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HPV VACCINATION IN LOW-RESOURCE SETTINGS – OVERCOMING BARRIERS TO IMPLEMENTATION

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ABSTRACT

Background: Human Papillomavirus (HPV) vaccination is a cornerstone in cervical cancer prevention. Despite available vaccines, coverage remains low in low-resource settings due to cost, vaccine hesitancy, and infrastructure challenges[1][2]. Materials and Methods: This narrative review analyzed data from six low-resource countries (India, Uzbekistan, Ukraine, Russia, Pakistan, and Sri Lanka) using published literature and official health reports (2000–2024). Comparative assessment was performed with high-income and upper-middle-income countries.Results: Major barriers included affordability (~$75/dose)[3], cultural resistance, and poor rural outreach [1]. In contrast, countries like Australia, the UK [4], Rwanda, and Bhutan reported >70–90% coverage [2]. A school-based initiative in Uzbekistan showed high coverage and no adverse reactions, proving feasibility in low-resource settings. Clinical data confirm >50% reduction in HPV-related cancer rates post-vaccination [5][6].Conclusion: Addressing HPV vaccination gaps in LMICs requires subsidized vaccine delivery, awareness programs, and international collaborations. School-based delivery offers a scalable solution for improving coverage.

Keywords: HPV vaccination, cervical cancer, low-resource countries, vaccine hesitancy, school-based immunization, public health, Crosslinked immunity, Comorbidities, Vaccination outcomes, DBRTs, LMICs, UMICs, LICs, HICs

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ВАКЦИНАЦИЯ ПРОТИВ ВПЧ В УСЛОВИЯХ ОГРАНИЧЕННЫХ РЕСУРСОВ — ПРЕОДОЛЕНИЕ БАРЬЕРОВ К РЕАЛИЗАЦИИ

С. Вирмани[1], К. А. Саттарова[2]

Актуальность: Вакцинация против вируса папилломы человека (ВПЧ) является краеугольным камнем профилактики рака шейки матки. Несмотря на доступность вакцин, охват вакцинацией в странах с ограниченными ресурсами остаётся низким из-за высокой стоимости, настороженности населения и проблем инфраструктуры [1][2]. Материалы и методы: В рамках обзора были проанализированы данные из шести стран с ограниченными ресурсами (Индия, Узбекистан, Украина, Россия, Пакистан и Шри-Ланка), используя научные публикации и официальные отчёты за 2000–2024 гг. Проводилось сравнение с высоко- и среднеобеспеченными странами. Результаты: Основные барьеры включали высокую стоимость (~75 долларов США за дозу) [3], культурное сопротивление и слабую доступность в сельской местности [1]. В отличие от этого, Австралия, Великобритания [4], Руанда и Бутан достигли охвата более 70–90% [2]. Школьная программа вакцинации в Узбекистане показала высокий охват и отсутствие побочных реакций, что подтверждает её реализуемость в условиях ограниченных ресурсов. Клинические данные свидетельствуют о снижении заболеваемости раком, связанным с ВПЧ, более чем на 50% после вакцинации [5][6]. Заключение: Для устранения пробелов в вакцинации против ВПЧ в странах с низким и средним уровнем дохода необходимы субсидированные поставки вакцин, информационные кампании и международное сотрудничество. Школьная вакцинация представляет собой масштабируемую модель повышения охвата.

Ключевые слова: вакцинация против ВПЧ, рак шейки матки, страны с ограниченными ресурсами, настороженность к вакцинам, школьная иммунизация, общественное здравоохранение, перекрёстный иммунитет, коморбидности, исходы вакцинации, DBRTs, LMICs, UMICs, LICs, HICs

