Evaluation of the feasibility of health facility-based initiation of civil registration (Unique Civil Identification Number) and the effect of usage on patient's identification in two selected districts in Zambézia Province

Final Results Report

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Abbreviations

ADS	Associate Director of Science
AJUDA	Analyzing Joint Underperformance and Determining Assistance
CRC	Child-at-Risk Clinic
CDC	US Centers for Disease Control and Prevention
CIBS-Z	Ethics Committee for Health of Zambézia Province (Portuguese: *Comité Institucional de Bioética para Saúde – Zambézia*)
CWH	Children living with HIV
CR	Civil registration
CRVS	Civil registration and vital statistics
DPS-Z	Provincial Health Directorate of Zambézia (Portuguese: *Direcção Provincial de Saúde*)
EPTS	Electronic Patient Tracking System
FGH	Friends in Global Health
HEI	HIV-exposed infants
HF	Heath facility
HIS	Health Information Systems
IRB	Institutional Review Board
LMIC	Low- and middle-income countries
MOH	Ministry of Health
MJCRA	Ministry of Justice, Constitutional and Religious Affairs
NHS	National Health System
NID	National Identification Number
NUIC	Unique Civil Identification Number (Portuguese: *Número Único de Identificação Civil*)
PEPFAR	President's Emergency Plan for AIDS Relief

PLHIV	Persons living with HIV
SD	Standard deviation
WHO	World Health Organization
VS	Vital statistics
VUMC	Vanderbilt University Medical Center

Evaluation Summary

Introduction

In December 2018, Mozambique passed legislation (law no. 12/2018) allowing for electronic civil registration of vital statistics on birth, and a phone-based registration system was introduced. In September 2021, Friends in Global Health (FGH), in collaboration with Ministry of Health, Ministry of Justice, and UNICEF, introduced health facility-based civil registration in Zambézia Province, to explore the integration of unique civil identification into the electronic patient tracking system (EPTS) of children living with HIV (CWH), a potential means to identify duplicated HIV care registration.

Methods

Implementation research was used in this collaborative pilot. In coordination with the other stakeholders, four FGH-supported health facilities were selected to pilot the project. Guardians were referred from Maternal and Child Health and Pediatric HIV service entry points to trained staff (focal point person for notification of unique civil identification number, or in Portuguese, número único de identificação civil [NUIC]) who completed the child's birth record notification via a mobile phone-based registration system, after which a unique civil registration number was generated, validated by a civil registration office and handed to the guardian. For CWH, this number was transcribed in the physical medical record (Master File) and entered into the electronic tracking system. A monitoring tool was used and a supervisor visited the health facilities weekly to oversee activities. Daily reports were completed and monitored in a secure shared platform. Descriptive analysis was done.

Results

Between September 2021-September 2022, 5,641 children (<13 years of age) received a NUIC, of whom 8.7% (488) were up to 1 month of age. Of the total number of children, 6.2% (351/5,641) were CWH. NUIC notification focal point (health staff) struggled to manage registrations when multi-tasking for other clinical care duties, and technical difficulties with the phone-based system resulted in varying results and delays in registration. From the children with a NUIC, 990 (17.6%) managed to complete the registration process. During the pilot period, 2,725 CWH were registered in EPTS as receiving ART (in the pilot HFs); of those, 12.9% (351/2,725) had the NUIC entered in this electronic database. We did not find any duplicated files among the CWH registered, nor any silent transfers.

Conclusions

Although many children were registered through this pilot, technical inconsistencies and clear task delineation could be addressed before strategy expansion. Lessons learnt could plausibly inform the design of mHealth systems used to improve the identification of silent transfers of individuals in HIV care through the use of a unique national registration number.

1. Project Background

1. Civil registration in Mozambique

Civil registration (CR) is the recording of vital events in a person's life (e.g., birth, death) and is a fundamental function of the national government. Birth registration establishes an individual's legal identity at the time of their birth. Civil registration records provide the basis for vital statistics (VS), which are data that can then be used to compute demographic and other key development indicators, for the nation or for a specific area.(1) The availability of reliable and up-to-date VS depends on the level and quality of CR data being captured and entered into registration systems.

Civil registration and vital statistics (CRVS) are critical to the 2030 Sustainable Development Goals.(2) Expansion of CRVS is essential to enhance women and children's access to services and basic civil entitlements (e.g., right to vote, to government services, to use public facilities, etc.) and to realize their rights to proper health care, education, and basic social benefits, including housing and social protection. However, recent reports have shown that more than 110 low- and middle-income countries (LMICs) have deficient CRVS systems.(3)

In December 2018, Mozambique passed legislation (law no. 12/2018) for the electronic registration of a "National Unique Civil Registration Number" (NUIC; in Portuguese: "*Número Único de Identificação Civil*") used for the civil registration of births and deaths and production of its official VS. By April 2022, more than 1,400,000 births had been electronically captured nationwide using the NUIC.[(4)] The formal registration is managed by the Ministry of Justice, Constitutional and Religious Affairs (MJCRA) under the National Directorate of Registrations and Notaries. The proof of registration is a certificate which contains information about the registered person and details regarding the notary archives to facilitate finding it when necessary.

Registration of data for infants up to 6 months of age is free of charge, whereas for older infants, a fee of 50 Metical is levied. Infants born prior to the NUIC legislation who were manually registered (i.e., already have a "*cédula*", or certificate, in the manual registration system) cannot be entered in the electronic system, as it would be a duplicate registration. The process for electronic registration outside the official services (i.e., at the community setting or health facilities [HF]) starts with a "notification" of birth which is done by a healthcare worker through a mobile device. The notification of birth data is then validated at the notary official (i.e., Notary Public) so a parent of the newborn infant can receive the certificate containing that infant's NUIC number. Thus, notification is the initial step in the registration process for births that are to be registered outside the official services (i.e., those registered at health facilities or another community setting). The general steps of birth notification and registration through the health sector are described below (**Figure 1**).

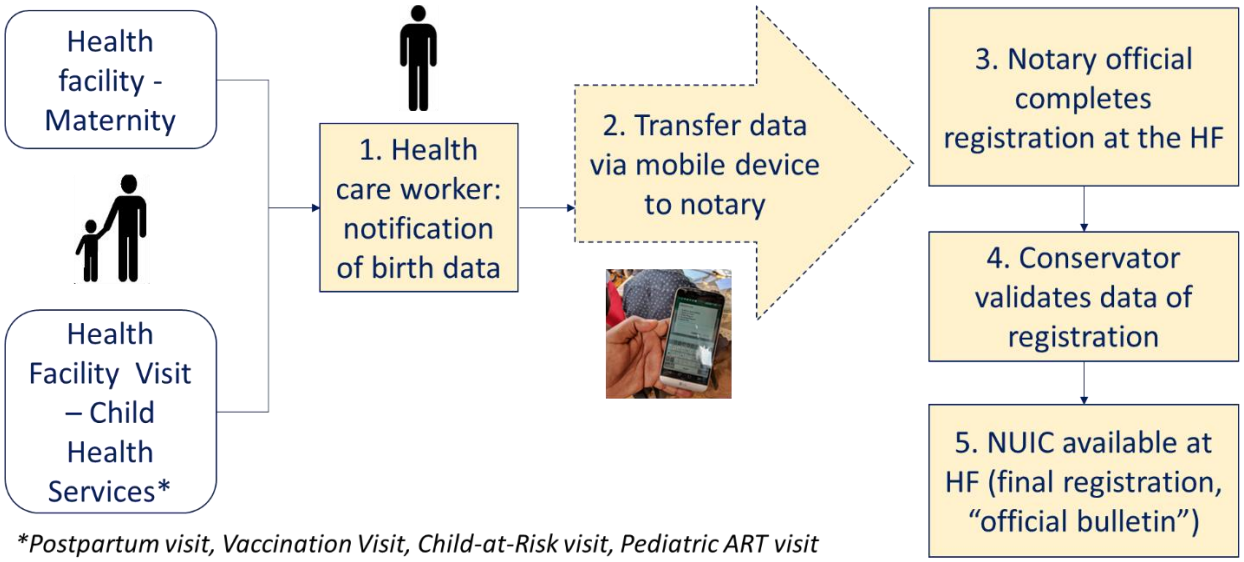


Figure 1. Electronic birth notification and registration system through the health sector in Mozambique, 2021.

