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ORIGINAL ARTICLE

Assessing knowledge and awareness levels regarding cervical cancer and HPV vaccination in the Jammu regions

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ABSTRACT

Background and Objectives: Cervical cancer global burden is highly skewed towards poor countries primarily due to lack of awareness, poor screening, and low uptake of prophylactic vaccines. The purpose of our study is to educate and raise awareness among young girls and women about the importance of cervical screening and HPV vaccination.

Materials and Methods: The present study, conducted from January 2023 to December 2023, focused on students, teachers, housewives, and healthcare professionals in the Jammu region to assess their awareness of cervical cancer and the HPV vaccine. HPV DNA testing was carried out using the Truenat Real-Time PCR method at Swastik Diagnostic Laboratory, Jammu.

Results: Knowledge of cervical cancer, awareness of the HPV virus, and the vaccination status of women were assessed in survey. In the HPV screening test, out of 2,400 women, 106 tested positive for HPV. Among these 106 women, 19% had a high viral load ($Ct < 20$), 11% had a low viral load ($25 \leq Ct < 30$), indicating a low relative concentration of HPV viruses, 40% had a medium viral load ($20 \leq Ct < 25$), and 30% had very low viral loads ($Ct \geq 30$).

Conclusion: These findings highlight the importance of routine cervical screenings, such as Pap smears and HPV tests, for the early detection of cervical cancer. There is an urgent need to implement cervical cancer screening and vaccination programs in the Jammu region.

Keywords: Cervical cancer; Human papillomavirus (HPV); HPV vaccine; Real time polymerase chain reaction; Vaccination

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INTRODUCTION

Cervical cancer ranks as the second most common malignant tumor among females worldwide, posing a significant threat to women's health (1). It has been well-established that persistent infection with high-risk human papillomavirus (HPV) is the essential factor leading to the development of cervical cancer (2, 3). The predominant sexually transmitted disease in the world is infection with Human Papillomavirus (HPV) (4). Cervical cancer screening methods include traditional Pap smear, visual inspection with acetic acid and Lugol's iodine (VIA/VILI), liquid-based cytology (LBC), and HPV testing (5, 6). In countries with limited resources, VIA combined with LBC is a cost-effective and efficient way to screen for Cervical cancer in addition to HPV immunization (7). Many of the women surveyed had inadequate knowledge about cervical cancer and had not received screening. Given that mass media was identified as a common source of information, it can be effectively leveraged to enhance women's awareness and encourage early detection efforts (8). Cytological screening has been shown to reduce the incidence of cervical cancer by as much as 80 percent (1). However, HPV-based testing has emerged as a crucial component of cervical cancer screening alongside cytology-based tests. Cytopathic changes and cervical intraepithelial neoplasia are mainly brought on by virus activity, which is also directly linked to cervical cancer (9). More than 200 distinct genotypes of the family of non-enveloped, double-stranded DNA viruses known as human papillomavirus (HPV) have been identified (10). One of the most frequent sexually transmitted diseases (STDs), HPV infection affects both sexes equally worldwide (11). HPV infections are known to be associated with up to five other types of cancer, including malignancies of the head and neck, vulva, penis, and anus, in addition to being the primary cause among all cases of cervical cancer (12). HPVs can be classified as high-risk or low-risk based on their association with precursor lesions and cervical cancer. Low-risk HPV types: 6, 11, 42, 43, and 44. HPV types 16, 18, 31, 33, 34, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68, and 70 are the most high-risk varieties.The classification of HPV into high-risk categories is based on factors such as genetic characteristics, and clinical symptoms. Eighty percent of cervical cancer cases worldwide are caused by HPV-16, HPV-18, HPV-45, and HPV-31. Human papillomavirus (HPV) strains 16 and 18 are responsible for over 70% of cases of invasive cervical cancer reported globally. The other HPV types, which make up around 10% of cases of cervical cancer, are HPV-45 and HPV-31, the third and fourth most common forms, respectively, and are known to cause cancer (13). Tumors of the urinary tract, head, neck, and gastrointestinal tract are caused by these viruses. It is well known that the immune system typically prevents HPV (14). In India, two commercially available HPV vaccines are the Quadrivalent vaccine (Gardasil TM, marketed by Merk) and the bivalent vaccine (Cervarix TM marketed by Glaxo Smith Kline) (15). These vaccines do not offer a defense against the serotype of infection that existed before immunization (16). According to the WHO's policy statement on HPV vaccination, vaccinating HPV-naive females is economical and essential for circumstances with few resources. For girls aged 9 to 14, HPV vaccinations have been commercially available in India since 2008, and the National Technical Advisory Group (NTAGI) has approved their use. Indian Academy of Paediatrics Committee on Immunisation (IAPCOI) recommends it for all females beginning at age 9 (17). Women who are older or have abnormal screening results may get vaccinations, but they must be informed that the vaccinations do not provide immunity against diseases that have already been acquired. Nonetheless, they can still gain protection against unexposed types. The Federation of Obstetricians and Gynaecologists of India (FOGSI) recommends immunization between the ages of 9 and 14 years as the ideal age (18). Schoolgirls aged 11 to 13 were given opportunistic HPV vaccinations in Delhi, which made it the first state in India to do so in 2016. With technical support from the ICMR, WHO, and UNICEF, the Government of Punjab developed operational guidelines for implementing HPV vaccination programs within healthcare institutions. In response to the high incidence rates of cervical cancer, Bathinda (with a rate of 17.5 per 100,000) and Mansa (with a rate of 17.3 per 100,000), the two districts most affected, initiated a vigorous vaccination campaign. Phase 1 commenced in November 2016, and upon its completion, an impressive 98% of the target population (9672 out of 9922) had received both doses of the vaccine in public and government-aided schools. By the conclusion of Phase 2 in November 2017, 94% (15,140 out of 16,106) of eligible girls had received their first dose, out of which 99% (14,988 out of 15,140) had successfully received their second dose.

