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IMPLEMENTATION PLAN FOR IMMUNOCHROMATOGRAPHIC TESTS IN PAPANICOLAOU FOR THE IDENTIFICATION OF HIGH-RISK VIRUSES, HEALTH FACILITIES 2025

Adán Joél Villanueva Sosa

Doctorate in Public Management and Governance, Lambayeque, César Vallejo University, mail Id: avillanuevaso@ucvvirtual.edu.pe , ORCID Id: 0000-0001-5784-6929

ABSTRACT

The co-occurrence coefficients indicate high relationships between different concepts in the data. The perfect associations (coefficient of 1.00) suggest that such pairs as low-cost community approach benefits and community approach benefits, urgent testing changes and speed of testing were always mentioned jointly. Furthermore, the terms multidisciplinary training coincides with interprofessional coordination difficulties and partial self-perception of competence is associated with the need to update professionally. The moderate correlations (0.50) indicate that there are significant associations between such items as "diagnostic support benefits" and the concept of workload reduction, and many of the training themes and problems faced by institutions that demonstrate the difficulty of the implementation of effective testing practices.

KEYWORDS: Cervical cancer screening, High-risk human papillomavirus (HPV), Immunochromatographic tests, Papanicolaou (Pap smear), Low-resource health settings, Public health implementation

INTRODUCTION

Cervical cancer is one of the health issues that women are facing in most parts of Latin America that have proved to be a disease that is mainly preventable (Eraso et al., 2026). Every year the region has an estimated 63,068 cases and more than 29,222 deaths, with women of disadvantaged socio-economic and geographic backgrounds being disproportionately affected (Chipana Díaz et al., 2025) (Chipana et al., 2025; WHO, 2025). The burden of the disease does not only indicate health issues but also structural inequalities in the access to prevention and early diagnoses services.

Boussettine et al. (2026) Cervical cancer is mainly caused by chronic infection with high-risk Human Papillomavirus (HPV) which is a preventable disease through proper screening and vaccination methods. The scientific community is sure of the fact that the use of conventional cytology and HPV testing can detect precancerous lesions long before the symptoms appear (Thong et al., 2026). The ESTAMPA trial, which was conducted by the International Agency on Research on Cancer (IARC), showed that molecular testing was more sensitive than cytology and has a higher chance of decreasing disparities in detecting cervical cancer in Latin America (Baena et al., 2025; Joshi et al., 2025).

Nevertheless, the presence of screening tools does not mean successful access. In other nations such as Peru, the rate of screening coverage is very low especially in rural, Amazon, or high-Andean regions or in poor populations (Móstiga et al., 2025). Khan et al. (2025) has also demonstrated that a good percentage of women get screened after one instance in their lifetime, which puts them at a higher risk of late detection and preventable deaths. Indeed, almost 80% of cases of cervical cancer diagnosed in Peru are at advanced stages, seriously decreasing the likelihood of the chance of cure (Gonzales Mariluz & Ruiz Saavedra, 2025).

This research can be added to the new literature on the use of context-specific innovations in HPV detection (Gomes et al., 2025). It is aimed at the execution of the immune chromatographic tests of high-risk HPV genotyping with the utilization of Papanicolaou samples within health establishments in Jaen, Peru (Rol et al., 2022). These cost-effective, fast screening methods are a good alternative to address structural challenges of geographic remoteness, limited laboratory facilities, and lack of trained data operators, which hamper the effectiveness of conventional screening in resource-constrained settings based on cytology (Yadav et al., 2022).This study is important because it can inform the development of equitable and scalable cervical cancer prevention. This study is in line with the Sustainable Development Goals (SDGs), in particular, SDG 3 (Good Health and Well-being), SDG 5 (Gender Equality), and SDG 10 (Reduced Inequalities) by examining the viability, acceptability, and practical applicability of point-of-care HPV testing in a high-burden area (Perkins et al., 2026). It will assist in health policy and practice by offering evidence of a more inclusive, effective, and timely way of cervical cancer screening, one that would reach underserved women and enhance the level of public health surveillance at the primary care level.

METHODOLOGY

This is a qualitative, practical research that utilized a multiple case study design to determine the institutional factors, resources available, and perception of the healthcare professionals in the application of immunochromatographic tests on Papanicolaou sample in detecting high-risk HPV in health facilities in Jaen, Peru. The analysis was based on four central categories, which are situational diagnosis, professional acceptance and adequacy, implementation plan design, and expert evaluation (Ramadan et al., 2026).

