

# Final Report

## Cold Chain Workshop

**UNICEF Regional Office for Latin America & the Caribbean (UNICEF-TACRO)  
Program for Appropriate Technology in Health (PATH)**

Panama City  
May 31–June 2, 2006



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## **Workshop Summary**

As new vaccines are introduced into Expanded Programme on Immunization (EPI) programs, the financial investment in vaccines will significantly increase. Yet growing evidence demonstrates that the existing cold chain may limit vaccine availability and effectiveness because of outdated equipment and procedures.

In response to this dilemma, UNICEF-TACRO and PATH convened a regional workshop to foster a practical discussion of cold chain management issues. EPI managers, cold chain managers, and ministry of health representatives from 14 Central and South American countries, in addition to UNICEF, PAHO, and PATH representatives, met for this three-day workshop in Panama City, Panama, May 31–June 2, 2006.

Interactive presentations and group activities addressed vaccine stability, temperature monitoring tools, vaccine volume spreadsheets, equipment options, and solutions to accidental freezing of vaccine. Representatives from each country identified priority problems and possible solutions for the improvement of their national cold chain. As an outcome of this meeting, a list of recommendations was prepared from group discussions throughout the workshop and ratified by participants during the final session. These workshop recommendations represent the knowledge and professional experience of all workshop participants and offer clear guidance on improvements to the cold chain in Latin America.

Participants returned to their countries with an enhanced understanding of the problem of freezing temperatures in the cold chain and an interest in conducting temperature-monitoring studies. There was a heightened awareness of vaccine heat stability and an interest in adopting Vaccine Vial Monitors (VVMs) to reduce vaccine wastage and to enable out-of-cold-chain strategies for vaccine storage and distribution. Discussions highlighted a strong interest in improving cold chain monitoring systems and tools. Many countries requested technical support to implement the WHO-UNICEF Effective Vaccine Store Management (EVSM) process and with the development of inventory assessment and tracking systems.

The dedication of participants to the delivery of safe vaccines to all children in their countries was inspirational. Yet they face many difficulties which must be addressed before significant and sustained improvements to the cold chain can be realized. Limitations in resources must be overcome with high-level advocacy for adequate and routine budgeting of cold chain expenses. Cold chain training and supervision must be strengthened. Updated cold chain policies must be made to reflect a complete understanding of the threats to vaccine stability and of new tools that can help immunize the hard-to-reach populations and increase the cold chain capacity for new vaccines.

Workshop recommendations are attached as well as the workshop agenda and a list of participants. Workshop presentations and reference material are available on CD from PATH.

## Workshop Recommendations

Through a series of discussions and exercises conducted during the three-day cold chain workshop, participants outlined their countries' primary cold chain challenges and developed recommendations for improvements. The following is a summary of the recommendations.

- 1. Financing and Budgeting:** There was widespread agreement that the annual budgeting processes do not adequately address cold chain needs, including the costs of routine equipment replacement and maintenance.

Recommendation:

- Conduct high-level advocacy to convince ministries of finance to budget capital cold chain costs on a routine, annual basis and to convince decision-makers of the need to meet new and higher standards of quality and safety.

- 2. Training:** The need for better training in cold chain management was widely acknowledged, including improved training of health workers through degree curriculum, in-service training, workshops, and supervision.

Recommendations:

- Develop clear guidelines for all cold chain procedures.
- Obtain external assistance to accelerate training of trainers. All participating countries committed to strengthening cold chain training activities.

- 3. Awareness of Vaccine Freezing:** There is a very low level of awareness at all levels of the public health system of the risks and potential consequences of freezing vaccine.

Recommendations:

- Conduct temperature monitoring studies in all countries using the PATH/WHO/UNICEF study protocol.
- Develop sensitization and communication materials to build an awareness and understanding of vaccine heat stability and freeze sensitivity.

- 4. Immunization Access in Hard-to-Reach-Areas:** The cold chain constrains access to immunization in remote areas. Taking advantage of the heat stability of vaccines provides opportunities for extended outreach. However, there is a need to improve awareness of the heat stability of vaccines.

Recommendations:

- Consider a region-wide policy to include VVMs on all vaccines.
- Identify opportunities where an out-of-cold-chain strategy could be implemented to increase coverage of hard-to-reach populations.
- Implement out-of-cold-chain strategies in phases in target areas.