Steps 1 and 2: The health care provider transmits the notification of birth data using a mobile phone. The NUIC is generated as soon as the notification is completed (all fields are filled). Then the provider records the NUIC on the child's health card.

Step 3: The notary official from the local civil registry office (available on a fixed or rotating/mobile schedule in the HF) completes the registration, and hands the number to the guardian. When there is no official visiting the HF for registration, the child's guardian(s) must go to the administrative post to complete registration.

Step 4: The Head of the notary official validates the registration.

Step 5: The official NUIC certificate (registration) is made available at the HF. At this point, the child's guardian can collect it from the HF.

Notes:

- *In a HF where there is no notary official available on a fixed or rotating basis, the child's parent(s)/guardian(s) have to go to the administrative post for registration.*
- *The notary official must inform the health care provider of the date that the registration form will be ready at the HF and then the health care provider informs the guardian(s) of the date for collection.*

In Zambézia province, UNICEF supports the CR process initiated within HFs or the community (i.e., "notification"). The provincial justice (MJCRA) authorities and UNICEF performed an assessment to identify the district within Zambézia province where a pilot project for the collection of CR data would best be initiated. The collaborative assessment focused on key program performance areas including the following: i) human resource capacity, ii) community worker capacity (specifically, community health

workers being supported by UNICEF), and iii) existing problems with current manual data collection and entry.

Vanderbilt University Medical Center (VUMC), through its wholly owned subsidiary Friends in Global Health (FGH), has been providing CDC/PEPFAR-funded technical assistance in Zambézia Province, Mozambique since 2006. Over the past few years, VUMC/FGH programs have expanded, currently supporting the provision of comprehensive HIV/AIDS services in 149 HFs (as of September, 2023) in Zambézia Province.

While FGH focused on supporting birth registration at the HF-level, UNICEF provided support to community health workers ("APE" – *Agentes Polivalantes Elementares*) in the proposed districts.

2. Integration of NUIC into the Patient Tracking System for Persons Living with HIV

The National Health System (NHS) uses an ID number referred to as a National Identification Number (NID) for the identification of persons living with HIV (PLHIV) (all adults and children) seeking care in the health sector. Formally introduced by the MOH in January 2013, the official NID is a 19-digit client code generated at the HF-level and defined by country, province, district, HF, service, calendar year (of original registration), and patient's sequence number. While a NID is unique at the time of its issuance, an individual could potentially have multiple NIDs due to subsequent entry into the HF where they originally registered (e.g., patient lost their initial NID card and needed to be provided a new one) and/or they could present for care at additional HFs and potentially provided a new NID at each.[4]

The Electronic Patient Tracking System (EPTS) supported by the President's Emergency Plan for AIDS Relief (PEPFAR) (in this context, OpenMRS), which is almost fully to scale, is being utilized in approximately 97% of supported (Analyzing Joint Underperformance and Determining Assistance, or) AJUDA HFs nationally. The EPTS captures medical record information for all PLHIV receiving care, specifically using the NID as its primary client ID with options for multiple entry of other unique IDs (e.g., "NUIT" – *Número Único de Identificação Tributária* or Unique Identification Tax Number).[4] The current verification process to identify duplication of NIDs within the same HF and between HFs where databases are linked, is based on searches for certain demographic data (e.g., name, date of birth, NID) of patients who are being registered for the first time in a HF's EPTS database. The process must be done manually and consists of triangulating the variables from different databases. Documentation of this verification process has not yet been standardized leading to inconsistencies in practice and data reconciliation.

In March 2019, electronic capture of the NUIC in the EPTS (i.e., OpenMRS) was introduced by the PEPFAR Mozambique Health Information System (HIS) team. By October 2020, the Mozambique Ministry of Health (MOH) was collaborating with U.S. Centers for Disease Control and Prevention (CDC)/PEPFAR, MJCRA, CRVS sector, and implementing donors such as UNICEF, World Bank, World Health Organization (WHO) and others to introduce usage of the NUIC to serve as an additional form of client identification in the MOH-led health sector.(4)

3. Description of the Pilot Project

According to the PEPFAR's Country Operational Plan (COP) for Mozambique in 2022, Zambézia and Sofala provinces were selected for piloting the introduction of NUIC registration into patients' files, and the pilot began in 2021 in Zambézia province. Expected investment benefits for scaling the pilot project include: facility-community tracking and reduction of silent transfers; authentication of patient-level records and elimination of duplicates; timely exchange and storage of information at varying levels of the National health information system (e.g., DHIS); and, the generation of new information derived from systems linkages for improved HIV/TB program management, case-based surveillance, and policy-making.(4) For the purposes of this project, a silent (i.e., undocumented) transfer was defined as one where the sending facility (i.e., the facility where the patient had been receiving treatment/services and from where they transferred their care out of) was unaware of the transfer and therefore did not have the transfer recorded as a patient outcome within its system or the patient's medical record.(5)

In the collaborative pilot project, FGH, in coordination with leading donors and the MJCRA, supported the registration of children in four HFs in Zambézia province: HF Gurué (district of Gurué); HF Lioma (district of Gurué); HF Coalane (district of Quelimane City), and HF 17 de Setembro (district of Quelimane City). The district of Gurué was identified by UNICEF as the priority district for HF-based NUIC notification as a result of the previously described assessment done jointly with MJCRA, specifically two HFs in Gurué. The other two HFs in the district of Quelimane City were selected due to their high volume of patients as well as estimates showing high rates of silent transfers.

The estimated duration of the pilot project was 12 months, after which the activities and registration data would be evaluated by implementers to determine next steps including potential pilot scale-up.

For all children (0-13 years of age, including HIV-exposed children)

The parent(s)/guardian(s) of children (0-13 years of age) were referred from the various participating service delivery points (e.g., Maternity ward, Postpartum ward, Child-at-Risk [CRC] services) to the NUIC notification focal point at the HF. The focal point managed the entry of the child's data into the mobile-based system but the NUIC was not sent to them right away as expected. They needed to wait for the notary registration staff to send the NUIC manually. Once available, the NUIC was registered on the Well Child Health Card (see **Figure 2**).

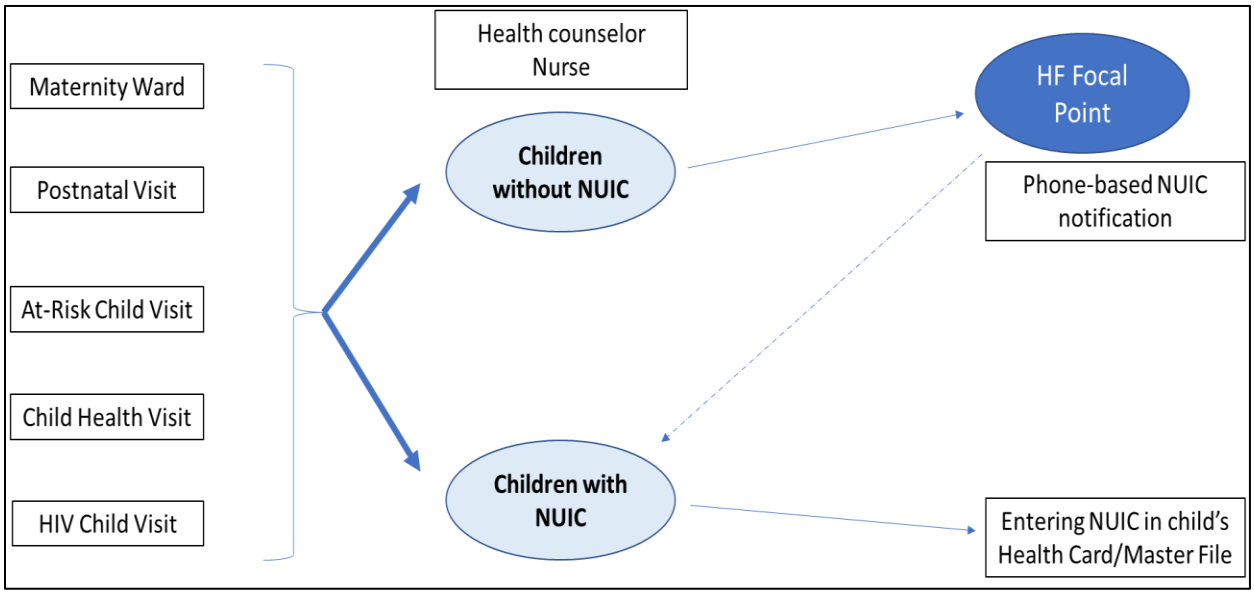


Figure 2. NUIC registration flowchart at the HF, facility-based initiation of civil registration (pilot project in Zambézia Province, Mozambique, 2021).

