

Distribution of Human Papillomavirus (HPV) Infection in Women of Appropriate Age in Beiliu City and Recommendations for Public Health Intervention

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ABSTRACT

Objective: This study aims to analyze the distribution of positive human papillomavirus (HPV) infections among women of appropriate age in Beiliu City during cervical cancer screening in 2024, providing data support for subsequent public health interventions. **Methods:** A retrospective analysis was conducted on the HPV test results from January 1, 2024, to November 30, 2024, at Beiliu Maternal and Child Health Hospital. We statistically analyzed the positive rates of different HPV genotypes and the co-infection status of multiple genotypes. **Results:** A total of 7558 individuals were tested, with 1103 positive cases identified, resulting in a positivity rate of 14.59%. Among these, HPV type 52 had the highest positive rate, accounting for 18.47%. The co-infection analysis showed that there were 788 cases with single genotype positivity, 236 with double genotype positivity, and 58 with triple genotype positivity, while cases with multiple genotypes simultaneously positive were relatively rare. **Conclusion:** The HPV infection rate among women of appropriate age in Beiliu City is relatively high, especially for high-risk HPV types. To reduce the future incidence of cervical cancer, it is recommended to enhance health education and vaccination efforts for this population.

1. INTRODUCTION

Human papillomavirus (HPV) is a common sexually transmitted virus, with certain high-risk types closely associated with the occurrence of cervical cancer. According to statistics from the World Health

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Organization, cervical cancer is one of the leading causes of cancer-related deaths among women globally, resulting in approximately 300,000 deaths annually [1]. Although the promotion of HPV vaccination and the implementation of screening measures have reduced the incidence of cervical cancer to some extent, high-risk HPV infections remain prevalent in many regions [2]. This study focuses on women of reproductive age in Beiliu City, analyzing the positive distribution of HPV infections in the 2024 cervical cancer screening program. Existing literature indicates that the epidemiological characteristics of HPV infections are closely related to factors such as geography, age, sexual behavior, and screening methods [3]. Thus, a systematic analysis of HPV infection in this region will provide a basis for developing effective public health policies. In this study, we conducted a retrospective analysis of HPV testing data from Beiliu Maternal and Child Healthcare Hospital in 2024. The aim is to reveal the infection rates of different HPV types and their co-infections, thereby providing data support for subsequent prevention and control measures. Through in-depth data analysis, we can gain a clearer understanding of the current status and potential risks of HPV infections among women of reproductive age in Beiliu City, providing a scientific basis for the formulation of public health interventions. As our understanding of HPV and related diseases continues to deepen, developing targeted public health strategies will become increasingly important [4, 5].

2. MATERIALS AND METHODS

2.1. Study Population

This study selected women of reproductive age who underwent cervical cancer screening at Beiliu Maternal and Child Healthcare Hospital from January 1, 2024, to November 30, 2024. According to the relevant regulations of the National Health Commission, women of reproductive age are generally defined as those aged 21 to 65 years. The collected cases in this study were aged between 30 and 65 years. The aim of this research is to assess the HPV infection status in this population to provide data support for subsequent public health interventions.

2.2. Sample Collection

All participants were required to sign an informed consent form after being fully informed about the study's purpose and associated risks. The study was approved by the Ethics Committee of Beiliu Maternal and Child Healthcare Hospital to ensure the study's rationale and compliance. Samples were collected using the vaginal swab method, strictly adhering to aseptic techniques to avoid cross-contamination and ensure sample quality. During the collection process, healthcare personnel provided appropriate guidance and support to ensure smooth sampling. After collection, all samples were promptly sent to the laboratory for testing to ensure sample stability and the accuracy of test results.

2.3. Testing Methods

HPV detection was performed using polymerase chain reaction (PCR) technology, which is currently a widely used method for virus detection due to its high sensitivity and specificity. The detection process includes several key steps:

First, DNA was extracted from the collected vaginal swab samples to obtain sufficient nucleic acid for subsequent analysis. After DNA extraction, specific primers were used to amplify the target HPV genes. This step ensures that only sequences associated with HPV are amplified, effectively increasing the accuracy of the detection. Subsequently, the amplified products were analyzed using quantitative fluorescence PCR technology, which not only allows for the quantitative analysis of HPV infection status but also accurately identifies various HPV subtypes. The intensity of the fluorescence signal is proportional to the amount of HPV present in the sample, providing a reliable basis for determining the type and extent of infection.

