VILLAGE REACH®

REPORT
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The Bate-Papo Vacina! Project in Zambézia, Mozambique

Enhancing community engagement in immunization programming and under-two immunization coverage: The Impact of the Bate-Papo Pilot Project in Mozambique

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Acronyms

ANCOVA	Analysis of Covariance
APS	Agentes Polivalentes de Saude
ARIMA	Autoregressive Integrated Moving Average
BCG	Bacillus Calmette–Guérin
CBPR	Community-Based Participatory Research
CFIR	Consolidated Framework for Implementation Research
CHW	Community Health Workers
DHIS	District Health Information Systems
DPS	Direcção Provincial da Saúde
DPT	Diphtheria-Tetanus-Pertussis
EPI	Expanded Immunization Program
FGD	Focus Group Discussion
GAVI	The Vaccine Alliance
GOM	Government of Mozambique
HCD	Human-centered design
HFW	Health facility workers
ITS	Interrupted Time Series Analysis
JSI	John Snow, Inc.
M&E	Monitoring and Evaluation
MISAU	Ministério da Saúde (Ministry of Health)
MMR	Measles, Mumps and Rubella
MOH	Ministry of Health
RE-AIM	Reach Effectiveness Adoption Implementation Maintenance
RED/REC	Reach Every District/Reach Every Community
SIS-MA	*Sistema de Informação de Saúde para Monitoria e Avaliação* (Health Information System of Mozambique for Monitoring and Evaluation)
TOC	Theory of Change
UCT	University of Cape Town
UWC	University of the Western Cape
USAID	United States Agency for International Development
VR	VillageReach
WHO	World Health Organization

Executive Summary

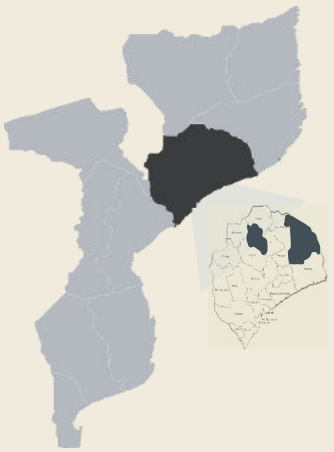
Enhancing Community Engagement in Immunization Programming and Under-Two Immunization Coverage: The Impact of the Bate-Papo Vacina! Pilot Project in Mozambique

The Bate-Papo Vacina! (Let's Talk about Vaccines!) Project is a five-year project, funded by Wellcome, aimed at improving coverage of routine immunizations in Namarroi and Gile, Mozambique and Lilongwe and Mzimba North, Malawi. The project works with caregivers of children under two, health workers and the Ministries of Health (MoH) to understand the barriers caregivers face in fully vaccinating their children. This collaborative approach involves identifying, implementing and evaluating interventions to reduce routine immunization dropouts.

This report details the results of evaluating the one-year pilot implementation of the co-created interventions. These interventions were designed through community-based participatory research and human-centered design sessions in Mozambique. These interventions were implemented across 11 health facilities in Gile and Namarroi Districts of Zambézia Province, Mozambique.

What are the Bate-papo Vacina pilot project interventions in Zambézia, Mozambique?

The Bate-Papo Vacina! Interventions work with community stakeholders, health care workers and community health workers to empower caregivers and their families with the knowledge and agency to demand immunization resources for their children as well as improve access to under-two routine immunization in the hardest to reach areas.



The end-line evaluation results of the Bate-Papo Vacina! pilot project provide a comprehensive assessment of its impact on improving routine vaccination coverage, increasing access to immunization services in hard-to-reach areas and enhancing community engagement. The project aimed to reduce immunization dropouts and improve immunization services for 8,257 children as a target annually in 11 health facilities across two districts in Zambézia, Mozambique.

Evaluation Overview

Using RE-AIM Evaluation Framework, the evaluation conducted by University of the Western Cape (UWC) and University of Cape Town (UCT) focused on three key areas:

1. **Understanding the mechanisms underlying the implementation process of community-driven interventions.**
2. **Assessing the impact of the interventions on access to immunization services and reducing dropout rates.**
3. **Identifying any unintended consequences of the implemented interventions**

To assess the effectiveness of the Bate-Papo Vacina! co-created interventions and the implementation process, UWC and UCT conducted a cross-sectional evaluation using both quantitative and qualitative methods. They employed an embedded realist approach to ensure that the evaluation was closely aligned with the project's activities.

Key Findings

Overall, the evaluation demonstrates that the Bate-Papo Vacina! project has made significant strides in boosting community involvement in childhood (under two) immunization programs. This involvement is linked to a positive rise in immunization coverage and a decrease in routine immunization dropouts. The success suggests that both the Bate-Papo Vacina! approach (combining Community-Based Participatory Research [CBPR] and Human-Centered Design [HCD]) and its interventions can serve as a valuable model for similar future programming. This evaluation provides insights into the project's impact, challenges faced and recommendations for sustaining the project's positive outcomes.

Key highlights include:

- **The Bate-Papo Vacina! project exceeded its set target** by contributing to the full vaccination of 9,041 children, surpassing monthly vaccination goals throughout the one-year pilot.
- During the 12 months of implementation, there was a substantial **133% reduction in diphtheria-tetanus-pertussis (DPT) vaccine series dropouts[1] and a 47% increase in the proportion of children under two fully vaccinated** in comparison to the 12 months preceding the implementation
- Comparison of health system-reported vaccinations between the intervention and comparison sites shows **a gradual improvement over time in 6 of the 16 antigens, which can be attributed to the implemented solutions.**

[1] DPT is one of the principal indicators used to monitor performance of childhood immunization programs. To be fully protected against diphtheria, tetanus and pertussis children require three doses during of DPT in their first year of life. https://data.unicef.org/data-for-action/tracking-dtp-vaccine-dropout-rates-protects-children-from-preventable-diseases/

- Qualitative findings highlight **positive shifts in knowledge, attitudes and practices among caregivers of children under the age of two**, leading to increased participation in routine vaccination activities and improved vaccination coverage. The project also fostered community engagement, enhanced immunization planning processes, empowered caregivers through accessible immunization education and intensified community immunization and primary care mobilization efforts expanding the reach.
- **The project's alignment with existing government strategies,** such as the Reach Every District/Reach Every Community (RED/REC) strategy as well as its focus on both improving vaccination demand and accesses, yielded positive outcomes and amplified its potential for adoption, ensuring strong stakeholder buy-in.
- **The implementation of the Bate-Papo Vacina!! project demonstrated a high level of fidelity to the implementation plan across all sites.** This was established through various mechanisms with participants and communities, such as monthly collaborative meetings, communication channels, monitoring structures, supportive tools (prioritization matrix and educational materials) and feedback informed adaptations, thus enabling effective monitoring and community involvement. Challenges to implementation included logistics and technological limitations associated with competing campaign priorities and poor communication network availability within some health facilities and communities, impacting the efficiency of information dissemination and community engagement.
- **The Bate-Papo Vacina! project shows a strong potential for maintenance and scalability, with local structures ready to sustain implementation due to robust community engagement and health care facility collaboration**. Participants in the evaluation emphasized that because the interventions were developed in partnership with health care workers, community representatives and government health officials to align with local structures, officials were primed to sustain and expand project implementation beyond the pilot phase. Recommendations for project maintenance included continuing project routines, equitable support for all health facilities, regular visits and ongoing support, integration within the existing structures such as Reach Every District/Reach Every Community (RED/REC), utilization of digital platforms and educational resources, knowledge sharing of experiences and funding decentralization. It is recommended that VillageReach monitor the long-term impact of the intervention beyond the pilot phase, including tracking changes in behaviour, health outcome and organizational practices.

The Bate-Papo Vacina! Project: Gile and Namarroi, Mozambique

The Bate-Papo interventions were developed through community-based participatory research (CBPR) and human-centered design (HCD) workshops. The CBPR/HCD approach aimed to generate new knowledge and targeted interventions to meet the routine immunization needs of caregivers and health care workers in Zambezia, Mozambique. The project took place in three distinct phases:

(1) Phase 1 - identification of immunization barriers,
(2) Phase 2 -co-design and piloting of co-created interventions and
(3) Phase 3 - evaluated the implemented interventions.

During Phase 1 of the research, VillageReach hired and trained Caregiver Researchers from the study communities, who worked to identify key barriers hindering the routine immunization journey. This research was guided by the behavioral and social drivers of vaccination framework (1) and immunization journey framework (2) and identified four key reasons why children under two missed their vaccinations:

(1) Concerns about side effects, particularly if the child falls behind schedule.
(2) Lack of social support and the prevailing perception that vaccination is solely the "mother's" responsibility.
(3) Uneven social dynamics between caregivers and health care workers.
(4) Reduced trust in the health system due to repeated negative experiences in accessing vaccinations and other health care services.

Image 1: Select quotes and photovoice photos from the caregivers of partially vaccinated children from Phase 1 research

"[The mobile brigades] bring vaccines, but even in these brigades, when we are late, we are not served. Sometimes we are not aware of the arrival of these mobile brigades, when we arrive from our fields, we hear that they are vaccinating children. You run there and find other mothers giving their children health cards and when you try to do the same, the health staff says you are already late."

"... I want to show that during the first months I vaccinated; but when I started missing the following months, the child would get all the vaccines simultaneously causing more adverse reactions to the vaccine, that forced me to abandon the process to allow my child to rest...the thing that made me miss were these side effects of the vaccine that made me quit. "

"...my husband was absent for a very long period, I had no one else to support me and no money for transportation. As a result, I was unable to return to the hospital to vaccinate my daughters."

**Consent for use of photos was obtained from participants during data collection*

The research findings were published in BMJ Open in 2022 (3) and shared with key stakeholders, including community leaders, caregivers, government officials and health care workers during two HCD workshops. During the workshops, participants actively built upon these findings to co-create low-cost interventions that were subsequently implemented as part of Phase 2.

During **Phase 2,** the Provincial Department of Health reviewed and prioritized the interventions based on the available budget (approximately $75,000 direct material and travel costs), feasibility and alignment with government and

partner priorities, ultimately approving a one-year pilot program. Throughout this process VillageReach conducted several feedback and engagement sessions with the participating provincial health department, district health departments and health facilities to present findings from the research, share plans for implementation and gather further information and feedback.

