

# Remote Temperature Monitoring

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RESULTS OF A RANDOMIZED CONTROLLED TRIAL  
IN MOZAMBIQUE

# Mozambique context: cold chain monitoring

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- Standard SOPs require twice daily thermometer recording:
  - Adherence is not reliable
  - Little data collection or analysis
  - Twice daily thermometer recording presents many opportunities for missing excursions; could lead to potency issues
- Maintenance practices are weak:
  - Weak maintenance plans in place
  - Lack of spare parts
  - Multiple CCE in one province complicates the skill set necessary for preventive and corrective maintenance
- EVM identified recommendations related to the cold chain:
  - Temperature monitoring devices for cold rooms and freezer rooms
  - Standard record keeping and filing system established for the vaccine storage temperature record and review process
  - Establish a maintenance recording system for CCE
  - Create SOPs for planned preventive maintenance and training on user and technical level preventive maintenance training

# Unique opportunity to study improved temperature monitoring approaches

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- Possibility of new remote temperature monitoring device: ColdTrace developed by Nexleaf.
- Responding to a call from global partners such as WHO and UNICEF for evidence for improved decision making on cold chain temperature monitoring approaches.
- Using a randomized control trial design, health facilities were randomized into three groups controlling for the age of the refrigerators and distance of the facility from the provincial Ministry of Health (MOH).
- Research protocol designed with contributions by international experts in cold chain (Nexleaf, UNICEF, VillageReach)
- Implementation partner to ensure deployment of devices, training, and on-going support (VillageReach, MOH and Provincial Directorates of Health)

# Randomized trial conducted to compare different monitoring approaches



**TIMELINE:**  
August 2014  
– May 2015

**Group 1:**  
**ColdTrace (RTM)**  
29 clinics



**SMS and Escalated Alerts; Monthly PDF Reports**  
Training provided

**Group 2:**  
**Fridge Tag**  
28 clinics



**Visual Alert**  
Training provided

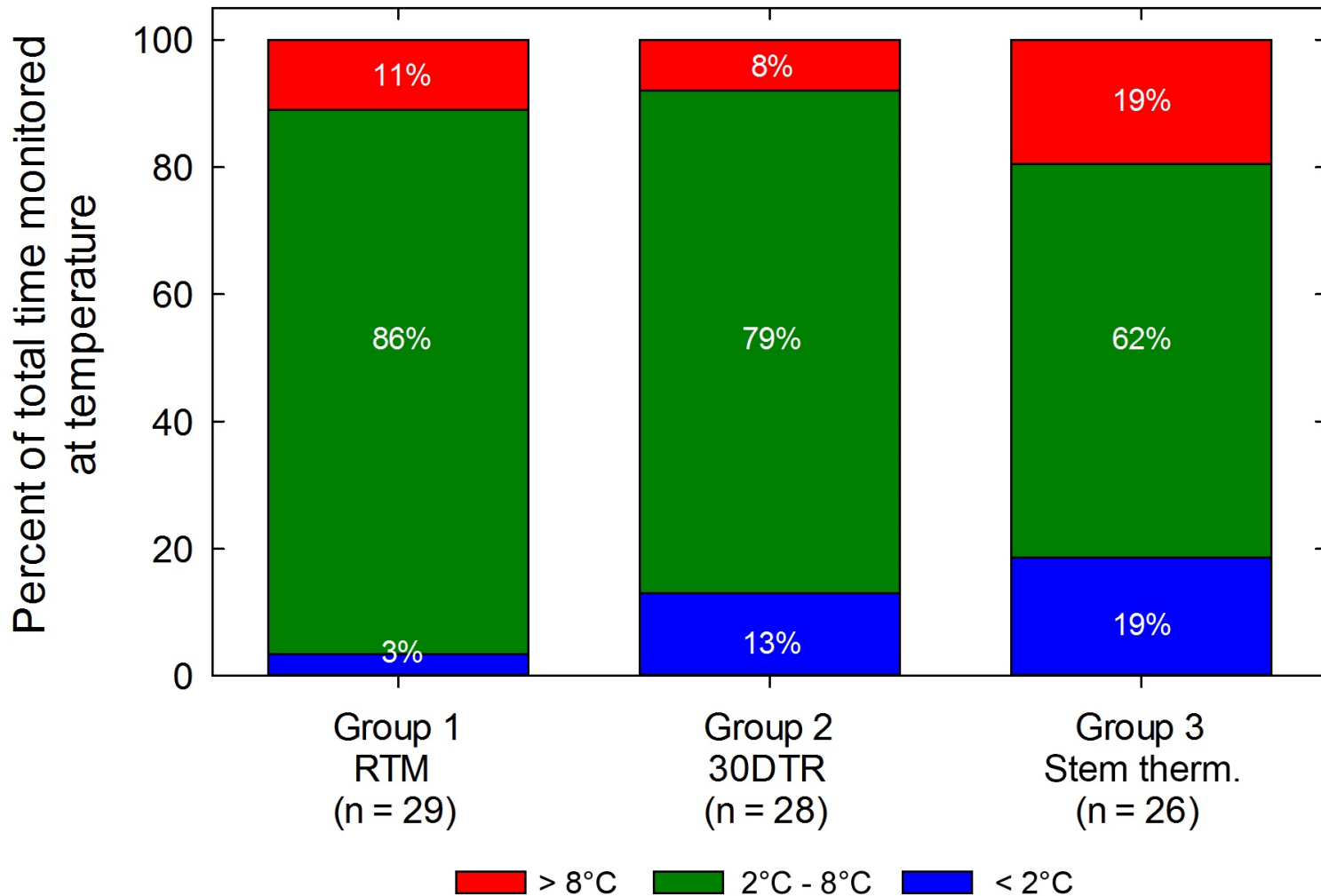
**Group 3: Stem Thermometers**  
26 clinics



