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Barriers and Facilitators of Programmatic HPV Testing: Lessons Learnt From Two In-Depth Provincial Case Studies Ten Years After the Jujuy Demonstration Project in Argentina

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Abstract

Introduction: Achieving the global goal of cervical cancer elimination faces major challenges, particularly in ensuring the large-scale and sustained implementation of proven technologies. In Argentina, HPV testing as primary screening was introduced through the Jujuy Demonstration Project (JDP) in 2012. The aim of this study is to analyze barriers and facilitators of the implementation of HPV testing in two provinces—Jujuy, and Catamarca—a decade after the JDP's completion. **Methods:** We carried out a descriptive in-depth case study using a mixed-method approach, using qualitative and quantitative methods. Data were collected through participant observations in health services, semi-structured interviews with key informants, analysis of secondary sources, and program indicators. Barriers and facilitators were analyzed using an adapted Health System Framework focusing on four key dimensions: stewardship, organizational capacity, financing, and technology. **Results:** Regarding stewardship, reduced technical support and monitoring from the National Program emerged as significant barrier. About financing, the most critical obstacle was the national interruption in the provision of HPV tests. Although both provinces have initiated procedures to purchase tests using provincial funds, this process was constrained by limited financial resources and competing priorities. Finally, regarding organizational capacity, challenges persisted in maintaining laboratory centralization, sustaining the offer of self-collection, and fully utilizing information systems for program monitoring. Facilitators related to stewardship included the stability of human resource in both provinces and the long-standing institutional recognition and leadership of provincial program staff. Sustained adherence to national guidelines and the existence of provincial resolutions were key enablers of continuity. In addition, acceptability of the technology remained high, with HPV testing continuing to be widely accepted in both provinces. **Conclusions:** Our findings reveal barriers and facilitators in the implementation ten years after JDP finalization, providing valuable lessons for scaling up HPV-based screening in national cancer control programs.

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Plain Language Summary

Cervical cancer can be prevented through effective screening. Testing for human papillomavirus (HPV) is one of the most effective methods available. In Argentina, HPV testing was first introduced in 2012 through the Jujuy Demonstration Project, which helped expand this strategy nationwide. However, maintaining screening programs over time can be challenging, particularly when resources and support change. This study describes barriers and facilitators of HPV testing implementation in two Argentine provinces, Jujuy and Catamarca, 10 years after the original project ended. We used different sources of information, including interviews with health professionals and authorities, observations in health services, program documents, and screening indicators. The study found that stable health teams, strong leadership from provincial program staff, and adherence to national screening guidelines helped sustain HPV testing. However, reduced technical support and monitoring at the national level were challenges. A major difficulty arose when the national supply of HPV tests was disrupted in 2023, forcing provinces to purchase tests with their limited resources. Despite these challenges, HPV testing remains widely accepted by health care providers and is the preferred screening method in both provinces.

Keywords

implementation, HPV, Argentina, cervical cancer, screening- health system framework

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Introduction

Each year, approximately 662,000 women are diagnosed with cervical cancer (CC), and 340,000 die from the disease, with nearly 80% of these deaths occurring in low- and middle-income countries (LMICs).[1] Despite advances in prevention and treatment, CC also persists as a significant public health problem globally where disparities in access to screening, diagnosis, and treatment continue to affect vulnerable populations disproportionately.

Over the past two decades, human papillomavirus (HPV) testing has evolved as an alternative screening method for CC prevention.[2] HPV testing has a high sensitivity and negative predictive value, thus women without HPV infection are at very low risk of cervical cancer and do not need screening for at least 5 years after being tested negative.[3,4] In addition, HPV testing allows for sample self-collection, which is effective in increasing screening uptake.[5,6] These features have made HPV testing the preferred tool for CC screening, that in combination with HPV vaccination, could accelerate CC elimination.[7]

However, implementation of the CC elimination strategies faces significant challenges, particularly regarding the large-scale population-based roll-out of HPV testing.[8-11] Multiple barriers can hinder the implementation of HPV-based screening, including insufficient political commitment,[10] unstable financing,[8,10,11] lack of organizational capacity and resources,[8] and low acceptability of the HPV test among either the target population or the healthcare providers.[9] While these elements are often well-supported in pilot or controlled studies,[12,13] they tend to weaken during programmatic scale-up.[8] This is especially critical in LMICs[8,10,11,14] where unstable political environments, frequent budget constraints, and under-resourced health systems, significantly restrict access to effective screening, timely diagnosis, and appropriate treatment.

In Argentina, HPV testing as primary screening was introduced through the Jujuy Demonstration Project (JDP),[12,13] a population-based study carried out between 2012-2014 to evaluate large-scale programmatic introduction of HPV testing. The JDP had high levels of political, technical and financial support from national and provincial authorities. The evaluation of the JDP showed that, relative to cytology screening, the introduction of HPV test doubled CIN2+ detection rates and also showed improvements in program quality indicators.[12] The results of the JDP were the basis for the programmatic incorporation of HPV test for routine primary screening nationwide (Res. N° 2381/2015). In 2015, the strategy was scaled-up in four additional provinces (Catamarca, Misiones, Neuquén, and Tucumán). At present, 14 out of 24 provinces in Argentina have implemented HPV-testing in the public health sector.

Analyzing the scale-up of HPV testing under real-world conditions is essential to assess the sustainability of cervical cancer prevention strategies. The aim of this study is to analyze barriers and facilitators of the implementation of HPV testing in two Argentine provinces—Jujuy, where the JDP was initially implemented, and Catamarca, which adopted the strategy in 2015. By comparing these settings, a decade after the JDP's completion, we identify which components of the original intervention were maintained, adapted, or discontinued, and how these components act as barriers or facilitators to implementation, providing insights for countries seeking to integrate HPV testing into national screening programs.

Methodology

Study Design

We carried out a descriptive study using a mixed method approach involving quantitative and qualitative evaluations of the programmatic implementation of HPV test guided by the Health System Framework. Mixed methods designs have been increasingly utilized to identify and overcoming barriers to implementation[15,16] as qualitative methods allow a deep understanding about barriers and facilitators of the implementation,[17] while quantitative methods allow for measurement of program outcomes. In this study, we will integrate quantitative and qualitative methods in multiple ways and follow Greene's typology of mixed-methods for convergence and complementarity.[18]

We carried out a descriptive in-depth case study in the two selected provinces. The case study approach is particularly useful when there is a need to obtain an in-depth appreciation of an issue, event, or phenomenon of interest, in its natural real-life context.[19] We considered the JDP implementation as a model to analyze the implementation of HPV testing in two different contexts ten years after its completion. This analysis is key to understanding which aspects have been maintained and which have been modified a decade after the programmatic implementation of the strategy.

To describe our case studies, we used a mixed-method approach involving quantitative and qualitative methods in multiple ways. We carried out participant observations during facility visits, guided by a structured Checklist. This tool enabled the systematic collection of data on the organizational capacity of screening, diagnosis, and treatment services (quantitative/qualitative method). Semi-structured interviews were conducted with key stakeholders involved in CC prevention. The data collected through the interviews complemented the information obtained during participant observations to complement data (qualitative methods). We also reviewed secondary sources, including program reports (n = 2), provincial resolutions (n = 2), and materials used by the provincial program during trainings or meetings with healthcare providers (qualitative methods). Finally, we carried out a retrospective analysis of routine data to report program indicators of screening, diagnosis and treatment (quantitative methods).