These vaccination rates underscored the success of the program and enabled informed decision-making (19). Sikkim became the first state to immunize all 9-14-year-old females living there. It was directed at 25,284 girls in 1166 schools, and the first dosage was given to 97% of the girls there or in a health Centre (for those who weren't in school), with the second dose given six months later (20). Minor side effects like headaches, nausea, and soreness at the injection site were reported, although they quickly passed. Barriers to successful vaccination uptake include the high expense of vaccines, lack of knowledge, misunderstanding, and negative attitudes, in addition to poverty (21, 22). Education levels and knowledge of HPV and the HPV vaccine are correlated. Increasing parental knowledge is essential for raising the HPV vaccine's level of acceptance (23). The management and treatment of HPV-related diseases are closely linked to various factors, including the specific HPV types present, the availability of treatment options, and the stage and progression of the disease (24). For the treatment of HPV infections, Laser therapy has so far been consistently effective and practical. The majority of therapies have relatively high recurrence rates, and several otherwise efficient regimens are constrained by treatment requirements or adverse effects. Cytodestructive therapies include surgical removal, cryotherapy, laser therapy, dichloroaceticacid/ trichloroacetic acid, and podophyllotoxin, among others (21, 25). Fig. 1 illustrates different approaches for the HPV treatment. The study conducted by Rohit Bhardwaj in 2016 was the first of its kind in the Jammu region. The study findings reveal a high prevalence of high-risk HPV DNA in the cervical tissue of women in the Jammu region of Jammu and Kashmir State. These findings emphasize the urgent need for HPV DNA testing in cervical cancer screening and the importance of regular follow-up for HPV-positive cases. This proactive approach can contribute to early detection and improved management of cervical cancer risk factors in the region (26). The purpose of our study is to educate and raise awareness among young girls and women about the importance of cervical screening and HPV vaccination.

