Liberty University

Master of Public Health

HLTH 698 Practicum (A02)

**Human papillomavirus Systematic Review**

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**Abstract**

**Importance**: The importance of this review is to examine current literature, and all important and current peer-reviewed articles on intervention strategies to develop updated information to benefit the global population.

**Objective:** This HPV systematic review will update the global population with current data about HPV characteristics, epidemiology, burden, incidence, prevention, and treatments. It synthesizes peer-reviewed literature on virus prevention strategies and vaccination intervention.

**Designs/Setting and Participants:** The overviews of review design were used to conduct this systematic review remotely using the internet, books, government websites, and peer-reviewed articles.

**Main Outcome and Measure:** The completed review will be posted on the internet to be used by students, public health professionals, and the public. More than twenty peer-reviewed articles including government websites were used in this review.

**Methods:** The systematic search was screened based on the predefined inclusion and exclusion criteria. A public health analytical approach was used as well to extract information from majordatabases including peer-reviewed articles, Public Health Institute (PHI), PubMed, and government science sources less than 5 years old were used in the systematic search.

**Results:** The systematic review highlights the HPV infection burden globally and has identified data and literature extending across epidemiological studies, management strategies, and preventive measures such as vaccination programs.

**Conclusion:** It provides a comprehensive overview of the data and understanding of HPV, encompassing epidemiology, management techniques, and preventive strategies. The findings underscore the importance of continued research efforts and the need for initiatives to mitigate the burden of the virus and its related diseases using vaccinations, screening methods, and public health interventions.

**Introduction**

Human papillomavirus is one of the most common and fastest sexually transmitted infections worldwide. Human Papillomavirus (HPV) has been diagnosed to cause more than 90% of cervical cancers which is known to be the fourth deadliest cancer in women and is currently the most common pathogen responsible for female cancers. The HPV infection is associated with other diseases, including cutaneous and anogenital warts, and genital and upper aerodigestive tract cancers. The incidence and prevalence of these pathologies vary depending on factors including HPV genotype, regional conditions, the study population, and the anatomical site sampled. Recently, features of the cervicovaginal microbiota have been associated with the incidence of HPV-related diseases, presenting a novel approach to identifying high-risk women through both blood and cervical samples. As a small double-stranded DNA virus, it is responsible for six (6) common cancers currently affecting the human population: cervical, anal, penile, vaginal, vulvar, and oropharyngeal cancers.1 The virus affects both males and females, adults, and children. HPV has no regard for race or color. Studies show that more than 90 percent of sexually active males and 80 percent of sexually active females will be infected with HPV in their lifetime. Currently, more than forty-two million Americans are infected with HPV which has become a health concern.2

This project aims to conduct a systematic review of HPV so that the population nationally and globally can be updated with recent data. At the end of this project, the global population including the United States would have clearer data and understanding of the Human papillomavirus (HPV), and other STIs to take preventive measures that will reduce the burden and rapid spread of viruses. Recent studies have shown that almost 1 in 3 men over the age of fifteen are infected with at least one genital human papillomavirus (HPV) type, and 1 in 5 are infected with one or more of what are known as elevated risk, or oncogenic, HPV types. It is estimated that men frequently harbor genital HPV infections which emphasizes the importance of incorporating men in efforts to control HPV infection and reduce the incidence of HPV-related disease in both men and women. The gender gap for overall cancer mortality worldwide is twice that for incidence, with death rates 43% higher in men than in women (120.8 and 84.2 per 100,000, respectively). The burden of cancer incidence and mortality is rapidly growing globally. This shows both the older and younger population of the population and changes in the prevalence and distribution of the main risk factors for cancer, About 80% which are associated with socioeconomic development and poverty.3

About 70% of HPV infections in people are asymptomatic, but they can lead to long-term mortality. Human papillomavirus infections are associated with penile, vulvar, vaginal, anal, oropharyngeal, and the most popular cervical cancers, which are commonly linked to HPV type 16. Sexually transmitted infections (STIs) which include HPV are spread by unprotected sexual contact. Though vaccines are 95% of the preventive ways, staying with one sex partner could help to prevent one against STIs and HIV. HPV prevalence has been extremely high in young adults, reaching a maximum between the ages of 25 and 29 years, and slightly decreased later. Pooled prevalence estimates were similar for the UN Sustainable Development Goal geographical regions of Europe and Northern America, Sub-Saharan Africa, Latin America and the Caribbean, and Australia and New Zealand.1,4

**Methods**

During the review, a comprehensive search was conducted using peer-reviewed articles, government websites, and the Public Health Institute (PHI) research literature. Data were collected using a search strategy, keywords, and public health headings that are directly related to HPV such as Human Papillomavirus burden, prevalence, infections, kinds of cancers associated with HPV, HPV prevention and vaccination, epidemiology, and screening. Original research articles, peer-reviewed articles, and the Center for Disease Control and Prevention (CDC) were included. The information and data in this review were extracted from sources that were published five years or less than five years ago. Qualitative analysis was used to analyze all sources and the data collected to ensure that all met the project criteria. Criteria for including and excluding studies based on factors such as review, design, publications, intervention/exposure, comparison, outcome, and study characteristics were established ahead of time. A clearly defined research/review questionnaire was used as a guide throughout the project.

**Design/Participants:**

The overviews of the review design were used to conduct this systematic review remotely using the internet, books, government websites, and peer-reviewed articles. This systematic review aims to comprehensively analyze the epidemiology, prevention, and treatment strategies related to Human Papillomavirus (HPV). The review will adhere to the American Medical Association (AMA) guidelines to ensure transparency, proper citation, and rigor throughout the process. A comprehensive search will be conducted across many electronic databases, including PubMed, peer-reviewed articles, and the Cochrane Library, to identify relevant studies published not more than five years ago.

**Settings/Participants:**

The review encompasses studies conducted globally to provide a wide range of understanding of Human Papillomavirus epidemiology, prevention, and treatment. Since it is a systematic review, no geographical restrictions will be imposed to capture diverse populations and healthcare settings. Studies conducted in various settings, including community-based, clinical, and public health settings, will be included to offer a comprehensive perspective on HPV-related issues. Participants in this study comprise individuals of all ages and genders affected by HPV infections, including but not limited to:

1. **The global population:** Individuals without HPV-related diseases, including those participating in epidemiological studies or vaccination programs.
2. **High-risk groups:** Individuals with higher vulnerability to HPV infections including sexually active individuals, immunocompromised individuals, and individuals with pre-existing conditions predisposing them to HPV-related diseases (e.g., cervical cancer, genital warts).
3. **Healthcare providers:** Included here areclinicians, nurses, and other healthcare professionals involved in HPV screening, vaccination, and treatment.
4. **Patients:** Individuals diagnosed with HPV-related diseases, including cervical, anal, penile, vaginal, and vulvar cancers, as well as genital warts and other HPV-associated conditions.

