

# Evaluation of the Project to Support PAV (Expanded Program on Immunization) In Northern Mozambique, 2001-2008:

An Independent Review for VillageReach  
With Program and Policy Recommendations

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\*Statistical Analysis available under separate cover.

## *Abbreviations*

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DDS	Direcção Distrital de Saúde
DPS	Direcção Provincial de Saúde
DTP	Diphtheria-tetanus-pertussis
FDC	Fundação para o Desenvolvimento da Comunidade
HepB	Hepatitis B
MISAU	Ministerio da Saúde
OMS	Organização Mundial de Saúde
Polio	Vacina oral contra a poliomielite
PAV	Programa Alargado de Vacinação
US	Unidade Sanitária
VAS	Vacina Anti-Sarampo (Measles)
VAT	Vacina Anti-Tétano (Tetanus)
VR	VillageReach

## Acknowledgements

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*VillageReach thanks our project partners MISAU and the FDC for making the Project to Support PAV possible. VillageReach is grateful for the commitment and dedication of these project partners. We are honored to support the important and significant work that MISAU and DPS Cabo Delgado perform everyday to operate a vaccination program serving millions of people in a challenging environment.*

*VillageReach thanks MISAU for making the evaluation possible. The evaluation would not have been possible without the support from Prof. Dr. Paulo Ivo Garrido, Dr. Mouzinho Saide, Dr. Leonardo António Chavane and Dr. Nuno Gaspar at MISAU. VillageReach also thanks Dr. Mussa I. Hagy, Dr. Cesario Augusto Suege, Francisco Paulo, Randinho Farnela Tongai and Zacarias Adolfo Quirinde, at the Cabo Delgado Provincial Department of Health, for their assistance and support of the evaluation. VillageReach thanks the FDC for its contributions, particularly Paula Monjane for sharing her knowledge and experience in the methodology design and field work implementation.*

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# Executive Summary

## VillageReach Evaluation of the Project to Support PAV

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### Introduction and Background

In March 2002, the Foundation for Community Development (FDC), a national non-governmental organization (NGO) and VillageReach (VR), an international NGO, launched a 5-year pilot project designed to ensure prompt and universal access to vaccines in the northern Mozambican province of Cabo Delgado. The project was conducted in partnership with the Mozambican Ministry of Health (MISAU)<sup>1</sup>, and worked to support the Expanded Program on Immunization (PAV<sup>2</sup>).

Cabo Delgado is a very poor rural province in northern Mozambique with a dispersed population of 1.5 million people, very limited electricity, and poor roads which are often impassable during heavy rains. Most health centers have few trained staff and no vehicles. Supervision and training of the health staff is often inadequate or absent, health budgets are insufficient and shortages of funds to pay health workers and buy supplies are common. The partners implemented the Project to Support PAV in Cabo Delgado, where these challenges were greater than in other areas of the country and the need for support to PAV was the greatest. The project specifically addressed these challenges and improved the logistics system that enables quality healthcare.

The Project to Support PAV strengthened the logistics system by creating a simple delivery system, improving the flow of information and providing a reliable source of energy. In coordination with MISAU, PAV and the Provincial Directorate of Health (DPS) of Cabo Delgado, VR and the FDC distributed vaccines, propane, medicines and other essential medical supplies each month to all health facilities providing immunization. At the same time, field coordinators collected information from each health center for use in vaccine forecasting, planning and logistics management and provided supportive supervision to health workers.

An especially innovative aspect of the Project to Support PAV was the establishment of a social business, VidaGas, to import and distribute propane to health centers and hospitals, as well as to private customers, throughout northern Mozambique. By providing a reliable source of energy, the project was able to improve the cold chain and establish a consistent and reliable supply of vaccines to health centers.

The project was expanded to Nampula Province in August 2006 with the FDC in charge of on-going Project administration. In March 2007, the pilot project ended in Cabo Delgado and project activities were transitioned to DPS. In January 2008, VillageReach undertook an evaluation to assess the impact, sustainability and replicability of the Project to Support PAV in Cabo Delgado. This report incorporates the findings from the evaluation fieldwork conducted in July 2008 and

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<sup>1</sup> MISAU or Ministério da Saúde is the Ministry of Health in Mozambique.

<sup>2</sup> In Portuguese-speaking Mozambique, the Expanded Program on Immunization is called the Programa Alargado de Vacinação, or PAV.

briefly documents the project history, objectives, performance, and impact. The primary purpose of this report is to inform the planning of future immunization activities in Mozambique, including the scale up of the Project from two provinces to the entire country, and how VR and its partners can support and contribute to this work.

## Evaluation Methodology

The evaluation fieldwork consisted of a representative household survey of the entire Cabo Delgado province, including a 30x7 WHO Immunization Coverage Cluster Survey, a household survey developed by VR, and qualitative interviews with health workers, community leaders, and Project staff and provincial officials in both Cabo Delgado and Nampula. A total of 474 children age 12-23 months and 24-35 months were included in the survey, conducted in July 2008.

The 1997 and 2003 Demographic and Health Surveys (DHS) were used as baseline information. Comparison data was obtained from a 2007 immunization coverage cluster survey conducted by DPS in the neighboring province of Niassa, in which the Project did not operate, as well as from administrative data obtained by the WHO and UNICEF.

An independent team of investigators completed the data collection and field work. Ms. Katie Leach-Kemon, Ms. Mariana Dionisio and Ms. Nelia Taimo conducted the statistical analysis of the data. Dr. Mark Kane<sup>3</sup>, an international leader in immunization, completed the evaluation by conducting an independent review of both the survey data and a five-year project report.

## Key Findings

The “MISAU/FDC/VR Project to Support PAV” in Cabo Delgado was highly successful. Specifically, the evaluation found the following:

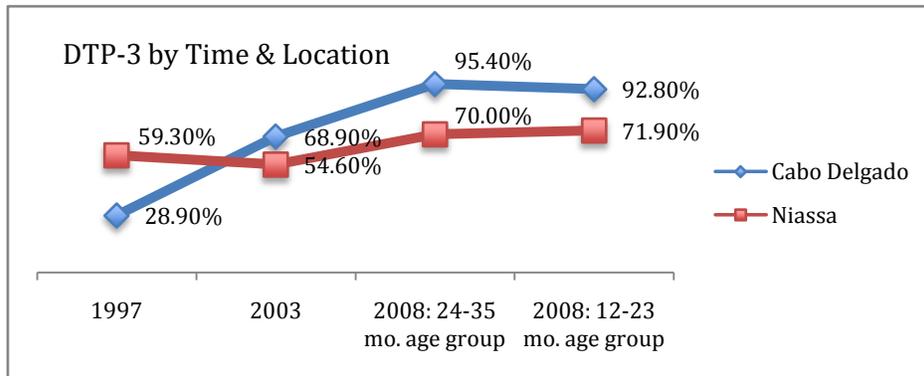
### 1. *The Project to Support PAV dramatically increased vaccination coverage.*

- ✓ In 2003, the DHS reported a DTP3 coverage rate in Cabo Delgado of 68.9%. In the 2008 evaluation, DTP3 coverage had increased to 95.4% for children age 24-35 months.
- ✓ All other vaccines had similar increases resulting in a 92.8% coverage rate for all vaccinations given to children age 24-35 months.
- ✓ The change in DTP3 coverage from the 2003 DHS baseline in Cabo Delgado was much greater than the change in coverage where the project was not implemented. In Cabo Delgado, DTP3 coverage increased from 68.9% to 95.4% (i.e. 26.5% difference) for children age 24-35 months. In Niassa province, where the project was not implemented, DTP3 coverage increased from 54.6% to 70% (i.e. 15.4% difference) for children in the same age group. Elsewhere in the country, administrative data and

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<sup>3</sup> Dr. Kane graduated from Brandeis University in 1969 and served in the Peace Corps. Following this, he went to Medical School at Penn State University at Hershey. He received pediatric training at Dartmouth and public health training at the Harvard School of Public Health. He then received EIS training at the US Centers for Disease Control and worked for the CDC for 20 years in the Divisions of Viral Hepatitis and Viral Diseases. For the last ten years of his CDC career Dr. Kane was seconded to the World Health Organization in Geneva where he worked in the Expanded Programme on Immunization (EPI) in charge of Hepatitis B Control and other New Vaccines. In 1999 Dr. Kane moved to Seattle to become the Director of the Children’s Vaccine Program at PATH. In that capacity he served on the Founding Board of GAVI, the GAVI working group, and was the Founding President of the Global Fund for Children’s Vaccines (later the Vaccine Fund and now the GAVI Fund). Dr. Kane retired at the end of 2005 and is now a private consultant in Seattle.

surveys by the WHO and UNICEF report national coverage rates for a similar time period as 72%.