The participants were divided into frontline health personnel (general practitioners, obstetricians, medical technologists) and administrative staff, who were chosen using a purposive sampling technique with maximum variation in healthcare level (I, II, III). The theoretical saturation was used to determine the sample size. Semi-structured interviews were conducted using a non-premeditated instrument that adhered to ad hoc interviews as reviewed by experts and tested through cognitive piloting were used in collecting the data.

Analysis of the transcripts was conducted with the help of ATLAS.ti 9 through a three-step process open coding, axial coding, and thematic synthesis. A qualified panel rated the proposed implementation plan on the basis of qualitative rating tool of relevance, feasibility, and applicability. Quantitative measures (AIPenny V, Kendall W) were used to supplement the content validation where possible. The ethical considerations were followed according to the Cesar Vallejo University and Peruvian Ministry of Health rules, including voluntary and anonymous participation and an informed consent.

RESULTS

The results of this work were obtained due to the qualitative analysis of the interviews with healthcare workers in Jaen. A comparison was done through ATLAS.ti version 9 after an open and an axial coding procedure. The semantic networks were created to understand the connection between the codes and categories by relying on the narratives of the participants.

Open Coding

An in-depth review of the interview transcripts led to the identification of 84 codes related to the implementation of immunochromatographic tests for detecting high-risk HPV in Papanicolaou samples. The relevance of these codes was assessed using two indicators: grounding (frequency of code appearance) and density (number of connections between codes).

The code usefulness - rapid detection obtained the greatest grounding (9) and was densified with 5 scores, which means that the speed of diagnosis was a repetitive and intertwined code. Other codes that were mentioned frequently were professional development benefits, early detection benefits and teamwork benefits (Raffuzzi et al., 2026).

The training codes (general training, protocol training, sample collection training) and the codes associated with professional competence (self-perceived competence, previous experience) showed how all participants focused on the correct staff preparation in terms of the test implementation. The codes that had low grounding (less than 2) were summarized as they had low descriptive weight.

Axial Coding

The code usefulness - rapid detection obtained the greatest grounding (9) and was densified with 5 scores, which means that the speed of diagnosis was a repetitive and intertwined code (Lee & de Weck, 2026). Other codes that were mentioned frequently were professional development benefits, early detection benefits and teamwork benefits.

The training codes (general training, protocol training, sample collection training) and the codes associated with professional competence (self-perceived competence, previous experience) showed how all participants focused on the correct staff preparation in terms of the test implementation. The codes that had low grounding (less than 2) were summarized as they had low descriptive weight.

Inferential Analysis

Table 2 and Figure 3 show co-occurrence coefficients of two codes generated as a result of the qualitative analysis based on the ATLAS.ti, showing their relationship with each other in the discourse of the participants. It is important to note that a coefficient of 1.00, would mean that there is a perfect co-occurrence, in that, some of these concepts were always mentioned in the same sections of the text. Particularly, perfect relationships were found between low-cost community approaches and community approach benefits, and urgent testing changes and test speed. Also, the problem of interprofessional coordination was ideally correlated with the concept of multidisciplinary training, whereas the concept of cognitive biased view of ability was associated with the necessity of professional updating. These findings highlight the interrelations that exist between certain concepts used by participants. Regarding moderate correlations based on the coefficient of 0.50, the analysis revealed the relationships between the support benefits of diagnostics and a less workload and between thoroughness and urgent testing changes and test speed. The other moderate co-occurrences were training themes e.g., false result management protocol training and sample collection training coupled with institutional variables such as professional resistance compatibility and team disarticulation problems. This brings out the significance of the interaction of training needs, organizational structure and operational issues in the application of the test.

Table 1: Co-occurrence Coefficients Between Code Pairs

Code X – Code Y	Coefficient
Low-cost community approach benefits – Community approach benefits	1.00
Urgent testing changes – Speed of testing	1.00
Multidisciplinary training – Interprofessional coordination difficulties	1.00

Partial self-perception of competence – Need for professional updating	1.00
Diagnostic support benefits – Reduced workload	0.50
Thoroughness – Urgent testing changes	0.50
Thoroughness – Speed of testing	0.50
Protocol training for false result management – Sample collection training	0.50
Timing training – Sample transport training	0.50
Professional resistance compatibility – Team disarticulation difficulties	0.50

Note: This table was generated from the co-occurrence analysis in ATLAS.ti, using the software's built-in co-occurrence coefficient. Only associations with coefficients equal to or greater than 0.40 and with relevant co-occurrence frequencies are shown, as these were considered analytically significant for the study.