Conceptual Framework

An adaptation of the Health System Framework (HSF) guided the analysis of the barriers and facilitators of the implementation (Figure 1).[20-23] This adaptation of the HSF has already been used to evaluate the implementation process of the JDP in Argentina.[13] The HSF integrates six functions, or building blocks (service delivery, health workforce, information, technology, funding, and stewardship) that influence system performance.[20] We have re-configured and simplified these functions to incorporate an organizational dimension, which is a key factor for CC prevention program effectiveness.[24] The main adaptation involved consolidating three building blocks — service delivery, health workforce, and health information — into a single dimension called Organizational Capacity. Workforce availability, training, task allocation, and supervision were found to directly shape how screening services were organized and delivered, making it difficult to analytically disentangle human-resource from service delivery performance in practice. This integrated dimension further enables a comprehensive assessment of each key level of an organized program — including laboratory services, primary care, diagnosis, and treatment — capturing the operational functioning of each level in its entirety. Health information systems are incorporated as a sub-dimension within Organizational Capacity, given their foundational role in the monitoring and evaluation of service provision within organized screening programs. Combining these three building blocks under a single dimension allowed us to capture organizational functioning as a coherent and integrated operational domain. Thus, this adaptation presents four blocks (dimensions) instead of the original six, with specific sub-dimensions, as follows:

a. ***Stewardship:*** refers to the policy environment in which the implementation of a health strategy is made possible.[25] We included information regarding leadership and coordination, regulation (guidelines and legislation) and accountability (monitoring and evaluation activities).
b. ***Funding:*** implies availability of sustainable funding for the strategy.[20]
c. ***Organizational capacity:*** refers to the capacity of the health system to implement an intervention in all stages of the screening/diagnoses/treatment continuum, including facilities and health workforce; availability of health information systems, and monitoring and evaluation.
d. ***Technology/*strategy:** refers to access to essential medical products/vaccines/technologies and their scientifically sound and cost-effective use. In this analysis we considered the subdimensions of acceptability and consensus about the effectiveness of the strategy.

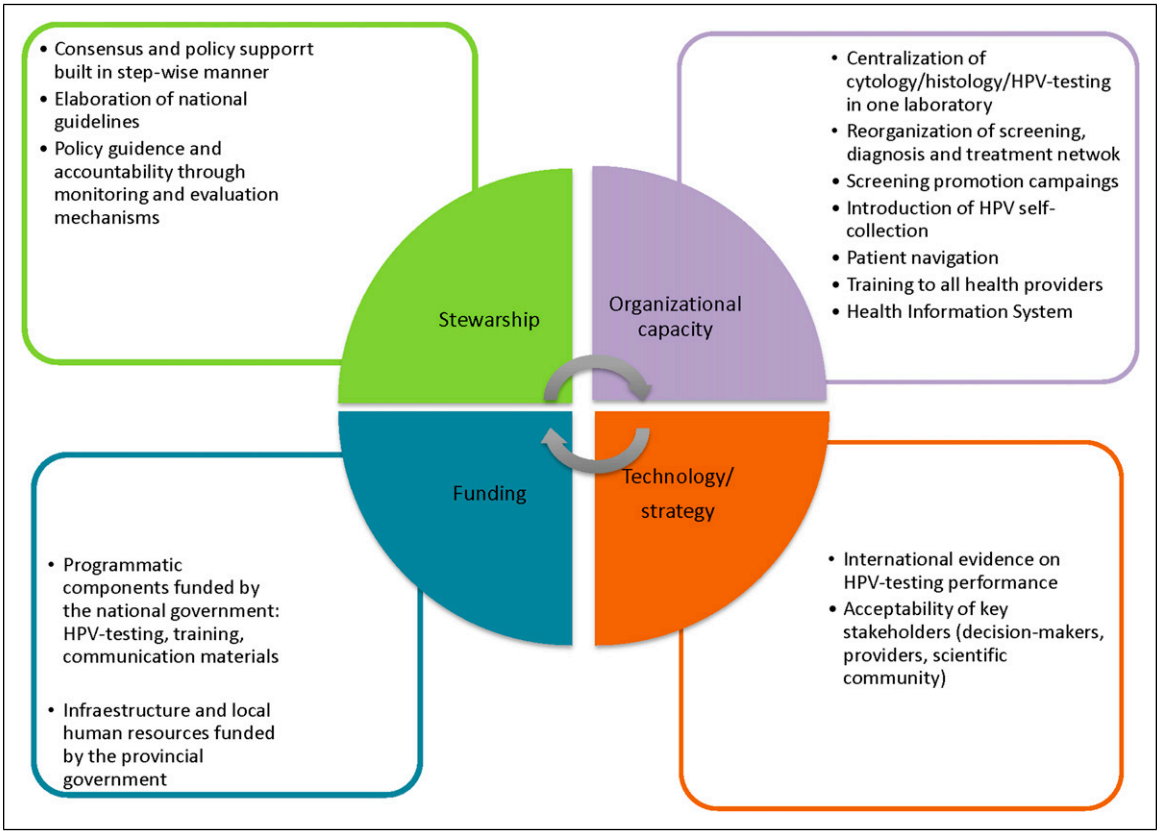

Figure 1. HSF for analysis of cervical cancer prevention.Source: Adapted from Arrossi et al., 2021[9]

Setting

Argentina is a democratic, federal country comprising 24 provinces, each of which is an autonomous entity responsible for the organization, management and financing of the provincial health system. Among other activities, the National Ministry of Health provides a regulatory framework for health care provision and training and financing for specific programs through nationally and internationally funded programs. Provincial health ministries can choose whether or not to adhere to the proposed national health programs or activities; their adherence mainly depends on formal agreements in which responsibilities and funding are negotiated.

Jujuy and Catamarca are located in Northwest Argentina. Jujuy has around 818,000 inhabitants. The 51% are women and among them 225.000 are 30 or older.[26] 85% of its population lives in urban areas and 46% of households are poor.[27] Catamarca has around 430.000 inhabitants. The 50% are women and among them, 120.000 aged 30 or older.[26] The 70% of its population lives in urban areas and 46% of households are poor.[27]

As mentioned before, in Jujuy, the HPV test was introduced through the Jujuy Demonstration Project (JDP).[12,13] In Catamarca, HPV testing was introduced in 2015 in a programmatic context. Catamarca was selected for the analysis because it was one of the first provinces to incorporate HPV testing after the JDP and presented organizational characteristics that differed from those of Jujuy's health system. For example, Catamarca does not have an extensive network of community health workers and centralizes diagnostic and treatment services. These characteristics made it an interesting case for comparison with Jujuy. Its early adoption and operational readiness made it a relevant setting for evaluating the replicability and sustainability of the JDP model under real-world conditions. The scaling-up in Catamarca was carried out by the provincial programs through joint work with the team of the National Cervical Cancer Prevention Program (NCCPP). The phases of HPV testing implementation in Argentina are shown in Figure 2.

Data Collection

We carried out participant observations during facility visits, guided by a structured Checklist. This Tool Enabled the Systematic Collection of data on the Organizational capacity of screening, diagnosis, and treatment services. The visits to

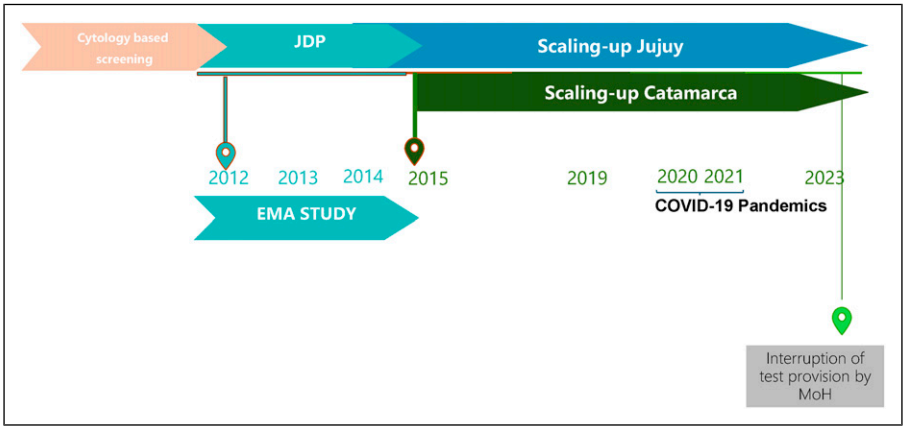

Figure 2. Phases of HPV implementation in Argentina

Catamarca and Jujuy took place from August 27 to 29, 2024, and from September 16 to 18, 2024, respectively. Three female researchers with experience in implementation cervical cancer screening programs (SA, MP, and RL) visited the HPV laboratories (one in each province); diagnosis and treatment units at referral hospitals (two per province); and primary health care (PHC) centers (two per province, one urban and one semi-urban). We also visited the Provincial Cervical Cancer Prevention Programs (PCCPP) offices at the provincial ministries of health.