MATERIALS AND METHODS

The Human Ethical Commission (IEC/ GMC/2020/85) from Govrnment Medical College gave its approval before this study was permitted to be carried out in the region of Jammu from January 2023 to December 2023. This study was based on the estimated numbers of students, teachers, housewives, and healthcare professionals. For the analysis of the study, students below higher secondary, graduates, postgraduates, and medical trainees have all been included. The participants were educated about the study and thereafter written consent was taken. A questionnaire was made using a literature review and references to similar studies. The survey included 11 questions, with 5 focusing on the participant's fundamental sociodemographic information and 6 assessing their understanding of HPV and cervical cancer. Out of 11 questions, 6 contained a YES/NO option.

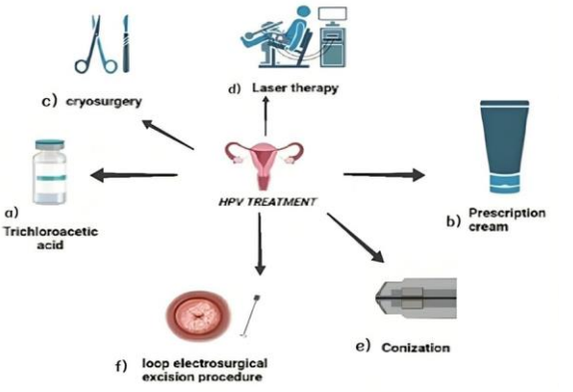

Fig. 1. Various approaches for the treatment of HPV infection. To treat external genital warts caused by non-oncogenic HPVs, clinicians recommend using a) trichloroacetic acid b) podophyllotoxin (antimitotic cream), which helps destroy the warts. Surgery is recommended to treat cervical precancerous lesions caused by oncogenic HPVs. This includes c) cryosurgery (freezing) d) Laser Therapy, e) Conization, f) loop electrosurgical excision process [LEEP]), and excision treatment.

Collection and processing of samples. Patients who gave consent for cervical screening were tested for HPV via Truenat Real-Time PCR. Standard nylon-flocked swabs were used to collect the swab specimens. The gynaecologist took the sample from the cervix. The swab and specimen were placed in the vial with a transport medium and thoroughly mixed. The swab was squeezed to remove extra liquid. Such a specimen remained stable for 3 days at 40°C or 7 days at 30°C. One ml sample from the vial was then put into a lysis buffer tube to commence the DNA extraction process. The Truelab RT PCR test procedure

consists of a Trueprep AUTO sample preparation device and a Truelab Uno Dx real-time quantitative micro polymerase chain reaction (PCR) analyzer, also including a microtip holding stand and cartridge. DNA was extracted from the specimen using a cartridge in the completely automated Trueprep AUTO where nucleic acid released by chemical and thermal lysis of cells bind to the proprietary matrix. In subsequent steps, the master mix was again washed with buffer to remove the PCR inhibitors, and bound nucleic acid were finally eluted from the matrix using the elution buffer. After the extraction process, a master mix was introduced into the extracted sample, along with a positive control. After this 0.6 micro litre sample was introduced in the HPV chip. Real-time PCR was carried out on the Truenat HPV-HR, a microchip that is ready to use chip. The True Lab Uno Dx analyzer features 3-wavelength fluorescence detection. Amplification of HPV 16 and 31 can be detected on one channel, HPV 18 and 45 on a second and internal positive control (IPC) on a third. To verify the run conditions, the IPC was co-extracted with the sample from the Trueprep Autocartridge (27).

Interpretation. The screen of the True Lab Real-Time Quantitative mini PCR analyzer shows three amplification curves that show the test's progress. In a valid test run, IPC curve show exponential growth in all cases. The test turns out invalid, if the IPC curve remains horizontal. When fluorescence surpasses the threshold value in positive samples, one or both of the target and internal positive control (IPC)* curves will follow a steep, exponential curve. The quantity of viral genomes in the sample will determine the Ct (Threshold cycle). Throughout the test, the target curve will remain horizontal, if a negative sample is received. When the test run ends, the results screen will show "NOT DETECTED" or "DETECTED" for positive results.