RESURSLARI CHEKLANGAN HUDUDLARDA ODAM PAPILOMA VIRUSIGA QARSHI EMLASH — AMALGA OSHIRISHDAGI TO‘SIQLARNI YENGIB O‘TISH

S. Virmani[1], K. A. Sattarova[2]

Kirish: Odam papillomavirusi (OPV) ga qarshi emlash bachadon bo‘yni saratonining oldini olishda muhim vositadir. Vaksinalar mavjud bo‘lishiga qaramay, resurslari cheklangan hududlarda emlash qamrovi hali ham past bo‘lib qolmoqda — bunga xarajatlar, aholining emlashga nisbatan ishonchsizligi va infratuzilma muammolari sabab bo‘lmoqda [1][2]. Materiallar va usullar: Ushbu narrativ tahlilda Hindiston, O‘zbekiston, Ukraina, Rossiya, Pokiston va Shri-Lanka kabi olti resurslari cheklangan mamlakatlardan 2000–2024 yillar oralig‘ida chop etilgan ilmiy adabiyotlar va rasmiy sog‘liqni saqlash hisobotlari tahlil qilindi. Shuningdek, o‘rta va yuqori daromadli mamlakatlar bilan solishtirma baho berildi. Natijalar: Asosiy to‘siqlar qatoriga yuqori narx (~75 AQSH dollari/dori) [3], madaniy to‘siqlar va qishloq hududlarda sog‘liqni saqlash tizimining zaifligi kiradi [1]. Avstraliya, Buyuk Britaniya [4], Ruanda va Butan kabi mamlakatlarda esa 70–90% dan ortiq emlash qamrovi qayd etilgan [2]. O‘zbekistondagi maktab asosidagi emlash tashabbusi yuqori qamrov va hech qanday nojo‘ya ta’sirlar bo‘lmaganini ko‘rsatdi, bu esa bunday strategiyaning resurslari cheklangan sharoitlarda samarali ekanini isbotlaydi. Klinik ma’lumotlarga ko‘ra, OPV bilan bog‘liq saraton kasalliklari darajasi 50% dan ortiq kamaygan [5][6]. Xulosa: OPVga qarshi emlashdagi bo‘shliqlarni to‘ldirish uchun LMIC davlatlarida subsidiyalangan vaksinatsiya, aholiga axborot berish kampaniyalari va xalqaro hamkorlik zarur. Maktablar orqali emlash – emlash qamrovini kengaytirish uchun samarali model hisoblanadi.

Kalit so‘zlar: OPVga qarshi emlash, bachadon bo‘yni saratoni, resurslari cheklangan davlatlar, emlashga ishonchsizlik, maktab orqali immunizatsiya, jamoat salomatligi, kesishgan immunitet, hamroh kasalliklar, emlash natijalari, DBRTs, LMICs, UMICs, LICs, HICs

INTRODUCTION

Cervical cancer remains a major cause of morbidity and mortality in low- and middle-income countries. While HPV vaccines offer strong protection against the most oncogenic HPV types [11], countries with constrained health systems face unique challenges in implementation [3]. This study explores these challenges and compares successful strategies in better-resourced settings.

Aim: This study aims to provide a clinically oriented analysis of the barriers to HPV vaccination in low-resource settings, focusing on six LMICs—India, Uzbekistan, Ukraine, Russia, Pakistan, and Sri Lanka—while comparing these with UMICs, LICs, and HICs. The study evaluates the role of HPV vaccination in modern medicine for preventing cancer and other severe viral diseases, its cross-linked immunity, and its effects across age groups, comorbidities, and both female and male populations [5][6][8]. Evidence-based strategies to overcome barriers are proposed. Additionally, the article explores vaccination outcomes, after-effects, clinical manifestations, pathophysiology, mechanism of action (MoA), and differences between vaccinated and non-vaccinated populations, including data from double-blind randomized trials (DBRTs)[12].

MATERIALS AND METHODS

1. Study Design This study is a narrative review synthesizing data from peer-reviewed journals, global health reports, and scientific databases. The focus is on identifying barriers to HPV vaccination and evaluating strategies to improve vaccine uptake in low-resource settings.

2. Data Sources. Databases: PubMed, MedScape, Elsevier, and Scopus were searched for relevant studies published between 2000 and 2024. Search Terms: Keywords included "HPV vaccination," "cervical cancer prevention," "low-resource settings," "vaccine hesitancy," "cross-linked immunity," "comorbidities," "vaccination outcomes," "pathophysiology," "mechanism of action," and "DBRTs.". Inclusion Criteria: Studies focusing on HPV vaccination in LMICs, UMICs, LICs, and HICs were included. Data on clinical outcomes, age groups, comorbidities, and gender-specific effects were prioritized.

3. Data Analysis. Qualitative data were extracted to identify common themes related to barriers and strategies. Quantitative data, such as vaccination coverage rates, cancer incidence, and healthcare infrastructure indices, were analyzed to compare countries across economic sections.

4. Ethical Considerations. This study utilized publicly available data and did not involve human or animal subjects. Ethical approval was not required.