Semi-structured interviews were conducted with key stakeholders involved in CC prevention, including PCCPP coordinators, health authorities (Cancer Directors, the Secretary of Preventive Health, the Secretary of Health Planning and the Minister of Health), HPV laboratory staff, professionals from diagnosis and treatment units, PHC area heads, and sample-taking professionals. In total, we conducted 32 semi-structured interviews, comprising 28 in—person (five of these interviews involved more than one respondent from the same health service and profession simultaneously) and four online sessions. Participants were selected through purposive sampling based on their relevance and involvement in CC prevention, ensuring a diverse range of perspectives and facilitating meaningful comparisons across participants.

Interviews lasted approximately one hour on average. All participants signed informed consent forms, and permission was obtained to audio-record the interviews. No other individuals were present during the interviews. The data collected through the interviews complemented the information gathered during participant observations. We also conducted meeting and discussions with health care authorities (Minister of Health, Cancer Directors and program coordinators) to identify key issues, service strengths, and areas for improvement.

We also reviewed secondary sources, including program reports (n = 2), provincial resolutions (n = 2), and materials used by the provincial program during trainings or meetings with healthcare providers (e.g., PowerPoint presentations, n=5)

We also include quantitative data of screening, diagnosis and treatment from Screening Information System (SITAM, for its initials in Spanish).[28] We included data from all women aged 30 years and older screened in the programs of Jujuy and Catamarca between January 2015 and December 2023. HPV-positive women without colposcopies, biopsies, and treatments data not registered in SITAM were considered lost to follow-up. Data was provided by the Provincial Programs staff.

Data Collection Instruments

Data collection instruments were developed based on the review of data collection instrument used in previous studies in Argentina and in the CervScreen-SARA protocol for health system capacity assessment developed by IARC.[29] The interview guide included close-ended questions, and open questions for an in-depth description of the core components of the cervical cancer prevention programs, and barriers and facilitators of the HPV-test implementation. The dimensions and sub-dimensions included in the interview guides are shown in Table 1.

Analysis

Qualitative Analysis

Secondary documents and field notes from site visits were analyzed. Data from semi-structured interviews were transcribed. Coding followed predetermined themes aligned with the HSF dimensions and sub-dimensions. After coding, a content analysis was conducted.[30] Qualitative findings were validated through triangulation of data sources. Preliminary results were discussed

Table 1. Dimensions and Sub-dimensions Included in the Interview Guides

Dimension	Sub-dimensions
Main characteristics of PCCPP	Year of HPV-testing implementation
	Legislative framework
	Recommended age and frequency
	Target population
	Geographic extension
	HPV-test modality
	Organized/Opportunistic screening.
	Type of HPV test
	Type of triage
	Funding
Laboratory services	Laboratory organization (cytology/histology/HPV laboratory)
	Human resources
	Training
	Sample transport
	Sample registration and storage
	Implementation of quality controls
	Infrastructure -supplies
	Protocol for samples outside screening age and frequency
Screening organization at PHC level	Invitation systems
	Promotion activities
	Health providers in charge of sample taking
	Sample transportation to the HPV/cyto/hysto laboratories
	Appointment organization
	System for delivery of results
	Referral system for HPV+/Abnormal Pap women.
Colposcopy/treatment services	Organization of the colposcopy/treatment services
	Information/counseling provided during the diagnosis/treatment consultation.
	Referral system
	Availability of human resources
	Type of treatment provided.
	System for delivery of results
	System to contact women diagnosed with precancerous lesions (e.g., navigation program)

with key stakeholders—including program coordinators, provincial program staff, and cancer control directors from both provinces. The meetings were recorded, and the discussions around the findings contributed to refining the final analysis.

Statistical Analysis

Program indicators were analyzed through frequencies and percentages. For screening, we included the total number of women screened in 2015-2023 and coverage among the target population. Coverage was defined as the proportion of women aged 30–64 years with public health insurance who were screened at least once during five years periods (2012-2016 and 2017-2021 in Jujuy, and 2015-20219 in Catamarca), relative to the estimated target population. For the purposes of this study, and as an analytical exercise to evaluate program performance, the coverage target was established based on the WHO recommendation of reaching 70% of the total eligible population (women aged 30–64 years with public health insurance), corresponding to 57,479 women in Jujuy and 27,954 in Catamarca, according to the 2022 National Census.[26] Accordingly, coverage estimates should be interpreted relative to this denominator.

For the completion of follow-up of HPV-positive women we calculated: (1) adherence to triage: proportion of HPV-positive women who had a triage procedure (2) adherence to diagnosis: the proportion of HPV-positive women with atypical squamous cells of undetermined significance or worse (ASCUS+) on triage cytology who had a colposcopy; and 3) adherence to treatment: proportion of women who received treatment of the total number of women with cervical intraepithelial neoplasia grade 2 or worse (CIN2+) lesions.

The study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2024. It was approved by three Bioethics Committees: the Bioethics Review Committee of the Jujuy Ministry of Health (Exp-780-220-2024; 23 May 2024), the CEMIC Research Ethics Committee (No. 12746; 1 July 2024), and the IARC Ethics Committee (ID IEC 24-32; 24 September 2024). All committees reviewed and approved the study protocol and procedures. All interviewers signed informed consent. As the quantitative analysis relied exclusively on routine program data provided by the provincial

programs, informed consent from women undergoing screening was not required. Only aggregated program data were used for analysis, and access to the underlying data is restricted to authorized healthcare workers and researchers.

The reporting of this study conforms to the STROBE[31] and COREQ[32] guidelines.

Results

Jujuy Demonstration Project Model

The implementation process of JDP has been described elsewhere.[13] Briefly, the JDP introduced HPV testing as the primary screening method for women aged 30 and older attending the public health system. Screening, diagnosis and treatment were free of charge.

Guidelines recommended that HPV-positive women undergo cytology triage, and those with ASCUS+ are referred for colposcopy and biopsy, if needed. Women with histologically confirmed CIN2+ are referred for treatment. HPV-negative women are advised to repeat screening in five years. When HPV testing was performed at health centers, cytology samples were collected simultaneously but only analyzed if the HPV test was positive.[33] In 2014, HPV sample self-collection was introduced as a programmatic strategy mainly for under screened women: those without screening in the last 5 years and with public health insurance.[12] Women with positive results on self-collected samples were to attend health centers to undergo cytology. These recommendations remain in place.

Stewardship

The key components of this dimension included strong leadership and coordination from the NCCPP; early engagement and active commitment of stakeholders across all levels of the health system; and the establishment of formal agreements between national and provincial authorities defining responsibilities and performance goals. Additionally, national guidelines for screening, diagnosis, and treatment were developed through a consensus process, followed by the enactment of a provincial resolution to ensure local alignment. Together, these elements institutionalized collaboration, strengthened accountability, and promoted the sustainability of program efforts. The NCCPP played a central coordinating role, acting as a key facilitator of communication and alignment among provincial stakeholders.

Funding

The clear definition of financing responsibilities across different levels of government was a key pillar for the sustainability of the JDP. Financial coordination was structured through a complementary scheme in which the national government covered the program's strategic components—such as HPV testing, training, communication materials, the information system (SITAM), and support staff (navigators and data entry clerks)—while the provincial government financed operational personnel, diagnostic and treatment infrastructure, mobile units, and logistical systems for sample transport and delivery of results.

