Cold Chain Equipment Evaluation
January-March 2017
Democratic Republic of Congo

Results of a Field Study
April 2017

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The Vaccine Alliance

PATH

Photo: Albert Rushingwa Bahati

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Background and Methodology

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Background

In 2015, the Ministry of Health (MOH), Democratic Republic of Congo (DRC) and their partners oversaw the deployment of 2522 solar direct drive (SDD) vaccine refrigerators across the country. These were installed by a local agent of the refrigerator manufacturer together with engineers recruited and trained by the DRC Expanded Programme on Immunization (EPI) and logisticians from the provinces and health zones. The refrigerators had been purchased with funds from the DRC's Health System Strengthening Grant #2 (HSS2) from Gavi, the Vaccine Alliance.

From January through March 2017, PATH carried out an evaluation of the deployment of HSS2 equipment in the provinces of Nord-Kivu, Sud-Kivu, Maniema and the four provinces of the former Province Orientale (Bas Uele, Haut Uele, Ituri and Tshopo).

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Evaluation Objectives

The evaluation sought to assess the following components of the cold chain equipment (CCE) installation:

- The effectiveness of the installation process and the service provided by the installer, including supply, management, distribution, installation, maintenance, and training processes used.
- The current technical status of the equipment deployed, including functionality, performance, suitability, and effectiveness.
- Early indication of the impact of the new CCE on immunization services provided in these provinces.

In addition, PATH sought information about other recent investments in the immunization supply chain in DRC.

Methodology

- PATH recruited an international consultant to lead and manage the evaluation.
- A protocol was developed and approved by the project advisory committee, which was composed of members of the National Immunization Logistics Committee of DRC. The protocol included questionnaires for the following targets:
  - Expanded Programme on Immunization (EPI) workers in the health posts;
  - EPI workers in health zones;
  - National EPI managers and team members;
  - Immunization partners at the national level;
  - The in-country representative of the CCE manufacturer.

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Methodology (2)

- A WHO tool was used to make a random selection of sites for physical inspection and others to be targeted for telephone interviews.
  - For physical inspection, the target was to reach 10% of the sites where HSS2 CCE were installed during the second quarter of 2016. Selection resulted in 232 sites, including some non-HSS2 sites. Data collection was completed in 245 sites, 167 of which were HSS2 sites (21% of the HSS2 sites in the 7 provinces).
  - For telephone interviews, the target was to reach an additional 50% of the installation sites, though that was scaled back during site selection to about 880. Data collection was completed in about 400 sites.
- Data entry forms were developed for both the physical inspection and the telephone interviews.
- Data were collected and sent to the study lead on an ongoing basis as the study proceeded so that they could be cleaned and analyzed.
- A final report was prepared and presented to the advisory committee in Kinshasa.

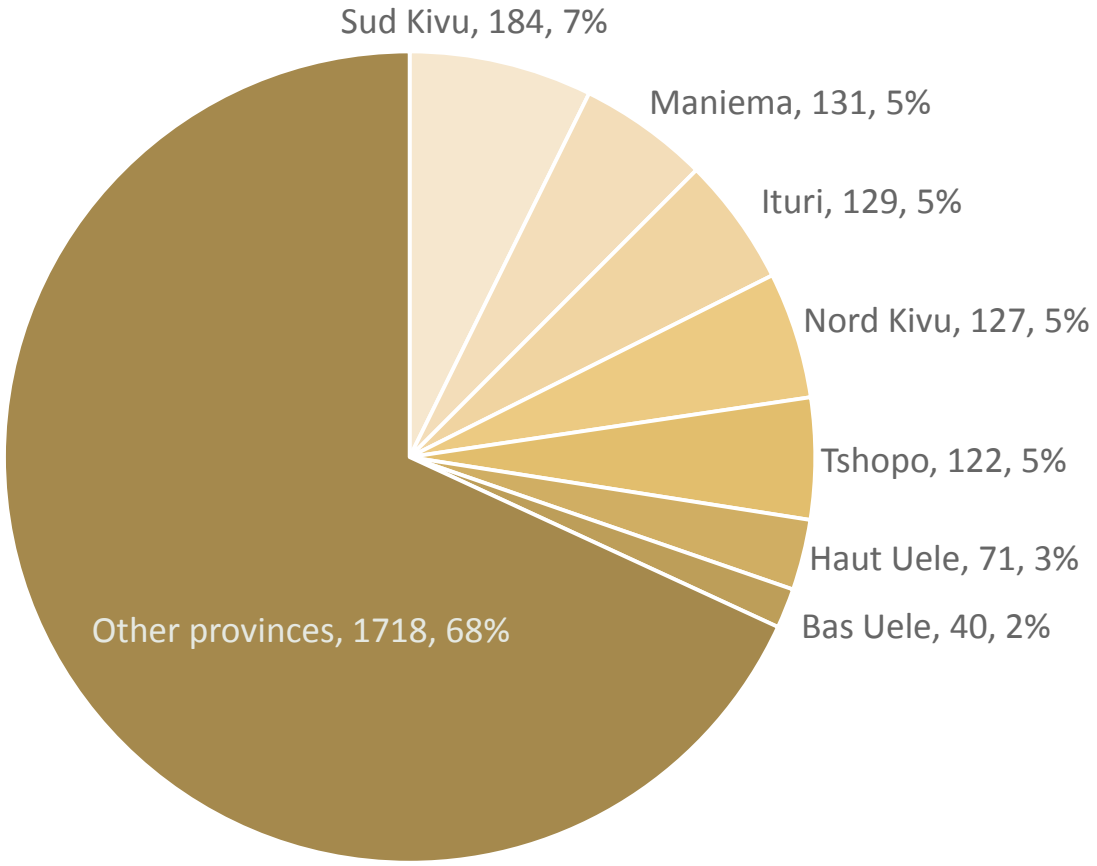
Implementation of the Evaluation

Surveys were conducted between 11th of February and the 20th of March, 2017:

- Eight consultants with cold chain logistics background were recruited for the data collection in seven provinces, and their names were submitted to the advisory committee for review.
- Three supervisors were designated to follow the evaluation.
- Training on objectives and methodologies was provided to the consultant group before their deployment to the field.
- The team proceeded to the targeted provinces and carried out the data collection.

Results—Equipment

Total Distribution of HSS2 Cold Chain Equipment



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Evaluation Site Visits Conducted

In the case of Bas Uele, the consultant visited additional sites that were on the way, explaining why the coverage was beyond 100%.

In the cases of Bunia, Tshopo, and Sud Kivu, the allotted time did not allow for the visits to the last health zone and its associated health centers.

In the case of Maniema, one of the target health zones were inaccessible due to issues of security.) Some health centers from a neighboring zone with HSS2 CCE were visited.

PROVINCE/ TERRITORY	TYPES DE SITES	VISITS PLANNED	ACTUAL VISITS	HSS2 SITES	% of PLANNED
BAS UELE	Zonal store	5	10	0	200%
	Health center	10	20	16	200%
HAUT UELE	Zonal store	9	9	0	100%
	Health center	18	18	16	100%
ITURI (ARU TERRITORY)	Zonal store	10	10	0	100%
	Health center	20	20	20	100%
ITURI (BUNIA TERRITORY)	Zonal store	11	10	1	91%
	Health center	22	18	18	82%
TSHOPO	Zonal store	14	13	3	93%
	Health center	28	24	24	86%
MANIEMA	Zonal store	8	7	1	88%
	Health center	18	25	20	139%
NORD KIVU	Zonal store	10	14	3	140%
	Health center	20	19	19	95%
SUD KIVU	Zonal store	12	11	11	92%
	Health center	17	17	15	100%
ALL PROVINCES	**Zonal store**	**79**	**84**	**19**	**106%**
	Health center	**153**	**161**	**148**	**105%**
TOTAL SITES		**232**	**245**	**167**	**106%**

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Installation of equipment

Experience of the Manufacturer's Representative Agency

- Training of trainers for the installation took place both at the manufacturer's headquarters and in country.
- Installers traceability documents detail the following:
  - The installations of 2522 refrigerators (serial numbers documented);
  - Training of the users;
  - Provision of technical manuals.
- In case of straw roofing (285 sites) wooden solar panel support structures were designed according to a model for wind turbines, and integrating experience in other countries to avoid theft and fire.
- There were 247 deviations to the installation plan throughout all 14 provinces where the installation was performed. In the seven target provinces of the evaluation, 51 deviations occurred.