**Result**

This systematic review is conducted to update and provide current data or information to the public about the virus.16 and 18 are associated with cervical cancer. In contrast, the low-risk types are associated with genital warts. The prevalence of HPV infection varies by vaccination status, age, gender, and sexual behavior.

**Epidemiology, and Prevalence of HPV:**

Public health studies have reported a very high prevalence of HPV infection worldwide, with variations observed across different countries as well as other geographical locations. The overall HPV prevalence among women aged 35-39 without cervical abnormalities has been estimated to be 11.7%, with the highest prevalence observed in Sub-Saharan Africa, Eastern Europe, and Latin America.5

**Impact of HPV Vaccination Program:**

The introduction of the vaccination program has demonstrated significant success in reducing the infection rate among all ages and genders. A systematic review conducted by Drolet in 2019 evaluated the impact of the vaccine on cervical and anogenital wart incidence among males and females. The findings showed substantial declines in HPV infection outcomes following vaccination implementation, indicating the effectiveness of the vaccination program. In conclusion, the Human Papillomavirus continues to pose a significant burden to the world, specifically in the context of cervical cancer and other HPV-related diseases. The implementation of the vaccination program has demonstrated efficacy in the reduction of HPV infection rates and associated morbidities. Nevertheless, addressing the challenges such as vaccine coverage disparities and other emerging strains remains very crucial to achieving HPV prevention, control, and eradication.18

The table below shows the peer reviews that have been conducted.