## 2. *The Project improved the quality of health services and access to vaccines.*

- ✓ The Project to Support PAV dramatically reduced stock-outs.
  - Regularly less than 1% of health centers reported a stock-out in 2006 compared to almost 80% in 2004.
  - Field coordinators reliably visited over 90% of the health centers every month to deliver vaccines, gas and other supplies, provide supportive supervision to health center staff and to collect health center data for use in vaccine management, supply and logistics planning.
  
- ✓ The Project to Support PAV directly improved the cold chain.
  - 92.6% of the health centers visited had reliable and easy to maintain gas or gas/electric refrigerators provided by the project.
  - 26 of the 27 health centers visited had a working refrigerator over one year after the pilot project ended.
  - 96% of health workers interviewed reported that the refrigerators had never been broken and 74% reported that they had been appropriately trained to maintain the refrigerator temperature and other elements of the cold chain without any problems.

## 3. *Among communities served by health facilities benefiting from the project, knowledge of, trust in, and use of health services increased.*

- ✓ Drop-out rates between DTP 1 and DTP 3 decreased from 12% in 2001 to as low as 3.8% in 2008.
  
- ✓ 94% of respondents had heard of vaccines but only 42% knew that the purpose of a vaccine was to prevent illness; 76% had received the last vaccination at a health center.

- ✓ 91% of the families interviewed had visited the health center in the last month despite 47% of families living over two hours away, 85% of them having to walk to get there and the most common reason for vaccination failure being “place of immunization too far.”

4. *The positive impacts of the project are sustainable, if essential project components are maintained.*

- ✓ Coverage rates for children vaccinated during and after the end of the project (i.e. 12-23 month age group) remained close to 90% or above, even though they dropped slightly compared to the coverage rates for children vaccinated at the peak of the Project.
- ✓ Project staff and DPS officials emphasized that provincial-level delivery and early integration with DPS are essential to sustainability and a successful transition.
- ✓ The supportive supervision and data management provided by the Project improved the ability of health workers and DPS to accurately forecast vaccine usage and supply needs over time.

5. *The project is replicable.*

- ✓ The Project has already been replicated in Nampula, where it is currently being implemented by the FDC. Incorporating some of the “lessons learned” from Cabo Delgado, Project Staff and DPS officials in Nampula reported that the Project has already:
  - Dramatically improved the cold chain by providing gas refrigerators that were reliable and easy to use and by training health workers in refrigerator maintenance, vaccine and waste management and social mobilization;
  - Improved access to vaccines by basing delivery at the provincial level when previously the inability of districts to pick up and deliver vaccines had led to frequent stock outs;
  - Improved the frequency and quality of supervisory visits by Project Staff which allowed for essential on-the-job training and supportive supervision; and,
  - Improved the ability of health workers and DPS to manage vaccine services, including ordering vaccines in a timely manner, planning so as to avoid stock outs and organizing vaccines for multiple brigades.
- ✓ Project Staff and DPS officials interviewed supported the expansion of the project to other provinces and areas, including expansion into water/sanitation, malaria and the provision of mosquito nets and support for vaccination mobile brigades.

## Conclusions and Recommendations

This evaluation shows that the Project to Support PAV played a significant role in the marked improvement seen in immunization coverage in Cabo Delgado. The Project directly improved the cold chain, reduced vaccine stock outs from 80% to regularly about 1% per month, greatly improved vaccine forecasting, helped to reduce dropout rates between DTP1 and DTP3 from 12% to as low as 3.8%, and greatly improved the supervision and training of health center staff.

Attributing these impacts to the Project is supported by the comparisons to DHS data from 1997 and 2003, other administrative data and the fact that vaccination coverage rates in the neighboring province of Niassa, where the Project did not undertake any activities, were significantly lower than those found in Cabo Delgado for a similar time period. In addition, no other organizations were working to improve vaccination coverage in all districts of Cabo Delgado during the project period.

The evaluation also highlighted the components of the Project model that are essential to sustaining the high vaccination coverage rates found in Cabo Delgado. The data suggests that following the discontinuation of field coordinator teams delivering supplies and performing supervision (as occurred in Cabo Delgado following the pilot project), the districts and health centers are having difficulty reliably picking up supplies, stock-outs of vaccines are beginning to occur again, there is some (not statistically significant) evidence that immunization coverage is beginning to fall and district level budgets are not being maintained for these activities.

This experience has critical implications for the sustainability of the project and for planning the national rollout. The clear lesson is that the benefits of the Project can be sustained if field teams, vehicles and budgets are maintained and supervised at the Provincial level. The definition and roles of MISAU central, provincial and district level offices in vaccine logistics need to be fully explored and articulated prior to national implementation of the Project. In addition, full and early integration into each DPS program is critical to the Project's sustainability.

The evaluator highly supports efforts to scale-up the project to the National Level in Mozambique. This national roll-out, however, must be actively supported at the highest political levels and by the highest officials in MISAU. Also, while decentralization is the national policy, the author believes that the Project can only be successful and sustainable if logistics and the supply of vaccines are decentralized to the *appropriate* level, which in the case of the Project to Support PAV, appears to be at the provincial level.

MISAU, PAV and DPS in Cabo Delgado have put invaluable resources and time into improving PAV services and ensuring that children throughout Mozambique receive full and effective vaccinations. The Project to Support PAV has developed effective procedures to improve the performance and impact of these services in two provinces. Efforts should now be made to scale-up the project to the national level throughout Mozambique.

# Evaluation Report

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## Introduction

In February 2001, the Foundation for Community Development (FDC), a national non-profit organization (NGO) and VillageReach (VR), an international NGO, launched an initiative which resulted in the signing of a memorandum of understanding with the Government of Mozambique. In partnership with the Mozambique Ministry of Health (MISAU), the initiative aimed to ensure the prompt and universal access to vaccines and other medical supplies in Mozambique.

The first project undertaken by this initiative was a yearlong study that included a review of public health systems in Mozambique and other African countries to better understand the factors that were constraining the effective operation of the immunization system. Based on this study, MISAU, the FDC and VillageReach found that a focus on transport, logistics, stock management, strengthening the cold chain, improved supervision and training, and a better information system for vaccine forecasting and management would be an appropriate set of interventions to solve some of the problems limiting access to vaccines for the people of northern Mozambique.

In March 2002, a 5-year pilot project (extending from April 2002 to March 2007) was initiated. In the project, the FDC and VillageReach, in coordination with MISAU, the Expanded Program on Immunization (PAV<sup>4</sup>) and the Provincial Directorate of Health (DPS) of Cabo Delgado, distributed vaccines, gas, medicines and other essential medical supplies each month to all the health facilities providing immunization. This included rural health facilities, which were often isolated from the normal distribution systems due to insufficient public infrastructure. In 2006, the project was extended to a second northern province (Nampula).

Cabo Delgado is a very poor rural province with dispersed populations (47% of the population is estimated to live more than two hours walk from a health center, an additional 23% live 1-2 hours away<sup>5</sup>), very limited electricity, and poor roads which are often impassable during heavy rains. Most health centers have few trained staff and may or may not have a vehicle. Supervision and training of the health staff is often inadequate or absent, health budgets are insufficient and shortages of funds to pay health workers and buy supplies are common.

