

# **Inhibiting Factors and Promotion Strategies to the Implementation of HPV Vaccination Provision in our Country: Analysis Based on the Smith Model**

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**Abstract:** In recent years, the incidence rate of cervical cancer has continued to rise and shows a trend towards younger individuals, making cervical cancer prevention and control an important aspect of safeguarding public health. HPV vaccination significantly reduces the incidence of cervical cancer, highlighting the crucial importance of promoting HPV vaccination among eligible women. Currently, the implementation of HPV vaccination provisions remains imperfect. To further increase vaccination rates and maximize the benefits of HPV vaccination, this study, based on the Smith model, analyzes the inhibiting factors in provision implementation from four aspects: idealized provision, provision implementation entities, target population, and provision implementation environment. Based on this analysis, the study proposes generalizable suggestions and recommendations to contribute to advancing HPV vaccination and cervical cancer prevention and control efforts.

**Keywords:** HPV Vaccination; Implementation of HPV; Smith Model; Inhibiting Factors; Promotion Strategies

## **1. Problem Statement**

Cervical cancer is a common malignancy among women, primarily caused by persistent infection with high-risk types of human papillomavirus (HPV). In recent years, there has been a continuous increase in the incidence rate of cervical cancer, with a trend towards younger age groups. Global data on HPV vaccine coverage and vaccination rates indicate a significant gap in achieving the goal of accelerating the elimination of cervical cancer. Similar challenges exist in China, where despite efforts in some regions to

promote HPV vaccination, overall vaccination rates and coverage remain low. According to incomplete statistics, the HPV vaccination rate among women aged 18-45 is only 3% nationwide, and less than 1% for girls aged 9-14.

To address this challenge, the National Health Commission and ten other departments jointly issued the "Action Plan for Accelerating the Elimination of Cervical Cancer (2023-2030)", which explicitly aims to achieve the elimination of cervical cancer through a three-tiered prevention strategy involving HPV vaccination, screening, and treatment. Additionally, the National Health Commission and thirteen other departments jointly formulated and released the "Healthy China Action - Cancer Prevention and Control Action Implementation Plan (2023-2030)", which emphasizes the importance of scientifically promoting HPV vaccination, encouraging eligible populations to get vaccinated, and integrating HPV vaccination into local welfare provisions in eligible regions. Through national-level provision support and collective efforts from various sectors of society, the aim is to increase HPV vaccination rates and coverage, effectively reduce the incidence of cervical cancer, and demonstrate the determination and efforts of the Chinese government in cervical cancer prevention and control.

However, to achieve the goal of eliminating cervical cancer by 2030, issues such as insufficient supply, high acquisition costs, and accessibility of vaccination need to be addressed. Currently, HPV vaccination is not included in the national immunization program and is administered on a voluntary, self-paid basis. During the 2024 China Conference, delegate Chen Gui'e proposed that based on the experiences gained from pilot provinces

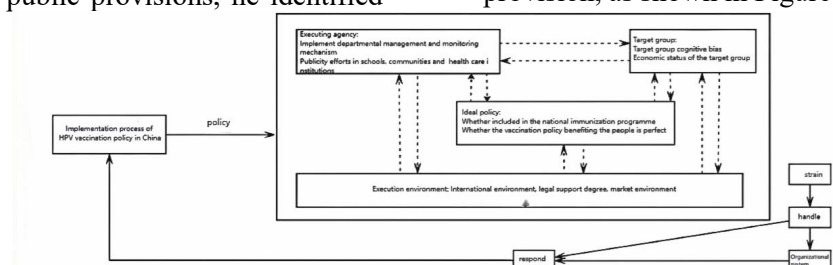
and cities, HPV vaccination should be incorporated into the national immunization program at the national level. She suggested allocating central funds to initiate a nationwide HPV vaccination program for eligible women, accelerating the process of cervical cancer elimination, and safeguarding and promoting the health of women across the country.

Existing studies on the implementation of HPV vaccination provisions are fragmented and lack comprehensive and detailed systematic research. In light of this, this study is based on the Smith public provision implementation theory model, analyzing the issues existing in the implementation process of China's HPV vaccination provision from four dimensions: provision substance, implementing agencies, target groups, and implementation environment. It explores feasible promotion strategies to provide theoretical and practical references for the formulation and implementation of future HPV vaccination provisions, safeguarding and promoting the health of women across the country.