Organizational Capacity

During JDP the health services were reorganized to address key inefficiencies identified in the prior cytology-based screening: single-staff provincial program teams without support personnel, decentralization of cytology reading in small laboratories lacking quality control, limited adherence to recommended screening ages and intervals, the use of informal systems for sample transport and result delivery, and a fragmented referral network for diagnosis and treatment. Key steps taken to overcome these problems are described below.

Laboratory Services

A central cytology-histology-HPV laboratory was created under the direction of a pathologist. Cytology reading was centralized in this laboratory with reassignment of human resources. A protocol to not process HPV samples that arrived at the lab after 14 days or that did not comply with the established age and frequency was created. The system of sample transport to the laboratory was reorganized, establishing responsibilities at health centers for assuring transport on specified days. Also, the system to send screening results to the health centers was changed: It was decided that printed results would no longer be sent to health centers, and instead they would be downloadable from the SITAM.

Screening Services at PHC Level

In the JDP all PHCs (around 300) offered HPV tests. The strategies to promote screening included TV/radio campaigns and active invitations by CHWs using a nominated list. In addition, two mobile trailers travelled around the province to screen hard-to-reach women.

In 2012, the EMA Project,[5] a randomized-controlled trial to evaluate the effectiveness of HPV self-collection to increase screening coverage, was embedded in the JDP. The trial was also a collaborative project between the national/provincial ministries and demonstrated four times improvement in screening participation among women who were offered self-collection. Based on this result programmatic HPV self-collection was introduced in 2014. CHWs were provided with a list of women with public health insurance who were eligible for screening. A personalized offer of HPV self-collection was made to the under-screened, socially vulnerable population.

Diagnosis and Treatment Network

Referral network for triage, diagnosis and treatment was reorganized at second and third level facilities based on an analysis carried out by the national and provincial programs of the capacity of each unit to respond to the estimated demand. To increase women's access to follow-up, a colposcopy unit was included in the province's mobile trailers.

Patient navigation was implemented, funded by the NCCPP: two navigators were in charge of contacting women with HPV/abnormal cytology (ASCUS +) results who had not continued with diagnosis and treatment. To do so, navigators identified non-adherent women through SITAM, contacted them through telephone calls or home visits, and provided women with specific support. Navigators were monitored by the NCCPP.

Screening Information System

In JDP, a specific HPV module was added to SITAM,[28] adding an easy-to-use tool that displayed monitoring indicators at provincial, hospital and health center level. All data in SITAM were shared and available for the provincial program and health services. The NCCPP was in charge of SITAM funding, its maintenance and helpdesk. Based on data from SITAM, the national program provided regular feedback regarding project performance.

Technology/Strategy

Regarding the effectiveness of the strategy, international evidence on HPV testing performance served as the backbone of the project. It served as the basis for national regulations to introduce HPV testing and was disseminated among health authorities and providers through several scientific meetings and seminars, featuring the participation of renowned national and international scientists.[13]

There was high acceptability among national leaders of the scientific/medical community about the effectiveness of HPV testing and the need for changing the paradigm of CC screening. A key issue for the acceptability of HPV testing was the understanding of the advantages of HPV testing in relation to cytology-based screening.

Implementation oF HPV-Test Screening in Catamarca and Jujuy Ten Years After Finalization of JDP

The main results regarding the barriers and facilitators of the implementation process are presented in Table 2 and described in the following sections.

Stewardship

Ten years after the JDP, the provincial programs have maintained their human resource structures, including a program´s coordinator and dedicated work teams(Table 3). These staff have sustained high engagement and active commitment since the beginning of the programs(Table 4). They are widely recognized by provincial stakeholders and health professionals across all levels of the health system, who highly value their expertise and experience:

> The program was, in a way, born with us, and over time it was refined (…) the provincial staff also became increasingly engaged.
>
> (Health professional, HPV Laboratory, Catamarca)

> There is a strong commitment from the entire team; everyone holds the same level of importance in making this work (…) everyone is essential.
>
> (Gynecologist, Jujuy)

Table 2. Stewardship. Barriers and Facilitators Related to the Implementation of the JDP Model Ten Years After Its Completion. Catamarca–Jujuy

Sub-dimension	JDP model	Barriers	Facilitators
Leadership and coordination	Strong leadership and coordination from the NCCPP Consensus building process with early engagement of stakeholders across all levels Formal agreements defining funding responsibilities and performance goals.	Reduction of coordinating role of the NPCC that negatively affected communication and coordination of activities between different health areas (e.g., Primary Health Care Direction).	PCCPP have maintained their human resource structures Long-standing institutional recognition and leadership: the PCCPP staff widely recognized by provincial stakeholders across all levels of the health system
Regulation	National guidelines for screening, diagnosis, and treatment were developed through a consensus process. A provincial resolution was enacted to adopt the new protocol.		National and provincial resolutions remain in place. Continued adherence to national recommendations for screening, diagnosis, and treatment.
Accountability	MoH held regular meetings to monitor program performance	Difficulty sustaining intensive program monitoring.	

In addition, the continuity of provincial regulations—Provincial Resolutions enacted during the JDP in Jujuy and in 2015 in Catamarca, both still in effect—and the consistent adherence of both provinces to national guidelines for screening, diagnosis, and treatment have been key enablers of the sustained implementation of the strategy.

Along the years a main challenge for the provincial programs has been the reduced level of technical support, monitoring and coordination from the NCCPP. In effect, key informants reported that, these activities were gradually reduced after COVID-19 pandemic. At the moment of the interviews, the visits of the NCCPP staff had been replaced by virtual meetings between national and provincial program teams.

> -The national program reduced its presence in the province since the pandemic. We continued our work willingly and with motivation, but it's essential to have someone who encourages you, provides support and feedback, and shares data with you. (…) It should be a two-way exchange.
>
> (Health professional, Catamarca)

Table 3. Funding. Barriers and Facilitators Related to the Implementation of the JDP Model Ten Years After Its Completion. Catamarca–Jujuy

JDP model	Barriers	Facilitators
HPV testing funded by the National Ministry of Health.	Interruption of HPV test provision by the national government at the end of 2023. Changes in national policies and reductions in public spending led to the discontinuation of national funding for HPV testing and the allocation of specific human resources (e.g., patient navigators).	Mechanisms established to purchase HPV tests with provincial funds.
Provincial funding allocated to human resources and to diagnostic, treatment, and laboratory infrastructure.		Sustained provincial funding for human resources (program staff and local providers) and for maintaining diagnostic, treatment, and laboratory infrastructure.
Screening, diagnosis, and treatment provided free of charge.		Screening, diagnosis, and treatment remain free of charge.

Table 4. Health System Organization. Barriers and Facilitators Related to the Implementation of the JDP Model Ten Years After Its Completion. Catamarca–Jujuy

Sub-dimension	JDP model	Barriers	Facilitators
Laboratory organization	Laboratory centralization.	HPV and Pathology/Cytology laboratories operating under different supervision	Existence of a central HPV–Cytology–Pathology laboratory under unified supervision.
	Centralized data registration.	Limited communication and coordination between HPV and Pathology/Cytology laboratories.	Dedicated data entry staff hired by the NCCPP.
	Adequate infrastructure and availability of supplies.		Adequate infrastructure and availability of supplies maintained.
	Protocol to reject samples that do not comply with age, frequency, or follow-up criteria.		The protocol to reject samples that do not comply with age, frequency, or follow-up criteria remains in place
Screening organization at the primary health care level	Established PHC network for screening.		Availability of midwives throughout the PHC network responsible for sample collection.
	HPV self-collection as a key strategy to increase coverage.	Difficulty maintaining an active offer of HPV self-collection, limiting outreach to vulnerable populations.	
	Reorganized system for sample transport to the HPV laboratory.		Well-established system for sample transport to the HPV laboratory.
	Availability of mobile health units and health campaigns targeting rural and remote areas.	Limited coordination of mobile unit activities; overlap with PHC services.	Outreach health campaigns in rural and remote areas.
Colposcopy and treatment services	Reorganized referral network for triage, diagnosis, and treatment.	Shortage of specialists to perform colposcopy due to retirements without replacements.	
	Patient navigation program established.	Delays in entering results into SITAM hindered timely access to information for professionals and patients. Lack of quality assurance mechanisms for colposcopy services.	Existence of a navigator program recognized and valued by the entire health care team.
Information systems, monitoring, and evaluation	Incorporation of an HPV-testing module into SITAM, the national screening information system.		Use of SITAM as the main information system for cervical screening.
	Data entry performed across all levels (PHC, laboratory, diagnosis, and treatment) with high completeness.	Insufficient human resources for data entry at some levels (e.g., Pathology Laboratory), leading to delays in data availability. Duplication of records across paper-based systems (notebooks, service logbooks) and Excel sheets, overloading staff. Limited training in data analysis.	

