Temperature monitoring and performance management of cold chain equipment – two complimentary approaches

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16ᵗʰ TechNet Conference
Shaping a resilient and adaptive immunization program

CCE reporting with the Varo Android app

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16 th **TechNet Conference**
Shaping a resilient and adaptive immunization program

Agenda

Introduction / Opportunity

Varo overview

Country use cases

  Kenya – one-time snapshot as part of inventory exercise

  Bauchi – monthly use led by the state.

Summary

Varo unlocks CCE insights

Inadequate visibility into real-world CCE performance has been a longstanding challenge.

- Local temperature loggers are included in every CCEOP-funded fridge, implicitly creating a large but scattered dataset on CCE performance
- The lack of a systematic way to capture/aggregate data from these loggers has left most data locked inside fridges

The *Varo* Android app was developed as a simple tool to enable capture of existing CCE data

Machine-readable reports are transmitted via email and can be processed by reporting and visualization tools

- **Emails only go to account established by EPI program**
- Equipment installation can be rapidly/consistently verified
- Users are empowered to call for help for their CCE

# Create the Connection – short video
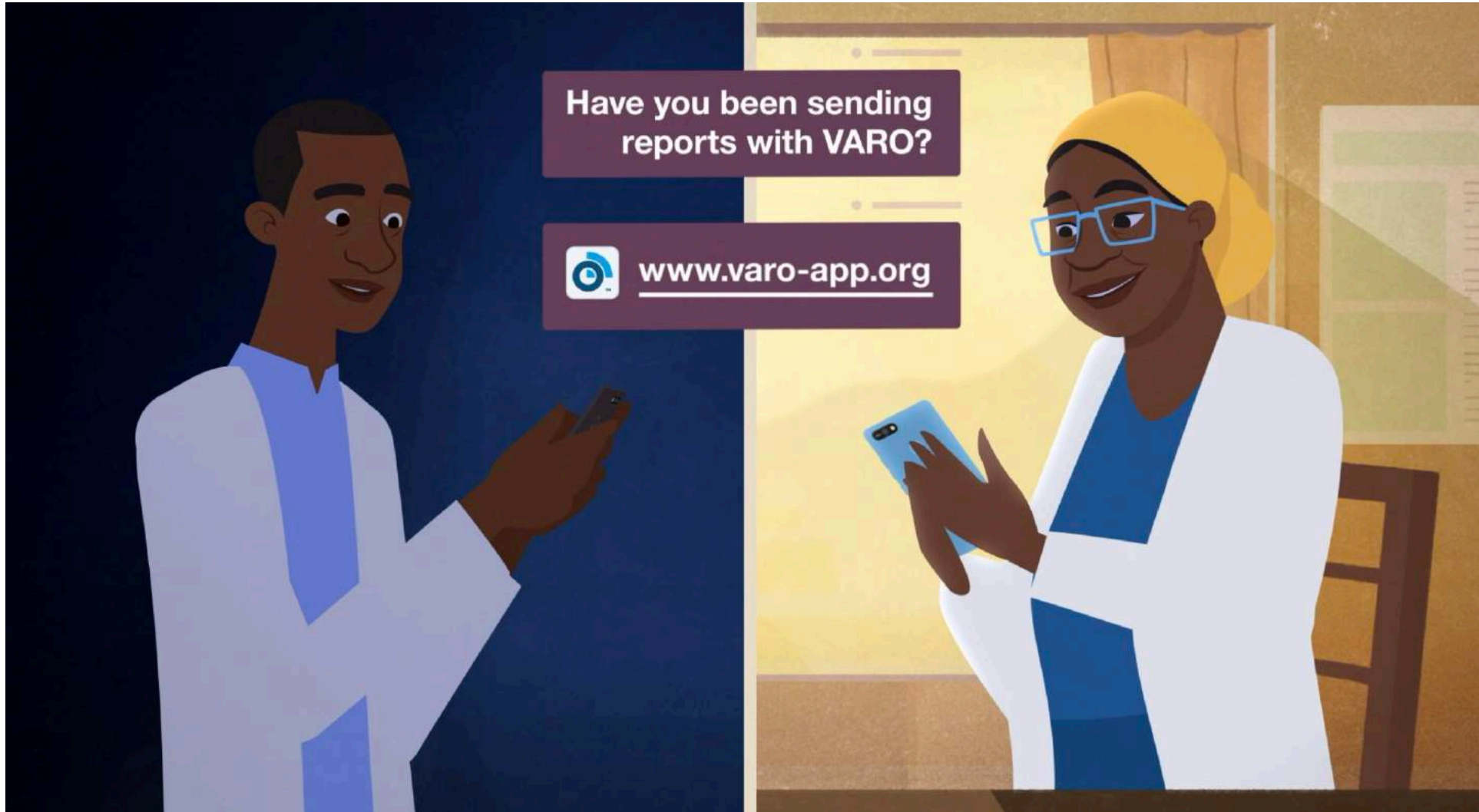
Varo unlocks CCE insights

The Varo mobile app enables capture and transmission of temperature reports from CCE, using only a mobile phone or tablet

- The 30DTR logger is connected to the phone or tablet using a USB OTG adapter/cable

- The app guides the entire process for report generation and e-mail transmission in < 2 minutes

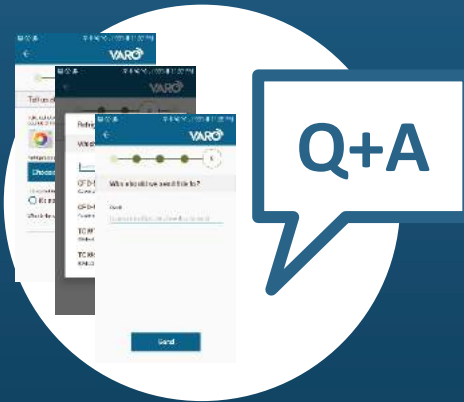- The Varo app is available as a free download from the Google Play store
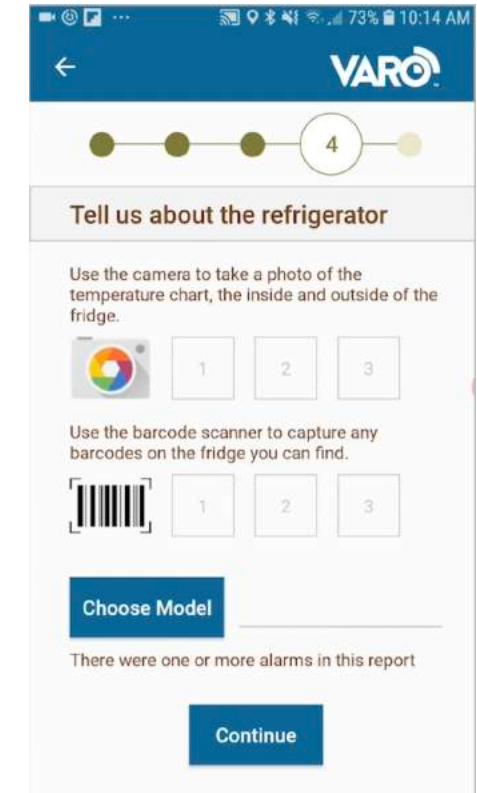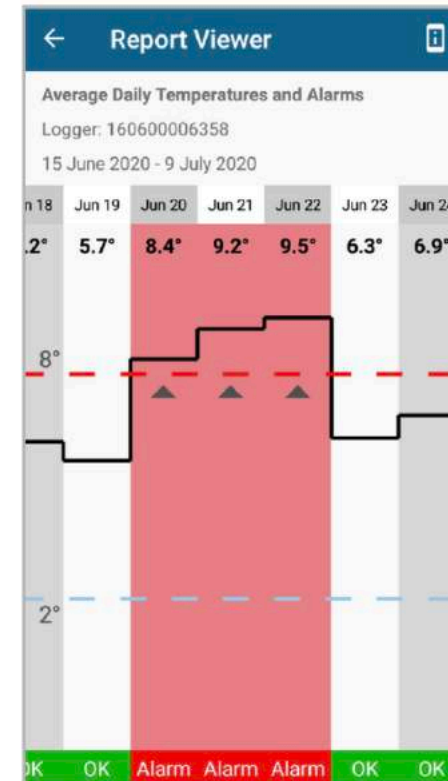
Varo use: EPI programs

Two separate case studies show how Varo has been deployed to suit different organizational goals

Kenya National Vaccines and Immunization program (NVIP):

- Initial use as part of nationwide CCE inventory exercise
- NVIP now implementing Varo as part of normal monthly reporting cadence

Bauchi State Primary Health Care Development Agency (BSPHCDA), Nigeria:

- Monthly use of Varo for ongoing CCE monitoring and deploying maintenance resources

© New Horizons

State vaccine delivery staff generate a Varo report in Bauchi, Nigeria

National Cold Chain Inventory - Kenya

Varo was used as part of 2019 nationwide CCE inventory exercise

Training/rollout approach:
- App training was conducted at national level with staff from each county
- USB adapters (OTG) were provided along with training
- New Gmail address established to receive all reports

Over course of the inventory exercise, 4,218 emailed Varo reports were transmitted, giving insights into both CCE performance and the value of the Varo tool for data collection

> **Building on this experience, NVIP is rolling out Varo for sustained monthly use**

Goal: make CCE report generation a new normal recurring activity – Varo tool becomes a part of everyday process

