International Journal of Research in Medical Sciences
Gautam A et al. Int J Res Med Sci. 2026 Oct;14(10):4667-4673
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20263539

Original Research Article

Strengthening cervical cancer prevention through district-wide HPV vaccination: an implementation case study from Bareilly district, Uttar Pradesh, India

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Received: 17 July 2026
Revised: 04 September 2026
Accepted: 09 September 2026

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ABSTRACT

Background: Persistent infection with high-risk human papillomavirus (HPV) is the primary cause of cervical cancer, one of the leading cancers among women in India. Introduction of HPV vaccination under India's universal immunization programme (UIP) represents an important step towards achieving the World Health Organization (WHO) strategy for cervical cancer elimination. Although vaccine efficacy is well established, published evidence describing district-level implementation experiences remains limited. To describe the planning, implementation, operational performance, and lessons learned from the district-wide HPV vaccination programme in Bareilly district, Uttar Pradesh.
Methods: A retrospective descriptive implementation case study was conducted using programme data collected from 28 February 2026 to 4 August 2026. Data were obtained from district HPV vaccination monitoring reports, session reports, beneficiary registers, microplans, vaccine stock records, supervisory reports, and electronic vaccine intelligence network (eVIN) records. Indicators included session completion, beneficiaries vaccinated, vaccine utilization, and reconciliation between administrative and eVIN records.
Results: A total of 3,865 vaccination sessions were planned and 3,863 (99.95%) were conducted. Overall, 25,276 adolescent girls received HPV vaccination. eVIN documented 24,897 vaccine doses utilized, giving an absolute difference of 379 doses (1.5%) between administrative vaccination records and eVIN utilization. CHC Faridpur achieved complete implementation, with 152 of 152 planned sessions conducted, 2,478 beneficiaries vaccinated, and zero difference between beneficiary records and eVIN utilization.
Conclusion: The Bareilly implementation demonstrates that large-scale HPV vaccination can be integrated within routine immunization infrastructure through strong leadership, detailed microplanning, intersectoral collaboration, supportive supervision, and digital vaccine logistics monitoring. The operational experience may inform implementation in similar districts.

Keywords: Human papillomavirus, Cervical cancer, HPV vaccine, Implementation science, eVIN, Universal immunization programme, India

INTRODUCTION

Cervical cancer remains one of the leading causes of cancer-related morbidity and mortality among women worldwide despite being largely preventable through vaccination and screening. According to the World Health Organization, approximately 660,000 new cervical cancer cases and 350,000 deaths occurred globally in 2022, with India contributing a substantial proportion of the global disease burden.[1] Persistent infection with oncogenic HPV types, particularly HPV-16 and HPV-18, accounts for a large proportion of cervical cancers.[2] Prophylactic HPV

vaccination before exposure to the virus provides highly effective protection against persistent infection and precancerous lesions and is therefore an important cancer-prevention intervention.[3]

Recognizing this evidence, WHO launched the global strategy to accelerate the elimination of cervical cancer, targeting 90% HPV vaccination coverage among girls by 15 years of age, 70% screening coverage, and 90% treatment of cervical disease.[4] India has initiated HPV vaccination through the universal immunization programme, supported by operational guidance emphasizing school-based delivery, cold-chain maintenance, community engagement, and programme monitoring.[5]

Implementation of adolescent vaccination programmes presents operational challenges distinct from infant immunization. Success depends on collaboration between health and education departments, accurate beneficiary identification, community acceptance, uninterrupted vaccine supply, supportive supervision, and reliable programme monitoring.[6] Digital innovations such as the eVIN strengthen immunization logistics by improving vaccine stock visibility, temperature monitoring, and supply-chain management.[7]

Bareilly district implemented a comprehensive HPV vaccination programme involving 28 government health facilities, schools, and outreach sites. This implementation case study documents the programme strategy, operational outcomes, and lessons learned, with particular attention to digital vaccine accountability through eVIN.

METHODS

Study design

This implementation case study employed a retrospective descriptive design to document the planning, implementation, monitoring, and operational performance of the district-wide HPV vaccination programme conducted in Bareilly district, Uttar Pradesh, India. The study was developed using implementation-science principles and was reported with reference to the standards for quality improvement reporting excellence (SQUIRE 2.0) framework.[8] The objective was to describe how the programme was operationalized within the existing public health system and to identify implementation strategies, operational achievements, and lessons relevant to future programme expansion.