The co-occurrence coefficients indicate high relationships between different concepts in the data. The perfect associations (coefficient of 1.00) suggest that such pairs as low-cost community approach benefits and community approach benefits, urgent testing changes and speed of testing were always mentioned jointly. Furthermore, the terms multidisciplinary training coincides with interprofessional coordination difficulties and partial self-perception of competence is associated with the need to update professionally. The moderate correlations (0.50) indicate that there are significant associations between such items as "diagnostic support benefits" and the concept of workload reduction, and many of the training themes and problems faced by institutions that demonstrate the difficulty of the implementation of effective testing practices.

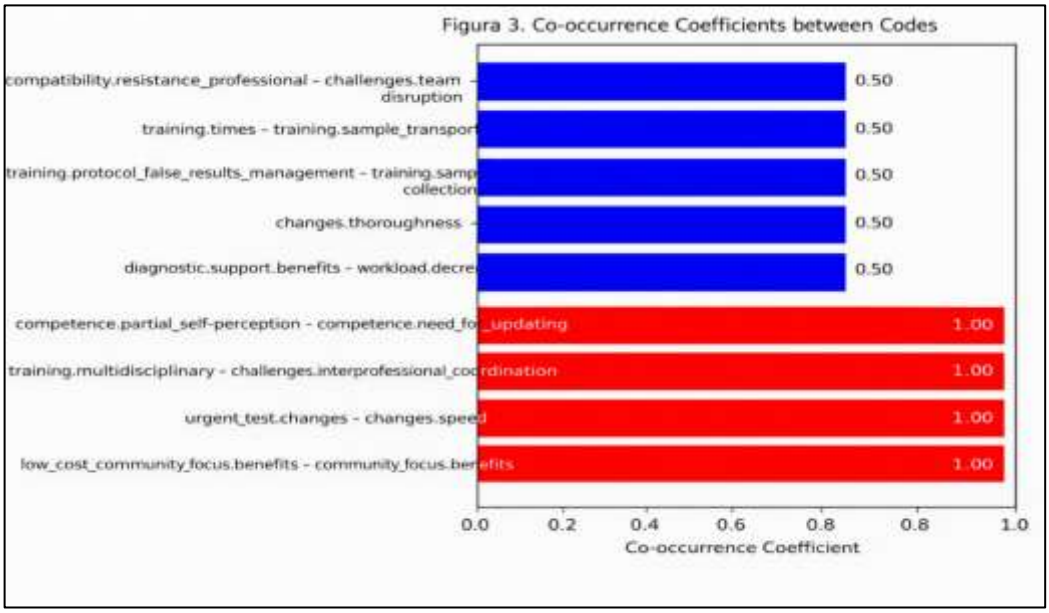

Figure 1 Co-occurrence Coefficients Between Codes in Qualitative Analysis

The willingness and acceptability to adopt the test will be influenced by a complex of interdependent organisational, operating and professional processes which are united by primarily the same motif of professional satisfaction (Meng, 2026). The fact that the introduction of the immunochromatographic test does not lead to a significant change in the current practice and does not create additional workloads is an aspect contributing to a favorable attitude of the health professionals. The impression lessens the oppositions against change and maintains the stability of the working patterns.

The compatibility of the institution and the practicality of the test in regard to its operational costs are also justified by the possibility of technological adaptation and the ease of applying it to the existing workflow and strengthening positive attitudes to its use. These operation enablers are vital in ensuring a high level of acceptability.

Also, there are perceived professional benefits including the professional growth and recognition, enhanced teamwork which directly influence professional satisfaction. These gain advantages to a favorable approach to the adoption of the test.