- All EPI personnel should submit Varo reports when they visit facilities – Biomeds, Supervisors, Maintenance techs
- Monthly report generation by health workers planned to start Q4 2020 in three counties, then to scale nationally after that

➤ **Recurring 30DTR collection activity with Varo is planned to inform more targeted maintenance interventions**

PDF document of the Fridge-tag® 2

Identification number:	350600017115
Date and time of report creation:	05.03.2020 14:55h
Activation date:	14.12.2017 14:13h
Upper alarm limit:	Above +8.0°C for 10h
Lower alarm limit:	Below -0.5°C for 1h
Measurement interval:[1]	1min (fixed)

No.	Date (dd.MM.yyyy)	Events[2]	Average temp.	Lower alarm limit Status	Min. temp.	Cumulative daily time below the limit	Alarm trigger time	Upper alarm limit Status	Max. temp.	Cumulative daily time above the limit	Alarm trigger time	Signat. Action
1	Today		+6.4°C	In progress	+4.1°C	0min		In progress	+9.0°C	3h 14min		
2	04.03.2020		+6.1°C	ok	+4.1°C	0min		ok	+9.6°C	4h 28min		
3	03.03.2020		+5.3°C	ok	+5.0°C	0min		ok	+6.1°C	0min		
4	02.03.2020		+5.3°C	ok	+4.6°C	0min		ok	+6.0°C	0min		
5	01.03.2020		+5.4°C	ok	+4.2°C	0min		ok	+7.4°C	0min		
6	29.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
7	28.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
8	27.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
9	26.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+9.6°C	8min		
10	25.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+6.0°C	0min		
11	24.02.2020		+5.3°C	ok	+5.1°C	0min		ok	+5.9°C	0min		
12	23.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
13	22.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
14	21.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
15	20.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+6.0°C	0min		
16	19.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
17	18.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
18	17.02.2020		+6.0°C	ok	+4.0°C	0min		ok	+9.2°C	3h 47min		
19	16.02.2020		+5.3°C	ok	+4.8°C	0min		ok	+6.0°C	0min		
20	15.02.2020		+6.2°C	ok	+4.1°C	0min		ok	+9.5°C	4h 9min		
21	14.02.2020	09:12	+5.4°C	ok	+5.0°C	0min		ok	+10.6°C	8min		
22	13.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
23	12.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+5.9°C	0min		
24	11.02.2020		+5.3°C	ok	+4.9°C	0min		ok	+6.0°C	0min		
25	10.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+6.0°C	0min		
26	09.02.2020		+5.3°C	ok	+5.0°C	0min		ok	+6.0°C	0min		
27	08.02.2020		+5.3°C	ok	+4.9°C	0min		ok	+6.0°C	0min		
28	07.02.2020		+5.3°C	ok	+4.9°C	0min		ok	+6.0°C	0min		
29	06.02.2020	10:34	+5.3°C	ok	+4.9°C	0min		ok	+6.0°C	0min		
30	05.02.2020		+5.3°C	ok	+4.9°C	0min		ok	+6.0°C	0min		

1) Sampling and data analysis every minute
2) t = time / date changed, hh:mm = status checked

Date and place: _____   Signature: _____

Varo email

This data was collected at 19-06-2020 07:56 UTC from:
GPS coordinates:
(-1.784456, 37.6283122) +/- 17.52 m
Facility name:
█████ health Centre
Subcounty/ District/ LGA:
makueni
State/ County:
makueni
Country:
Kenya
Facility Manager:
████████
Facility Manager Phone:
████████

The refrigerator unit is:
Manufacturer:
Vestfrost
Model:
VLS 024 SDD
Device ID:
350600039676
Device Manufacturer:
Berlinger

App Version:
1.5.0(1912181338)
Phone Model:
JKM-LX1
OS Version:
28
Using True Time:
NO
Automatic Time Enabled:
YES

Standard Varo report contents showing NVIP photo collection recommendations for CCE: logger, interior, CCE data plate

Vaccine delivery + Varo deployment – Bauchi State

State-directed implementation of CCE monitoring program successfully transitioned from pilot project to routine process

- **Vaccine delivery drivers use Varo to collect CCE reports monthly at health facilities during regularly scheduled restocking visits**

- **Bauchi State Logistics Working Group carried out a phased deployment plan to initiate Varo use**

  - **Varo capture of 30DTR data was started by eHealth Nigeria** as part of their vaccine delivery contract with Bauchi State in late 2018
  - **In 2020 Bauchi State took over vaccine delivery and Varo data capture.** Android phones were purchased by Bauchi to enable continued Varo data collection

VDD PROGRAM:
In Bauchi and some other states in Northern Nigeria, vaccines are delivered directly from State Cold stores to health facilities using dedicated trucks. Varo is used on these delivery trips to collect CCE data

eHealth Africa

Monthly CCE review process – Bauchi State

State Logistics Working Group makes evidence-based decisions guided by recurring Varo data collection

- Varo reports are reviewed monthly as part of the State Logistics Working Group meeting – this creates a clear pathway for addressing problems

- **More than 2,010 30DTR reports were captured** since January 2020
  - **Number of alarming CCE in Bauchi State was reduced** from 36 to 4 from June to Sept 2020 using Varo to guide interventions

- Varo reports are used as mechanism for confirming reports of non-functional CCE and identifying facilities that need replacement 30DTR loggers
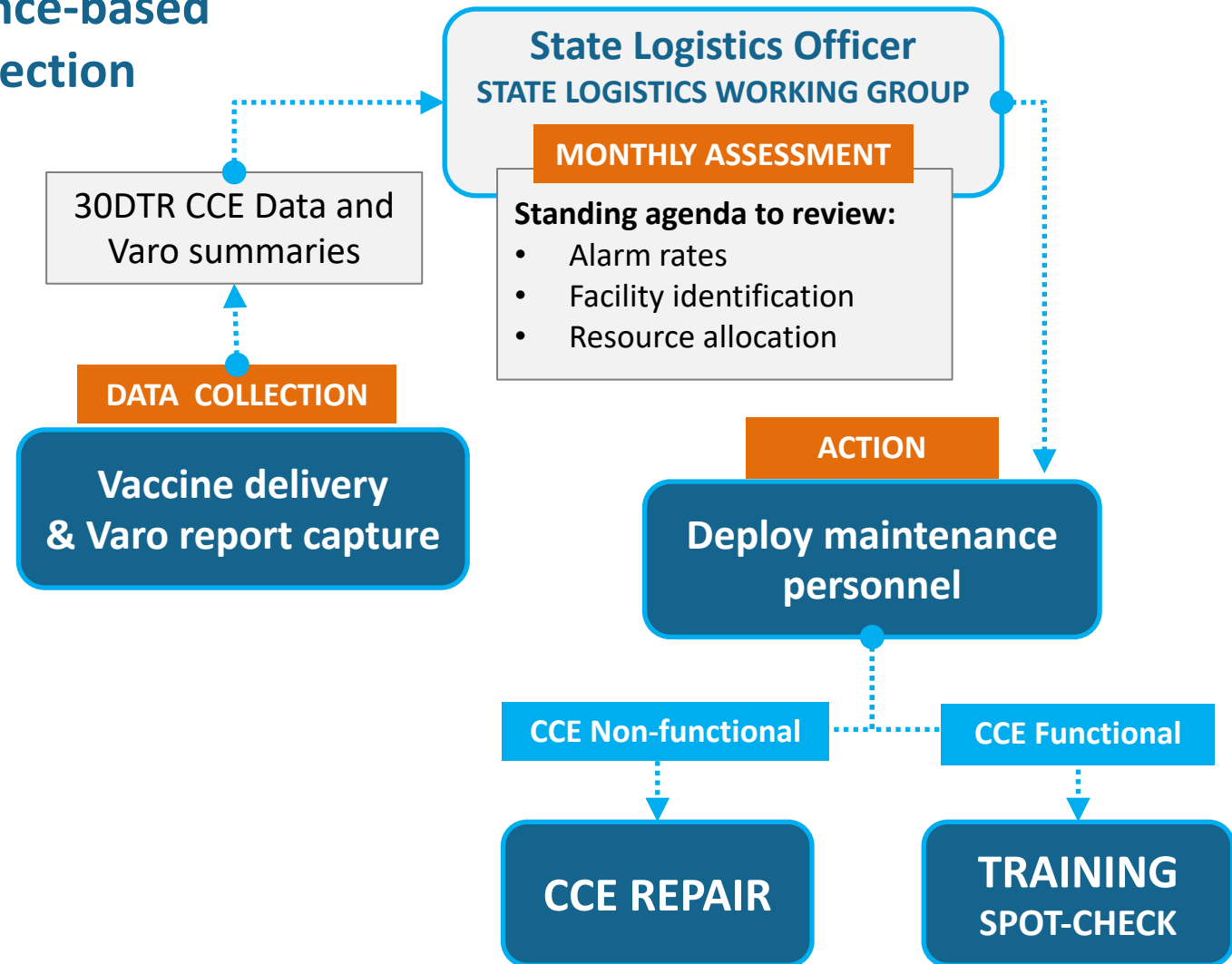
State Logistics Officer
STATE LOGISTICS WORKING GROUP

MONTHLY ASSESSMENT

Standing agenda to review:
- Alarm rates
- Facility identification
- Resource allocation