Deviations—Multiple Reasons

- Insecurity of the site;
- Inaccessibility of the site (route not passable);
- A different site was identified with larger catchment area;
- Designated site was not a part of the public health system;
- Confusion related to naming conventions.

In all cases, the decision for deviation was taken by the responsible authorities within the relevant provincial department of health and resulted in good use of the procured equipment.

Initial Installation Plan for the Seven Study Provinces

Batch		Arrival gateways	Departure gateways	Arrival at Health fac	Gateways	Province	Total Equipement	Start of the Installations	End of the Installations
2015-2016	First batch	December 4	December 14	January 14	Bukavu	Sud Kivu	295	2016, January 21	2016, February 13
					Goma	Nord Kivu	128		
2016	Second batch	January 13	January 23	May 11	Bunia	Prov Or.	381	2016, May 14	2016, July 29
	TOTAL FOR THE 7 PROVINCES						**804**	2016, January 21	2016, July 29

Abbreviations: Prov Or., Province Orientale

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Final Deployment and Installation Plan

	TCW 40	TCW 2000	Nbre de techniciens	Nbre de jours	Janvier										Février															
										23			30	31	1	2										19		29		
Nord Kivu	120	7	19	28						**23**																**19**				

	TCW 40	TCW 2000	Nbre de techniciens	Nbre de jours	Février							Mars									Avril										
					10						29	1	2							31	1									30
Maniema	130	1	13	52	**10**																**1**									

	TCW 40	TCW 2000	Nbre de techniciens	Nbre de jours	Février							Mars									Avril										
					10						29	1	2							31	1					17				30
Ex Prov Orientale	360	2	22	68	**10**																					**17**				

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Installation and Maintenance of Equipment

- The survey has revealed some additional challenges:
  - In isolated cases, the user did not know they needed to open a stopper to drain accumulated condensation;
  - 63 of 215 logistics officers interviewed report that they did not receive refrigerator maintenance training;
  - User manuals were not received.

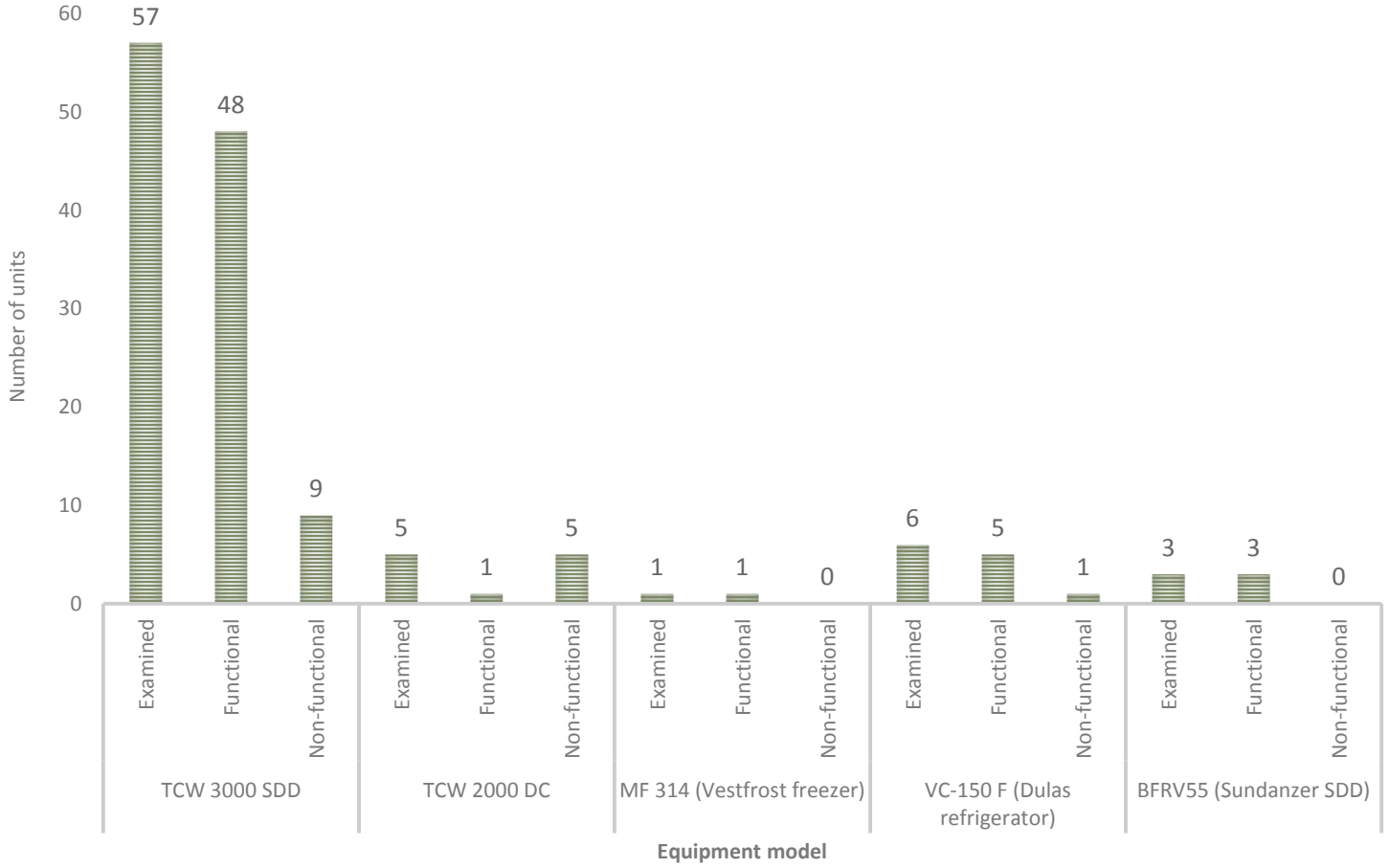
  On investigation, it seems that the provision of training and manuals was sometimes sacrificed when time was short in an effort to stay on schedule for the overall deployment.

- Maintenance of the equipment is sufficient so far in most cases, but lack of long term maintenance plans is a concern.
- As part of the study preparation, the consultants developed maintenance sheets, which have been explained and distributed to users in the course of the survey.
- A refrigerator inventory data collection sheet was also developed.

Functionality of HSS2 Equipment

- In the data of 167 HSS2 refrigerators examined, 100% were functioning (148 TCW 40 SDD and 19 TCW 2000 SDD.)
- The consultants provided minor repairs in some cases.
- One non-HSS2 refrigerator required technical repair. The installer has agreed to replace it and return the defective device to Kinshasa for repair. The EPI logistics officer will follow this.

Functionality of non-HSS2 Equipment (52) Found in the Sites Visited



Abbreviations: SDD, solar direct drive refrigerator;