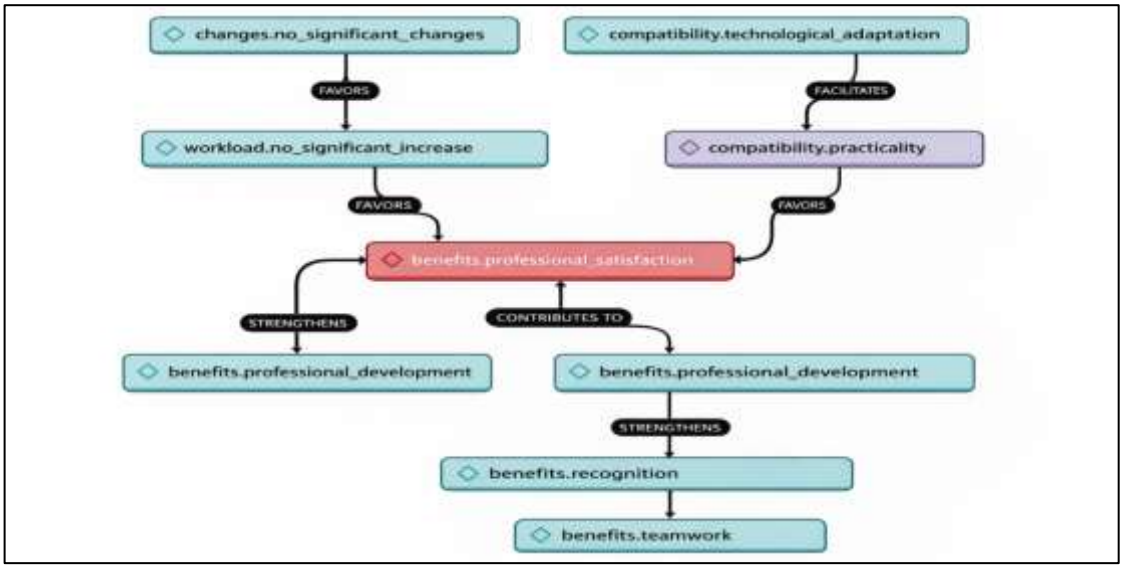

Figure 2 Semantic Network of Acceptability and Willingness to Adopt the Test

Early detection has a direct influence on the rate of diagnosis strengthening the perceived usefulness of the test on timely diagnosis (Karmakar et al., 2026). This is a high turnover rate that is accompanied by the enhancement in patient care and this is an indication that the capacity to get prompt results is connected with more effective and timely clinical services. Better care, in turn, will make the diagnostic support better, cementing the feeling that the test does not only simplify the processes but also makes clinical decision-making firmer. This implies that the perceived benefits are not limited to the operational concerns but rather the test is incorporated as an effective means of profession diagnostic assistance. The relationships noted indicate that these perceived benefits are constructed in a cycle and consecutive way starting with the availability of clinical significance, early detection, the speed of diagnosing, better care, and finally to diagnostic help. This development is an extensive view of the usefulness of the test in clinical practice.

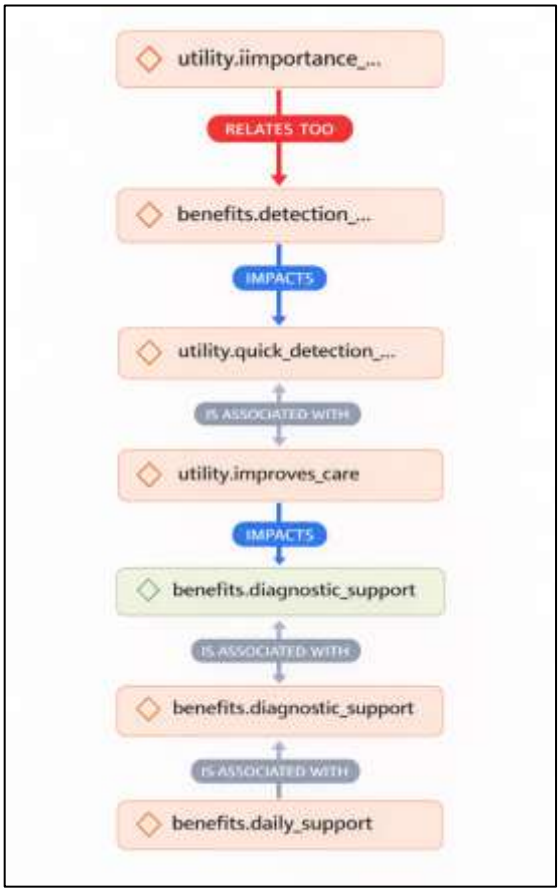

Figure 3 Semantic Network of Perceived Benefits of Implementation

Early detection has a direct influence on the rate of diagnosis strengthening the perceived usefulness of the test on timely diagnosis. This is a high turnover rate that is accompanied by the enhancement in patient care and this is an indication that the capacity to get prompt results is connected with more effective and timely clinical services (Hsu et al., 2026).