## 2. Framework of Theory Analysis

Since the mid-20th century, Western provision researchers have actively engaged in the study of public provisions and have formed a research trend in provision implementation [1]. In 1973, the renowned American provision researcher Thomas B. Smith proposed a theoretical model in "The Provision Implementation Process," outlining four factors and their interactions that influence provision implementation [2]. Given the complexity of public provisions, he identified

four primary influencing factors: First, idealized provisions, which refer to provisions possessing rational, legitimate, and feasible characteristics. The formulation of idealized provisions by provisionmakers is a prerequisite to ensure that provision implementation proceeds without deviation. Second, provision implementers, referring to public sectors led by the government responsible for implementation. The extent of their understanding of the provision, implementation methods, and responsiveness will affect the effectiveness of provision implementation and promotion. Third, target groups, which are directly or indirectly affected by the provision during implementation. Their acceptance, cooperation, and participation will influence the effectiveness of the provision. Fourth, the provision implementation environment refers to the complex and variable political, economic, cultural, and social context in which provision implementation takes place. The process of provision implementation involves a balancing act among these four factors, and during their interaction, there may be "tension" and "divergence." If the provision implementation does not proceed as expected, it is then necessary for relevant agencies to promptly "address" and "institutionalize" in order to "respond," and to provide "feedback" on the provision implementation outcomes to both implementers and provisionmakers, thereby re-entering the provision formulation process[1]. This paper, based on the Smith model, analyzes the challenges and promotion strategies faced by China's HPV vaccination provision, as shown in Figure 1.



**Figure 1. Analysis Framework of Implementation Provision of HPV in Our Country**

## 3. Current Status of HPV Vaccination Provision Implementation in China

### 3.1 Existing Provisions

Since July 2017, the bivalent HPV vaccine has been officially launched in China, followed by

the quadrivalent HPV vaccine in November 2017. This marks the official introduction of HPV vaccines in China, beginning to be used as one of the important means to prevent cervical cancer. Since 2021, several local governments have successively introduced provisions to support HPV vaccination,

providing free or low-cost vaccination for eligible women through fiscal subsidies or medical insurance reimbursement, achieving good results. In pilot areas, the first-dose vaccination rate among eligible girls has reached a high level, and valuable experience has been accumulated. Since 2022, Guangdong Province has provided free vaccination of domestic bivalent HPV vaccine to girls under 14 years old with Guangdong Province's school registration who have not been vaccinated against HPV since September of that year. This is the first province in the country to provide free vaccination of domestic HPV vaccines on a provincial basis. On November 19, Wuxi City announced that starting from December 2021, free vaccination of 2 doses of HPV vaccine would be provided to girls in the second year of junior high school in the urban area... [3] In addition, Hainan Province, Ordos in Inner Mongolia, Jinan in Shandong, Xiamen in Fujian, and many other places have successively introduced provisions to benefit the people, to some extent expanding the supply of HPV vaccine resources and reducing the economic burden on vaccine recipients. Although some regions have implemented free or subsidized HPV vaccination programs, the sustainability of such provisions remains to be observed. Furthermore, due to significant regional and demographic differences, some high-risk populations are excluded from these beneficial provisions.

### 3.2 Provision Implementation Agencies

The National Health Commission is the main implementing agency of this provision, responsible for coordinating and supervising the implementation of the HPV vaccination provision. Meanwhile, health departments at the provincial, municipal, and regional levels also play important roles in the execution process, promoting the implementation of the provision at the local level. Although China has introduced HPV vaccines and relevant departments are actively promoting their vaccination, the actual vaccination rate is not ideal. For example, the HPV vaccination rate among eligible girls in a certain city is less than 1%, and although there is a high willingness to vaccinate nationwide, the actual implementation is low. In terms of practical effectiveness, including relevant provision

implementation agencies at all levels of government, only basic provision promotion work has been achieved, and there has been a failure to unite schools, communities, medical institutions, and other parties to achieve a common promotional effect.

### 3.3 Target Population

Regarding the target population for HPV vaccination, only a portion of women understand the importance of receiving this vaccine, but most eligible women are not aware of it. As local governments in China continue to increase their investment in promoting cervical cancer screening and outreach efforts, women's awareness of cervical cancer and the HPV virus has improved somewhat, and their self-protection awareness has gradually increased. However, their understanding of cervical cancer and the HPV virus remains superficial. Additionally, the price, safety, and effectiveness of the HPV vaccine also influence the attitude of college students towards vaccination.