30DTR CCE Data and Varo summaries

DATA COLLECTION

Vaccine delivery & Varo report capture

ACTION

Deploy maintenance personnel

CCE Non-functional

CCE Functional

CCE REPAIR

TRAINING
SPOT-CHECK

Typical deployment data flow

CCE

CCE temperature loggers

Android app for CCE data capture
+ photos
+ location
+ model/barcodes
+ facility info

EMAIL
Gmail account used for EPI data ownership

Typical deployment data flow

CCE

CCE temperature loggers

Android app for CCE data capture
+ photos
+ location
+ model/barcodes
+ facility info

EMAIL
Gmail account used for EPI data ownership

VARO REPORT - TEMPERATURE ALARM
VARO REPORT - NO ALARMS
VARO REPORT - NO ALARMS

POGO LT

.pdf .xlsx

Free Windows app for automated aggregation of Varo reports (www.pogo-lt.org)
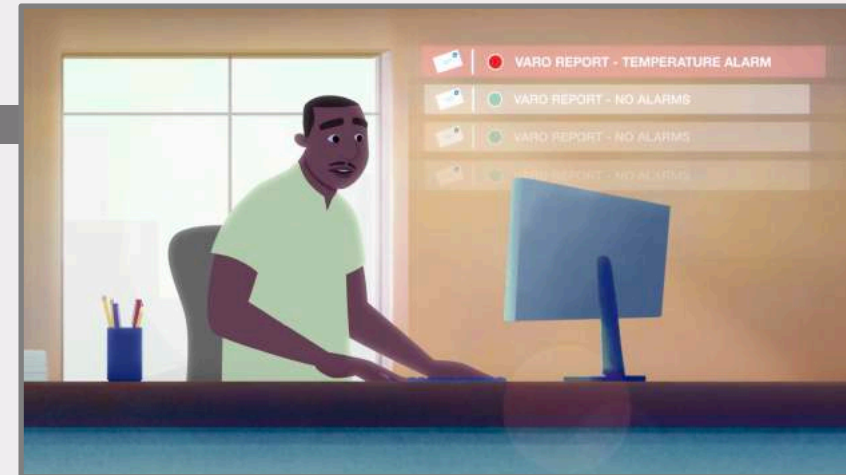
Pogo LT converts bulk-captured Varo reports into aggregated summaries
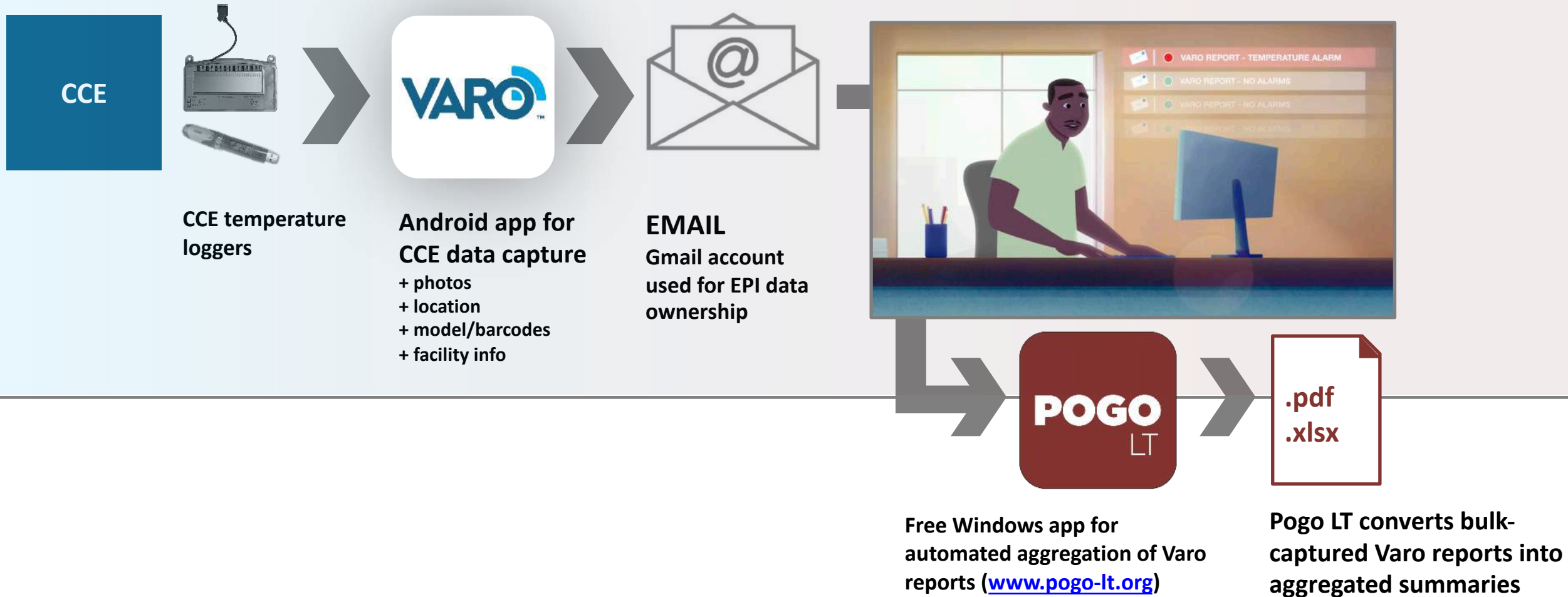
Easily transmit cold chain temperature reports to any inbox

Varo is a simple and free smartphone app that collects and forwards useful cold chain information to the inbox of your choice.

- **Captures temperature data from 30DTR loggers**
- **Matches alarms with photos, location and other information**
- **Transmits standardized reports that can be aggregated**
- **Has been implemented successfully by EPI programs in multiple countries**

Create the connection with Varo.

www.varo-app.org

Further inquiries: datatools@nhgh.org

Background

- Thermometers were the gold standard for recording/monitoring temperatures of CCE
- Later shifted to Fridge and freeze tags
- Both require physical visit to HFs
- Studies showed 40% - 50% of HFs store vaccines beyond the recommended temp *(Makuru M, 2012; Sia Ringo et.al, 2017)*
- Temp Monitoring Study (2014), of 40 shipments, indicated 36% exposed to freezing and 85% exposed to high temperatures.

- Tanzania started implementing the RTM system since 2014 at the central, regional and some district stores using Beyond Wireless devices.

- Health facilities and in many DVS were still monitored using Fridge-tag and Freeze-tag.

- The MoHCDGEC decided to expand ColdTrace RTM system to the HF's level after good experience of the RTM system at central, regional and district vaccine stores

- Tanzania Government in partnership with JSI and Nexleaf Analytics with support from GAVI, Google.org and ELMA Foundation decided to introduce ColdTrace, a Remote Temperature Monitoring (RTM) solution at the Health Facility level and remaining district vaccine stores (DVS) in the country in August 2017

- The aim was to improve Cold Chain Performance and hence ensure vaccine safety and potency at all levels of the supply chain

Overview: Visibility along the Vaccine Cold Chain
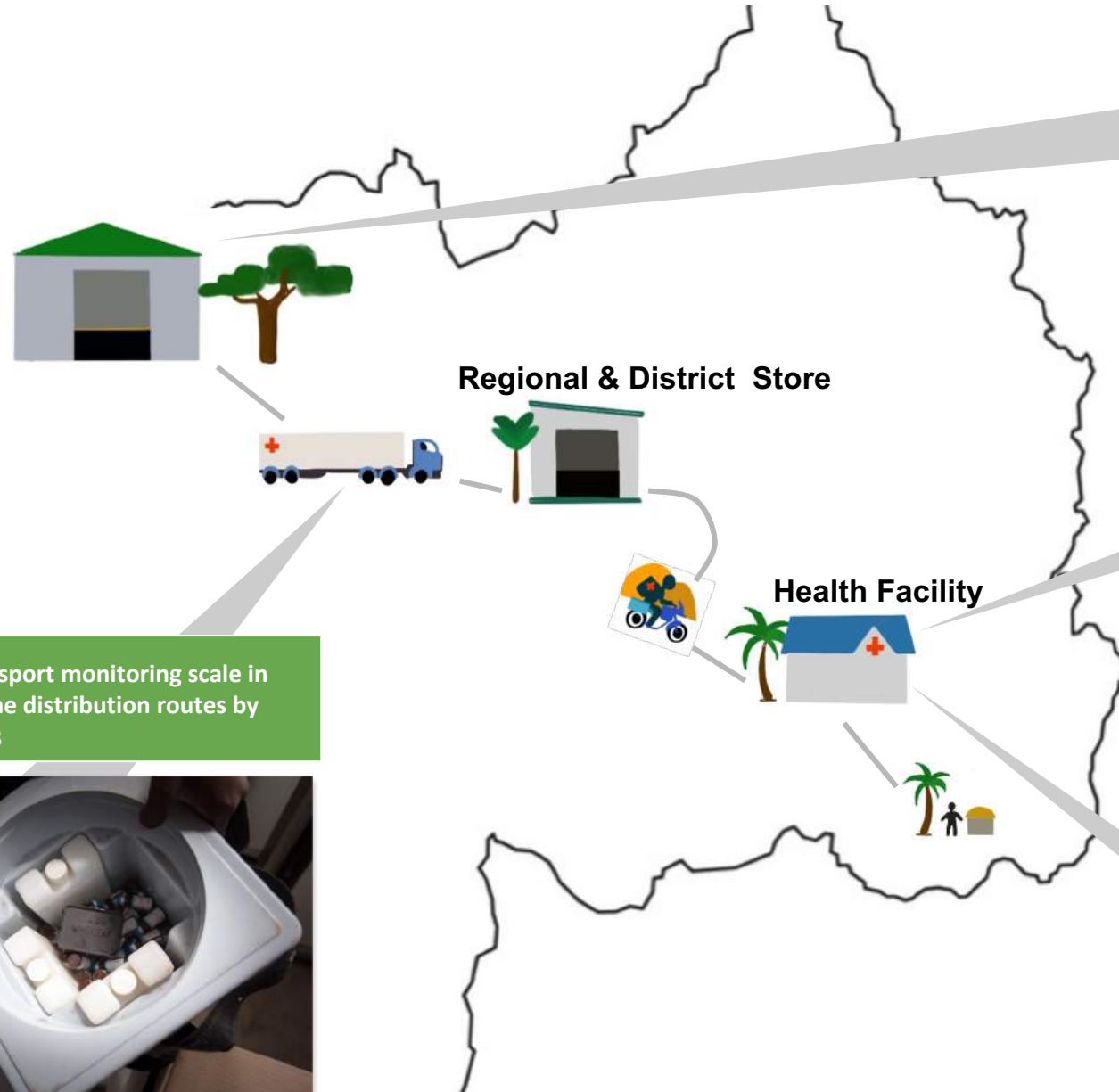
Integration of RTM dashboard into LMIS system (VIMs)