RESULTS

A total of 2500 completed questionnaires were collected out of 3000 distributed. The survey consisted of 2500 women, and their demographics are as follows: 48.16% of women were in the age group of 20-30. 28.2% were in the age group of 31-40. 12.04% were in the age group of 41-50.11.6% were in the age group of 51-60. 26.7% of women had a medical background. 55.8% were graduates or had higher education qualifications. 17.5% had education levels below the 10th grade. 67.5% of female participants were married and 32.5% were unmarried. 55% of women were either unemployed or students. The remaining 45% were employed. This demographic summary is outlined, providing a clear and concise overview of the participant distribution within the survey.

Knowledge of cervical cancer and awareness of HPV. Data provided offers insights into the awareness levels of cervical cancer and HPV infection among the surveyed women. Among the 2500 women, only 532 women (21.3%) demonstrated awareness of cervical cancer and HPV infection. It's highlighted that HPV serves as both the name of the virus and the infection it causes, emphasizing its role in the development of cervical cancer. Among the 532 women who were aware of HPV: 44% fell into the age group of 20-30, 36% were in the age group of 31-40, 9% were in the age group of 41-50 and11% were in the age group of 51-60. These findings indicate that awareness of HPV and cervical cancer is relatively low in the surveyed population, with younger age groups showing higher levels of awareness. So, it is observed that older women should be made aware of cervical cancer and HPV; so that they prioritize regular screenings and early detections. Among the women surveyed, the age group of 20-30 years exhibited the highest awareness of HPV and cervical cancer, with 44% of them knowing the HPV infection. This finding can be attributed to several factors: younger women, especially those in the 20-30 age range, are more likely to be actively engaged in educational pursuits, which can expose them to health education and information about HPV and cervical cancer. This age group often has greater access to information through the Internet and social media, which are common platforms for disseminating health-related knowledge. Many countries have implemented HPV vaccination campaigns, often targeting younger women, which could contribute to increased awareness among this age group.

Vaccination status and demographics. In our survey, merely 5% of the women reported being vaccinated against HPV, while the remaining 95% were unvaccinated. The data indicates that women who were vaccinated against HPV belonged to the age group of 31-40. These vaccinated women are highly educated, with a substantial portion having a medical

background. This suggests that within this specific age group, women with medical knowledge and higher education were more likely to have received the HPV vaccination. The introduction of HPV vaccination in 2008 is one of the reasons why younger generations tend to have more knowledge about HPV vaccination (Table 1).

Furthermore, when we inquired whether they would permit their daughters or close relatives to receive the vaccine, 52.5% of respondents expressed their agreement, while the remaining 47.5% declined. A portion of women held misconceptions about HPV, primarily arising from inaccurate information. The data shows that out of 2400 women, 1188 (47.5%) declined HPV vaccine; a substantial majority approximately 80.9% belonged to a low socioeconomic status. Employment status can be linked to access to healthcare information and resources. Nearly half of the women who declined vaccination, had education levels below matriculation. Lower educational attainment can impact health literacy and decision-making regarding healthcare. These findings highlight the importance of addressing socioeconomic and educational disparities in HPV vaccination awareness and acceptance. Women who tested positive for the HPV strain were primarily in the age group of 30-40. (Fig. 2) illustrates the sociodemographic characteristics of women tested positive for HPV Infection. All women in this group reported experiencing lower abdomen pain (100%). Half of the women (50%) reported experiencing vaginal discharge, which can sometimes be associated with HPV infection.