Based on these findings VillageReach co-developed an intervention consisting of four key components:

Image 2: Pictorial Immunization Education Cards

(1) Immunization education: Village Reach collaborated with community leaders, caregivers, and health education experts at Digital Medic, an initiative from the Stanford Center for Health Education, to develop pictorial cards and key messages to improve caregiver knowledge and agency, empowering them to make informed decisions about immunization. Pictorial cards were designed by Digital Medic's team of instructional design, medical, and visual design specialists. The four key messages are:

1. Vaccines save children's lives.
2. In a baby's first 18 months they should have about 6 vaccine appointments.
3. Side effects are normal and there are simple things you can do to make your baby more comfortable, however, know the signs of when to seek help.
4. Vaccinating your child is a shared responsibility.

(2) Mobile brigade prioritization: A paper-based tool was developed during the HCD workshop to enhance the use of RedRec reporting books by community focal points and health workers for planning, equity and execution of mobile brigades. The tool aims to utilize existing data collected at the community and health facility levels on the number of children requiring vaccination and their vaccination status. This data is collated into an easy-to-use format to help prioritize where the mobile brigade teams should focus their efforts (Appendix A). The goal of this intervention is to use the often-limited resources available for mobile brigades more efficiently, prioritizing communities furthest from the health facility or those most in need of vaccination services.

(3) Collaborative immunization planning: The goal of this component is to improve communication and coordination between communities and health facilities regarding planning and immunization activities, particularly mobile brigade services. Monthly meetings are held at health facilities where community focal points, APSs (community health workers) and health care workers met to complete the mobile brigade prioritization matrix and discuss planning for the monthly mobile brigades, including identifying targets and strategies. VillageReach provides a monthly stipend for snacks to incentivize participation in these meetings, as well as communication credit so that health care workers could routinely coordinate and communicate with APSs and community leaders before mobile brigade outreach events. This enables APSs and community leaders to alert and mobilize caregivers for the mobile brigades.

(4) Supportive Supervision: Early in the implementation, VillageReach added a component for the district Expanded Programme on Immunization (EPI) to conduct bi-monthly supportive supervision at health facilities. This aims to assist with the intervention components and provide additional support to the immunization teams. This component was added after APS and health care workers provided feedback indicating a desire for more support from their supervisors.

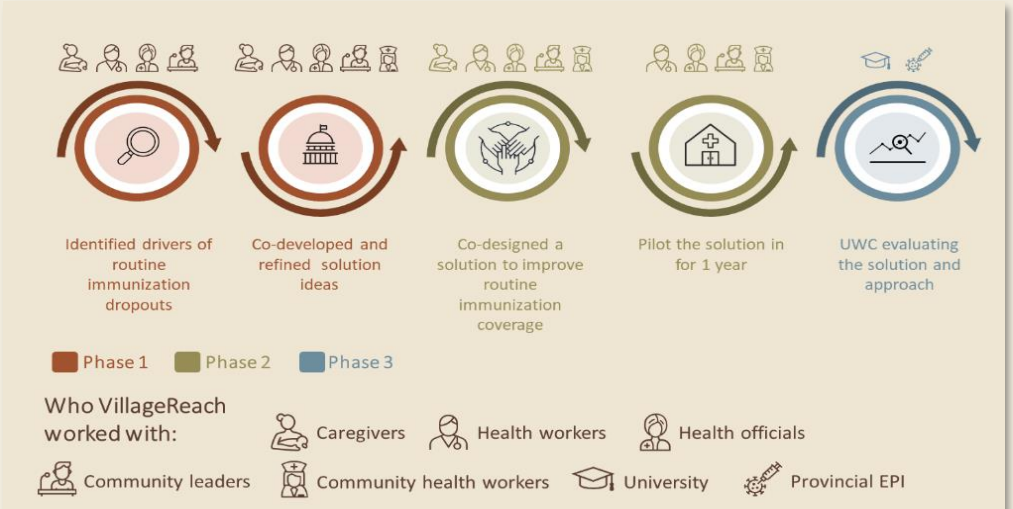
To support implementation, VillageReach conducted the following start-up and supportive activities:

- **Training:** VillageReach provided training to 118 APSs, health care workers, community leaders, community focal points and district EPI managers. The training covered intervention components, empathetic communication techniques for vaccine-hesitant caregivers and a refresher on the Reach Every District, Reach Every Community (RED/REC) strategy, upon which the Bate-Papo interventions were built. This training was conducted in collaboration with the Provincial Health Department EPI Manager. In a pre-post survey of the training, participants reported a significant improvement in confidence in using RedRec data to plan monthly mobile brigades, confidence in providing education on under-two routine immunization within their communities and confidence in having conversations with individuals who are vaccine hesitant.
- **Routine monitoring and evaluation**: VillageReach conducted regular monitoring to ensure fidelity to the planned interventions. This included tracking metrics such as the deployment of mobile brigades, the percentage of mobile brigades meeting prioritization requirements and the number of education sessions using new materials. Additionally, data on the total number of antigens administered and the number of fully vaccinated children were tracked, with a target of reaching 95% coverage in all health facility catchment areas. District health officials collected this data from health facilities and provided it to the project team. VillageReach offered regular updates on project progress to provincial and district health officials, as well as to health facilities during bi-annual visits.
- **Stakeholder engagement**: VillageReach routinely engaged with provincial and district health officials and health care workers through meetings and visits. These engagements included presentations of monitoring results and mid-line evaluation findings. Additionally, a WhatsApp channel was created to facilitate communication with health care workers.

For further details on the intervention, can be accessed via this overview and the process for developing the pictorial cards can be accessed via this joint brief authored by VillageReach and Stanford Digital Medic. The actors involved in implementing the interventions include:

- Caregiver Researchers (VillageReach contract employees)
- Community leaders/focal points
- RED/REC focal points
- Health workers responsible for vaccination,
- Community health workers (known as APSs) and
- District Expanded Immunization Program (EPI) officials.

Figure 1: The Bate-Papo Vacina! Project Overview



Evaluation Overview

EVALUATION APPROACH

To assess the effectiveness of the Bate-Papo Vacina! co-created interventions and the implementation process, we conducted a cross-sectional evaluation using both quantitative and qualitative methods. We adopted an embedded, realist approach was adopted to ensure that the evaluation activities were aligned closely with the project's activities, providing continuous feedback and insights into the contextual mechanisms driving the interventions' success and areas for improvement. This evaluation aimed to capture project achievements, challenges and best practices to inform future programs with similar goals.

The evaluation focused on three key areas:

1. Understanding the mechanisms underlying the implementation process of the community-driven interventions
2. Assessing the impact of the interventions on access to immunization services and reducing dropout rates
3. Identifying any unintended consequences of the implemented interventions

Additionally, we explored the project's scalability in similar contexts by identifying crucial factors for successful replication.

THE RE-AIM FRAMEWORK

The RE-AIM framework guided the evaluation process, including conceptualization, data collection and analysis. This widely used framework evaluates the implementation and outcomes of public health interventions (4-6). It incorporates contextual and equity considerations into the evaluation process.

Table 1 outlines the RE-AIM evaluation dimensions and how they were applied in this project's evaluation.

Table 1: RE-AIM dimensions and evaluation focus

RE-AIM Dimension	Evaluation focus examined:
Reach	Evaluating the intervention's success in meeting vaccination targets and changes in vaccination services delivery and access to vaccination services in hard-to-reach areas. This involved comparing the reach before the project commenced with the current reach and identifying opportunities to extend the reach to more caregivers.
Effectiveness	Measuring the project's effectiveness in improving under-two immunization coverage, reducing dropouts and assessing perceptions of the project's impact among caregivers, government officials and health care workers. This included evaluating changes in caregivers' and community members' knowledge, attitudes and practices, addressing of caregivers' needs

	equitably and enhancing health facility performance for vaccination services. These areas of inquiry were determined by the project's Theory of Change (Appendix 1).
Adoption	Determining the alignment of the project's co-created interventions with existing government strategies and policies to assess potential adoption.
Implementation	Assessing the extent to which the project was implemented as planned and in line with the training provided, ensuring fidelity and consistency across the intervention sites, analysing implementation cost and cost drivers and identifying implementation barriers and facilitators.
Maintenance [and Scalability]	Providing recommendations for maintaining and expanding the interventions, along with lessons learned for scaling up.

EVALUATION METHODS

To evaluate the program against the RE-AIM dimensions we employed a mixed-methods approach, using qualitative methods to assess all five RE-AIM dimensions, quantitative methods to evaluate effectiveness and costing to understand implementation and maintenance.

QUALITATIVE METHODS

We conducted interviews and focus group discussions (FGDs) to explore perspectives on the project's reach, effectiveness, adoption, implementation and maintenance

Sampling

A total of 44 participants took part in the qualitative evaluation (see Table 2). We purposively selected 26 government, health workers and community participants in collaboration with VillageReach staff to participate in the interviews. This purposive sampling ensured the inclusion of individuals with firsthand knowledge of the Bate-Papo Vacina! Project and interventions. Eighteen caregivers with multiple children under five were purposively selected from the mobile brigade outreach sites before immunization services had commenced in 4 of the 11 intervention health facilities.

Table 2: Qualitative data collection participants

Category	Number of participants
Provincial and district health officials	6
Community representatives	5
Health facility workers	6
APSs	7
Caregivers	18
VillageReach staff	2
Total	**44**

Below is a breakdown of the sampling criteria:

- **Provincial and district health officials:** Individuals actively involved in the project across both districts and the Provincial office were included.
- **Health facility workers, APSs and community representatives:** Interviewed participants were drawn from those directly involved with the project at the selected intervention health facilities and their catchment areas.
- **Caregivers:** For the FGDs, caregivers with multiple children under five were selected. This provided a comparative perspective on their current and past vaccination experiences. Specifically, FGD participants had:
  - ✓ An older child aged no more than four years.
  - ✓ A child or children currently undergoing vaccination, all under the age of two.
  - ✓ Experience with the outreach sites.
- **VillageReach staff**: Staff who were involved in the coordination of the Bate-Papo project.

Data collection

Qualitative data collection involved both key informant interviews and FGDs. Key informant interviews lasted 45 to 60 minutes and were conducted with health officials, VillageReach staff, APSs, community representatives and health care workers. Additionally, three focus group discussions, each lasting about 60 minutes, were conducted with caregivers. All participants were provided with information sheets and had the evaluation explained to them before providing written consent to participate.