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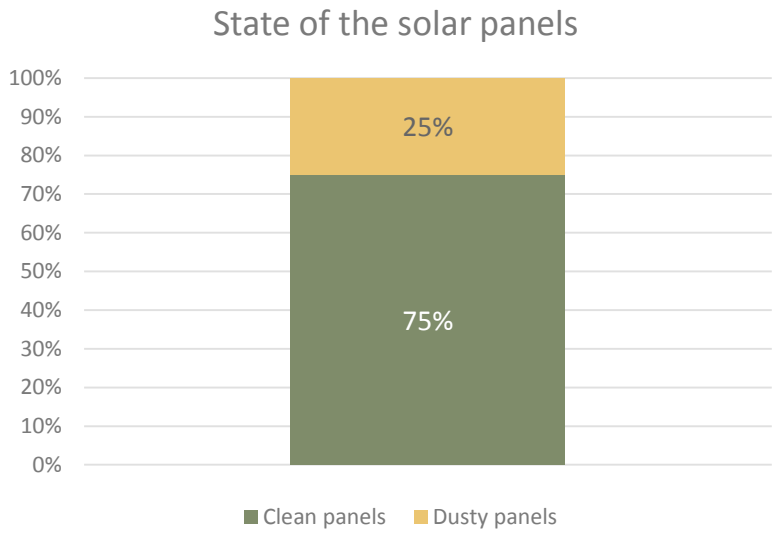
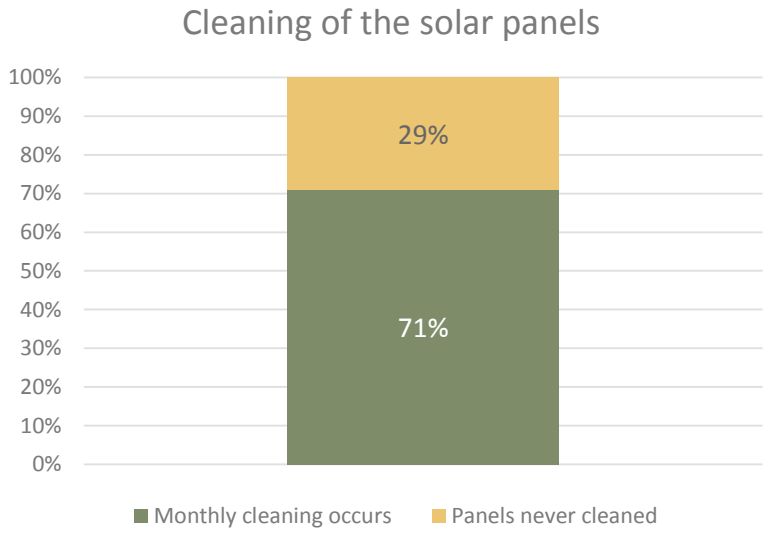
Solar Panels of the HSS2 CCE





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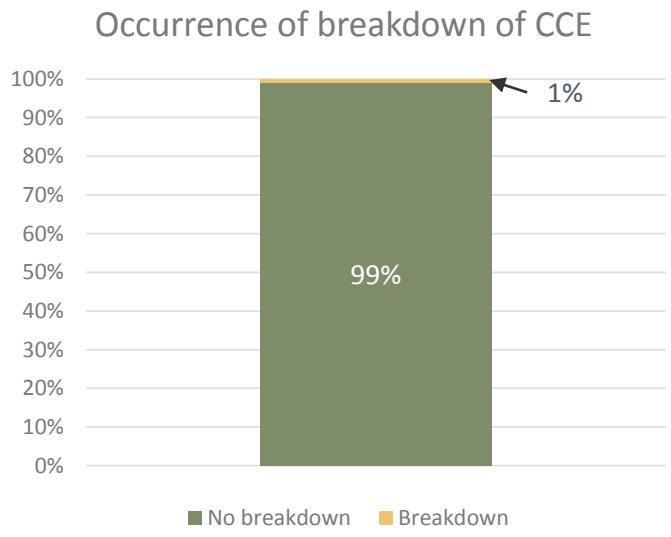
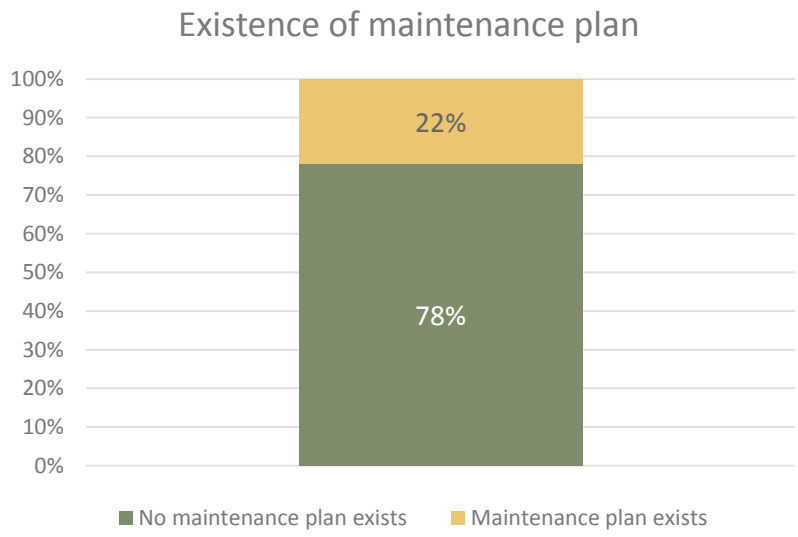
Equipment Breakdown and Maintenance Plans HSS2 CCE





The equipment is new and functions well. It would be useful to put in place a good system of maintenance for ensuring the good operation of the CCE, and thus the continuity of immunization.

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Example Intervention by Study Consultants

- Intervention at Saliboko (Bunia Territory): the compressor ventilator was detached and rattling loudly. It was repaired.

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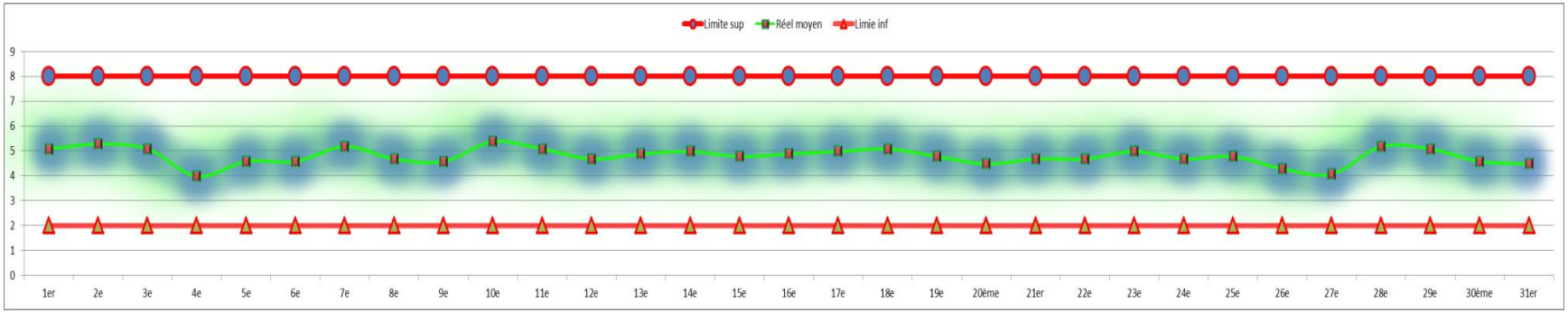
Example intervention by study consultants

- Intervention à Logo Tapka (Bunia Territory) : the pipe between the condenser and the filter was sectioned, and the refrigerator was not functioning.

Temperature Data



The graph above displays data downloaded from a FridgeTag2 in a Dometic TCW2000 solar direct drive refrigerator at the zonal store of Minova.

- During January 2017, temperature remained between 2C and 8C. No high temperature nor low temperature alarms occurred.
- Quality of the vaccines was therefore assured.
- In a majority of sites, the temperature monitoring showed temperatures within the required range.