### 3.4 Provision Implementation Environment

In the international context, the HPV vaccine has been widely adopted, with many countries and regions incorporating it into their national immunization programs, such as the United States, the United Kingdom, Canada, and others. This provides valuable insights and references for China's HPV vaccination provision. Currently, there are five HPV vaccine products approved for registration in the Chinese market, including three imported and two domestically produced vaccines. With the continuous expansion of the vaccine market, the price of HPV vaccines is gradually decreasing, making it more affordable for a larger population.

Currently, HPV vaccine vaccination in China is receiving some support, but still faces challenges such as expensive vaccine prices, supply shortages, insufficient financial support, and public concerns about the safety and efficacy of vaccines.

## 4. Inhibiting Factors to the Implementation of HPV Vaccination Provision

As an emerging provision, there are evident shortcomings in the formulation and promotion of the HPV vaccination provision.

Therefore, analyzing the obstacles to provision implementation based on the theoretical framework of the Smith model is of great significance. It can provide an important basis and reference for further improving and promoting the HPV vaccination provision.

#### **4.1 Idealized Provision**

4.1.1 HPV vaccine has not been included in the national immunization program in China. As of November 16, 2023, among the 194 member states of the World Health Organization, 136 countries and regions have included the HPV vaccine in their immunization programs. Among them, Canada is one of the earliest countries to implement publicly funded HPV vaccination programs. During the period from 2007 to 2011, all Canadian jurisdictions initiated school-based HPV vaccination for girls in their publicly funded immunization programs. However, due to reasons such as a large population of eligible vaccine recipients and tight vaccine supply in China, the HPV vaccine has not been included in the national immunization program. Citizens still need to voluntarily and self-pay for vaccination, resulting in relatively low vaccination rates among the population.

4.1.2 Imperfect vaccine subsidy provisions in many regions of China

Since 2021, six provinces in China, including Guangdong, Hainan, Fujian, Jiangsu, Jiangxi, and Chongqing, have successively launched HPV vaccine subsidy provisions aimed at benefiting the public. These provisions provide free or low-cost HPV vaccination for eligible women through financial subsidies, significantly increasing local vaccination rates. Although the current subsidy provisions in many regions have achieved positive results, there are still significant issues that cannot be ignored.

One issue is the insufficient coverage of the current provisions for the floating population. Many provisions only cover women with school enrollment or household registration. However, due to economic and social development, as well as urbanization, China has seen a significant increase in the floating population, and women in floating families also face a higher risk of infection. The current subsidy provisions do not adequately guarantee the rights of this group, neglecting their needs.

Another issue is the lack of long-term institutional arrangements. The widespread and sustainable administration of the HPV vaccine requires consideration of economic costs and benefits. After studying the matter, the World Health Organization's Strategic Advisory Group of Experts on Immunization found in 2022 that administering one or two doses to girls aged 9-14 or 15-20, respectively, is as effective as three doses in preventing cervical cancer, making it highly effective. However, China currently adheres to the vaccination strategy of administering two or three doses as per the instructions provided in the domestic market approval of the vaccine. This results in increased demand for HPV vaccines in China and higher costs. Adhering to the latest vaccination recommendations from the World Health Organization could reduce costs and alleviate vaccine supply shortages, thereby expanding the benefits of vaccination for eligible age groups. Additionally, while the government's goal of "eliminating cervical cancer" through HPV vaccination requires long-term investment, the current HPV vaccination subsidy provisions are short-term and have not been included in the government's annual livelihood projects. The stability of the provision remains to be considered.

Thirdly, apart from the pilot provinces that have introduced preferential provisions for HPV vaccine vaccination, many other regions where conditions are not yet ripe due to reasons such as vaccine shortages and tight finances have not implemented comprehensive provisions for HPV vaccine vaccination. If eligible women in other regions cannot be universally vaccinated against HPV in the short term, under the condition of long-term vaccine shortages, relevant enterprises prioritize supplying vaccines to pilot areas, exacerbating the problem of vaccine supply in other regions and ultimately leading to the "Matthew effect." The imbalance in HPV vaccine supply between regions will worsen, with a significant gap in HPV vaccine coverage between underdeveloped and developed areas, highlighting the imbalance in protecting women's health in China.