**5. Cold Chain Equipment Capacity and Replacement:** Inventories of cold chain equipment and supplies are essential for routine equipment replacement. They are also useful for developing strategies to provide capacity for introduction of new vaccine.

Recommendation:

- Conduct inventory surveys and establish equipment management information systems that ensure routine updating. Follow Peru's inventory model.

**6. Temperature Monitoring of International Shipments:** Shipments by vaccine suppliers from different sources arrive with different temperature monitoring devices.

Recommendation:

- Use a single, standard temperature monitoring device (e.g., Q-tag2) for all shipments by suppliers from all sources.

**7. Central Vaccine Stores:** Temperature monitoring devices in central vaccine stores (national and regional levels) are currently inadequate to provide continuous temperature records on all vaccine storage equipment. There is a need to optimize vaccine store management practices.

Recommendations:

- Specify and install computer-based temperature recording for all primary vaccine stores, according to available resources. At minimum, there should be continuous temperature recording devices for these stores.
- Conduct EVSM assessments, applying the principle of WHO certification of achieving 80 percent on all ten EVSM performance criteria.

**8. Temperature Monitoring at Service Delivery Levels:** Temperature monitoring at the service delivery level is compromised by a wide variety of poor-quality thermometers.

Recommendation:

- Specify and install standard electronic min/max thermometers or 30-day electronic recorders (e.g., FridgeTag) for refrigerators in all health facilities at service delivery levels. At minimum, there should be alcohol stem thermometers and freeze indicators complying with WHO specifications for these refrigerators.

**9. CFC Refrigerant Gases:** Significant numbers of refrigerators containing CFC refrigerant gases remain in the cold chain systems of most of the participating countries.

Recommendation:

- All new procurement of refrigeration equipment should specify non-CFC gases. Subject to the existence of national policies and practices favoring the introduction of HC gas, equipment that is too new to replace may be converted to HC gas.

**10. Ice-Lined Refrigerators (ILRs):** ILRs were recognized as an appropriate response to interrupted power supplies in the region; however, this equipment can accidentally freeze vaccines.

Recommendation:

- All new procurement of ice-lined refrigerators should specify adequate protection against freezing temperatures. Users should be trained to set the thermostat of existing equipment. Procedures for modifying existing refrigerators to prevent freezing should be developed.

**11. Domestic Refrigerators:** Domestic refrigerators are widely used for vaccine storage. Many models of domestic refrigerators are used without first verifying that their performance meets the requirements of vaccine storage.

Recommendation:

- Use temperature recorders (e.g., TTMs) to verify the performance of these refrigerators before vaccine storage, check the quality and availability of electricity, and provide voltage regulators with all refrigerators.

## **Annex A: Overview of Presentations and Discussions**

The following section summarizes each of the workshop modules. The complete modules and their accompanying materials may be viewed in the forthcoming CD and binder.

### **Introductory Remarks**

Opening remarks were made by speakers from UNICEF, PAHO, and PATH. Main points included:

- Cold chain improvement is an integral part of the WHO-UNICEF Global Immunization Vision and Strategy (GIVS) initiative. To accomplish the initiative's objectives of improving coverage and introducing new vaccines, it is essential to expand and improve the cold chain.
- GIVS also sees a strengthened immunization program as a platform for child survival interventions and improving access to hard-to-reach populations. A better cold chain will help meet these goals.
- Cold chain partnerships, as demonstrated in this workshop, are an effective way to introduce technical innovations into immunization programs.
- Peru is working hard to improve its cold chain and immunization programs. Advocacy has brought cold chain issues to the attention of the Minister of Health. An inventory of equipment was conducted which showed 134 different types of cold chain equipment in use, much of it obsolete and not WHO-approved. Increased awareness is necessary to prioritize a large investment in equipment replacement.
- Cold chain improvements are needed to reinvigorate immunization efforts to improve coverage and introduce new vaccines. It is important to build a good cold chain and maintain it, not simply try to sustain the existing, weak cold chain.