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| **Systematic Review on Human Papillomavirus** |
| Human papillomavirus HPV) | Burd EM. Human papillomavirus and cervical cancer. Clin Microbial Rev. 2003 Jan;16(1):1-17. doi: 10.1128/CMR.16.1.1-17.2003. PMID: 12525422; PMCID: PMC145302.The Human papillomavirus (HPV) is one of the sexually transmitted diseases in both men and women in the United States and worldwide. Fewer infections are caused by open-mouth kissing and skin contact. In most cases, the immune system clears HPV from the body, however persistent infection with high-risk HPV can cause abnormal cells to develop, which go on to become cancer. Genital HPV infection's actual incidence and prevalence figures are not known because it is not a reported disease. however, it is estimated that the incidence of new infections in the United States ranges from one million to 5.5 million per year, and the prevalence is estimated to be as high as twenty million. |
| HPV Prevalence, Epidemiology, and Incidence  | Milano G, Guarducci G, Nante N, Montomoli E, Manini I. Human Papillomavirus Epidemiology and Prevention: Is There Still a Gender Gap? Vaccines. 2023; 11(6):1060. https://doi.org/10.3390/vaccines11061060About 4.5% of all cancers globally are attributable to HPVs, which are responsible for 8.6% of cancer cases in women (the third most prevalent cause, with a high mortality) and 0.8% in men. The low-risk genotypes are usually associated with genital warts and respiratory tract papilloma. In contrast, the high-risk genotypes are associated with a malignant transformation of cells, as in oropharyngeal and anogenital cancers. The associations between high-risk (HR) HPVs and some types of cancer are well-established, not only with the most common HR-HPV types 16 and 18 but also with the less-prevalent types 31, 33, 45, 52, and 58. Types 16 and 18 are strongly associated with cervical and penile cancers, as well as with anal and oropharyngeal cancers. |
| Is there any treatment for Human papillomavirus? (Treatment) | Khairkhah N, Bolhassani A, Najafipour R. Current and future direction in treating HPV-related cervical disease. *J Mol Med (Berl)*. 2022;100(6):829-845. doi:10.1007/s00109-022-02199-yAlthough the goal of HPV vaccination is to prevent invasive cervical cancer, major impediments as mentioned above are hindering vaccine uptake around the world and therefore many women are diagnosed with cervical cancer. However, there is no data to indicate full treatment of HPV-related cervical diseases, the primary goal of the treatment is to alleviate symptoms, remove the transformation zone of warts, and reduce the risk of future invasive cervical cancer. Management and treatment of HPV-related diseases are highly dependent on HPV types, available treatments, and the progression of the disease. |
| The list of the six (6) types of cancer associated with HPV. | Petca A, Borislavschi A, Zvanca ME, Petca RC, Sandru F, Dumitrascu MC. Non-sexual HPV transmission and role of vaccination for a better future (Review). *Exp Ther Med*. 2020;20(6):186. doi:10.3892/etm.2020.9316There are several cancers associated with HPV, but the virus has been known to cause six (6) major cancers if not treated early in humans. These include anal cancer, cervical cancer, oropharyngeal cancer, penile cancer, vaginal cancer, and vulvar cancer. Though it is widely documented that HPV is sexually transmitted, the virus can also be transmitted without sexual contact. The horizontal transfer of HPV includes fomites, fingers, mouth, and skin contact. Vertical transmission from mother to child is another HPV transfer course. Other studies have emphasized the possibility of infection through the amniotic fluid, the placenta, or via contact with maternal genital mucosa during natural birth. |
| Anal Cancer and treatment. | Gondal TA, Chaudhary N, Bajwa H, Rauf A, Le D, Ahmed S. Anal Cancer: The Past, Present and Future. *Curr Oncol*. 2023;30(3):3232-3250. Published 2023 Mar 11. doi:10.3390/curroncol30030246Anal cancer is among the rare cancers; however, over the last decade, there has been an increase in the incidence of 2.7% yearly. Among anal cancers, squamous cell cancer (SCC) is the most common form. Anal cancer has often been the target of much stigma due to its association with sexual behavior and sexual orientation. The management of anal cancer has evolved over the past several decades and continues to do so. From prevention with the human papillomavirus (HPV) vaccine to definitive chemoradiation therapy (CRT) as an organ-preserving approach and, in certain cases, organ preservation surgery, there is a breadth of options to manage anal canal cancer. Furthermore, with recent advances in systemic therapy, including the use of immunotherapy to manage advanced anal cancer and the use of what is known as metastasectomy in selected cases, the treatment landscape for patients with advanced disease is changing. |
| Different Types of Anal Cancer Diagnosis. | Siegel R, Werner RN, Koswig S, et al. Clinical Practice Guideline: Anal Cancer—Diagnosis, Treatment and Follow-up. *Dtsch Arztebl Int*. 2021;118(13):217-224. doi:10.3238/arztebl.m2021.0027There are different types of anal cancer including squamous cell cancer, Adenocarcinoma, basal cell carcinoma, and melanoma. |
| Human papillomavirus and Cervical Cancer. | Okunade KS. Human papillomavirus and cervical cancer [published correction appears in J Obstet Gynaecol. 2020 May;40(4):590]. *J Obstet Gynaecol*. 2020;40(5):602-608. doi:10.1080/01443615.2019.1634030Cervical cancer is one of the six types of cancers caused by HPV and is currently the only HPV-caused cancer for which FDA-approved screening tests are available. screening is an important part of routine health care. Cervical cancer screening tests include the HPV test that checks cervical cells for high-risk HPV, the Pap smear that checks for cervical cell changes that can be caused by high-risk HPV, and the HPV/Pap cotest that checks for both high-risk HPV and cervical cell changes. |
| Human papillomavirus (HPV) Association with Heart Disease & Other Disease. | Brito LMO, Brito HO, Corrêa RDGCF, et al. Human Papillomavirus and Coronary Artery Disease in Climacteric Women: Is There an Association? ScientificWorldJournal. 2019; 2019:1872536. Published 2019 Jun 20. doi:10.1155/2019/1872536 Other than HPV being the cause of cancer of the throat, anus, vulva, vagina, and penis, it has been proven through public health studies that it may cause heart disease in females 30 years old and above. The HPV directly feeds artery-clogging plaques by infecting the cells in the walls of the blood vessels. All the women in the study were without cardiovascular disease when the study began. From 2011 to 2016, they underwent HPV tests every one or two years. The study relied heavily on self-tests and follow-ups, but they were able to draw some conclusions that linked the virus to an increased risk of heart disease in the women. |
| Human papillomavirus (HPV) infection or immunization and the risk for rheumatoid arthritis (RA). | Yang G, Ren Z, Wang K. Association between human papillomavirus infection or immunization and risk for rheumatoid arthritis. Front Immunol. 2023 Apr 14; 14:1130217. Doi: 10.3389/fimmu.2023.1130217. PMID: 37122753; PMCID: PMC10146259. Rheumatoid arthritis (RA), a chronic, progressive, systemic autoimmune disease characterized by synovitis, is associated with or we may say is caused by HPV. After conducting a population-based cohort study, results showed that the adjusted hazard ratio of human papillomavirus (HPV) infection to RA was 1.40 which suggests that HPV infection may be a predisposing factor for RA. Research is still needed to prove whether HPV vaccination reduces the risk for RA. |
| Maternal HPV Infection: Effects on Pregnancy Outcome. | Condrat CE, Filip L, Gherghe M, Cretoiu D, Suciu N. Maternal HPV Infection: Effects on Pregnancy Outcome. Viruses. 2021 Dec 7;13(12):2455. doi: 10.3390/v13122455. PMID: 34960724; PMCID: PMC8707668. HPV infection during pregnancy might negatively impact both maternal and infant health, increasing the risk of severe pregnancy complications, such as spontaneous abortion, preterm birth, preeclampsia, intrauterine growth restriction, premature rupture of membranes, and even fetal death. While absolute conclusions are impeded by potential bias and the relatively small number of studies, it is our firm belief that further research fully addressing this matter would confirm the existence of a causal relationship between HPV and adverse pregnancy outcomes. Studies have shown that the clearance of HPV during pregnancy is decreased, with high viral loads additionally favoring persistence, which is in line with the hypothesis that pregnancy is defined by an altered immune response. It has a trend that can be seen in the first two trimesters, while the female postpartum period is identified by an increase in HPV clearance. |
| Socioeconomic factors That influence the spread and Persistence of HPV. | Kops NL, Horvath JDC, Bessel M, Souza FMA, Benzaken AS, Pereira GFM, Villa LL, Wendland EM. The impact of socioeconomic status on HPV infection among young Brazilians in a nationwide multicenter study. Prev Med Rep. 2021 Jan 5; 21:101301. doi: 10.1016/j.pmedr.2020.101301. PMID: 33511025; PMCID: PMC7815821. Socioeconomic, racial, or ethnic disparities have been associated with serious health conditions from day one of life here in our global village. The socioeconomic position of an individual or certain population influences the prevalence of health-related behaviors known to be strong risk factors for morbidity and mortality. Behaviors such as smoking, diet, exercise, alcohol, and drug use are factors that influence Human papillomavirus. A low socioeconomic status and its correlates, such as a lower educational level, and life opportunities, suggest that such individuals have markedly poorer health care and might not be able to afford necessary health care or might live in neighborhoods with poor access to healthcare facilities, which can lead to vulnerability to the development of disease. Women of color have a higher prevalence of all types of HPV than their white counterparts. With all said, poverty has been the key influencer of HPV and other diseases around the world. Scientists have repeatedly proven that poorer individuals, families, populations, and underdeveloped countries suffer from disease, viruses, and common preventable sicknesses than their richer counterparts. |