Study setting and study place

The study was conducted in Bareilly district, Uttar Pradesh, India. Programme records were maintained by the district immunization office, Bareilly, and implementation occurred through 28 government health facilities comprising community health centres (CHCs), primary health centres (PHCs), urban primary health centres (UPHCs), and outreach vaccination sites. The manuscript specifically documents the implementation experience of CHC Faridpur, Bareilly, as the highest-performing facility and model implementation site. The district programme was implemented in collaboration with government schools, the Department of Education, local administration, and community stakeholders. School-based vaccination was the principal delivery strategy, supplemented by outreach and mop-up sessions to include out-of-school and absent beneficiaries.

Study duration

The study analysed cumulative programme data from 28 February 2026 to 4 August 2026.

Data sources

Programme information was obtained from official district records maintained by the District Immunization Office. Sources included district HPV vaccination monitoring reports, daily vaccination session reports, beneficiary registers, session microplans, eVIN vaccine-utilization reports, vaccine stock registers, cold-chain monitoring records, supervisory visit reports, and block-level review reports. Only aggregated programme data were analysed; no individual-level identifiers or confidential patient information were included.

Programme implementation

Before programme launch, district and block-level planning meetings were conducted, educational institutions were mapped, eligible beneficiaries were enumerated, vaccine requirements were forecast, cold-chain capacity was assessed, logistics were planned, vaccinators and supervisors were trained, and communication materials were developed. During implementation, vaccination sessions were conducted according to approved microplans at schools and designated health facilities.

Eligible adolescent girls were verified and counselled before vaccination and were observed for 30 minutes after vaccination in accordance with programme guidance. Implementation was monitored through daily reporting, block-level supervision, district review meetings, field monitoring visits, eVIN dashboard review, and vaccine stock reconciliation. Corrective actions were initiated when operational discrepancies were identified.

Study variables and outcomes

The principal implementation indicators were the number of planned and conducted vaccination sessions, session completion rate, number of beneficiaries vaccinated, average beneficiaries vaccinated per session, eVIN-recorded vaccine utilization, and the difference between administrative vaccination records and eVIN utilization. Additional implementation domains included

microplanning, training, supportive supervision, community participation, cold-chain functionality, and digital reporting compliance. The primary outcomes were overall operational performance, session completion, vaccination delivery, and vaccine accountability. Secondary outcomes included facility-level performance, operational challenges, corrective measures, and implementation practices.

Demographic information

The programme dataset available for this implementation case study was aggregated and did not contain individual-level demographic variables such as age in completed years, residence, socioeconomic status, or school category for each vaccinated beneficiary.

The eligible programme population was adolescent girls targeted under the district HPV vaccination programme. Because individual-level demographic information was not available in the source records used for this analysis, no unsupported demographic values have been imputed or generated. This limitation is explicitly reported to maintain data integrity.

Vaccine accountability and data analysis

Vaccine accountability was assessed by comparing vaccine utilization recorded in eVIN with administrative vaccination records. A difference of zero indicated complete agreement between beneficiary records and eVIN utilization. Data were entered into Microsoft Excel and verified against district programme reports.

Descriptive analysis included frequencies, percentages, means, ratios, and facility-wise comparisons. Programme indicators were summarized using tables and figures. Because the analysis used programme-wide aggregated data rather than a sampled population, inferential statistical testing was not undertaken.

Quality assurance

Data quality was supported by cross-verification of district and block reports, validation of eVIN stock records, daily reconciliation of vaccine utilization, supervisory verification of session reports, review of documentation completeness, and regular district-level monitoring meetings.

Ethical considerations

The study used anonymized secondary programme data generated during routine implementation of the universal immunization programme. No identifiable personal information was collected or analysed. Administrative permission for analysis of programme records was obtained from the district health authorities. Because only de-identified aggregated programme data were used, individual informed consent was not required.

RESULTS

Overall programme performance

The district-wide HPV vaccination programme was implemented across Bareilly district through coordinated efforts of the health department, education department, and participating healthcare facilities. A total of 3,865 vaccination sessions were planned, of which 3,863 were conducted, corresponding to a session completion rate of 99.95%.

Overall, 25,276 adolescent girls received HPV vaccination during the implementation period. The average number of beneficiaries vaccinated per conducted session was 6.54. eVIN documented 24,897 vaccine doses utilized, giving an absolute difference of 379 doses, equivalent to 1.5% of the administrative vaccination count.

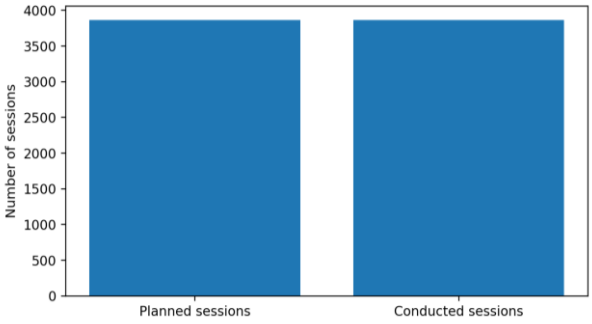

Figure 1: Planned and conducted HPV vaccination sessions.