#### **4.2 Provision Implementation Entities**

Government agencies, as the main body of public provision formulation and

implementation, play a core role in overall coordination and planning. In the field of public health, the implementation of the existing HPV vaccination provision lacks efficient collaboration among government departments, schools, communities, and medical and health institutions.

#### 4.2.1 Ineffectiveness of beneficial provisions and great fiscal pressure on the government

During the period from 2021 to 2023, 28 provinces and cities concentrated on releasing information on HPV vaccine beneficial projects. However, despite the introduction of these beneficial provisions, China's HPV vaccination rate still remains far below the WHO's target of 90%. The number of females aged 9-45 in China is close to 400 million. Calculated based on two to three doses per person, the number of vaccine doses is enormous. Based on the current market price of the vaccine, achieving an increase in vaccine penetration and full coverage of eligible populations through government subsidies places enormous fiscal pressure on government departments, and a multi-level funding model has not yet been formed.

#### 4.2.2 Weak government bargaining power, deficiencies in regulation and control

Despite the advancement of the free vaccination program, the government remains in a relatively passive position with weak bargaining power in the face of a "seller's market." Since the approval of the nine-valent HPV vaccine for sale in China in 2018, the phenomenon of "difficulties in obtaining a single shot" has persisted, indicating that demand for the HPV vaccine in the market far exceeds supply. This makes it difficult for the government to obtain more favorable prices and conditions during procurement, restricting the government's bargaining space. In addition, due to the scarcity of the nine-valent vaccine in public hospitals, many consumers choose to make appointments at private institutions. However, private hospitals often charge service fees in a disguised manner or engage in "bundled sales" by tying medical examinations or other services with the vaccine. This not only increases the burden on consumers but also reflects deficiencies in the government's regulation and control of vaccine prices.

#### 4.2.3 Insufficiently optimized approval procedures, chaotic situation in vaccine administration

Due to the current supply of quadrivalent and nine-valent HPV vaccines in China being solely from a single manufacturer, Merck & Co., even if its production capacity were increased, it would still be unable to meet the vaccination needs of the vast eligible population in the country. To meet the demand for free HPV vaccination among the vast eligible population, reliance on domestic vaccine manufacturers' supply is inevitable. However, there is still room for improvement in the incentives provided by government departments to encourage domestic companies to increase investment in HPV vaccine research and development, especially for high-value vaccines such as the nine-valent HPV vaccine. Taking the example of WanTai Biological Pharmacy, which is at an advanced clinical stage with its nine-valent HPV vaccine, it completed the first subject enrollment in September 2020. According to the company's estimated clinical trial design, the entire Phase III clinical trial period is expected to be approximately 66-78 months, or about 5.5-6.5 years. Considering the lengthy clinical trial period, hastily shortening the trial duration to expedite the process would not be advisable. Therefore, the only viable approach would be to urge government agencies such as the National Medical Products Administration to prioritize the review and approval process for HPV vaccines, thereby improving their accessibility. This implies that it would be possible to shorten the time from the development to the market launch of domestically produced HPV vaccines, thereby accelerating their market supply.

In order to provide vaccination services for the eligible population, vaccination appointment systems have been launched in various regions. However, these systems encounter a series of issues in practical operation, such as information asymmetry and network congestion, leading to situations of scrambling and even the emergence of a "vaccine scalping" business. According to Xinhua Viewpoint, there is a large number of advertisements for the appointment of the nine-valent HPV vaccine on online platforms, with fees for appointment and reservation ranging from hundreds to thousands of yuan. Scams involving the four-valent and nine-valent HPV vaccines also occur from time to time. For instance, according to a

report from the Health Commission of Jiangbei District, Chongqing Municipality, some individuals collect fees from others under the pretext of assisting in booking cervical cancer vaccines, and then substitute saline solution or the two-valent HPV vaccine for the four-valent or nine-valent HPV vaccines. There are also cases of fraudulent transactions under the pretext of booking the nine-valent HPV vaccine, deceiving individuals of their money. These incidents reflect loopholes in the implementation of the HPV vaccination provision, indicating a lack of government oversight in vaccination administration, which makes it difficult to ensure the legitimacy and rationality of the medical resources provided.