RTM Scale across all immunization sites (~5,000) at district and health facilities by end of 2021

Regional & District Store

Transport monitoring scale in all the distribution routes by 2023

Health Facility

Maintenance data collection, and data for decision making

RTM for Emergency Response Planning: COVID-19

Real-time cold chain performance data across the country can help the Ministry to:

- Identify the strong and weak cold chain links throughout the country for effective delivery of emergency vaccination

- Use the strongest cold chain links as a robust network for covid-19 vaccine distribution
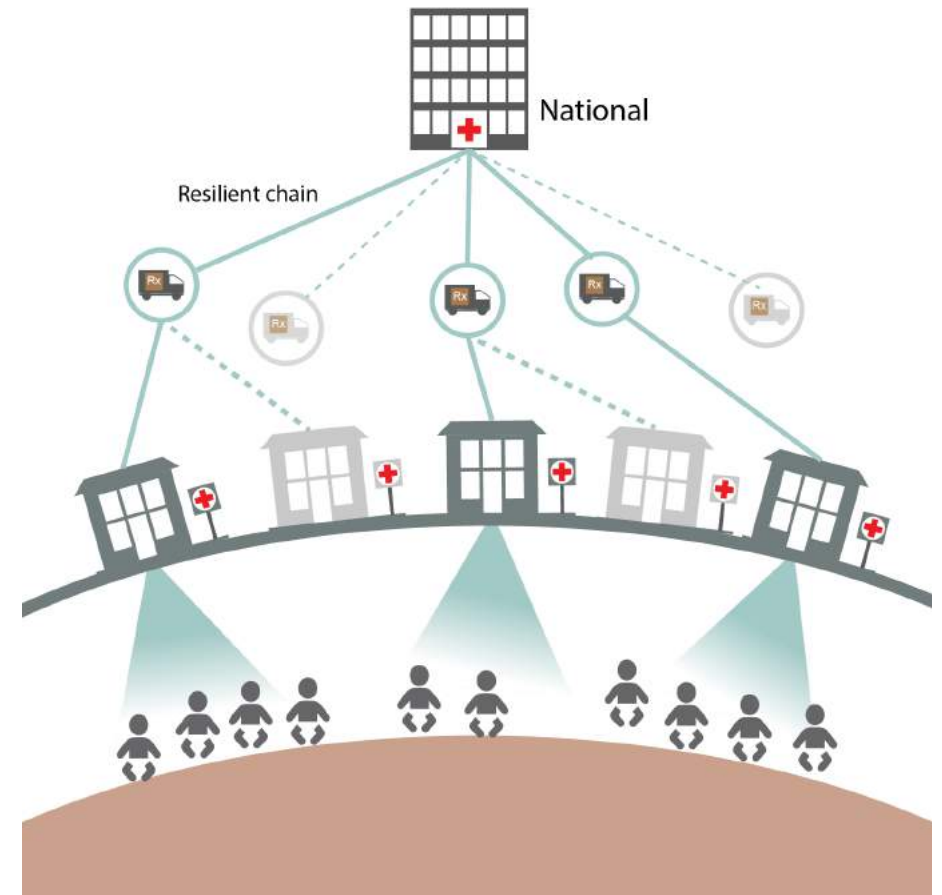
ROLL OUT OF RTM DEVICES IN TANZANIA

Implemented Divided in Three Phases

- Phase 1 with 2000 RTM Devices installed in 7 Regions across all levels i.e RVS, DVS, and HF's with good network coverage (Completed)

- Phase 2 with 3000 RTM Devices to be installed in 13 regions, prioritizing bordering region (Oct 2020-Apr 2021)

- Phase 3 has ~ 1500 RTM procured directly by the Government to cover the rest of the regions (future)
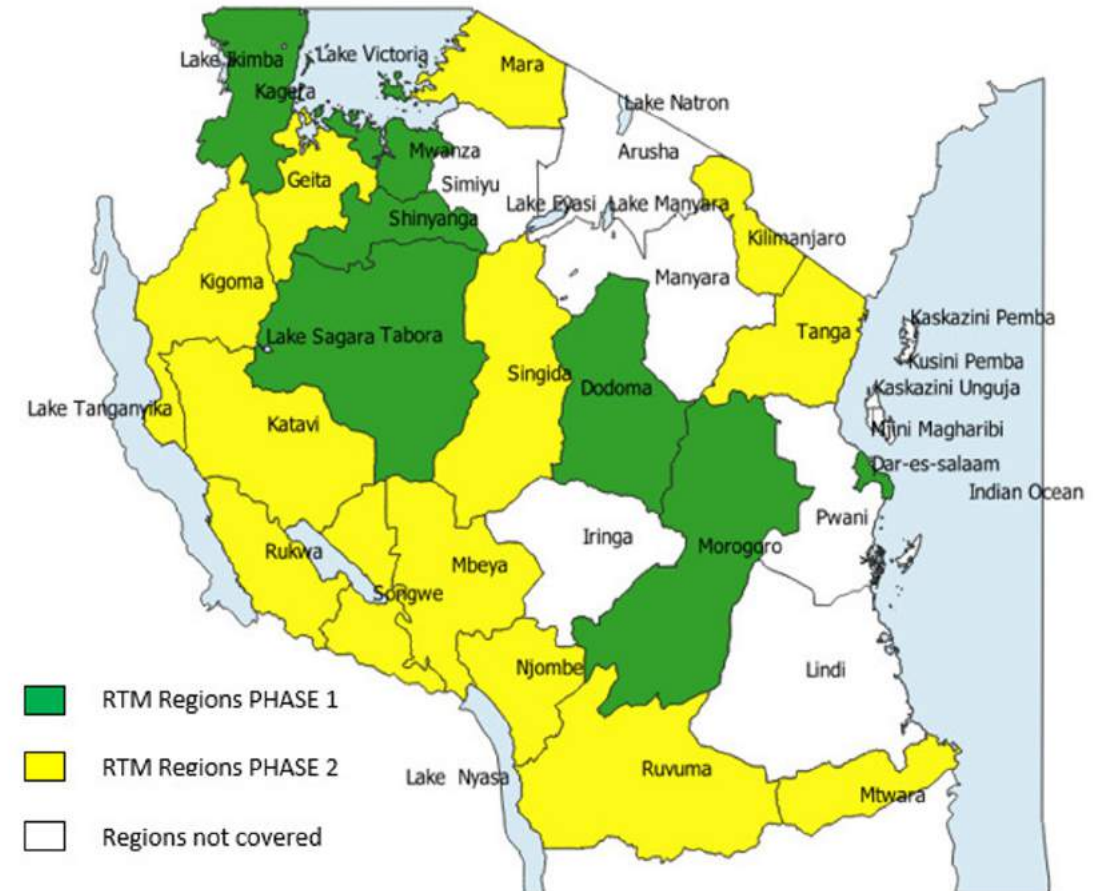
Critical Use Case: SMS Alerts for Nurses

SMS ALERT: Temp is -2°C!

Vaccines kept too COLD for 7 hours, in danger of freezing.