In Jujuy, the reduction of the coordinating role of the NCCPP negatively affected communication and coordination of activities between different health areas. This is in part due to the fact that the provincial program does not have the authority to decide on activities that have to be performed by other health areas, as for example Primary Health Care, a Direction that is in charge of the primary health care workers:

> It's not coordinated with Primary Health Direction (...) it's like they are very willing, but maybe doing things alone isn't good. They do things on their own.
>
> (Health professional, Jujuy)

Funding

Provincial funding for staff working at the PCCPP, local health services, diagnostic and treatment infrastructure, and the system for sample transport and result delivery was maintained.

The main obstacle identified by the interviewees of both provinces was the interruption of HPV test provision by the national government at the end of 2023, which had not yet been restored.

In this context, programs from both provinces, initiated procedures to purchase HPV tests with provincial funds, showing a commitment from cancer authorities to continue the strategy:

> "When the government changed, we thought the program would continue to be funded by the national level. Now it's quite clear that the province must assume the program's costs."
>
> (Health authority, Jujuy).
>
> "The national program is not sending tests, so we said, let's buy them ourselves… let's request price quotes"
>
> (Provincial program staff, Catamarca).

However, in a context of limited provincial health resources, programs encountered difficulties as purchasing supplies with provincial funds required negotiating priorities with the provincial Minister of Health:

> And at some point, in that context, they [the health authorities] are selective about what program gets funded and which doesn't. It's about who knocks on the door first.
>
> (Health authority, Jujuy).

In this context, provincial teams described adopting ad hoc strategies to maintain screening activities, including fragmented purchasing processes to cope with budgetary and administrative constraints:

> "We need 10.000 but, we prepare a purchase file every month for 2,000, 2,000, 2,000 (HPV test)… and well, we'll start moving forward." (Provincial program staff, Jujuy).

Organizational Capacity

Laboratory Services

At present, in Jujuy, the central cytology–histology–HPV laboratory remains fully operational under the direction of a pathologist, thereby maintaining continuity of the laboratory centralization model established under the JDP. In Catamarca this centralized model was not implemented as it was not possible to unify the HPV-cytology-and Pathology laboratory under a unified headship as in Jujuy, despite their co-location within the same hospital. Ten years later, the HPV laboratory continues to operate independently from the Pathology Laboratory. According to key informants, this fragmentation has undermined effective monitoring, as the provincial program has no formal authority to oversee the performance of the Pathology Laboratory. One barrier mentioned was the lack of a systematic registry for biopsy results generated by the laboratory. To address this gap, administrative staff from the PCCPP have taken on the task of entering biopsy results into SITAM, although this is done with varying frequency. As one provincial program staff member from Catamarca explained:

The lab staff say that it's not their responsibility to enter data into SITAM. So, there was always someone from the program who go to the lab and did the data entry.

(Provincial program staff, Catamarca)

The sample transport and the system to send screening results to the health centers established during the JDP remain unchanged in Jujuy. In Catamarca these systems were implemented with adaptations: samples and forms are first sent to the PCCPP, where administrative staff enter data into SITAM before forwarding them to the HPV laboratory. Results are recorded in SITAM and also printed at the PCCPP for distribution. Although this adds an additional step, key informant considered that this system is efficient as it centralizes data entry and reduces errors:

We used to bring the tubes here… we centralized the samples here so that it wouldn't interrupt the laboratory's work. Here, we perform the initial data entry for the samples, ensuring the lab has an accurate record, and only then do the samples proceed to the laboratory.

(Provincial program staff, Catamarca)

The sample rejection protocol developed during the JDP remains in place in both provinces:

— If the previous result was negative (within the past five years), they're given that earlier report, since sometimes it might not have reached them.

Q: But do they actually process it, or is there a pre-screening step?

— No, there's a prior filter.

(Health professional, HPV Laboratory, Catamarca)

In both provinces, human resources, laboratory infrastructure and supplies are considered adequate, with appropriate equipment, space, and no significant barriers in supply management (except for the HPV test).

Screening Services at PHC Level

The network of primary care centers that offer the HPV test has been maintained in both provinces. Key informants mentioned that the availability of professionals responsible for sample collection is adequate to meet the demand for screening. They also highlighted the presence of midwives throughout the primary health care network, noting that this has increased in recent years as a key program strength. In Jujuy, the incorporation of midwives as key actors in screening has been essential to strengthening the screening program. In Catamarca, university-level midwifery education represents a strategic asset for the healthcare system. Additionally, these personnel are highly valued by the healthcare teams.

Q: Do You Have one Midwife per Center?

— Yes, they're key personnel.

Q: So It's a Qualified Human Resource..

— Yes, yes. Their training comes from the university and also from the residency program. We have gynecologists, but in all the centers, they are staffed by midwives.

(Provincial program staff, Catamarca)

Mobile trailers continue to travel throughout both provinces, providing screening and colposcopy services and facilitating access to care. However, in Jujuy, stakeholders mentioned that activities are not fully coordinated with the provincial program Staff:

The staff from the mobile unit told the woman, "Go tomorrow to the hospital, and they will attend to you." You know what? No one knew that she was coming. Neither the navigators nor the service — no one was expecting her. It's not coordinated with primary care.

(Provincial program staff, Jujuy)

In Jujuy since 2022 the offer of HPV self-collection diminished (only less than 5% of screened women performed HPV self-collection). According to the interviewees, the PCCPP prioritized clinician-collected testing to avoid the loss to follow up for HPV-positive women with self-collection. Although each primary health center has the autonomy to offer HPV-self-collection (mainly in remote regions), there has been no active offer:

> Yes. But it's been a long time since we stop doing self-collection, that's over.
>
> (Health professional, Jujuy)

In contrast, in Catamarca, self-collection has been actively offered since 2015 (except in 2020 because of the COVID-19 pandemic). Self-collection has been provided during community health meetings—held in schools, parks or markets—organized by local health professionals in collaboration with Provincial Cancer Directorate and local institutions (e.g. Argentinian League Against Cancer (LALCEC, for its initials in Spanish) rather than solely through door-to-door outreach. These activities have been coordinated by highly motivated and committed health staff:

> We worked together with the Police, (..) even Nacion Bank collaborated with us — they put up posters, made flyers, held raffles.
>
> We have an excellent relationship with the provincial program. For example, this weekend we're doing an activity together again — We will give talks and counseling, we will take samples in the changing rooms"
>
> (PHCs staff, Catamarca).

Diagnosis and Treatment Network

The network of diagnosis and treatment centers has been maintained in both provinces. Interviewees mentioned that they have adequate infrastructure and the necessary materials and supplies, and that no major difficulties are encountered in managing or maintaining stock. In n Jujuy, colposcopy services are distributed across different regions of the province, whereas in Catamarca, diagnostic and treatment services are centralized in the provincial capital (Figure 3). For women who face transportation barriers to reach diagnostic centers—particularly those living in the northern region—the public health system provides transportation to facilitate access to diagnostic and treatment procedures.