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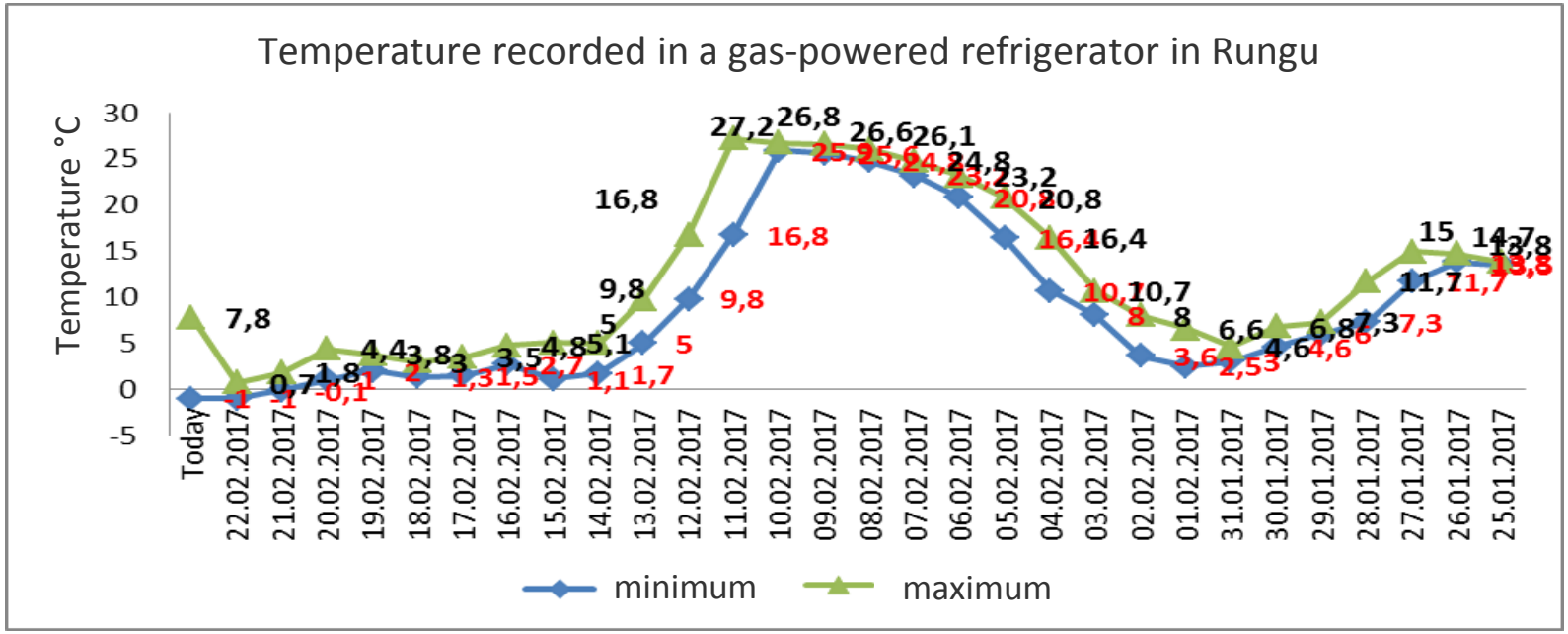
Variations of Temperature in a Gas-powered Refrigerator

By contrast, these data downloaded from a Fridge-tag2® device in a gas-powered refrigerator in Rungu health center, Biringi health zone shows the temperature of the vaccine compartment during a month when gas was unavailable. During this time, the vaccine was moved out of the health center and stored at the health zone, requiring multiple trips to collect vaccine for immunization sessions.



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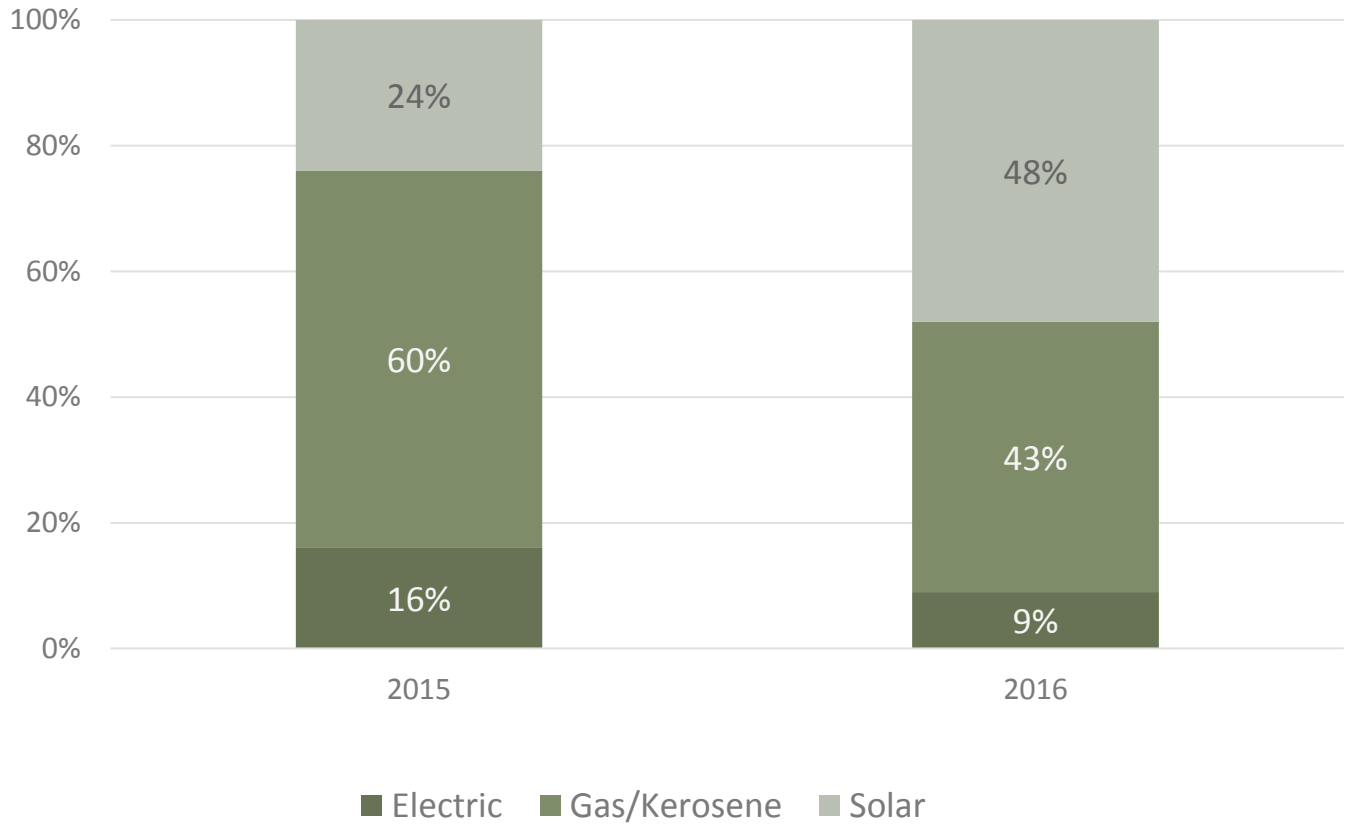
Source of Energy, Cold Chain Equipment Ex-Province Orientale



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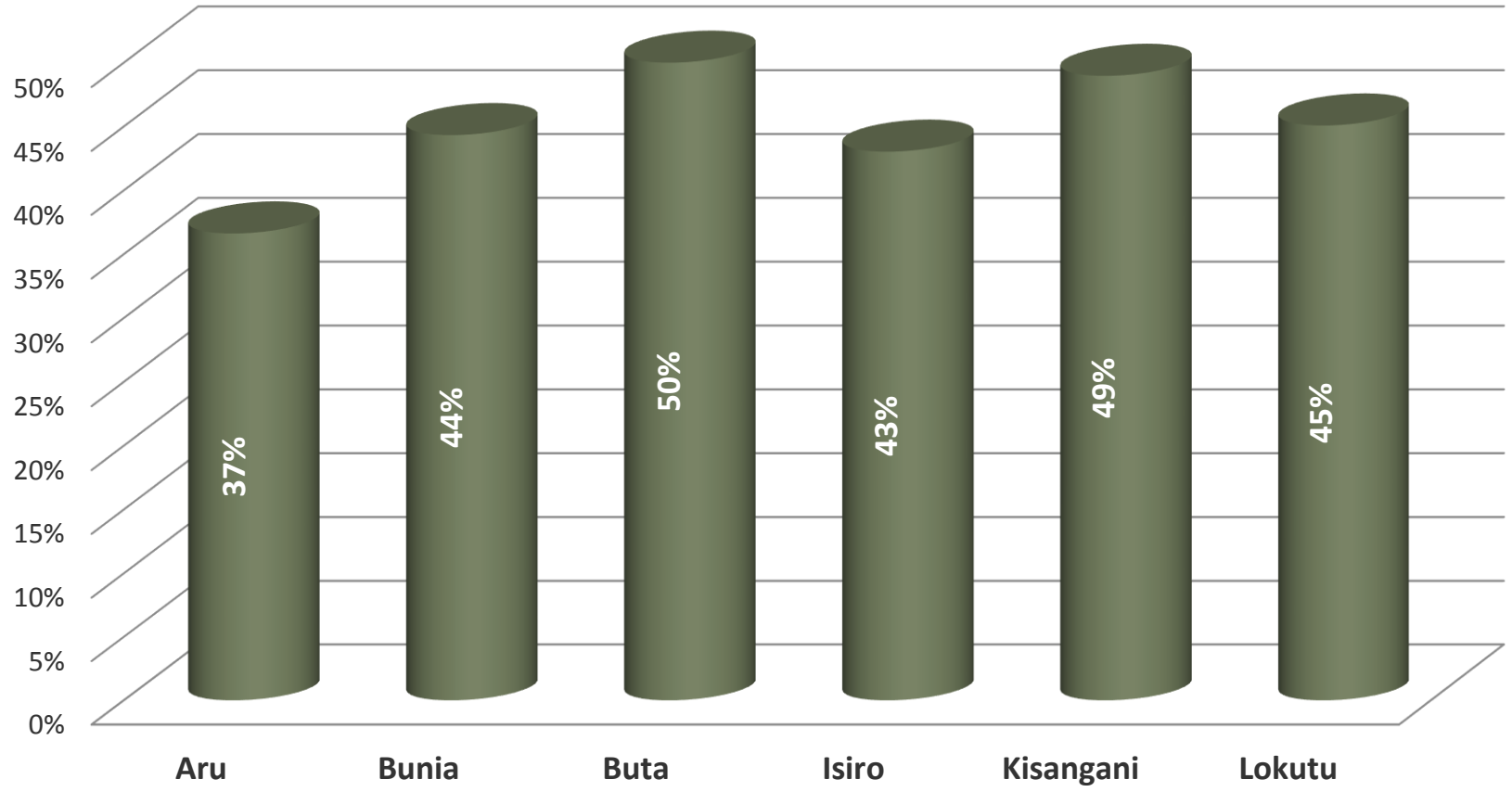
Health Structures with Functioning Solar Equipment (Ex-Province Orientale, 2016)