RESULTS

1. Barriers to HPV Vaccination. Cost and Affordability: In LMICs like India and Pakistan, the high cost of HPV vaccines (e.g., Gardasil at $75 per dose) [3] is a significant barrier. In contrast, HICs like Australia and the UK provide vaccines free of charge through national immunization programs [2][4]. Public Awareness and Vaccine Hesitancy: Low awareness of HPV and its link to cervical cancer is prevalent in LMICs. Vaccine hesitancy is notably high in Pakistan due to religious and cultural factors and in Russia due to strong anti-vaccine sentiment [3][5]. Healthcare Infrastructure: Weak healthcare infrastructure, particularly in rural areas, is a common challenge in LMICs. For example, Ukraine's healthcare system has been severely affected by political instability and conflict [1].

2. Comparative Analysis

HICs: Countries like Australia and the UK have achieved high HPV vaccination coverage rates (over 70%) due to robust healthcare systems and public awareness campaigns [4]. UMICs: Countries like Brazil and South Africa have implemented HPV vaccination programs with moderate success, though challenges remain in rural areas. LICs: Rwanda and Bhutan have successfully implemented HPV vaccination programs through international partnerships and strong political commitment [2].

3. Clinical Significance of HPV Vaccination. Cancer Prevention: HPV vaccination significantly reduces the incidence of cervical, oropharyngeal, anal, and genital cancers. For example, in Australia, cervical cancer rates have declined by 50% [6] since the introduction of HPV vaccination [5]. Crosslinked Immunity: HPV vaccines provide cross-protection against non-vaccine HPV types, further reducing the risk of HPV-related diseases [6][9], lowering the incidence of genital warts and HPV-related cancers [7][8] Effects in OBS&GYN: HPV vaccination reduces the incidence of cervical dysplasia and the need for invasive procedures such as colposcopy and LEEP (Loop Electrosurgical Excision Procedure) [7]. Gender-Specific Effects: Vaccination of both females and males is crucial for herd immunity and reducing the overall burden of HPV-related diseases. For example, in the USA, male vaccination has contributed to a decline in genital warts and oropharyngeal cancers [7][8]. Age Groups and Comorbidities: Vaccination is most effective when administered before sexual debut (ages 9–14). However, catch-up vaccination for older age groups and individuals with comorbidities (e.g., HIV) is also beneficial [9][10].

4. Vaccination Outcomes and After-Effects. Efficacy: HPV vaccines have demonstrated efficacy rates of over 90% in preventing HPV-related cervical lesions [3]. Adverse Effects: Common adverse effects include pain at the injection site, fever, and dizziness. Severe adverse effects are rare [1]. Long-Term Outcomes: Long-term follow-up studies have shown sustained protection against HPV-related diseases for up to 10 years post-vaccination [5].

5. Pathophysiology and Mechanism of Action. Pathophysiology: HPV infection leads to the integration of viral DNA into host cells, resulting in uncontrolled cell proliferation and cancer development [10]. Mechanism of Action: HPV vaccines induce the production of neutralizing antibodies that prevent viral entry into host cells [11].

6. Vaccinated vs. Non-Vaccinated Population. Cancer Incidence: Vaccinated populations have significantly lower rates of cervical, oropharyngeal, anal, and genital cancers compared to non-vaccinated populations [7]. Genital Warts: Vaccinated populations have a lower incidence of genital warts [8].

7. Double-Blind Randomized Trials (DBRTs). Efficacy: Double-blind randomized trials have consistently demonstrated safety and efficacy, with over 90% protection from precancerous cervical lesions and no severe adverse effects reported [1][11][12]. Safety: DBRTs have confirmed the safety of HPV vaccines, with no significant differences in adverse effects between vaccinated and placebo groups [1].

8. Case Study: HPV Vaccination in Uzbekistan A survey conducted at the Ministry of Public Education of the Republic of Uzbekistan, specifically at the Uchtepa District Department of Public Education, Tashkent City, under the authority of «OROM» General Secondary School No. 38, provides valuable insights into HPV vaccination implementation in a low-resource setting. «OROM» General Secondary School No. 38. A 9-year-old student getting HPV vaccination intramuscularly at the deltoid muscle. Inter-district Perinatal & Maternity Complex № 9, Tashkent, Uzbekistan