### **Vaccine Stability**

#### **Presentation:**

- Vaccines are sensitive to heat and some are also sensitive to freezing temperatures.
- New vaccines are less sensitive to heat but many remain sensitive to freezing temperatures.
- Within the vaccines commonly found in Latin American Expanded Programme on Immunization (EPI) programs, there are differences in heat and freeze sensitivities.
- Most vaccines have tolerances to heat that are greater than expected, as conservatively determined by WHO vaccine vial monitor (VVM) category assignment and based on manufacturer-supplied data.
- There is a difference in the rate of freeze and heat damage to vaccines (damage caused by freezing is instantaneous, while heat-damage is progressive).
- A group exercise challenged participants' knowledge of specific vaccines' temperature sensitivities. There was particular interest in the heat- and freeze-sensitivity of rotavirus vaccines.

#### **Discussion:**

- Participants expressed some concern with the variety of temperature indicators received with shipments from manufacturers and that vaccine may be damaged before it is received.
- Many country representatives expressed interest in learning more about the science and application of the VVM technology.
- Freeze indicators are needed at all levels to know whether vaccines have been damaged due to freezing.

- Care should be taken when telling field workers about vaccine heat stability as it could result in reduced cold chain discipline or a feeling that the cold chain is not necessary.

## **Flexible Cold Chain**

### **Presentation:**

- Indonesia, China, and Vietnam implemented successful cold chain strategies that extend immunization access by taking hepatitis B vaccine outside of the cold chain during the final legs of distribution.
- VVMs were used to monitor vaccine exposure to excessive heat and deliver effective birth doses of hepatitis B vaccine in home-delivery settings.
- Serology data from several studies demonstrate that heat-stable vaccines such as hepatitis B can be safely stored at ambient temperature using VVMs without compromising immunogenic response.
- Oral polio vaccine and tetanus toxoid vaccine have also been used out of the cold chain to extend coverage and reach hard-to-reach populations.

### **Discussion:**

- Participants were interested in using VVMs and out-of-cold-chain strategies to reach inaccessible populations with immunization services. Several countries cited examples of where such approaches would help them reach remote populations.
- Some countries access difficult-to-reach populations, but with high wastage of vaccine—out-of-cold-chain strategies would reduce wastage and extend immunization services further into hard-to-reach populations.
- Since new rotavirus vaccine has high volume impact and high heat stability, could it be taken out of the cold chain at some points to reduce refrigeration needs?
- While VVMs will accurately measure heat exposure, they do not indicate whether vaccines have been exposed to freezing temperatures.

## **Evidence of Freezing**

### **Presentation:**

- A recent literature review by PATH highlights the widespread occurrence of freezing temperatures in the vaccine cold chain in both developed and developing countries.
- It is important to prioritize the prevention of freezing temperatures in the vaccine cold chain.
- Data from cold chain assessments using a PATH/WHO/UNICEF protocol demonstrate widespread freezing in the cold chain in all countries that implemented the protocol.

### **Discussion:**

- Countries such as Bolivia and Indonesia that have documented vaccine freezing by implementation of the PATH/WHO/UNICEF protocol have taken corrective action in a systematic and informed way. They have been praised for their dedication to increasing the quality of their cold chains.
- The studies presented in the literature review show the incidence of freezing temperatures in the 2-8°C cold chain, not freezing of vaccine.
- Although sub-zero temperatures do not indicate that all vaccines are damaged, they represent a consistent and significant weakness in immunization programs that must be addressed. The current evidence on freezing of vaccine indicates that immediate action is needed to prevent compromising more vaccines—we know the problem exists and should act to prevent freezing before we see the result in sick children or compromised communities. The analogy was raised, “Why wait for the plane to crash? We need to take corrective action now.”

## **Protocol to Evaluate the Risks of Freezing**

### **Presentation:**

- There is an established UNICEF/PATH/WHO protocol to monitor cold chain temperatures throughout the cold chain levels using electronic data loggers. It has been implemented in several countries.
- Results identify weak points in the cold chain and raise awareness of freezing problems.
- After documenting the performance of the cold chain, these results should be distributed to build awareness and mobilize resources that will improve the quality of the vaccine cold chain.

### **Discussion:**

- Protocol is flexible—it is easily adaptable for different countries.
- Protocol is applicable to all temperature monitoring, not just freezing.
- Several countries expressed interest in conducting the study and will approach their local governments and UNICEF offices for support.
- Results need to be communicated carefully and not give the impression that impotent vaccines have been used.

