IMPLEMENTATION OF A PILOT CERVICAL CANCER SCREENING PROGRAMME INTEGRATED IN ROUTINE PRIMARY HEALTH-CARE SERVICES IN BENIN, CÔTE D'IVOIRE, AND SENEGAL

REPORT OF A PILOT PROJECT (CARE4AFRIQUE) IN THREE AFRICAN COUNTRIES

International Agency for Research on Cancer

World Health Organization

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FONDATION LALLA SALMA PRÉVENTION ET TRAITEMENT DES CANCERS

مؤسسة لالا سلمى للوقاية وعلاج السرطان

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REPORT OF A PILOT PROJECT (CARE4AFRIQUE) IN THREE AFRICAN COUNTRIES

Project period: November 2017 to January 2021

Care4Afrique is a collaborative project of

The International Agency for Research on Cancer
Lyon, France

and

The Lalla Salma Foundation for Cancer Prevention and Treatment
Rabat, Morocco

IARC, 2023

Suggested citation.
IARC; Lalla Salma Foundation for Cancer Prevention and Treatment (2023). Implementation of a pilot cervical cancer screening programme integrated in routine primary health-care services in Benin, Côte d'Ivoire, and Senegal: report of a pilot project (Care4Afrique) in three African countries. Lyon, France: International Agency for Research on Cancer. Available from: https://publications.iarc.fr/614. Licence: CC BY-NC-ND 3.0 IGO.

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IARC Library Cataloguing-in-Publication Data

Names: International Agency for Research on Cancer. | Lalla Salma Foundation for Cancer Prevention and Treatment.
Title: Implementation of a pilot cervical cancer screening programme integrated in routine primary health-care services in Benin, Côte d'Ivoire, and Senegal: report of a pilot project (Care4Afrique) in three African countries / prepared by the International Agency for Research on Cancer and the Lalla Salma Foundation for Cancer Prevention and Treatment.
Description: Lyon: International Agency for Research on Cancer, 2023. | "Project period: November 2017 to January 2021." | Includes bibliographical references.
Identifiers: ISBN 9789283204534 (ebook)
Subjects: MESH: Uterine Cervical Neoplasms. | Early Detection of Cancer. | Primary Health Care. | Benin. | Côte d'Ivoire. | Senegal.
Classification: NLM WP 480

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Contributors

Project Partners

Lalla Salma Foundation for Cancer Prevention and Treatment, Rabat, Morocco

Dr Rachid Bekkali
Professor Maria Bennani
Dr Youssef Chami Khazraji

Claudine Talon Foundation, Benin

The First Lady Ms Claudine Talon, Claudine Talon Foundation

Ministry of Health Benin

Dr Benjamin Hounkpatin, Ministry of Health
Dr Djima Patrice Dangbèmey, CHU MEL (principal investigator)
Dr Moufalilou Aboubakar, CHU MEL

Ministry of Health Senegal

Dr Ndeye Mbombe Dieng, Ministry of Health (second principal investigator)
Dr Mamadou Saidou Diallo, Gaspard Kamara District Hospital, Dakar (gynaecologist)
Dr Amadou Lamine Ndaw, Gaspard Kamara District Hospital, Dakar (surgeon)

International Agency for Research on Cancer, Lyon, France

Dr Partha Basu
Dr Farida Selmouni
Dr Catherine Sauvaget
Dr Richard Muwonge
Mr Eric Lucas
Ms Loubna Boulegroun
Ms Krittika Pitaksaringkarn

Ministry of Health Côte d'Ivoire

Dr Denise Olga Kpebo Djoukou, National Institute of Public Health (principal investigator)
Dr Jacques Katche Ayéréby, National Institute of Public Health
Dr Patrick Fulgence Aga Ahouo, National Institute of Public Health

Production Team

Ms Harriet Stewart-Jones
Technical Editor

Dr Karen Müller
Managing Editor

Ms Sylvia Lesage
Publishing Assistant

Ms Krittika Pitaksaringkarn
Information Assistant

Acknowledgements

The authors would like to thank all participants in the three focus countries. Special thanks go to all the health-care workers of the demonstration project for a job well done, and for the tireless efforts of the country teams.

Benin

- Claudine Talon Foundation: Professor René Xavier Perrin, President of the Fédération Africaine de Gynécologie et d'Obstétrique
- Team from CHU MEL: Ms Olga Adoukonou, Ms Sylvie Ahoyo, Ms Bignon Adanho, Ms Pascaline Egounlety, Ms Genevieve Koudjo, Dr Véronique Tognifode
- Team from Surulere General Hospital: Ms Roseline Agbofoun, Ms Claire Sabine Damassoh Dedi, Ms Laetitia Agbikpame, Ms Jocelyne Ahouannou, Ms Christelle Balogoun
- Team from PHC Missessin: Ms Joinise Ayihonsi, Ms Leonie Liady, Ms Irike Allaho
- Team from PHC Gbégamey: Ms Viviane Aholou, Ms Lucresse Zounon, Ms Agnès Atimbada, Ms Andrea Sottin
- Team from PHC Ahouansori: Ms Evelyne Fandohan Tohou, Ms Antoinette Apedo, Ms Fidelia Dansou, Ms Nina Dossou, Ms Mireille Adandedjan
- Data management: Ms Tricia Claudia Videgla

Côte d'Ivoire

- Ministry of Health: Professor Dinard Kouassi, National Institute of Public Health
- Team from FSU COM Edmond Basque: Ms Hadja Kone Epse Dosso, Ms Eugénie Ebrottie Epse Ekra Koua, Ms Jeanne Affi Epse Tondoh, Ms Krotoumou Ouattara Epse Haïdara
- Team from CSU 220 Logements: Ms Thérèse Toure Saty Epse Kesse, Ms Alice Brou Epse Acafou Abah, Ms Eugénie Houegban Yawa Epse Diomande, Ms Marie Elisabeth Viviane Beugre Gnabahon Epse Adouko, Dr Aya Victorine Assuikwe, Ms Aurélie Simi
- Team from Service de SMI/NIPH: Ms Ansita Sery-Coulibaly, Ms Mabindou Kouadio-Coulibaly, Ms Odette Zanhouo Lou Amenan, Ms Joséphine Djako Appi
- Team from Hôpital Général d'Abobo-Sud: Ms Christiane Kouassi Epse Kokora, Ms Berte Mariatou, Ms Aminata Doumbia Epse Diarrassouba, Ms Magnagalé Bamba Epse Toure, Dr Pierre Oura N'Guessan, Ms Alice Viviane Adou
- Data management: Mr Georges Tanoh Affi

Senegal

- Ministry of Health: Dr Babacar Gueye, Dr Serigne Niang (first principal investigator, replaced by second principal investigator)
- Team from Gaspard Kamara District Hospital: Dr Rokhaya Daba Sy, Dr Mbissane Sarr (first gynaecologist, replaced), Ms Penda Ndiaye, Ms Soukaye Ndiaye, Ms Adam Diagne, Ms Khady Dieng, Ms Awa Agnès Diop, Ms Diégane Faye, Ms Fatou Niang Guéye, Ms Rokhaya Mballo, Ms Adji Ndoumé Mboup, Ms Awa Diakhaté, Ms Aissata Ba, Dr Nadia Maliki
- Team from PHC HLM: Dr Ibrahima Ndour, Ms Aminata Samb, Ms Khady Ba, Ms Mame Bassé Dione, Ms Rokhaya Gueye, Ms Fama Ndiaye, Ms Alimatou Ba

- Team from PHC Liberté VI: Ms Aissatou Aida Ndoye, Ms Khoudia Diop, Ms Estella Diédhiou, Ms Yayi Mbaye Ndoye, Ms Maimouna Ndir
- Team from PHC Maristes: Dr Pathé Diakhaté, Ms Awa Mbaye, Ms Ndaté Ndir, Ms Saoudatou Oumarou, Dr Fatou Loum, Mr Ibrahima Seck, Dr Fatou Binetou Thiam, Ms Madina Kane, Ms Ndioba Thiam, Ms Hortense Faye, Ms Maty Niang
- Data management: Ms Fama Ndao Ndiaye

Master trainers from France and Morocco

- Dr Isabelle Heard (Senior Visiting Scientist)
- Dr Monique Marien (retired gynaecologist)
- Professor Moulay Abdelilah Melhouf, CHU Hassan II, Fes, Morocco
- Professor Lahcen Boukhanni, CHU Mohammed VI, Marrakesh, Morocco

Foreword

The International Agency for Research on Cancer (IARC) is pleased to publish *Implementation of a pilot cervical cancer screening programme integrated in routine primary health-care services in Benin, Côte d'Ivoire, and Senegal*. This publication summarizes the outcomes of the Care4Afrique pilot project, which was implemented in the three focus countries in Africa in close collaboration with the ministries of health of the countries and the Lalla Salma Foundation for Cancer Prevention and Treatment (Morocco).

Although the burden of cervical cancer is very high in Francophone sub-Saharan Africa, very little evidence is available on how best to integrate cervical cancer screening and treatment services, especially using new technologies such as thermal ablation, into routine primary health-care services. The Care4Afrique project, which was implemented in three Francophone countries in West Africa, highlights solutions to overcome some of the common system-level barriers to implementation that are faced in many countries in sub-Saharan Africa. The ministry of health in each participating country and other local stakeholders, including the leading academic institutions, were the key implementation partners in this project, in which a total of 16 530 women underwent opportunistic screening at primary health centres and the screen-positive women were managed. Strong collaborations were established among multiple African countries to build capacity in the primary health-care facilities. The project demonstrated that implementation of screening by visual inspection with acetic acid (VIA) followed by immediate treatment with thermal ablation in primary health-care services is feasible in these resource-constrained settings provided there is strong leadership, active stakeholder engagement, and meticulous attention to the quality of services at all levels.

The latest guidelines from the World Health Organization (WHO) on cervical cancer screening and treatment emphasize the need for implementation research to document the challenges and opportunities in the local context when planning to introduce or scale up a cervical cancer screening programme. The Care4Afrique project provides an implementation model that other countries may emulate and thus remain aligned with the WHO strategy to eliminate cervical cancer as a public health problem globally.

IARC is grateful to its local collaborators in Benin, Cote d'Ivoire, and Senegal for their involvement and efforts, and to the Lalla Salma Foundation for Cancer Prevention and Treatment (Morocco) for its support. This project is another excellent example of IARC's mission: cancer research that matters.

Dr Elisabete Weiderpass
Director, International Agency for Research on Cancer

Préface

Au Maroc, la détection précoce des cancers du sein et du col utérin a constitué une des toutes premières priorités du Plan National de Prévention et de Contrôle du Cancer (PNPCC) 2010–2019 élaboré par la Fondation Lalla Salma et le Ministère de la Santé. S'appuyant sur les recommandations de l'Organisation mondiale de la Santé, le Maroc a mis en place un modèle de détection précoce des cancers du sein et du col utérin intégré dans son système de santé et adapté aux spécificités médico sanitaires, culturelles et socioéconomiques du pays. La mise en œuvre s'est faite de façon progressive jusqu'à la couverture totale de tout le territoire national.

Les résultats encourageants des évaluations faites au cours du premier PNPCC ont permis au Maroc de fixer, parmi les priorités du deuxième PNPCC (2020–2029) le contrôle du cancer du col utérin.

Ces résultats ont motivé la Fondation Lalla Salma et le Centre International de Recherche sur le Cancer (CIRC) à développer un projet de recherche opérationnelle pilote intitulé « *Care4Afrique: Implementation of a pilot cervical cancer screening programme based on a single-visit approach and improving capacity for breast cancer early diagnosis* » au Bénin, en Côte d'Ivoire et au Sénégal, ces trois pays étant déjà en partenariat avec la Fondation Lalla Salma dans la lutte contre le cancer.