An especially innovative aspect of the Project to Support PAV was the establishment of a public-private initiative in which the partners formed a company (VidaGas) to import and

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<sup>4</sup> In Portuguese-speaking Mozambique, the Expanded Program on Immunization is called the Programa Alargado de Vacinação, or PAV.

<sup>5</sup> Evaluation of the PAV Program, November 2008

distribute liquefied petroleum gas (also known as propane, or LPG) to the health centers and hospitals, as well as to private customers.

In addition, VillageReach established a management information system (MIS) to track the Project's operations and impact. The MIS tool provides reliable vaccine supply, demand and logistics information from the "last mile" health centers. This information is collected on the monthly rounds of field coordinators and supports effective decision-making for forecasting, planning, and logistics at all levels of the health system.

In January 2008, VillageReach undertook an evaluation to assess the impact, sustainability and replicability of the Project to Support PAV in Cabo Delgado. The evaluation fieldwork, conducted in July 2008, consisted of a representative household survey of the entire province, including the WHO Immunization Coverage Cluster Survey, a household survey developed by VR, and qualitative interviews with health workers, community leaders and Project staff and DPS officials in both Cabo Delgado and Nampula.

This report incorporates the findings from the evaluation fieldwork (See Statistical Analysis) and briefly documents the project history, objectives, performance, and impact. The primary purpose of this report is to inform the planning of future immunization activities in Mozambique, including the scale up of the Project to Support PAV from two provinces to the entire country, and how VR and its partners can support and contribute to this work.

## Evaluation Sources

This report is compiled from a number of sources including:

- The "5-Year Assessment of the Project to Support PAV in Cabo Delgado Province," by Village Reach ▪ FDC ▪ MISAU, (October 2007)<sup>6</sup>; and,
- The "Statistical Analysis of Field Work Results" analyzing the *data* collected during the evaluation field work (July 2008), including
  - The results from qualitative and quantitative surveys<sup>7</sup>, and
  - The results of the VR immunization coverage survey compared with the results of DHS surveys in 1997 and 2003, and with an EPI survey done in the province of Niassa by DPS in 2007.

The reviewer also examined strategic plans, policy documents, and other reports prepared by VR.

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<sup>6</sup> 5-year Report available upon request from VillageReach

<sup>7</sup> Survey questionnaires are available upon request from VillageReach

This report was compiled by Mark Kane, MD, MPH, a consultant, following review of these materials and extensive discussions with VillageReach staff. Many of the opinions and viewpoints in this report are those of the reviewer, and do not necessarily represent the views of the VR, its staff or Project implementation partners.

A useful framework for this report is included in the evaluation's Statistical Analysis, which provides an introduction with additional detail on the Project to Support PAV, international EPI developments and trends, and some of the country conditions affecting immunization services within Mozambique.

The evaluation was designed to test five hypotheses:

1. The Project to Support PAV will increase vaccination coverage in the Cabo Delgado province of Mozambique.
2. The Project will increase the quality of health services and access to vaccines.
3. Among communities served by health facilities benefiting from the Project, knowledge of, trust in, and use of health services will increase.
4. The positive impacts of the Project will be sustainable.
5. The Project will be replicable in other Mozambican provinces.

### **The Essential Concepts of the Project**

VR is a unique organization that brings together the skill sets and viewpoints of both the business and public health communities to address the systemic problems constraining effective delivery of immunization and other health services in the developing world. This combination, along with the FDC's experience working with communities and MISAU's leadership and support, laid the foundation for the Project to develop innovative solutions to old problems.

The early research conducted by the Project in Mozambique and other African countries confirmed the hypothesis that systemic constraints in the logistics and cold chain systems were important impediments to the effective delivery of vaccines. Frequent stock outs of vaccines led to a lack of trust in the health system as parents, often walking for hours, would arrive at an immunization session to find that there was no vaccine available for their child. After several experiences like this they were less likely to return with the child or siblings in the future. Furthermore, the effectiveness of the immunization of the children who were vaccinated may have been compromised by improper storage or freezing, and the injections given to the child may have been unsafe. Bringing together business and public health ideas to address these problems, the project partners developed an intervention with the four major components described below.

### ***Dedicated Teams***

The project partners agreed that a small number of teams focused specifically on transport, logistics, cold chain, stock management, supportive supervision and improved information management was the best way to resolve these problems. With dedicated teams based at the provincial level, the responsibility, accountability, and authority was specifically assigned to individuals rather than diffused among numerous individuals in each district and health center, who had many other activities to conduct and many other demands on limited budgets. An additional reason for implementing the system at the provincial level was to create economies of scale in the transport system. The delivery vehicles that carried vaccines, syringes, safety boxes, and gas could also deliver additional medical commodities, thus reducing the need for separate transport for vertical programs. By using this delivery system for other medical commodities, the transport and delivery costs are reduced.

### ***Vaccine Delivery***

A primary concept of the project was a change in the way vaccines and fuel were distributed: from a system in which each health facility was responsible for picking up vaccines and supplies from the provincial store, or the district store if the district had the supplies, to a system in which field coordinators assigned to the project reliably traveled to each district and health center every month, delivering vaccines, gas and other supplies, providing supportive supervision and training, and bringing back data from the health centers.

### ***Management Information for Decision-Making from the Ground-Up***

A new cold chain and logistics management information system (MIS) was also designed and implemented to improve management of the system. The MIS contributes to health center support not only by gathering, storing and compiling data but, more importantly, by helping field staff and those up the management chain translate data into knowledge. The MIS allows users to identify patterns across months of data that need to be addressed, such as health centers repeatedly not visited, cold chain equipment problems or recurrent stock-outs of vaccines. In this way, the MIS enables users to develop an understanding of how data can be used to support appropriate action.

### ***Social Business: VidaGas***

The lack of a reliable source of energy was an enormous threat to maintaining the cold chain for vaccines. To address this problem, the project replaced all of the old, unreliable and often broken kerosene refrigerators in the districts with much more reliable and cleaner burning propane refrigerators. Other equipment such as lamps, permitting night lighting, and sterilizers for medical equipment were also supplied. A company called VidaGas was started to import and deliver the gas to health centers and to private customers. This social business was designed to be self sustaining from profits from the private sector and government contracts to supply gas. The concept of starting a private company in one of the poorest developing countries to solve logistics problems in the public sector was innovative. A challenge for the project is to prove the sustainability of this model.<sup>8</sup>

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<sup>8</sup> For more information on VidaGas see attached description.

## Challenges Under the PAV System Before the Project

Prior to the Project to Support PAV, health facilities were individually responsible for picking up vaccines and supplies from the DPS cold stores or district stores and taking them back to their health facility for use. This system encountered various problems.

### ***Challenges to PAV Before the Project:***

- *Intermittent closing of health facilities during business hours so health workers could pick up vaccines and supplies.*
- *Challenges securing transport to go to the DPS cold stores. Each district generally had one vehicle, which was for all health service trips by all health system personnel, and was also the ambulance in case of emergencies. Often, when the vehicle was needed to pick up or deliver vaccines, it was out on an emergency, in use by someone else for some other health-system function, broken down, or out of gas.*
- *Difficulty maintaining proper vaccine temperatures during transport.*
- *Uncoordinated vaccine supply requirements.*
- *Frequent stock-outs of vaccines in health facilities.*
- *Shortage of supervision visits at health facilities.*
- *Funds were often liberated late – both quarterly from the provincial level to the districts, and monthly from the district administrator to the PAV Chief who needed to purchase gas for the refrigerators, fuel up the district vehicle, and pick up and distribute vaccines.*
- *Lack of planning capacity at the district level.*

## Project Activities and Goals

The system implemented by the Project to Support PAV was designed to address many of these challenges. The project created 3 field teams (one for each zone) in Cabo Delgado and, later, 4 teams in Nampula based at the DPS depository. The teams consisted of a field coordinator and a driver with a vehicle, who traveled to each of the fixed vaccination posts (88 in Cabo Delgado and 163 in Nampula) every month to deliver vaccines, supplies, propane, and other medicines.