For all CWH (0-13 years of age)

For all HIV-exposed infants (HEI)/children who were diagnosed with HIV (i.e., children living with HIV, CWH) during one of the visits, the parent/guardian was asked if the child already had a NUIC, which was then verified by the health care worker by checking the registration on the Well Child Health Card. If the parent/guardian could not provide the NUIC, the NUIC was verified using the parent's name in the notification database.

If the child had a NUIC, the health care provider would check whether this NUIC has already been correctly registered within the patient's Master Card, specifically in the "*No. de B.I.*" (or identification number) data field of the "*Ficha Resumo*" section of the Master Card. If it had not yet been documented there, the NUIC was entered for the first time on the patient's Master Card.

If the child did not have a NUIC, the health care provider would refer the parent/guardian to the NUIC notification focal point person to proceed with the notification procedures for the child as described earlier. Later, the NUIC was entered in the "*Ficha Resumo*" section of the patient's Master Card and entered in the corresponding data field of the "*Ficha Resumo*" form in the EPTS at the HF by the data clerk (see **Figure 3**).

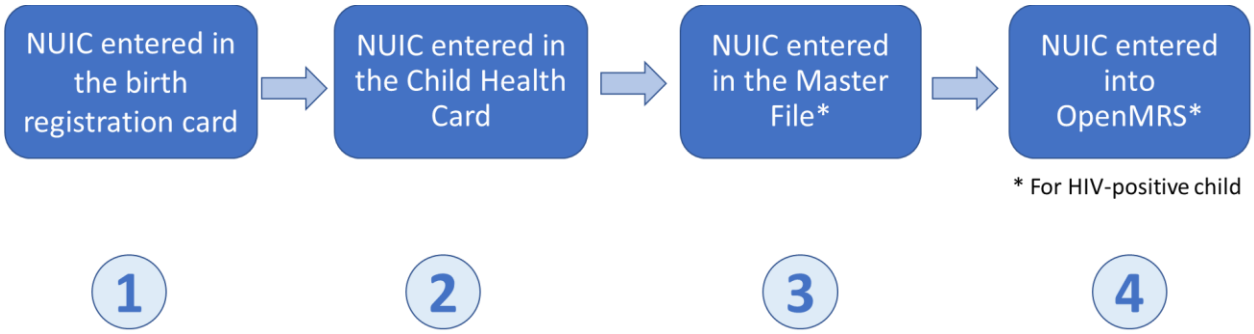


Figure 3. Steps for NUIC registration in the HF, facility-based initiation of civil registration (pilot project in Zambézia Province, Mozambique, 2021).

After the initial NUIC notification, a completion of the registration procedure was needed, with the MJCRA being the only entity authorized to do so. This final step in the registration process could be done through one of the various strategies available, and were defined by MJCRA:

1) Fixed post at HF: the notary official (MJCRA) was present at the health facility for all or nearly all of the week.
2) Mobile post at HF: the notary official (MJCRA) operated a registration post at HF for a few days monthly.
3) No registration at HF: the child's parent(s)/guardian(s) had to go to the administrative post for registration.

The following strategies were available at the four pilot HFs:

Health Facility	Type of registration post*
HF 17 Setembro	Fixed post at HF
HF Coalane	Fixed post at HF
HF Gurué	No registration at HF
HF Lioma	Mobile post at HF

**Note: the type of registration post to be implemented at each HF was decided by the Officer at the Zambézia Provincial Notary, taking into account budgetary and human resources considerations. Among the types of posts, fixed posts offered more convenience to clients, as a notary officer was more often available at these locations to support registration.*

FGH supported the implementation of the pilot project through i) the provision of cellphones, office furniture and connection costs (i.e., costs for mobile phone minutes) for the registration of birth notifications, and ii) of the provision of technical support (with UNICEF collaboration) including data quality checks. In addition, FGH hired four lay health counselors and a supervisor to manage the activities in the selected HFs, developed Standard Operational Procedures for the implementation of the pilot

activities at the HF and a monitoring tool to facilitate close tracking of the data collection. The lay counselors were demand creators guiding the parents/guardians to the NUIC notification focal point and bridging with the notary official for registration completion.

2. Evaluation Purpose

Goals

The overarching goal of the evaluation was to assess the feasibility of HF-based birth registration (using NUIC) of children aged 0-13 years (including the success in capturing the NUIC of CWH in the EPTS) and to explore the effect on pediatric patient care, with a focus on the timely identification of silent transfers, the elimination of duplicated patient registry, and the improvement of data quality for reporting.

The main hypotheses were:

a) Notification at the HFs would increase the number of children having a NUIC.
b) Inclusion of NUIC in the EPTS would improve the timely identification of silent transfers.

Objectives

The objectives of the evaluation were as follows:

1. Describe the proportion of NUIC registrations among newborns and infants at selected HFs supported by FGH.
2. Assess the proportion of children who had a NUIC validated after initial notification at selected HFs.
3. Describe the proportion of CWH with their NUIC captured in EPTS at the selected HFs.
4. Evaluate trends over time in the duplication of files among CWH registered within the selected HFs.
5. Compare the proportion of silent transfers among CWH receiving care at selected HFs within the district of Gurué (HF Gurué and HF Lioma) and Quelimane City (HF Coalane and HF 17 de Setembro), using the current validation system and verification when adding NUIC to the search parameters.
6. Assess the contribution of the community health workers to the birth registration (with UNICEF support).

Justification

Anticipated benefits to investing in and implementing such a novel system on a national scale and evaluating its pilot implementation include the following: facility-community tracking and reduction of silent transfers; authentication of patient-level records and elimination of duplicates; timely exchange and storage of information at varying levels of the national health information system (e.g., DHIS); and

generation of new information derived from system linkages for improved HIV program management, case-based surveillance, and policy-making.

3. Evaluation Design/ Methods/ Limitations

1. Evaluation Design

We conducted an internal process evaluation. Secondary analyses were performed on data collected from children who were attended in the four HFs selected for participation in the pilot project.

2. Evaluation Period and Locations

The evaluation covers a period of just over 12 months, from September 13th, 2021 to September 30th 2022, in four FGH-supported HFs in Zambézia province:

- HF Gurué (district of Gurué);
- HF Lioma (district of Gurué);
- HF Coalane (district of Quelimane City);
- HF 17 de Setembro (district of Quelimane City).

3. Sampling Strategy

Data from all children 13 years of age or younger (including CWH) were eligible for inclusion in the evaluation.

Inclusion criteria:

- Child visiting the HF for a health service;
- Newborn delivered at the HF (or coming from the community);
- Guardians willing to register the child.

For this evaluation, data were extracted from different sources:

1) Routinely collected data from the EPTS (*for CWH data**),
2) Routinely collected data from the NUIC notification database (developed for this pilot), and
3) FGH DHIS routinely collected data on birth registration.