## **Bolivia Cold Chain Monitoring Findings**

### **Presentation:**

- Using the UNICEF/PATH/WHO protocol, Bolivia conducted cold chain temperature monitoring in three provinces, representing the three climates in Bolivia: high altitude mountainous, transition zone, and tropical rainforest.
- Freezing was found in all shipments at most levels of the cold chain.
- Each province had 4 monitoring legs, for a total of 12 data sets.
- Study results prompted high-level action, including: transport using cool water packs, additional training of cold chain managers, and development of clear guidelines for health workers.
- Temperature monitoring will be conducted again to quantify improvements.

### **Discussion:**

- Participants expressed interest in conducting similar studies in their countries.

## **Vaccine Monitoring Tools**

### **Presentation:**

- Advantages/disadvantages of the different types of tools and levels of cold chain where each type is used.
- How good monitoring equipment and systems can protect large investments in important vaccines.
- Group exercises demonstrated different types of monitoring tools, their uses, and advantages/disadvantages:
  - Continuous temperature monitors for cold rooms.
  - Thermometers for vaccine refrigerators.
  - Temperature indicators for freezing (Freeze-Tag and FreezeWatch) and heat (VVM).
  - VVM exercise where participants determined whether vaccines could still be used according to VVM status, expiry date, vial condition.

### **Discussion:**

- Need to improve monitoring to better understand the freezing problem and correct it.
- Need better monitoring equipment and clear guidelines on how to use it.

- VVMs are an important tool for reducing vaccine wastage: vaccines that have been exposed to heat during cold chain breaks may not need to be discarded if VVMs are available.
- Advocacy for new/improved monitoring systems in central stores is an essential component of improving vaccine management practices—these systems, once operational, are low maintenance and highly reliable.
- Better monitoring in smaller health centers is urgently needed.

### **Solutions to Accidental Freezing**

#### **Presentation:**

- Simple approaches to preventing vaccine freezing in cold stores, chest refrigerators, domestic refrigerators, ice-lined refrigerators, and transport.
- What to do when freezing temperatures may have damaged vaccine: conducting the shake test.
- A group exercise demonstrated the best practices for:
  - Domestic refrigerators: water packs, loading.
  - Chest refrigerators/ice-lined refrigerators (ILRs): proper setting, loading.
  - Transport: ice pack conditioning, cool water packs.
  - Shake test: procedures, practice, use when freezing is suspected.

#### **Discussion:**

- Some countries have received vaccines from manufacturers using unconditioned eutectic cold packs and no freeze indicators. Occasionally these shipments included frozen, freeze-sensitive vaccines.
- UNICEF should provide guidance to these manufacturers on how to keep these vaccine shipments safe and well monitored.
- There is interest in TinyTalk Temperature Monitor (TTM) data loggers as described in the PATH/WHO/UNICEF assessment protocol for monitoring suspect equipment such as domestic refrigerators and ILRs.
- There is significant field evidence that ILRs freeze vaccines in the field.

### **Cold Chain Equipment and Using the Vaccine Volume Calculator**

#### **Presentation:**

- Review of refrigerator types and main features and international specifications, overview of WHO Product Information Sheets (PIS)/Performance, Quality, and Safety (PQS) systems.
- How to use the vaccine volume calculator to forecast the impact of introducing a new vaccine or calculating necessary vaccine storage capacity.
- Participants simulated use of the vaccine volume calculator during a group exercise.

#### **Discussion:**

- Small generators are being used in some remote parts of Latin America to accommodate for power cuts.
- Participants expressed an interest in low-maintenance ice bank refrigerators such as SolarChill (awaiting WHO approval) and wind-powered refrigerators (in early stages of development).
- Areas with freezing ambient temperatures face unique challenges because currently equipment that can warm vaccines is not available (however such equipment is included in the new PQS guidelines). A suggested solution is to ensure refrigerators are kept in heated rooms in sub-zero climates. Water packs will keep vaccines from freezing during transport.

- With solar refrigerators, it is important to purchase the entire system from one supplier, as purchasing the components separately may cause compatibility challenges. Countries may purchase from private suppliers, but should keep in mind that all components should be purchased together as a system. Several countries reported good experiences with solar refrigerators but noted that a strong maintenance program is required.