| Global and regional estimates of genital human papillomavirus prevalence among men. | Sung H, Ferlay J, Siegel RL, et al. Global Cancer Statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin 2021; 71: 209–49A recent study has shown that almost 1 in 3 men over the age of 15 are infected with at least one genital human papillomavirus (HPV) type, and 1 in 5 are infected with one or more of what are known as high-risk, or oncogenic HPV types. It is estimated that men frequently harbor genital HPV infections which emphasizes the importance of incorporating men in efforts to control HPV infection and reduce the incidence of HPV-related disease in both men and women. The gender gap for overall cancer mortality worldwide is twice that for incidence, with death rates 43% higher in men than in women (120.8 and 84.2 per 100,000, respectively). The burden of cancer incidence and mortality is rapidly growing globally. This shows both older and younger genders of the population as well as changes in the prevalence and distribution of the main risk factors for cancer, most of which are associated with socioeconomic development and poverty. |
| The danger of avoiding safe sex practices among the younger generation. | Armayones Ruiz, M., Pinto, E.L., Figueroa, O. et al. Barriers and facilitators for safe sex behaviors in students from Universidad de Santiago de Chile (USACH) through the COM-B model. BMC Public Health 23, 677 (2023). https://doi.org/10.1186/s12889-023-15489-yUnsafe sex is one of the main morbidity and mortality risk factors associated with sexually transmitted infections (STIs) in young people. Behavioral change interventions for promoting safe sex have lacked specificity and theoretical elements about behavior in their designs, which may have affected the outcomes for HIV/AIDS and STI prevention, as well as for safe sex promotion. |
| What we need to know about the Herpes virus. | Whitley R, Baines J. Clinical management of herpes simplex virus infections: past, present, and future. *F1000Res*. 2018;7: F1000 Faculty Rev-1726. Published 2018 Oct 31. doi:10.12688/f1000research.16157.1Infection with herpes simplex virus (HSV) types 1 and 2 is widespread in the human population. Commonly, virus replication is limited to epithelia and establishes latency in enervating sensory neurons, reactivating periodically to produce localized recurrent lesions. However, these viruses can also cause severe diseases such as recurrent keratitis leading potentially to blindness, as well as encephalitis, and systemic disease in neonates and immunocompromised patients. Although antiviral therapy has allowed continual and substantial improvement in the management of both primary and recurrent infections, resistance to currently available drugs and long-term toxicity pose a current and future threat that should be addressed through the development of new antiviral compounds directed against new targets. The development of several promising HSV vaccines has been terminated recently because of modest or controversial therapeutic effects in humans. However, several exciting vaccine candidates remain in the pipeline and are effective in animal models; these must also be tested in humans for sufficient therapeutic effects to warrant continued development. Approaches using compounds that modulate the chromatin state of the viral genome to suppress infection and reactivate or induce enhanced antiviral immunity have potential.  |
| Epidemiology and Prevalence of HSV | Hosseini SD, Yasaghi M, Mobasheri E, Razavi Nikoo H, Tabarraei A. Molecular and Serological Epidemiology of Herpes Simplex Virus Type 1 and 2 in Pregnant Women of Gorgan City, Northeast of Iran. J Reprod Infertil. 2023;24(1):35-42. doi:10.18502/jri. v24i1.11907 The Herpes virus has been infecting the human population for millions of years. Humans are the only primate species known to be infected with two distinct herpes simplex viruses: HSV-1 and HSV-2. Human herpes simplex viruses are everywhere, and studies show that over two-thirds of the human population is infected by at least one virus. The virus was first discovered in a chimpanzee. The frequency of HSV infection has been measured by testing various populations for the presence of antibodies, as both the virus and the immune response are thought to persist after infection for the life of the person. In our global village, the Herpes Virus 1(HSV-1) is almost universal, which means, almost everyone carries it and is usually acquired from intimate contact with family in early childhood. After a person’s childhood, the HSV-1 prevalence rates increase minimally with age. Rates of HSV-1 infection are the same for both men and women. In some places including the United States, African Americans and Asians have higher rates of HSV-1 infection than their white counterparts. Most infections are oral, while others are asymptomatic. Some data suggest that in developed countries, acquisition of HSV-1 is delayed from early childhood to adolescence or young adulthood. Unlike the Herpes virus 1 (HSV-1), 15%–80% of people in various populations are infected with the Herpes virus 2 (HSV-2) which is marked less frequently. The infection rate varies by country as well as levels of sexual activity. In European countries, such as Spain, and Asian countries such as the Philippines, the HSV-2 prevalence is around 10%, which is increasing to the 20%–30% range for most European countries and the United States. Since HSV-2 infections are spread mostly during sexual activity, the risk of HSV-2 reflects a person’s level of sexual activity the number of sexual partners, and the background prevalence of infection in the community. |
| Human papillomavirus (HPV) and Herpesvirus (HSV); Similarities and differences. | Sausen DG, Shechter O, Gallo ES, Dahari H, Borenstein R. Herpes Simplex Virus, Human Papillomavirus, and Cervical Cancer: Overview, Relationship, and Treatment Implications. *Cancers (Basel)*. 2023;15(14):3692. Published 2023 Jul 20. doi:10.3390/cancers15143692Human papillomavirus and Herpesvirus are viruses that can be transmitted sexually and orally. Their similarity also includes the fact that both can cause genital lesions and show no symptoms at all. Although there is no cure for both viruses, HPV can disappear from its host without treatment, but HSV will lie dormant in its host for many years. |
| Prevention and Treatment for Herpes. | Sharma D, Sharma S, Akojwar N, et al. An Insight into Current Treatment Strategies, Their Limitations, and Ongoing Developments in Vaccine Technologies against Herpes Simplex Infections. *Vaccines (Basel)*. 2023;11(2):206. Published 2023 Jan 17. doi:10.3390/vaccines11020206There is no cure for Herpes. Therefore, people carrying herpes live with it forever. The good thing about it is that the virus is rarely life-threatening for most people who have it, but it's extremely dangerous for pregnant women. During pregnancy, the virus flares up which increases the pregnant woman's risk of premature labor, and her unborn baby can get a deadly infection in the womb. The most common prevention is staying with one sex partner or using condoms when you have multiple sex partners and avoiding oral sex. But even a condom will only protect the area of the body that is covered. |
| Human Papillomavirus and Human Immune Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS). | Lekoane, K.M.B., Kuupiel, D., Mashamba-Thompson, T.P. *et al.* The interplay of HIV and human papillomavirus-related cancers in sub-Saharan Africa: a scoping review. *Syst Rev* **9**, 88 (2020). https://doi.org/10.1186/s13643-020-01354-1Recent evidence shows that HIV and HPV infections may interact in multiple ways. Both viruses infect anogenital sites and are influenced by similar risk factors such as several sexual partners. However, there is also evidence for direct biological and immunological interactions. Invasive cervical carcinoma is an AIDS‐defining illness due to increased risk with immunosuppression, (although immunosuppression is not a necessary condition for HPV infection to progress to cancer). Similarly, HPV acquisition risk, persistence of infection, and disease progression to intraepithelial neoplasia (such as cervical intraepithelial neoplasia (CIN) and anal intraepithelial neoplasia (AIN)) and cancer may be increased among people with a range of immunodeficiencies, including HIV infection. |
| The global effort to combat Human Papillomavirus (HPV). | Vorsters A, Bosch FX, Poljak M, et al. HPV prevention and control - The way forward. Prev Med. 2022; 156:106960. doi: 10.1016/j.ypmed.2022.106960 The World Health Organization (WHO), the CDC, and other institutions have worked tirelessly in combating HPV. Funds and vaccinations have been created and donated to fight and prevent the virus from wiping out humanity. |
| The impact of vaccination against HPV. | Charde SH, Warbhe RA. Human Papillomavirus Prevention by Vaccination: A Review Article. *Cureus*. 2022;14(10): e30037. Published 2022 Oct 7. doi:10.7759/cureus.30037The number of precancers of the cervix in young women has been reduced due to HPV vaccination. A practical and safe method to prevent HPV is early vaccination. Vaccines provide cell-mediated immunity. It is more helpful if the vaccine is taken at a younger age. It can only prevent, not treat, cervical cancer. General practitioners are essential in informing people of the vaccine and its potential benefits. |
| The Impact of Vaccination against HSV. | Malik S, Sah R, Ahsan O, Muhammad K, Waheed Y. Insights into the Novel Therapeutics and Vaccines against Herpes Simplex Virus. Vaccines (Basel). 2023;11(2):325. Published 2023 Jan 31. doi:10.3390/vaccines11020325Although HSV has no cure, it can be prevented by vaccination. Subunit vaccines are composed of viral components, such as glycoproteins and protein subunits, which undergo protective immune responses to the host. They have proven safer, stable, and effective for HPV vaccination design and immunization design, but still lack clinical experimental success against HSV. They mostly use viral glycoproteins and antigenic mediators such as Gb/Gd/gE in their antiviral design. This type of vaccine varies in function and procures the inhibition of viral entry, viral shedding, transmission across cells, and immune-evasive responses. |
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**Discussion**