Data analysis

Audio recordings of the key informant interviews and FGDs were transcribed verbatim and the transcripts were entered into Atlas.ti for qualitative data analysis. The qualitative analysis employed a combination of deductive and inductive approaches, guided by the RE-AIM framework dimensions.

QUANTITATIVE METHODS

To further evaluate our reach and effectiveness aims, we analyzed district health system data using a quasi-experimental design to assess whether drop-out rates declined more in intervention sites relative to comparison sites over the course of the intervention.

Sampling

All 11 intervention sites were included in our analysis. Ten comparison sites were selected based on the following criteria:

- comparable under-two immunization drop-out rates (main outcome of interest), as indicated with color coding in the tables below. Whilst the dropout rates varied, each color code matched intervention and comparison sites with a similar range of dropout rates;
- located in rural areas, as are all intervention sites.
- located in multiple districts in the province to maximize distribution.

Table 3: Intervention and comparison sites

Intervention District	Intervention Sites	Dropout rate		Comparison District	Comparison site	Dropout rate
Namarroi	CS Mudine	-8%		Alto Molocue	CS Bonifacio Groveta	52%
	CS Mutatala	20%			CS Cololo	26%
	CS Namone	-1%			CS Mugema	-3%
	CS Regone	28%			CS Novanana	37%
	CS Rumala	4%		Chinde	PS Centro Educacional	39%
Gile	CS Alto Ligonha	78%		Ile	CS Niboia	-28%
	CS Intxotxa	-1%		Maganja Da Costa	CS Cariua	5%
	CS Moneia	-34%			PS Vila Valdez	-14%
	CS Muiane	75%		Mocuba	CS Magogodo	2%
	CS Pury	-12%			CS Namagoa	71%
	CS Uape	33%				

During an initial analysis, we observed that Ile and Mocuba comparison sites had high numbers of children being vaccinated. This prompted us to investigate the reason behind this trend and we discovered that these sites both had NGOs implementing interventions supporting immunization. The interventions included radio communication as well as fuel to support the mobile brigades. As a result, the number of vaccinated children in the comparison sites was boosted, potentially confounding the effect of the intervention.

Data collection

Data were collected from September 2020 until December 2023 from the Mozambique District Health Information Systems (DHIS) and the Health Information System of Mozambique for Monitoring and Evaluation (SIS-MA). Data related to antigens administered to under one year old, except for the second dose of measles, which is administered during the second year of life.

Data analysis

The main outcomes were defined as the dropout from:

(1) The 1st dose of diphtheria, pertussis, tetanus vaccine (DPT) administered at two months of age to the third dose of DPT, administered at four months of age; and

(2) Measles dropout, defined as dropout from receiving the first does of the tuberculosis vaccine (BCG) delivered at birth and the first does of the measles-rubella (MR) vaccine administered at 9 months of age (see Appendix 2 for the formulae).

Secondary outcomes included separate antigens (e.g., MR dose 1, polio dose 2), the number of fully vaccinated children and the sum of all 16 antigens (doses) delivered as part of the childhood routine immunization schedule (Table 4).

Table 4: Childhood routine immunizations, Mozambique (Vaccine and doses)

Vaccine	Antigen (doses)
Tuberculosis	BCG
Oral Polio	OPV 0
	OPV 1
	OPV 2
	OPV 3
Pentavalent: diphtheria, pertussis, tetanus, hepatitis B, haemophilus influenzae type B	DPT-HepB-Hib 1
	DPT-HepB-Hib 2
	DPT-HepB-Hib 2
Pneumococcal conjugate	PCV 1
	PCV 2
	PCV 3
Rotavirus	RV 1
	RV 2
Inactivated Polio	IPV
Measles, rubella	MR 1
	MR 2

First, a pretest-posttest evaluation was conducted for each arm and outcome by comparing the monthly reported number of vaccinations during the 12 months preceding the intervention with the 12 months of intervention implementation.

Second, a difference-in-difference analysis was performed per outcome based on the mean of the 12 months preceding the intervention and the mean of the 4 months post-implementation using Analysis of Covariance (ANCOVA).

Third, a longitudinal analysis was conducted from the start of the implementation until 4 months thereafter (i.e., 16 months) comparing intervention and comparison sites for each outcome. Repeated measurements per center over time were accounted for by including a random effect.

Fourth, interrupted time series analysis was carried out to compare intervention and comparison sites over the course of the implementation until 4 months thereafter (i.e., 16 months). Autoregressive Integrated Moving Average (ARIMA) modelling was used to control for seasonal effects and autocorrelation.

COSTING METHODS

To explore implementation and maintenance aims, VillageReach conducted a costing analysis to understand and estimate the total direct costs of delivering the intervention, excluding costs such as VillageReach overhead. To understand the total direct cost of the co-created interventions, we adopted the payer perspective with VillageReach as the implementing partner.

We costed the interventions using a bottom-up approach. This involved identifying and costing each resource consumed during the study period to arrive at the total direct financial cost of the solution. We conducted interviews with the project team and conducted a detailed review of all financial records to identify all activities across the phases of the project and the resources/inputs for each as well as review of project financial data, including staff time billed and expense reports.

Second, we estimated costs as it relates to scalability of the solution.

Costing Framework

To organize implementation costs, we used the following cost categories: personnel, materials and supplies, travel, rental and subcontract costs. These were estimated across the different implementation activities. For staff billed time, we estimated the time spent directly supporting this project and excluded estimated allocations towards supporting the evaluation, grant management and other aims of the project, including the ongoing dissemination of research findings from Phase 1 and support for the project implementation in Malawi. Costs excluded from this analysis include VillageReach overhead costs and shared cost allocations due to the difficulty of estimating them.

The costs were estimated along implementation activity lines as follows:

(1) Solution Start-up Costs: This refers to all expenses incurred on all activities prior to and necessary for the successful launch of the solution. They included costs of government engagement and sensitization, training for health care workers and APSs and the design of educational materials.

(2) Ongoing costs: These are recurrent costs, fundamental for the routine implementation of the Bate Papo interventions. Key operational activities include immunization education, mobile brigade prioritization and collaborative immunization activity planning, monitoring and evaluation activities and cross-cutting staff time. The cost of immunization education refers to expenses incurred in distributing the educational materials. The mobile brigade prioritization and collaborative immunization activity planning were jointly implemented and the cost of these activities include communication and transportation stipends paid to the HCWs and APSs. Monitoring and evaluation activities were the cost of periodic supervisory visits by VillageReach and EPI officials to the health facilities. Cross-cutting VillageReach staff time refers to the personnel cost associated with VillageReach implementing the co-created interventions.

(3) Estimated Scale-Up Costs: We streamlined costs relevant for scale as the sum of the solution launch costs and ongoing recurrent costs. We have not projected the future cost to scale nationally and can estimate this amount based on the size of scale-up.

Key Costing Assumptions

The following assumptions were made in determining costs:

(1) Personnel costs consist of Caregiver Researchers, government staff (health care workers and district/provincial health officials) and VillageReach staff costs. For VillageReach Staff costs, only time spent by core program staff is material. Time spent by other VillageReach staff providing one-off or non-routine support to the core program staff was not costed.

(2) Only financial costs were included in estimating total costs. VillageReach staff time was estimated as the cost of time spent on each activity on the project.

(3) VillageReach staff time was calculated as a percentage of individual staff costs for the project, based on time allocations by the VillageReach team to each activity.

Data Collection and Data Sources

Data was collected through secondary data captured through review of financial records of the project and interviews with the VillageReach Bate-Papo team.

The data sources used for the analysis are listed below:

- VillageReach Financial Records
- VillageReach Budget Documents
- Interviews with the project implementation team

Limitations

The costing analysis has the following limitations:

- The costing analysis was conducted retrospectively, relying on the project team's recall ability to allocate the percentage of their time spent across the different phases of the project.
- When estimating the cost of technical assistance provided by VillageReach, we were unable to break down the costs by the specific activities and sub activities of the intervention.

ETHICS APPROVAL

This evaluation received ethics approval from the Biomedical Science Research Ethics Committee of the University of the Western Cape (Ethics Reference Number: BM22/4/3) and the Mozambique National Bioethics Committee for Health (Reference: 588/CNBS/22).

Evaluation Findings

REACH AND EFFECTIVENESS

To evaluate the project's reach in vaccination services and effectiveness on vaccination indicators, we assessed the monitoring data on its success in meeting vaccination targets set by the project team and DHIS data on its impact on immunization coverage and dropout rates. We also explored the project's responsiveness to caregiver needs in terms of vaccination delivery focusing on access to hard-to-reach areas and convenience of mobile brigade location and schedules.

The project aimed to reduce immunization dropouts and improve immunization services for 8,257 children across 11 health facilities in Gile and Namarroi. Evaluation results show that the project's reach exceeded its target and that there were improvements in coverage and quality of services. Both quantitative and qualitative findings are presented below.

Key Takeaway
Reach and Effectiveness

The pilot exceeded vaccination targets, achieving a total of 9,041 fully vaccinated children in a one-year period.

A substantial pre-post improvement occurred among the solution-exposed sites. A significant improvement occurred during the solution implementation compared to the comparison sites for measles dropout rate, polio, PCV and Rota vaccinations, but not for the other antigens.

Quantitative Findings

The project surpassed its target for the number of fully vaccinated children, achieving a total of 9,041, surpassing the initially projected 8,257. In addition, all targets were exceeded for the number of children vaccinated each month (Appendix 3).

In a pre-post analysis of intervention-exposed sites, a significant improvement in targeted outcomes was observed. During the 12 months of implementation, there was a substantial 133% reduction in DPT dropouts and a 47% increase in the proportion of children fully vaccinated in comparison to the 12 months preceding the implementation (See Table 5). In the comparison sites, on the other hand, no significant change occurred during the same time period.

Table 5: Main outcomes over 12 months before vs. during implementation.