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Results—Immunization

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Immunization Data

Data collection included total number of infants vaccinated in 2015 and 2016 with the following five vaccine doses: Bacille Calmette-Guerin (BCG), oral polio 3rd dose, pentavalent 1st and 3rd doses, and measles.

- A majority of health centers show increased vaccination for at least three of the five vaccines collected. For example, in Sud Kivu province, in the 15 health centers with data collected for both 2015 and 2016, 12 show an increase for at least three doses, and 8 of those show an increase across all five doses.
- Not all health centers in the study show an increase in vaccine doses administered. Reasons contributing to lower immunization coverage included stock-outs, disruption in human resources, and poor security situations.
- The province level data include facilities that did not receive new CCE.
- Success in administering vaccine is due to many factors, available CCE only one, and the findings of this study alone cannot establish causality. However, it is reasonable to infer that the presence of properly-functioning CCE can reduce the number of missed opportunities to vaccinate.

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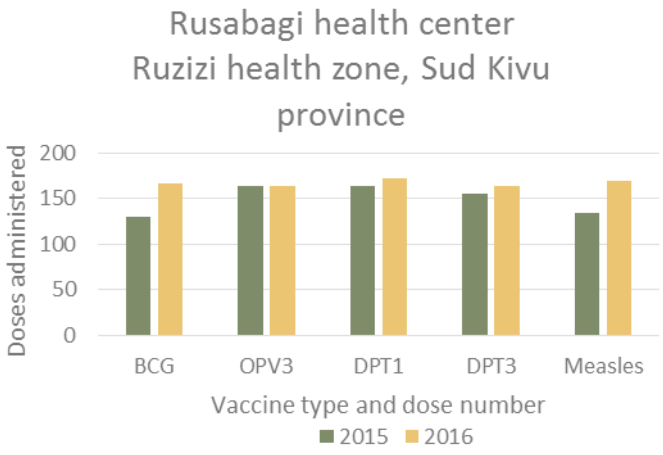
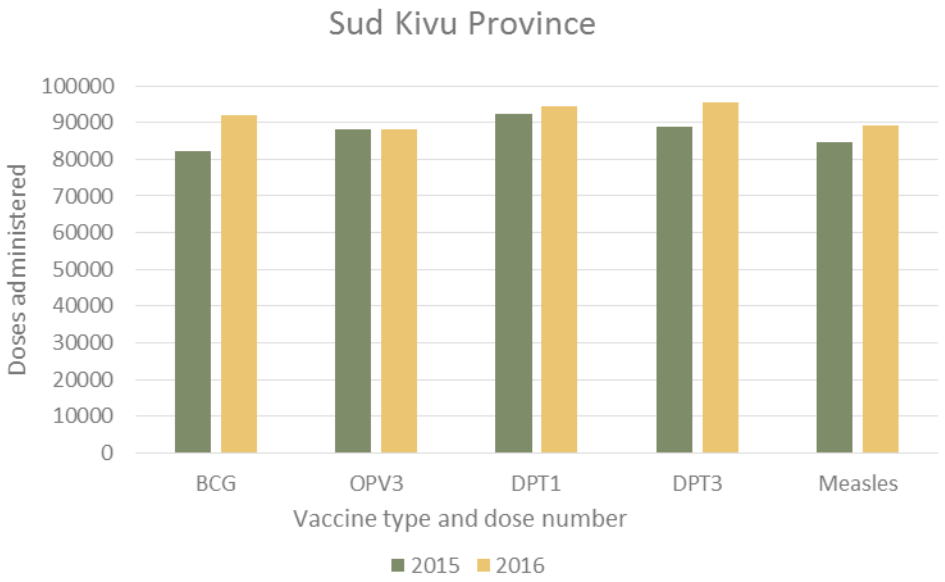
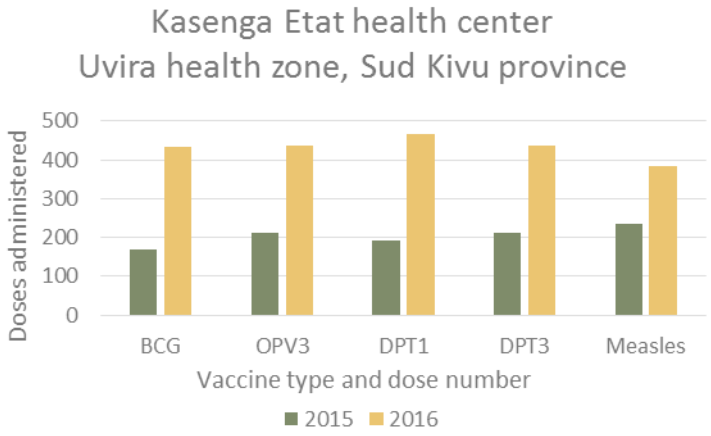
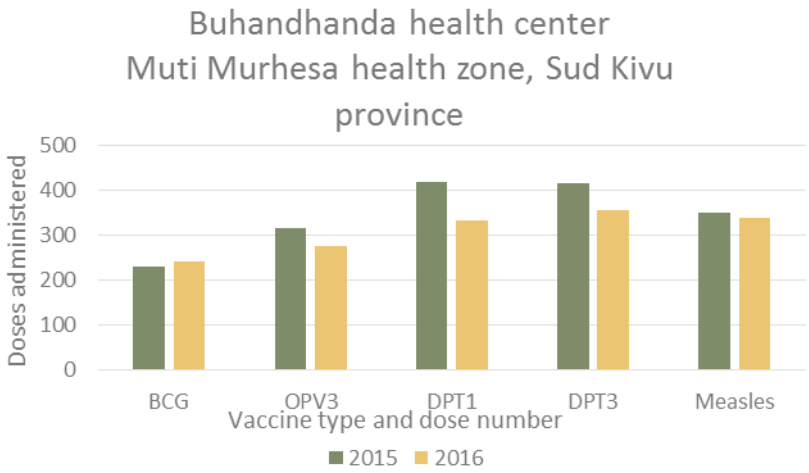
Example Immunization Data, Sud Kivu Province









Abbreviations: BCG, bacillus Calmette–Guérin (vaccine); OPV, oral polio virus (vaccine); Penta #, pentavalent vaccine dose #.