In Jujuy, key informants noted that in recent years, new barriers have emerged, hindering the functioning of the diagnosis and treatment network. One of the main challenges is the retirement of gynecologists with extensive experience in the public health system. The lack of adequate replacements for these professionals has been perceived as a significant loss of institutional capacity:

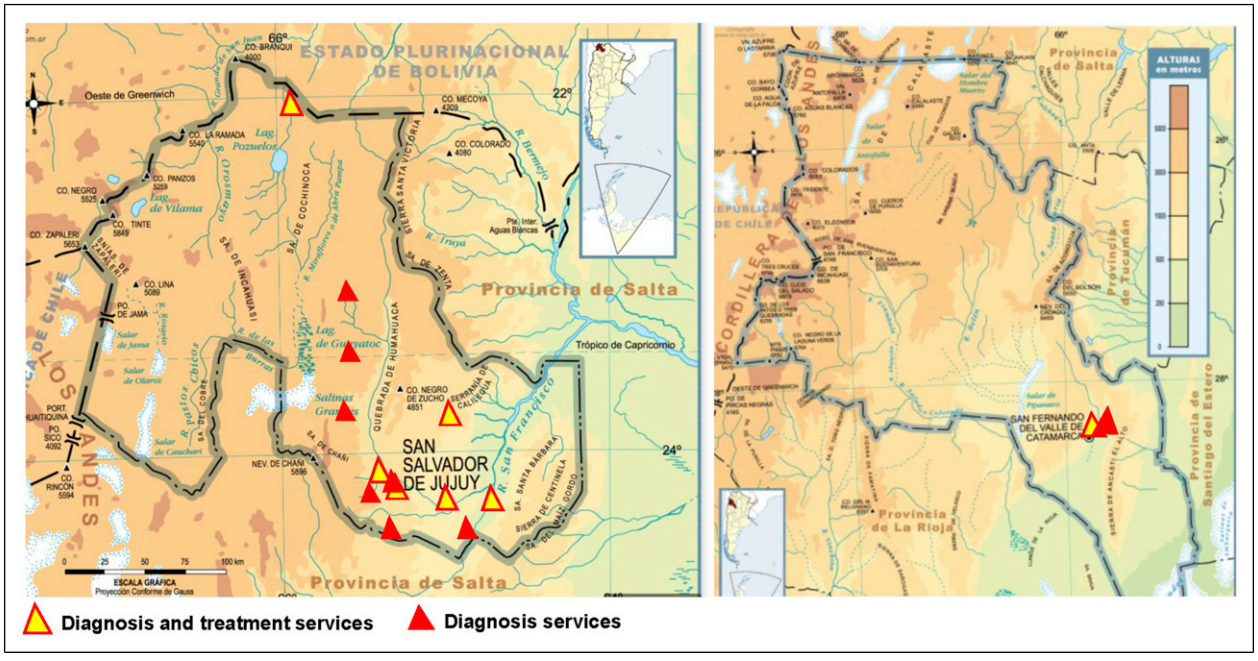

Figure 3. Diagnosis and treatment services

Q: How is the diagnosis and treatment network today?

- Today, the network is not as strong as it used to be (…)

some people have left or changed roles (…) there are fewer doctors for diagnosis and treatment.

(Provincial program Staff, Jujuy)

Another problem is that, in many cases PHC staff face barriers to coordinate an appointment (e.g., they cannot contact the center by phone, or there are no available appointments within the same month):

Q: How is the referral for colposcopy handled? How do you do it?

— We have been having problems with that…

Q: Why?

— I'm not sure why, … we're in September now — around March we still had communication with a nurse who scheduled the appointments for us, but after that, it seems she was reassigned to another area (…) Getting in touch with referral center is complicated, because the phone doesn't work; we must wait for hours there.

(PHCs staff, Jujuy)

In Catamarca, one of the obstacles mentioned by key informants is that women must personally collect their biopsy results and bring them to the colposcopy and treatment service. When results are not registered in SITAM on time, women inevitably must retrieve them directly from the laboratory and deliver them to the clinical service. As one gynecologist from the diagnostic and treatment service in Catamarca explained:

"*We have the problem that the results we need aren't being registered in SITAM (…). Women have to come with the biopsy in their hand, bring it to me, and I have to look at it.*"

(Gynecologist, diagnostic–treatment service, Catamarca)

Patient Navigation

Patient navigation remains in place in both provinces, but at present funded by the provincial programs. In both provinces, the navigation program is recognized and valued by the entire health team and is identified as one of the main facilitators of access to diagnosis and treatment.

Q: Who follows up with women who don't return?

— Through the navigators. The secretary and the navigator work very closely

Q: They do the follow-up…

— Yes. The navigator comes and tells me, "Look, this woman can come on such a day," and we figure out what day works.

(Gynecologist-diagnostic-treatment service- Jujuy)

— The navigator is the link — She takes care of each woman. Usually, they handle all communication with the patient

(Gynecologist-diagnostic-treatment service- Catamarca).

Screening Information System

At present, both provinces continue to use SITAM as the primary information system for cervical cancer prevention. However, an issue that remains unresolved ten years after the JDP is the coexistence of SITAM with other record-keeping systems,—such as notebooks, service logbooks, and Excel spreadsheets. The need to record the same information across multiple registries imposes an additional burden on human resources, which likely undermines both the quality and timeliness of program data.

Q: So you actually have double records — the SITAM record and your own notebook?

— Yes, yes. My own record, with additional data.

Q: And do you also enter data in the medical record?

— Yes. Triple entry. I record everything —

Q: And there's no link between them? You have to enter it every time?

— Every time, you have to enter it again.

(Health professional, diagnostic-treatment service- Catamarca).

Both provinces use SITAM daily as an essential tool for case-by-case follow-up, leveraging its role as a unified medical record that captures procedures related to cervical cancer prevention for each woman. However, the use of the system for program monitoring—particularly for generating indicators and analyzing aggregated data to track performance and inform decision-making—has encountered greater difficulties at the provincial level and has only been partially achieved without the active support of the NCCPP:

- What I do is filter the pathology results and see what's happen (with each women)

Q: And do you also use the statistics section?

—Not so much. I used to check how many biopsies we did, how many we did in a month… but I haven't done that in a long time.

(Gynecologist- diagnostic-treatment service- Jujuy).

The main barriers to effective data use at the provincial level are limited trained personnel and insufficient time. An advantage observed in Jujuy is that the provincial team's participation in multiple research projects over the years has strengthened its capacity to utilize data appropriately for monitoring and evaluation.

Technology

HPV testing continues to be highly accepted and is currently the preferred screening method in both provinces. There is a high consensus that HPV testing is more effective than cytology and offers many advantages for preventing cervical cancer:

"And for a long time, we had used the HPV test, trusting the results and, in a way, taking the liberty of scheduling appointments less frequently (…) you trust the test, because it's reliable—much more reliable than cytology"

(Gynecologist- diagnostic-treatment service- Jujuy).

Program Indicators

Between 2015 and 2023, 70,388 women aged 30 and over in Jujuy and 24,506 in Catamarca were screened with HPV test. Among them, 23,159 women in Jujuy and 6,978 in Catamarca were screened using self-collection, representing 33% and 28% of all HPV-tested women, respectively (Table 5). Coverage was calculated using five-year intervals: Jujuy achieved 73% coverage between 2012 and 2016 (n=41,580/57,479), and 50% (n=28,237/57,479) between 2017 and 2021. In Catamarca, coverage reached 34% during the 2015–2019 period (n=8724/27,154).

Adherence to triage of women screened with self-collection in Jujuy was similar to that in the JDP, at 77%, while it was lower in Catamarca (43%). The percentage of women with ASCUS+ who underwent colposcopy was similar across both provinces, around 70%. Likewise, the percentage of CIN2+ lesions treated was higher than in the JDP in both provinces, exceeding 87% (Table 5).