Cette étude, lancée en 2017 dans le cadre d'un projet de coopération multilatérale, a permis d'engager les ministères de la santé de ces pays et toutes les parties prenantes dans chaque pays afin de faciliter la décision d'étendre ledit projet à travers les territoires nationaux de ces pays, leurs ministères de la santé étaient les principaux investigateurs du projet. Au terme de l'évaluation de ce projet, les résultats sont satisfaisants et montrent qu'une planification adaptée aux capacités et ressources disponibles, permet d'atteindre les objectifs tracés.

Le cancer du col utérin est l'un des cancers les plus faciles à prévenir et à traiter si on le détecte précocement. La complémentarité des partenaires, et l'expérience vécue à travers ce projet dans ces trois pays est un bon exemple à suivre pour arriver à l'élimination du cancer du col utérin en tant que problème de santé publique.

Dr Rachid Bekkali
Directeur général, Fondation Lalla Salma – Prévention et traitement des cancers

Preface

In Morocco, the early detection of breast cancer and cervical cancer was one of the top priorities of the National Plan for Cancer Prevention and Control (NPCPC) 2010–2019 developed by the Lalla Salma Foundation and the Ministry of Health. Based on the recommendations of the World Health Organization, Morocco set up a model for the early detection of breast cancer and cervical cancer integrated into its health system and adapted to the specific medical, health, cultural, and socio-economic context of the country. The implementation was done gradually until the entire national territory was fully covered.

The encouraging results of the evaluations carried out during the first NPCPC enabled Morocco to set the control of cervical cancer among the priorities of the second NPCPC (2020–2029).

These results motivated the Lalla Salma Foundation and the International Agency for Research on Cancer (IARC) to develop a pilot operational research project entitled "Care4Afrique: Implementation of a pilot cervical cancer screening programme based on a single-visit approach and improving capacity for breast cancer early diagnosis" in Benin, Côte d'Ivoire, and Senegal, three countries that were already in partnership with the Lalla Salma Foundation in the fight against cancer.

This study, launched in 2017 within the framework of a multilateral cooperation project, made it possible to engage the ministries of health of these countries and all the stakeholders in each country, in order to facilitate the decision to extend this project across the national territories of these countries (their ministries of health being the project's principal investigators). At the end of the evaluation of this project, the results are satisfactory and show that when planning is adapted to the capacities and resources available, it is possible to achieve the objectives set.

Cervical cancer is one of the most preventable and treatable cancers if it is detected early. The complementarity of the partners and the experience gained through this project in these three countries provide a good example to follow to achieve the elimination of cervical cancer as a public health problem.

Dr Rachid Bekkali
Director-General, Lalla Salma Foundation for Cancer Prevention and Treatment

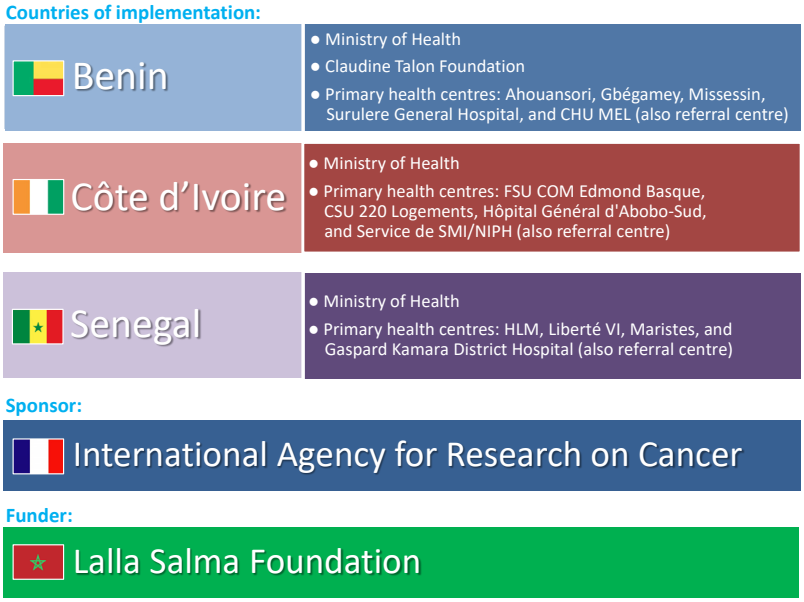
Executive summary

Cervical cancer remains a critical public health concern worldwide, particularly in low- and middle-income countries (LMICs). More than 85% of deaths from cervical cancer occur in LMICs, which do not have adequate health system capacity to implement effective cervical cancer screening programmes with the model that is used in high-income countries. Like other LMICs, countries in sub-Saharan Africa need to identify locally appropriate and evidence-based cervical cancer screening and treatment strategies. The World Health Organization (WHO) has identified cervical cancer screening and treatment as a "best buy" (highly cost-effective in any health setting) and has recommended the incorporation of such services into the basic health-care package.

Sporadic screening activities are conducted in many countries in sub-Saharan Africa, without any time-bound plans for scaling up. Very little evidence is available on how best to incorporate screen-and-treat services, especially using new technologies such as thermal ablation, into routine primary health-care services. The Care4Afrique pilot project was designed to address this evidence gap in implementation. The experiences gained from the pilot project implemented in **Benin, Côte d'Ivoire, and Senegal** in close collaboration with the ministries of health and other key stakeholders in each country (Fig. 1) were designed to inform pragmatic decision-making by policy-makers in order to scale up cervical cancer screening and treatment.

The **International Agency for Research on Cancer** (IARC) in collaboration with the **Lalla Salma Foundation for Cancer Prevention and Treatment** (LSF) launched the project in November 2017; the project incorporated visual inspection with acetic acid (VIA) as the screening test, thermal ablation as a novel technology to treat cervical precancers, and screen-and-treat as the management approach. The main objective of the project was to assess the feasibility, safety, and acceptability of cervical cancer screening and treatment delivered opportunistically through existing primary health-care services in sub-Saharan Africa, with

Fig. 1. Partners involved in the Care4Afrique project.

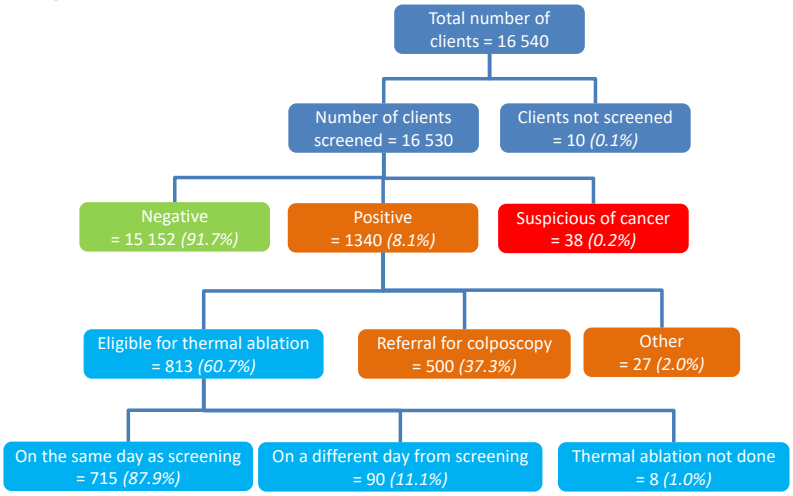


Benin, Côte d'Ivoire, and Senegal as the focus countries. The ministry of health in each country was the key implementation partner, and other local stakeholders, such as civil society organizations, nongovernmental organizations, and the leading academic institutions, were involved to ensure wider buy-in of the project outcomes. The protocol for screening and treatment was customized for each country in consultation with the national stakeholders.

Another ambition of the pilot project was to build capacity within the public health-care system in the focus countries to deliver cervical cancer screening and treatment. A team of master trainers was identified in each country and trained. These master trainers trained a large number of providers at the primary and secondary levels of care to deliver screening and treatment and also mentored them regularly. On the basis of a systematic assessment of needs, the project supplied the equipment needed to deliver VIA, colposcopy, and treatment services. An electronic database was developed and customized to each country setting to enable the capture of data to monitor and evaluate the screening and treatment services.

Between April 2018 and January 2021, a total of 16 530 women in the three focus countries were screened through the project. Overall, 8.1% of the women screened were VIA-positive, and among them, 0.2% of the women had lesions suspicious of cancer on VIA. A total of 60.7% of all VIA-positive women were eligible for thermal ablation; most of them (87.9%) received treatment on the same day as screening, and only 1.0% refused treatment (Fig. 2).

Fig. 2. Flow chart of the Care4Afrique project in Benin, Côte d'Ivoire, and Senegal.



The Care4Afrique project showed that implementation of screening with VIA and treatment with thermal ablation in a single-visit approach in existing health services at the primary care level is feasible in limited-resource settings. It also demonstrated that treatment with thermal ablation is safe and highly acceptable to women. The keys to the success of cervical cancer screening in any health setting, including sub-Saharan Africa, are strong leadership, stakeholder engagement, appropriate coordination between the primary and secondary levels of health services, adequate investment in training and refresher training of service providers, and stringent quality assurance. The implementation experience gained from this project will greatly help these countries to scale up cervical cancer screening and treatment to remain aligned with the WHO strategy to eliminate cervical cancer as a public health problem globally.

Care4Afrique Project in Benin, Côte d'Ivoire, and Senegal – key achievements

- Seven gynaecologists were trained in VIA, thermal ablation, colposcopy, and large loop excision of the transformation zone (LLETZ) as master trainers. They trained health-care providers in these procedures.
- A total of 73 nurses and midwives were trained to perform VIA and thermal ablation.
- Collaborations among LMICs in the region were established for the training of service providers.
- Thirteen primary health clinics were set up to provide VIA screening and thermal ablation treatment services.
- Three colposcopy clinics were set up to provide colposcopy, cervical biopsy, thermal ablation, and loop excision treatment services.
- A total of 16 530 women were screened with VIA.
- A total of 892 VIA-positive women were treated.
- Histopathologically confirmed cervical cancers were detected in 6 women, who were then referred for cancer treatment.
- Awareness of cervical cancer was raised among policy-makers and health officials.

Abbreviations

CHU MEL	Centre Hospitalier et Universitaire de la Mère et de l'Enfant Lagune, Cotonou, Benin
CIN2	cervical intraepithelial neoplasia grade 2
CSU	Centre de Santé Urbain
FSU COM	Formation Sanitaire Urbaine à Base Communautaire, Abidjan, Côte d'Ivoire
GP	general practitioner
HDI	Human Development Index
HIV	human immunodeficiency virus
HLM	Habitations à Loyer Modéré
HPV	human papillomavirus
IARC	International Agency for Research on Cancer
ISRCTN	International Standard Randomized Controlled Trial Number
KPI	key performance indicator
LLETZ	large loop excision of the transformation zone
LMICs	low- and middle-income countries
LSF	Lalla Salma Foundation for Cancer Prevention and Treatment
MoH	ministry of health
NDMCH	Nargis Dutt Memorial Cancer Hospital, Barshi, India
NIPH	National Institute of Public Health (Institut National de Santé Publique), Abidjan, Côte d'Ivoire
PHC	primary health centre
PPV	positive predictive value
REDCap	Research Electronic Data Capture
SMI	Santé Maternelle et Infantile
VIA	visual inspection with acetic acid
WHO	World Health Organization

CHAPTER 1.

Introduction

1.1 The Care4Afrique project in the context of cervical cancer elimination in sub-Saharan Africa

Cervical cancer is the fourth most common cancer type in women worldwide and is responsible for many premature deaths, especially in countries in sub-Saharan Africa. Every year, more than 300 000 women die from cervical cancer globally. More than 85% of the deaths from cervical cancer occur in low- and middle-income countries (LMICs), which do not have adequate health-care resources to implement effective cervical cancer screening programmes [1]. Most deaths from cervical cancer occur in women of childbearing age. A mother's death is associated with increased child mortality; for every 100 women who die from cervical cancer in sub-Saharan Africa, at least 14 children die before age 10 years [2].

