EVIDENCE BRIEF

World Health Organization unicef

Perception of health workers on the use of remote temperature monitoring systems

The ability to monitor vaccines for optimal temperatures throughout the supply chain is a cornerstone of successful immunization programmes. As stated in the WHO Vaccine Management Handbook, *in "How to monitor temperatures in the vaccine supply chain" [1]], it is considered best practice to use remote temperature monitoring (RTM) systems in primary and subnational stores, where large quantities of vaccines are stored. RTM systems continuously monitor vaccine temperatures; they can trigger alarms when temperatures fluctuate outside the appropriate range and can alert relevant health workers for a faster reaction to prevent damage to vaccines.*

This evidence brief provides supply chain managers in low- and middle-income countries with a summary of how health workers throughout Africa perceive the use of RTM systems in their vaccine cold rooms.

A vaccine cold room from the UNICEF repository
Credit: UNICEF/UNI200117/OMESH MATTA

The need for remote temperature monitoring systems

Effective, well-managed temperature monitoring is essential for ensuring vaccine quality throughout the supply chain and for preventing wastage of vaccines due to heat or freezing. Vaccines stored outside the recommended temperature ranges in primary and subnational cold stores can lead to a loss of vaccine potency and children receiving these vaccines not being immunized.

Today the cost and volume of vaccines in the The Expanded Programme on Immunization (EPI) programmes are increasing and cold rooms store millions of US dollars' worth of vaccines. Compromised temperatures in this equipment can result in vaccines having to be discarded, which leads to children not being vaccinated and significant monetary loss.

Temperature monitoring systems are needed to track the temperature in cold rooms where vaccines are stored.

Previously, cold rooms were equipped with a temperature monitoring system – namely a temperature display and 7-day temperature recorder. Assessments show evidence that the recording system is generally not functional, due to a shortage of ink or paper to record the readings. In cases where problems occur, the system is also not enabled to send an alert for a faster reaction.

The WHO Vaccine Management Handbook [1], and the Effective Vaccine Management initiative [2] which sets standards for safe vaccine handling in the supply chain, recommend RTM as the best option for primary and subnational stores. RTM devices continuously monitor the temperature and can alert on fluctuations out of the recommended range. This allows a more rapid reaction from health workers to prevent damage to vaccines; regular analysis of data collected should inform appropriate action.

Implementation and use

The 'Temperature monitoring - technical resources' area of the TechNet-21 website [3] provides valuable information on RTM implementation and use. RTM systems are programmable electronic temperature and event logger systems with temperature sensors placed in the cold room or freezer room. The sensors are directly linked to a central computer-based monitoring server via wired or wireless connections. All data received and stored on the server are analysed electronically; the system can be configured to produce reports and send alarm notifications.

Clear rules that establish who needs to receive the notification of alarms as primary respondents or supervisors are critical to ensure clear roles and accountability for the most effective use of the RTM system. This is important to ensure a swift reaction by both primary respondents onsite and supervisors and managers who provide support and oversight.

The UNICEF Supply Division Cold Chain Support Package [4] and the WHO Performance, Quality and Safety (PQS) catalogue [5] are reference documents that provide a list of prequalified RTM devices and define the product best suited for specific needs.

Survey results of health workers' perceptions

An online survey conducted in September 2016 sought feedback on the use of RTM devices from health workers throughout Africa. A total of 37 responses were received from respondents in 24 countries. The average time the respondents worked at vaccine cold stores was six years. The results compiled from the responses are summarized in this section.

Reasons for monitoring temperatures

Respondents monitored temperatures in the vaccine cold chain for a variety of reasons: 94% thought that the reason was to rapidly detect exposure of vaccines to heat or freezing temperatures in the cold chain and take corrective actions; 86% thought it was to ensure the cold chain equipment was performing according to the recommended temperature standards; 17% thought it was to provide a lot of data to their supervisor during regular visits; and 17% responded that it was for all of the above reasons.

Experience using RTM devices and types used

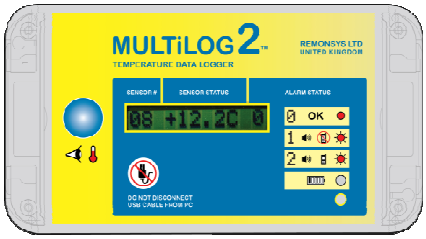
Of the respondents, almost 35% did not have a continuous temperature monitoring system as recommended for cold rooms at the time of the survey. Some 17% of respondents had experienced vaccines that had to be discarded due to freezing. Of those who discarded vaccine due to freezing, 100% had completed a shake test (used to determine whether vaccine has been frozen); 83% reported that an RTM device was used to detect the freezing event.

It appears from the survey that two major types of RTM devices are used in cold rooms in Africa: the devices from Beyond Wireless Technology Ltd (48% of respondents) and the Multilog devices from Remonsys Ltd (43% of respondents). A further 9% of respondents use other types of RTM devices.

Types of devices used

FIGURE 1.

RTM device from Beyond Wireless Technology



Multilog 2 TM temperature data logger from Remonsys Ltd

Training and ease of use

Among respondents using RTM devices in their cold rooms, nearly 68% reported being trained to use such devices and 32% were not trained. The majority (93%) of respondents who were trained participated in onsite training and 7% attended a training workshop.