Table 5. Program Indicators

	JDP (2012-2014)	Jujuy (2015-2023)	Catamarca (2015-2023)
Total screened women aged 30 years and over	49,545	70,388	24,506
Women with SC test	4,865 (10%)*	23,179 (33%)	6,978 (28%)
Women with CC test	44,680	47,209	17,528
% positivity (CC and SC test)	13.4	16.1	14.5
HPV+ women with triage (cytology/colposcopy)	CC: 98% SC: 77%	CC: 99%; SC: 77%	CC: 99%; SC: 43%
Follow-up: triage-positive women who had a colposcopy (%)	74.1	74.5	70.4
Follow-up: women with CIN2+ who had registered treatment (%)	83.0	87.2	89.4

*Self-collected testing was introduced in 2014, so its contribution to reach is based on 1 year only. CC: Clinician-collected test; SC: Self-collected test.

Discussion

This study analyzed the barriers and facilitators to the programmatic implementation of HPV testing in two Argentine provinces ten years after completion of a successful demonstration project. Following the HSF, we identified factors influencing the sustainability of the strategy. Overall, our findings revealed both barriers and facilitators in the implementation of the JDP model, offering insights for countries aiming to implement HPV testing in national screening programs.

Stewardship refers to the functions through which health authorities provide strategic direction, establish an enabling policy environment, and ensure accountability within the health system. It encompasses the processes by which priorities are set, policies are formulated and implemented, and coordination among actors is achieved.[20-22,25] In this sense, stewardship reflects the broader governance context —across national, provincial, and local levels—that directly or indirectly influences the implementation and sustainability of health strategies.[25,34] Our results indicated that maintaining the level of political and technical support and alignment between national and provincial authorities achieved during the JDP was challenging. Mechanisms such as management roundtables and continuous communication between national and provincial teams—both of which were central during the JDP—became diminished over time.[14] Evidence from a multi-country study conducted in Argentina, Kenya, Malaysia, Peru, and Zambia highlighted the key role that stewardship plays in long-term sustainability.[10] Its results showed that frequent changes in healthcare policy are often linked to shifts in political leadership, resulting in unstable leadership teams and requiring repeated "back-to-the-drawing-board" processes in policy implementation. These disruptions negatively affect long-term sustainability.[10] A study in Montenegro also showed that frequent changes in health ministry leadership make it challenging to develop new and consistent strategies and policies.[35] Thus, the difficulty to maintain the national government's coordinating role impacted negatively in program stewardship, leading to decreased monitoring and coordination among the different provincial health areas of the ministry involved in cervical cancer prevention. This limited opportunities for collaboration, open feedback, and exchange across hierarchical levels—factors that are essential for effective implementation.

Implementation also depends on the capacity, motivation, and commitment of local implementation leaders and teams. The implementation science literature underscores that early and continuous engagement of local actors enhances sustainability by fostering ownership, alignment with local contexts, and adaptive capacity.[36-38] Evidence from Malawi shows that the lack of local coordination teams is one of the main challenges in managing cervical cancer prevention programs at the district level. This study found that some districts lacked designated coordinators to manage the CC screening program.[39] In the absence of a district-level coordinator, there is no clear responsibility for planning and conducting supportive technical supervision in health facilities, which can negatively affect program performance and quality of care. In contrast, in our study, health personnel in both provinces have been involved since the early stages of HPV test implementation,[9] and the institutional capacity developed during these initial phases helped mitigate the effects of subsequent changes in national policy. This long-standing institutional recognition, together with the leadership of program staff, has supported the continued development and sustainability of program activities. Sustained engagement of local stakeholders emerged as a key facilitator, particularly through their ability to negotiate resources and priorities, especially during periods when the national government interrupted the provision of HPV tests. Our results demonstrate how local leadership, institutional embeddedness, and long-term team engagement sustain implementation over time. It highlights the importance of developing local capacity as a key strategy within implementation processes.

By using legal, regulatory, and policy instruments to steer health system performance, stewardship is closely related to the concept of regulation.[25,34] Our study showed that national guidelines for screening, diagnosis, and treatment, as well as the national and provincial resolutions enacted during the JDP, remain in effect in both provinces. This continuity has been a key facilitator of the sustained implementation of the JDP model in spite of the diminished technical and monitoring support of the NCCPP, underscoring the importance of establishing formal regulations from the beginning. Adherence to screening (e.g., age and frequency) recommendations has long been a challenge in cytology-based screening. The development of these recommendations within the framework of the JDP—through collaboration with highly recognized external scientific leaders in CC prevention—facilitated adherence to the guidelines and regulations, an alignment maintained in both provinces to this day.

As widely noted in the implementation science literature, the absence of stable financing represents a significant barrier to the institutionalization of public health interventions.[10,40] The JDP and the subsequent scaling up of the strategy in Jujuy and Catamarca were financed through regular national and provincial health budgets within a system that provides free access to screening, diagnosis, and treatment. Over the years, however, the main challenge has been the interruption of HPV test provision by the national government. In both Jujuy and Catamarca, the lack of national test supplies led to a two-year suspension of the HPV-based screening strategy, which has not yet been fully reinstated. The interruption in the national supply of HPV tests affected all provinces simultaneously so challenges related to the shift from national to provincial funding are not unique to these two provinces. Financing barriers have also been identified in other studies.[35,41,42] For

example, a qualitative study based on in-depth interviews with stakeholders in two regions of Peru found that low levels of health spending constitute a critical issue. Public health expenditure in Peru is lower than in other Latin American countries, and, in addition to insufficient resources, the health system's financing is highly segmented[42] Similarly, in Albania, key challenges affecting CC screening include persistent funding gaps. Limited government funding and reliance on external donors make it difficult both to implement and sustain the program.[35] However, in our study, disruptions in the national provision of HPV tests prompted provincial programs to negotiate with their respective Ministries of Health to procure HPV tests using provincial funds. Although it is still too early to draw definitive conclusions, this shift toward provincial financing may represent a step toward greater local ownership and long-term sustainability of CC prevention efforts. Nonetheless, the move to decentralized procurement entails potential risks, as purchasing smaller quantities at the provincial level may result in higher costs, threatening financial sustainability over time. To mitigate these risks, strategies such as establishing inter-provincial pooled procurement mechanisms, incorporating HPV testing into cancer control legislation that allocates specific resources for test procurement, and integrating screening costs into multi-year cervical cancer budgets and tender processes could help stabilize funding and ensure the continuity of the strategy.

Regarding organizational capacity, laboratory centralization carried out during JDP, has not been possible to implement in Catamarca. Key informants perceived this fact as a barrier to coordinate and implement activities. Furthermore, the absence of a centralized laboratory structure required additional human resources for data entry into SITAM at each site, and ensuring these resources proved challenging. Currently, Catamarca has initiated the procurement of PCR reagents. However, this innovation also brings new coordination challenges related to sample transport. In Catamarca, for instance, the virology laboratories where PCR testing are located in institutions separate from cytology and pathology laboratories. This separation could exacerbate previously identified coordination difficulties or require implementing new strategies to mitigate potential issues, such as sample loss, delays in data entry, and the need for additional human resources for data management.

Achieving high screening coverage remains one of the major challenges for cervical cancer control in low- and middle-resource settings.[43,44] An analysis of 202 countries by Bruni and colleagues[44] reported screening coverage of 43% in the previous five years in upper-middle-income countries compared with less than 9% in lower-middle- and low-income countries. Consistent with this global pattern, coverage in both provinces remained below the 70% target for the eligible population within the recommended timeframe.