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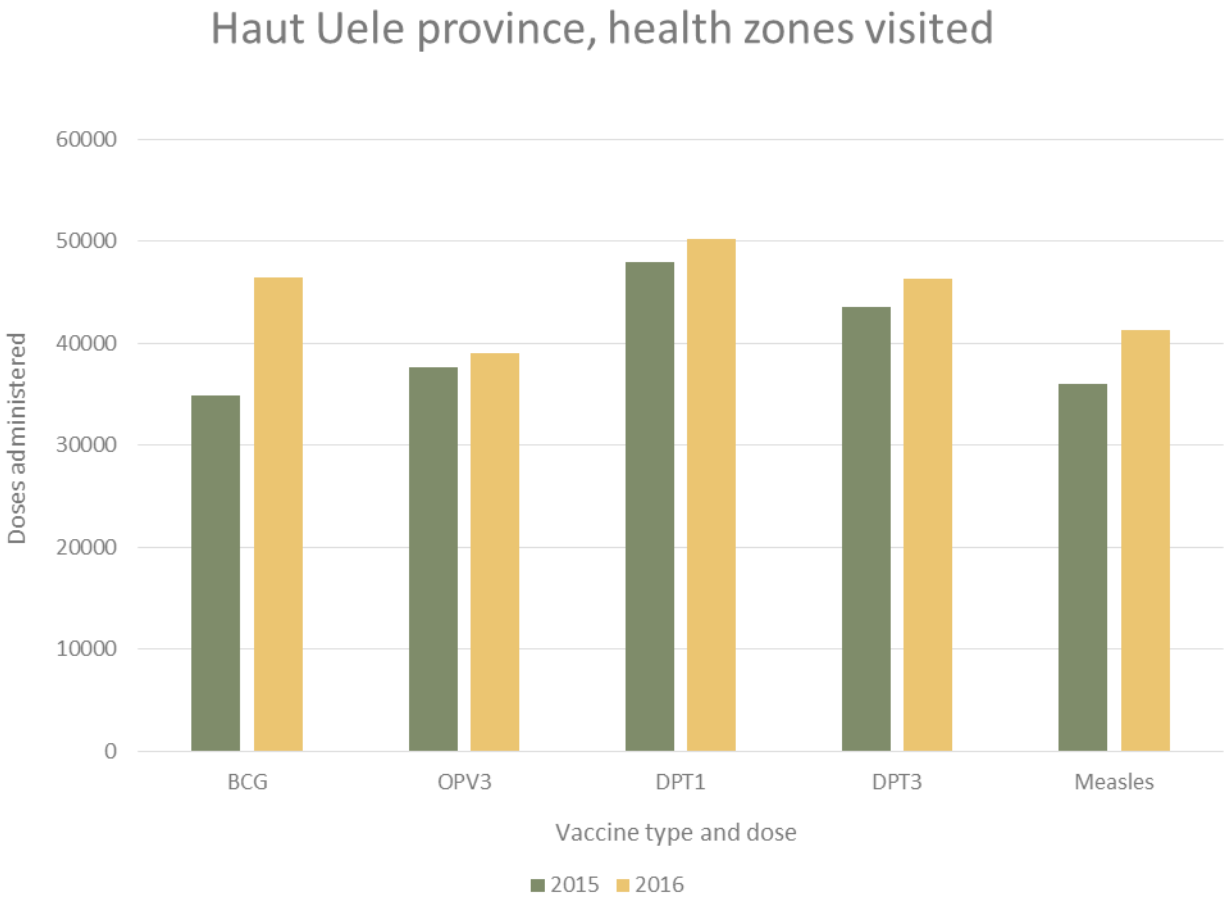
Haut Uele Province Summary



Abbreviations: BCG, bacillus Calmette–Guérin (vaccine); OPV, oral polio virus (vaccine); Penta #, pentavalent vaccine dose #.

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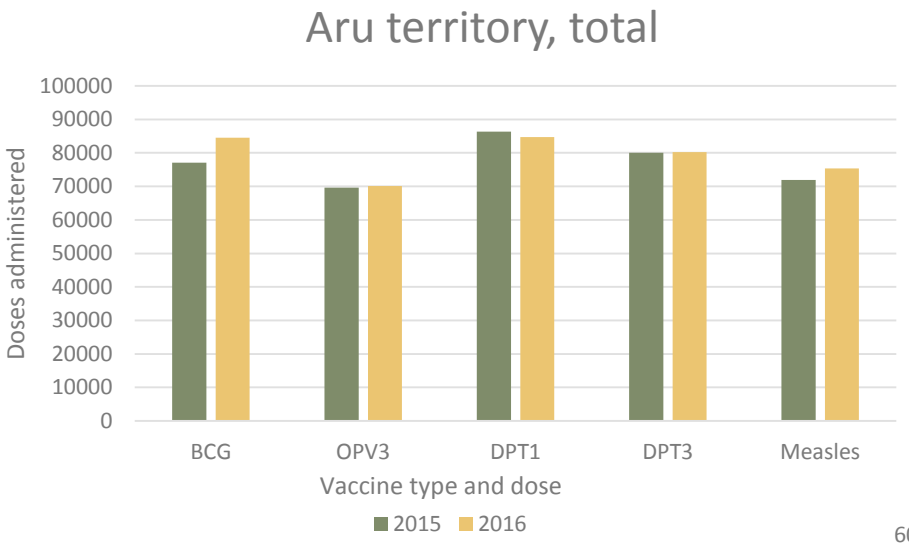
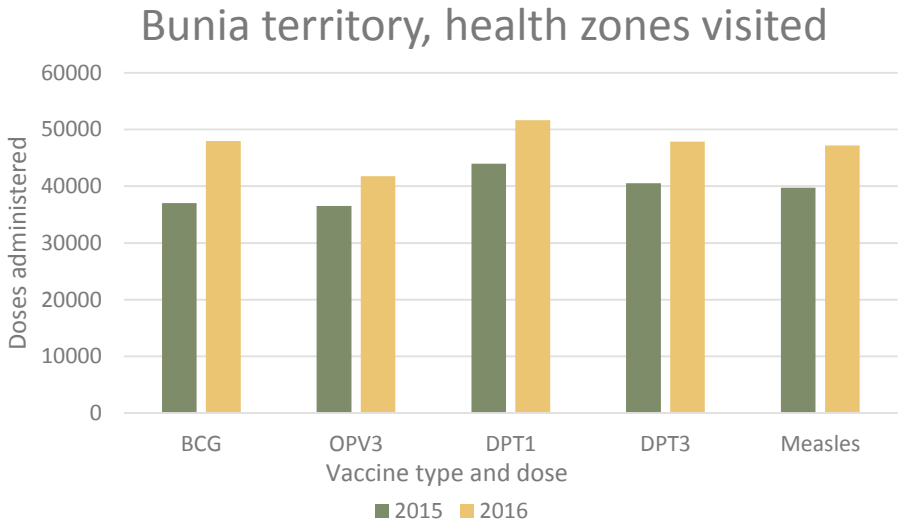
Ituri Province, Aru and Bunia Territories





Abbreviations: BCG, bacillus Calmette–Guérin (vaccine); OPV, oral polio virus (vaccine); Penta #, pentavalent vaccine dose #.

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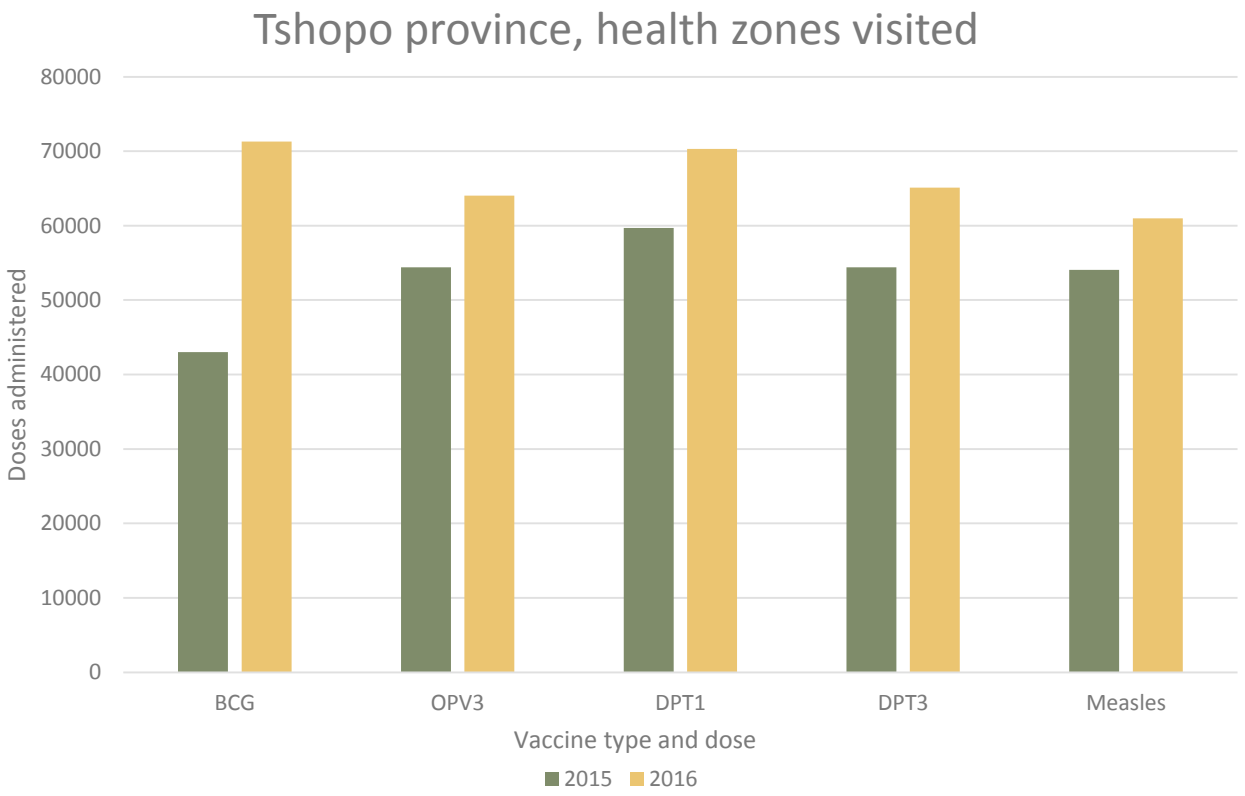
Tshopo Province, Immunization Data



