

EVALUATING THE BENEFITS AND COSTS OF REMOTE TEMPERATURE MONITORING: EVIDENCE FROM MOZAMBIQUE

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Background

Current protocol for using thermometers twice-a-day to monitor and record vaccine refrigerator temperatures often fails to detect and ensure proper reporting of excursions above or below the recommended 2°C to 8°C range for vaccine storage.

Hypothesis

By using short-message service (SMS) technology to alert health facility staff about temperature excursions and escalate unresolved issues to supervisors, the **remote temperature monitoring (RTM)** device, ColdTrace, can help facility staff to promptly address problems and better protect vaccine potency.

Although our evaluations remain ongoing, findings communicated here reflect work conducted from August 2014 to April 2015.

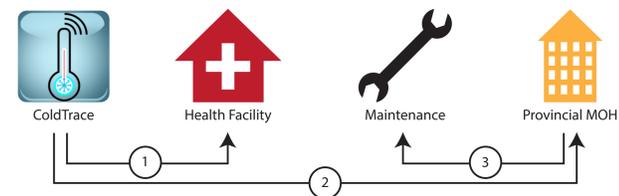
Evaluation design

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).

- **Group 1** included 29 health facilities using RTM + SMS alerts (Staff trained on ColdTrace usage).
- **Group 2** included 28 health facilities using 30-day temperature recorders (30DTRs) with visual alerts; staff trained on usage.
- **Group 3** included 26 health facilities with stem thermometers (this is the status quo with twice-a-day temperature readings).

To inform comparisons, continuous temperature and power data were collected and transmitted remotely from all participating health facilities using RTM devices. We also calculated the total cost of ownership (TCO) for the RTM ColdTrace device and collected qualitative data through informal interviews with health facility and MOH staff.

Figure 1: Role of SMS alerts in Group 1.



1. ColdTrace SMS alerts are sent to health facility staff when refrigerator temperature is less than 2°C for 30 minutes or more than 8°C for 5 hours.
2. Escalated SMS alerts are sent to supervisors when refrigerator temperature is less than 2°C for 60 minutes or more than 8°C for 10 hours.
3. Technician is informed of faulty refrigerators and visits health facility to address the issues promptly.

Results

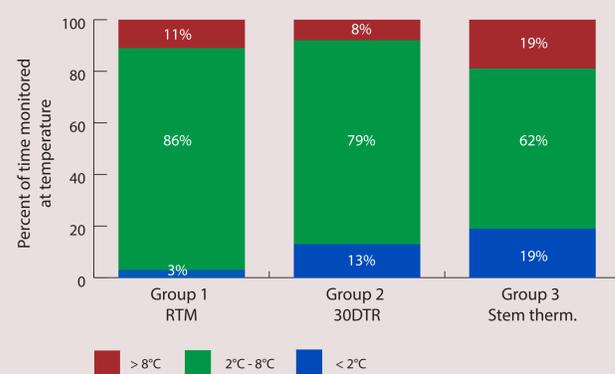
All temperate data presented in these results have been collected by a RTM device placed in each health facility, including at facilities in Groups 2 and 3.

Key outcomes

63%-88%
Reduction in Cold and Freezing Duration

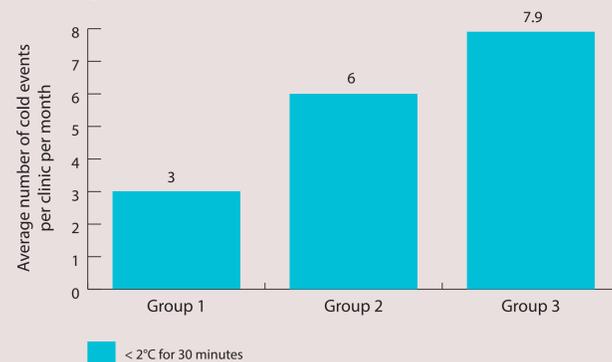
RTM reduced cold and freezing alarm duration by 63%-88% compared to 30DTR and stem thermometers

Figure 2: Fridge uptime achieved in each group.



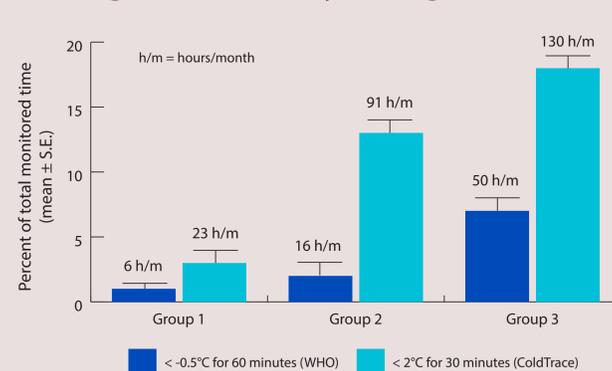
Facilities in Group 1 (RTM + SMS) achieved an average uptime of 86%, while those in Group 2 (30DTR) and those in Group 3 (stem thermometers) achieved average uptimes of 79% and 62% respectively.

Figure 3: Average number of cold events per clinic per month.



Facilities in Group 1 (RTM + SMS) had 50% fewer cold excursions than those in Group 2 (30DTR) and 62% fewer than those in Group 3 (stem thermometers) (p<0.02).

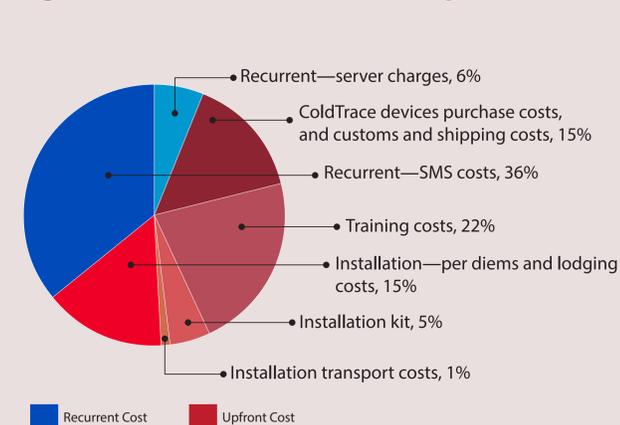
Figure 4: Total monthly duration of cold and freezing alarms (facility average).



The RTM in Group 1 reduced total duration of cold alarms by 75% compared to Group 2 (30DTR) and by 82% compared to Group 3 (stem thermometers) (p<0.02).

The RTM in Group 1 reduced total duration of freezing alarms by 63% compared to Group 2 (30DTR) and by 88% compared to Group 3 (stem thermometers) (Group 3 only p<0.05).

Figure 5: Total cost of ownership of RTM.*



* Costs for RTM annualized over three years; does not include cold chain equipment maintenance and repairs costs.

- Annualized RTM costs per health facility are \$US208.
- A health facility serving an annual target population of 250 children stores approximately \$226 worth of freeze-sensitive vaccines each month.
- Therefore, for this size of a health facility, the value of vaccines that could be damaged by one freezing incident in a given month is more than the annual costs of RTM.

Figure 6: Qualitative feedback on the value of RTM + SMS.

nurse "Before I received a SMS alert, I realized the fridge was unplugged accidentally when clinic was being pointed so I corrected the problem."

technician "Before, there was lack of information about 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."

MOH "While on field distribution, we received high temperature alerts due to power outage. We communicated with another colleague in province to load ice packs into the fridge, to request fuel for the generator, and to monitor temperature to prevent loss of vaccines."

Conclusion

Lower freezing duration was observed in Group 1 health facilities, this 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.