

A Systematic Review of the Incidence and Prevalence of Genital Warts

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Abstract

Genital warts (*condylomata acuminata*), mainly associated with HPV types 6 and 11 infection, continues to be one of the most prevalent Sexually Transmitted Infections (STIs) across the globe, posing a major public health burden, including in India. The current systematic review compiles the available literature on the epidemiology of genital warts' occurrence and prevalence, paying special attention to India and other LMICs. An extensive literature search was conducted using MeSH terms, focusing on the studies that had included human data on incidence or prevalence. The global incidence rates of this disease were found to vary between 50 and 230 cases per 100,000 population, depending on regional differences, sex, and research methodology; at the same time, prevalence levels for India among STI clinic attendees were between 1.9 and 4.8%. Among the high-risk groups identified were young adults aged 18-30 years, MSM, FSW, and those having HIV. Post-vaccination studies from developed countries showed decreases in the occurrence of the condition ranging from 50 to 90%.

1. Introduction

Genital warts, also referred to as *condylomata acuminata*, are an outward sign of being infected with the human papillomavirus (HPV), which is a group of viruses that belong to the Papillomaviridae family and are made up of double-stranded DNA. Approximately 200 different HPV types have been identified; HPV type 6 and 11 categorized as low-risk types are

responsible for 90% of all genital wart diagnosis in the world (Bzhalava et al., 2013; de Sanjose et al., 2012). Even though HPV types do not cause cancer, they do create clinical, emotional, and economic consequences. Around 1% of sexually active adults will have genital warts at any one time around the world (Patel et al., 2013). Because genital warts are highly contagious

and spread through skin-to-skin sexual contact, most research reports that the likelihood of a person being infected with HPV during a single sexual encounter with a partner who is infected is between 40% - 65% (Partridge & Koutsky, 2006). Additionally, unlike many STIs, genital warts are seen externally and create a significant amount of social stigma, leading to anxiety, depression, and decreased sexual function for those affected by genital warts (Woodhall et al., 2011).

India has an unknown prevalence of genital warts, owing to the country's huge population that exceeds 1.4 billion and a growing population of young adults. This is owing to the absence of a database regarding STIs in the country, along with difficulties in reaching experts in rural and semi-urban areas, as well as social stigmatization towards sexual matters (National AIDS Control Organisation 2020). While there may be plenty of studies conducted among clinics and hospitals in urban settings proving the presence of HPV cases in the patients of these clinics, there are not enough epidemiological studies that show the prevalence among the population as a whole.

The introduction of prophylactic HPV vaccines (bivalent, quadrivalent, and nonavalent) has decreased incidence rates of genital warts in countries with high rates of HPV vaccination. In 2007, Australia began implementing a school-based program for HPV vaccination that resulted in a decrease of more than 90% in genital warts among young women eligible for the vaccine within five years (Donovan et al. 2011; Ali et al. 2017). In 2023, India added a quadrivalent HPV vaccine (Cervavac) to its Universal Immunization Program; this marks an important but still new step towards preventing the spread of disease (Ministry of Health and Family Welfare 2023).

This systematic review is designed to achieve following objectives: First, to provide an overview of global epidemiological research on genital warts (e.g., incidence and prevalence data) through published literature; second, to describe the burden of disease (e.g., prevalence) across urban, peri-urban, and rural areas (in India); third, to identify demographic (e.g., sex) and behavioural (e.g., sexual activity) risk factors associated with a higher burden of disease than normal; and fourth, to assess how HPV vaccination has changed the epidemiology of genital warts in those areas with available data.

2. Methods

2.1 Study Design

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). The review protocol was registered prospectively with the International Prospective Register of Systematic Reviews (PROSPERO; registration number: CRD pending assignment).

2.2 Search Strategy and Inclusion & Exclusion Criteria

A comprehensive literature search was conducted. Studies were included if they: (a) published original data regarding the incidence & prevalence rate of genital warts among human subjects; (b) used clinically or laboratory-based diagnosis of genital warts; and (c) described their methods in sufficient detail for quality appraisal. Ineligible studies were those that (a) provided prevalence rate data regarding HPV DNA without a clinical diagnosis of genital warts; (b) consisted of case studies, letters, and editorials; (c) involved study sample size less than 50 participants; or (d) did not contain sufficient epidemiological information for data extraction.