	Intervention-exposed sites				Comparison sites			
	Baseline	Endline	Diff.	Change	Baseline	Endline	Diff.	Change
DPT Dropout	17.2	-5.6	-22.9	-133%*	19.0	10.7	-8.3	-44%
MR Dropout	33.1	12.1	-21.1	-64%*	30.6	31.4	0.8	3%
Total number of vaccinations for all 16 antigens	137981	167054	29073	21%*	95255	98891	3636	4%

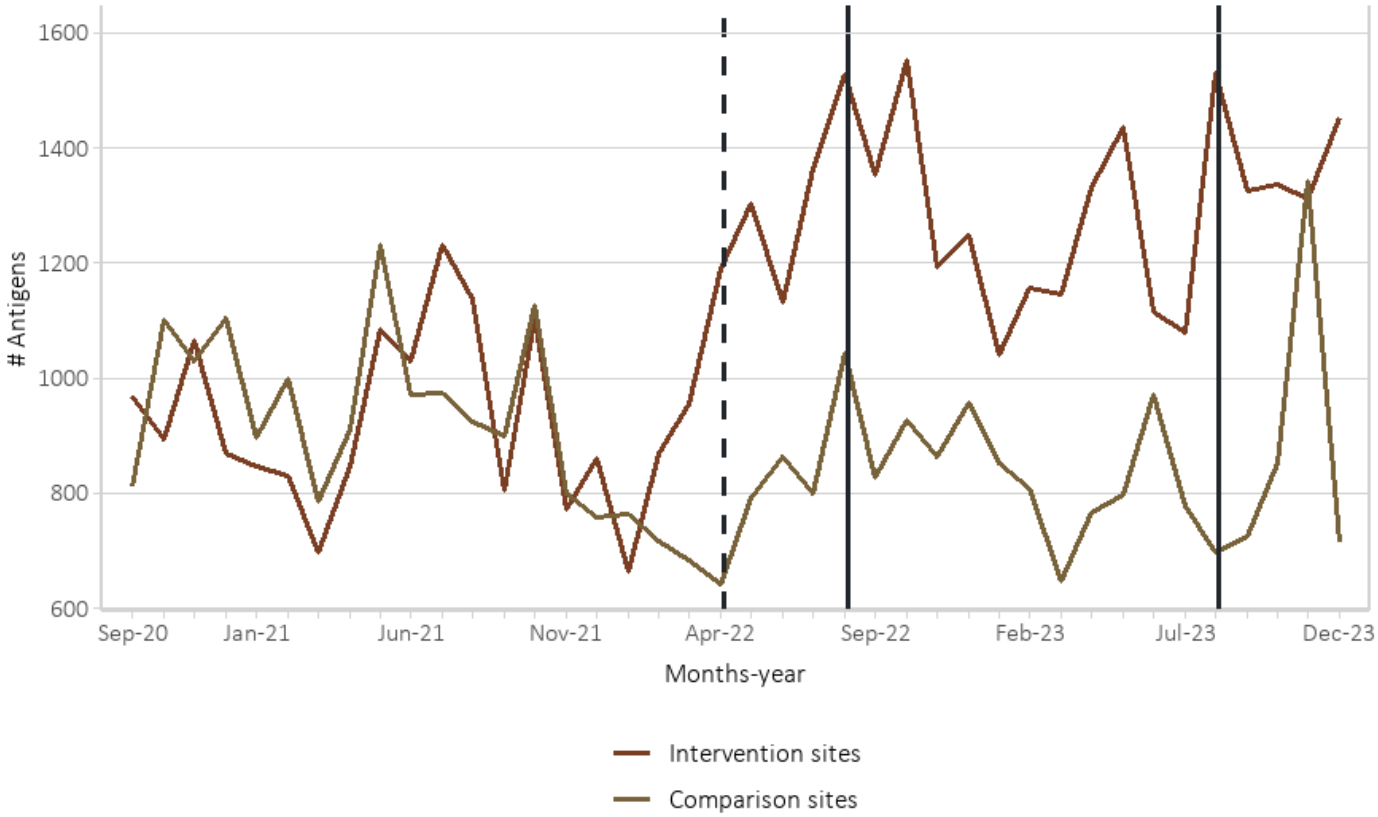
# of children fully vaccinated	6640	9734	3094	47%*	4686	4893	207	4%

Note: *Baseline covers the period from September 2021 until August 2022 (i.e., 12 months preceding the implementation of the intervention); Endline covers the period from September 2022 until August 2023 (i.e., 12 months of the implementation of the intervention). Negative values for the dropout rates occur if the follow-up vaccination (DPT 3rd dose or MR 1st dose) was reportedly higher than the selected reference point (e.g., DPT 1st dose or BCG).*

**Change significant at a 0.05 level.*

Graphical assessment indicates that much of the improvement in the intervention-exposed sites occurred before the actual implementation and started as early as February 2022 (see Figure 2). Part of this increase could potentially be attributed to preparatory workshops and engagement sessions conducted as integral components of the research, human-centered design and community engagement facets of the project (see Appendix 4 for more detail). Time series analysis corroborates these findings, revealing no significant improvement of the main outcomes during the implementation after adjustment for the comparison sites. For specific antigens as well as measles dropout rate, however, a significant improvement in vaccinations did occur in the intervention sites compared to the comparison sites during implementation. An effectively increasing trend was revealed for 6 of the 16 antigens: the pneumococcal conjugate vaccine (PCV) 2nd dose, the first three doses of polio and both the first and second dose of Rota.

Figure 2: Trends of the intervention and comparison sites over time. Intervention implementation started in September 2022 and ended in August 2023 (see solid black lines for the intervention start and dotted black line for the start of the pre-intervention activities).



Qualitative Findings

Interviews and focus group discussions provided deeper insight into what specifically had changed for caregivers and aspects of the project that were most important for improving its reach and effectiveness. The major themes that emerged are detailed below

Noticeable improvements in routine vaccination indicators

Qualitative findings indicated that gains in coverage and reductions in drop-out rates were perceptible to health officials and health care workers. As one health official said,

> *"Yes, something is changing. To say that, when the project started here in the district, we had a 40% dropout rate, but until the first nine months, we were at 8%. So, we are already at that acceptable level according to WHO international standards." Health official, Namarroi*

Improved mobile brigades and advance communication about them emerged as critical factors for expanding reach. Respondents reported that the advanced notice of mobile brigades provided by APSs significantly boosted caregiver participation compared to the pre-pilot period when communication was lacking. As a result, respondents felt caregivers were less likely to miss vaccinations due to a lack of awareness, especially in areas with long travel distances to health facilities.

In addition, we explored a range of outcomes beyond immunization coverage and dropout rates, including knowledge, attitudes and practices and gained insights on the broader impact of the interventions. Findings illuminated positive changes in service delivery that improved the effectiveness of immunization efforts, as well as challenges.

Enhanced operations for health facilities

Health officials and health care workers applauded the shift in planning processes, which prioritized communities and children most in need. This included redirecting mobilization and awareness activities to communities with the highest number of missing children, aligning with the project's objective of improving equity of access to routine childhood vaccines. Respondents noted that the project introduced a more organized approach to monitoring and evaluating the performance of the intervention, enabling better identification of challenges and areas for improvement. Exposure to the HCD approach during the co-design phase, fostered empathy, leading health care workers to consistently reflect on their work and find ways to enhance caregivers' experience of vaccination. A health official describes the changes compared with actors in new health facilities that were not yet exposed to the project,

> *"The actors in the other five Health Facilities that we just expanded only arrived, handed in their reports and left. They didn't sit down to discuss anything else. For example, regarding the same experience, saying that with Bate-Papo now, at the end of the Mobile Brigades the Health facility sit down and make a balance. In this balance, the technician only leaves after the community leader knows whether there was adherence or not. And the technician asks why there was a failure and what happened so that the mothers could not arrive or join in a higher number than was expected." Health official, Namarroi*

APSs who had been trained reported broader responsibilities, such as covering more locations and mobilizing communities suggesting a broader reach and impact of health care services, which may lead to improved health outcomes in previously underserved areas.

Enhanced service experience for caregivers

Caregivers reported improved vaccination services due to the convenience of mobile brigades, though challenges like long wait times and inconsistent communication on future appointments remain. Caregivers expressed relief during focus group discussions, appreciating the convenience of mobile brigade services near their communities. This proximity not only alleviated the strain of long-distance travel but also motivated increased support from community members in facilitating access to vaccination services. A caregiver highlighted these improvements,

> *"Talking about the experiences with vaccination services comparing my older child who finished immunization and the current child who is [attending] vaccination, I see differences and changes because before this project brought health services near the community, we used to delay or take long time waiting to be attended. Now that we meet here to access health services through the mobile brigade, we see that our community is growing and other children of age of adolescence couldn't take the youngest relatives to health facilities because of distance and you [couldn't] think of taking long pathways with a baby sick. So, the mobile brigades are helping so much because any diseases like malaria, fever are treated here receiving tablets and vaccine." Caregiver, Namarroi*

In addition, most caregivers noted that their past experiences with health care services were negatively affected by long queues and the attitudes of health care providers, leading to missed appointments. They commented that the Bate-Papo Vacina! interventions have improved the service experience as it has made health care services more accessible through mobile brigades, supported efforts towards improved relationships with health care workers and increased flexibility in accommodating health needs.

Despite improvements, some issues identified in the original CBPR/HCD research were not resolved. Interactions with health care workers varied among caregivers, with some reporting positive changes in their interactions with health care workers and APSs while others described instances of rudeness and mistreatment. Prolonged wait times also persisted for some, particularly in areas far from health facilities. A caregiver shared her concerns:

> *"The last experience that my child had was not so good concerning the issue of waiting time is not improving, even comparing from before with the other children who are now over two years. We live far away from the health facility, so we come early but the treatment starts late and the queue was too long until reach ones turn. Taking into consideration of distance and the weather, we don't deserve [to] stay long waiting and we see no change at all." Caregiver, Gile*

Some caregivers also highlighted inconsistencies in the communication of future vaccination appointments, with some caregivers reporting receiving clear guidance while others encounter challenges in obtaining essential registration cards for their children's health care records. Caregivers also stressed the importance of constructing a local health facility to ensure around-the-clock access to health care services, a suggestion that also came up in the CBPR interviews and HCD workshops.