***Project activities*** included:

- Provide and maintain the cold chain equipment, replacing the petrol and poorly functioning solar refrigerators with gas refrigerators;
- Regularly and reliably distribute vaccines, gas, essential medicines and other medical supplies;
- Strengthen the capability and the mobility of the mobile brigades;
- Carry out social mobilization actions aiming to increase the vaccination coverage and quality;
- Establish a communication system for coordination and emergency response in the health facilities;
- Implement medical waste management systems and allow for safe injection;
- Monitor and supervise the logistic process;
- Strengthen the technical capabilities of the health workers involved with the immunization activities by supporting their training;
- Develop the skills of the health workers involved with immunization activities;
- Strengthen the management capacity of PAV staff; and
- Strengthen the quality, availability and use of PAV data and information.

***The advantages of the project system*** are as follows:

- Reduction in stock-outs of vaccines. In July 2004, 79% of Cabo Delgado's fixed vaccination posts had a stock-out of at least one type of vaccine. With Project activities, the percentage is regularly reduced to below 1%.
- Consistent delivery dates – affording consistent supply, which contributes to fewer missed opportunities due to stock-outs, greater trust in the health system, and more children immunized.
- Reliable cold chain during transport (and in health facilities).
- Supportive supervision at health facilities during delivery visits. The Project field coordinators are experienced public health personnel and perform supportive supervision activities during delivery visits. This work improves overall health facility management, stock management, vaccine conservation, injection safety, waste management, data records, and adherence to PAV policies.

- Improved knowledge for DPS and district PAV staff. Because the field teams are based at the DPS depository and maintain regular and frequent communication with the district PAV staff, the knowledge that they gain about current and anticipated problems at health facilities is shared with DPS PAV staff. This allows for immediate or preventive action to resolve problems. This also allows for aggregation of issues province wide, which enables PAV to better understand trends and underlying causes of problems with PAV field operations.
- A standardized, province-based, data collection system that provides for consistent collection and reporting of monthly data. When the field coordinators visit the health facilities, they systematically record and track data regarding the quality and usage of PAV stock.
- Dedicated personnel and transport, with consistent control and maintenance of transport assets.
- Consistent monitoring and preventive maintenance of refrigerators.
- Consistent link between provincial, district, and health center levels.

### Project Timeline

Date	Rollout Activity
July 2002	Deliveries began in the South Zone of Cabo Delgado to 34 health facilities in 5 districts
July 2003	2 more districts (Pemba Metuge & Mecufi) in the Central Zone of Cabo Delgado were added. The total health facilities served in Cabo Delgado came to 39 health centers in 7 districts.
November 2004	Rollout of Cabo Delgado was complete. The total health facilities served came to 87 in 17 districts in Cabo Delgado.
September 2005 <sup>9</sup>	Added 88th health center (Paquitequete in Pemba Cidade) that began offering PAV services. The total health facilities served in Cabo Delgado came to 88 health centers in 17 districts.
August 2006 <sup>10</sup>	Began deliveries in 85 health centers (in North and Central zones in 12 districts) in Nampula.
October 2006	3 more health centers online in Nampula to total 88 health facilities served in Nampula.
January 2007	Rollout of Nampula complete and project implementation fully transitioned from VR to the FDC. The total number of health facilities served is 163 in 21 districts in Nampula.
April 2007	Phase-out of the project in Cabo Delgado and transfer of staff and responsibilities to the DPS.

<sup>9</sup> The children aged 24-35 months included in the VR survey were receiving vaccines at this time. This age group received vaccines from June 2005 – May 2007.

<sup>10</sup> The children aged 12-23 months included in the VR survey were receiving vaccines at this time, as well as the 24-35 month age group. The 12-23 month age group received vaccines from June 2006 – May 2008.

<b>Project to Support PAV Status and Coverage Study Age Groups</b>		
June 2005 – May 2006	June 2006 – May 2007	June 2007 – May 2008
Project fully operational	Last year of project	No project activities
24 – 35 month age group receiving vaccines		
	12 – 23 month age group receiving vaccines	

## **Making a Sustainable System**

From the start of the project, the partners aimed to create a sustainable system with sustainable benefits and impact. The plan for sustainability had two components. First, the partners agreed to transfer the system operations to DPS at the end of the project period. This meant that, from the beginning, the partners integrated the Project into DPS as much as possible. In Cabo Delgado, the project office was inside the DPS PAV office and the project was seen as a DPS initiative, even though the budgets and administrative structures were run through the NGO partners. Project staff were initially hired and paid by the NGO partners until the Project was turned over to DPS, at which time they became DPS staff.

In Nampula, the field coordinators are DPS staff seconded to the project but the Project Management is NGO staff paid by the FDC, which has been implementing the project since January 2007.

Second, the partners agreed that both VR and FDC should have the capacity to implement the project. By placing the program administration and management in a local NGO, the project would be more sustainable than if it was implemented solely through an international NGO. To accomplish this, VR provided technical assistance and built the capacity of FDC to implement the program throughout 2007.

## **Scale and Performance of the System**

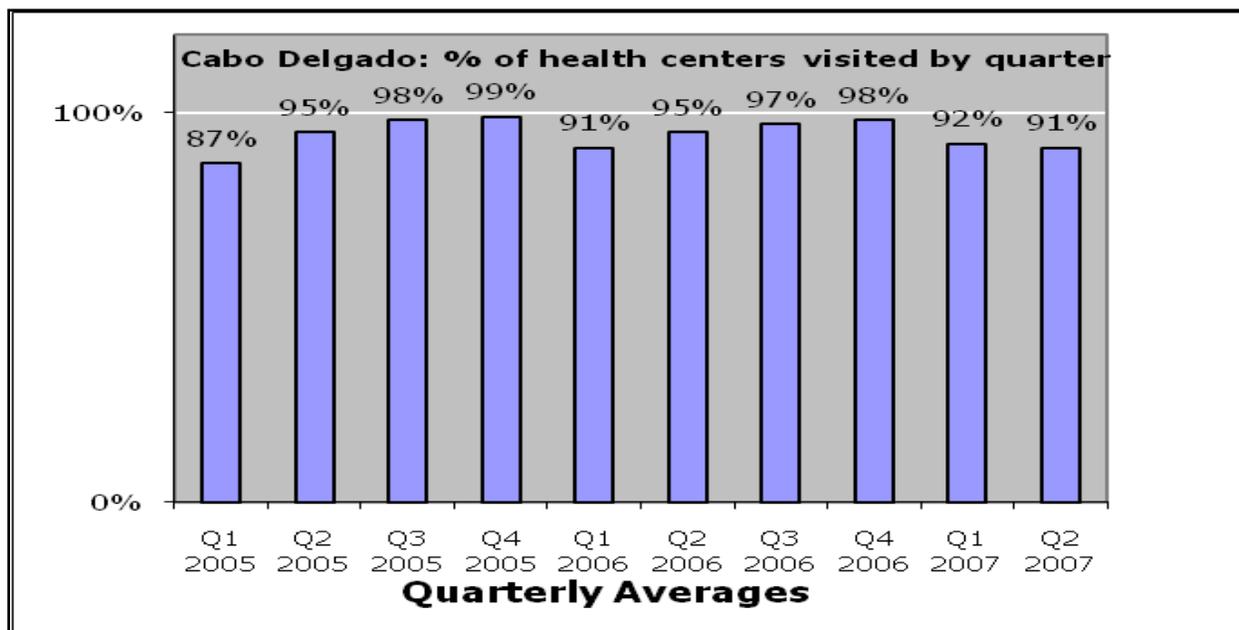
The Project's "5-year Report" shows that the Project to Support PAV was a major initiative delivering hundreds of thousands of vaccine doses and other supplies to health centers each year. The table below totals the systematized items delivered during the project from August 2004 – April 2007.