**Note: The EPTS only captures data for PLHIV who receive/received care at a health facility.*

Table 1. List of indicators of interest and data sources (Mozambique, 2021).

Objective	Indicator	Source
1. Describe the proportion of NUIC notifications among newborns (i.e., children up to one month of age) at the selected HF.	- Numerator: Number of NUIC notifications since the start of the evaluation - Denominator: Total number of births since the start of the evaluation	NUIC notification database at HF FGH DHIS birth registry at the HF (including deliveries outside the HF seeking for immediate care) (monthly reports)
2. Assess the proportion of children who had a NUIC validated after initial notification at the selected HF since the start of the evaluation.	- Numerator: Number of NUIC registrations validated after initial notification at selected HFs - Denominator: Total number of initial NUIC notifications at selected HFs	NUIC notification database at HF
3. Describe the proportion of CWH with the NUIC registered in EPTS in the selected HFs.	- Numerator: Number of children on ART with a NUIC registered in EPTS - Denominator: Number of children on ART	EPTS*
4. Evaluate trend in duplication of CWH registered at each of the selected HFs.	- Number of duplicated files of CWH identified for children with NUIC and without a NUIC in each HF	EPTS*
5. Compare the proportion of silent transfers of CWH among the HFs of Gurué and Quelimane districts using the current verification system and verification when adding NUIC to the search parameters.	- Numerator: Number of duplicated files of CWH registered in EPTS in 1) Gurué/Lioma and 2) Coalane/17 Set - Denominator: Number of children registered in EPTS in 1) Gurué/Lioma and 2) Coalane/17 Set	EPTS*
6. Assess the contribution of the health workers to the birth registration.	- Numerator: Number of reported registrations that were completed by health care workers - Denominator: Total number of registrations reported in the notary of the village/town	E-CRVS system report (UNICEF)

**Note: The EPTS only captures data for PLHIV who receive/received care at a health facility; as such, for these objectives only CWH could be included in the analysis.*

4. Methods

We included in the evaluation all children up to 13 years of age from the various service delivery points (e.g., Maternity ward, Postpartum ward, Child-at-Risk [CRC] services) involved at the four HFs covered by the pilot, from the period of September 2021 to September 2022.

Sources of data

We used three sources of data: EPTS database, FGH DHIS database and the NUIC notification database (a logbook developed for this pilot).

5. Analysis Plan

Descriptive analysis was performed, and data were presented mainly with frequency tables.

6. Limitations of the evaluation

Data not accessible

It was not possible to address Objective #6 (as described above) during the time frame of this evaluation due to an inability to access the necessary dataset (i.e., E-CRVS database) required to conduct that intended analysis.

Malfunctioning of mobile-based registration system

The mobile-based national civil registration system was not working properly for the NUIC notifications for the entire duration of the evaluation. The HF staff managed to enter the child's data into the system, but the NUIC was not sent to them as expected. They needed to wait for the notary registration staff to send the NUIC manually and sometimes completion of that step in the process was delayed for many days.

4. Ethical considerations

This secondary data analysis is covered under the blanket protocol "*Quality Improvement for HIV Care and Treatment in Zambézia province of the Republic of Mozambique under the President´s Emergency Plan for AIDS Relief (PEPFAR)*" (Cooperative Agreement # GGH001943). This data use and evaluation plan was approved by the VUMC Institutional Review Board (IRB, #201887), the Institutional Research Ethics Committee for Health of Zambézia Province (*Comité Institucional de Bioética para Saúde – Zambézia*; CIBS-Z-20).[i]

5. Stakeholder engagement

A collaborative group with members from the MOH, MOJ, UNICEF and FGH/VUMC were involved in the pilot project and the evaluation. From the MOH, DPS (*Direcção Provincial de Saúde*) Focal Point in Zambézia participated in the follow-up of the activities of the pilot. Furthermore, the Provincial Office of the MJCRA, provided staff and technical expertise to implement the pilot. From UNICEF, the collaboration and involvement extended from concept note design (i.e., evaluation conceptualization) through follow-

[i] See 45 C.F.R. part 46.101(c); 21 C.F.R. part 56

up of the activities of the pilot project. From FGH/VUMC, evaluation collaborators included members of the Technical team and the Evaluations team. All project collaborators were involved in the design and implementation of the evaluation. The concept note for secondary analysis was reviewed and approved by the CDC-MZ Associate Director of Science (ADS) team prior to implementation.

6. Deviations from Scope of Work (SOW)/protocol

There were no protocol/concept note deviations during the implementation of this assessment.

7. Data quality assurance

Programmatic data used in this evaluation were subject to routine data verification processes conducted by trained members of FGH's Monitoring and Evaluation (M&E) team. All data were stored securely on password-protected databases at district- and provincial-level FGH offices. The performance of the program indicators was continuously monitored by HF staff. All subsequent indicators were collected and internally reported on a monthly frequency by the FGH Health Information Systems (HIS) team, following the regular reporting period for program data.

Upon receipt of the requested extracted dataset for this evaluation/analysis, data were cleaned and reviewed to ensure they were consistent and appropriate with the evaluation inclusion and exclusion criteria.

8. Findings

From the 7,329 children who arrived at the notification post in the selected HFs, 5,886 (80.3%) children had NUIC notifications initiated (see **Figure 4**). From those who had NUIC notifications, 245 (4.2%) who were missing age and/or sex information data in the NUIC notifications database were excluded from the analysis. In total, data from 5,641 children aged 0 to 13 years of age were included in the analysis.

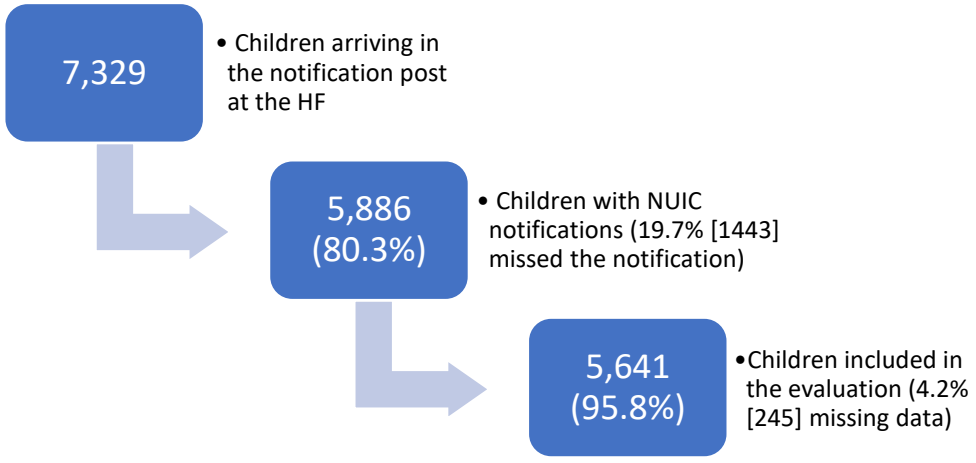


Figure 4. Diagram of children whose data were eligible for inclusion in the analysis, facility-based initiation of civil registration using NUIC (pilot project in Zambézia Province, Mozambique, 2021).

1. Demographics

Data from 5,641 children aged 0 to 13 years of age who were notified, and 2,725 CWH listed in EPTS, were included in the analysis. These children received services at one of the 4 selected HFs, with 2,842 (50.4%) being male. The mean age of all children was 2.5 years (standard deviation [SD] 2.5). Data per age group and sex is described in **Table 2**. From all children included, 351 (6.2%) were CWH.