All respondents using RTM devices who had been trained (68%) did not consider the RTM device difficult to use. Nearly all (95%) appreciated that RTM devices were able to direct alarms to accountable parties; however, 70% felt comfortable reacting immediately to an alarm from the device. Some difficulties were reported; these included (i) insufficient training that did not include troubleshooting, (ii) difficulty in finding a technician for repairs in cases of failure and (iii) the use of multiple functions requires additional training.

The 32% of respondents using RTM devices but not trained found the RTM device difficult to use. Of these respondents, 57% used Multilog devices and 43% Beyond Wireless devices.

Storing data history

Most respondents who used RTM devices (~65%) reported downloading and saving temperature recordings in electronic format. Of those who reported that temperature recordings were saved, the persons who downloaded or archived the information were the respondents themselves (46%), their supervisors (46%), or others (8%). All respondents (100%) who saved recordings believed that saving this information was useful.

Acceptability

Overall acceptability of implementing an RTM device in cold rooms was positive, with 100% of respondents who used RTM devices reporting that it made their jobs easier. Comments from respondents included:

+ "RTM is a good continuous temp recorder and its alarm system is connected to the phone portable; it's awesome!"
+ "The RTM device we have is good but it does not allow us to have information online when you are away from the service."

All respondents who used an RTM device (100%) believed that such devices should be used in all cold rooms; 95% would recommend RTM devices to other cold room managers, and 89% thought that RTM devices helped identify cold rooms in need of maintenance.

Limitations

Despite an appreciation of RTM devices, health workers highlighted some limitations in their use:

+ RTM devices are not difficult to use, but the difficulty in finding a technician for repairs in case of failure is a limitation.
+ Management and central data are located remotely in another country; they should be onsite.
+ The sensors in the cold room need to be adjusted or increased in order to have more temperature-reading information.
+ The software for RTM devices should be more user-friendly and the user interface for data analysis should be cloud-based.
+ Implementing RTM is costly.

Lessons learned

To address some of the concerns and limitations raised by health workers, the following are recommended:

+ Documentation of RTM total cost (TCO) that includes: procurement, deployment and installation costs, as well as operational and all ownership costs. These should be made available to countries for planning and funding.
+ Procurement of RTM devices should be staggered with cold rooms procurement and information included in the strategic planning and funding process (cMYP/HSS).[1]
+ Proper training of users to know how to activate, record and interpret the data, and proper training of local technicians to enable installation and maintenance; this would help reduce reliance on external capacity to support implementation.
+ Set-up of RTM sensors in a cold room for routine monitoring (i.e. number of sensors and locations in the cold room) should be guided by a prior temperature mapping study of cold rooms.

Conclusion

This evidence brief highlights the importance of continuous temperature monitoring in vaccine cold rooms and the perceptions of health workers who use RTM devices. Overall, health workers value RTM devices, but some concerns remain related to cost, server and data management, maintenance and technical support, and the location of the data.

References

1. World Health Organization (WHO). WHO Vaccine Management Handbook. Module VMH-E2-0.11. How to monitor temperatures in the vaccine supply chain. Geneva: WHO; 2015. (http://apps.who.int/iris/bitstream/10665/183583/1/WHO_IVB_15.04_eng.pdf)
2. World Health Organization (WHO). EVM Model SOP. User guide for the Effective Vaccine Management Model Standard Operating Procedures. Version 1. Geneva: WHO; 2011. (www.who.int/immunization/programmes_systems/supply_chain/evm/en/index2.html)
3. TechNet-21 Resource website. (http://www.technet-21.org/en/resources)
4. World Health Organization (WHO). WHO Performance, Quality and Safety (PQS) catalogue. (http://apps.who.int/immunization_standards/vaccine_quality/pqs_catalogue)
5. UNICEF Supply Division. Cold Chain Support Package. Procurement Guidelines. Temperature monitoring devices. 2016. (www.unicef.org/supply/files/Temperature_Monitoring_Devices_Oct_06_2016.pdf)

[1] cMYP: comprehensive Multi-Year Plan
HSS: Health System Strengthening

Finding more information

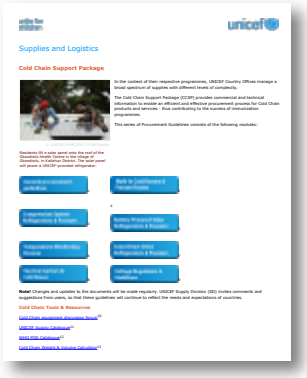
The following resources may be useful when investigating RTM systems.

RESOURCE 1

Cold Chain Country Support Package, UNICEF Supply Division

A website to support UNICEF country offices and procurement service partners in strengthening immunization supply chains through the procurement of cold chain equipment and services. The website provides information on important technical and commercial considerations in the planning and procurement phases of cold-chain implementation projects.

+ www.unicef.org/supply/index_68367.html



RESOURCE 2

Performance, Quality and Safety Catalogue, WHO

A list of WHO-prequalified equipment, including temperature monitoring devices, is available in the PQS Devices Catalogue, available on the WHO website.

+ http://apps.who.int/immunization_standards/vaccine_quality/pqs_catalogue

RESOURCE 3