Refrigerator Calls for Help

How RTM Works for Vaccines

Periodic PDF Reports

Escalated Alerts + Summary

SMS

National MOH

District/Provincial Ministry of Health

Health Facility Staff
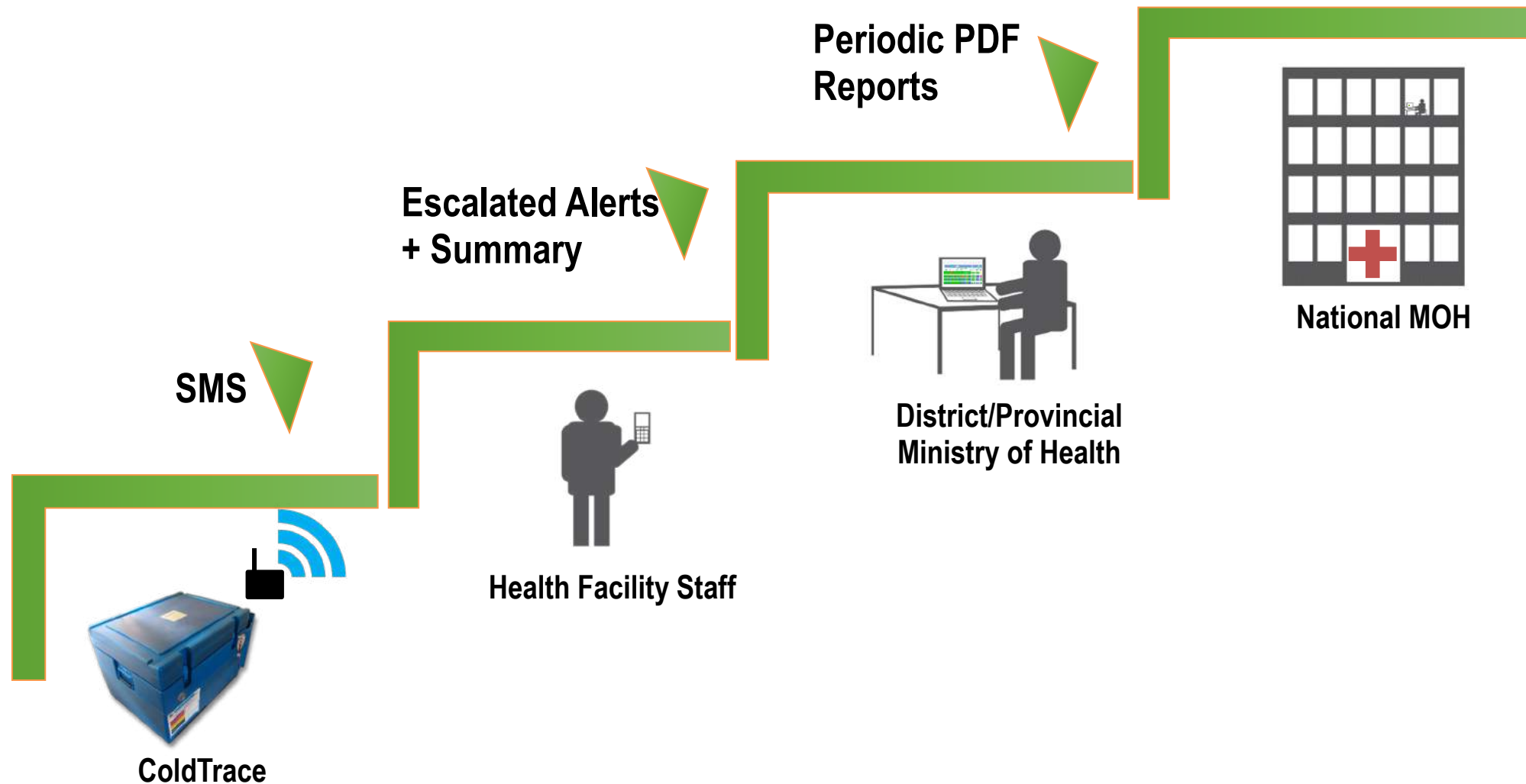
ColdTrace

Integration of ColdTrace Dashboard with VIMS

- Cold Chain data from ColdTrace Dashboard has been integrated into VIMS, Tanzania's LMIS system
- **RTM** system **detects CCE** with **issues** and **flags** them **within VIMS**.
- This integrated system notifies stakeholders about **immediate outages** in cold chain equipment, allowing **for rapid detection and resolution** of any issues.
- With VIMS, logisticians can **plan stock supply**, as well as **assess the state** of the overall cold chain equipment functionality.

Benefits of Data Integration

Overall improvement on reporting completeness from 76% to 95%
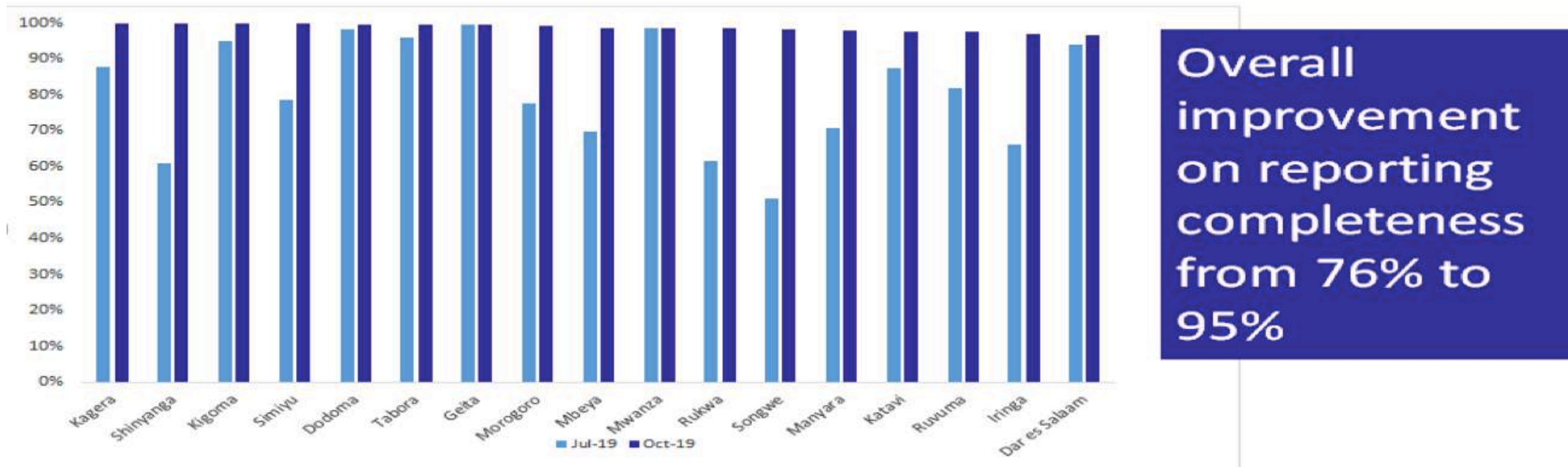
- Integrating the two data systems (RTM and VIMS) has forced the improvement of data quality in VIMS, leading to improved completeness of reports over time
- Constant follow up with the Regions and Councils has improved CCE data in VIMS

# HOW RTM DATA LEADS TO ACTION & CCE PERFORMANCE IMPROVEMENT

Improved Uptime from Jan-Sep 2020

- Improved performance of uptime since the start of the year 2020 to date, such that improved time of all CCE operating at optimal temperature
- This has been contributed by actions taken by individuals and management at all levels to ensure vaccine are stored at recommended temperature
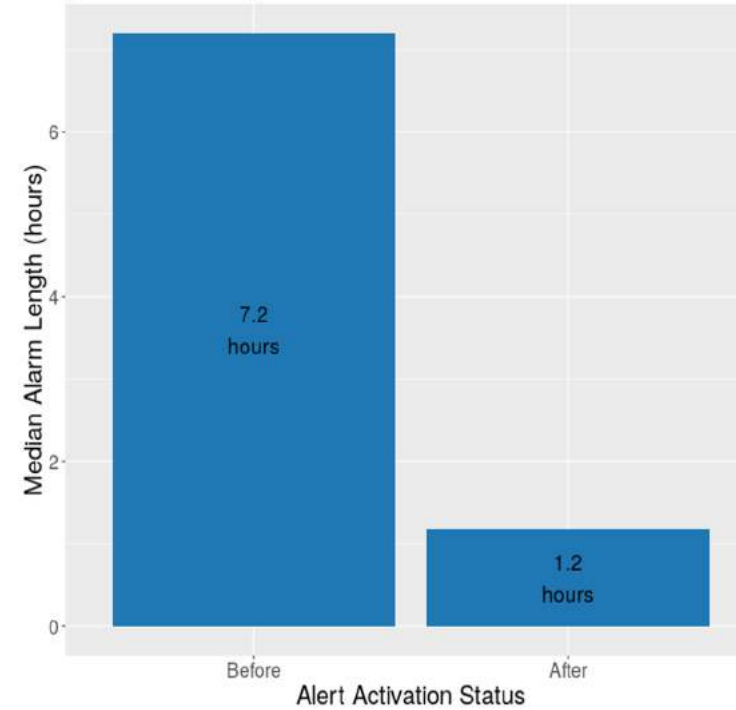