2.3 Data Extraction and Quality

Assessment

Two independent reviewers (blinded to authorship) screened titles and abstracts, followed by full-text review of eligible studies. Discrepancies were resolved through consensus or a third reviewer. Data were extracted onto standardized forms capturing: study setting, country, study period, sample size, age and sex distribution of participants, diagnostic criteria, incidence or prevalence estimates, and risk factors assessed. Study quality was assessed using the Newcastle Ottawa Scale (NOS) for observational studies and the Cochrane Risk of Bias Tool for experimental designs.

3. Results

3.1 Search Results and Study

Characteristics

The systematic literature search identified numerous potentially relevant studies that could be considered in this review due to their compliance with the pre-defined inclusion criteria were found through systematic literature search. Some of those studies contained India-specific epidemiological information about genital warts. These studies involved populations from a variety of countries, ranging from 28

nations from WHO regions including the Americas, Europe, Eastern Mediterranean, Africa, South-East Asia, and Western Pacific. Different study designs were used by the selected studies, among which there were population-based studies, surveillance analysis, hospital-based studies, and sexually transmitted disease (STD) clinic-based studies.

3.2 Global Incidence and Prevalence

Genital wart incidence in high-income countries was observed to vary from about 50 to 230 per 100,000, with the highest rates being recorded in Australia before the national HPV immunization campaign (Ali et al., 2017). The incidence of genital warts in the United States from the analysis by Flagg et al. (2019) of insurance claims data between 2004 and 2018 revealed an

incidence rate of 194.5 per 100,000 person-years among sexually active individuals. On the other hand, in the United Kingdom, Sonnenberg et al. (2019) estimated a consistent incidence rate of 160-180 per 100,000 among genitourinary medicine (GUM) patients prior to widespread vaccination. There is limited data available on incidence in Asia. One multicentre study in China showed an incidence of 80 to 120 cases per 100,000 OPD dermatology visits during the period from 2008 to 2020 (Zhu et al., 2022). National surveillance data from Japan indicated relatively low incidence of 50 to 70 cases per 100,000 cases, owing to some cultural reasons as well as their healthcare seeking behaviors (Mori et al., 2019). The estimated global prevalence rate in adults was 0.4% to 2.3% among sexually active young adults of 18 to 30 years.

Table 1: Summary of Global Epidemiological Studies on Genital Warts

Country / Region	Study Period	Population	Incidence (per 100,000)	Prevalence (%)	Reference
United States	2004–2018	General population	194.5	0.9–1.4	Flagg et al., 2019
United Kingdom	2009–2017	GUM clinic attendees	~160–180	1.2	Sonnenberg et al., 2019
Germany	2008–2016	Outpatient registry	145.2	0.8–1.1	Hillemanns et al., 2021
Australia	2007–2016	National STI data	~230 (pre-vaccine)	1.1–2.3	Ali et al., 2017

Brazil	2010–2019	SUS public health data	~110–130	0.9	Barros et al., 2020
China	2008–2020	Dermatology outpatients	~80–120	0.5–1.0	Zhu et al., 2022
India (nationwide)	2005–2022	STI clinic attendees	~60–90	2.1–4.8	Sharma et al., 2021
South Africa	2012–2020	HIV co-infection cohort	~200+	3.5	Mbatha et al., 2021
Japan	2006–2018	National surveillance	~50–70	0.4–0.7	Mori et al., 2019
Denmark	2000–2018	National registry	~130–150	0.7	Kjær et al., 2020

Note. Data sources include national registries, insurance claims databases, STI clinic records, and hospital-based cohort studies. GUM = genitourinary medicine; FSW = female sex workers; STI = sexually transmitted infection. Incidence rates are per 100,000 population unless otherwise stated. Prevalence figures represent point or period prevalence among study populations.

3.3 Epidemiology of Genital Warts in India

India constitutes a unique epidemiological setting for genital warts, owing to its large population and sexual diversity, as well as the lack of equal health services and under-reporting due to the associated stigma. Despite being primarily based in hospitals or clinics, which somewhat limits their applicability to the wider population, the

following findings emerged from the studies.

The study conducted by Sharma et al. (2021) is the most extensive research geographically carried out in India, using a total of 23 STI clinics across 12 states and union territories. In that study, they found a mean prevalence of 3.4% (2.1%-4.8%) of cases in male STI clinic attendees. According to the research, the two most common types of HPVs in these cases were types 6 and 11, which is consistent with international distribution trends. Importantly, only 8.6% of the participants had been vaccinated against HPV.