### **Equipment Inventory in Peru**

#### **Presentation:**

- In 2004, Peru conducted an inventory assessment of cold chain equipment using a WHO rapid data collection tool.
- The assessment found that over 5,000 new or replacement refrigerators would be needed to provide adequate storage capacity at health centers.
- This assessment of 100% of primary health facilities was conducted by trained teams of MOH workers who collected most of the data.
- The data was then entered into software developed in Peru for analysis and reporting. The software permits forecasting of equipment needs due to replacement and planning for new vaccine introduction.

#### **Discussion:**

- It is important to establish a system for updating the inventory rather than having to repeat the assessment survey periodically.
- There was a high level of enthusiasm for this system: software is clear and user friendly.
- This is useful for understanding capacity and preparing for introduction of new vaccines—this is a good planning tool.
- This is a useful tool to counter the occasional false demand for new equipment.
- This is useful for scheduling equipment maintenance and replacement.
- Local technological expertise is essential to maintaining and modifying the software.

### **Equipment Repair Systems**

#### **Presentation:**

- Techniques and tools for maintaining cold chain equipment.
- Training in equipment repair and maintenance for managers, technicians, and health workers.
- The environmental impact of poor maintenance practices.
- The environmental effects of CFCs, HCFCs, HFCs, HCs, and HFC blends.

#### **Discussion:**

- Because the amount of HCs in a refrigerator is so minimal (40 grams), concerns about combustion are unnecessary when replacing HCFCs with HCs.

### **Cold Rooms and Effective Vaccine Store Management**

#### **Presentation:**

- The ten criteria for effective vaccine store management.
- WHO's guide on conducting a self assessment of vaccine cold stores.
- Cold room equipment options and requirements.

#### **Discussion:**

- Cold chain staff may be aware of what improvements should be made, but program directors may not understand the value of their suggestions. The EVSM accreditation program helps prioritize these improvements:
- Criteria are needed to maintain the quality of vaccine stores management.
- Several countries indicated their interest in conducting EVSM assessments.

## **TTM Demonstration**

### **Presentation:**

- Demonstration of how to program data loggers for UNICEF/PATH/WHO cold chain assessment protocol, download and export data, and how to install software.
- In small groups, participants practiced programming data loggers and downloading temperature data.
- Each country went home with a TTM and software as well as information on how to order additional data loggers.

### **Discussion:**

- This technology was welcomed by all participants. It is expected that they will use it or similar technology to monitor their cold chains both during implementation of the PATH/WHO/UNICEF protocol and to monitor the performance of some cold chain equipment such as ILRs.

## **Conclusions: Country Priorities and Solutions**

Each country team listed their primary cold chain problems and then identified recommended solutions.

<b>Country</b>	<b>Priority Cold Chain Problem</b>	<b>Recommended Solution</b>
<b>Bahamas</b>		
	Low awareness of freezing.	Use FreezeTag, temperature recorders, TTMs. Conduct cold chain monitoring study.
	Vaccine wastage due to heat exposure.	Use VVMs.
	Poor stores management.	Conduct EVSM.
<b>Bolivia</b>		
	Documented cold chain freezing.	Implement improved practices and procedures (use posters, training); conduct cold chain monitoring on additional provinces.
	Wastage and limited outreach.	Demand VVMs from vaccine manufacturer.
	Poor quality equipment.	Purchasing plan.
	No quality management.	Implement EVSM.
	Inadequate cold chain financing.	Advocacy at national and donor level.
<b>Brazil</b>		
	Temperature variations.	Conduct cold chain monitoring study.
	No temperature monitoring systems.	Develop guidelines and standards; purchase monitoring tools.
	Capacity limitations; obsolete equipment.	Establish inventory system; purchase.
	Access to hard-to-reach areas with no power.	Purchase solar refrigerators; implement out-of-cold-chain strategies.
<b>Chile</b>		
	Capacity limitations to new vaccines.	Inventory system.
	Poor awareness of freezing problem.	Conduct cold chain monitoring study.