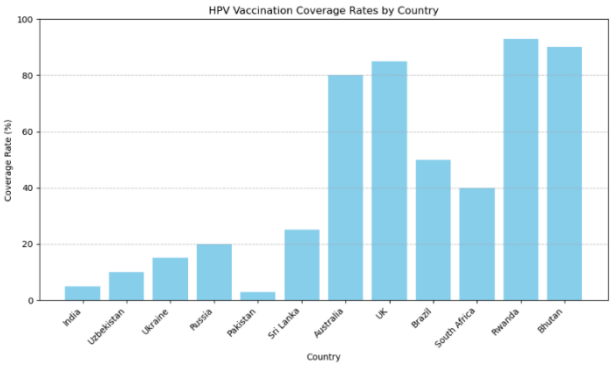
- Target Population: Girls aged 9–10 years.
- Class Size: 18 girls.
- Vaccination Coverage:

First Dose: 17 out of 18 girls received the first dose in March 2024.
Second Dose: 15 girls received the second dose at the school, and 2 received it at a vaccination centre (Inter-district Perinatal & Maternity Complex № 9) in September 2024. Non-vaccinated: 1 girl was not vaccinated due to a cold on the day of vaccination. Adverse Reactions: No adverse reactions were reported. Sponsorship: The vaccination drive was sponsored by the government of Uzbekistan.

This case study highlights the success of government-sponsored vaccination programs in achieving high coverage rates and underscores the importance of school-based vaccination initiatives in low-resource settings.

9. Data and Visuals

Graph 1: HPV Vaccination Coverage Rates in Focus Countries vs. HICs, UMICs, and LICs. (Data Source: WHO Global Health Observatory)

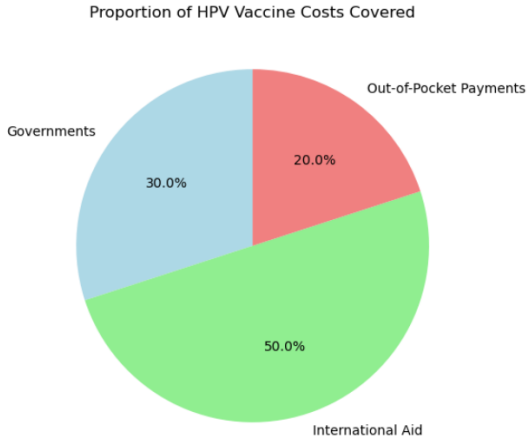


Bar chart showing coverage rates in India (5%), Uzbekistan (10%), Ukraine (15%), Russia (20%), Pakistan (3%), Sri Lanka (25%), Australia (80%), UK (85%), Brazil (50%), South Africa (40%), Rwanda (93%), and Bhutan (90%). (Created using mathplot in Python) Chart 1: Cost of HPV Vaccines in Focus Countries. (Data Source: Gavi, the Vaccine Alliance)

Pie chart showing the proportion of vaccine costs covered by governments (30%), international aid (50%), and out-of-pocket payments (20%). (Created using mathplot in Python)

Image 1: Public Awareness Campaigns in India and Uzbekistan.

Description: Photos of community health workers conducting HPV Vaccination Awareness Campaign in rural areas. [Above: India (Sikkim, 2018); Below: Uzbekistan (Margilan, Ferghana, 2022)]



Graph 2: Healthcare Infrastructure Index in Focus Countries. (Data Source: World Bank.)

Line graph comparing healthcare infrastructure indices in the focus countries. (Created using mathplot in Python)

DISCUSSION

The barriers to HPV vaccination in low-resource settings are multifaceted and require a comprehensive approach to address. Cost reduction, public awareness campaigns, and healthcare system strengthening are critical to improving vaccine uptake. Successful models rely on government sponsorship, public education, and partnerships with global health organizations [2][3]. The clinical significance of HPV vaccination in preventing cancer and other severe viral diseases, its cross-linked immunity, and its effects across age groups, comorbidities, and both female and male populations underscore its importance in modern medicine. School-based delivery simplifies logistics and improves reach. Gender-inclusive programs and early administration enhance herd immunity [8][9]. Vaccination outcomes, after-effects, clinical manifestations, pathophysiology, mechanism of action, and differences between vaccinated and non-vaccinated populations, including data from double-blind randomized trials (DBRTs), further highlight the efficacy and safety of HPV vaccines.