**Stem Thermometer**  
Status quo with twice-a-day Temp. readings

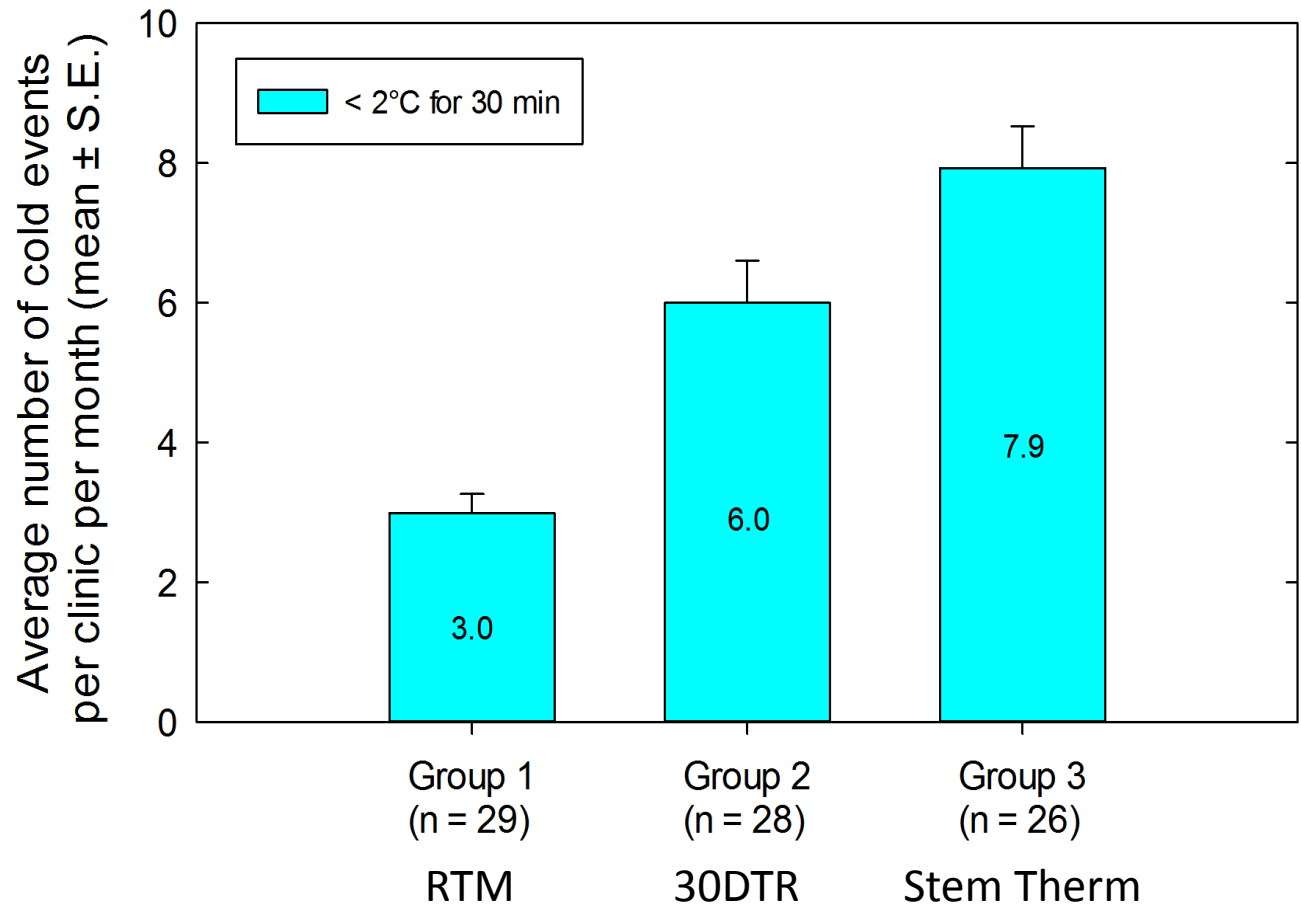
Data Collection for Analysis: ColdTrace devices were installed in all facilities across 3 groups to collect continuous temperature and power data for comparison purposes.