Increased male and family involvement

During the project, efforts to involve men and other family members in vaccination activities showed promising results. Before the project, male participation was limited. However, respondents expressed that community mobilization and education have led to a positive shift in male and family involvement in vaccination activities. Fathers are increasingly attending education sessions, taking children for vaccinations and receiving priority in health care settings. Other family members, such as grandparents and uncles, are also playing supportive roles in bringing children for vaccination and helping with household chores. Health care workers noted that the previous lack of family involvement was due to a lack of education in the community regarding the shared responsibility of taking a

child for vaccines. While there are still challenges such as delays in health care facilities which demoralize fathers and some husbands' reluctance, health care workers confirmed a noticeable improvement in male engagement, contributing to better vaccination coverage and uptake. One health care worker expressed,

> *"Yes, there is involvement, they participate in the lectures and contribute. [How do they contribute?] They say that before; they didn't know that a [non] parent could take a child to the vaccination center. Just like a grandfather or a grandmother. And if the mother is sick, any member of the family at home could accompany the child to the vaccination center. They did not have this knowledge, but through the use of those cards, they already know that if the mother is unable or something makes it impossible for her to accompany the child to Health Facility or to a vaccination center, that anyone can accompany." Health Facility Worker, Namarroi*

Caregivers confirmed the improvement in male involvement, that family members help to remember vaccination appointments and participate in education sessions. This increased involvement is likely to reduce logistical barriers faced by caregivers in accessing health care services. However, all caregivers who participated in the FGDs in both districts were unemployed and relied on their husbands and extended family members for financial support to access health care services, suggesting that economic dependency is a significant barrier to health care access.

Improved caregiver knowledge, attitudes and practices regarding vaccination

Health care workers, APSs and RED/REC focal points indicated a substantial improvement in caregivers' understanding of immunization schedules, potential side effects and the importance of vaccination compared to the period before the project.

Importantly, interviewed caregivers themselves attested to the success of educational efforts in improving their understanding and confidence in vaccines. Across the three FGDs conducted, caregivers consistently indicated increased levels of confidence and trust in immunization services relative to their previous experiences with older children. They expressed comfort in the vaccination process and faith in the health care workers who administer vaccines to their children. Caregivers mentioned increased confidence regarding the safety of vaccines and the benefits of multiple doses, relative to past experiences with older children. This is noteworthy as this was a key barrier identified in the CBPR/HCD phase of the project. The caregivers attribute their heightened knowledge to their participation in immunization education sessions and the use of immunization educational cards. One caregiver explained,

> *"Yes, we have been part of immunization education and mobilization. I really see that a vaccinated child grows better than one not vaccinated, we now know that vaccines are good to protect the health of the child because there are side effects we see from the child after taking [vaccines] … Before this project, we only used to see the child crying and we didn't really know what was behind that but from now with immunization education and the flashcards [pictorial cards] we received, we can see the images showing different stages after a baby [has] taken [the] vaccine." Caregiver, Namarroi*

APSs and health care workers also noted that caregivers became more proactive in seeking vaccinations, adhering to schedules and managing side effects.

Overall, while some aspects of the vaccination service experience have not seen improvement, such as waiting times, the consistent availability of vaccines and improved relationships with health care providers suggest positive aspects of the project and within the health care system that can be built upon for further enhancements.

Systemic Factors Mitigating Impact

Various systemic and contextual challenges surfaced, impacting implementation and overall vaccination service delivery. Based on interview responses, these challenges include:

(1) Transportation Challenges: Limited transport infrastructure affects health care workers' ability to reach communities, follow up on missing vaccinations and conduct mobile brigades effectively. APSs walk long distances to reach caregivers and some health care workers do not have functional motorbikes.

(2) Resource Constraints: Insufficient resources, including funding and fuel and disrupted planned mobile brigades led to dissatisfaction among caregivers. Intervals of two to three months between mobile brigade sessions were reported. As a result, some caregivers, while acknowledging the improved knowledge dissemination, opted to travel to health facilities to ensure their children's timely vaccinations. Despite their dedication, some caregivers felt discouraged by cancellations of mobile brigades or delays due to resource limitations.

(3) Cultural and Religious Beliefs: Deeply ingrained beliefs, such as those prohibiting health care interventions other than prayers, posed challenges to immunization efforts.

(4) Geographical and Environmental Barriers: Distance between communities and health care facilities, compounded by lack of transport, hindered access to immunization services. Adverse weather conditions such as floods were frequently highlighted as significant obstacles to mobile brigade execution, often limiting their reach and effectiveness.

(5) Challenges in maintaining cold chain logistics compromised vaccine efficacy and delivery.

The persistence of these challenges undoubtedly influenced the impact of the Bate-Papo Vacina! project. However, addressing these systemic challenges fell beyond the project's scope.

ADOPTION

To evaluate the potential adoption of the interventions by health workers, APSs, provincial and district health officials, we analysed the project components that contributed most to the improved access and uptake of immunization. We also examined how the project aligned with existing public health strategies.

Qualitative Findings

Two key themes emerged as factors that have led to strong adoption of the co-created interventions: alignment to existing government strategies and policies resulting in strong buy-in and interconnectedness of intervention components.

Key Takeaway
Adoption

The project has strong support and aligns with existing government public health strategies and policies. It's clear communication and interconnected components yielded positive vaccination outcomes, contributing to widespread adoption among implementers.

Alignment with Existing Government Strategies and Policies Resulting in Strong Buy-in

The Bate-Papo project aligns closely with both local and national government strategies and policies related to childhood immunization, particularly with the RED/REC strategy. The RED/REC strategy is a collaborative effort that fosters coordination between health care providers and communities to enhance equitable routine immunization services and uptake. It provides tailored support at provincial, district and community levels, emphasizing the importance of local engagement and proactive measures to address barriers to immunization (6). Bate-Papo supports the objectives of these plans by facilitating the location of children who require vaccinations, conducting surveys, follow-ups and active searches for absentees. A health official highlighted this alignment by stating,

> *"Speaking of alignment with other programs, I will say that it [referring to the Bate-Papo project] is a strategy to reach hard-to-reach communities. So, Bate-Papo ends up marrying RED/REC in implementing what are community activities. Because if we look at what the components of RED/REC are, which have to do with planning, implementation of activities, monitoring these same activities, social mobilization and increasing demand for immunization, then, all of this ends up aligning with Bate-Papo." Health official*

This alignment was said to have positively impacted vaccination rates and helped address issues such as vaccination dropout rates in the areas where it is implemented, ultimately supporting the broader goals of national health programs and strategies to improve health outcomes.

Interconnected Project Components Yielded Positive Outcomes

Monthly collaborative planning meetings for immunization activities and immunization education sessions supported by educational materials (posters and pictorial cards) complemented each other to address identified immunization barriers. Participants generally concurred that these intervention components worked well together, with varying degrees of importance depending on the implementor's perspective.

Health officials emphasized the interconnectedness of solution components, highlighting how immunization education for mothers and the use of monthly meetings were an interconnected mechanism for communication and soliciting community feedback.

Planning was deemed crucial for ensuring accurate information exchange between the community and health facilities regarding vaccination services, while visual aids such as cards played a significant role in sensitizing both mothers and fathers. APSs highlighted the impact of immunization education and educational materials, including cards and posters, in aiding caregivers' understanding of immunization information.

From the perspective of health care workers, active searches for absent children and educational posters were instrumental, along with planning meetings and prioritization matrices. Caregivers identified immunization education and visual aids, such as cards with images, as key factors in enhancing comprehension. A health official emphasized the importance of these interconnected components:

> *"…without one [project component] the other cannot work... I think that they are all better in general because they are all interconnected." Health official*

This strategic alignment of the project with national public health plans and the interconnectedness of the project components, including the initial HCD/CBPR components, are crucial factors amplifying the adoption of the intervention components. The elements ensure strong buy-in from stakeholders and demonstrate the project's capacity to produce positive outcomes in childhood immunization efforts.

IMPLEMENTATION

In assessing implementation, we evaluated the execution of the project, including fidelity, consistency across sites, implementation cost and cost drivers, communication and feedback mechanisms and challenges faced during implementation.

Key Takeaway
Implementation

VillageReach successfully executed all planned activities, or intervention components, maintaining high fidelity to the implementation plan. Moreover, they were able to make necessary adjustments based on ongoing monitoring and feedback from stakeholders, which played a major role in the overall success of the project.

The project showed high fidelity to the implementation plan, maintaining consistency across all sites and employing strong implementation, communication and monitoring mechanisms to facilitate effective implementation. However, logistical and technology limitations posed challenges during implementation. These key findings are explained in detail below:

Qualitative Findings

High Fidelity to the Implementation Plan

The implementation of all project components was characterized by high fidelity to the implementation plan and adherence to training protocols. Health care workers, APSs and RED/REC focal points reported that they worked closely with community members to ensure consistent implementation was maintained across all sites through regular monthly collaborative meetings, utilization of the prioritization matrix, mobilization and the integration of educational materials (pictorial cards and posters) in immunization education sessions at health facility and community levels. These components were implemented as planned according to the project goals leading to increased caregiver participation in vaccination activities. According to one health care worker in Namarroi

While maintaining adherence to the overarching implementation plan, certain sites demonstrated adaptability by adjusting the number of actors involved and adding more focal points to cover more communities. This flexibility helped address local needs while ensuring adherence to project goals.

The graphs below are taken from VillageReach's monitoring data that depict the percentage of educational sessions implemented using the new educational materials (Figure 3) and prioritization activities in monthly meetings (Figure 4). Findings also indicate that all monthly meetings held during the one-year pilot included community members.