Tanzania: 2020 - Temperature Distribution
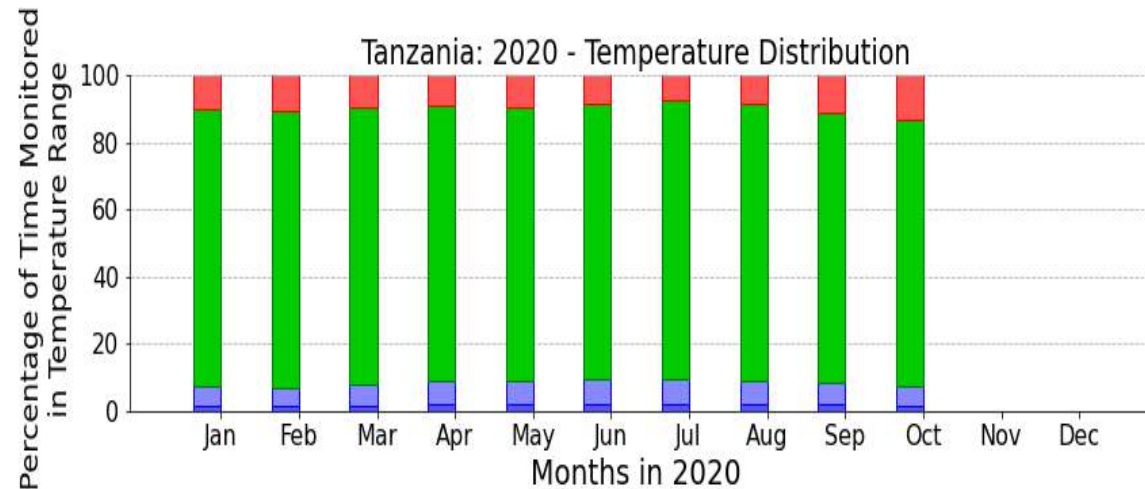
Actions has led to Reduced Freezing
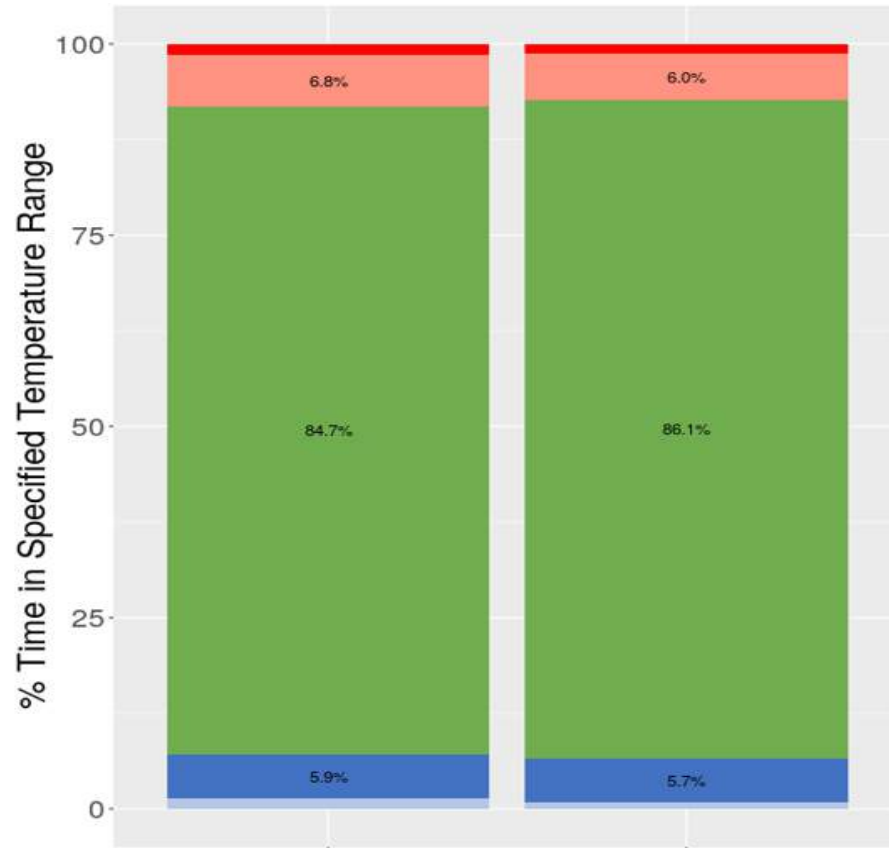
Uptime before and after the alerts were activated increased,

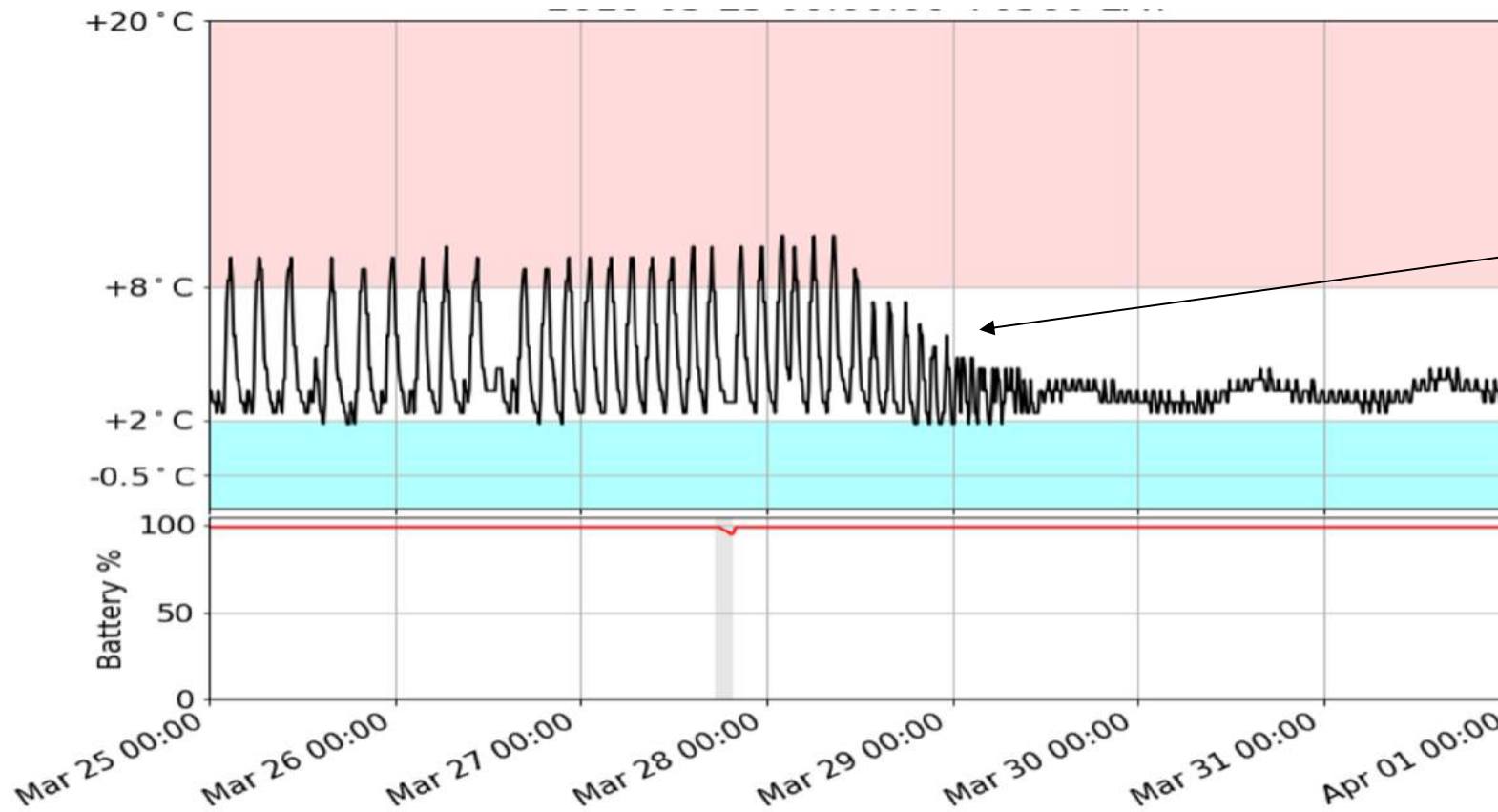Overall 84% less freezing after baseline and alert system activation.