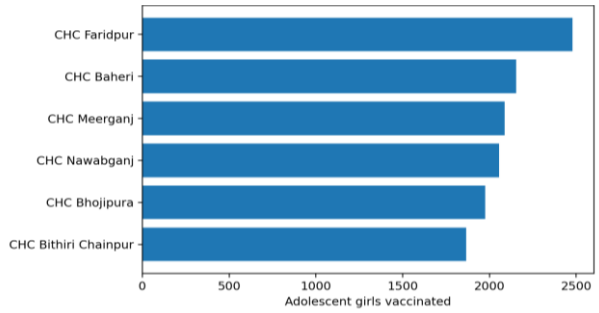

Figure 2: Highest-performing vaccination facilities.

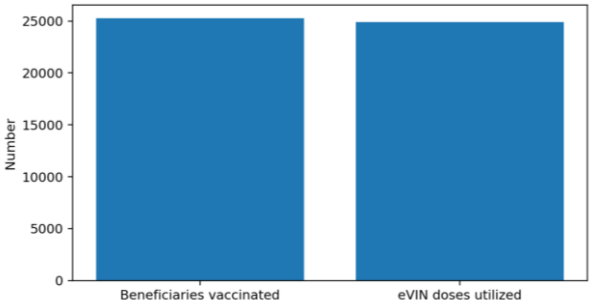

Figure 3: Administrative vaccination records compared with eVIN vaccine utilization.

Facility-level vaccination performance

CHC Faridpur recorded the highest number of vaccinated beneficiaries among participating facilities, followed by CHC Baheri, CHC Meerganj, CHC Nawabganj, CHC Bhojipura, and CHC Bithiri Chainpur.

Vaccine accountability

Facility-wise reconciliation between beneficiary records and eVIN demonstrated generally strong vaccine accountability. Several facilities, including CHC Faridpur, CHC Bhojipura, CHC Bhamora, PHC Ramnagar, and PPC Bareilly, showed complete agreement between administered doses and eVIN-recorded utilization.

Table 1: Overall programme performance indicators.

Indicators	Value
Planned vaccination sessions	3,865
Conducted vaccination sessions	3,863
Session completion rate	99.95%
Total beneficiaries vaccinated	25,276
Average beneficiaries per conducted session	6.54
eVIN vaccine doses utilized	24,897
Administrative–eVIN difference	379 (1.5%)

Table 2: Highest-performing vaccination facilities.

Rank	Health facility	Vaccinated beneficiaries
1	CHC Faridpur	2,478
2	CHC Baheri	2,154
3	CHC Meerganj	2,087
4	CHC Nawabganj	2,055
5	CHC Bhojipura	1,976
6	CHC Bithiri Chainpur	1,865

Table 3: Facilities with the largest reported reconciliation differences.

Facility	Difference between administrative record and eVIN
CHC Meerganj	−248
CHC Nawabganj	−241
CHC Baheri	−65
PHC MN Bux	−51
UPHC old city	+156
UPHC Aonla	+94
UPHC Bankhana	+41
UPHC Bakarganj	+40

Table 4: Performance indicators of CHC Faridpur.

Indicators	CHC Faridpur
Planned sessions	152
Conducted sessions	152
Session completion	100 %
Beneficiaries vaccinated	2,478
eVIN vaccine utilization	2,478
Difference	0

Table 5: District-level comparison of vaccination records and eVIN utilization.

Data sources	Value
Administrative vaccination records	25,276
eVIN vaccine utilization	24,897

Continued.

Data sources	Value
Absolute difference	379
Difference as proportion of administrative count	1.5%

Negative differences may reflect delayed stock reconciliation or reporting delays, whereas positive differences may reflect stock adjustments, vaccine wastage entries, or delayed beneficiary reporting. These discrepancies were reviewed through routine monitoring and reconciliation.

CHC Faridpur: model implementation site

CHC Faridpur demonstrated exemplary programme implementation. The facility conducted all 152 planned vaccination sessions, vaccinated 2,478 adolescent girls, and recorded 2,478 vaccine doses utilized in eVIN, resulting in zero difference between beneficiary records and eVIN utilization.

Administrative records and eVIN utilization

At the district level, 25,276 adolescent girls were recorded as vaccinated and 24,897 vaccine doses were recorded as utilized in eVIN.

