households.
- ▶ **Key Points:Problem:** Traditional prevention programs focus only on women, overlooking the cultural, social, and economic barriers that men can influence. **A lack of male awareness contributes to stigma and limits women's access to screening and vaccination.**

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Men's role in women's health: Engaging male partners in cervical cancer prevention efforts in low-to-middle-income countries

Laila Afroze , Md Sazedur Rahman

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Received 14 November 2024; Accepted 17 November 2024; Available online 17 December 2024

Men's role in women's health 2024

- **Solution & Benefits:** Involving men through **education, couple-based interventions, and community leaders** can:
 - **Increase women's uptake of screening services.**
 - **Reduce stigma** and normalize conversations about cervical cancer.
 - **Improve overall health outcomes** by encouraging early detection.
- **Conclusion:** Male engagement is a crucial strategy for improving women's health in LMICs. Success requires a collaborative approach that combines education, community involvement, and supportive policies to overcome entrenched gender norms.

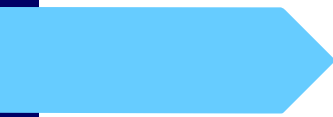
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