#### 4.2.4 Insufficient promotional efforts have led to varied levels of public awareness

Among the existing welfare provision information, most initiatives are implemented among female students, with schools playing a crucial role as one of the executing bodies in expanding publicity and ensuring vaccination implementation. Despite strengthened health education related to cervical cancer prevention and HPV vaccination, the effectiveness of the promotion remains limited due to factors such as the scope of dissemination, methods of promotion, expertise of personnel, and enthusiasm in their work. There still exist disparities in students' awareness of HPV vaccines, indicating that schools have not effectively conveyed relevant information about HPV vaccines and failed to fully explain the value and long-term benefits of vaccination to students. Furthermore, some studies suggest that most students are coerced into vaccination due to recommendations from doctors or family members, rather than out of their own health awareness. Practices of mandatory vaccination may provoke resistance among students, undermining their trust and acceptance of vaccination.

### 4.3 Target Group

#### 4.3.1 Cognitive biases in the target group

In recent decades, thanks to economic development and improved health conditions, with the introduction of foreign HPV vaccines and the availability of domestic HPV vaccines, more and more women in China have taken the initiative to learn about cervical cancer control and prevention, including knowledge

about HPV vaccination provisions. However, due to inadequate dissemination of information by implementing agencies, there exist cognitive biases among the public regarding HPV vaccination.

When HPV vaccination was first introduced in China, most of the general public were in a stage of vaccine hesitancy. Misconceptions such as “only mature women can get cervical cancer,” “only those who are sexually active can get cervical cancer,” and “HPV vaccines are not suitable for young children” fundamentally led to the public's disbelief in the effectiveness of HPV vaccines in preventing cervical cancer. The question of “Is it necessary to get HPV vaccines?” became the greatest concern among the public. The low willingness to receive vaccination hindered the implementation of vaccination provisions, and the “wait-and-see” attitude and concerns delayed the vaccination of many eligible women, thus missing the optimal vaccination period.

As HPV vaccination gradually entered China, the public's awareness and understanding of HPV vaccines improved. However, the inherent perception of “higher price, better effect” led to a rush for expensive imported nine-valent HPV vaccines, resulting in a supply shortage for the nine-valent vaccine. Moreover, misconceptions such as “imported vaccines are more effective than domestic vaccines” increased the demand for imported vaccines, driving up prices, while domestically produced vaccines with the same effectiveness but lower prices received less attention. The public's queueing for scarce imported vaccines delayed their vaccination, hindering the progress of vaccination provisions.

In addition, although HPV vaccination has come into the public's view, there is still a characteristic of “high willingness, low vaccination rate” among eligible women in China. A multicenter study conducted a cross-sectional survey on female university students in eastern, central, and western China, revealing that nearly 54% of female university students were willing to receive HPV vaccination, but the vaccination rate among the survey participants was only 11.0% [4]. Similarly, a study in North China found that 78.8% of female university students had the intention to receive vaccination, but only 10.9% had actually received HPV vaccination

[5]. The high willingness and low vaccination rate are primarily influenced by the target population's doubts about the safety of the vaccine, with 71.4% of female university students expressing concerns about vaccine safety, and some still doubting the effectiveness of preventing cervical cancer [6]. The survey results by Zheng et al. [7] also showed that 47.8% and 35.6% of female university students were concerned about the safety and effectiveness of HPV vaccines, and their willingness to receive vaccination was difficult to translate into action. Research by Xiao et al. [8] also found that 19.31% of female university students lacked correct knowledge about scheduling HPV vaccination appointments.

In conclusion, at various stages of promoting vaccination provisions, despite the widespread dissemination of knowledge, the target group still exhibits varying degrees or aspects of cognitive biases or insufficient understanding.

#### 4.4 Target Population

4.4.1 Cognitive biases of the target population  
In recent decades, due to economic development and improvements in health conditions, as well as the introduction of HPV vaccines from abroad and the availability of domestic HPV vaccines, an increasing number of women in China have actively sought out information on cervical cancer control and prevention, including understanding HPV vaccination provisions. However, due to inadequate dissemination of provisions by implementing agencies, there are cognitive biases among the public regarding HPV vaccination.