The World Health Organization (WHO) recently announced a comprehensive strategy to eliminate cervical cancer as a public health problem globally [3]. To eliminate cervical cancer as a public health problem, all countries must reach and maintain an incidence rate of fewer than 4 new cases of cervical cancer per 100 000 women per year. To reach the elimination target, every country must ensure that at least 70% of eligible women are screened with high-performance screening tests, that at least 90% of women with cervical precancer are treated and 90% of women with invasive cervical cancer are managed, and that at least 90% of girls are fully vaccinated against human papillomavirus (HPV) by age 15 years. Each country should meet these targets by 2030 to be on the path towards cervical cancer elimination within the next century.

Currently, the situation in Africa with respect to cervical cancer screening is highly variable. Some countries, such as Morocco, Zambia, and Zimbabwe, have made concerted efforts to introduce and scale up cervical cancer screening based on visual inspection with acetic acid (VIA). However, most countries in sub-Saharan Africa have low-volume opportunistic screening of doubtful quality, and very limited facilities for management of cervical precancer. These countries require a contextually appropriate model of cervical cancer screening and treatment services that is feasible, acceptable, and integrated in the existing primary health-care system. The third edition of *Disease Control Priorities* recommended opportunistic screening with VIA and treatment of

precancerous lesions – a screen-and-treat approach – as part of an essential package of cost-effective health interventions (to be delivered through primary care) in low-income countries, because of the high cost of the model of systematic invitation-based screening [4]. The integration of cervical cancer screening in primary health-care services will ensure wider reach of the programme and lower costs for the health system; this will make the programme sustainable.

The success of cervical cancer screening depends on the ability of the programme to ensure appropriate treatment of any precancers and cancers detected by screening. Treatment is the weakest component of the cervical cancer screening programmes in LMICs. It is impractical to implement in LMICs the model that is used in high-income countries, which relies heavily on colposcopy, histopathology, and large loop excision of the transformation zone (LLETZ) for treatment. Therefore, WHO strongly recommended immediate ablative treatment for selected screen-positive women without waiting for colposcopic or histopathological verification. Even this single-visit screen-and-treat approach, which aims to improve compliance with treatment, faced a major challenge in sub-Saharan Africa. WHO initially recommended cryotherapy as the ablative technique of choice, but this requires a supply of refrigerant gas (nitrous oxide or carbon dioxide). It may be challenging to ensure a regular supply of refrigerant gas in primary care settings in countries in sub-Saharan Africa, and this limits the capacity to scale up cryotherapy. Two meta-analyses by researchers from the International Agency for Research on Cancer (IARC), published in 2014 and 2019, demonstrated that the use of thermal ablation (previously known as cold coagulation) as an ablative treatment for cervical precancers was not only safe and acceptable but also as effective as cryotherapy [5, 6]. IARC and partners subsequently developed and evaluated an inexpensive, battery-operated, portable thermal ablator through a research project supported by the United States National Institutes of Health [7]. In 2019, WHO recommended thermal ablation as a method of choice for ablative treatment [8].

IARC and the Lalla Salma Foundation for Cancer Prevention and Treatment (LSF) launched the Care4Afrique pilot project in November 2017, when very few countries in the world had adopted thermal ablation as a method of treatment. The project aimed to evaluate the feasibility, safety, and acceptability of the new approach (VIA followed by thermal ablation) in real health-care settings where the intervention would be provided by many health-care providers with variable levels of expertise. Experience gained from wide-scale use of VIA followed by thermal ablation in primary care settings and shared with health professionals, programme managers, and health policy-makers is likely to convince them to adopt the new technology and scale up its use. Moreover, about 30% of screen-positive women are not eligible for treatment with any ablative technique and would require treatment with LLETZ, preferably under colposcopic guidance. Colposcopy and LLETZ facilities linked to the screening centres were set up through the Care4Afrique project to ensure complete care of the women undergoing cervical cancer screening. This experience and expertise will be extremely valuable for the focus countries as they plan to scale up cervical cancer screening and treatment.

Only 1.2% of the female population aged 10–20 years in sub-Saharan Africa had been vaccinated against HPV by 2019 [9], and cervical cancer screening and treatment programmes in the region must be improved if countries are to remain aligned with the WHO strategy to eliminate cervical cancer. The experience gained from the Care4Afrique pilot project in three different countries can be used to inform pragmatic decision-making by policy-makers to scale up cervical cancer screening and treatment.

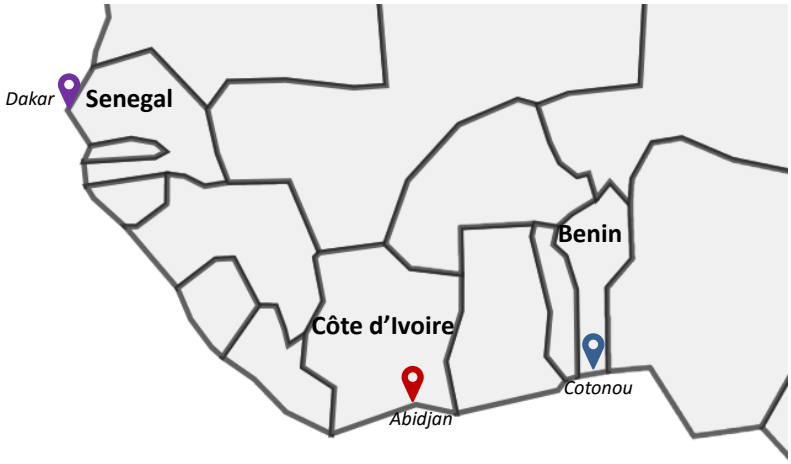
1.2 The implementation sites for the Care4Afrique project

The Care4Afrique pilot project was implemented in three Francophone countries in West Africa: Benin, Côte d'Ivoire, and Senegal (Fig. 3). All three countries are in sub-Saharan Africa.

Benin has a total female population of 5.5 million and a Human Development Index (HDI) value of 0.545 (category: low) [10]. Cervical cancer is the second most common cancer type in women in the country. In 2020, there were an estimated 560 new cases of cervical cancer and 368 deaths from the disease in Benin; the age-standardized incidence rate of cervical cancer was 15.1 per 100 000 woman-years, and the age-standardized mortality rate was 10.4 per 100 000 woman-years [11]. The Care4Afrique project was implemented in the capital city of Cotonou.

Côte d'Ivoire has a total female population of 11.7 million and an HDI value of 0.538 (category: low) [10]. Cervical cancer is the second most common cancer type in women in the country. In 2020, there were an estimated 2067 new cases of cervical cancer and 1417 deaths from the disease in Côte d'Ivoire; the age-standardized incidence rate of cervical cancer was 31.2 per 100 000 woman-years, and the age-standardized mortality rate was 22.8 per 100 000 woman-years [11]. The Care4Afrique

Fig. 3. Implementation sites for the Care4Afrique project in Benin, Côte d'Ivoire, and Senegal.



project was implemented in the capital city of Abidjan.

Senegal has a total female population of 7.8 million and an HDI value of 0.512 (category: low) [10]. Cervical cancer is most common cancer type in the country. In 2020, there were an estimated 1937 new cases of cervical cancer and 1312 deaths from the disease in Senegal; the age-standardized incidence rate of cervical cancer was 36.3 per 100 000 woman-years, and the age-standardized mortality rate was 26.0 per 100 000 woman-years [11]. The Care4Afrique project was implemented in the capital city of Dakar.

The implementation site in each focus country was selected by the ministry of health (MoH) of the country in consultation with other national stakeholders. Before the project began, a few women were being screened with VIA at some of the sites, but the VIA-positive women were not being treated with thermal ablation at any of the sites.

1.3 Aims and objectives of the Care4Afrique project

The primary aim of the Care4Afrique project was to engage with the key officials of the MoH in each focus country and support them to start opportunistic cervical cancer screening and treatment as an integrated primary health-care service with VIA and thermal ablation. The project provided technical support only, by organizing training for health-care providers of different levels, supplying essential equipment, and developing an electronic database for record-keeping. The ambition was that the project sites would continue to provide the services even after the completion of the project and would consider gradual scale-up.

The specific objectives of the pilot project were:

1. to assess the feasibility of establishing a fully functional VIA-based screen-and-treat service at selected primary health centres (PHCs) in the focus countries;
2. to assess the feasibility of establishing a fully functional colposcopy and precancer management service linked to the screening service in the focus countries;
3. to evaluate the feasibility, acceptability, and safety of treatment with a new battery-operated, portable thermal ablator in primary health-care settings by nurses and general practitioners (GPs);
4. to assess the feasibility of developing and implementing an electronic record-keeping system that would be useful to monitor and evaluate the cervical cancer screening and treatment services;
5. to generate a pool of master trainers in cervical cancer screening and treatment who will catalyse the continued development of human resources in the country.

This report summarizes key events and activities that have taken place since the inception of the pilot project in three African countries: Benin, Côte d'Ivoire, and Senegal. The aim of this report is to highlight observations and conclusions, particularly in relation to the feasibility and acceptability of this approach in the real health-care settings of these three countries. Finally, lessons learned are discussed and recommendations are made for the scale-up of services.

CHAPTER 2.

Methodology

2.1 Advocacy and project planning

The preparatory phase of the Care-4Afrique project began in September 2017 with meetings organized in each focus country between representatives of IARC, the LSF, the MoH, WHO country offices, academic institutions, and civil society organizations. At these meetings, several topics were discussed at length, including the need to improve cervical cancer screening, the objectives of the project, the implementation plan, and the support required from the different stakeholders. The national stakeholders in each focus country identified one project leader (principal investigator) for their country. After extensive discussions with the national stakeholders, the project protocol was customized for each country, taking into consideration the existing national screening guidelines (if any) and the local needs, feasibility, and expectations.

In each country, the services were planned to be delivered through a maximum of five PHCs (to provide VIA and thermal ablation services)

Official launch of the Care4Afrique project in Dakar, Senegal, on 28 November 2017.

and one secondary care facility (to provide colposcopy, cervical biopsy, and LLETZ services). It was decided that the nurses, midwives, and GPs providing routine care at the PHCs would be trained to perform VIA and thermal ablation, and the gynaecologists at the secondary care facilities would be trained to perform colposcopy and LLETZ. The master trainers were identified from the departments of gynaecology at the academic institutions. The data collection tools were designed and finalized after discussion with the stakeholders and were used to develop an electronic database. A data manager was identified in each country to collect the paper records from the screening and colposcopy centres and enter the data into the electronic database regularly. A country-specific final project plan was drafted and approved by the respective national team.

The screening and treatment protocol and the project implementation plans were approved by the national ethics committee in each country as well as by the IARC Ethics Committee. The project was registered in the International Standard Randomized Controlled Trial Number (ISRCTN) trials registry (registration number: ISRCTN21518741; https://doi.org/10.1186/ISRCTN21518741).

The project activities started at different times in different countries, because the time taken to finalize the project plan and obtain the regulatory approvals varied.

2.2 Site selection and assessment of site readiness

The project was designed to screen at least 5000 women per country in the target age group within 18 months from the start of the project and to manage the screen-positive women appropriately. In each country, the project implementation sites and the service delivery sites were identified in consultation with the MoH and other national stakeholders. On the basis of their suggestions, four or five PHCs were selected in each country to provide VIA-based screen-and-treat services, and one secondary-level facility was selected for the referral of the screen-positive women who were not eligible for thermal ablation. The MoH also provided the required regulatory clearances and approvals to use the designated health facilities for the project and to release the staff members for training. A focal point for the project was identified within the MoH to liaise with the principal investigator and other national stakeholders.

The screening facilities were set up at five PHCs in Benin, four PHCs in Côte d'Ivoire, and four PHCs in Senegal. In each country, the nearest district hospital was identified as the secondary-level facility to provide colposcopy services (Table 1).

The principal investigators visited the designated facilities together with the representatives of IARC and the LSF and completed a checklist to assess the site readiness. Lists were made of the staff members to be trained to provide various services, and of the equipment and consumables that were available and those that had to be procured to start services. Equipment and consumables, including vaginal specula, punch biopsy forceps, electro-diathermy machines for loop excision, and thermal ablation devices, were provided to the project sites according to their requirements, to enable the screening and management of at least 5000 women.