<b>Country</b>	<b>Priority Cold Chain Problem</b>	<b>Recommended Solution</b>
	High staff turnover.	Improved cold chain training and supervision.
<b>Cuba</b>		
	Poor cold chain standards.	Update standards using UNICEF/PAHO/WHO workshop.
	Poor equipment tracking.	Implement inventory system.
	Poor temperature control during transport.	Conduct cold chain monitoring study.
	Vaccine wastage and outreach limitations.	Use VVMs on vaccines.
	Ineffective training.	Training seminars and workshops.
<b>Ecuador</b>		
	Unprepared for new vaccines.	Establish cold chain inventory system.
	Personnel do not know about vaccine stability.	Conduct cold chain monitoring study.
	Cold store problems.	EVSM.
	Reaching inaccessible populations.	Out-of-cold-chain systems with VVMs.
<b>Guatemala</b>		
	No inventory system.	Install inventory software; conduct survey; update regularly.
	Obsolete or insufficient equipment.	Purchase equipment; conduct training; decentralize purchasing.
	Poor temperature monitoring.	Conduct cold chain monitoring study; systemize monitoring tools/procedures.
	Insufficient monitoring tools.	Identify appropriate tools and purchase; develop procedures; train.
<b>Haiti</b>		
	Absence of updated cold chain equipment inventory.	Conduct detailed cold chain equipment inventory. Standardize and replace cold chain equipment.
	Unknown incidence of accidental freezing during transportation and storage at lower cold chain levels.	Conduct a rapid assessment. Train staff to recognize conditions that lead to freezing. Establish policy, supervision, and monitoring.
	No specific personnel assigned to vaccine management at national level.	Advocacy for cold chain management at national level.
	Lack of vaccine distribution system.	Design and implement computerized vaccine distribution system throughout country. Staff training on vaccine needs and storage capacity calculation. Training on alternative cold chain vaccine stability.

<b>Country</b>	<b>Priority Cold Chain Problem</b>	<b>Recommended Solution</b>
<b>Honduras</b>		
	Cold Chain inventory is not up to date.	Bring up-to-date and review annually.
	Lack of equipment to accommodate new vaccines.	Manage financial resources.
	No evaluation of vaccine management.	Conduct national evaluation (EVSM self-assessment of vaccine stores).
	Limited up-to-date cold chain knowledge (lack of training).	Resource management for implementing a national capacity plan.
	Lack of vaccine temperature monitoring technologies.	Resource management for acquiring and implementing new technologies.
<b>Nicaragua</b>		
	Capacity and equipment weaknesses.	Establish inventory system.
	Software for cold chain management is out of date.	Get technical support for updating software.
	Limited financial resources.	Apply to national treasury and donors for additional funding.
	Limited monitoring and supervision of cold chain.	Develop a plan to promote monitoring and supervision at all levels.
	High staff turnover.	Conduct regular trainings.
<b>Panama</b>		
	Supply inconsistencies.	Improvements to purchasing process.
	Lack of technicians at regional levels.	Hire cold chain technicians for each region, under EPI authority.
	Insufficient cold chain funding.	Advocacy
	Introducing new vaccine considering only political criteria.	Promoting technical needs over political criteria through support from international institutions (UNICEF); scientific evidence.
	Barriers to continued training of technicians.	Capacity planning; acquire scholarships for training.
	Insufficient monitoring.	Identify best tools, purchase, systematize.
<b>Peru</b>		
	Poor cold chain management.	National training, awareness raising.
	Hard-to-reach populations.	Get VVMs and use out of cold chain strategy.
	Power failures.	Install generators; use VVMs.
	Old refrigerators.	Identify budget for replacement.
	Limited storage capacity.	Advocate for new equipment; install inventory systems.
<b>Suriname</b>		
	Poor equipment management.	Establish inventory system.
	Poor vaccine management.	EVSM, training.
	Cold store capacity limitations.	Identify funding to expand.
	Low awareness of freezing.	Train.

<b>Country</b>	<b>Priority Cold Chain Problem</b>	<b>Recommended Solution</b>
	High wastage/limited access of hepatitis B birth dose.	Implement out-of-cold-chain strategy.
<b>Venezuela</b>		
	Insufficient capacity for new vaccines.	Find funding partnerships. Install new cold rooms. Develop inventory system like Peru's.
	Insufficient temperature monitoring.	Identify tools, especially VVM and FreezeTag.
	Low awareness of freezing and stability.	Conduct cold chain monitoring assessment; hold workshops.