Better care, in turn, make the diagnostic support better, cementing the feeling that the test does not only simplify the processes but also makes clinical decision-making firmer. This implies that the perceived benefits are not limited to the operational concerns but rather the test is incorporated as an effective means of profession diagnostic assistance (Raheja et al., 2026). The relationships noted indicate that these perceived benefits are constructed in a cycle and consecutive way starting with the availability of clinical significance, early detection, the speed of diagnosing, better care, and finally to diagnostic help. This development is an extensive view of the usefulness of the test in clinical practice.

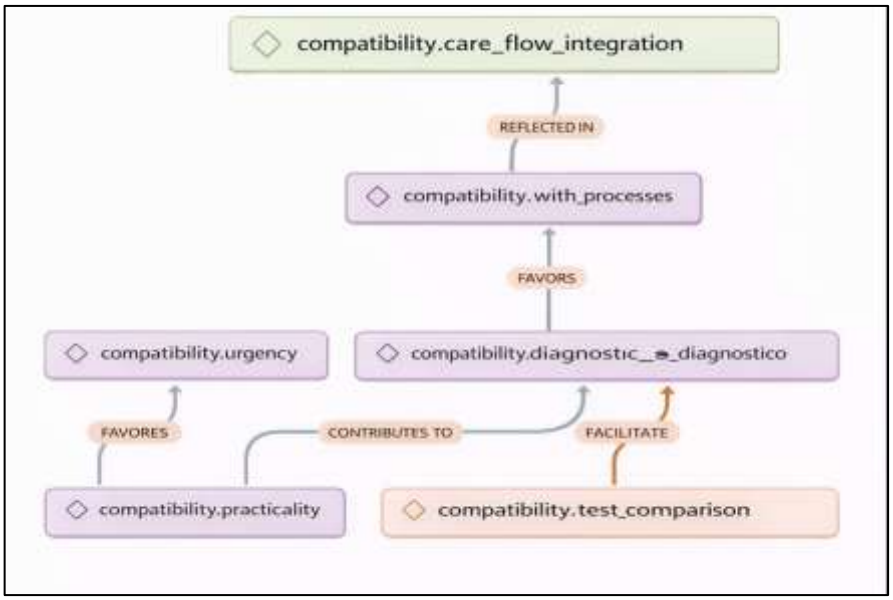

Figure 4 Semantic Network of Institutional Compatibility and Resources

The skills and training to apply the test is a step-by-step process, which incorporates the previous knowledge, the work experience, and the systematic training. Knowledge of quick tests is a factor that leads to the creation of previous experience, and ease of the process helps that experience, establishing a first working base among the medical community. Clinical capacity is increased by prior experience that is directly supported by basic procedure training (Carvalho et al., 2026). This training is supported by theoretical-practical education, which is arranged according to a particular protocol, and it allows standardizing the application of the test. The development of protocols also contributes to minimizing the challenges of managing false outcomes, as it proves that systematic training, besides reinforcing clinical competencies, also allows reducing the risks of operations in the implementation process to a minimum.

The acquisition of the competencies is not based on a simple knowledge of an individual but the overall training procedure which incorporates the experience, the essential teaching, the theoretical-practical education, and the unambiguous guidelines. (Figure 5)