Patient screened for cervical cancer. Out of the total 2500 women, 2400 underwent screening for cervical cancer through Truenat HPV PCR testing. Out of 2400, 106 Patients were HPV positive, 194 were not processed due to sample shortage and 2100 were reported as not detected. The age group 31-40 years old underwent the maximum testing, while the age group 51-60 years old had the least testing. Specifically, 76 women tested positive for HPV 16/31 strains, and 30 women tested positive for HPV 18/45 strains. 19% of the population had a high viral load (Ct<20) while 11% of patients had a low viral load (25≤Ct<30) indicating a low relative concentration of HPV viruses. 40% of patients were detected with medium viral load (20≤Ct<25) while 30% of the patients were detected with very low viral loads Ct ≥30. This data provides insights into the prevalence of HPV infections, including the specific strains detected, among the screened women. The Truenat Real-Time Quantitative Micro PCR analyzer shows three amplification curves to check the test progress. These curves show the fluorescence signal produced when the target and internal positive control are amplified (IPC). The graphs displayed three amplification curves, with the green line representing the control value, the blue line representing the 18/45 HPV strain, and the red lines representing the 16/31 HPV strain. The final result is

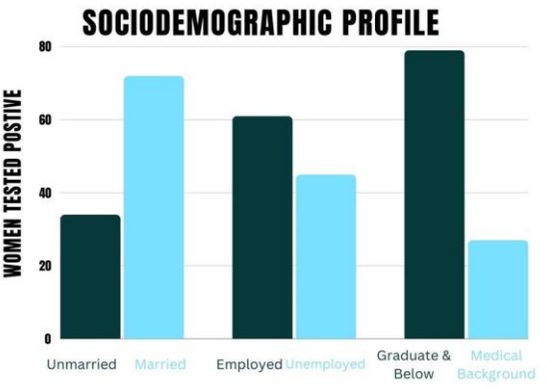

Fig. 2. Sociodemographic Characteristics of Women Tested Positive for HPV Infection.HPV positivity was significantly increased in married women than unmarried and in employed than unemployed women patients. This is due to increased participation in HPV testing of employed women. Patient having Medical background have lower positivity possibly due to awareness of risk factors.

Table 1. An overview of the study women's knowledge about HPV (N = 2500)

SR No	Statement	Yes	No
1	Have you ever heard of cervical cancer and HPV?	532 (21.3%)	1968 (78.75%)
2	Does HPV infection cause cancer?	387 (15.5%)	2113 (84.5%)
3	Have a family history of cervical cancer?	94 (3.75%)	2406 (96.25%)
4	Are you vaccinated against HPV?	125 (5%)	2375 (95%)
5	Would you allow your daughter to get vaccinated?	1312 (52.5%)	1188 (47.5%)
6	Are you willing to screen for cervical cancer by HPV PCR testing?	2400 (96 %)	100 (4%)

displayed as "detected" or "not detected." Additionally, the viral load is categorized as "very low," "low," "medium “or” high” (Fig. 3).

Statistical analysis. In our study, educational background and socioeconomic status showed a significant association ($p<0.05$) with HPV infection. A regression analysis was used to calculate the value.

DISCUSSION

In the current study, HPV knowledge and awareness among students, housewives, and healthcare professionals were evaluated. Despite the majority of the population in Jammu being educated, very few were aware of cervical cancer and HPV. In our study, 78.75% of the women did not know anything about cervical cancer and HPV screening. Notably, women who were aware of HPV were predominantly well-educated, and married, and many of them had a medical background. A similar study conducted in Brazil revealed that individuals with higher levels of education were more likely to have a better understanding of HPV infection (28). This suggests that education and medical knowledge might have played a significant role in their awareness of HPV. This is significant because women with medical training or education are more likely to have a deeper understanding of health-related topics, including HPV and cervical cancer. Overall, these factors likely contributed to the higher awareness of HPV and cervical