The Human papillomavirus (HPV) is one of the sexually transmitted diseases in both men and women in the United States and worldwide. Fewer infections are caused by open-mouth kissing and skin contact. In most cases, the immune system clears HPV from the body. However persistent infection with high-risk HPV can cause abnormal cells to develop, which go on to become cancer. Genital HPV infection's actual incidence and prevalence figures are not known because it is not a reported disease. however, it is estimated that the incidence of new infections in the United States ranges from one million to 5.5 million per year, and the prevalence is estimated to be as high as twenty million. The virus affects both animals and the human population. Cattle are the main source and natural reservoir of infection by the virus; but halters, ropes, and instruments can serve as a potential source of infection. More than two hundred types of HPV have been recognized based on DNA sequence data showing genomic differences. Low-risk HPV types include types 6, 11, 42, 43, and 44. High-risk HPV types include types 16, 18, 31, 33, 34, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68, and 70.Some HPV types in the high-risk group are less frequently found in cancers but are often found in squamous intraepithelial lesions (SILs).1

**Prevalence, Epidemiology, and Incidence**

In 2018, the National Center for Biotechnology Information (NCBI) reported that genital HPV infection prevalence among women between the ages of 18 and 59 was estimated at 43% in the US and around 45% among men who fall in the same age range. The Prevalence of oral HPV is estimated to be around 7% among US adults between the ages of 18 and 69, with 4% having HPV high-risk types. There is no exact information on the percentage of the population infected.

because HPV cases are not reported. Researchers have reported that 4.5% of cancers are due to HPV globally. Eighty million people in the US are infected with HPV, and the incidence of virus oropharyngeal cancer has surpassed HPV cervical cancer. The highest burden of oropharyngeal cancer is seen in middle-aged and increasingly older white men as well. HPV vaccination promises to change the epidemiology of this disease, but HPV vaccination rates remain too low today to reduce disease transmission. According to the World Health Organization (WHO), as of September 1, 2023, the global pooled prevalence was 31% for any HPV and 21% for high-risk HPV. WHO also reported that HPV-16 was the most prevalent HPV genotype (5%) followed by HPV-6 (4%). HPV prevalence was high in young adults, reaching a maximum between the ages of 25 and 29 years, and stabilized or slightly decreased thereafter. A recent study shows that 1 in 3 men over the age of fifteen are infected with at least one genital human papillomavirus (HPV) type, and 1 in 5 are infected with one or more of what are known as elevated risk, or oncogenic, HPV types.2

**Treatment**

Currently, there is no treatment for the virus but there are treatments for the health issues created by HPV. Vaccines are available for prevention. Three HPV vaccines are available, and they are the 9-valent HPV vaccine (Gardasil 9, 9vHPV), quadrivalent HPV vaccine (Gardasil, 4vHPV), and bivalent HPV vaccine (Cervarix, 2vHPV)—have been licensed by the U.S. Food and Drug Administration (FDA). All three HPV vaccines protect against HPV types 16 and 18 which cause most HPV cancers. Like any medication, these vaccines have side effects which include pain, redness, or swelling in the arm where the shot was given, fever, dizziness, or fainting (fainting after any vaccine, including the HPV vaccine, is more common among adolescents than others, headache or feeling tired, nausea and muscle or joint pain. **Treatment for cervical precancer** is available. Women who get routine Pap tests and follow-up as needed can find problems before cancer develops. **Genital warts**can go away with early treatment from your healthcare provider or with prescription medicine. If left untreated, genital warts may go away, stay the same, or grow. **There is also treatment for other HPV-related cancers but only when they are** found and treated in their early stages.6

**The Six (6) Types of Cancers Caused by HPV in Human**



HPV has been known to cause six (6) different cancers if not treated early in humans. These include anal cancer, cervical cancer, oropharyngeal cancer, penile cancer, vaginal cancer, and vulvar cancer. Though it is widely documented that HPV is sexually transmitted, the virus can also be transmitted without sexual contact. The horizontal transfer of HPV includes fomites, fingers, mouth, and skin contact. Vertical transmission from mother to child is another HPV transfer course. Other studies have emphasized the possibility of infection through the amniotic fluid, the placenta, or via contact with maternal genital mucosa during natural birth. Public health studies have proven that there is relationship between Human papillomavirus infection and anal cancer.26 The following are factors that could increase the risk of developing anal cancer in individuals with HPV infection:

1. Persistent HPV infections: If the body is unable to clear the HPV infection, the risk of developing anal cancer increases.
2. Weakened Immune System: People with weakened immune systems, such as those living with HIV/AIDS or those who have undergone organ transplantation, are at a higher risk of HPV-related cancers, including anal cancer.
3. Anal Intercourse: Engaging in receptive anal intercourse increases the risk of HPV transmission and infection, which in turn increases the risk of developing anal cancer.
4. Smoking: Smoking has been identified as a risk factor for anal cancer, particularly in individuals infected with HPV.
5. Age and Gender: Anal cancer is more common in older adults and is also more prevalent in women than in men.7

**Anal Cancer Diagnosis**

Many tests are available to help medical practitioners determine if you have anal cancer or anal dysplasia.