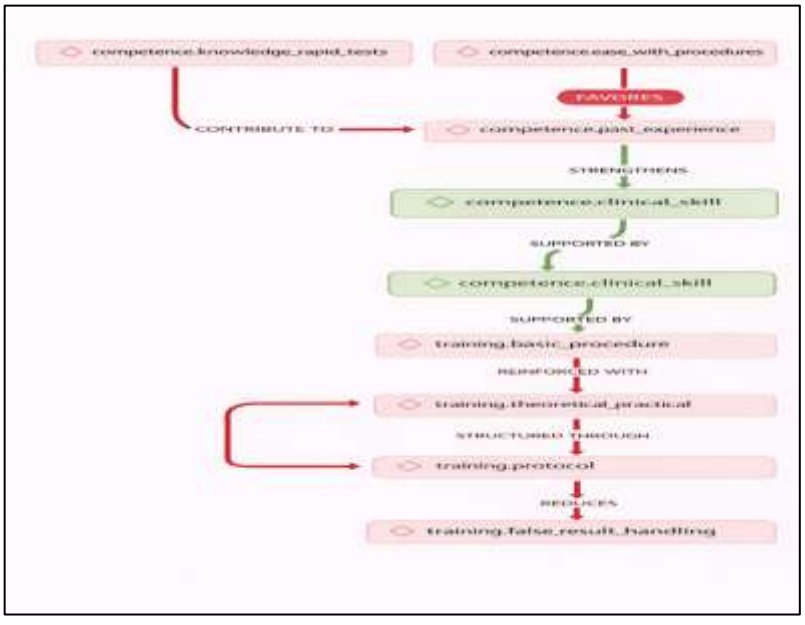

Figure 5 Network on Required Competencies and Training

An integrated chain includes operational and institutional problems that include updating of the professional, resistance to change, and workload, all of which have a direct impact on the test implementation. The lack of training is one of the

reasons of resistance in the staff, and the perceived workload makes the coordination and integration of the team more complex. Poor sample handling is also associated with limited training that increases the chances of false results and also operational errors (Essuman et al., 2026). The two issues illustrate the tight integration between the technical and educational aspects. Finally, the results indicate that barriers to implementation are not isolated but rather a series of events of training, support and institutional preparedness gaps. (Figure 6)

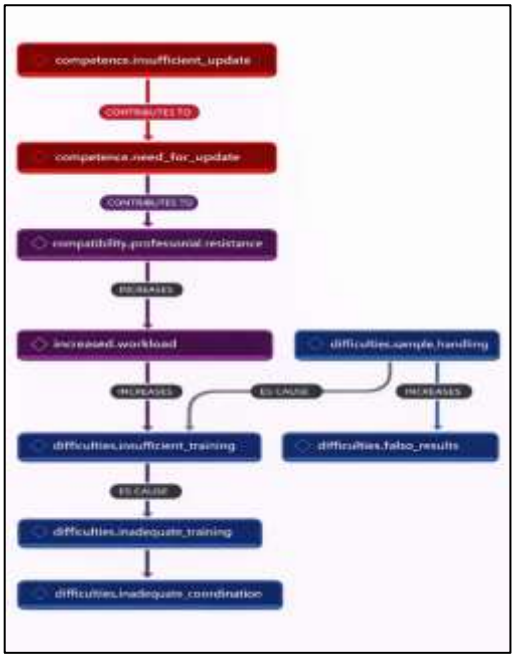

Figure 6 Network on Operational and Institutional Challenges

The resulting effect on the health and care services of the population is determined by the gradual implementation of the test and its related advantages which result in a growth of services and better care. The initial practices are adopted to help drive the growth of the services, as there is a dual advantage of institutional and user-level effects. Expansion of services increases the quality of care, especially by increasing capacity to diagnose. Low price of the test makes it sustainable and accessible and is aligned to a community-based strategy that expands coverage and serves underserved communities. These results indicate that the effect of the public health impact can be realized due to a series of adoption, service growth, better care, and affordability factors that facilitate larger and community-based delivery of healthcare. (Figure 7)

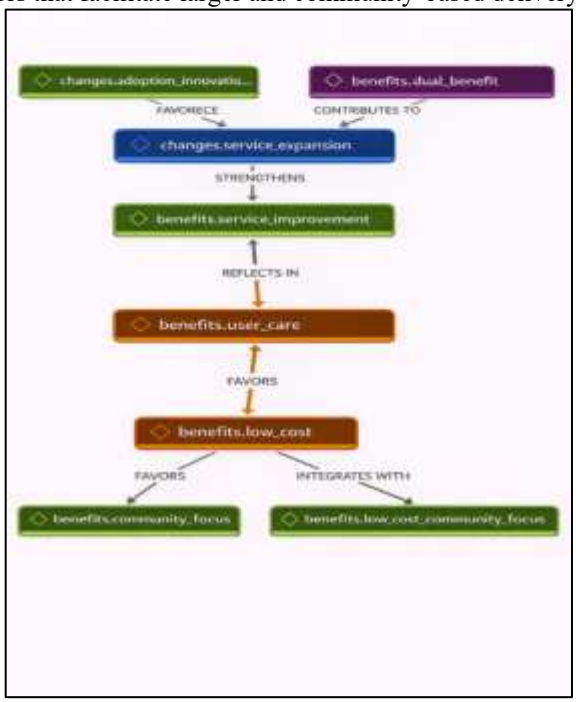

Figure 7 Impact on Public Health and Services

DISCUSSION

The implementation of immunochromatographic tests for high-risk HPV detection in Papanicolaou samples represents a strategic response to the persistent gaps in cervical cancer screening in Peru, particularly in underserved regions like Jaén.