Table 2. Demographics data from the children registered through the mobile-based system in the HFs: a) gender and b) by gender and age (Zambézia Province, Mozambique, 2021-2022).

a)	**Sex of all children**			**Sex of children with HIV**		
	Male	Female	Total	Male	Female	Total
HF 17 de Setembro	738	600	1338	40	37	77
HF Coalane	524	521	1045	56	51	107
HF Gurué	801	831	1632	45	87	132
HF Lioma	779	847	1626	13	22	35
TOTAL (n, %)	2842 (50.4%)	2799 (49.6%)	5641	154 (43.9%)	197 (56.1%)	351

b)	**Sex and age groups of all children**							
	Male				**Female**			
	<1 month	1-11 months	1-4 years	5-13 years	<1 month	1-11 months	1-4 years	5-13 years
HF 17 de Setembro	18	197	344	179	18	159	275	148
HF Coalane	36	161	214	113	35	137	230	119
HF Gurué	23	137	533	108	28	126	567	110
HF Lioma	23	237	414	105	42	280	414	111
TOTAL (n, %)	100 (3.5%)	732 (25.8%)	1505 (53%)	505 (17.8%)	123 (4.4%)	702 (25.1%)	1486 (53.1%)	488 (17.4%)

2. Proportion of NUIC notifications among newborns (i.e., children up to one month of age) at the selected HF during the evaluation period

Table 3. Proportion of NUIC notifications among newborns (Zambézia Province, Mozambique, 2021-2022).

HF	Total number of NUIC notifications	Number of NUIC notifications among newborns	Total number of births registered at the HF*	Proportion of NUIC notifications among newborns
HF 17 de Setembro	1338	67	2782	2.4%
HF Coalane	1045	127	1514	8.4%
HF Gurué	1632	113	4271	2.6%
HF Lioma	1626	181	1898	9.5%
Total	**5641**	**488**	**10465**	**4.7%**

** Includes children who had birth outside of HF and went there within 1 month.*

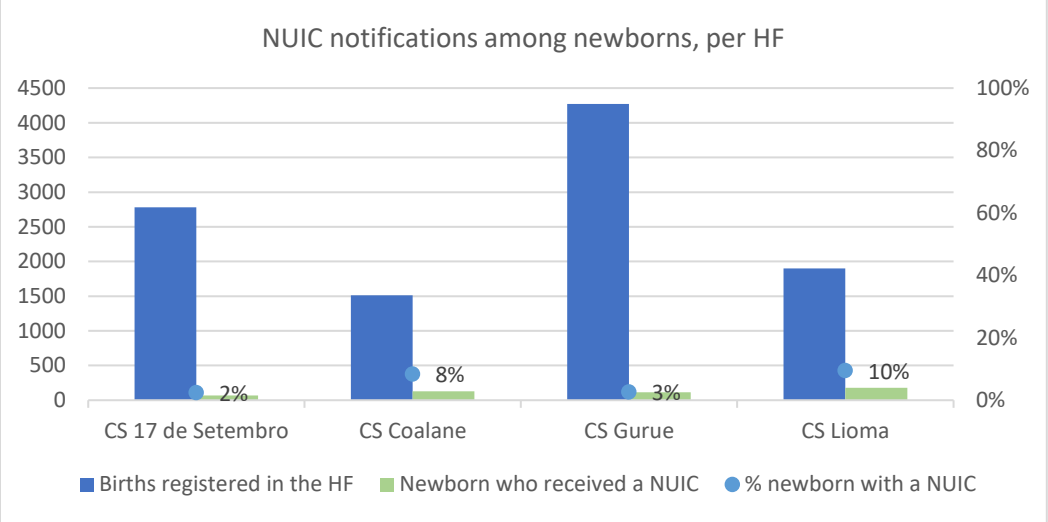


Figure 5. NUIC notifications among newborns, per HF included in the pilot (facility-based initiation of civil registration in Zambézia, Mozambique, 2021-2022).

3. Proportion of children who had a NUIC validated after initial notification at the selected HF

a) Proportion of newborns (i.e., children up to one month of age) who had a NUIC validated after initial notification.

Table 5. Proportion of newborns with a validated NUIC registration after initial notification (Zambézia Province, Mozambique, 2021-2022).

HF	Total number of newborns with NUIC number received	Number of NUIC registrations validated	Proportion of newborns with NUIC registrations validated
HF 17 de Setembro	67	17	25.4%
HF Coalane	127	56	44.1%
HF Gurué	113	0	0.0%
HF Lioma	181	14	7.7%
Total	**488**	**87**	**17.8%**

b) Proportion of infants (i.e., cumulative children up to one year of age) who had a NUIC validated after initial notification.

Table 6. Proportion of infants with a validated NUIC registration after initial notification (Zambézia Province, Mozambique, 2021-2022).

HF	Total number of infants with NUIC notifications	Number of NUIC registrations validated	Proportion of infants with NUIC registrations validated
HF 17 de Setembro	621	190	30.6%
HF Coalane	513	245	47.8%
HF Gurué	828	0	0.0%
HF Lioma	915	52	5.7%
Total	**2877**	**487**	**16.9%**

c) Proportion of all children (0-13 years) who had a NUIC validated after initial notification.

Table 7. Proportion of all children with a validated NUIC registration after initial notification (Zambézia Province, Mozambique, 2021-2022).

HF	Total number of initial NUIC notifications	Number of NUIC registrations validated	Proportion of children with NUIC registrations validated
HF 17 de Setembro	1338	350	26.2%
HF Coalane	1045	568	54.4%
HF Gurué	1632	0	0.0%
HF Lioma	1626	72	4.4%
Total	**5641**	**990**	**17.6%**

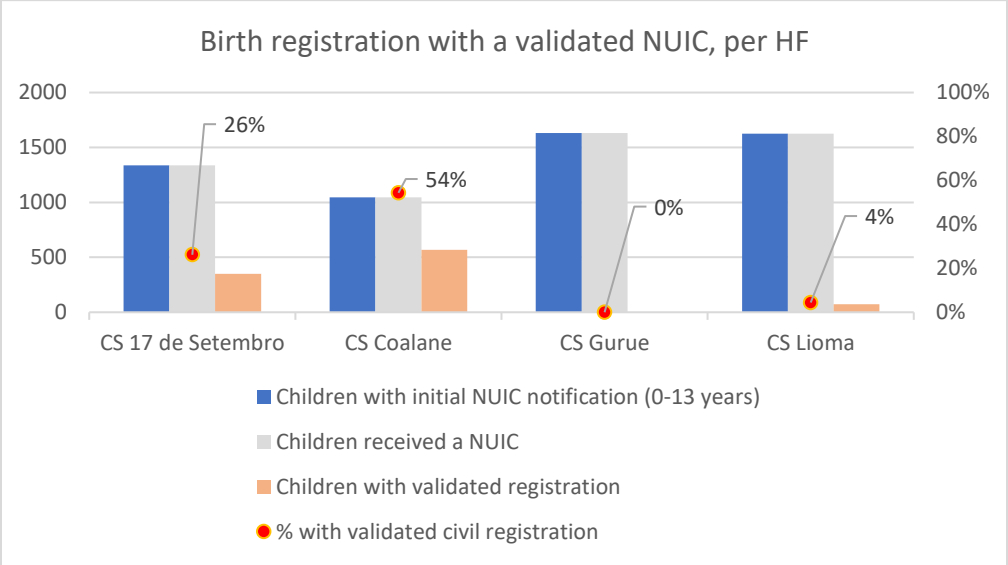


Figure 6. Birth registration validated for all children (0-13 years), per HF included in the pilot (facility-based initiation of civil registration in Zambézia Province, Mozambique, 2021-2022).

4. Proportion of children with HIV who had a NUIC captured in EPTS in the selected HFs

Table 8. Proportion of children with HIV who had a NUIC captured in EPTS (Zambézia Province, Mozambique, 2021-2022).