**Supplies Delivered  
August 2004 - April 2007**

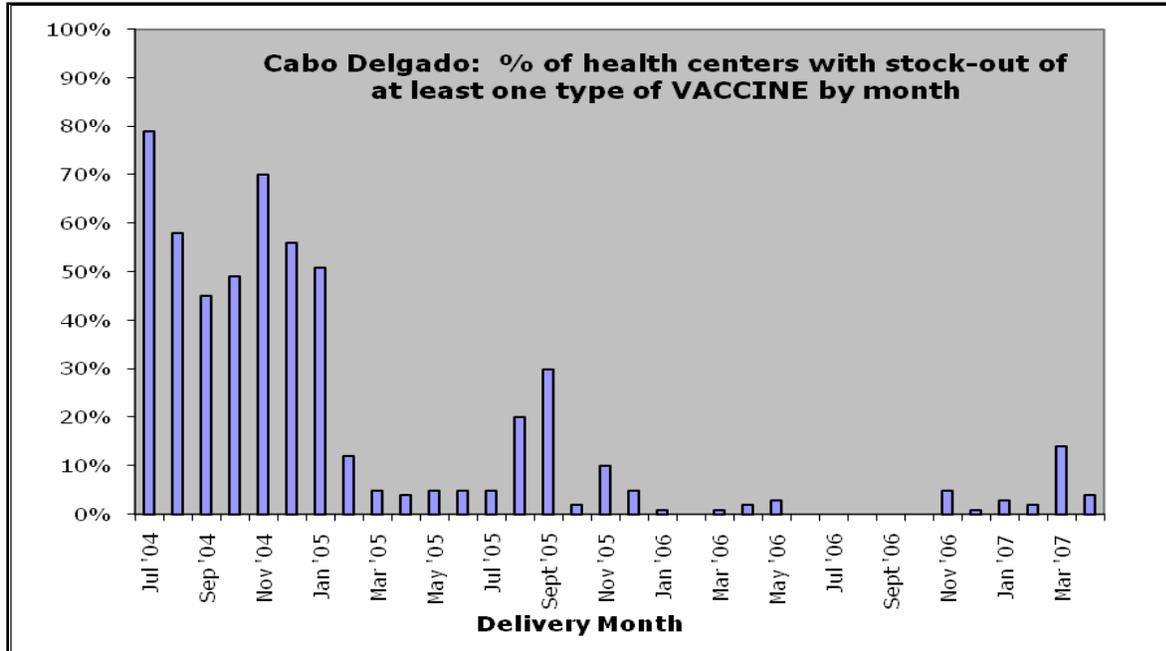
	<b>Vaccine Doses</b>				
	<b>BCG</b>	<b>DPTHpB</b>	<b>Polio</b>	<b>Measles</b>	<b>Tetanus</b>
<b>August – December 2004</b>	39,000	37,640	87,800	19,580	42,630
<b>2005</b>	129,200	173,310	244,480	61,210	182,720
<b>2006</b>	131,260	171,330	303,730	77,130	189,230
<b>January – April 2007</b>	43,700	47,020	79,020	18,390	61,290
<b>TOTAL</b>	<b>343,160</b>	<b>429,300</b>	<b>715,030</b>	<b>176,310</b>	<b>475,870</b>

	Syringes			Safety Boxes	Gas	
	0.5 ml	0.05 ml	5 ml		Cylinders	Kg
August - December 2004	52,793	7,769	991	906	485	2,668
2005	134,757	25,523	15,209	1,517	2,091	11,501
2006	60,073	20,570	6,684	2,105	2,286	12,573
January - April 2007	18,202	7,696	2,650	22	692	3,806
<b>TOTAL</b>	<b>265,825</b>	<b>61,558</b>	<b>25,534</b>	<b>4,550</b>	<b>5,554</b>	<b>30,548</b>

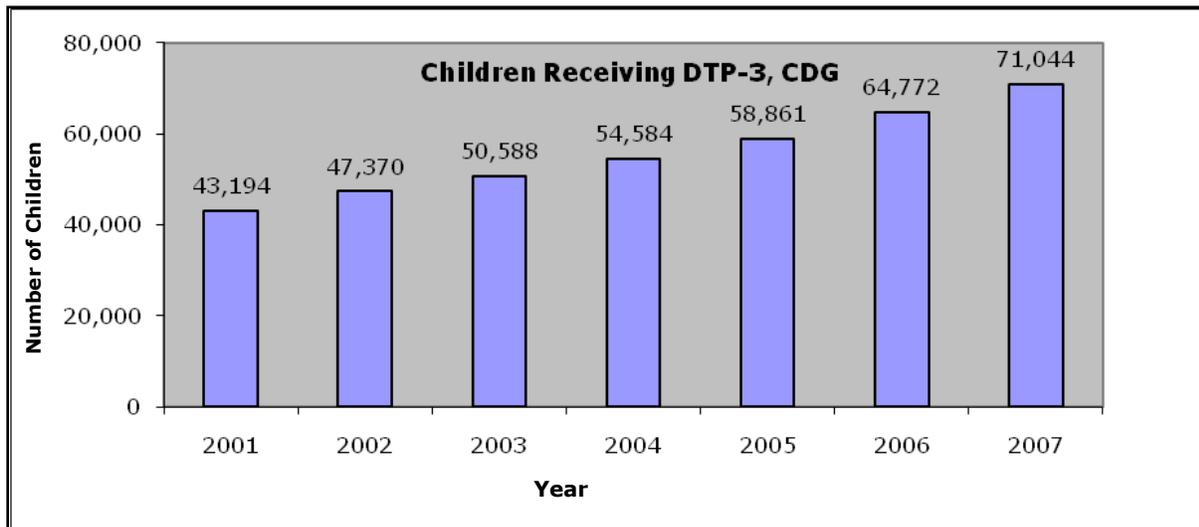
The field teams successfully visited all accessible health centers each month. The Project aimed to visit 100% of all fixed vaccination posts each month but a target of 90% was deemed acceptable due to road conditions that prevented access to some health centers on a regular basis. The graph below shows the consistently high percentage of the 88 fixed vaccination posts in Cabo Delgado that were visited each quarter starting in 2005.



The data from the “5-year Report” also shows very positive impact on key immunization indicators during the Project period. The graph below shows the dramatic decrease in the percentage of health centers reporting stock-outs each month. From July 2004 – March 2007, stock-outs of one or more vaccine decreased from a high of 80% to regularly below 1%.

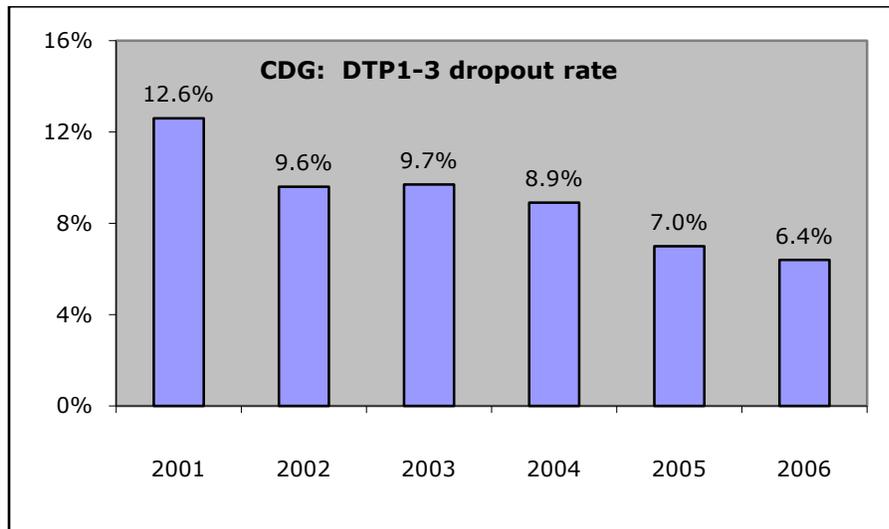


The number of children receiving DTP-3 steadily increased every year from 2001- 2007.