Figure 3: Percentage of educational sessions using new educational immunization materials at Health Facility and Community level

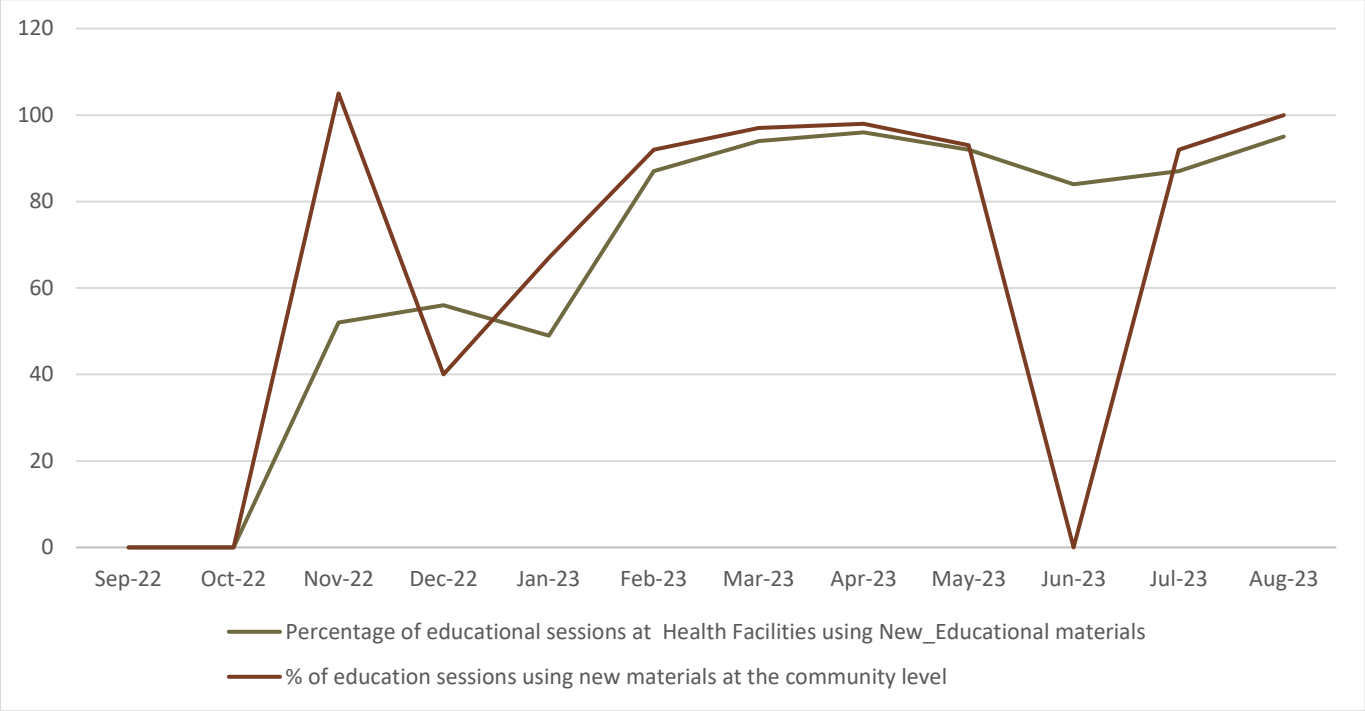
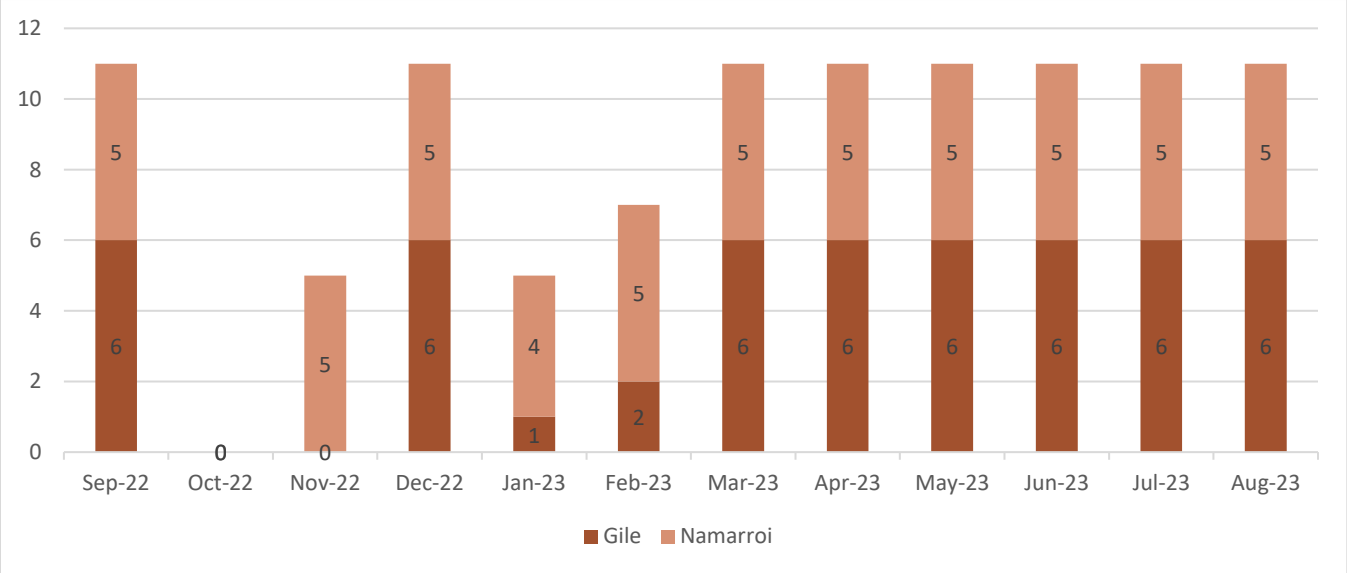


Figure 4: Sum of Total # of prioritization matrix filled out and saved in each HF by APS's/FP & HCW



Strong Communication and Monitoring Mechanism Facilitated Effective Implementation

The interventions were successfully implemented, facilitated by strong implementation, communication and monitoring mechanisms, rooted in the foundation of the CBPR and HCD approach. These elements successfully yielded positive outcomes.

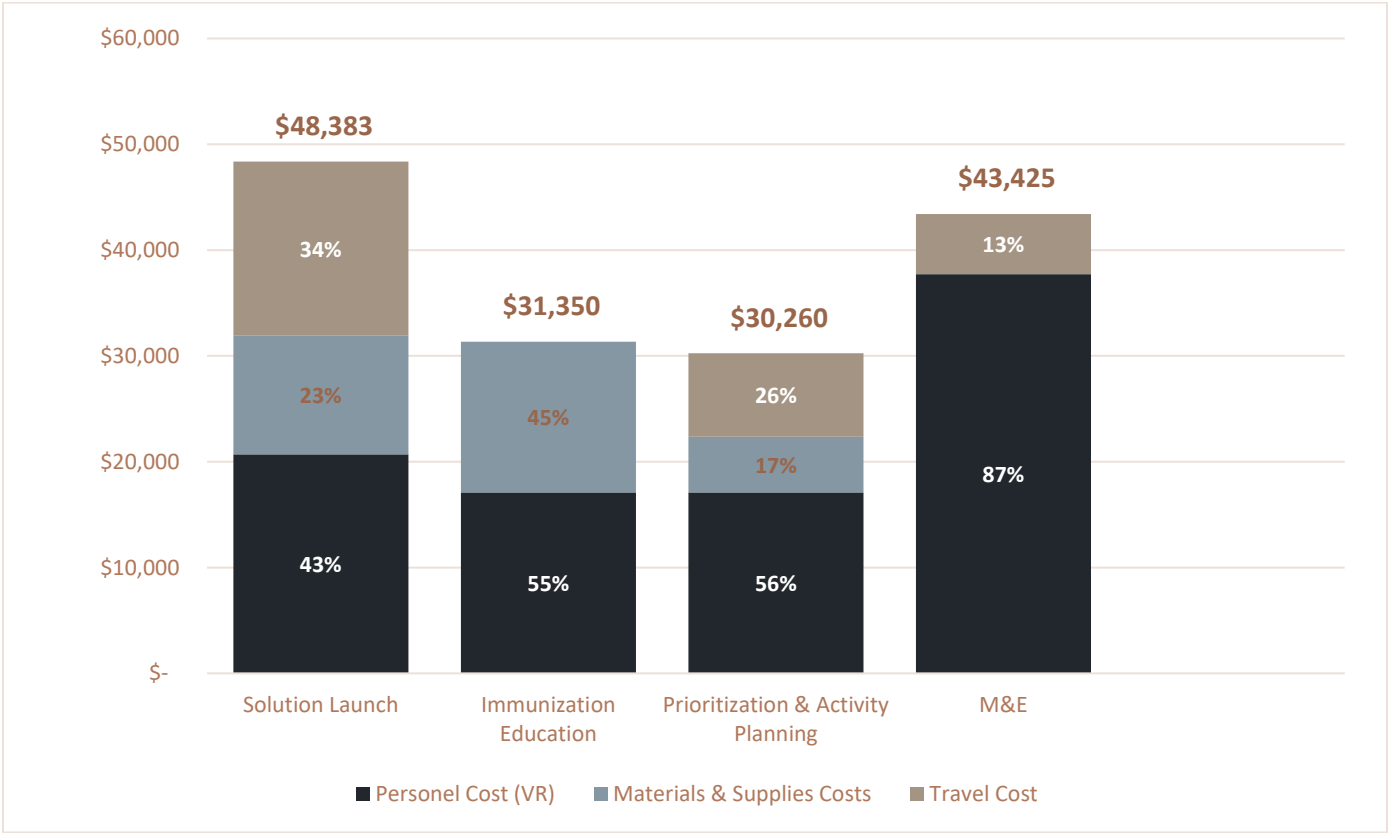
Key strategies employed were described earlier on page 9 and 10. Overall, these mechanisms not only ensured the successful implementation of the project but also facilitated meaningful community involvement in immunization programming. Worth highlighting is that the active involvement of APSs in planning is said to now be a practice, enhancing the coordination and execution of mobile brigades' activities. One APS from Gile expresses their involvement in the collaborative planning process,

> *"Before the Bate-Papo project, we did not know that an APS should participate in the mobile brigade's planning. Now we are involved in the mobile brigade's planning. In terms of activities, we first plan the dates on which each person will go to carry out the mobile brigade, then we must take the same information to the secretary (community leaders), as soon as possible so that people are aware promptly. During planning, the APS chooses the date… After planning and after the information arrives in the community, the technician or supervisor…goes to the community to do the mobile brigade once the day arrives." APS Gile*

Implementation Costs

The total direct costs of implementing the co-created solutions for one year in 11 health facilities, across two districts was $153,418 USD. These costs consider the direct costs of materials, supplies, travel and estimated personnel costs that can be directly attributed to the project activities but do not include overhead or personnel costs associated with general management of the grant. The primary cost driver for the pilot interventions was VillageReach staff time (personnel costs), accounting for 60% of implementation costs, followed by material costs at 20% and travel costs which accounted for 19.6% of implementation costs and include the costs of travel associated with training, government engagement, supportive supervisions and VillageReach staff site visits. Figure 5 below shows a breakdown of total costs by activity/intervention and the contribution of each cost driver to total costs.