Abbreviations: BCG, bacillus Calmette–Guérin (vaccine); OPV, oral polio virus (vaccine); Penta #, pentavalent vaccine dose #.

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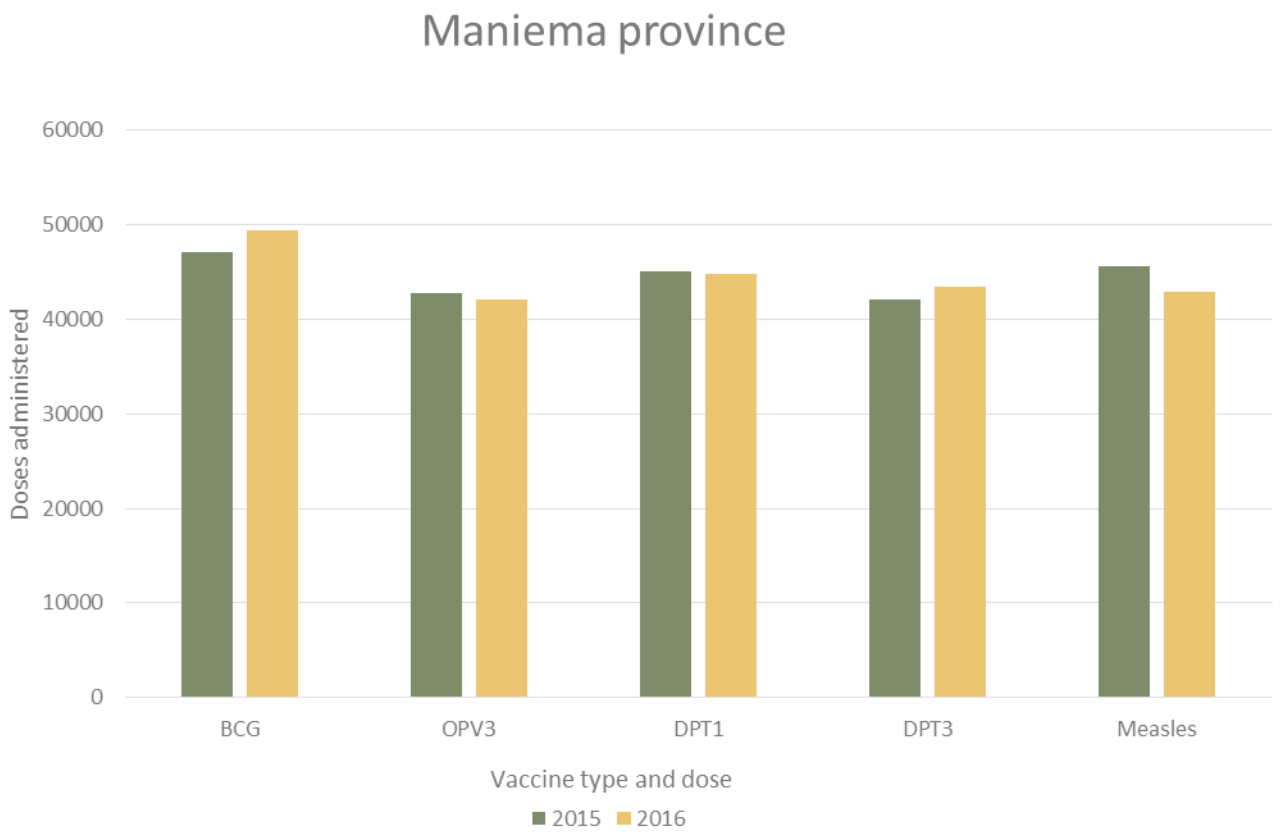
Maniema Province, Immunization Data



Abbreviations: BCG, bacillus Calmette–Guérin (vaccine); OPV, oral polio virus (vaccine); Penta #, pentavalent vaccine dose #.

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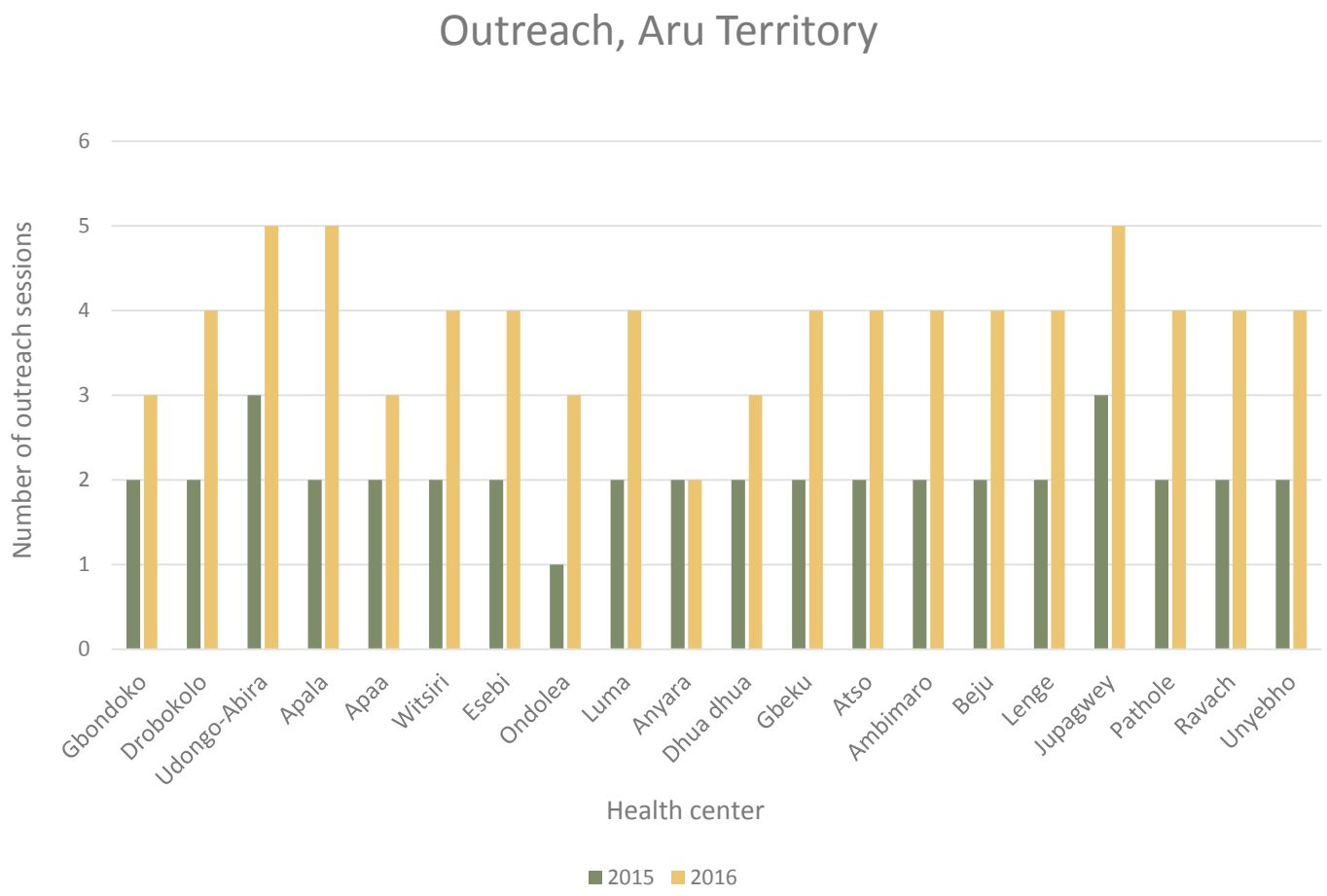
Growth of Outreach Activities Aru territory, Ituri Province