\*DTP3 is used as a proxy for “Fully Vaccinated”

As the graph below shows, the drop-out rate for children receiving DTP-1 but not DTP-3 also improved each year from 2001 - 2006. The household data collected during the evaluation in July 2008 also supports this trend.



## Transition Planning

In Cabo Delgado the transition from the Project structure to the district administration of the project activities yielded important lessons relevant to the rollout plan. Under the Project, the field coordinator teams were based in the provincial capital of Pemba and reported to the PAV Chief in Pemba, who himself reported to the DPS and the National PAV Manager. The Project staff sat in the office adjoining the provincial PAV Chief. Gas, vaccines, syringes and supplies were picked up in Pemba and driven by the field coordinator teams to the health centers and hospitals, where supportive supervision and data collection for the information system also occurred. This system worked well and achieved the impressive outcomes of the project.

When the transition to DPS occurred at the end of the project, DPS decided to revert to the older system and re-assign the field coordinator teams to various positions within the province and districts. The existing district staff was again tasked with the responsibility for picking up vaccines from the DPS warehouse or district stores and distributing them to the health centers in their catchment area. Districts were supposed to continue to pick up gas, vaccines and supplies and deliver them to the health centers as well as provide supervision. However, the ability of the Districts to do this eroded as they managed other tasks, used the vehicles for other purposes, and failed to maintain budgets allowing the benefits of the Project to continue. The Project evaluation found that 56% of health centers do not receive vaccine deliveries from the district and, instead, collect the vaccines themselves. See Figure 3-1, Method of Vaccine Delivery, Statistical Analysis.

As described by Project Staff:

*In April 2006, the districts in the south zone of Cabo Delgado initiated a transition experiment whereby the districts were responsible for the vaccine and supply distribution and to buy their own gas. This experiment was in preparation for the project transition to DPS scheduled for April 2007. During the experiment, none of the five districts succeeded in fulfilling the required responsibilities. Reports from the field teams indicated that by mid-month, four districts had succeeded in picking up supplies, two districts had succeeded in delivering supplies to health centers, and no districts had succeeded in purchasing their own gas. DPS evaluated the experiment and recommended that DPS abandon the idea of using a district-level delivery system. The districts maintained some delivery responsibilities, but starting the following month, the Project once again visited all health facilities as a safety net. Districts' ability to fulfill the three basic tasks improved somewhat over subsequent months as new quarterly funds were distributed from DPS. However, these "successes" remained inconsistent from month-to-month and district-to-district.*

*This experiment indicated that DPS was not yet prepared for managing the delivery operations and highlighted some areas where training was necessary before the transition to DPS could occur. The Project trained relevant DPS and DDS staff in preparation for the transition. In spite of the earlier failed experiment, in February 2007, the south zone of Cabo Delgado was transferred to the districts and in June 2007, the north and central zones followed.*

## **Impact Evaluation**

In 2008, a quantitative and qualitative impact evaluation of the Project to Support PAV was undertaken by consultants and VillageReach project staff (see "*Statistical Analysis of Field Work Results*").

As part of the evaluation, Village Reach conducted a WHO Immunization 30 x 7 Coverage Cluster Survey in Cabo Delgado in July 2008. Because the initial design of the Project did not include baseline immunization coverage surveys in either Cabo Delgado or Nampula, and did not include an "a priori" designated "control" province or provinces, the authors of the evaluation decided to compare the results of the immunization coverage survey to the Demographic and Health Surveys (DHS) implemented in Cabo Delgado in 1997 and 2003. For a "comparison" Province they used the neighboring province of Niassa, which had data from the DHS surveys in 1997 and 2003, and from an EPI cluster survey in 2007 conducted under the auspices of DPS for reasons unrelated to this Project.

All of these surveys looked at immunization coverage in children 12 to 23 and 24 to 35 months of age. For the Cabo Delgado 2008 study, this corresponded to children immunized during the full operation of the Project (the 24 to 35 month group) and at the end and after the Project when it was transferred to the FDC and then to routine DPS control (12 to 23 month group).

For this review, we will consider the DTP-3 coverage as the most relevant metric, following the example of GAVI. This is because DTP-3 levels are thought to best reflect routine immunization coverage, while measles coverage sometimes reflects a mixture of routine and campaign delivered vaccines. For additional vaccination coverage rates, see the Impact Evaluation Statistical Analysis.

### ***Evaluation Results***

The results of the evaluation indicate that there has been a dramatic improvement in immunization coverage in 2008 in Cabo Delgado compared to coverage levels in Cabo Delgado in 1997 and 2003, as reported by the DHS. In contrast, Niassa, where the Project did not operate, had higher immunization coverage than Cabo Delgado in 1997, but experienced a less dramatic improvement by 2008. See Table 2-4 and Figure 2-3.

In the 2008 evaluation, there was also some evidence to support the hypothesis that DTP-3 coverage had dropped somewhat following the end of the project in Cabo Delgado. See Table 2-4 and Figure 2-3 below.

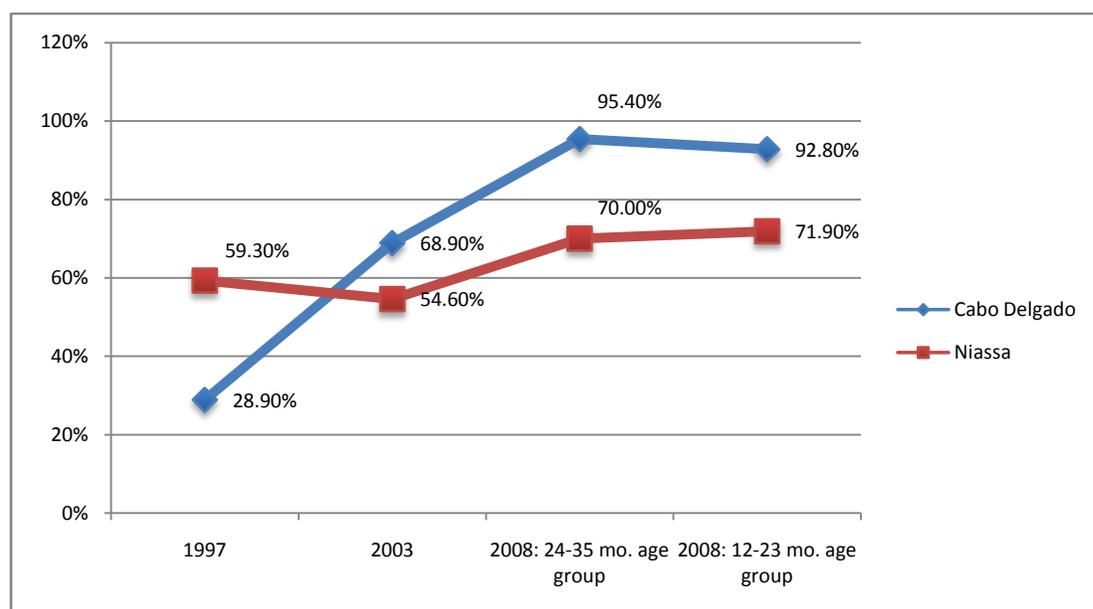
The evaluation also showed drop-out rates for DTP1-3 as low as 3.8% for children during the Project, with slightly higher rates after the project was over. See Table 1-13 below.

The evaluation also found dramatic improvement in the refrigeration provided to maintain the cold chain. Every health center now has a refrigerator, of which the vast majority is gas (85%) and had never been broken. 96% of the health workers interviewed reported that the refrigerator had never broken down and 74% reported that they did not have any problems maintaining the correct temperature for the cold chain.