# Results show improved fridge uptime with RTM



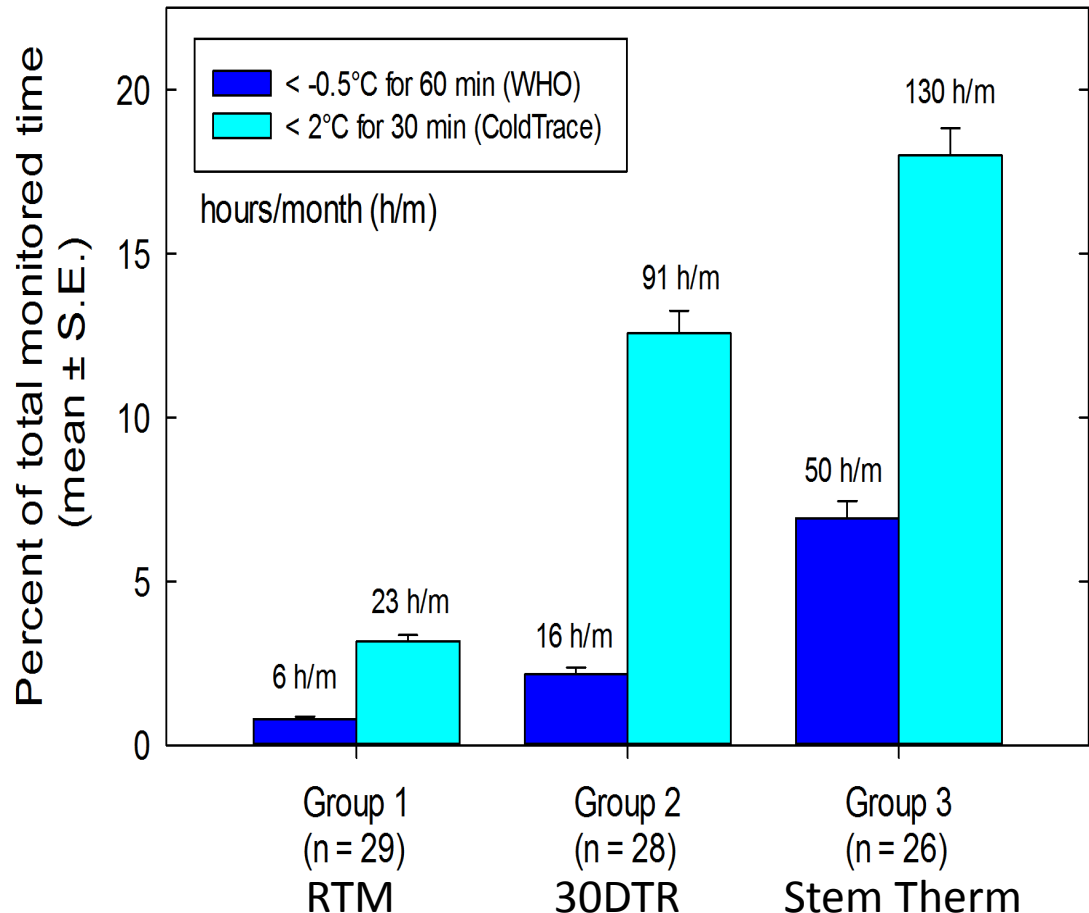
# Clinics with RTM had fewer cold excursions than other approaches