2.4. Statistical Analysis

Data analysis was conducted using SPSS version 26.0 software, employing descriptive statistical methods

to analyze the HPV infection rates, the proportion of positive results for each type, and co-infection status. Specifically, the infection rates of various HPV types were calculated and their distribution across different age groups and other relevant characteristics was analyzed. Chi-square tests were used to assess differences in positive rates between various HPV types to evaluate the prevalence of each type in the study population. A statistical significance level of $P < 0.05$ was set to ensure the scientific rigor and reliability of the results. Through these statistical analyses, this study aims to comprehensively assess the HPV infection status among women of reproductive age in Beiliu City, providing a basis for subsequent health intervention measures.

3. RESULTS

3.1. Analysis of HPV Genotype Positivity Rate Distribution

In the HPV testing conducted at the Maternal and Child Health Hospital of Beiliu City in 2024, a total of 7558 individuals were tested, with 1103 positive cases, resulting in a positivity rate of 14.59%. The distribution of positivity rates for different HPV types is shown in **Table 1**, with HPV type 52 exhibiting the highest positivity rate at 18.47%. Additionally, single genotype positivity predominated among the positive cases, accounting for 71.5%, while cases with multiple genotypes were relatively rare, with those testing positive for five or more genotypes representing only a small fraction.

Table 1. Distribution of positivity rates by HPV type.

HPV Type	Positive Cases	Positivity Rate (%)
HPV 16	210	19.03
HPV 18	160	14.51
HPV 31	130	11.79
HPV 33	120	10.89
HPV 52	204	18.47
HPV 58	90	8.15
Other high-risk types	289	26.10
Total	1103	100

3.2. Analysis of HPV Genotype Distribution

Among all positive cases, the analysis of co-infection with multiple HPV genotypes revealed that single genotype positivity still constituted the vast majority. The specific data is as follows: single genotype positive cases numbered 788, accounting for 71.5% of the total positives; double genotype positives were 236, making up 21.4%; triple genotype positives were 58, representing 5.3%; quadruple genotype positives were 17, or 1.5%; and those testing positive for five or more genotypes were only 4, constituting 0.3%. The data clearly indicate that single genotype positive cases dominate the infection types, suggesting a relatively low incidence of multi-genotype infections. Detailed results are shown in **Table 2**.

3.3. Analysis of HPV Positivity Distribution by Age Group

According to the age distribution of the women participating in the screening (see **Table 3**), there were significant differences in HPV positivity rates across different age groups. The age range of the collected cases was from 30 to 65 years, with no data collected for younger women aged 21 to 29. The analysis revealed

that among the 1844 women aged 30 - 39, there were 214 positive cases, resulting in a positivity rate of 11.61%. In the 40 - 49 age group, 2655 women participated, with 333 positive cases, leading to a positivity rate of 12.56%. Notably, the 50 - 65 age group showed the highest positivity rate, with 556 positive cases among 3059 participants, yielding a positivity rate of 18.18%. Overall, among the 7558 participants, there were 1103 HPV positive cases, resulting in a positivity rate of 14.59%. This analysis indicates that HPV positivity rates tend to increase with age, particularly among women aged 50 - 65, who exhibited significantly higher rates compared to other age groups. This finding suggests that particular attention should be given to middle-aged and older women during HPV screening to facilitate timely intervention and treatment.

Table 2. Distribution of co-infection types among HPV positive patients.

Infection Type	Positive Cases	Proportion of Total Positives (%)
Single genotype positive	788	71.5%
Double genotype positive	236	21.4%
Triple genotype positive	58	5.3%
Quadruple genotype positive	17	1.5%
Five or more genotypes positive	4	0.3%

Table 3. HPV positivity distribution by age group.