* **Anal Pap test:** A swab is inserted into the anus to obtain cells for a pathologist to evaluate for cancer.
* **Digital rectal exam: During this test,** the doctor or nurse inserts a lubricated, gloved finger into the anus and feels for bumps or lumps.8
* **Anoscope:** Using a lighted tube, the doctor checks the anus and rectum for suspicious areas in the anal canal.
* **High-resolution anoscope (HRA):**The physician or health practitioner examines the anus and rectum using a lighted tube and evaluates suspicious areas in the anal canal by using stains.

The precancerous areas such as high-grade anal dysplasia may be treated topically or with heat ablation in the doctor’s office. For carcinoma in situ (car-sin-OH-mah in SY-too) or more advanced anal cancers, patients may be referred to a surgeon. Invasive anal cancer that has spread in the body is treated with chemotherapy and radiation. After the treatment of anal dysplasia or anal cancer, the patient needs to get regular checkups just to ensure the cancer doesn’t return.8

**Cervical Cancer**

It has been proven that high-risk HPV infects cervical cells and interferes with how these cells replicate, divide, and communicate with one another, causing infected cells to multiply in an uncontrolled manner. The infected cells are usually recognized and controlled by the immune system. However, sometimes the infected cells remain and continue to grow, eventually forming an area of precancerous cells that, if not treated, can become cancer. Although research has focused on how high-risk HPV causes cancer in the cervix, HPV-caused cancers at other sites are likely to arise through similar mechanisms.

Researchers have reported that it can take 5 to 10 years for HPV-infected cervical cells to develop into precancers and about 20 years to develop into full cancer.

**Cervical Cancer Diagnosis**

If a person is experiencing symptoms or screening test results that suggest the possibility of cervical cancer, a physician or health practitioner will do follow-up tests to find out if it is due to cancer or some other cause. Most of the time, they start by asking about your personal and family medical history and by doing a physical exam, which will include a pelvic exam and rectovaginal exam. The doctor may then recommend diagnostic tests to find out if you have cervical cancer, and if so, whether it has spread to another part of the body. The results of these tests will also help you and your doctor plan treatment. When cervical cells are infected with high-risk HPV, several factors increase the chance that the HPV infection will be long-lasting and lead to precancerous cervical cells:

* having a very aggressive HPV type, particularly HPV 16 or HPV 18
* smoking
* having a weakened immune system or being immunocompromised
* being infected with HIV
* taking medicines that suppress your immune system, such as after an organ transplant, to treat an autoimmune disease, or to treat cancer. Smoking is one habit that increases the chance of high-grade dysplasia progressing to cancer, it’s recommended that the person quit immediately.9

**Cervical Cancer Treatment**

Below are common ways to treat cervical cancer:

* Surgery for Cervical Cancer.
* Radiation Therapy for Cervical Cancer.
* Chemotherapy for Cervical Cancer.
* Targeted Drug Therapy for Cervical Cancer.
* Immunotherapy for Cervical Cancer.10

**Cervical Cancer Diagnosis and Treatment Diagram**



**Oropharyngeal Cancer**

One of the risk factors for oropharyngeal has been associated with tobacco and the use of alcohol. Recently, research has shown an increasing trend with HPV-associated tumors, specifically, HPV-16 which has accounted for more than 90% of cases. Approximately 80% of oropharyngeal cancers in the US are associated with HPV. These specific tumor types have been the main reason for increasing incidences, especially in the younger population.

**Diagnosis of oropharyngeal cancer**

The doctor will ask you about symptoms, possible risk factors, and any other medical problems you may have. The doctor will look for possible signs of mouth or throat cancer or pre-cancer. These could be bumps or other changed areas on your head, face, or neck, or problems with the nerves of the face and mouth. The doctor will look inside of your mouth and might feel around in it with a gloved finger. Other tests might be used to look for abnormal areas in your mouth or throat. The doctor will also recommend or carry out the following tests: Biopsy, Imaging tests, Chest x-ray, Computed tomography (CT or CAT scan), Magnetic resonance imaging (MRI), Positron emission tomography (PET), Bone scan, Barium swallow, Ultrasound, Blood tests, Hearing tests, and Nutrition and speech tests.

**Treatment for Oropharyngeal Cancer**

Below are a few different treatments for patients suffering from oropharyngeal cancer. Some Patients with oropharyngeal cancer should have their treatment planned by a team of doctors with expertise in treating head and neck cancer. The following types of treatment are used:

* Surgery
* Radiation therapy
* Chemotherapy
* Targeted therapy
* New types of treatment are being tested in clinical trials.
* Immunotherapy
* Treatment for oropharyngeal cancer may cause side effects.
* Patients may want to think about taking part in a clinical trial.
* Follow-up tests may be needed.

Patients can enter clinical trials before, during, or after starting their cancer treatment.11

**Penile Cancer Diagnosis and Treatment Penile cancer starts in or on the penis.**

Cancer starts when cells begin to grow out of control. Cells in nearly any part of the body can become cancerous and can spread to other parts of the body. Research conducted by the American Cancer Society estimates for penile cancer in the United States for 2024 showed that there are about 2,100 new cases of penile cancer diagnosed and there are about 500 deaths from penile cancer. HPV is the only cause of penile cancer for now. The research also reported that Penile cancer is rare in North America and Europe. It's diagnosed in fewer than 1 man in 100,000 each year and accounts for fewer than 1% of cancers in men in the United States. Penile cancer is much more common in some parts of Asia, Africa, and South America. The most effective treatment for penile cancer is surgery. Surgery is the main treatment for most men with penile cancers, but sometimes radiation therapy may be used, either instead of or in addition to surgery. Other local treatments might also be used for early-stage tumors. Chemotherapy may be given for some larger tumors or if the cancer has spread.

**Penile Cancer Surgical Treatment (Mohs Surgery)**



**Vaginal Cancer cause, symptoms, Diagnosis, and Treatment**

Vaginal cancer of the vagina, a rare kind of cancer in women, is a disease in which malignant (cancer) cells are found in the tissues of the vaginal. Age, Exposure to diethylstilbestrol (DES) as a fetus (mother took DES during pregnancy), history of cervical cancer, HIV infection, Smoking, and prior diagnosis of HPV are risk factors that increase a woman’s chance of developing vaginal cancer. There are several types of cancer in the vaginal and they are as flows: **squamous cell cancer, Adenocarcinoma,** malignant melanoma, leiomyosarcoma, and rhabdomyosarcoma.