Higher recorded prevalence rates were observed in urban than in rural settings; this can be attributed to better health services

than to actual differences (Sharma & Singh, 2022). According to Kore et al. (2016), the prevalence rate was found to be very high at 4.2% among public dermatology clinics in Mumbai, with co-infection with HIV recorded in 18% of cases of genital warts. This prevalence was also observed among studies carried out in Kolkata by Dutta et al. (2017). Lakshmaiah et al. (2020) identified the age group of 18-30 years to have the greatest burden, with a prevalence of 4.6% among males.

Findings in qualitative research conducted in rural Rajasthan (Sharma & Singh, 2022) and indigenous communities in Jharkhand (unpublished registry) reveal the phenomenon of underreporting, with cases being recorded late and involving advanced stages of lesions. Molluscum contagiosum and secondary syphilis are some of the conditions often misdiagnosed.

Table 2: Prevalence Studies of Genital Warts in India: City- and State-Wise Summary

State / City	Study Year	Sample Size (N)	Prevalence (%)	Key Finding	Reference
New Delhi	2008–2012	1,240	3.8	Higher in MSM; HPV-6/11 dominant	Ramesh et al., 2013
Mumbai, Maharashtra	2010–2015	980	4.2	Co-infection with HIV in 18% cases	Kore et al., 2016
Chennai, Tamil Nadu	2012–2017	756	2.9	Linked to low condom use	Palani et al., 2018
Kolkata, West Bengal	2009–2016	1,100	3.5	FSW population highest burden	Dutta et al., 2017
Pune, Maharashtra	2015–2020	850	2.6	HPV vaccination reduced incidence	Naik et al., 2021
Hyderabad, Telangana	2013–2019	620	3.1	Male patients outnumbered females 2:1	Reddy et al., 2020

Rural Rajasthan	2016–2021	430	1.9	Underdiagnosis in rural areas noted	Sharma & Singh, 2022
Bengaluru, Karnataka	2011–2019	910	4.6	Highest prevalence in 18–30 age group	Lakshmaiah et al., 2020

Note. All studies were conducted in urban STI clinics, dermatology outpatient departments, or sexual health services unless stated otherwise. MSM = men who have sex with men; FSW = female sex workers; HIV = human immunodeficiency virus. Prevalence figures represent proportions among clinic attendees. Rural Rajasthan study utilized community-based sampling with active case finding.

3.4 Risk Factors and High-Risk Populations

Some recurring risk factors were identified through reviewed literature for acquiring and recurring genital warts. Age is the strongest demographic factor associated with genital warts with a universal peak age range between 18-30 years of age for all studied populations, irrespective of being high-income nations or LMIC countries (Patel et al., 2013; Sharma et al., 2021). However, in addition to the aforementioned peak age group, a second peak age group for genital warts was observed in individuals above 60 years in Europe-based registries

due to immunosenescence and increase in sexual intercourse following break-ups (Kjær et al., 2020).

It is important to note that MSM are at a disproportionate risk for developing genital warts in all parts of the world. Incidence of anogenital warts among MSM was reported to be 4.7 times more than that of heterosexual men, regardless of declining incidences due to vaccines in London's Dean Street Sexual Health Clinic (Desai et al., 2019). Moreover, a study conducted by Ramesh et al. (2013) reported an anogenital warts prevalence rate of 6.1% among Indian MSM visiting a New Delhi Sexual Health Clinic, while 2.8% among heterosexual men.

HIV co-infection dramatically increases the risk and recurrence of genital warts. For instance, Mbatha et al. (2021) found in a South African cohort study a three times higher incidence of genital warts in the HIV infected population in comparison with the HIV uninfected one irrespective of the CD4+ cell number. As for Indian studies, Kore et al. (2016) and Palani et al. (2018)

reported significantly higher prevalence rates and recurrence of warts in HIV positive subjects. Among high-risk groups, FSW (female sex workers) have higher prevalence rates that exceed 5% according to Indian authors (Dutta et al., 2017).

In addition to being HIV-infected, immunosuppressive conditions, such as transplantations, steroid therapy, or malignant haematology diseases, are independent risk factors for susceptibility to infection and recalcitrant disease (Wieland et al., 2021; Pandey et al., 2022). Furthermore, pregnancy due to immunosuppression and altered local immunity leads to the proliferation of warts and mother-to-infant transmission of HPV, which might lead to juvenile-onset recurrent respiratory papillomatosis (Silverberg et al., 2003).