2.3 Training of service providers

An assessment of training needs was performed for each country, and a training plan was prepared accordingly. Two master trainers (gynaecologists) to be trained in cervical cancer prevention, early detection, and management were identified in each country.

The training of trainers course was organized by IARC in February 2018 in collaboration with the Nargis Dutt Memorial Cancer Hospital

Ethics approval

1. Approval date 17 October 2017, IARC Ethics Committee (150 cours Albert Thomas, 69372 Lyon Cedex 08, France; Tel: +33 (0)4 72 73 83 41; Email: iec-secretariat@iarc.fr), Ref. Project No. 17-33.
2. Approval date 7 September 2018, National Ethics Committee for Health Research of Benin (BP 01-882 Benin, Cotonou, 01882, Benin; Tel: +229 (0)21 33 2178; Email: info@sante.gouv.bi), Ref. N_58/MS/DC/SGM/DRFMAT/CNERS/SA.
3. Approval date 21 June 2018, National Ethics Committee of Life and Health Sciences (16ème Étage-Tour C Cité Administrative Abidjan-Plateau, Abidjan, 00225, Côte d'Ivoire; Email: ministere.sante@egouv.ci), Ref. 078-18/MSHP/CNESVS-km.
4. Approval date 18 December 2017, Health Research of Senegal (Rue Aimé Césaire – Fann Résidence, Dakar, 12500, Senegal; Tel: +221 (0)869 42 42; Email: informatique@sante.gouv.sn), Ref. Protocol SEN 17/65.

Master trainers were trained in cervical cancer prevention, early detection, and treatment at the Nargis Dutt Memorial Cancer Hospital, Barshi, India.

Table 1. Facilities and categories and numbers of health professionals providing screening, colposcopy, and treatment services in the three focus countries

Country	Sites providing screening services	Screening performed by	Site providing colposcopy services	Colposcopy performed by
Benin	CHU MEL, Cotonou	Midwives (*n* = 4) GP (*n* = 1)	CHU MEL, Cotonou	Gynaecologists (*n* = 2)
	Surulere General Hospital, Cotonou	Nurse (*n* = 1) Midwives (*n* = 4)		
	PHC Missessin, Cotonou	Midwives (*n* = 4)		
	PHC Gbégamey, Cotonou	Nurse (*n* = 1) Midwives (*n* = 3)		
	PHC Ahouansori, Cotonou	Nurse (*n* = 1) Midwives (*n* = 4)		
Côte d'Ivoire	Service de SMI/NIPH, Abidjan	Midwives (*n* = 4) Gynaecologist (*n* = 1)	NIPH, Abidjan	Gynaecologists (*n* = 2)
	CSU 220 Logements, Abidjan	Midwives (*n* = 4) Gynaecologist (*n* = 1)		
	FSU COM Edmond Basque, Abidjan	Midwives (*n* = 4) Gynaecologist (*n* = 1)		
	Hôpital Général d'Abobo-Sud, Abidjan	Midwives (*n* = 4) Gynaecologist (*n* = 1)		
Senegal	Gaspard Kamara District Hospital, Dakar	Nurses (*n* = 2) Midwives (*n* = 15) GPs (*n* = 4)	Gaspard Kamara District Hospital, Dakar	Gynaecologists (*n* = 2)
	PHC HLM, Dakar	Nurses (*n* = 2) Midwives (*n* = 4) GP (*n* = 1)		
	PHC Liberté VI, Dakar	Nurse (*n* = 1) Midwives (*n* = 5) GP (*n* = 1)		
	PHC Maristes, Dakar	Nurses (*n* = 5) Midwives (*n* = 4) GPs (*n* = 2)		

CHU MEL, Centre Hospitalier et Universitaire de la Mère et de l'Enfant Lagune; FSU COM, Formation Sanitaire Urbaine à Base Communautaire; GP, general practitioner; HLM, Habitations à Loyer Modéré; PHC, primary health centre; SMI/NIPH, Santé Maternelle et Infantile/National Institute of Public Health.

Providers were trained in visual inspection with acetic acid (VIA) and thermal ablation in Côte d'Ivoire.

Providers were trained in Benin.

Nurses and midwives were trained in visual inspection with acetic acid (VIA) and thermal ablation in Benin.

(NDMCH), India, and the LSF. The course used a hybrid approach, in which each trainee completed a self-paced online learning module made available on the IARC website before they attended the 1-week practical hands-on training at NDMCH. The French-speaking faculty members included two master trainers from Morocco and two from France. The master trainers from Benin were not able to attend the training of trainers course in India. A separate training course was organized for them in Dakar, Senegal.

Local training courses were conducted for the nurses, midwives, GPs, and gynaecologists who participated in the project at each site. These courses were led by the master trainers in each country. The training included both theoretical knowledge and activities to develop practical skills. An assessment of competency was performed for each trainee, after which a certificate was issued. Continuing supportive supervision and at least one refresher training within a year was provided by the master trainers in each country. Training in data management with the electronic database developed with Research Electronic Data Capture (REDCap) software was conducted in each country by an IARC staff member.

The training sessions held in the three focus countries are listed in Table 2.

Table 2. Training sessions in the three focus countries

Country	Details of the training sessions
Benin	• Primary training course: conducted on 28–31 May 2019 at the Claudine Talon Foundation • Total number of trainees: 27 • Virtual refresher training courses for midwives: conducted on 15 October 2020 and 19 November 2020
Côte d'Ivoire	• Primary training course: conducted on 16–19 July 2018 at the National Institute of Public Health (Institut National de Santé Publique), Abidjan • Total number of trainees: 20
Senegal	• Primary training course: conducted in two sessions (9–12 April 2018 and 16–19 April 2018) at Gaspard Kamara District Hospital, Dakar • Total number of trainees: 45 • Refresher training: conducted independently at each primary health centre (PHC) involved in the project on 19–21 December 2018 • Training course and refresher training on colposcopy and management of cervical precancers: conducted on 14 and 15 January 2019 at Gaspard Kamara District Hospital to train gynaecologists from Senegal and Benin

2.4 Protocol for screening and treatment services

Target age ranges for cervical cancer screening vary between countries. According to the national recommendations, the recommended target age range was 25–49 years in Benin and Côte d'Ivoire and 30–49 years in Senegal. Screening was performed with the VIA test, and VIA-positive women were immediately assessed for eligibility for ablative treatment using the standard criteria. The criteria used to determine eligibility for ablative treatment were as follows: the squamocolumnar junction is fully visible and is on the ectocervix, the lesion is ectocervical and occupies less than 75% of the ectocervix, and there is no suspicion of invasive cancer. The women who were eligible for thermal ablation were offered treatment on the same day. The women who were not eligible for thermal ablation were referred for colposcopy and further investigation. Women with suspected invasive cancer were also referred to the colposcopy facility. Screen-negative women were advised to attend for repeat VIA after 3 years in Benin and Côte d'Ivoire and after 5 years in Senegal. In Senegal, women living with HIV were advised to attend for screening more frequently (every 3 years).

Cervical cancer screening was performed by trained nurses, midwives, or GPs at the designated screening clinics. All women aged 25–49 years (in Benin and Côte d'Ivoire) or 30–49 years (in Senegal) who attended the clinics for various reasons and provided informed consent were offered VIA opportunistically. Women with debilitating illnesses, those with a diagnosis of cervical cancer, and those who had been screened for cervical cancer within the previous 36 months were excluded. The women were counselled either individually or in groups.

Women who required referral for colposcopy were adequately counselled and provided with the details of the colposcopy clinic. At the colposcopy clinic, most of the women with suspected high-grade lesions on colposcopy were offered LLETZ treatment on the same day without waiting for histopathological verification. Women with suspected cancer had cervical biopsies taken at the colposcopy clinic and were managed on the basis of the histopathology report (Fig. 4).

Examination rooms in primary health centres (PHCs) providing visual inspection with acetic acid (VIA) and thermal ablation services in Côte d'Ivoire and Senegal.

2.5 Follow-up of women after treatment

After treatment, women were advised to attend the screening centre for follow-up after 12 months. The VIA test was repeated at follow-up. Women with persistent lesions after thermal ablation were referred to the colposcopy clinic. Women with a normal cervix at follow-up were advised to attend for routine screening after 3 years in Benin and Côte d'Ivoire and after 5 years (or after 3 years for women living with HIV) in Senegal.

2.6 Operational framework and project monitoring

The operational framework of the Care4Afrique project is shown in Fig. 5. At the community level, project activities included creating awareness through communication and education targeting women in the age group 25–49 years (in Benin and Côte d'Ivoire) or 30–49 years (in Senegal). At the primary care level, VIA was performed. Women with a positive VIA result received immediate treatment with thermal ablation or, if the lesion did not meet the criteria for thermal ablation, were referred to the secondary level, where further evaluation could be provided (colposcopy, LLETZ, or biopsy). Healthcare providers were trained and services were monitored and evaluated at all levels.

The principal investigator in each country and the facility in charge were responsible for regular monitoring of the project activities. From time to time, IARC shared the analysed data on screening performance with them.

Periodic discussions were held with all the service providers to track the progress of the work and to receive feedback from them. During the course of the project, at least one supportive supervision visit was held, and the specific activities listed in Table 3 were reviewed to track the progress of the project in each of the three countries. The supportive supervision visit was conducted jointly by IARC and the LSF, and recommendations were made for improvement. The facilities in charge were actively involved in all the supportive supervision visits.

Fig. 4. Flow chart of cervical cancer screening and management. LLETZ, large loop excision of the transformation zone; PHC, primary health centre; VIA, visual inspection with acetic acid.

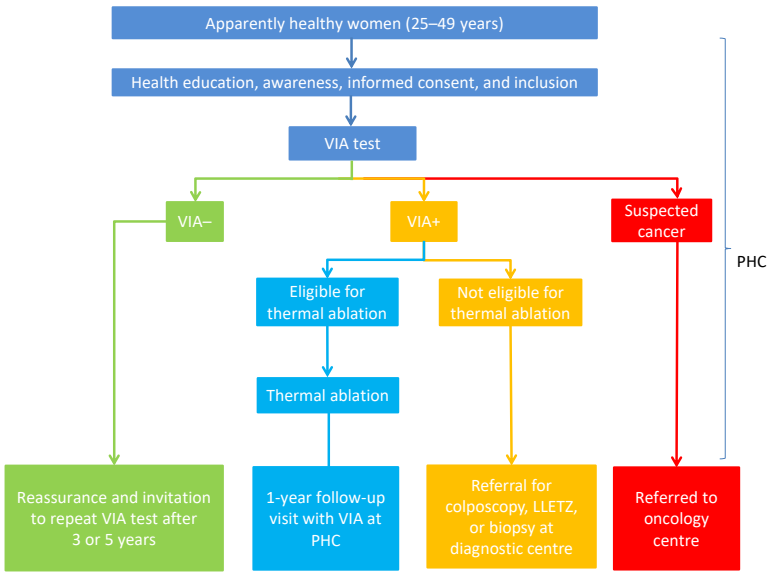


Fig. 5. Operational framework of the Care4Afrique project. IARC, International Agency for Research on Cancer; LLETZ, large loop excision of the transformation zone; LSF, Lalla Salma Foundation for Cancer Prevention and Treatment; MoH, ministry of health; PHC, primary health centre; TA, thermal ablation; VIA, visual inspection with acetic acid.