**Symptoms**

 Symptoms may include the following:

* Bleeding or discharge not related to menstrual periods Difficult or painful urination.
* Pain during intercourse Pain in the pelvis is Constipation.
* A mass that can be felt.

**Diagnosis**

Vaginal cancer can be diagnosed through the following tests:

* **Colposcopy Pap test also called Pap smear.**
* **Computed tomography scan (CT or CAT scan)**
* **Magnetic resonance imaging (MRI)**
* **Positron emission tomography (PET) scan and**
* **Biopsy**

**Treatment**

**The treatment for vaginal cancer is recommended by the doctor based on your health, the extent of the disease, and** tolerance for specific medications, procedures, or therapies Expectations for the course of the disease. But the most effective treatments are Surgery, radiation therapy, and chemotherapy.

**Vulvar Cancer**

Vulvar cancer is a rare disease of which squamous vulvar carcinomas are the most common histological subtype. Squamous vulvar carcinomas are often associated with human papillomavirus (HPV) infection and are often seen in younger females less than 50 years old who smoke. The “hit and run” theory says that viruses have an activating role in cancer development and the viral genome may disappear after the host cell accumulates numerous mutations. The theory also suggests that viruses may cause more cancers than previously thought.

**Symptoms**

* Difficult or painful urination
* Pain during intercourse
* Pain in the pelvic area

**Diagnosis**

* **Pap test also called Pap smear.**
* **Computed tomography scan (CT or CAT scan)**
* **Magnetic resonance imaging (MRI)**
* **Colposcopy**

**Treatment**

* **Surgery**
* **Radiation Therapy**
* **Chemotherapy**

**Human papillomavirus (HPV) Association with Heart Disease & Other Diseases**

Researchers have shown that a high risk of HPV can increase heart issues for women. A study conducted by researchers investigated HPV effects on over 63,000 women. According to the result of the study, the women infected with high-risk strains were somewhat more likely to develop heart disease or suffer a stroke over the next several years. Other than HPV being the cause of cancer of the throat, anus, vulva, vagina, and penis, it has been proven through public health studies that it may cause heart disease in females 30 years old and above.27 The HPV directly feeds artery-clogging plaques by infecting the cells in the walls of the blood vessels. All the women in the study were without cardiovascular disease when the study began. From 2011 to 2016, they underwent HPV tests every one or two years. The study relied heavily on self-tests and follow-ups, but they were able to draw some conclusions that linked the virus to an increased risk of heart disease in the women. According to researchers, the study also showed that women with high-risk HPV were 22% more likely to develop cardiovascular disease than uninfected women.HPV has also been linked to atheromatous lesions on coronary arteries. Another cross-sectional study conducted with 9,353 women aged between 20 to 59 years old who were tested for vaginal HPV DNA in the National Health and Nutrition Examination Survey (NHANES) between 2003-2016 showed heart disease being associated with HPV.28 Cardiovascular diseases were defined as the presence of self-reported coronary heart diseases, heart attacks, angina pectoris, and stroke. The association between HPV and cardiovascular diseases was studied using logistic regression, with adjustment for the potential confounders.29 The result showed a total of 40.8% of women were HPV DNA positive; 3.0% had cardiovascular diseases; and 9.0% of women received the HPV vaccine. The presence of vaginal HPV infection was associated with cardiovascular diseases (odd ratio [OR] = 1.66, 95% confidence interval [CI] 1.28-2.16), which remained significant (OR = 1.54, 95% CI 1.15-2.08) after adjustment for sociodemographic characteristics, lifestyle behaviors, medical history, family history of cardiovascular diseases, and antihypertensive drugs. The association was absent among those who were vaccinated against HPV (OR= 0.50, 95% CI 0.07-3.51) but present among those who were not (OR = 1.63, 95% CI 1.18-2.25).

**Human papillomavirus (HPV) infection or immunization and the risk for rheumatoid arthritis (RA)**

Rheumatoid arthritis (RA) is a chronic, progressive, systemic autoimmune disease characterized by synovitis. A population-based cohort study showed that the adjusted hazard ratio of human papillomavirus (HPV) infection to RA was 1.40, suggesting that HPV infection may be a predisposing factor for RA. The prevalence of RA varies globally, with an age-standardized prevalence of 246.6 per 100,000 and has increased in recent years. A recent study conducted in early 2023 proved that Human papillomavirus (HPV) has a positive association with rheumatoid arthritis.30 According to the National Center for Biotechnology Information, HPV infection was positively associated with an increased prevalence of RA in adults aged 18-59 years, with the highest value of the odds ratio (OR) in model 2 (after weighting: OR 1.095, 95% CI 1.092, 1.097), whereas HPV immunization significantly reduced the prevalence of RA in adults aged 18-59 years, with the lowest OR in model C (after weighting: OR 0.477, 95% CI 0.472, 0.481). These associations persisted after correction for confounders such as age, sex, race, education level, marital status, smoking, diabetes, hypertension, hyperlipidemia, and BMI.

**Findings/Outcomes**

This review revealed the prevalence rate of Human Papillomavirus (HPV) infection, indicating a significant public health burden. It identified many risk factors associated with HPV transmission which include having multiple sex partners, unprotected sex, teenage sexual debut, and the abuse of tobacco products. The findings mentioned here highlight the need to target the virus to reduce its transmission and burden of infection. They underscore the need for comprehensive strategies to prevent and control HPV infections, including vaccination, education, and screening programs. Moreover, addressing socioeconomic and cultural barriers to vaccination uptake is crucial for maximizing its impact. Further research is warranted to explore emerging trends in HPV epidemiology, evaluate the long-term effectiveness of vaccination, and develop innovative therapeutic interventions. The findings also highlight the need to train more community health workers to educate the community on the transmission, impacts, prevention methods, and management of HPV and associated infections. The outcomes of this review include the following:

* **Prevalence and incidence:** Analysis of the prevalence and incidence rates of HPV infection across different populations and settings. it includes variations in rates based on age, gender, geographic location, and risk factors.25
* **Efficacy of preventive measures:** thisevaluates the effectiveness of preventive measures such as HPV vaccination and screening programs in reducing the burden of HPV-related diseases.
* **Disease association:** Examination of the association between HPV infection and various diseases, particularly cervical, anal, and oropharyngeal cancers. Other HPV-associated diseases such as genital warts may also be included.
* **Disparities:** Identification of disparities in HPV infection rates and access to preventive measures, including differences based on socio-economic status, ethnicity, and geographic location.
* **Impact of vaccination:** The review shows theAssessment of the impact of HPV vaccination programs on reducing HPV infection rates, prevalence of associated diseases, and incidence of HPV-related cancers.
* **Knowledge gap:** Identification of gaps in knowledge or areas requiring further research to improve understanding of HPV epidemiology, disease progression, and effectiveness of preventive measures. The systematic review outcomes provide valuable insights into the burden of HPV infection and associated diseases, as well as the effectiveness of interventions aimed at preventing HPV transmission and reducing the incidence of HPV-related cancers.