HF	Number of CWH listed in EPTS	Number of CWH listed in EPTS with a notification	Number of CWH in EPTS that have a NUIC entered	Proportion of CWH with NUIC entered in EPTS
HF 17 de Setembro	890	77	77	8.7%
HF Coalane	982	107	107	10.9%
HF Gurué	762	132	132	17.3%
HF Lioma	91	35	35	38.5%
Total	**2725**	**351**	**351**	**12.9%**

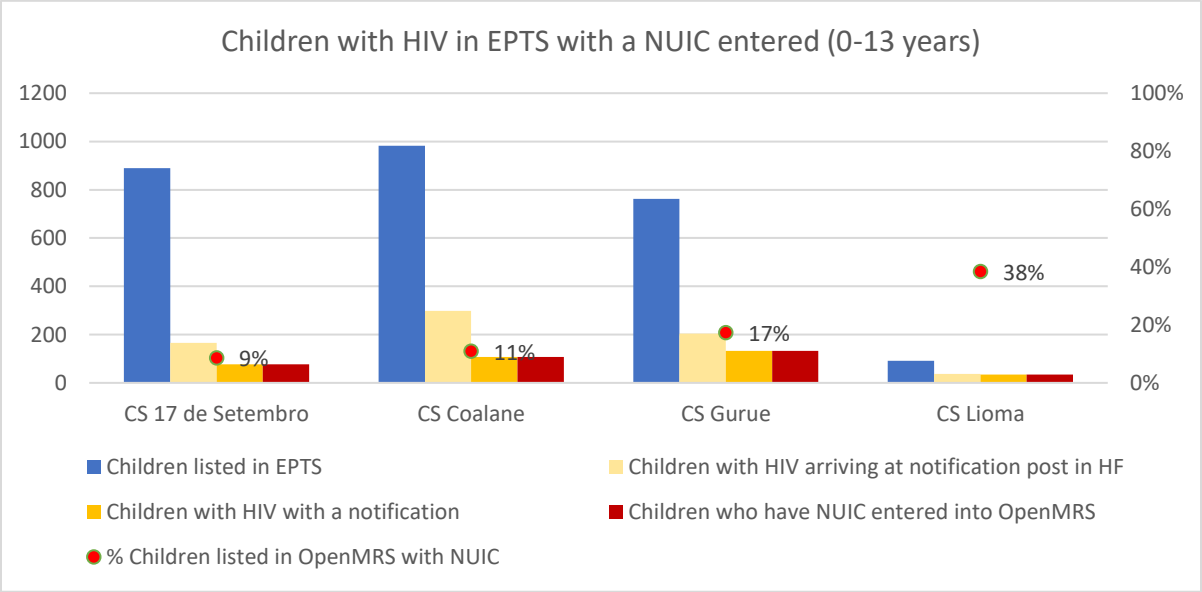


Figure 7. Children living with HIV (0-13 years of age) with data captured in EPTS who have a NUIC entered (facility-based initiation of civil registration, pilot project in Zambézia Province, Mozambique, 2021-2022).

5. Evaluate trend in duplication of CWH registered at each of the selected HFs

We considered all the CWH listed in EPTS for each selected site. Using the current verification process, searches were conducted in the database for certain demographic data (e.g., name, date of birth, age and NID from the children whose data were eligible for inclusion in the analysis), however, no duplicated records were found. Thus, there was no reason to proceed with the analysis of duplicated files using the NUIC variable as expected in the data analysis plan (Objective #4).

6. Compare the proportion of silent transfers of HIV positive children among the HFs of Gurué and Quelimane districts using the current verification system and verification when adding NUIC to the search parameters

We put together, in the same Excel sheet, data of HFs from the same district and used the function to identify duplicated values. Using the current verification process, based on searches for certain demographic data of the CWH (e.g., name, date of birth, age and NID), no duplicated files were found. For the same reason mentioned above, there was no cause to proceed with the analysis (for Objective #5) using the NUIC variable.

7. Assess the contribution of the community health workers to the birth registration (with UNICEF support).

This Objective #6 was not satisfied due to an inability to access the data required for this component of the analysis. Instead, we assessed the contribution of the health care workers to the birth registration through the phone-based system used in the four pilot HFs.

Table 9. NUIC registrations through the mobile-based system in all the pilot project HFs during the evaluation period (Zambézia Province, Mozambique, 2021-2022).

HF	Number of children with registration started by the health worker	Total number of births registered in the HF	Proportion of children with registration started by the health worker at the HF
HF 17 de Setembro	1338	2782	48.1%
HF Coalane	1045	1514	69.0%
HF Gurué	1632	4271	38.2%
HF Lioma	1626	1898	85.7%
Total	**5641**	**10465**	**53.9%**

9. Discussion and Conclusions

This pilot project in four HFs in Zambézia province aimed at assessing the feasibility of health facility-initiated notification for birth registration and NUIC registration. Demand creation was done through health counselors who referred guardians with children aged 0-13 years to the notification focal point.

A proportion of children arriving at the notification post in the selected HFs (19.7%) did not have NUIC notifications initiated (Figure 4). The reasons raised by the health counselors for children not being notified included notification system failure and multitasking or absence of the notification focal points. Additionally, lack of ownership (among HF management and notification focal points) may explain poor task delineation and weak enforcement of the activity, i.e., NUIC notifications. Despite technical

challenges with phone-based notification system, 5886 children had a NUIC notification over the period of one year.

The proportion of children having a validated NUIC registration after the initial NUIC notification was far less (990 [17.6%]). Nevertheless, we noted high proportions of validated NUIC registrations in the HFs with a fixed notary official at the HF, such as HF 17 de Setembro and HF Coalane, i.e., when there were notary official visits every day of the week (previously coordinated between the MJCRA Provincial Office and the HF leadership/management team). HF Lioma had visits from the notary official to complete the NUIC registrations, but HF Gurué – who had the lowest completed NUIC registrations – had none of the two scenarios; there, parents/guardians had to go the main district's notary office to complete their child's registration. Considerations may be given to the importance of bringing services to the client(s) (i.e., to the HF for "one-stop" registration services), to avoid loss of opportunity and/or delay for civil registration.

Results from the pilot project have demonstrated that improvements could be achieved for the established method to validate the NUIC for a child who had their NUIC notification done through the health mobile-based system. In observing the lower rates of registration completion when additional steps were necessary (i.e., had to go to another location than the HF where services were received), perhaps parents/guardians are not willing (or available) to have more than one encounter with the registration system to have their child registered with a NUIC. Strategies for registration service that reduce burden on parents/guardians could be supportive for registration completion, such as the one-stop model ("*paragem única*") approach,(6) where the patients can have what they need just interacting with one health care provider or complete all at one location at one time.

Overall, 12.9% of CWH on ART had their NUIC captured in the EPTS. We are reporting a 12-month period of time which could have had more CWH with NUIC entered into EPTS since (per MOH guidelines for pediatric HIV care) follow-up and treatment-related visits are frequent, during which HCW could have the occasion to ask about the children`s NUIC, capture it if available and refer the child to the notification focal point if the child does not have a NUIC. However, considerations for the various aspects that may affect this scenario such as: i) the willingness of the parents/guardians to register the child (most of the time the child's mother reports she needs to ask permission from her male partner before registering the child), ii) the performance of the registration staff (for example, the HF's focal point nurses and notary officials are not always available when a parent/guardian brings their child for registration), and iii) the phone-based registration system performance (which was not functional during the period of data collection for this evaluation).

The evaluation did not identify any duplication of patient registry (among children eligible for inclusion) when adding the NUIC into the query to assess for duplications. The sample size was relatively small, and possibly increasing the number of HFs into the pilot could provide more evidence, as persons in care can transfer to other HFs outside of this evaluation, especially in urban setting such as Quelimane.

The pilot project has shown that HCW can contribute to the birth registration through the phone-based system used in the HFs. However, the first key constraint encountered was the fact that the system was not working properly; it was expected to get the NUIC after the initial notification via receiving an

automatic message from the system, however, that was not happening due to technical difficulties, which meant that the lay health counselors had to find the NUIC manually at the notary office. The second major constraint observed was a lack of pilot project ownership by the health facility staff (e.g., the focal point persons trained to perform the NUIC notification process) may have contributed to poor involvement and low registration performance on a daily basis in some cases.

Conclusions

Many children were registered in this pilot project through the phone-based system in the HFs. Yet nearly one in five children did not have a NUIC notification registered. Technical inconsistences of the system and clear task delineation among the health staff could be addressed before strategy expansion.