- 50% fewer cold excursions than 30DTR
- 62% fewer than Stem Thermometer



# Clinics with RTM had reduced duration of excursions

- Reduced total **duration of cold alarms** by 75% compared to 30DTR and 82% compared to Stem Thermometer
- Reduced total **duration of freezing alarms** by 63% compared to 30DTR and 88% compared to Stem Thermometer



# Actions taken to reduce excursion frequency and duration



ColdTrace



Health Facility



Maintenance



Provincial MOH

## Health Facility staff:

- Defrosted the fridge
- Adjusted the thermostat
- Switched to propane in case of power-outage
- Called managers to report issues
- Performed shake test upon freezing exposure
- Came to clinic or called the clinic clerk during the weekend in case of temperature excursions or power outage

## Technicians:

- Was able to do a preliminary diagnosis of issues the fridges were facing before visiting the clinic.
- Tracked the performance of fridges in the districts by looking at the temperature data on dashboard

## District/Provincial Managers:

- Followed up with clinics with faulty fridges
- Informed the technician about the issues in the field so they can follow up with clinics on the phone or to visit the clinics
- Turned on the generator in case of power outage at provincial store



# RTM and SMS lead to immediate response from health workers to solve the issue

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“It was only when I received the SMS alert that I realized the fridge was unplugged accidentally when the clinic was being painted and I could correct the problem.”

Health  
Facility

“Before, there was lack of information about the fridges. Now, there are some improvements as I get information about any problem that occurs inside the fridge; it facilitates a quicker intervention in equipment giving us a preliminary diagnosis.”

Maintenance  
Technician

“While in the field on distribution, the EPI personnel received high temperature alerts due to power outage. They communicated with another colleague in the province to load ice packs into the cold chain, request fuel for the generator and monitor the temperature to prevent loss of vaccines.”

Provincial  
MOH

# RTM brings benefits to the many levels of the system

| RTM empowers.....                      | To.....   |
|--|---|
| Health workers                         | <ul style="list-style-type: none"><li>• Intervene &amp; save vaccine doses</li><li>• Monitor equipment</li><li>• Perform fridge preventive care when needed</li><li>• Gather evidence of problematic equipment</li></ul>        |
| Maintenance staff                      | <ul style="list-style-type: none"><li>• Diagnose problems</li><li>• Troubleshoot equipment malfunctions</li></ul>   |
| District supervisors                   | <ul style="list-style-type: none"><li>• Work with clinics to move or evaluate vaccines as needed to ensure efficacy</li><li>• Work with maintenance staff to document and submit proposals for spare parts</li></ul>            |
| National & provincial decision makers  | <ul style="list-style-type: none"><li>• Monitor cold chain equipment inventory</li><li>• Safeguard large stores of vaccine doses</li><li>• Procure new equipment based on actual need &amp; performance on the ground</li></ul> |
| Government, ministries, & stakeholders | <ul style="list-style-type: none"><li>• Track power outages &amp; identify clinics in need of solar options</li><li>• Monitor equipment performance by model</li><li>• Allocate resources effectively</li></ul>                 |

# MOH and Provincial Directorates of Health see the benefits of RTM

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- We infer that lower freezing duration observed in Group 1 health facilities could be because health facility staff and supervisors in Group 1 were informed about temperature excursions through SMS and escalated alerts in real-time and therefore had the opportunity to take prompt actions and inform technicians when needed.
- The RTC design of the evaluation allows the government to make better informed decisions about the performance and benefits of different temperature monitoring practices and technologies.

# MOH and Provincial Directorates of Health see the benefits of RTM

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- RTM is a tool that improves fridge uptime by empowering health workers and managers to take immediate action to overcome an issue in order to avoid spoiled vaccines
- Reduces burden on health workers by providing a second set of eyes on the cold chain
- Estimated cost of ownership is ~\$208/year for each of three years utility, cheaper than the estimated value of \$226 worth of freeze sensitive vaccines at a health facility in each given month.

# Considerations for future deployments

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- Benefits justify the costs; do they justify these costs at national scale?
- In case of budgetary constraints, how does one determine priority areas for deployment?
- Can existing IT staff in the provincial government be used to support RTM?
- How can the case be made for including financial support for these types of systems in national budgets?
- Are there ways to reduce the on-going costs of SMS and data through Corporate Social Responsibility or better negotiated contracts for the SIM cards?



Thank you