Contributing Factors to the Improved Uptime

- Remote support by managers to the HF's

- On job training during supervision

- Repair and maintenance of the CCE's

- Availability of spare parts to non-CCEOP equipment

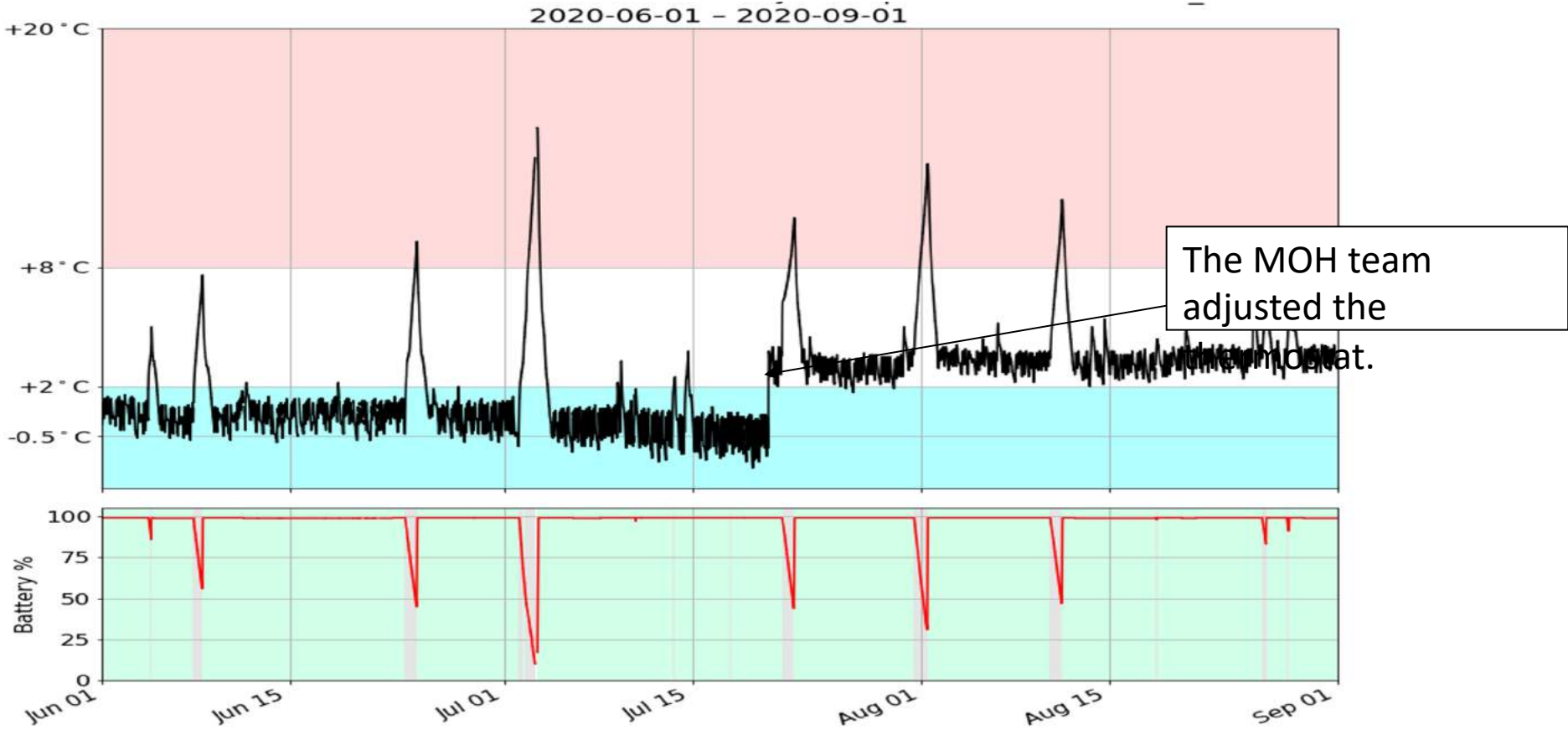- Good response of the management at all levels
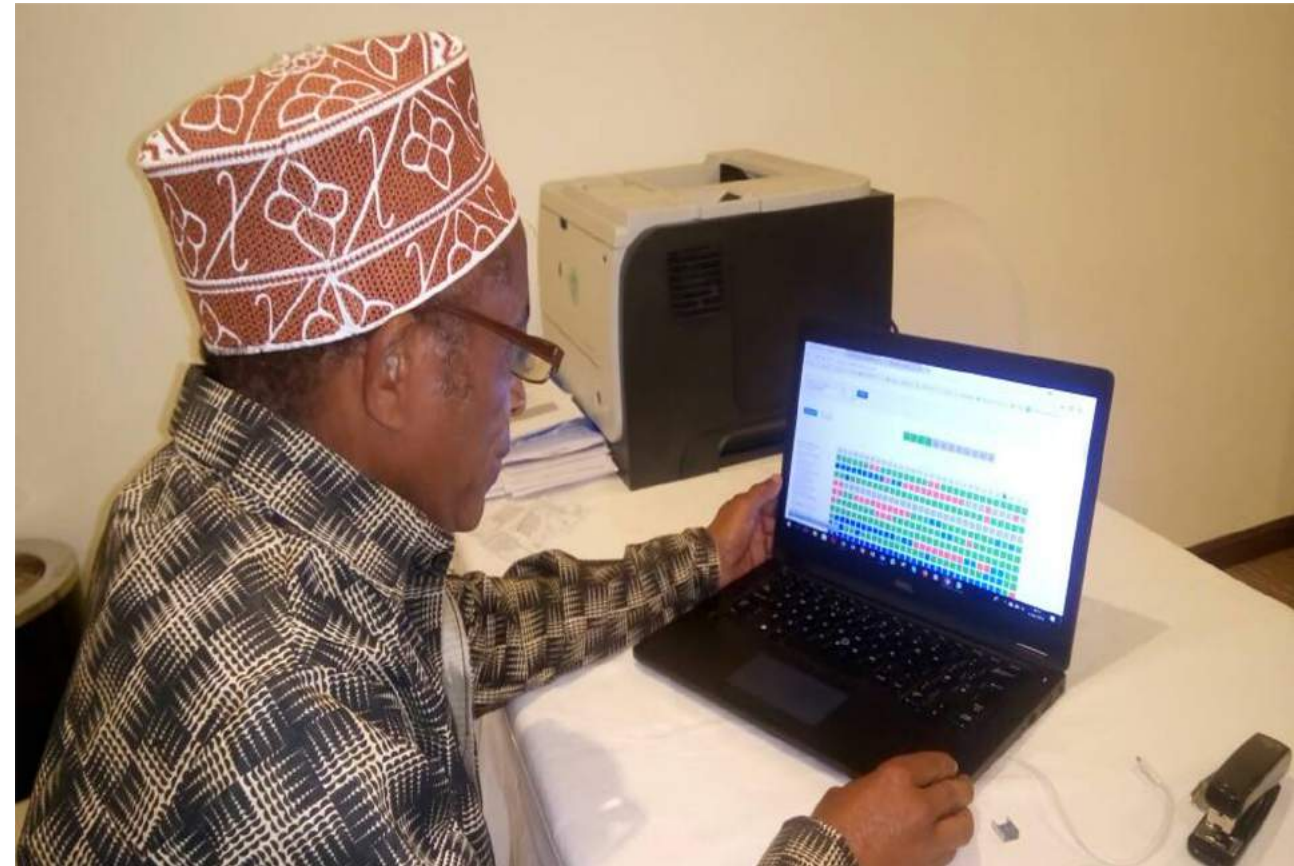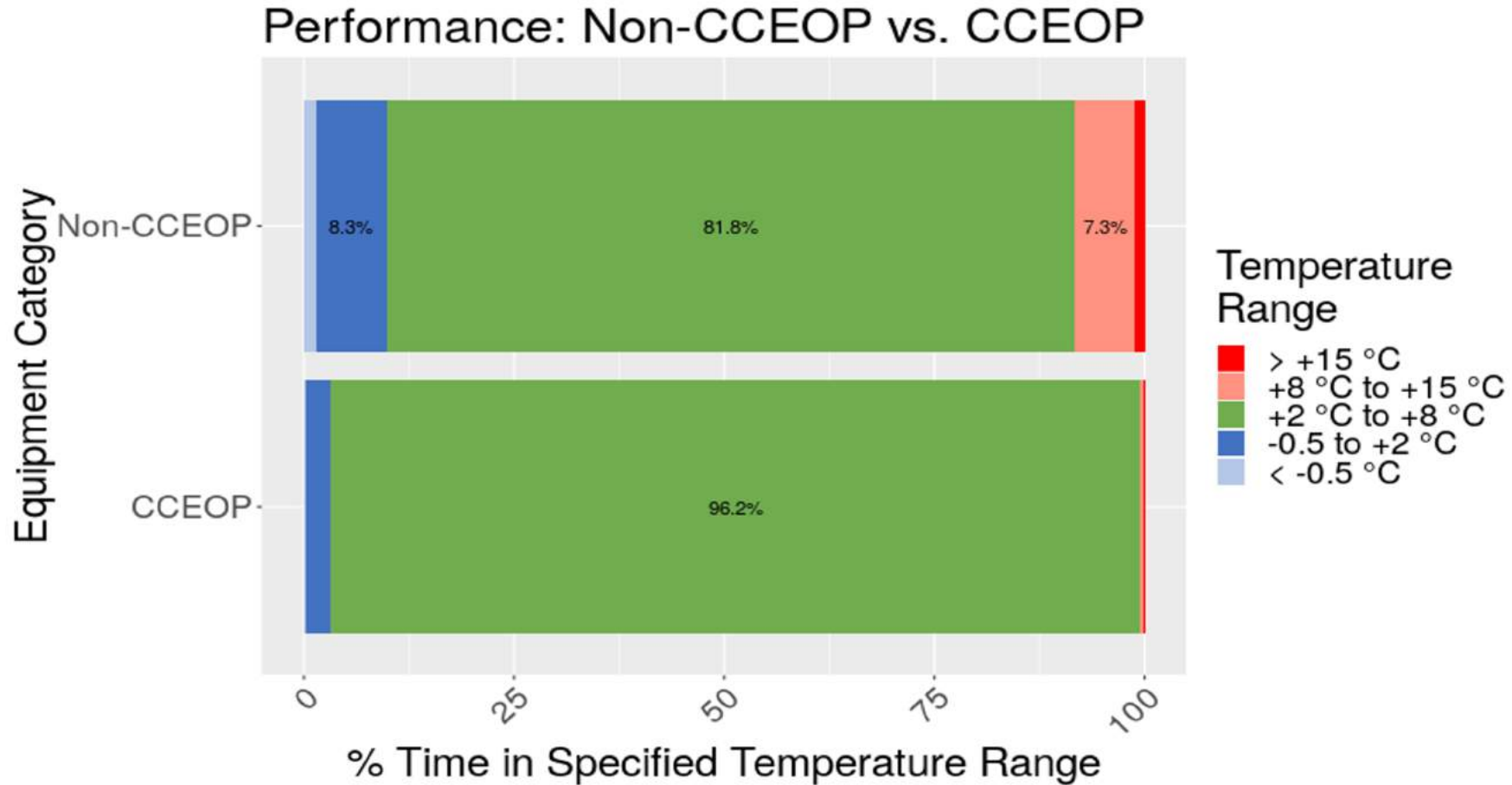
Examples of Data for Action