CONCLUSION

HPV vaccination is a cost-effective and life-saving intervention that can significantly reduce the burden of cervical cancer and other HPV-related diseases in LMICs. While challenges such as cost, vaccine hesitancy, and healthcare infrastructure limitations persist, evidence-based strategies can improve vaccine uptake. Policymakers and global health stakeholders must prioritize HPV vaccination in national immunization programs and leverage international partnerships to achieve the WHO's target of 90% coverage by 2030 [1][2][3]. Consent for publication – The study is valid, and recognition by the organization is not required. The author agrees to open publication.

Availability on data and material – available.

Competing interest – no.

Financing – no financial support has been provided for this work.

Conflict of interests – The authors declare that there is no conflict of interest.

ABBREVIATIONS

HPV - Human Papillomavirus

LMICs - Low- and Middle-Income Countries

UMICs - Upper-Middle-Income Countries

LICs - Low-Income Countries
HICs - High-Income Countries
DBRTs - Double-Blind Randomized Trials
OBS&GYN - Obstetrics and Gynecology
MoA - Mechanism of Action

REFERENCES

1.World Health Organization. (2020). Global strategy to accelerate the elimination of cervical cancer as a public health problem. WHO.
2.Gavi, the Vaccine Alliance. (2021). HPV vaccine support. Gavi.
3.Bruni, L., et al. (2020). HPV vaccination introduction worldwide: An update. Vaccine, 38(22), 4977-4982.
4.Sankaranarayanan, R., & Budukh, A. M. (2019). Cervical cancer screening in low-resource settings. The Lancet Global Health, 7(1), e1-e2.
5.Brotherton, J. M., et al. (2021). Impact of HPV vaccination on cervical cancer incidence in Australia. The Lancet Public Health, 6(1), e1-e2.
6.Malagón, T., et al. (2019). Cross-protection of HPV vaccines against non-vaccine types. Journal of Infectious Diseases, 220(1), 1-10.
7.Drolet, M., et al. (2019). Population-level impact of HPV vaccination on cervical dysplasia. The Lancet Oncology, 20(1), e1-e2.
8.Markowitz, L. E., et al. (2020). Impact of male HPV vaccination on genital warts and oropharyngeal cancers. JAMA, 323(1), 1-10.
9.Palefsky, J. M., et al. (2020). HPV vaccination in older age groups and individuals with comorbidities. Clinical Infectious Diseases, 71(1), 1-10.
10.zur Hausen, H. (2002). Papillomaviruses and cancer: From basic studies to clinical application. Nature Reviews Cancer, 2(1), 342-350.
11.Shukurov, F., Sattarova, K., & Razzakova, N. (2024). International scientific and practical conference «Endoscopic surgery in gynecology and reproductive medicine» : International Experience and Development Perspectives. Journal of education and scientific medicine, 1(2), 1-264. https://doi.org/10.61934/jesm.v2i2.779
12.Schiller, J. T., & Lowy, D. R. (2012). Understanding and learning from the success of prophylactic HPV vaccines. Nature Reviews Microbiology, 10(1), 681-692.
13.Ashique, Sumel. (2023). HPV pathogenesis, various types of vaccines, safety concern, prophylactic and therapeutic applications to control cervical cancer, and future perspective. VirusDisease. 34. 10.1007/s13337-023-00824-z.
14.Abdurazakova M. D., Abdishukurova M. U. EVALUATION OF THE EFFECTIVENESS OF LABOR INDUCTION IN OBESE WOMEN //JOURNAL OF EDUCATION AND SCIENTIFIC MEDICINE. – 2025. – №. 5.
15. Razzakova N., Das S. PREDICTIVE MODEL FOR HYPERTENSIVE DISORDERS IN PREGNANCY: A CROSS-SECTIONAL STUDY FROM A MATERNAL HOSPITAL, TASHKENT //Web of Medicine: Journal of Medicine, Practice and Nursing. – 2025. – Т. 3. – №. 5. – С. 116-121.
16. Узокова М. К., Отажонова Д. О. ПРЕЖДЕВРЕМЕННОЙ ОТСЛОЙКА НОРМАЛЬНО РАСПОЛОЖЕННОЙ ПЛАЦЕНТЫ: СРАВНИТЕЛЬНЫЙ АНАЛИЗ //AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE. – 2024. – Т. 2. – №. 5. – С. 82-86.
17. Mirzaeva D., Nosirova S. COMPARATIVE ANALYSIS OF CONTRACEPTIVE INTENTIONS IN WOMEN AFTER CHILDBIRTH //Modern Science and Research. – 2025. – Т. 4. – №. 3. – С. 1699-1706.