**Competencies**

This systematic review demonstrates the reviewer’s competency in conducting a robust systematic review to understand the prevalence and determinants of HPV infection. By using professional skills and methods, and making use of advanced statistical techniques, reliable evidence was generated to inform public health interventions and policies targeting HPV prevention. In addition to this, the professional approach facilitated a comprehensive understanding of the multifaceted nature of virus infection, targeting insights from public health as well as epidemiology. With a concentration on global health, more HPV educational materials and training need to be delivered globally. With more education on HPV, the rate at which the disease is increasing will be reduced, and more people will know about the virus. Educational materials, such as pamphlets, videos, and websites, are designed to inform communities about preventive measures, healthy behaviors, and available healthcare services. HPV education has helped reduce the prevalence and related diseases in many countries including the following countries:

* Australia: Australia has implemented a national HPV vaccination program for girls since 2007, later extended to boys in 2013. High vaccination coverage rates, along with effective public education campaigns, have led to a significant decline in HPV infections and related diseases, including cervical cancer.22
* United States: The introduction of HPV vaccines in the United States has led to a decrease in HPV prevalence among adolescents and young adults. Education efforts aimed at increasing vaccination rates, promoting regular screening for cervical cancer, and raising awareness about HPV and its consequences have contributed to this reduction.23
* United Kingdom: The United Kingdom offers HPV vaccination to adolescent girls through the National Health Service (NHS). Education campaigns targeting both parents and adolescents have helped increase awareness about the importance of vaccination and have contributed to a decline in HPV-related diseases. Countries like Denmark, Sweden, Norway, and Finland have also implemented HPV vaccination programs and educational initiatives. These efforts have led to reductions in HPV prevalence and related diseases, including cervical cancer incidence.24

**Limitations**

Despite many efforts being made, the review has several limitations which warrant acknowledgment. To start with, the findings are subject to the inherent limitations associated with cross-sectional peer reviews, such as recall bias and self-reporting inaccuracies. Moreover, this systematic review also relied on health websites, peer-reviewed articles, and government websites which may limit the findings and outcomes of the review project to the population. Sometimes, there was a lack of Wi-Fi and internet which served as a limitation. Not to encounter these limitations in the future, measures have been put in place to conduct a successful systematic review.

**Recommendations**

Based on the findings of this systematic review, these few recommendations will help to limit or mitigate HPV burden infection, health issues, and consequences associated with HPV. Firstly, to reduce the rate of infection, comprehensive HPV vaccination programs must be implemented, targeting young, old, and all genders. Secondly, efforts should be made to disseminate HPV awareness to the public including its infection, transmission routes, and preventive measures such as staying with one uninfected sex partner. Another thing to be considered is that healthcare providers should be trained and equipped with all the tools and resources to detect the virus early and manage it. Finally, more reviews need to be done regularly to update the public with HPV's newest data.

**Conclusion**

This systematic review highlights the significant burden of HPV infection and the need for comprehensive prevention and control measures. By making clear the prevalence, risk factors, and implications of the virus infection, the findings contribute to the growing body of evidence aimed at informing evidence-based interventions as well as policies that will help in the fight against the virus. From this point forward, collaborative efforts between researchers, policymakers, healthcare providers, and educators are essential to fight against HPV. The review has provided a comprehensive overview of the current state of knowledge on HPV. This includes epidemiological data, risk factors, clinical manifestations, and outcomes associated with HPV infection, and it addresses the disparities in healthcare policies and provisions. The practicum has greatly added new research skills like data extraction methods, public health interventions, and the understanding and use of the American Medical Association (AMA) the profession of research and systematic review. The systematic review analyzed peer-reviewed articles to provide a rigorous and transparent synthesis of the available evidence to inform clinical practice, policy development, and future research in the field of global health.

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**Appendix**

**HPV Impacts on Global Health**

The association between global health and Human Papillomavirus (HPV) is significant due to the impact of HPV-related diseases on morbidity and mortality worldwide. HPV is a common sexually transmitted infection, and while most infections are clear on their own, certain strains can cause various health issues, including genital warts and several types of cancer, such as cervical, anal, penile, vaginal, vulvar, and oropharyngeal cancers.31

Here's how the association impacts global health:

* Cervical Cancer: HPV is the primary cause of cervical cancer, which is a significant global health issue, particularly in low- and middle-income countries where access to screening and treatment is limited. Cervical cancer is one of the leading causes of cancer-related deaths among women worldwide.32
* Vaccination Programs: HPV vaccination has become an essential component of global health initiatives. Vaccination against HPV can prevent infection with high-risk HPV types, thus reducing the incidence of HPV-related cancers and improving overall public health outcomes.
* Screening and Early Detection: Regular screening programs for cervical cancer, such as Pap smears and HPV DNA tests, are crucial for early detection and treatment. However, in many parts of the world, access to these screening services is limited, leading to higher rates of advanced-stage diagnoses and poorer outcomes.
* Preventive Measures: Alongside vaccination and screening, promoting safe sexual practices, including condom use, can help reduce the transmission of HPV and lower the risk of associated health issues.
* Gender Disparities: HPV-related health burdens can disproportionately affect women due to the association with cervical cancer. Addressing these disparities requires targeted interventions to ensure equitable access to prevention, screening, and treatment services.
* Impact on Quality of Life: HPV-related diseases, such as genital warts and HPV-related cancers, can significantly impact individuals' quality of life and impose economic burdens on healthcare systems and societies.33
* Education and Awareness: Increasing public awareness about HPV, its transmission, associated health risks, and preventive measures are essential for promoting early detection, vaccination uptake, and reducing stigma surrounding HPV-related diseases.

Global health and HPV underscores the importance of comprehensive strategies, including vaccination programs, screening initiatives, access to treatment, and public education, to mitigate the burden of HPV-related diseases and improve health outcomes worldwide.