DIVO intervention through the district medical officer and national CCE technician.
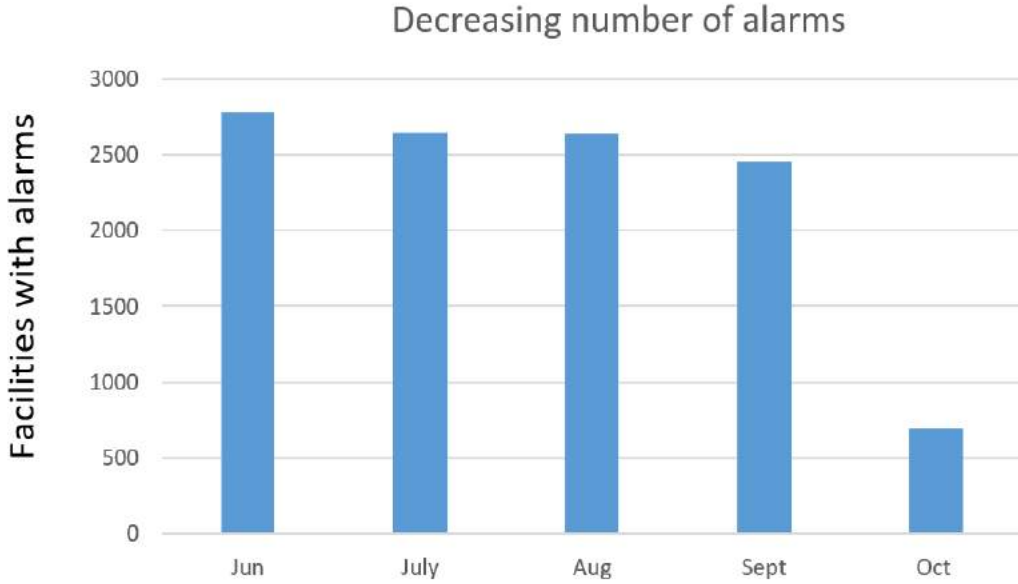
Examples of Data for Action

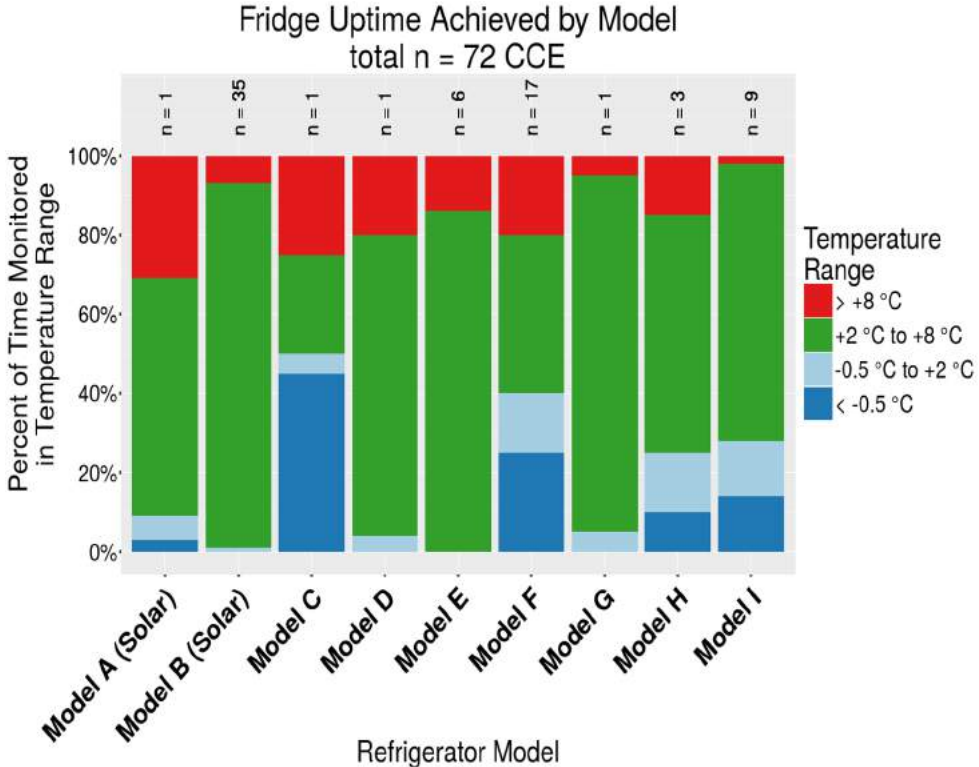

2020-06-01 – 2020-09-01

The MOH team adjusted the thermostat.

RTM for Continuous Monitoring of CCEOP Equipment

Performance: Non-CCEOP vs. CCEOP

Supporting MOHs: Data-driven Planning and Budgeting

Fridge Uptime Achieved by Model
total n = 72 CCE

Decreasing number of alarms

Note: Anonymized data

RTM is not just about the Technology

People:

- Stronger communication and alignment among different MOH personnel since data can guide the priorities

- Faster and targeted response to cold chain failures

Processes

- RTM can strengthen daily SOPs and strategic planning processes

- Data can guide immunization meetings (e.g. LWG, HSS) at the country for cold chain planning and budgeting
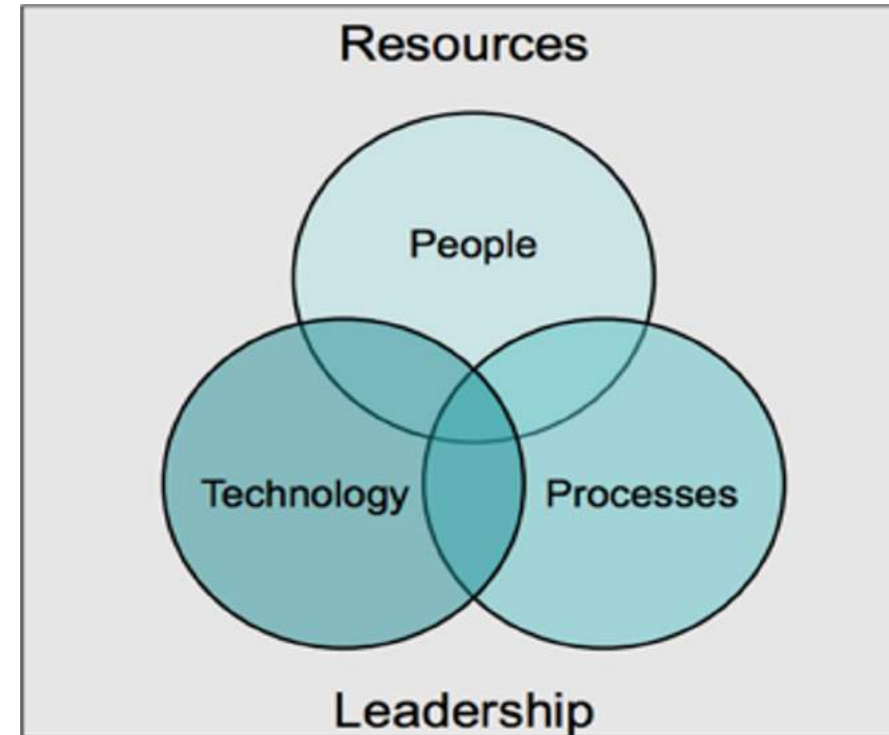
LESSONS LEARNED

Challenges

RTM and Integration Challenges

- Network
  - Some devices were removed due to network coverage being very low
  - Failure to operate of Mobile towers due to inaccessibility to provide supplies especially during rain season
  - Some devices are not sending data because of weak internet connection
- Failure of the RTMD sensors
- Staff turn over
- Integration with VIMS: having exact same serial numbers of CCE to track in both systems complicates the integration process

CCE Challenges

- Inadequate supply of CCE spare parts
  - Untimely repair of the failed CCE due to shortage of spare parts
  - Greater visibility into CCE performance demands more response to maintenance issues
- Lack of CCE data review forums
  - There is no CCE review forums at regional and district levels where most of the decisions needs to be taken
- Staff turn over: New healthcare workers without cold chain management orientation
- Unreliable power and lack of stabilizers

Lessons Learned

- Strong leadership at all levels is vital to support follow up of CCE performance reports by the RTMDs

- Establishment of feedback mechanisms to motivate and sustain CCE data visibility and action for decision making at all levels (.e Technical Support Unit)

- Having financing/budgeting mechanisms for preventive, repair and maintenance is important if RTM is to succeed.

- Continuous monitoring and on-job learning systems on CCE by health staff and technicians is helpful to data use culture manufacturing.

- Constant institutionalization of a data use to facilitate decision making guided by data provided for by RTMD.

Vision for 2021 and Beyond

- **Real time cold chain performance** data from ~ 6000 immunization sites and all the distribution routes

- Goal is to have 90% of CCE with at least 90% uptime.

- Full data integration into VIMS & real-time synchronization of updates

- **Ownership and Sustainability by 2021:** Training, maintenance and operational RTM costs integrated into 5-year government budget

- Improved process for spare parts forecasting and procurement

- **Establishment of RTM Technical Support Unit:** This is a group of cold chain practitioners with a focus on overall spearheading of RTM success of in the country

Thank You Very Much
Asante Sana