3.5 Impact of HPV Vaccination

The most powerful evidence supporting the preventability of genital warts is the information about genital warts gathered after vaccination programs in nations with very high rates of vaccinations. The Australian school-based program of HPV vaccinations, starting in 2007 using the quadrivalent vaccine, resulted in remarkable and fast drops in rates of genital warts. The

Donovan et al. (2011) discovered a decrease in rate of diagnosis of genital warts in women younger than 28 years old at Melbourne sexual health clinics by 59%. By 2015, the prevalence of genital warts among young Australian women eligible for vaccination had dropped more than 92%, and herd immunity was seen in heterosexual males (Ali et al., 2017).

Similar results were found in the UK, USA, Denmark, Sweden, and Canada. Drolet et al. performed a meta-analysis of data from fourteen countries in their article published in 2019, showing that within four years after the implementation of vaccination programs, the number of diagnosed genital warts in girls aged 15-19 years decreased by 67%, while in women aged 20-24 years, the number decreased by 48%.

India's Universal Immunisation Programme incorporated the domestically manufactured quadrivalent HPV vaccine (Cervavac, Serum Institute of India) in early 2023, targeting girls aged 9–14 years (Ministry of Health and Family Welfare, 2023). Long-term epidemiological data on vaccine impact are not yet available, but modelling studies project a 60–70% reduction in genital wart incidence within 10–15 years of sustained high-coverage vaccination (Chauhan et al.,

2022). Achieving the projected impact will require sustained coverage above 80%, equitable distribution across urban–rural divides, and concurrent male vaccination programmes.

4. Discussion

This review proves that despite many efforts made by the scientific community to combat the issue, genital warts continue to be an important public health concern with insufficient control mechanisms. The findings of this review have proved several patterns of the epidemiology of this problem with clinical importance.

Firstly, the worldwide burden of this condition, although steadily decreasing in industrialized countries with vaccination programs in place, continues to be high in LMICs such as India. In addition, the prevalence of this disease in India is likely underestimated, since the Indian studies mostly used urban populations in tertiary hospitals and STI clinics, with little information on the burden in rural areas. Moreover, some of these studies included patients seeking consultation at gynecologists rather than genitourinary medicine specialists, leading to possible diagnostic biases.

Second, the age-group demographics associated with increased risks of diseases such as the high prevalence among young adults (18-30 years old), men who have sex with men (MSM), female sex workers (FSW), and people living with HIV in all geographic settings emphasise the need for prioritised screening, treatment, and vaccination programmes for these specific groups. For India, especially with its context involving the intersectional nature of MSM and FSW populations within both legal and societal exclusionary frameworks, such actions should also be combined with rights-based initiatives.

Third, the success of HPV vaccination in preventing cases of genital warts – particularly successful in Australia but also evidenced through other instances in high income countries – constitutes proof of efficacy that supports the initiation of India’s vaccination programme. On the other hand, the review brings forth several infrastructure-related issues that will need to be addressed by India, including cold storage provisions, proper training of healthcare workers, and implementing school-based programmes in the midst of dropout rates.

Fourthly, the problem of frequent occurrence and resistant genital warts among HIV-infected persons requires special attention in the Indian scenario because of the concurring problem of HIV, which is prevalent in Indian urban and risky population groups. Integrated services for STIs and HIV care and screening for genital warts as part of HIV care is a realistic way of handling both conditions (World Health Organization, 2021).

This review is limited by its reliance on clinic-based samples, restricting the generalizability of its findings to the broader population. Variability due to differences in methods of diagnosis (clinical vs genotyping of HPV virus) may also be considered. Publication bias may result in under-reporting of negative or low prevalence results. There is clear under-representation of rural and tribal Indians in the current literature base. It would be more appropriate to conduct future community-based cross-sectional seroprevalence studies and develop STI registers for the Indian population.

Conclusion

Genital warts, caused by HPV types 6 and 11, are one of the commonest and most important economic diseases among all

sexually transmitted diseases in the world. The disease burden in India is also significant, but no concrete data exist regarding the same; however, available information indicates that the disease is highly prevalent among patients visiting STD clinics, affecting the most vulnerable groups and the unavailability of any preventive or treatment options, except in metropolitan cities. The inclusion of the HPV vaccine in India's Universal Immunisation Program heralds a revolutionary change, and this change can only be harnessed by making investments in the implementation of such programs.

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