Our findings suggest that simplification of steps and consistency in being able to offer services at the HFs could be factors in the successful completion of NUIC registrations for children at those HFs. Expansion activities could consider prioritizing sufficient resources for ensuring a dedicated service location and a more fixed presence by notary officials at indicated HFs.

Lessons learnt could plausibly inform the expansion of HF-based NUIC notification registration services, as well as the design of mHealth systems used to improve the identification of silent transfers of individuals in HIV care through the use of a unique national registration number.

10. Dissemination Plan

This report will be shared (in English and/or Portuguese, according to the target group) with the staff/managers of the four pilot HFs, the ethics/IRB committees, CDC Mozambique (funder), district health directorate, provincial health directorate and the MOH. The findings will be disseminated via suitable means according to the audience. The final evaluation report will be uploaded to the FGH website within 90 days after clearance/approvals by all relevant authorities.

In addition, findings from this evaluation were reported in international scientific conferences such as an abstract in the *INTEREST Conference 2023* (May 2023, Maputo, Mozambique) and as an e-poster in the *International AIDS Society Conference 2023* (July 2023, Brisbane, Australia). Confidentiality of participants was maintained by the fact that no individual results were reported or published, only aggregate results.

11. Appendices

1. Approved protocol/ SOW

This secondary data analysis is covered under the VUMC/FGH blanket protocol for program evaluations, titled, "*Quality Improvement for HIV Care and Treatment in Zambézia province of the Republic of Mozambique under the President´s Emergency Plan for AIDS Relief (PEPFAR)*", which was approved by the Mozambique provincial-level ethics committee (CIBS-Z) and the VUMC Institutional Review Board (IRB), and approved by the CDC's Global Health Center (Project Determination #0900f3eb81dc7dd5). The concept note outlining this evaluation which was approved by the CDC-MZ ADS is submitted along with this final report for reference.

2. Informed consent

Informed consent was not required for use of data in this evaluation, as it was a secondary analysis of routinely collected, de-identified, programmatic data. A waiver of consent was approved, as the evaluation involved no more than minimal risk, would not have been possible without the waiver, and the waiver did not adversely affect the rights nor welfare of the patients whose data were included in the evaluation.

3. Biosketches

Provided for first (Caroline De Schacht) and second (Sara Van Rompaey) co-authors of this evaluation.

Caroline De Schacht graduated from Medical School at the University of Ghent (Belgium), where she specialized in Family Medicine (2000). She has a Diploma in Tropical Medicine (2001) from the Prince Leopold Institute of Tropical Medicine in Antwerp, Belgium, and a Masters in Science Degree in Clinical Trials (2008) from the London School of Hygiene and Tropical Medicine. She obtained her PhD Degree in Biomedical Sciences, studying Prevention of Mother-to-Child Transmission (PMTCT) of HIV in Mozambique (2015) at the University of Ghent, Belgium.

Dr. De Schacht has 25 years of experience as an HIV technical advisor and researcher, of which the last 20 years in Mozambique. As technical advisor, she worked closely with the Ministry of Health and the Provincial Health authorities, having gained valuable insight into the Mozambican Health System that helped the development of study protocols.

As a researcher, she has been involved in many clinical and operational research activities, and has been leading various public health evaluations in the field of Mother and Child Health Care, Enlarged Vaccination Program, and HIV, including cohort studies on HIV incidence, and on COVID-19 incidence. Since 2017, she is the Evaluations Director at Friends in Global Health, leading HIV-related operational research projects in Zambézia Province, and manage various secondary data analyses of HIV-program results and has 30+ publications in peer-reviewed journals.

Capacity building on technical/clinical services and research methodologies have been important throughout her career. Together with the Provincial Health services, and/ or National Institute of Health Mozambique, she has been serving as a trainer in different capacity building areas (quantitative and

qualitative research methods, Good Clinical Practice (GCP)/research ethics, protocol/abstract/manuscript writing, etc.), and mentor/supervise young researchers and PhD students. She is also an invited member of the Eduardo Mondlane University (UEM) /Instituto Nacional de Saúde (INS) Jury for the Masters in Field Epidemiology (FELTP), and a member of the scientific committee of the Mozambican Health Conference.

BIOGRAPHICAL SKETCH

NAME: Van Rompaey, Sara

POSITION TITLE: Clinical Advisor for Health Information Systems, Tun HIS consultancy firm, Based in Tunis, Tunisia

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD OF STUDY
Leuven University, Belgium	MD	2001	Medicine
Institute of Tropical Medicine, Antwerp, Belgium	Certificate	2004	Tropical Medicine
Leuven University, Belgium	GP (Family Medicine)	2004	General Practice/Family Medicine
Basel University, Switzerland	MIH	2010	International Health

A. Personal Statement

I am a Medical Doctor and International Health Specialist with seventeen years of experience with health programmes in countries with limited resources, with a particular focus on infectious disease service delivery in sub-Saharan Africa. From 2015 until 2020 was based in Mozambique, leading and developing quality improvement strategies within the 'Avante Zambézia' project, funded primarily by the Centers for Disease Control and Prevention. From 2020 onwards I have been providing services as a clinical advisor to the team who manages the Health Information Systems on central/national level, also funded primarily by the Centers for Disease Control and Prevention.

B. Positions and Honors

Positions

2001 - 2004 GP Registrar (Family medicine) in UK and Belgium

2004 - 2008 Médecins Sans Frontières Belgium: MD/coordinator of MSF projects in DRC, Haiti, Italy and Belgium

06/09 - 09/09 Medical Advisor for PMTCT, paediatric HIV care and nutrition programme in Kinshasa, Magna – Children at risk, DR Congo:

11/09 - 06/10 Medical Coordinator of the HIV project 'Protege a Tua Vida' Médicos do Mundo, Guinea- Bissau

06/10 - 12/10 International HIV/AIDS Evaluation Expert (Treatment, Care, and Support Activities) UNDP Tajikistan:

2010 - 2013 International Consultant: UNICEF Guinea-Bissau

2009 - 2014 Frequent part-time contracts as Expert Consultant in ART in low resource settings Institute of Tropical Medicine, Antwerp, Belgium

08/13 - 03/14 Expert Consultant Sexual and Reproductive Health Médecins du Monde France

02/15 – 05/2020 Pres National Quality Improvement Technical Advisor Friends in Global Health/Vanderbilt University, Mozambique

05/20 – Pres Clinical Advisor for Health Information Systems Advisor Friends in Global Health/Vanderbilt University, Mozambique (from November 2021 onwards as consultant)

Honors and Memberships

2001- present Member, ordre des medecins, Belgium

2004 – present Licensed in Belgium as General Practitioner

2010 – present Journal reviewer for AIDS Care and BMC Pregnancy and Childbirth

C. Contributions to Science

1. **Studying approaches to improve male engagement in PMTCT services**, as Co-Investigator on Dr. Audet's funded R01 award, Partners-based HIV treatment in antenatal care services:

    a) De Schacht Caroline; Sara Van Rompaey; Ezequiel Barreto; Almiro Emilio, Arifo Aboobacar; Erin Graves; Carolyn Audet, Male engagement optimization in women´s care to answer Pre-Exposure Prophylaxis needs in serodiscordant couples: estimation based on preliminary data from a cluster randomized trial in Zambézia province, Mozambique. Approved as Oral Presentation at INTEREST - 13th International Conference on HIV Treatment, Pathogenesis, and Prevention Research in Resource-Limited Settings 14 May- 17 May 2019, Accra, Ghana
    b) Carolyn M. Audet, Erin Graves, Ezequiel Barreto, Caroline De Schacht, Wu Gong, Bryan E. Shepherd, Arifo Aboobacar, Lazaro Gonzalez-Calvo, Maria Fernanda Alvim, Muktar H. Aliyua, Aaron M. Kipp, Heather Jordan, K. Rivet Amico, Matthew Diemer, Andrea Ciaranello, Caitlin Dugdale, Sten H. Vermund, Sara Van Rompaey, Partners-based HIV treatment for seroconcordant couples attending antenatal and postnatal care in rural Mozambique: A cluster randomized trial protocol. Contemporary Clinical Trials Volume 71, August 2018, Pages 63–69 https://doi.org/10.1016/j.cct.2018.05.020