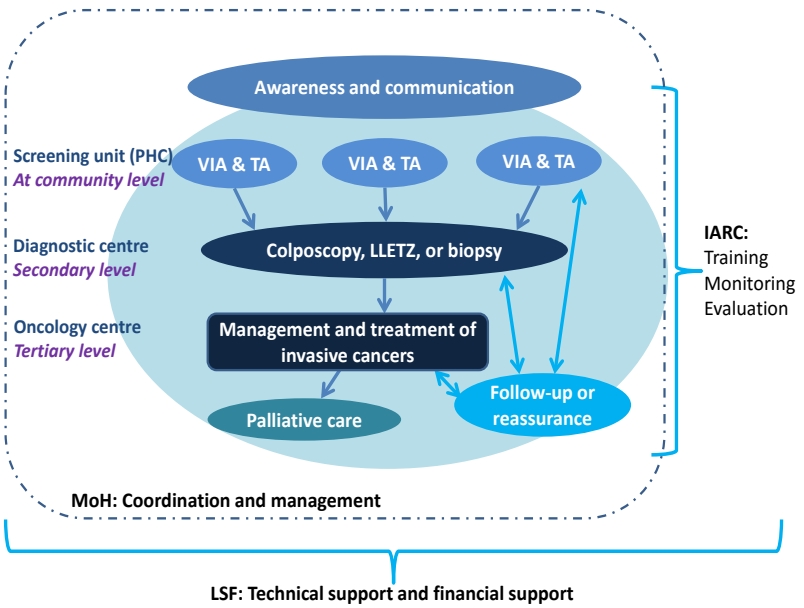


Table 3. Activities included in the supportive supervision visit

1. Assessing the infrastructure of the clinic, the adequacy of privacy and cleanliness, the condition of the equipment, and the supply of consumables
2. Assessing the performance of the service providers for screening, treatment, and other procedures, using a performance checklist
3. Reviewing the infection prevention protocol and the adherence to this protocol by the staff members in the clinic
4. Assessing the quality and completeness of record-keeping
5. Receiving feedback from the different categories of service providers
6. The following key performance indicators were estimated from the records maintained at the clinics and monitored: a. Number of women screened per month b. Proportion of the women screened beyond age 25–49 years (in Benin and Côte d'Ivoire) or 30–49 years (in Senegal) c. VIA positivity rate d. Proportion of VIA-positive women referred to a diagnostic and treatment clinic (secondary care facility) e. Proportion of VIA-positive women eligible for ablative treatment who received treatment f. Proportion of VIA-positive women eligible for ablative treatment who received same-day treatment g. Proportion of women who attended a diagnostic and treatment clinic for positive VIA results who underwent colposcopy (for diagnostic and treatment clinic only) h. Proportion of women with suspected high-grade lesions on colposcopy who were treated (for diagnostic and treatment clinic only)

2.7 Awareness campaign

The screening services in the project were opportunistic, and women who attended the PHCs for various reasons were counselled to undergo screening. Where feasible, community mobilization was done by the community health workers and/or through public awareness campaigns in the newspaper, on the radio, on television, or on the Internet with the help of local nongovernmental organizations, established supportive foundations, and the MoH. The women who underwent screening were asked to spread the word by telling their relatives and friends about the screening service.

2.8 Data collection and data management

Every woman who underwent screening received a registration card with a unique identity number. The outcomes of VIA, colposcopy, treatment of precancerous lesions, and follow-up assessments were entered on paper case record forms and were later entered into REDCap, an electronic data capture tool hosted at IARC [12, 13]. REDCap is a secure, web-based software platform designed to support data capture for research studies, providing (i) an intuitive interface for validated data capture, (ii) audit trails for tracking data manipulation and export procedures, (iii) automated export procedures for seamless data downloads to common statistical packages, and (iv) procedures for data integration and interoperability with external sources. Data were regularly monitored locally and by IARC, to assess the progress of the project and to estimate the key performance indicators.

Supportive supervision visit in Senegal.

(a) The installation of a banner at the entrance to Gaspard Kamara District Hospital in Dakar, Senegal, at the launch of the project, announcing free-of-charge cervical cancer screening and treatment services. (b) Awareness messages delivered to women waiting for cervical cancer screening at a facility in Benin. (c) Face-to-face discussion with participants to explain the screening procedures in Côte d'Ivoire.

(a) The records of each woman who underwent screening were entered in a primary health centre (PHC) register. (b) Data from paper case record forms were entered into the electronic database developed with REDCap software.

CHAPTER 3.

Project outcomes

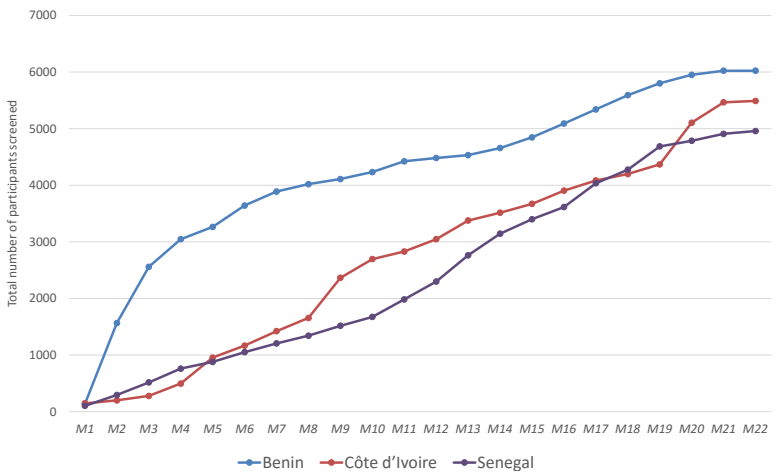
3.1 Screening with VIA

A total of 16 530 women were screened opportunistically in the three countries. The time required to screen 5000 women varied between the countries (Fig. 6). In Benin 6029 women were screened from January 2019 to January 2021 (25 months), in Côte d'Ivoire 5500 women were screened from July 2018 to June 2020 (24 months), and in Senegal, 5001 women were screened from April 2018 to June 2020 (27 months).

The number of women screened during the originally planned project duration of 18 months was 4482 in Benin, 3048 in Côte d'Ivoire, and 2299 in Senegal. The number of women screened per month during the first 12 months of the project ranged from 58 to 1423 in Benin, from 54 to 709 in Côte d'Ivoire, and from 105 to 314 in Senegal (Fig. 7).

Table 4 shows the number of women screened and the VIA outcomes by country and project site. A total of 1340 (8.1%) of the women screened were VIA-positive, and among them, 38 (0.2%) had lesions suspicious of cancer on VIA. The VIA positivity rate varied between the project sites, from 17.6% at CHU MEL in Benin to 0.7% at Hôpital Général d'Abobo-Sud in Côte d'Ivoire. In general, the project sites in

Fig. 6. Cumulative number of women screened by month and country.



Senegal reported lower VIA positivity rates than those in the other two countries.

The VIA positivity rate did not vary much between the age groups in Côte d'Ivoire and Senegal (Fig. 8). In Benin, the VIA positivity rate was much higher in the age group 45–49 years (15.6%) than in the age group 25–29 years (10.4%). The proportion of women screened at age 25–29 years was 26.1% in Benin and 22.6% in Côte d'Ivoire.

Fig. 7. Number of women screened per month during the first 12 months of the project by country.

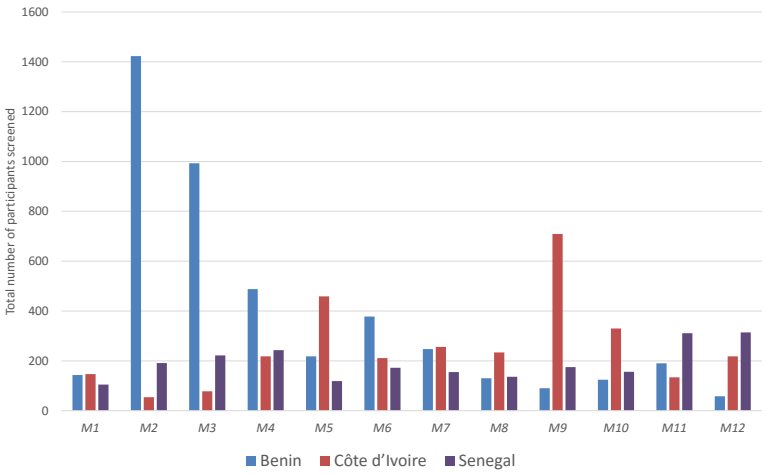


Table 4. Number of women screened and VIA outcomes by country and site

Country	Sites providing screening	No. of women screened	No. VIA-positive (%)	No. with suspected cervical cancer on VIA (%)
Benin	CHU MEL	1967	347 (17.6%)	8 (0.4%)
	Surulere General Hospital	1174	98 (8.3%)	2 (0.2%)
	PHC Missessin	899	76 (8.5%)	0 (0.0%)
	PHC Gbégamey	1035	104 (10.0%)	4 (0.4%)
	PHC Ahouansori	954	117 (12.3%)	6 (0.6%)
	All sites in Benin	**6029**	**742 (12.3%)**	**20 (0.3%)**
Côte d'Ivoire	Service de SMI/NIPH	3126	333 (10.7%)	1 (0.0%)
	CSU 220 Logements	1027	69 (6.7%)	5 (0.5%)
	FSU COM Edmond Basque	675	15 (2.2%)	0 (0.0%)
	Hôpital Général d'Abobo-Sud	672	5 (0.7%)	0 (0.0%)
	All sites in Côte d'Ivoire	**5500**	**422 (7.7%)**	**6 (0.1%)**
Senegal	Gaspard Kamara District Hospital	2620	77 (2.9%)	0 (0.0%)
	PHC HLM	669	45 (6.7%)	10 (1.5%)
	PHC Liberté VI	457	10 (2.2%)	2 (0.4%)
	PHC Maristes	1255	44 (3.5%)	0 (0.0%)
	All sites in Senegal	**5001**	**176 (3.5%)**	**12 (0.2%)**
Total		**16 530**	**1340 (8.1%)**	**38 (0.2%)**

CHU MEL, Centre Hospitalier et Universitaire de la Mère et de l'Enfant Lagune; FSU COM, Formation Sanitaire Urbaine à Base Communautaire; HLM, Habitations à Loyer Modéré; PHC, primary health centre; SMI/NIPH, Santé Maternelle et Infantile/National Institute of Public Health; VIA, visual inspection with acetic acid.
Source: Selmouni et al. (2022) [14]. Copyright © 2022, by the American Society of Clinical Oncology.

3.2 Treatment with thermal ablation

Table 5 shows the number of women treated with thermal ablation by country and project site.

Of the 1340 women with a positive VIA result, 813 (61%) were eligible for thermal ablation. Of those eligible for thermal ablation, 715 (88%) received the treatment on the same day as screening, 90 (11%) returned to the clinic for treatment on a different date, and only 8 (1%) were lost to follow-up.

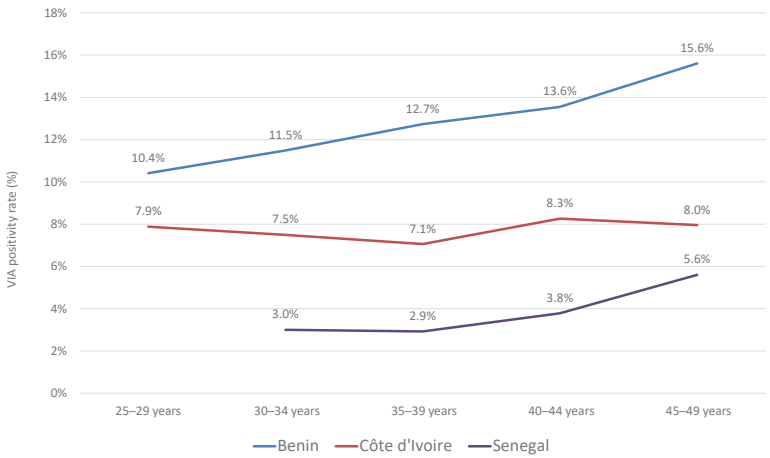
The proportion of VIA-positive women who were eligible for thermal ablation varied widely between the

Table 5. Number of women treated with thermal ablation by country and site

Country	Site	No. VIA-positive	No. eligible for ablation (%)	No. accepted for same-day treatment (%)	No. accepted for treatment later (%)
Benin	CHU MEL	347	122 (35%)	112 (92%)	7 (6%)
	Surulere General Hospital	98	84 (86%)	78 (93%)	5 (6%)
	PHC Missessin	76	26 (34%)	24 (92%)	1 (4%)
	PHC Gbégamey	104	100 (96%)	89 (89%)	10 (10%)
	PHC Ahouansori	117	108 (92%)	90 (83%)	18 (17%)
	All sites in Benin	**742**	**440 (59%)**	**393 (89%)**	**41 (9%)**
Côte d'Ivoire	Service de SMI/NIPH	333	281 (84%)	254 (90%)	27 (10%)
	CSU 220 Logements	69	30 (43%)	27 (90%)	3 (10%)
	FSU COM Edmond Basque	15	15 (93%)	11 (79%)	3 (21%)
	Hôpital Général d'Abobo-Sud	5	4 (80%)	4 (100%)	0 (0%)
	All sites in Côte d'Ivoire	**422**	**329 (78%)**	**296 (90%)**	**33 (10%)**
Senegal	Gaspard Kamara District Hospital	77	10 (13%)	4 (40%)	6 (60%)
	PHC HLM	45	4 (9%)	3 (75%)	1 (25%)
	PHC Liberté VI	10	2 (20%)	0 (0%)	0 (0%)
	PHC Maristes	44	28 (64%)	19 (68%)	9 (32%)
	All sites in Senegal	**176**	**44 (25%)**	**26 (59%)**	**16 (36%)**
Total		**1340**	**813 (61%)**	**715 (88%)**	**90 (11%)**

CHU MEL, Centre Hospitalier et Universitaire de la Mère et de l'Enfant Lagune; FSU COM, Formation Sanitaire Urbaine à Base Communautaire; HLM, Habitations à Loyer Modéré; PHC, primary health centre; SMI/NIPH, Santé Maternelle et Infantile/National Institute of Public Health.
Source: Selmouni et al. (2022) [14]. Copyright © 2022, by the American Society of Clinical Oncology.