Despite cervical cancer being preventable, low screening coverage and late diagnoses remain critical issues (do Carmo et al., 2026). Although cervical cancer can be prevented by efficient screening and vaccination, this disease remains a significant population health problem, especially in low-resource environments. The low screening coverage rates and the large percentage of late-stage diagnoses are critical issues that flaw any attempts at decreasing mortality (Yu et al., 2026). Women are in most instances screened once in their lifetime, which predisposes them to incidences of late diagnosis and the low chances of survival (Alatise et al., 2026). Latin American and African research highlight that better access to screening and early diagnosis instruments is urgently required to decrease the cervical cancer burden and close healthcare disparities (Boussettine et al., 2026; do Carmo et al., 2026).

This study highlights that rapid, low-cost tests are not only operationally feasible but also highly valued by healthcare professionals for their speed and diagnostic utility. Low-cost diagnostic tests are rapidly being considered as key instruments to improve health care delivery particularly in low resource environments (Mansour et al., 2026). Acosta et al. (2026) these tests are being appreciated due to their affordability as well as the ability to operate, high turnaround times, and the quality of diagnosing. Medical workers are happy with the fact that they are easy to integrate into the current work procedures without seeking sophisticated infrastructure (Polat, 2026). The World Health Organization has highlighted the need to use rapid, sensitive and simple diagnostics to enhance early disease detection (Organization, 2020). In cervical cancer screening, especially, such tools can bridge the access gaps and minimise late-stage diagnosis to ensure early interventions and improved health outcomes (Omolo & Janapati, 2026). Their compatibility with existing workflows encourages adoption without disrupting care routines.

Successful implementation of tests relies on structured training and standardized protocols, with professional acceptance influenced by perceived benefits like teamwork and job satisfaction (Kudabayev et al., 2026). Operational barriers such as inadequate training and coordination must be systematically addressed. The public health impact involves enhancing access to early detection and reducing health inequities (Luke et al., 2026; Periyasamy et al., 2026). A phased pilot approach facilitates controlled rollout and adjustments based on feedback. Long-term success requires supportive health policies and an equity-focused strategy for sustainable integration into cervical cancer prevention programs.

Practical Implications

- The Ministry of Health may start with pilot studies that can be controlled to examine the diagnostic qualities and feasibility of immunochromatographic tests and adopts mixed-methods research design to merge qualitative and quantitative data with each other. This method will increase the knowledge of the effectiveness of screening and guarantee the contextual relevance.
- Introduce organized training in the field of the healthcare personnel working with the cervical screening and formulate official protocols on the use of immunochromatographic tests. The protocols must include usage criteria, referral pathways and quality control measures that will enhance test acceptance and decrease mistakes in operating the test.
- Focus more on incorporation of immunochromatographic tests in primary care centers in rural or high-vulnerability locations. Check to make sure that logistical and financial sustainability is evaluated prior to mass adoption, with the emphasis made on ensuring that there are stable supply chains and that the tests should be included in the routine prevention program budgets.

CONCLUSION

Immunochromatographic assay in high risk HPV detection in Papanicolaou samples is a practical and effective intervention that can be applied to mitigate loopholes in cervical cancer screening in low-resource, such as Jaen in Peru. Healthcare professionals find the tests to be of great value because they have rapid diagnostic power, can be operated effectively and are cost effective. The structured training, set protocols, and institutional fit are closely related to their successful adoption. Even though professional motivation and integration facilitate acceptance, issues concerning training gaps, team coordination and institutional preparedness have to be dealt with persistently. Finally, the research highlights the possibility of such tests to shorten diagnostic delays, enhance the quality of care, and facilitate the equitable provision of people with health services, particularly those who are underserved. They should be incorporated into national screening so that the battle against cervical cancer in Peru and other related scenarios could go a long way.

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