When HPV vaccination was initially introduced in China, most of the public was in a stage of vaccine hesitancy. Several cognitive misconceptions, such as "only mature women get cervical cancer," "you have to be sexually active to get cervical cancer," and "children are too young for HPV vaccination," fundamentally led to a lack of acceptance of the role of HPV vaccines in preventing cervical cancer, with "Is it necessary to get the HPV vaccine?" being the biggest concern among the public. The low willingness to be vaccinated has hindered the implementation of vaccination provisions, and the "wait-and-see" attitude and concerns have also delayed the vaccination of many eligible women, missing

the optimal vaccination period.

As HPV vaccination gradually becomes more widespread in China, public understanding of HPV vaccines is improving, and there is increasing recognition of the vaccine's efficacy. However, the inherent belief that "higher price means better effect" has led to a rush for expensive imported nine-valent HPV vaccines, resulting in a shortage of these vaccines. Additionally, misconceptions such as "imported vaccines are more effective than domestic vaccines" have inflated the demand for imported vaccines and raised prices, while the equally effective and lower-priced domestic vaccines have received less attention. The public's queueing for the "hard-to-find" imported vaccines has delayed vaccination, hindering the progress of vaccination provisions.

Furthermore, although HPV vaccination has entered the public's view, there is still a phenomenon in China's eligible female population of "high willingness, low vaccination rate." A multicenter study of female university students in eastern, central, and western China found that while nearly 54% of female university students were willing to be vaccinated against HPV, only 11.0% of the participants surveyed had been vaccinated. Similarly, a study in North China found that 78.8% of female university students were willing to be vaccinated, but only 10.9% had received the HPV vaccine. The high willingness and low vaccination rate are mainly influenced by the target population's doubts about the safety of the vaccine, with 71.4% of female university students expressing concerns about vaccine safety, and some still doubting the effectiveness of preventing cervical cancer. Surveys by Zheng Hao et al. also showed that 47.8% and 35.6% of female university students respectively worried about the safety and effectiveness of HPV vaccines, making it difficult to translate willingness into action. Research by Xiao Ling et al. also found that 19.31% of female university students lacked correct knowledge about HPV vaccine appointments.

In conclusion, at various stages of the vaccination provision implementation, despite the widespread dissemination of knowledge, the target population still exhibits varying degrees or aspects of cognitive biases or insufficient knowledge.

#### 4.4.2 Economic disparities among target populations

China faces significant regional development disparities, with large differences in social development levels between the eastern, central, and western regions as well as between urban and rural areas. Underdeveloped areas and vast rural regions experience lagging economic development, lower incomes, lack of emphasis on healthcare at the societal level, and insufficient local medical resources, all of which pose challenges to vaccinating eligible women against HPV in these areas. Against the backdrop of HPV vaccination not yet being included in the immunization program, underdeveloped regions have not implemented comprehensive provisions to make HPV vaccination accessible to the population [8]. The cost of around 500 yuan per dose for the bivalent vaccine imposes significant financial pressure on eligible women from impoverished families. Particularly in western regions, the number of eligible women from disadvantaged families receiving HPV vaccination is low.

### 4.5 Provision Environment

#### 4.5.1 Sudden impact of the pandemic on the vaccine market

The sudden emergence of the global COVID-19 pandemic at the end of 2019, coupled with its prolonged and challenging containment, has had a massive impact across various industries. As there was only one vaccine manufacturer in the United States globally, production schedules were disrupted due to the pandemic, and stringent import controls and sanitation measures during the pandemic limited mass imports, significantly affecting industry approvals, distribution, and sales. The heightened standards for market entry overseas have introduced uncertainties in the promotion and administration of HPV vaccines. The high transmissibility of the Delta variant has also added uncertainties to global anti-pandemic efforts, indirectly affecting HPV vaccination plans [9].

#### 4.5.2 Lack of legal support for vaccination provisions, lower legal hierarchy

The inclusion of HPV vaccines in the national immunization plan and the level of support for related provisions are crucial factors influencing the execution of vaccination

provisions. Currently, provisions regarding HPV vaccination remain at the level of provisions, regulations, and institutional frameworks, without ascending to the level of laws. This means that in the realm of HPV vaccination, China's legal framework lacks specialized laws directly addressing HPV vaccination. While there are joint action plans and work schemes issued by multiple departments, such as the "Healthy China Action—Cancer Prevention and Control Action Plan (2023-2030)" and the "Accelerated Elimination of Cervical Cancer Action Plan (2023-2030)," these documents primarily reflect the government's guiding ideology and provision orientation regarding HPV vaccination rather than specific legal norms. Furthermore, although the Vaccine Administration Law provides a legal basis for vaccination, strengthening vaccine management and regulating preventive vaccination, it does not specifically address HPV vaccination. This indicates that in the field of HPV vaccination, China's legal hierarchy is relatively low, relying solely on provisions and regulations to promote and implement related measures. Although some local governments have started incorporating HPV vaccination into welfare provisions, the lack of higher-level legal support means that the effectiveness and sustainability of these efforts remain to be seen [10].