Fig. 8. Rates of positive results on visual inspection with acetic acid (VIA) by age group and by country. Source: Selmouni et al. (2022) [14]. Copyright © 2022, by the American Society of Clinical Oncology.



countries, ranging from 25% in Senegal to 78% in Côte d'Ivoire. Eligibility proportions for thermal ablation decreased gradually with age in all three countries (Fig. 9).

Most eligible women (88%) received thermal ablation on the same day as screening and were treated immediately. Overall, 96% of eligible women were treated within 1 week of screening, and there was no significant difference in this proportion between the countries. The proportion of women who were treated on the same day as screening was lower in Senegal (59%) than in Benin (89%) and Côte d'Ivoire (90%) (Fig. 10).

3.3 Management of VIA-positive women who are not eligible for thermal ablation

The women who had lesions suspicious of cancer and those who were not eligible for thermal ablation were referred to a higher-level health facility for further evaluation and treatment. Fig. 11 shows the outcomes of further management for the 38 women with suspected cervical cancer on VIA. Only 21 women (55%) were documented to have undergone further investigation at the colposcopy clinic. Very few of the women

Fig. 9. Eligibility proportions for thermal ablation by age group and country. Source: Selmouni et al. (2022) [14]. Copyright © 2022, by the American Society of Clinical Oncology.

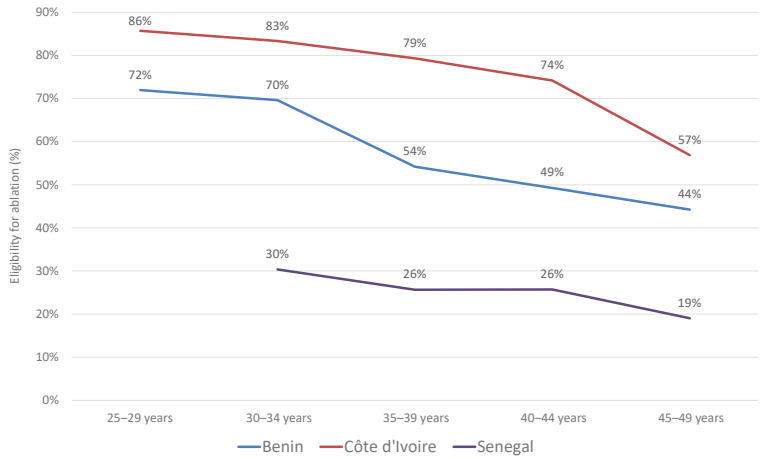
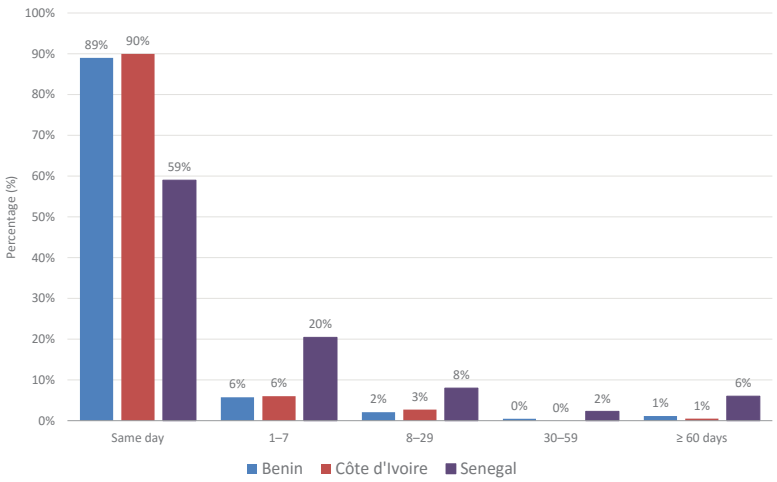


Fig. 10. Percentage of women eligible for thermal ablation who were treated on the same day as screening or at various time intervals (in days).



(4; 19%) had suspected cancer on colposcopy. The remainder of the women had either a normal cervix or suspected cervical precancer. Women with suspected precancer were treated by the colposcopists.

Of the 500 VIA-positive women referred to a colposcopy clinic, only 335 (67.0%) attended the clinic to undergo the examination. In 145 (43.3%) of the women who underwent examination, no abnormality was detected on colposcopy. Among the VIA-positive women, 114 (34.0%) had suspected low-grade lesions on colposcopy, 53 (15.8%) had suspected high-grade lesions on colposcopy, and 3 (0.9%) had lesions suspicious of cancer on colposcopy. It should be noted that the colposcopy result is unknown in 20 women (6%) (Fig. 12).

Most of the suspected low-grade or high-grade lesions were treated with thermal ablation or LLETZ on the basis of the colposcopic diagnosis. A substantial number of women were treated with thermal ablation by the colposcopist even though they were considered by the VIA provider to not be eligible for thermal ablation. A few of the women with low-grade or high-grade lesions were referred to higher-level centres for LLETZ or cold knife conization because the lesions were too large to be managed at the secondary care level.

For the women with suspected low-grade or high-grade lesions on colposcopy who underwent biopsy, histopathology reported 3 cases of cervical intraepithelial neoplasia grade 2 or 3 (CIN2/3) in women with suspected low-grade lesions (Fig. 13) and 11 cases of CIN2/3 and 3 cases of cancer in women with suspected high-grade lesions (Fig. 14).

Of the 167 VIA-positive women with suspected low-grade or high-grade lesions on colposcopy, only 17 (10.2%) were found to have CIN2 or worse lesions on histopathology.

A total of 806 VIA-positive women were treated with thermal ablation by nurses or midwives at PHCs; an additional 83 women were referred and treated with thermal ablation or LLETZ by gynaecologists, and 3 women with cervical cancer were referred to oncology centres. A total of 892 VIA-positive women were treated.

3.4 Side-effects of thermal ablation

Table 6 shows the side-effects reported by women during or immediately after thermal ablation. Moderate or severe pain or cramping during or after treatment was reported by 31 women (3.8%); 24 of them were in Benin. All 6 women who reported severe pain were in Benin. In 4 of them, treatment could not be completed because of pain. The same provider had attempted to treat 3 of the 4 women who abandoned thermal ablation. No other major side-effects or complications were reported in the 805 women treated.

Fig. 11. Investigation and treatment of women with lesions suspicious of cancer on visual inspection with acetic acid (VIA).

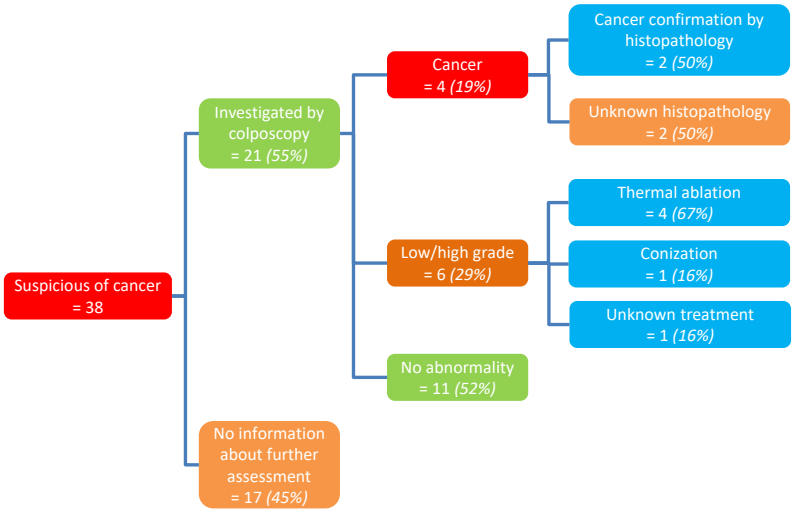
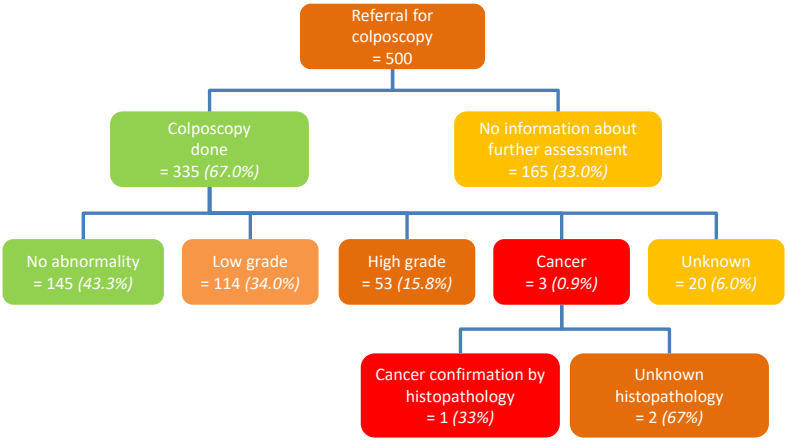


Fig. 12. Colposcopy outcomes for the women who were referred for colposcopy because of a positive result on visual inspection with acetic acid (VIA).



3.5 Follow-up of women treated with thermal ablation

Table 7 shows the numbers of women who were treated with thermal ablation and who attended for follow-up.

The proportion of women who attended for follow-up 1 year after treatment with thermal ablation at the PHCs was very low: 35.9% in Benin and 4.6% in Côte d'Ivoire. None of the women treated in Senegal returned for follow-up. Overall, 18.8% of the treated women were found to be positive on VIA at follow-up and were referred for colposcopy.

3.6 Key implementation challenges identified

The following key implementation challenges were identified:

- It was difficult to continue to screen a large number of women through a purely opportunistic approach. Some of the women visit the PHCs repeatedly, whereas many do not visit PHCs unless they are very ill. Only a few of the project sites benefited from community mobilization (done by the community health workers and/or through local mass media campaigns).