In addition, in Jujuy, the observed decline in screening coverage between periods can be explained by a combination of external and internal factors. Externally, the last two years of the second period coincided with the COVID-19 pandemic, which disrupted the provision of non-urgent health services worldwide and should be considered when interpreting the observed decline. The impact of the COVID-19 pandemic on CC screening programs has been widely documented in the literature.[45,46] Regarding internal implementation factors, the first period—when coverage reached 73%—was implemented within the JDP, characterized by strong political support and intensive technical assistance from the National Program. The subsequent reduction in technical support likely contributed to lower coverage. This was further compounded by limited coordination between the provincial program and the PHC directorate, as well as a progressive reduction in the availability of self-sampling. Finally, sustaining high coverage over time remains challenging, as women who frequently use health services are more likely to be screened earlier. Reaching those who remain unscreened becomes increasingly difficult, representing a structural barrier to maintaining coverage in later periods.

In this regard, self-collection represents an essential tool to increase screening coverage among women who are underusers of health system, and, consequently, at higher risk of CC.[4-6] Although both provinces have implemented self-collection, accounting for approximately 30% of total screening over the past decade, in Jujuy, its implementation was interrupted over the last two years. This decision was made to prioritize clinician-collected samples, aiming to prevent loss to follow-up among HPV-positive women who performed self-collected tests. In the long term, however, this interruption could reduce access to screening, particularly among women who are not regular users of health services. In this context, it is necessary to develop new strategies to improve access to triage, which remains a challenge across the analyzed provinces. Several studies are currently evaluating alternative triage approaches.[47] For example, the introduction of PCR-based screening tests, which enable genotyping, offers an advantage by allowing the implementation of follow-up strategies that can reduce the number of visits to health facilities. Additionally, the implementation of mHealth strategies could enhance adherence to triage. In Argentina, the ATICA[48] study – a study that evaluated effectiveness and implementation of a SMS based intervention in Jujuy - demonstrated that sending SMS reminders effectively increased adherence to triage among women with HPV-positive self-collection. Adapting and implementing this strategy within programmatic settings could also support the continuity of self-collection, enhancing its potential to improve screening coverage while reducing losses to follow-up after a positive result.

Implementation teams are essential for the success of interventions, as individual leadership is rarely effective without collaborative support.[37,49] A clear example of motivated, well-trained, and experienced human resources that has demonstrated sustained results during the JDP and over more than ten years in both provinces is the Navigator Program. This

program has gained recognition across the healthcare system and achieved positive outcomes in diagnostics and treatment over the years, reaffirming the importance of maintaining and strengthening this strategy. Nevertheless, the reduction in the number of specialists performing colposcopy—mainly due to retirements without replacement—was perceived as a loss of critical human resources within the network, highlighting the need to develop future strategies to ensure continuity of services.

The systematic collection and use of health data are essential for planning, monitoring, and continuous improvement of CC prevention programs.[50] In low-resource settings, health information systems often face challenges related to insufficient funding for data registration, fragmented data sources, and limited interoperability across platforms.[51-54] In both provinces, the continued use of SITAM as an essential tool for case-by-case follow-up, represents a significant strength. However, the use of data for local monitoring faced barriers. During the JDP and in the years preceding the pandemic, there was continuous monitoring and feedback provided by the NCCPP. This intensive monitoring could not be sustained with the same intensity after the pandemic, and the use of available data for monitoring and decision-making could not be replicated in the same way at the local level. Similar to findings from other LMICs, weak coordination, limited data skills, and absence of standardized procedures contribute low data quality.[51,52] A recent scoping review of routine health information system data[54] in LMICs concluded that the main obstacle to effective use of routine data for monitoring at subnational levels is the weak institutionalization of planning and supervision processes. An institutional ethnography conducted in primary care facilities in Argentina revealed incomplete and fragmented records, duplication of data entry, and a degree of mistrust among staff regarding the purpose and use of data.[53] Addressing these challenges will require sustained investment in training and capacity building, the establishment of standardized data management procedures, and the promotion of a culture of data use within provincial health teams. Strengthening local capacities in data management, analysis, and interpretation is therefore essential to ensure the effective use of information for continuous program improvement and evidence-based decision-making.

Our study has some limitations that should be considered. First, the analysis draws on data from only two provinces, which may limit the generalizability of the findings to the national level. Although Catamarca - as an early adopter of HPV testing with organizational characteristics distinct from those of the original JDP- was an adequate case to compare with Jujuy, barriers related to the organization of provincial health systems and coordination mechanisms may vary substantially across settings. Therefore, the findings should not be considered generalizable to other provinces. Further research is needed to explore the barriers and facilitators to scaling up the JDP model across the remaining provinces where HPV testing is being introduced. Moreover, this paper presents aggregated data on screening, diagnosis, and treatment indicators, which will be examined in greater depth in future publications.

The timing of the study should also be considered when interpreting the results. Data collection coincided with a major national disruption in the supply of HPV tests; therefore, some of the barriers and facilitators identified may be specific to a crisis management context. However, this timing also represents a strength, as it provided a unique opportunity to observe real-time health system responses to disruption. This context allowed us to examine adaptive strategies, governance mechanisms, and informal problem-solving processes that are rarely visible under stable conditions. In this sense, our findings contribute to understanding health system resilience and adaptive capacity, which are particularly relevant in resource-constrained settings. Furthermore, although this study analyzed challenges related to supply disruptions, several of the barriers and facilitators identified extend beyond this specific context and reflect longstanding issues affecting cervical cancer screening programs.

Finally, our adaptation of the Health System Framework (HSF) may have reduced the details needed to distinguish whether barriers were primarily related to human resources or to service delivery and infrastructure constraints. To address this limitation, we differentiated relevant elements during data analysis. In addition, the use of a framework applied in previous studies may have introduced a risk of confirmation bias by directing attention toward previously identified barriers. To mitigate this, we maintained an inductive approach during data collection and analysis to capture emerging issues beyond the framework's scope. Despite these limitations, applying this adapted HSF across different phases of program implementation enabled a more integrated understanding of the process, facilitated comparability over time, and supported the transferability of findings to policymakers involved in implementation.

Conclusion

Overall, the sustainability of HPV testing in Argentina depends on the interplay of stewardship, financing, and organizational capacity that includes PHC, diagnosis and treatment network, and well stablished information system. Ensuring continuity will require not only stable funding and technical capacity but also strong governance mechanisms that foster coordination, accountability, and adaptation of changes. These cases highlight how early capacity-building at the provincial level can

buffer the effects of political and financial changes—a lesson relevant for other LMICs transitioning from pilot projects to sustainable, nationwide screening programs.

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Ethical Considerations

The study was approved by three Bioethics Committees: The Bioethics Review Committee of the Jujuy Ministry of Health (Exp-780-222-2024; 23 May 2024), the CEMIC Research Ethics Committee (No. 12746; 1 July 2024), and the IARC Ethics Committee (ID IEC 24-32; 24 September 2024). All committees reviewed and approved the study protocol and procedures.

Consent to Participate

All interviewers signed informed consent. As the quantitative analysis relied exclusively on routine program data provided by the provincial programs, informed consent from women undergoing screening was not required. Only aggregated program data were used for analysis, and access to the underlying data is restricted to authorized healthcare workers and researchers.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data Availability Statement

The datasets used in this study are available from the corresponding author on reasonable request. De-identified individual participant data on which results are based will be made available up to five years after the acceptance for publication of the main findings. These data can be requested to the principal investigator (Dr. Silvina Arrossi) and only under a data-sharing agreement.

Disclaimer

Where authors are identified as personnel of the International Agency for Research on Cancer/World Health Organization, the authors alone are responsible for the views expressed in this article and they do not necessarily represent the decisions, policy or views of the International Agency for Research on Cancer /World Health Organization

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Appendix

Abbreviations

ASCUS	Atypical squamous cells of undetermined significance or worse
CC	Cervical cancer
CIN2+	Cervical intraepithelial neoplasia grade 2 or worse
HPV	Human Papillomavirus
HSF	Health System Framework
JDP	Jujuy Demonstration Project
LMIC	Low- and middle-income countries
NCCPP	National Cervical Cancer Prevention Program
PHC	Primary Health Care
PCCPP	Provincial Cervical Cancer Prevention Programs
SITAM	Screening Information System
WHO	World Health Organization