**Table 2-4: Logistic Regression Models Examining Associations between DTP 3 Coverage and Survey by Time Period and Province. (Significant associations in bold)”**

Province & time period	n	DTP 3 n <sub>yes</sub> (%)	% Difference survey 2-survey 1	Crude OR (95% CI)	P-value
Cabo Delgado, 1997-2003					
DHS (1997)	71	28.9		Reference	
<b>DHS (2003)</b>	<b>169</b>	<b>68.9</b>	<b>40.0</b>	<b>5.5 [3.0-10.0]</b>	<b>&lt;0.001</b>
Cabo Delgado, 2003-2006					
DHS (2003)	169	68.9		Reference	
<b>VR 24-35 months</b>	<b>237</b>	<b>95.4</b>	<b>26.5</b>	<b>9.3 [4.7-18.4]</b>	<b>&lt;0.001</b>
Cabo Delgado, 2003-2008					
DHS (2003)	169	68.9		Reference	
<b>VR 12-23 months</b>	<b>237</b>	<b>92.8</b>	<b>23.9</b>	<b>5.8 [3.2-10.5]</b>	<b>&lt;0.001</b>
Niassa, 1997-2003					
DHS (1997)	70	59.3		Reference	
DHS (2003)	78	54.6	-4.7	0.8 [0.4-1.6]	0.572
Niassa, 2003-2008					
DHS (2003)	78	54.6		Reference	
<b>DPS 24-35 months</b>	<b>233</b>	<b>70.0</b>	<b>15.4</b>	<b>1.9 [1.1-3.3]</b>	<b>0.014</b>
Niassa, 2003-2008					
DHS (2003)	78	54.6		Reference	
<b>DPS 12-23 months</b>	<b>338</b>	<b>71.9</b>	<b>17.3</b>	<b>2.1 [1.3-3.5]</b>	<b>0.003</b>

**Figure 2-3: Coverage across Time and Location: DTP 3 (3 doses DTP)**



**Table 1-13: Immunization System Utilization (Drop-Out Rates)**

Differences in Coverage	12-23 Month Age Group (n=237)	24-35 Month Age Group (n=237)
	%	%
BCG - Measles		
By card	6.8	1.7
By card + history	8.0	3.4
DTP-1 - Measles		
By card	6.8	3.4
By card + history	7.2	3.4
DTP-1 - DTP-3		
By card	5.1	3.8
By card + history	5.5	3.8

### Validity

The *Statistical Analysis* for the quantitative surveys carefully describes the factors that could bias the evaluation results:

- Baseline surveys were not done at the inception of the project
- A “comparison” Province (or Provinces) was not designated at the initiation of the project
- Comparing the results of surveys done with different methodologies ( DHS and EPI cluster surveys) creates certain potential biases
- Relatively small sample sizes made it difficult to detect small changes in coverage between the two age groups
- Uncertainty about the reasons districts were chosen for the Niassa survey
- Uncertainty about the comparability of Niassa as a “comparison” province.

However, even with the above caveats, this reviewer feels that comparing the DHS surveys in 1997 and 2003 in Cabo Delgado with the results of the EPI cluster survey done by VR in 2008 was essentially valid. Such a comparison is consistent with international practice regarding the use of DHS data as a baseline. It is also valid to state that Cabo Delgado improved its immunization coverage more significantly than Niassa. While it appears that the Project is most likely responsible for this difference, additional information about the conditions in Niassa compared to those in Cabo Delgado is needed to better understand and interpret the comparison data.

### ***Attribution to the Project***

During the Project, Mozambique and most sub-Saharan African countries achieved significant improvements in their DTP-3 coverage, probably due to GAVI and its support for infrastructure development and provision of new vaccines and safe injection equipment. This probably accounted for some of the coverage increases in Cabo Delgado and other provinces, but most countries improved from the 50%-60% level to about 70%. Cabo Delgado improved to more than 90%. It is also unlikely that the activities of other NGO's, which are not very involved in immunization activities in Cabo Delgado, were responsible for the improvement.

Therefore, it is likely that the Project played a significant role in the marked improvement seen in immunization coverage in Cabo Delgado. Certainly, the Project directly improved the cold chain, reduced vaccine stock outs from 40%-80% levels to about 1% per month, greatly improved vaccine forecasting, helped to reduce dropout rates between DTP-1 and DTP-3 from 12% to as low as 3.8%, and greatly improved the supervision and training of health center staff.

The evaluation also included structured and open ended interviews with project staff, community leaders, health center staff and DPS officials. The analysis of these qualitative surveys is included in the Statistical Analysis so that the reader can examine these findings in greater depth. The reviewer has tried to reflect the results of these interviews in the conclusions and recommendations of this report.

## Conclusions

### ***The “MISAU/FDC/VillageReach Project to Support PAV” in the Cabo Delgado Province of Mozambique was a highly successful project.***

- ✓ The Project succeeded in developing a system that replaced old and unreliable refrigerators with modern liquefied gas models, and successfully developed a sustainable public private partnership by creating a company (VidaGas) that serves the energy needs of both the public and private sectors in northern Mozambique while reducing pollution and deforestation.
- ✓ The Project succeeded in reliably visiting all health centers each month, delivering vaccines, gas, and other supplies, providing supportive supervision and training to health center staff, and developing an improved information system for logistics management and vaccine forecasting. This was achieved with the addition of only 3 teams in Cabo Delgado dedicated to the Project, each consisting of a field coordinator and a driver with a vehicle.
- ✓ The Project succeeded in improving both immunization coverage and the quality of immunization services. Attainment of over 90% coverage of DTP-3 in an environment as difficult as Cabo Delgado is highly impressive. In July 2004, almost 80% of Cabo Delgado’s fixed vaccination posts had a stock-out of at least one type of vaccine. With the project activities, this percentage was regularly reduced to below 1%.
- ✓ The Project succeeded in improving the quality of, and trust in, health services. Reduction of vaccine stock-outs to less than 1% and reduction of drop-out rates between DTP-1 and DTP-3 is indicative of an improved quality of health services. Parents could reliably count on vaccines being available when they walked for more than one hour (on average) to visit a health center with their child.

The evaluation data and analysis support the claim that it is likely that the Project played a significant role in the marked improvement seen in immunization coverage in Cabo Delgado. Even though no coverage surveys were done with identical methodology at the inception of the Project, and no “comparison” or “control” province was designated and studied at the inception of the Project, comparison of the VR WHO Immunization Coverage Cluster Survey with the DHS surveys is essentially valid. The validity of the comparison of Cabo Delgado with Niassa Province needs to be better understood before valid conclusions can be drawn. However, comparisons with other national administrative data also support the claim that the increase in vaccination coverage in Cabo Delgado was due to Project activities.

There is evidence that the Project succeeded in improving the knowledge about immunization among both health workers and the public, and that trust in and use of the health system in the community improved with this project. However, there was no evidence of an improvement in outreach services from the health centers, nor was there much information on the efforts in the area of social mobilization. This is an area where

significant improvement could be made since about 20% to 25% of immunizations are delivered by outreach services in Cabo Delgado.

Cost data was not available during the evaluation. The Project has extensive data on its internal costs and VR staff attempted to get additional cost data during the evaluation so that they could model the Project's cost-effectiveness. However, neither the health centers nor DPS were able to provide sufficient relevant cost data on factors influencing cost-effectiveness. The field work teams discovered that gathering cost data was extremely problematic due to the combined usage of funds and bucket funding approach used in Mozambique.

Top officials in the Mozambique Ministry of Health were sufficiently convinced of the success of this project that they are supporting a proposal that the Project be rolled-out to the entire country.

A clear definition of roles is crucial to the success of program implementation. There were challenges in the relationship between the project partners that at times affected the Project staff and implementation activities, particularly during the transition of the project in Cabo Delgado. The project partners have agreed to work independently but to support each other to successfully implement the national program expansion in the most efficient and effective manner possible. To increase sustainability, most governmental officials interviewed in the qualitative studies also suggest that government staff be used to implement future activities.