Table 6. Side-effects reported during or immediately after thermal ablation by project site[a]

Side-effect	Benin (*n* = 438[b])	Côte d'Ivoire (*n* = 329)	Senegal (*n* = 42)	All sites (*n* = 809[b])
None	204 (46.6%)	97 (29.5%)	24 (57.1%)	325 (40.2%)
Mild pain or cramping	200 (45.7%)	225 (68.4%)	17 (40.5%)	442 (54.6%)
Moderate pain or cramping	18 (4.1%)	6 (1.8%)	1 (2.4%)	25 (3.1%)
Severe pain or cramping	6[b] (1.4%)	0 (0.0%)	0 (0.0%)	6[b] (0.7%)
Light bleeding	1 (0.2%)	2 (0.6%)	1 (2.4%)	4 (0.5%)
Moderate bleeding	1 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.1%)
Vaginal burning	8 (1.8%)	0 (0.0%)	0 (0.0%)	8 (1.0%)
Other	5 (1.1%)	0 (0.0%)	0 (0.0%)	5 (0.6%)

[a] Several side-effects may be reported by the same woman (total of 816 side-effects in 809 women).
[b] Of which 4 women abandoned treatment.
Source: Selmouni et al. (2022) [14]. Copyright © 2022, by the American Society of Clinical Oncology.

Fig. 13. Histopathology outcomes and management of suspected low-grade lesions on colposcopy (treatment was performed on the basis of the colposcopic diagnosis). CIN, cervical intraepithelial neoplasia; LLETZ, large loop excision of the transformation zone; TA, thermal ablation.

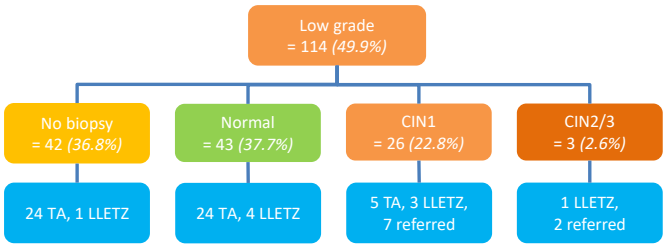
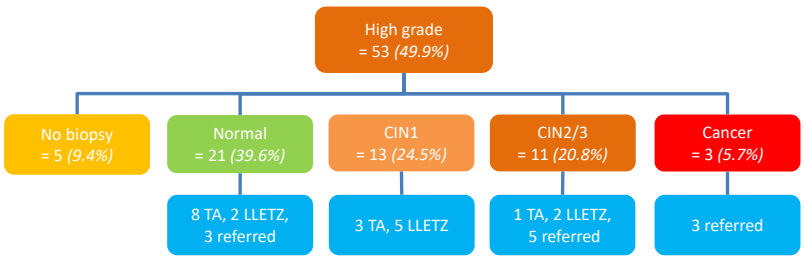


Fig. 14. Histopathology outcomes and management of suspected high-grade lesions on colposcopy (treatment was performed on the basis of the colposcopic diagnosis). CIN, cervical intraepithelial neoplasia; LLETZ, large loop excision of the transformation zone; TA, thermal ablation.



- Nearly one quarter of the women screened in Benin and Côte d'Ivoire were in the age group 25–29 years, because these young women tend to visit the PHCs more frequently than older women do. The older women were less accessible through such opportunistic screening.
- The acetic acid used was of variable concentration. The project recommended the use of 5% diluted acetic acid. At some of the project clinics, it was not possible to obtain the glacial acetic acid required to prepare 5% acetic acid. Vinegar intended for cooking was used as a replacement. Those project clinics used only cooking vinegar with the concentration of acetic acid given on the bottle. However, a complicated formula was required to obtain the appropriate dilution. In busy clinics, the nurses diluted the vinegar by adding an approximate amount of distilled water rather than by following the formula. In other clinics, the diluted acetic acid was purchased by the central pharmacy in bulk; therefore, it was not possible for the solution to be freshly prepared daily.
- The maintenance of colposcopy equipment was a major problem in some countries. At one of the referral centres, the colposcope could not be used for months because it was damaged and no maintenance engineer was available. The women who attended for colposcopy were referred to a tertiary care hospital, and this resulted in high loss to follow-up.
- At some of the PHCs, the thermal ablator developed mechanical problems. Each centre had only one device and could not offer treatment until the device was replaced.
- In some of the busy clinics, the routine workload of the nurses was very high. Initially, the nurses were very enthusiastic in counselling eligible women to undergo screening. However, the high workload meant that the nurses working in the busier clinics gradually became less able to find enough time and energy to counsel women to undergo screening. As a result, the number of women screened per month decreased with time. One

Table 7. Follow-up of women treated with thermal ablation by project site

Country	No. treated with thermal ablation	No. who attended for follow-up (%)	No. VIA-positive at follow-up (%)
Benin	434	155 (35.9%)	32 (20.6%)
Côte d'Ivoire	329	15 (4.6%)	0 (0%)
Senegal	42	0 (0%)	–
Total	805	170 (22.3%)	32 (18.8%)

PHC decided to open a cancer screening clinic with dedicated midwives and a specific room.

- The VIA positivity rates were extremely variable between the project sites, irrespective of the age group of the women. The VIA positivity rate was very high (up to 50%) at some of the PHCs when the nurses started the project. The VIA positivity rate decreased as the nurses became more experienced. However, in one country the VIA positivity rate remained low, probably as a result of technical issues (overdilution of the acetic acid solution, and examination of the cervix too soon after the application of acetic acid).
- Despite the efforts of the project team to counsel the women adequately, it was difficult to ensure high compliance with colposcopy of the women referred to a colposcopy clinic.
- Compliance with follow-up after treatment was very low.
- In one country, the colposcopists received very few referrals; this made it difficult for them to maintain their skills adequately. Some of the colposcopists felt that the training provided was not adequate.
- Histological confirmation was unaffordable at some sites, because of the limited budget of the local team.
- The implementation of an information system, the collection of questionnaires from the PHC, and the entry of data into the database required organization and the recruitment of an additional staff member. This is not sustainable.

CHAPTER 4.

Discussion and lessons learned

The Care4Afrique pilot project, which was implemented in three Francophone countries in West Africa, clearly demonstrated the advantages and the challenges of implementing opportunistic screening with VIA followed by immediate treatment with thermal ablation as a service integrated in the primary health-care system.

The project also highlighted the need for the establishment of colposcopy and LLETZ treatment services for the substantial number of VIA-positive women who would require further assessment and excisional treatment. The details of the lessons learned from the project are described in the subsequent sections.

4.1 Opportunistic screening at primary health centres – advantages and disadvantages

This project demonstrated that the delivery of cervical cancer screening and treatment services through PHCs is feasible in the three African settings studied. For cervical cancer screening to be accessible to the women who need the service most, it should be incorporated into the basic health packages delivered through primary care.

Most of the PHCs have facilities to examine women, and the nurses and GPs are generally experienced in performing speculum examination and minor procedures, such as the insertion of intrauterine contraceptive devices. Some additional inputs are needed to develop the infrastructure for screening and ablative treatment in those settings. For example, the project supplied one thermal ablator to each clinic, but it would be better to supply two devices per clinic to ensure continuity of service, in case one device develops technical problems.

To successfully start and maintain opportunistic screening in PHCs, the training of health-care providers and periodic supportive supervision are the key requirements. This is particularly important because there is a high turnover of providers in some clinics.

The main challenge of such an opportunistic approach is achieving high coverage. Most of the eligible women attend PHCs only when they are pregnant or seriously ill, which is not the optimal opportunity to perform cervical cancer screening. **The best way to improve coverage of screening is to incorporate some form of community mobilization**

activity. In this project, such mobilization was done by the community health workers and/or through local mass media campaigns and special events (e.g. the First Lady of Benin was invited to launch the cervical cancer screening programme in that country). Community mobilization is a sustained activity that involves various stakeholders (ministries of education and information, civil society organizations, media representatives, etc.).

The age of the women being screened at PHCs should be closely monitored. Women younger than 30 years often seek a pelvic examination because of vaginal discharge or menstrual problems. Young women willingly accept screening services, as was seen in many of the clinics in this project. **The providers of VIA should be aware that screening women younger than 30 years is not a cost-effective use of resources and may also subject the women to unnecessary harms.**

4.2 VIA as a screening test – advantages and disadvantages

VIA is a simple test, and implementation is feasible in primary care settings. The biggest advantage is its point-of-care nature, which enables a treatment decision to be made immediately. However, many challenges are associated with the use of VIA.

It is widely recognized that VIA performance can be highly variable and depends on the training, experience, and skill of individual providers. These limitations of VIA were also demonstrated in this project. The VIA positivity rates varied widely between the PHCs within the same country and the same region. **The subjective nature of VIA is the biggest hurdle to the scale-up of VIA-based screening.** Intensive efforts are needed to ensure that training and periodic retraining of providers is provided. Moreover, providers should be able to perform enough tests on a regular basis to maintain their skills adequately.

Regular mentoring by a more skilled provider is also key to improve VIA performance. In some settings, tele-consultation facilities have been created for VIA providers; these enable them to capture cervical images with a mobile phone and share the images with an expert for a second opinion. The subjective nature of VIA also makes quality control difficult.

The supply of acetic acid of the appropriate dilution is also a challenge in many African countries. Freshly prepared acetic acid of the appropriate dilution (3–5%) should be used to obtain accurate VIA test outcomes. Acetic acid is highly hygroscopic and attracts water from the atmosphere. This causes a stored solution to easily become diluted. Therefore, the solution should be freshly prepared daily. Vinegar intended for cooking is frequently used in health clinics in Africa; this practice is inadvisable because the concentrations given on the bottles are not reliable.

VIA test performance (sensitivity, specificity, and predictive values) can also vary widely between the settings. **A major limitation of the VIA-based screen-and-treat approach is the high proportion of women who are treated unnecessarily, because of the low positive predictive value (PPV) of the test.** This project was not designed to evaluate VIA test performance. However, the low PPV of the test can be deduced from the fact that only 4 of the 21 women with suspected cervical cancer on VIA who underwent further investigation were found to have cancer on colposcopy or biopsy.

4.3 Thermal ablation – advantages and disadvantages

This project established the feasibility, safety, and acceptability of thermal ablation performed by nurses or GPs with variable levels of expertise in primary care settings in multiple countries. **More than 800 women were eligible for treatment at the screening visit, and 88% of them were accepted for same-day treatment without any major complications being reported.** The proportion of women who reported moderate or severe pain during or after the procedure was very low, even though the treatment was performed without any anaesthesia. Only 6 women reported severe pain, and all of them were at the same clinic in one country. There may have been a problem with the correct application of the probes. No cases of primary or secondary haemorrhage or pelvic inflammatory disease were reported in the treated women.

A few centres reported technical problems with the thermal ablator, especially with the probes. On the basis of the feedback, the manufacturer improved the design, and the new device was found to be more robust. There were no reports of incomplete treatment due to technical failure or drainage of battery charge.

The only limitation of any ablative treatment is that a substantial proportion of screen-positive women (39% in this project) are not eligible for thermal ablation and require referral for excisional treatment. **A high variability was observed in the assessment of eligibility for ablative treatment.** The eligibility certainly depends on age, because a higher proportion of younger women have an ectocervical transformation zone compared with older women. The variability in the eligibility proportion was observed even when the women were stratified by age group.

The eligibility proportion in women aged 30–34 years varied from 30% in Senegal to 83% in Côte d'Ivoire. Many of the VIA-positive women who were considered by the VIA provider to not be eligible for thermal ablation were considered to be eligible by the colposcopist.

4.4 Colposcopy practice – feasibility and challenges

The project successfully set up a colposcopy facility in each country. It was challenging to find gynaecologists at the district hospitals who were willing to be trained in colposcopy. However, the project trained some of them to perform colposcopy and LLETZ. The PPV of the colposcopists to detect CIN1 or worse lesions was 46.7%, which is reasonably good in a VIA-based screening programme. However, many of the colposcopists were hesitant to perform difficult LLETZ procedures and preferred to refer such women to the tertiary care setting. In some countries, it was also a challenge to ensure a regular supply of the consumables required for electrosurgery (loop and ball electrodes, hand switches, etc.).

4.5 Training of health-care providers

Training of health-care providers at all levels is key to the success of screen-and-treat programmes. The cascading impact of training a core group of master trainers and using them to train, retrain, and mentor a large number of providers was demonstrated in this project. Because the nurses and GPs at the PHCs have a high workload and cannot be away from their routine duties for long periods, whenever possible such training should be delivered as self-paced online learning. The digital atlas on VIA and ablative treatment developed by IARC is a very useful resource for self-paced learning. The *Atlas of Visual Inspection of the Cervix with Acetic Acid for Screening, Triage, and Assessment for Treatment* is accessible online free of charge at https://screening.iarc.fr/atlasvia.php (Fig. 15).