Figure 5: Contribution of cost categories by intervention implementation costs



Challenges during implementation

During the implementation of the project, some challenges emerged, primarily logistical issues and technological limitations. Whilst coordination has improved, there were some instances of miscommunication regarding national vaccination campaigns, resulting in disruptions to implementation plans. Telecommunication network problems posed a significant obstacle, impeding communication and coordination efforts and consequently affecting the efficiency of information dissemination. A health care worker from Namarroi expressed frustration, stating, *"We have WhatsApp but here we have network problems, we have had a lot of network problems."*

Key Takeaway
Maintenance and scalability

Local structures were prepared to sustain project implementation with a strong foundation for the sustainability of the project rooted in the strong community engagement and collaboration with health facilities cultivated by the project.

While the education cards and key immunization messages were widely viewed positively, there were some concerns and opportunities for improvement identified by respondents. According to feedback from some caregivers, due to low literacy levels, some caregivers may struggle to fully comprehend the information presented on the educational cards (flashcards) especially if they do not attend the entire immunization educational session. This was explained by one of the caregivers,

> *"…the flashcards from VillageReach of course we have seen them but sometimes you don't know how to interpret [them] because you may arrive late at the education session place and you don't know what was spoken about the flashcards unless those who participate from the beginning might be capable of interpreting them. When you arrive late and you are not told anything, which means the flashcards give information to [those] who stay for the presentation until the beginning of other vaccine activities and if you arrive late, you think nothing happened before starting with vaccine session. So, we see the flashcards fixed and we realize that nothing is interesting for us." Caregiver Gile*

Additionally, some participants expressed concerns about delays in receiving educational materials, limited supply relative to the demand generated from mobilization efforts and lack of support materials such as identification materials, bags and transportation to better facilitate their work.

MAINTENANCE AND SCALABILITY

To assess maintenance at the settings and individual levels, participants were asked about their recommendations for sustaining and expanding the project as well as lessons learned for scaling up.

Qualitative findings

The findings reveal a strong foundation for sustainability with respondents emphasizing the readiness of local structures to sustain project implementation, due to the strong community engagement and collaboration with health care facilities. They also acknowledged proactive advocacy from stakeholders for project continuation, motivated by positive observed changes and buy-in, expressing satisfaction at the ongoing continuing of the project.

At the individual level, caregivers' positive shifts in knowledge and attitudes towards vaccination highlight initial success, but ongoing monitoring beyond the pilot phase is essential to assess long-term impact and ensure sustained

behavioral changes and organizational practices. Recommendations for long-term success and expansion are included in the recommendations section.

Respondents' views regarding scalability highlight several key elements identified from the project and as recommendations that are valuable for project success and in guiding the scaling-up process. These include gaining stakeholder buy-in, co-designing solutions, providing training for scalability, addressing practical needs, securing adequate resource allocation, engaging with the community, making small strategic investments such as capacity building of local structures, consistent planning, government involvement and endorsement of the project, transparency, accountability through regular reporting and engaging trusted community members. Integrating these factors into scalability strategies can enhance project impact and sustainability.

Costing evaluation findings

Total ongoing direct costs estimated as recurring delivery costs for the three components of the interventions within the current 11 implementation sites are estimated at $105,035 per year. The major cost drivers for direct ongoing implementation costs are travel and personnel costs. A major portion of the personnel costs represents the non-variable cost of staff time provided by VillageReach to EPI Managers and Health care workers to continue to successfully implement the solution during the period being costed. Staff time has been allocated to different activities of the project based on percentage allocations determined through staff interviews. Another major cost driver for ongoing costs is recurring and variable travel costs incurred during the bi-annual site supportive supervision visits by both VillageReach and EPI managers to the health facilities in both districts.

Recommendations

The following recommendations were suggested by the stakeholders interviewed to enhance the reach and ensure the long-term success of the project.

Suggested Improvements to Extend Reach

- Strengthen partnerships with community and religious leaders to ensure consistent messaging across all levels. By aligning with influential figures, accurate information can be disseminated and address vaccine hesitancy and misconceptions within communities.
- Consider providing incentives and material support for mobilizers such as transportation allowances, bicycles, or recognition rewards to boost motivation. Lack of transport resulted in not being able to reach more caregivers in far communities as APSs weren't able to go unless they slept in the community which resulted in more costs.
- Utilize the expertise and reach of community health workers to facilitate the distribution of vaccination cards to every household in need.

Factors to Ensure Long-Term Success

This section outlines key recommendations to sustain and expand the positive impacts of the Bate-Papo Vacina! project in Mozambique:

- Integrate project activities into existing government programs, such as RED/REC to ensure sustainability beyond the pilot phase.
- Ensure equitable and consistent support for involved health facilities by maintaining current project components and routines.
- Provide regular visits and ongoing support to health facilities to assist with transportation and material distribution.
- Coordinate with local authorities, such as the Provincial Health Department, to expand the project effectively, avoiding duplication of efforts and maximizing impact.
- Institutionalize feedback mechanisms and monitoring systems to track progress, address challenges and make informed decisions for sustaining the project's impact.
- Utilize digital platforms and educational resources to disseminate information, raise awareness and empower communities to take charge of their health.
- Strengthen the immunization structure through collaborative capacity building to ensure sustainable adoption and effectiveness of the program.
- Enhance visibility through identification materials for community mobilizers.
- Integrate transportation considerations into project planning and implementation to optimize service delivery and accessibility.
- Decentralize funding as a mechanism for supporting local initiatives and enable local authorities to invest more in the needs of districts ensuring sustainability beyond the pilot phase.

Discussion

The successful implementation and notable impact of the Bate-Papo Vacina! project in improving access to immunization services and vaccination indicators is evident. The evaluation offers important lessons and methodologies that provide guidance and a starting point for other contexts. The findings clearly show that the combination of the co-created interventions can be effective strategies to improve access to immunization services and vaccines for children under two. The following presents key interpretation of the findings under each RE-AIM dimension.

Reach and effectiveness

The project successfully met its vaccination targets and analysis of the health system data on reported vaccinations indicated positive results. Overall, we saw a substantial improvement pre-post implementation which was mainly due to an increase of vaccinations in the months preceding the actual implementation. This could have been partly due to preparatory activities related to the solution. However, one would expect a further increase during the actual implementation. Such an increase only happened gradually for 6 of the 16 antigens, after adjustment for the comparison sites. The other antigens did not show a significant change during the intervention implementation. These results suggest a potential but gradual effect and a longer implementation would be needed to measure a substantial impact.

The qualitative findings reinforce the quantitative results with health providers noting improved vaccination coverage and reduced dropouts. In addition, qualitative findings at the midline evaluation suggest that some of the comparison sites had additional add-on interventions to enhance mobile brigade outreach, potentially explaining trends in the current endline quantitative findings and thus data should be interpreted with caution as impact might have been 'diluted' given potential confounding effects. These interventions in the comparison sites included community-based communication methods, external support or partnerships for vaccination program elements and geographical advantages of certain health facilities, highlighting the multifaceted nature of intervention implementation and the importance of contextual factors in interpreting quantitative data.

Qualitative and to some extent also quantitative findings provide encouraging insights. Health officials and health care workers on the ground did perceive positive differences brought about by the project such as improved caregiver participation in vaccination activities and improved vaccination indicators. Overall, while some aspects of the vaccination service experience have not seen improvement, such as waiting times, the consistent availability of vaccines and improved relationships with health care providers suggest positive aspects of the project and the health care system that can be built upon for further enhancements.

Adoption

The adoption of the Bate-Papo project in immunization programming is significantly supported by its strategic alignment with existing government strategies and the interconnectedness of its components. Bate-Papo's alignment with the RED/REC strategy exemplifies how integrating with established health policies can facilitate buy-in and support (6-9). By aligning with the RED/REC strategy, Bate-Papo leverages existing structures at different levels and policies to support efforts to enhance routine immunization.

This integration helps in locating children needing vaccinations, conducting follow-ups and actively searching for dropouts thus working towards addressing immunization barriers effectively. This approach also aligns with the Immunization Agenda 2030's strategic priority goals, particularly on integration (8). The interconnected project components ensure a cohesive implementation process, with monthly planning meetings, prioritization matrix, immunization education sessions and educational materials, working synergistically to improve planning and support immunization efforts.

Implementation

The project's high fidelity to the implementation plan and alignment with the training protocols highlights the importance of structured yet adaptable implementation strategies. Rooted in CBPR and HCD approaches, strong implementation, communication and monitoring mechanisms facilitated effective community involvement and allowed for continuous improvement and adaptations.

While the project may have made strides in improving communication, education and coordination within communities, systemic challenges such as transportation and resource constraints require broader, systemic interventions. Addressing these ongoing challenges will require targeted interventions aimed at improving infrastructure, allocating sufficient resources, addressing cultural barriers and enhancing logistical support for vaccine distribution.

However, VillageReach can play an advocacy role by highlighting these persistent challenges that impact vaccination delivery. Discrepancies in communication on future appointments further emphasize the need for standardized protocols and improved communication practices within health care facilities to help caregivers better navigate the health care system and ensure continuity of care.

Maintenance and scalability

The Bate-Papo project has laid a strong foundation for sustainability, as evidenced by the readiness of local structures and the strong community engagement observed throughout its implementation. This highlights the importance of establishing mechanisms for continuous evaluation and support to maintain the project's benefits over time.

Recommendations for long-term success and scalability offer a roadmap for expanding the Bate-Papo project and enhancing its impact and sustainability. This ensures that it continues to deliver positive outcomes in new areas while maintaining the quality and effectiveness of its interventions.

Conclusion

The Bate-Papo Vacina! project's co-created interventions effectively addressed identified key barriers to routine immunization, documented in VillageReach's paper published in BMJ Open in 2022. Through a CBPR approach, the project identified four main drivers of dropouts: concern about side effects, lack of social support, uneven social dynamics between caregivers and health care workers; and reduced trust in the health system due to repeated negative experiences.

The project had a profound impact, directly addressing these barriers through various strategies: immunization education at the community and health facility level, distributing immunization education materials and promoting community mobilization and collaborative planning among community actors and health service providers. The success of these efforts is evident in the improved immunization outcomes and the creation of a more supportive and informed environment for routine immunization, as detailed in our qualitative and quantitative findings.

Strong communication and monitoring mechanisms, along with effective implementation, ensured community involvement and project adaptation. The project's success stemmed from the interconnectedness of its demand and access components, collaborative capacity building and alignment with existing government strategies. In addition, the project's readiness for integration into existing systems and the positive shifts in caregiver knowledge and attitudes towards vaccination bode well for long-term sustainability.