2. **Assessing the effect of Quality Improvement interventions**: for the last five years I have been leading and developing strategies to improve quality of HIV care in over a 200 health facilities supported by Vanderbilt University Medical Center's non-governmental Organization, Friends in Global Health (FGH) within the 'Avante Zambézia' project, under the President's Emergency Plan for AIDS Relief

    a) Mayra Melo, Caroline De Schacht, Themos Ntasis, José Tique, Julieta Matsimbe, Gael Claquin, Fernanda Alvim, Eurico Jose, Hamilton Mutemba, Antonieta Inácio, Anibal Naftal Fernando, Gustavo Amorim, C. William Wester, Sara Van Rompaey, Improved 12-months ART retention rates

through intensive monitoring of key process measures in Zambezia province, Mozambique. Approved as Poster exhibition 10th IAS Conference on HIV Science, Mexico City, Mexico, 21 to 24 July 2019

b) Mayra Melo, Caroline De Schacht, Julia Langa, Roque Pinto, Antonieta Inácio, Wilson Silva, Marzio Stefanutto, Puri Gonzalez, Jessica Greenberg Cowan, C. William Wester, Sara Van Rompaey, Implementing Quality Improvement in a large HIV clinic to improve the availability of pediatric viral load results for patient care in rural Zambézia, Mozambique. Approved as poster exhibition at INTEREST - 13th International Conference on HIV Treatment, Pathogenesis, and Prevention Research in Resource-Limited Settings 14 May- 17 May 2019, Accra, Ghana and the 10th IAS Conference on HIV Science, Mexico City, Mexico, 21 to 24 July 2019

c) Erin Graves, Caroline De Schacht, Wu Gong, Sara Van Rompaey, Maria Fernanda Sardella Alvim, Gaël Claquin, Bryan E. Shepherd, Ann F. Green, Jose A. Tique, Eurico José, Hélio Machabane, Eusébio Maposse, Magdalena Bravo, Anibal Naftal Fernando, and C. William Wester, Effectiveness of short message service (SMS) reminders on timely pick-up of antiretroviral therapy (ART) among consenting HIV-positive adults in Zambézia province, Mozambique. Approved as Poster exhibition at INTEREST - 13th International Conference on HIV Treatment, Pathogenesis, and Prevention Research in Resource-Limited Settings 14 May- 17 May 2019, Accra, Ghana and the 10th IAS Conference on HIV Science, Mexico City, Mexico, 21 to 24 July 2019

d) Sara Van Rompaey, Mayra Melo, Fernandes Bilhete, Ivan Tancredo, Wu Gong, C. William Wester, Caroline De Schacht, Improved viral suppression rates among HIV-positive adults receiving antiretroviral therapy (ART) via community adherence group (CAG) support in Zambézia province, Mozambique. Approved as Poster exhibition at INTEREST - 13th International Conference on HIV Treatment, Pathogenesis, and Prevention Research in Resource-Limited Settings 14 May- 17 May 2019, Accra, Ghana

e) Sara Van Rompaey; Mayra Melo; Josh Viele; Ann Green; Hélio Machabane; Amina Muicha; Chimoio Magumisse; C. William Wester, Improving documentation of antiretroviral therapy (ART) dispensation via electronic pharmacy barcode system in rural Mozambique. Poster presentation at IAS, July 2017 in Paris, France

3. **Assessing access and retention in HIV preventative and clinical services**: In DRC, Mozambique and as a member of an international community of practice I have contributed to the identification of factors that are fundamental for access to HIV preventative service and clinical care and retention.

f) C. Audet, S. Van Rompaey, W. Gong, E. Graves, M. Bravo, F. Melo, J.E. Malinha, E. Chele, C. De Schacht, Improved services, health seeking behavior, and outcomes for gender-based violence survivors, including post-exposure prophylaxis (PEP) in rural Zambézia province, Mozambique. Poster presentation AIDS, July 2018 in Amsterdam, the Netherlands. http://programme.aids2018.org/Abstract/Abstract/1737

g) Carolyn M. Audet; Lázaro González Calvo; Muktar H Aliyu; Meridith Blevins; Maria Fernanda Sardella Alvim; Sara Van Rompaey, Retention outcomes and mortality of lesbian, gay, bisexual and transgender intersex (LGBTI) versus heterosexual patients in HIV care in rural Mozambique. Poster presentation at IAS, July 2017 in Paris, France

h) Sara Van Rompaey (presenter), Operational assessment of access to ART in rural Africa: the example of Kisantu in Democratic Republic of the Congo. Oral Presentation at the Pan-African/World Health Summit Satellite Symposium, Berlin, Germany, 20 October 2012.

i) Bateganya, Moses; Zolfo, Maria; Kiyan, Carlos; Lequarre, Francoise; Dahal, Shishir; Van Rompaey, Sara; Van Griensven, Johan; Lynen, Lut and the (e)SCART alumni network. Tackling Retention in HIV Care: Communities of Practice an Online Learning event. Poster Exhibition Day 3, ICASA, Addis Abeba, Ethiopia, 7 December 2011. Abstract number: WEPE265.

j) b) Van Rompaey, Sara; Kimfuta, Jacques; Kimbondo, Pierre; Monn, Cecilia and Buvé, Anne. Operational assessment of access to ART in rural Africa: the example of Kisantu in Democratic Republic of the Congo. AIDS Care. 2011 Jun; 23(6):686-93. PMID: 21390887. DOI:10.1080/09540121.2010.532538

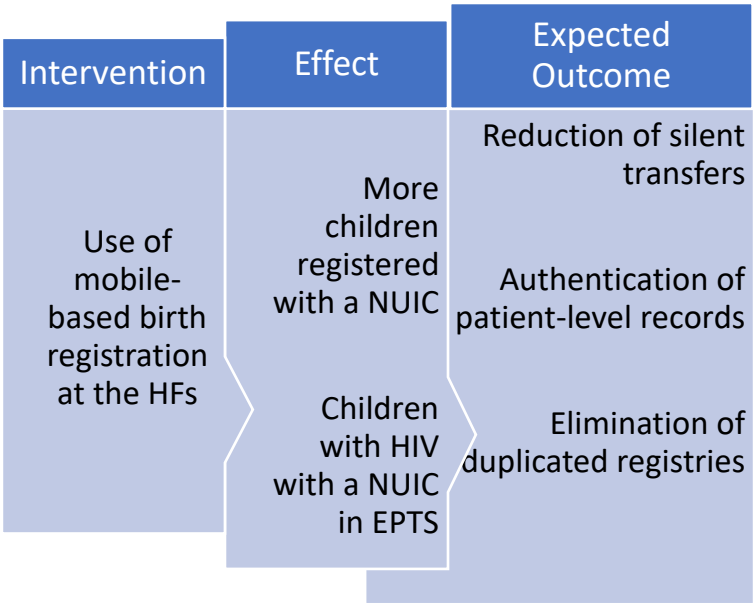
4. Conflict of interest statement

The collaborators in this evaluation have no conflicts of interest to declare.

5. Evaluation costs

Evaluation costs were limited to staff time required for routine secondary data extraction and analysis, review and discussion of results, and preparation of reports, with estimated expenses rounding to USD22,739.

6. Evaluation logical framework



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5. Etoori D, Kabudula CW, Wringe A, Rice B, Renju J, Gomez-Olive FX, Reniers G. Investigating clinic transfers among HIV patients considered lost to follow-up to improve understanding of the HIV care cascade: Findings from a cohort study in rural north-eastern South Africa. PLOS Glob Public Health. 2022;2(5):e0000296.
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