The structures (field coordinator teams delivering supplies and doing supervision) developed by the Project quickly deteriorated at the end of the Project in Cabo Delgado. Staff and vehicles were re-assigned to province and/or district level supervisors who used them for other duties, budgets supporting the project activities were not maintained, and the Province implemented a policy where districts were responsible for picking up supplies at the province and distributing them to the health centers in their catchment area. This occurred despite a trial during the Project that showed exactly this result if the project activities were turned over to District Supervision. The data suggests that following the discontinuation of field coordinator teams delivering supplies and performing supervision, the districts and health centers are having difficulty reliably picking up supplies, stock-outs of vaccine are beginning to occur again, there is some (not statistically significant) evidence that immunization coverage is beginning to fall, and district level budgets are not being maintained for these activities.

This experience in Cabo Delgado has critical implications for the sustainability of the project and for planning the national rollout. The clear lesson is that the benefits of this project are unlikely to be sustainable unless future project activities sustain the structure of field teams, vehicles, and budgets, maintained and supervised at the Provincial level. These teams must be dedicated to PAV logistical, supervisory, and information system work.

A major paradigm in global health and development work since the 1990's has been "health reform" and "decentralization," both of which are central to health system planning in

Mozambique. Under the concept of “decentralization,” functions and budgets should be decentralized to the lowest appropriate level. Many developing countries have learned the lesson that decentralizing procurement and logistics to an inappropriate level can cause serious problems. The project has demonstrated that the appropriate level for the field coordinator teams is at the provincial level, and that decentralization of the field coordinator teams to the district level does not work.

## **Recommendations**

1. This project has developed effective procedures to improve the performance and impact of the Expanded Program on Immunization (PAV) in two Provinces and efforts should be made to scale-up the project to the National Level in Mozambique.
2. The “National roll out” of the project must be actively supported at the highest political levels and by the highest officials in the Ministry of Health. There also needs to be buy-in and active support from WHO, UNICEF, GAVI, and other key partners in immunization and health system strengthening at global, regional and national levels. The GAVI Interagency Coordinating Committee (ICC) or Health System Strengthening Coordinating Committee (HSCC) would be an appropriate forum to discuss and “take ownership in” the roll-out of the Project. VR should continue to actively participate in the ICC, HSCC and/or new International Health Partnership (IHP) as appropriate.
3. VR and the FDC roles should be separate and well-defined. Clear and direct communication with MISAU by each organization is essential to the Project’s on-going success.
4. VR should support the concept of “decentralization” but insist that the project can only be successful if logistics and procurement are decentralized to the appropriate level. In the opinion of this reviewer VR should not pursue this project unless the Government and partners agree to this point.
5. The project should, as much as possible, implement future activities using government staff and insisting on government budgets at appropriate levels to support the project. However, effective management and oversight of Project activities must be built into the Project and actively enforced. In the opinion of this reviewer there should be at National Level a Management Oversight Committee composed of Government, VR, and other stakeholder partners in the project. The committee should meet several times per year, monitor the progress and milestones of the project, and have oversight of the budget.
6. VR and the Government of Mozambique should carefully consider the future of the Project in Cabo Delgado and Nampula since deterioration of the project in there has negative implications for long term sustainability of the effort. The project should be re-implemented in Cabo Delgado and efforts should be made to continue the project in an effective manner in Nampula.

7. The scale-up to future provinces should occur in Provinces where the Provincial Governor and the DPS are fully supportive of the project and, ideally, request that the Project be implemented in their Province.
8. The roll-out should have capacity building as a goal and important activity. The project should include and train national and provincial staff where the project will be rolled out in the future. This will make future scale-up much easier and develop buy-in for the project in future provinces. The project should also consider expanding its role in helping the PAV improve the quality of outreach services. This is especially important in rural areas where the population is thinly dispersed and parents must walk for several hours to fixed health centers. While the field coordinator teams cannot deliver outreach services, they could help with planning and possibly managing the outreach logistics and supervision.
9. The project should carefully consider monitoring and evaluation and conduct appropriate baseline coverage surveys and designation of “comparison” or “control” Provinces as needed at the inception of the Project in each province.
10. The project was not able to conduct a formal cost-effectiveness analysis of the project although extensive data on internal project costs and impacts are available. The reviewer believes that cost effectiveness analyses based on the external (and therefore artificial) inputs of a pilot project in a district or province are of limited usefulness in predicting sustainability. However, modeling using the cost data is often useful in predicting costs and benefits of a sustainable system and is helpful in planning for the new system. VR should continue to try and get the data necessary to conduct a modeling exercise to examine various options in planning for the rollout.

## Addendum: VidaGas -- A successful social business in support of health

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VidaGas is a private, limited liability company founded by two non-profit organizations: VillageReach and the FDC. It is the largest distributor of LPG in northern Mozambique and provides critical energy products and services to rural health centers, industrial customers and households.

VidaGas was established in April 2002 with the explicit social mission of strengthening the public health system in Mozambique. It began its operations in the northern province of Cabo Delgado by supplying 36 rural health centers consuming less than half a ton of LPG monthly. The equipment and LPG supplied to rural health centers enables the provision of critical health services, such as child and mother vaccinations, night-time birthing and the sterilization of medical equipment. Without the reliable energy supply and services to rural health centers provided by VidaGas, equipment failures and stock outs would be an ongoing problem that would prevent the large increases in coverage rates experienced by the Ministry of Health's vaccine program.

VillageReach and FDC also considered the environmental impact of providing energy services when founding VidaGas. Like most of sub Saharan Africa and other parts of the developing world, biomass is the primary source of cooking fuel for households and even large businesses, such as hotels. In Mozambique, an estimated 80% of the population uses wood or charcoal for cooking. VillageReach and FDC saw the opportunity to address two urgent environmental needs: reducing deforestation, which is the primary aggravating factor behind flooding in Mozambique, and reducing indoor air pollution, which is a primary cause of acute lower respiratory illnesses ("ALRI"), a major killer in the developing world.

VidaGas was structured as a business rather than a project because consumers beyond the Ministry of Health needed LPG. Hotels and restaurants in particular wanted to switch from charcoal to LPG, but were concerned about supply reliability from existing small retailers, which sold limited quantities of LPG along with sundries, electronics and other general goods. The two large LPG companies, PetroGal and Afrox Mozambique, ignored the northern Mozambican market because the time and resources needed to develop the market could be more profitably employed in the wealthier south. VidaGas' strategy for developing this Bottom-of-the-Pyramid ("BOP") market was to build a customer base from its anchor customer, the Ministry of Health. The same products and services provided to rural health centers were needed by the hospitality sector, which was growing rapidly because of large investments in hotels, resorts and other tourism-related infrastructure and services. Today, VidaGas distributes up to 25 tons of LPG monthly to 251 health centers and a wide variety of customers, including hospitals, hotels, restaurants, resorts, companies and households.

Beyond its triple bottom line and innovative approach for catalyzing much-needed basic services in a BOP market, VidaGas is unique because of its relatively large size and potential for significant scaling. Many social businesses in underserved markets are very

small and have little hope for growth. VidaGas is a dominant regional player in the energy services sector, which is a basic requirement for economic and social development. In addition to its plans to expand its customer base to different types of consumers, VidaGas also intends to expand its operations from Cabo Delgado and Nampula, where it currently has operations, into the neighboring provinces of Niassa and Zambezia

VidaGas had 2007 revenues of \$432,416 and is well on target to exceed \$500,000 in sales in 2008. If able to pursue its investment and expansion plans to the rest of Northern Mozambique, VidaGas expects sales to be three to four times current levels within five years.

VidaGas' role in a national expansion will differ depending on the Ministry of Health's (MISAU's) position on refrigerator technology. If LPG refrigerators are used, VidaGas will likely supply the PAV program with LPG in rural health centers. If only solar is allowed, VidaGas will sell to other MISAU customers, such as hospitals (kitchen installations and cooking fuel supply) and continue to serve non-MISAU customers. VidaGas may also build on its competence in energy, equipment, and serving MISAU by expanding into solar equipment if appropriate and if there is a need for a solar equipment supplier in the region.