The lack of legal support for vaccination provisions to some extent limits the implementation of HPV vaccination efforts, necessitating further strengthening and refinement through legislation and other means in the future.

#### 4.5.3 The contradiction between supply and demand is prominent, and vaccine resources are tight

Most of the current HPV vaccine inoculation provisions aimed at benefiting the public are provided through free or subsidized services, significantly reducing the economic costs for recipients to receive the HPV vaccine. However, the phenomenon of tight supply of HPV vaccines still exists in the market. The main reasons for this supply-demand contradiction include insufficient production capacity of vaccine manufacturers, inadequate import plans of production companies in China, and long vaccine batch approval cycles. Although there have been reports of the



approval and market launch of domestically produced bivalent HPV vaccines with relatively sufficient supply, appointments still need to be made in advance, indicating that even though the supply-demand contradiction has been partially alleviated, the HPV vaccine is still in short supply in the market. This supply-demand contradiction has led to difficulties in meeting the needs of all populations requiring HPV vaccination, even with provision support.

In addition, in the implementation of actual vaccination provisions, although the National Health Commission has stated that it will gradually address the shortage of HPV vaccine supply, the complete reliance on imported nine-valent HPV vaccines and the insufficient quantity of arrivals have led to many eligible women foregoing vaccination with bivalent or quadrivalent HPV vaccines while awaiting the nine-valent HPV vaccine. Relevant experts suggest that there is no need to miss the optimal vaccination time because of waiting for a higher-priced vaccine type, but this recommendation still faces practical challenges in implementation [11].

## **5. Strategies for Advancing the Implementation of HPV Vaccination Provisions in China**

Based on the framework of the Smith model, after a thorough analysis of the obstructive factors in four dimensions including idealized provisions, provision execution agencies, target groups, and provision environments, the following specific strategies for advancing provision implementation can be further derived to contribute to the improvement of vaccination rates and protection of public health and safety.

### **5.1 Optimize Vaccination Strategies: Reduce the number of doses, optimize subsidy provisions, etc.**

Establish a sustainable mechanism to promote HPV vaccine vaccination. Regions should combine practices such as the WHO's latest recommendation for single-dose vaccination and price negotiation mechanisms such as gradient pricing that have been implemented in other countries, connecting points to form a surface, transforming "one case, one negotiation" of livelihood projects into

long-term, systematic, and sustainable development plans at the national level. Leveraging opportunities such as the stage evaluation of "Healthy City Construction" and the promotion of the "Accelerated Elimination of Cervical Cancer Action", organize third-party organizations to evaluate the implementation effectiveness of public-benefit vaccination provisions in various regions, summarize the implementation experiences and problems of various regions, organize special experience exchange meetings on HPV vaccine vaccination, support media publicity on public-benefit vaccination provisions in various regions, and enhance the influence of public-benefit vaccination provisions [12]. Encourage more regions to support HPV vaccine vaccination through fiscal subsidies, medical insurance payments, and other means. Priority may be given to supporting vaccination in impoverished areas, low-income families, and providing subsidies for initial vaccinations. When conditions are ripe, consider incorporating HPV vaccine vaccination into the national immunization program. However, due to different conditions, experiences, and models in different regions, each region needs to explore public-benefit vaccination provisions for HPV vaccination that are suitable for local conditions.

### **5.2 Strengthen Government Oversight and Standardized Management, Provide Legal and Provision Support**

Due to the scarcity, difficulty in acquisition, and high prices of existing HPV vaccines, phenomena such as scalping, price inflation, and bundled sales are not uncommon, significantly affecting the standardization of the medical market operation and the actual interests of the people. To address these issues, it is necessary to further understand the vaccination rates and the disease and economic burdens associated with key non-immunization schedule vaccines, improve the fundraising and tender procurement strategies for non-immunization schedule vaccines, alleviate fiscal pressure through multiple financing channels, and enhance the capacity to provide vaccination services. Additionally, it's important to strengthen the standardized management of HPV vaccine administration, establish comprehensive records of vaccine procurement, storage, distribution, and supply,

regulate the establishment of HPV vaccine administration sites, promptly publish lists of qualified vaccination units, provide reasonable appointment vaccination services, and ensure the vaccination needs of women of different age groups [13].