The Bate-Papo Vacina! Pilot Project in Mozambique stands as a promising model for improving childhood immunization rates and enhancing community engagement in immunization programming. Overall, the project made significant strides in improving community engagement in under-two immunization, positioning it as a valuable model for future programming aimed at improving childhood immunization efforts. The evaluation process, based on the RE-AIM framework, provides valuable insights for potential future expansion.

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Appendix A: Prioritization Matrix

REPÚBLICA DE MOÇAMBIQUE
MINISTÉRIO DA SAÚDE
DIRECÇÃO PROVINCIAL DE SAÚDE DA ZAMBÉZIA
DISTRITO DE GILÉ

MATRIZ DE PRIORIZAÇÃO DE BRIGADAS MÓVEIS POR UNIDADE SANITÁRIA

Centro de Saúde de_____ Data _____

Ord	Nome da Comunidade	Distância da US	Total de Crianças Menores de 2 anos	# Crianças faltosas	# de mulheres grávidas	Comunidade priorizada para BM	Nome do Ape
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							

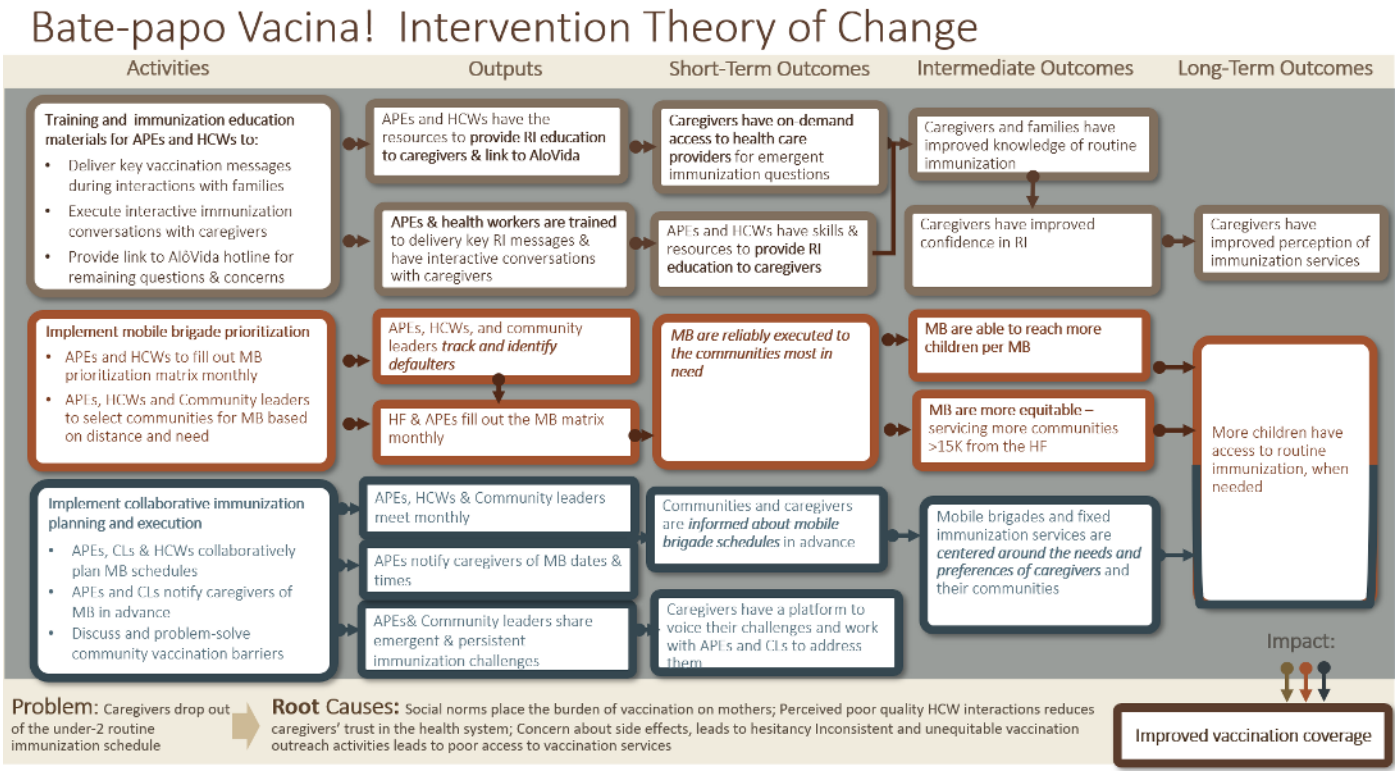
Assi. do PS_____ Assi. APE _____ Assi. LC_____

Bate-Papo Vacina!

VILLAGEREACH. Starting at the Last Mile

Appendix B: Theory of change

The Theory of Change (ToC) for the Bate-Papo is illustrated below. The ToC outlines the defines the logical sequence of steps employed by the intervention to achieve its objectives in community engagement and immunization. It was used to assess the impact of the project components and how they yielded positive outputs, short and intermediate outcomes in line with the ToC. Additionally, it was utilized to monitor key indicators and provide valuable insights into project performance, as well as to solicit and incorporate community input effectively, contributing to the project's success and sustainability.



Appendix C: Dropout Formulae

DPT drop-out:

$$\frac{(\#\ DPT\ 1°\ dose\ -\ \#\ DPT\ 3°\ dose) * 100}{(\#\ DPT\ 1°\ dose)}$$

BCG-Measles drop-out:

$$\frac{(\#\ BCG\ -\ \#\ MMR\ 1°\ dose) * 100}{(\#\ BCG)}$$

Appendix D: Timeline of preparatory activities

Date	Activity
April-May 2022	Engagement meetings with districts and communities.
June 2022	Prototype workshop in Mocuba district
August 2022	Training community health workers and health workers.

Appendix E: Additional Quotes

Reach and Effectiveness	
Enhanced service experience	"But to align with Bate-Papo's plan, let's assume that community X has more children than community Y and that in that month that we were going to do the mobile brigades we switched because of the number of missing children. We changed the plan that was already set and prioritized those with the most missing children and directed mobilization and awareness activities to those same missing children, so this only supports us much more through Bate-Papo, which makes us see that community X has more children compared to another community. Since our objective is to vaccinate all children, to have zero unvaccinated children, that's why we changed the annual plan that we had already put forward and have adapted it to the reality of Bate-Papo, which is the concentration with the most missing children." Health official Gile "It [mobile brigade planning process] changed, for example in the materialization of the prioritization of mobile brigades. In the past there was no prioritization, I just planned and did it. But now with Bate-Papo, we have been told that: (1) we should prioritize where we can find the greatest number of children after doing our absentee survey, (2) to try to find those children before they reach 1-year-old. So, I think a lot of things have changed with Bate Papo because there are a lot of things that we didn't do but with Bate Papo we already do [sic]." Health care worker Gile "There is good relationship in fact since you move from home to the health facility and you tell them what worries you, they treat you very well but building a nearby health facility would be helpful." Caregiver Gile "There are differences and changes of course children were not vaccinated considering the long distance to access health services and couldn't get strong. …now they are following up with the immunization schedule. One aspect to consider comparing the fulfillment to attending children's health care wasn't good due to long queues and health workers bad mood, we could go, stay long waiting and back without being attended or receiving medicine but now the relationship is good as health services come nearer to the community."- Caregiver, Namarroi
Increased Male and family involvement	"To be honest fathers or other family members take part of education sessions but what makes them regret is that when they go to a health facility delay to be attended and that weakens them." – Caregiver, Namarroi "yes of course they really help at looking at the yellow card and the immunization card and remind of upcoming vaccination session appointments and if in case they are not too busy, they tell you to go together until return home." Caregiver, Namarroi "Most often are our husbands [provide money] but there are moments in case a child is sick or you want to take for vaccine neither you or your husband don't so you resort to grandfather, grandmother, father, mother, uncle aunt or any other family member to

	support you with money to take transport to access the health facility services." – Caregivers Gile
Improved caregiver knowledge, attitudes and practices regarding vaccination	"It changed [caregivers' knowledge]. Improved greatly. Because even the mothers themselves can say that today, for example, is the 27th, I have to take my child to the health facility for vaccination and they show up because they know about their own child's vaccination schedule due to the mobilization and the information they are getting."- APS Gile
Challenges with reach	"In terms of frequency of mobile brigades, there may spend two or three months without mobile brigade but we only keep going to health facility to avoid accumulating the number of vaccines to be taken." Caregiver, Gile "But in this case, so far we haven't changed but it depends on the season. In the running period there are neighborhoods that we don't visit because of the rivers that flood. But when the temperature is normal and the rivers are not full, we go normally, we don't depend on the fact that, for example, we went this month, next month we shouldn't go, no." – Health Facility Worker Namarroi
Recommendations on reach	"There are missing mothers that you can travel 4 to 5 km to get to that location. Sometimes it's even 7km, to go to pick up a mother. It's difficult, so we ask, if possible, for transport to help us make it easier to reach those mothers who are absent so that they can adhere to vaccinations."- APS Gile
Adoption	
Alignment with national health plans	"Yes, the project supported Red-Rec a lot as such, because firstly, the vaccination record book has tabs and with the implementation of the project, this made it easier for us to find those children, that is, where the children are in that community. We go to that community, we survey those children, then follow up and after doing the MB, in turn in another month we sit down to evaluate among the absentees we had that month, which ones we recovered and which ones again we will do the active search again."- Health official "Well, we actually have indicators that are established at the national level. Even when we talk about indicators in this case, the program came to support us. We had a big problem with the vaccination dropout rate, which was an indicator that had to be supported at the level of the WHO at the level of the Ministry of Health and at the level of GAVI. So, we had a very high indicator and then we were not very aligned with what the highest level guidelines are and at this moment Bate-Papo managed to influence the alignment and what the sector's own plans are."- Health official
Implementation	
Challenges to implementation	"We don't record it like this because the planning may perhaps coincide with campaigns. We were planning and suddenly we heard information that we had a campaign. From there, we should deplan. This was mainly from last year. And as Bate Papo also started last year in October and since then the campaigns, especially those for Polio, were being carried out periodically the mobile brigades were planned and many were not carried out."- Health facility worker