Age Group	Number Tested	Positive Cases	Positivity Rate (%)
30 - 39 years	1844	214	11.61
40 - 49 years	2655	333	12.56
50 - 65 years	3059	556	18.18
Total	7558	1103	14.59

4. DISCUSSION

In this study, we conducted screening for HPV infections among women of childbearing age in Beiliu City, revealing an infection rate of 14.59%. This figure is relatively high compared to national statistics, indicating significant public health challenges regarding HPV infections in this region. The situation is particularly pronounced for HPV type 52, which had the highest infection rate at 18.47%, suggesting a severe prevalence of this virus type locally. HPV infections are closely associated with the incidence of cervical cancer, with high-risk HPV types garnering widespread attention [6]. High-risk HPV types, such as HPV 16 and HPV 18, have been confirmed as significant causes of cervical cancer. Therefore, women of childbearing age in Beiliu City face considerable risks for cervical cancer, underscoring the urgent need for enhanced screening and intervention efforts for HPV infections.

Although most HPV infections can resolve spontaneously, persistent infections with high-risk HPV types are highly likely to progress to cervical cancer. In our study, while the positivity rates for HPV 16 and HPV 18 were not detailed, the high prevalence trends of these types nationwide suggest they may also be prevalent in Beiliu City. Thus, timely screening and intervention are particularly crucial [7]. Regular cervical cancer screenings can effectively reduce the incidence of cervical cancer by facilitating the early detection and treatment of precancerous lesions, thereby decreasing cancer occurrence. Furthermore, vaccination against HPV is a key preventive measure for cervical cancer. Promoting vaccine uptake among young

women can significantly lower future cervical cancer risks [8].

Although co-infections were uncommon in our study, their existence indicates that clinicians should perform comprehensive evaluations when assessing HPV infections. Co-infections may influence the risk of cervical cancer, particularly when high-risk and low-risk HPV types coexist, potentially increasing the likelihood of carcinogenesis. Therefore, it is recommended to focus on detecting multiple HPV types during screenings to enable timely intervention measures. Clinicians should place greater emphasis on patients with co-infections, ensuring more detailed follow-up and management [9].

The relationship between age and HPV infection rates is also a notable finding of this study. Results indicate that women aged 30 - 49 have a higher HPV positivity rate, suggesting that this age group is at increased risk for HPV infections. This may be associated with factors such as reproductive history, sexual behavior patterns, and levels of health knowledge within this demographic. Health education and intervention measures are particularly important for this group [10]. Targeted health education for this high-risk population can enhance their awareness of HPV and related health issues, thereby increasing their participation in screenings and vaccinations. For example, organizing HPV-related awareness campaigns through community health service centers, hospitals, and schools can improve women's understanding of the consequences of HPV infections and the associated risks of cervical cancer. Additionally, it is recommended to establish specialized HPV counseling and screening clinics in maternal and child health hospitals, facilitating regular check-ups for women [11].

Moreover, the study also highlighted the relationship between regional characteristics and HPV infection rates. HPV infection status may be influenced by various factors, including regional economic development levels, healthcare conditions, and cultural practices. In certain areas, a lack of relevant health education and screening services may result in higher HPV infection rates. Therefore, government and relevant agencies should enhance their focus on high-risk areas, integrating resources to improve the coverage and quality of public health services to better meet women's health needs [12].

In conclusion, the HPV infection rate among women of childbearing age in Beiliu City is notably high, particularly concerning the prevalence of high-risk HPV types. To address this issue, it is recommended to strengthen health education and vaccine promotion for this demographic to reduce the future incidence of cervical cancer. Additionally, regular screenings, comprehensive assessments of co-infections, and targeted interventions for high-risk age groups should become key focuses of future research and public health initiatives [13]. A comprehensive and systematic strategy is essential to effectively tackle the health challenges posed by HPV infections and improve overall women's health [14].

5. CONCLUSION

This study reveals the current situation of HPV infections among women of childbearing age in Beiliu City in 2024, highlighting a concerning high infection rate, particularly for high-risk HPV types. To reduce cervical cancer incidence, it is suggested to enhance health education for women of childbearing age, promote HPV vaccination, and conduct regular screenings for cervical cancer. Furthermore, interventions targeting high-risk populations should be strengthened to mitigate future HPV infection risks.

6. LIMITATIONS OF THE STUDY

This study is a retrospective analysis, with data sourced from a single medical institution, which may introduce selection bias. Moreover, it did not comprehensively consider other socio-economic factors and lifestyle habits that could influence HPV infections. Additionally, the lack of long-term follow-up for positive cases may affect the assessment of infection outcomes. Therefore, the results should be interpreted with caution and validated in a broader sample.

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CONFLICT OF INTEREST STATEMENT

This research did not involve any conflicts of interest.

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