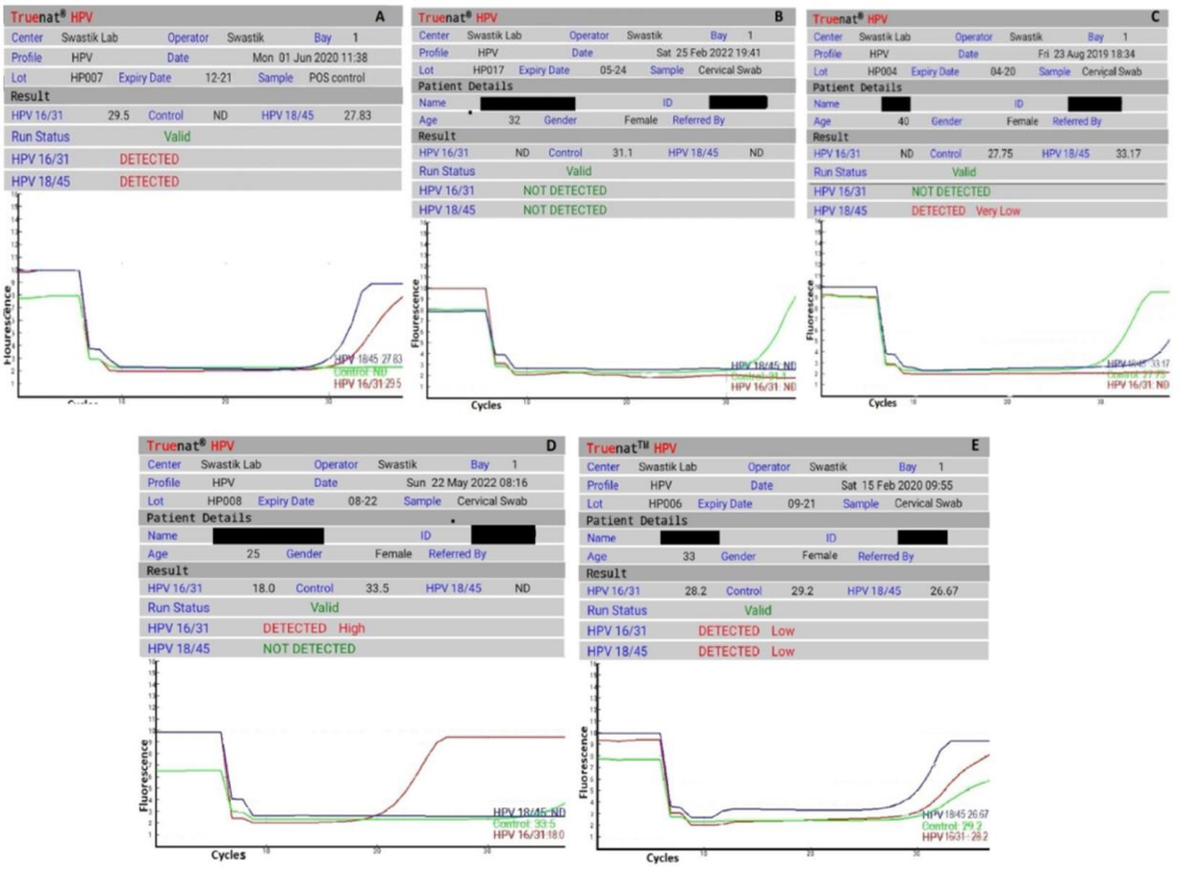

Fig. 3. Representative panel of HPV genotype results by Truelab Uno Dx Real Time PCR Analyzer. (A) Graph illustrating positive control sample where both the target (16/31) red line and (18/45) blue line amplified and negative control remain horizontal. Control ensured reliability of results. (B) Graph illustrating amplification only for internal control, result displayed was not detected. In this graph both the targets did not amplified and remained horizontal throughout the test. (C) Graph depicting exponential curve, for the positive amplification of HPV 18/45 genotype in the sample with (33.17) CT value (D) Graph illustrating positive amplification of 16/31 genotype. 18.0 was the calculated CT value. (E) Graph illustrating positive amplification for both the 16/31 and 18/45 genotype. 28.2 and 26.67 respectively was the CT values for genotypes 16/31 and 18/45.