Through the accumulation of experience, the National Medical Products Administration has expressed a high degree of importance for the innovative research and development of domestically produced HPV vaccines and has been continuously improving laws and regulations to promote this process. This indicates that the government is taking measures to promote the research and application of HPV vaccines through legal and provision means, and gradually revising and improving relevant laws and regulations is feasible.

### 5.3 Enhance Public Awareness

At present, based on the above analysis, there are cognitive biases and deficiencies among the target groups. Multiple departments should carry out propaganda in various ways to increase public awareness and acceptance of HPV vaccines. Government propaganda departments, schools, medical institutions, media, and other relevant units should use traditional media such as radio, television, newspapers, and magazines, as well as new media such as live streaming platforms and short-video platforms, to widely conduct educational activities through forms such as press conferences, lectures, free clinics, door-to-door outreach, and media coverage. Currently, some regions are expanding knowledge dissemination of vaccine administration among age-appropriate populations through methods like "little hands leading big hands" (where children who receive education at school bring health knowledge home to influence parents), while other regions can learn from the advanced experiences of pilot areas.

In terms of propaganda content, it's important to disseminate the latest research progress on HPV vaccines to reduce public cognitive biases. Authoritative experts should focus on promoting core information such as the optimal timing for HPV vaccination, the efficacy of domestically produced bivalent vaccines, and the equivalence of single-dose vaccination schemes to two or three doses, to

reduce the phenomenon of missing the best vaccination timing due to blindly waiting for expensive imported vaccines.

When conducting HPV health education, the educational level of the target audience should be considered to make it targeted. For groups with low education levels in rural or underdeveloped areas, schools can conduct appropriate sexual education with the support of relevant health and education departments, starting with educating parents and then guiding children to enhance awareness. In rural areas where internet usage is not widespread, special attention should be paid to offline communication by professionals [14].

In addition to increasing awareness among vaccine recipients, it's also necessary to improve the service level of medical personnel. It's recommended to strengthen the professional knowledge training of relevant medical personnel and improve their communication skills with vaccine recipients of different education levels or ages. Effective communication by medical personnel is more professional and effective than government propaganda on vaccine administration projects and health education.

### 5.4 Encourage the Production and Application of Domestic HPV Vaccines, Ensure Vaccine Supply Quality

Currently, some HPV vaccines are entirely dependent on imports, and domestically produced nine-valent vaccines are expected to be available no earlier than around 2025. In addition to strengthening the regulation of existing vaccine administration, as domestically produced HPV vaccines gradually enter the market circulation, the government can encourage more domestic HPV vaccine production and market entry by providing financial subsidies, tax incentives, and other measures to reduce vaccine costs, increase public willingness to vaccinate, and achieve "freedom of domestically produced vaccines."

According to the Vaccine Administration Law of the People's Republic of China (2019), strengthening vaccine management to ensure vaccine quality and supply is a legal requirement. At the same time, relevant laws and regulations, such as the Regulations on the Circulation and Administration of Vaccines, should be continuously improved to regulate

vaccine development, production, circulation, preventive vaccination, and supervision and management activities. Additionally, efforts should be made to actively promote the inclusion of HPV vaccines in priority review and approval procedures by departments such as the National Medical Products Administration, improve the accessibility of HPV vaccines, and, based on scientific evidence, promote pilot projects and guide various regions to actively explore effective models for HPV vaccine administration.

## 6. Concluding Remarks

The incidence of cervical cancer in Chinese women has been increasing year by year, and the trend of younger age has become a major issue in the field of public health. At present, China's HPV vaccine immunization strategy has not been fully implemented. In order to better improve the HPV vaccine coverage rate and maximize the advantages of HPV vaccine immunization, the paper analyzes the constraints in the implementation process from four aspects based on the Smith model. On this basis, it provides general provision recommendations for HPV vaccines and cervical cancer prevention and control.

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