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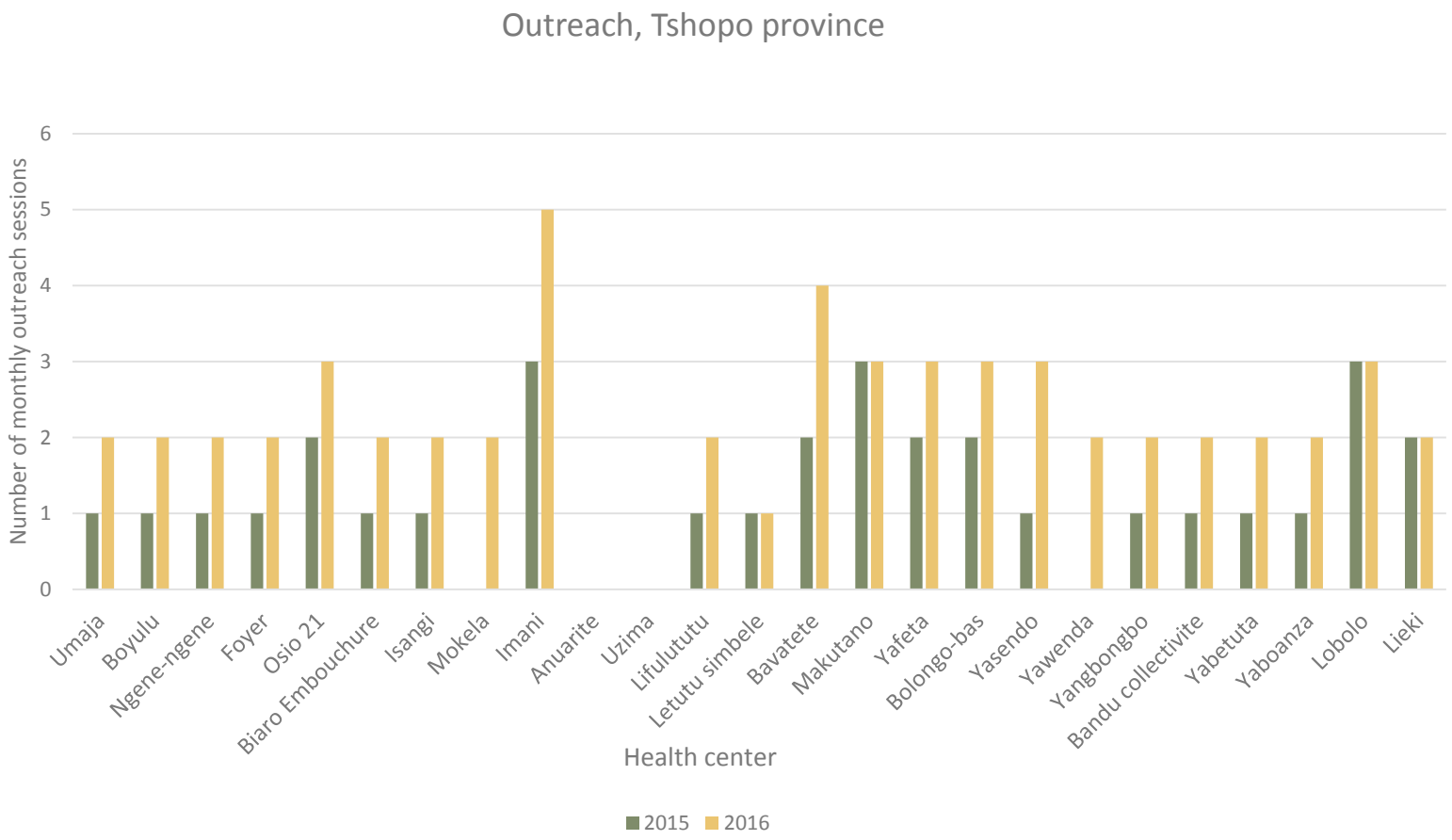
Growth of Outreach Activities, Tshopo Province



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Other Cold Chain Equipment Envestments

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Mapping of different cold chain equipment acquisitions in Ex-Province Orientale (2000-2016)

Funders of cold chain equipment, Ex-Province Orientale since 2000	
ANGLICAN	1
ASSP/IMA/CARITAS	7
BANQUE MONDIALE	31
BAD	23
CONSOLATA	2
COOPI	1
CORDAID	1
CTB	4
GAVI	382
Provincial Government(2015-16)	162
IRC	29
MALTESER	10
OMS	3
SANRU	16
UNICEF	766
VAS	2

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Mapping of CCE Investments in DRC

Year	Number of refrigerators procured (Zonal stores and health centers)	Of these, the number procured for health centers	Source of funding
2013	204		BANQUE MONDIALE
	48	48	PROSANI
2014	189	189	UNION EUROPEENNE
	13		UNICEF
	85		UNICEF
	35	35	PROSANI
	79		UNICEF
	10	10	OMS
	350	350	IMA
2015	91		UNICEF
	65	65	GAVI
	48	48	ROTARY ET USAID
	5	5	SAVE CHILDREEN
	50		GAVI
2016	2522	2312	GAVI

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Conclusions and Recommendations

Summary of Positive Findings

- 100% of the solar direct drive refrigerators purchased by HSS2 are functioning, with the manufacturers' warrantee still in place.
- In a majority of health centers (71%) cleaning of the solar panels is being performed regularly.
- The installation of new CCE has reduced recurrent costs in health centers:
  - Where the solar CCE replaced absorption, gas or kerosene is no longer needed.
  - Need for spare parts is reduced compared to absorption equipment.
  - There is less travel to get vaccine supplies—given the reliability of the refrigerator, health centers can store all vaccines needed for a month.
- We are witnessing an increase in the number of children vaccinated in the majority of sites visited.
- The coverage increase could be even greater in absence of vaccine stock-outs and with the provision of means for mobile strategies.
- Overall, the temperature in the new CCE is remaining in the correct range, ensuring quality of the vaccine.

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Summary of Remaining System Weaknesses

The evaluation uncovered the following problems:

- The absence of user manuals at certain sites;
- The neglect of solar panel maintenance, which may have a negative effect on the functioning of the solar CCE;
- The lack of maintenance training of the technicians;
- The lack of a maintenance plan to support the long-term viability and performance of the equipment.

Recommendations

- EPI should coordinate with the manufacturer representative to ensure that issues identified within guarantee period are sufficiently addressed.
- EPI should continue to strengthen user training and make sure that ample time is allowed in the installation timeline for training on new equipment.
- EPI should establish a national maintenance system and recruit technicians to deploy in all provinces.

Study Limitations

- The timeline for this evaluation was short, and not sufficient enough to perform all the interviews originally planned.
  - Only 1.5 hours were budgeted for each site visit, with an estimate that the consultant could visit 4 sites per day, including travel time, and data entry time. This was unrealistic.
  - The burden on health center staff was relatively high, and if the health center was busy, it required a lot of waiting by the consultant.
- Telephone interviews proved especially difficult and only about 400 were completed of the 1200 planned.
  - Health center contacts would often not answer the call if they did not recognize the number.
  - In some cases the health workers did not have time to complete the telephone survey.
  - This was addressed in some cases by using the phones of the supervisors at the zonal level. In other cases, consultants visited sites that had been designated as telephone interview sites but were located along their routes.