The digital atlas has an image bank that trainers and trainees can use. The use of a large number of images showing VIA outcomes helps to improve the confidence of trainees. Every trainee should receive adequate hands-on training, and trainers should ensure that trainees follow a systematic checklist when performing an examination. A checklist is available at https://screening.iarc.fr/atlasviadetail.php?Index=29.

Trainees should practise thermal ablation on a dummy model (e.g. on a chicken breast) before they perform the procedure on a patient. There is no standard guideline on the number of women a trainee should practise on before being considered proficient. At the end of training, the competency of each trainee should be assessed objectively, and a certificate should be issued to successful trainees.

IARC has also developed self-paced online learning materials on colposcopy and LLETZ, which are accessible free of charge in the *Atlas of Colposcopy: Principles and Practice* at https://screening.iarc.fr/atlascolpo.php (Fig. 15). This resource is very useful for colposcopy trainees.

4.6 Quality assurance of VIA-based screen-and-treat programmes

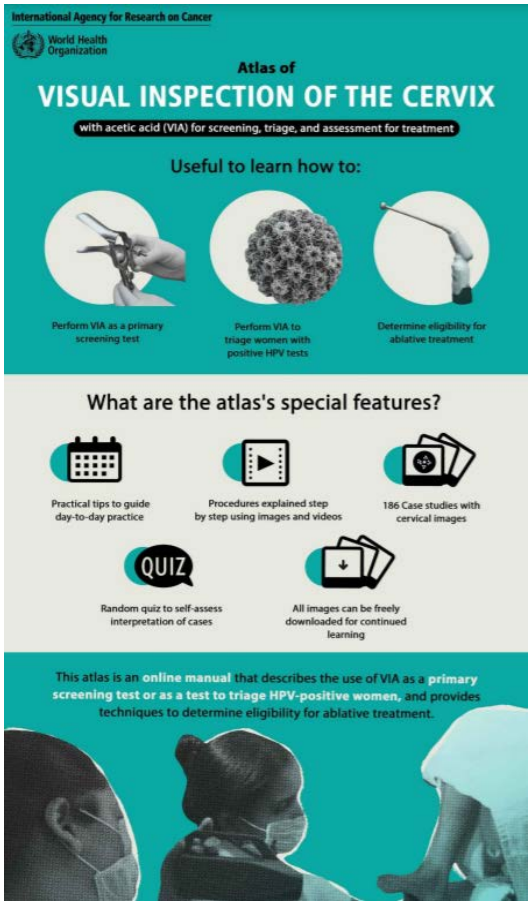
Any screening programme may cause harms to the participants unless all services are delivered with appropriate quality at each level. Quality assurance requires measuring the performance of all services, including not only the delivery of the screening test but also diagnostic verification, treatment, and follow-up.

The performance of a screening programme is measured with a set of key performance indicators (KPIs), for which systematic data collection is needed.

A simple electronic database was developed using REDCap software and customized to the requirements of each participating country. The providers were trained in appropriate documentation, and data from the paper records were entered into the electronic database regularly; therefore, it was possible to estimate the following KPIs of a VIA-based screen-and-treat programme.

- **VIA positivity rate** is defined as the percentage of women who tested positive on VIA out of the total number of women screened within a defined age group. VIA positivity rates may vary between populations depending on the prevalence of cervical precancer and cancer; positivity rates will be higher in populations with a higher prevalence of disease. The VIA positivity rate is also generally higher in younger women. However, high variability in the values of this indicator within the same population suggests quality issues, as was observed in this project. A VIA positivity rate that is too high indicates higher false positivity, which results in a higher proportion of women undergoing unnecessary treatment. A VIA positivity rate that is too low may lead to high-grade precancers and cancers being missed.
- **Treatment rate** is defined as the percentage of screen-positive women who completed the appropriate treatment of cervical precancer and cancer. The value of this indicator should be as high as possible. The treatment rate in this project was 66.3%

Fig. 15. Flyer to promote the IARC online *Atlas of Visual Inspection of the Cervix with Acetic Acid for Screening, Triage, and Assessment for Treatment* and the homepage of the online *Atlas of Colposcopy: Principles and Practice.*



▶ https://screening.iarc.fr/atlasvia.php
▶ https://screening.iarc.fr/atlascolpo.php

in the 1340 women found to be VIA-positive at the PHCs. The treatment rate was much higher in the women who were eligible for thermal ablation and could be treated at the PHCs.

- **Completion rate of screening and treatment in a single visit** is defined as the percentage of screen-positive women eligible for ablative treatment who complete treatment in a single visit. This indicator is key to understanding the efficiency of the programme and ensuring high compliance with treatment. In this project, 88% of the VIA-positive women eligible for ablative treatment received the treatment on the same day as screening.
- **Compliance with further evaluation** is defined as the percentage of screen-positive women referred for further evaluation and/or treatment who undergo the procedure. In this project, 565 women were referred for further assessment with colposcopy either because they were VIA-positive and not eligible for thermal ablation or because they had lesions suspicious of cancer. Only 356 (66.2%) of them underwent further assessment at the designated colposcopy clinic.
- **Detection rate of cervical cancer** is defined as the number of cervical cancers detected per 1000 women screened. In this project, 3 cases of histopathologically confirmed cervical cancer were detected in 16 530 women screened. The detection rate was 0.18 per 1000 women screened. There were an additional 4 cases of suspected cancer on colposcopy; however, the histopathology reports for these cases were not available.
- **Follow-up rate after treatment with thermal ablation** is defined as the percentage of treated screen-positive women followed up after 1 year. The follow-up rate at 1 year differed between countries, and 18.8% of treated women were not cured (i.e. had persistent disease at the follow-up visit).

The quality assurance process requires continuously monitoring the performance using the KPIs, comparing the values with expected standards, investigating the causes of suboptimal performance (if indicated), and taking the necessary steps to improve the performance. The same principle of continuous quality improvement was followed in this project. The KPIs were estimated from the data entered into the electronic database. The outcomes were shared with the facility managers and all the service providers. The gaps were identified, and corrective measures were implemented. Despite such proactive measures, there were several gaps in the quality. This underscores the inherent challenges in ensuring robust quality in a VIA-based screen-and-treat programme in LMICs.

CHAPTER 5.

Conclusions

- It is feasible to establish VIA-based screen-and-treat services in primary health-care facilities in sub-Saharan Africa and other limited-resource settings.
- Appropriate leadership from the MoH and support from all relevant stakeholders are necessary to implement such services within an appropriate budget.
- Most LMICs will have to depend on opportunistic screening until a robust health information system is developed to support systematic invitation of the target population.
- Opportunistic screening has several limitations. Women at higher risk of cervical cancer may never be screened because they seldom visit the primary health-care facilities. A comprehensive community mobilization strategy should be adopted to improve participation in screening.
- Capacity improvement is needed in the form of training for various categories of service providers and ensuring the availability of the necessary equipment and consumables.
- Having a critical number of master trainers in the country and establishing collaborations among LMICs in the region will have a cascading impact on the development of a large workforce in the long term.
- Treatment of eligible VIA-positive women with thermal ablation by nurses or general practitioners in primary care settings is safe, acceptable, and highly efficient in enabling the completion of screening and treatment in a single visit.
- It is essential to set up facilities for LLETZ, because a substantial proportion of VIA-positive women (about 40% in this project) are not eligible for ablative treatment.
- The programme leadership and the facility in charge should ensure a mechanism for a steady supply of the appropriate consumables and the maintenance of equipment, for seamless continuity of service.
- It is feasible to measure the performance of the programme on a continuous basis using a simple electronic database and record-keeping systems. The KPIs should be monitored, and appropriate corrective measures should be implemented when necessary. Such quality assurance exercises should involve service providers at all levels.

References

1. Singh GK, Azuine RE, Siahpush M (2012). Global inequalities in cervical cancer incidence and mortality are linked to deprivation, low socioeconomic status, and human development. Int J MCH AIDS. 1(1):17–30. https://doi.org/10.21106/ijma.12 PMID:27621956

2. Mailhot Vega RB, Balogun OD, Ishaq OF, Bray F, Ginsburg O, Formenti SC (2019). Estimating child mortality associated with maternal mortality from breast and cervical cancer. Cancer. 125(1):109–17. https://doi.org/10.1002/cncr.31780 PMID:30383913

3. WHO (2020). Global strategy to accelerate the elimination of cervical cancer as a public health problem. Geneva, Switzerland: World Health Organization. Available from: https://www.who.int/publications/i/item/9789240014107. Licence: CC BY-NC-SA 3.0 IGO.

4. Gelband H, Sankaranarayanan R, Gauvreau CL, Horton S, Anderson BO, Bray F, et al. (2016). Costs, affordability, and feasibility of an essential package of cancer control interventions in low-income and middle-income countries: key messages from *Disease Control Priorities*, 3rd edition. Lancet. 387(10033):2133–44. https://doi.org/10.1016/S0140-6736(15)00755-2 PMID:26578033

5. Dolman L, Sauvaget C, Muwonge R, Sankaranarayanan R (2014). Meta-analysis of the efficacy of cold coagulation as a treatment method for cervical intraepithelial neoplasia: a systematic review. BJOG. 121(8):929–42. https://doi.org/10.1111/1471-0528.12655 PMID:24597779

6. Randall TC, Sauvaget C, Muwonge R, Trimble EL, Jeronimo J (2019). Worthy of further consideration: an updated meta-analysis to address the feasibility, acceptability, safety and efficacy of thermal ablation in the treatment of cervical cancer precursor lesions. Prev Med. 118:81–91. https://doi.org/10.1016/j.ypmed.2018.10.006 PMID:30342109

7. Pinder LF, Parham GP, Basu P, Muwonge R, Lucas E, Nyambe N, et al. (2020). Thermal ablation versus cryotherapy or loop excision to treat women positive for cervical precancer on visual inspection with acetic acid test: pilot phase of a randomised controlled trial. Lancet Oncol. 21(1):175–84. https://doi.org/10.1016/S1470-2045(19)30635-7 PMID:31734069

8. WHO (2019). WHO guidelines for the use of thermal ablation for cervical pre-cancer lesions. Geneva, Switzerland: World Health Organization. Available from: https://apps.who.int/iris/handle/10665/329299. Licence: CC BY-NC-SA 3.0 IGO.

9. Amponsah-Dacosta E, Kagina BM, Olivier J (2020). Health systems constraints and facilitators of human papillomavirus immunization programmes in sub-Saharan Africa: a systematic review. Health Policy Plan. 35(6):701–17. https://doi.org/10.1093/heapol/czaa017 PMID:32538437

10. UNDP (2020). Human development reports. Human Development Index (HDI) ranking. United Nations Development Programme. Available from: https://hdr.undp.org/en/content/latest-human-development-index-ranking.

11. Ferlay J, Ervik M, Lam F, Colombet M, Mery L, Piñeros M, et al. (2020). Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer. Available from: https://gco.iarc.fr/today.

12. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG (2009). Research Electronic Data Capture (REDCap) – a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 42(2):377–81. https://doi.org/10.1016/j.jbi.2008.08.010 PMID:18929686

13. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al.; REDCap Consortium (2019). The REDCap consortium: building an international community of software platform partners. J Biomed Inform. 95:103208. https://doi.org/10.1016/j.jbi.2019.103208 PMID:31078660

14. Selmouni F, Sauvaget C, Dangbemey DP, Kpebo DDO, Dieng NM, Lucas E, et al. (2022). Lessons learnt from pilot cervical cancer screening and treatment programmes integrated to routine primary health care services in Benin, Côte d'Ivoire, and Senegal. JCO Glob Oncol. 8:e2200051. https://doi.org/10.1200/go.22.00051 PMID:36070534