DISCUSSION

This implementation case study documents the planning, execution, and operational outcomes of a district-wide HPV vaccination programme in Bareilly district, Uttar Pradesh. The programme demonstrated that HPV vaccination can be delivered through existing public health infrastructure using administrative leadership, intersectoral coordination, supportive supervision, and digital vaccine logistics monitoring. The campaign achieved a 99.95% session completion rate, vaccinated 25,276 adolescent girls, and maintained a 1.5% difference between administrative vaccination records and eVIN utilization. The near-complete implementation of planned vaccination sessions represents a major operational achievement. High session completion is consistent with effective district microplanning, coordination between the health and education departments, vaccine logistics, trained teams, and continuous monitoring. Published implementation experience indicates that school-based vaccination programmes benefit from accurate beneficiary identification, school engagement, trained healthcare workers, and regular monitoring.[9]

Vaccination of more than 25,000 adolescent girls within the implementation period demonstrates the operational feasibility of district-wide delivery using routine public health infrastructure. School-based delivery was complemented by outreach and mop-up activities to include absent and out-of-school beneficiaries. Evidence from international HPV vaccination programmes also supports school-based delivery as an effective approach for reaching adolescent girls.[10] Integration of eVIN was an important strength of the Bareilly programme. Digital vaccine logistics monitoring enabled tracking of utilization and reconciliation across participating facilities. The overall 1.5% difference between administrative vaccination records and eVIN utilization indicates strong accountability, while the facility-level discrepancies demonstrate the continuing need for routine reconciliation and supportive supervision. Earlier evaluations of digital vaccine logistics systems have similarly emphasized their value for stock visibility and supply-chain management.[7]

CHC Faridpur emerged as the highest-performing implementation site. The facility completed all 152 planned sessions, vaccinated 2,478 adolescent girls, and achieved zero difference between administrative beneficiary records and eVIN utilization. This performance suggests that strong local leadership, detailed microplanning, teamwork, accurate documentation, and coordination with educational institutions can support both high service delivery and strong vaccine accountability.

Community participation was also an important component of programme implementation. School principals, teachers, ASHAs, ANMs, Anganwadi Workers, parents, and community stakeholders contributed to beneficiary mobilization and communication. The programme's operational experience supports continued engagement of these groups as HPV vaccination expands.

The study has several strengths. It includes programme data from all participating government facilities in the district, uses administrative records together with eVIN data to assess vaccine accountability, and documents operational processes that may be useful to programme managers. However, the analysis has limitations. It relies on routinely collected administrative data, does not contain individual-level demographic or behavioural variables, and does not independently validate population coverage. It also does not evaluate vaccine effectiveness, long-term schedule completion, or beneficiary perceptions. Finally, the findings represent a single district implementation experience and should therefore be generalized cautiously.

Strengths and limitations

The principal strengths were district-wide implementation across 28 government facilities, very high session completion, integration of eVIN for vaccine accountability, strong health–education department coordination, detailed microplanning, and continuous supportive supervision. The principal limitations were reliance on routinely collected administrative data, absence of individual-level demographic and behavioural

information, lack of independent population-based validation of coverage, absence of vaccine-effectiveness assessment, and the single-district nature of the implementation experience.

Public health implications

District-level implementation using existing UIP infrastructure can achieve high operational performance when supported by governance, microplanning, school-health partnerships, community engagement, and digital monitoring. School-based vaccination combined with outreach sessions can help reach eligible adolescent girls, while digital logistics monitoring can facilitate reconciliation and timely corrective action.

CONCLUSION

The district-wide implementation of HPV vaccination in Bareilly district demonstrates that large-scale adolescent immunization can be integrated into the existing universal immunization programme through strong leadership, detailed microplanning, intersectoral collaboration, supportive supervision, and digital logistics monitoring. The programme achieved a 99.95% session completion rate, with 3,863 of 3,865 planned sessions conducted, and 25,276 adolescent girls vaccinated. The overall difference between administrative vaccination records and eVIN utilization was 1.5%.

CHC Faridpur emerged as a model implementation site by completing all 152 planned sessions, vaccinating 2,478 girls, and maintaining zero difference between beneficiary records and eVIN utilization. The Bareilly experience provides practical implementation lessons for other districts planning HPV vaccination through routine public health systems.

Recommendations

HPV vaccination should continue to be strengthened through routine immunization services, with sustained digital vaccine logistics monitoring, regular review meetings, supportive supervision, healthcare-worker training, school-health partnerships, periodic data-quality audits, and operational research on vaccine acceptance, cost-effectiveness, and completion of vaccination schedules. The implementation practices demonstrated at CHC Faridpur may be considered for adaptation in other districts.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Gautam A, Ranjan P, Yajurvedi V, Shrivas R. Strengthening cervical cancer prevention through district-wide HPV vaccination: an implementation case study from Bareilly district, Uttar Pradesh, India. Int J Res Med Sci 2026;14:4667-73.