cancer among the younger age group, emphasizing the importance of education and targeted awareness campaigns in increasing knowledge about these important health issues. A similar study was conducted by Ramavath Krishna Kavita et al. 2013 which involved 1,000 teenage girls from secondary schools and colleges in five major Indian cities—Ahmedabad, Cuttack, Lucknow, Gwalior, and Vishakhapatnam (29). A similar study done by Makwe et al. 2012 in Nigeria yielded comparable results. In this study 14 (6.9%) of those who were aware of cervical cancer expressed concern about their risk of developing the disease. Among the 52 students who had heard of the HPV vaccine, 24 (46.2%) correctly recognized that it is given for cervical cancer prevention, and 30 (57.7%) showed an interest in it (30). The critical need for a well-structured HPV educational program to bridge this knowledge gap remains of paramount importance. In our study, only a minority, specifically 15.5% of the women, knew that HPV infection can cause cervical cancer and 47.5% agreed to vaccinate their daughters against HPV infection. This highlights a significant gap in understanding the connection between HPV and cervical cancer, which is crucial for informed healthcare decisions. A similar study conducted in Italy revealed that a significant proportion of respondents, specifically 81.7%, expressed willingness to receive the HPV vaccine. This relatively high level of vaccine acceptance in Italy might be attributed to the influence of HPV educational programs and the national HPV immunization program, which provides free vaccinations for girls aged 12 years and above (31). The result that 95% of the surveyed women did not know about HPV vaccination and its significance in preventing cervical cancer highlights a critical need for educational initiatives. The substantial lack of awareness regarding HPV vaccination and its preventive benefits underscores a significant gap in public knowledge. These findings indicate a substantial need for public health campaigns. A similar cross-sectional study done by Ramavath et al. 2013 in metro cities of India which focused on people between the ages of 13 and 19, found that the majority of Women knew little about HPV infections and HPV vaccinations but they were interested in learning more about the vaccine (29). According to our survey of women with medical backgrounds, 38% lack the necessary knowledge concerning cervical cancer and HPV. In comparison, the remaining 62% do have some understanding of these cervical cancer screenings. The finding that 26.25% of people have misconceptions regarding HPV vaccination is a concerning and significant observation. Misconceptions can lead to vaccine hesitancy or refusal, which, in the case of HPV vaccination, can have serious public health implications. According to a related study done in South India by Ramesh et al. 2021 that women often knew very little about HPV and even less about the HPV vaccine. This study indicates that university students should receive more intensive HPV information and promotion, including vaccination (32). In conclusion, HPV vaccination and regular cervical screening is a cornerstone of cervical cancer prevention. Through health training, educational programs, and media campaigns held in community centres, workplaces, schools, and other public venues, we can raise women's knowledge of the HPV vaccine and cervical cancer Screening. Government programs offering subsidized HPV vaccines could be put in place to increase the completion rate of HPV vaccination among women. Furthermore, through cooperation and publicity, these initiatives can be strengthened by collaborating with institutions, women's organizations, NGOs, and educational institutions.

CONCLUSION

In conclusion, cervical screening is a critical tool for preventing cervical cancer, saving lives, and protecting women's health. Regular screening, in conjunction with HPV vaccination for eligible individuals, is a comprehensive strategy for cervical cancer prevention awareness. There is an urgent need to initiate cervical cancer screening and vaccination programs in the Jammu region. One of the limitations of our study on HPV and cervical cancer in the Jammu region was that it did not include women living in the outer skirts area of Jammu. Additionally, the low participation of women in HPV screening makes it difficult to determine the actual positivity rate. Secondly, many women are still unable to access this vaccine due to financial constraints. Although HPV vaccination is not universally free in India; metro cities are making efforts to include the HPV vaccine in school immunization programs. It is recommended that further research be conducted to develop vaccine programs against HPV and to enhance awareness about cervical cancer.

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