## Annex B: Workshop Agenda—PATH/UNICEF TACRO Cold Chain Workshop

Panama City, May 31-June 2, 2006

	Topic	Description	Materials
<b>DAY 1</b>			
8:30-8:45	<b>Registration and Distribution of Workshop Materials</b>	Participants can arrive before 8:30 for registration	Binders, name tags, seating arrangement
8:45-10:00	<b>Welcome</b> <ol style="list-style-type: none"> <li>1. UNICEF TACRO Health and Nutrition Representative: <b>Oswaldo Legon</b></li> <li>2. UNICEF HQ Representative: <b>Ahmed Magan</b></li> <li>3. UNICEF Immunization Plus TACRO Support to Cold Chain, 2003-2006: <b>Paulo Froes</b></li> <li>4. UNICEF CO Peru Representative: <b>Andres Franco</b></li> <li>5. PAHO Regional Representative: <b>Liliana Alarcon</b></li> <li>6. PATH Representative: <b>John Lloyd</b></li> <li>7. Introduction of Participants</li> <li>8. Administrative Update</li> </ol>	Start at 8:45 sharp	
10:00-10:30	Break and Posting of Country Materials on Cold Chain		

	<b>Topic</b>	<b>Description</b>	<b>Materials</b>
10:30 – 10:45	<b>Introduction to Workshop</b> <ul style="list-style-type: none"> <li>➤ Definition of cold chain</li> <li>➤ Workshop objectives               <ol style="list-style-type: none"> <li>1. Knowledge of vaccine stability, monitoring, and handling</li> <li>2. Knowledge of cold chain equipment, monitoring tools, decision-making criteria</li> <li>3. Prepare conclusions and recommendations on the improvement of the cold chain in participating countries</li> </ol> </li> </ul>	Presentation/Discussion	
10:45-11:15	<b>Introduction to Binders and Workshop Questionnaire on Cold Chain</b>		
11:15-12:15	<b>Vaccine Temperature Stability</b> <ul style="list-style-type: none"> <li>➤ Understand which vaccines are most sensitive to heat and freezing</li> <li>➤ Exchange and apply practical experiences from Latin America countries' EPI programs</li> </ul>	Presentation with group activity and discussion.	PowerPoint
12:15-13:00	<b>Evidence of Freezing</b> <ul style="list-style-type: none"> <li>➤ Why we need to prioritize freeze prevention</li> <li>➤ Where does accidental freezing occur</li> <li>➤ Field evidence of vaccine freezing</li> </ul>	Presentation and discussion	PowerPoint slides and copies of literature reviews
13:00-14:00	=Lunch=		
14:00-14:30	<b>Protocol to Evaluate the Risks of Freezing in the Vaccine Cold Chain</b>	Presentation and demonstration	PowerPoint slides, hardcopies of UNICEF/PATH Protocol for Latin America, TTM, vaccine box

	<b>Topic</b>	<b>Description</b>	<b>Materials</b>
14:30-15:00	<b>Bolivia Cold Chain Monitoring Findings</b>	Presentation describing implementation and results	PowerPoint slides
15:00-18:00	<b>Vaccine Monitoring Tools (with 15 minute break)</b> Become familiar with temperature monitoring tools and when to effectively use them	Presentations, small group activity, and discussion	Equipment samples, exercise Refrigerators and vaccine carriers VVM flash cards, TTM
18:00-18:30	<b>Identification of Highlights of the Day</b>	Facilitated discussion with a volunteer	Volunteer and cards for posting on walls
18:30-	Installation of TTM Software and Vaccine Volume Calculator on Participants' Computers		
<b>DAY 2</b>			
8:00-8:30	Demonstration of Downloading TTM Temperature Data	TTMs prepared on Day 1	
8:30-10:00	<b>Prevention of Accidental Vaccine Freezing in the Cold Chain</b> <ul style="list-style-type: none"> <li>➤ Load vaccines correctly in cold rooms, refrigerators, and carriers</li> <li>➤ Condition ice packs for safe transport <b>or</b> use water packs</li> <li>➤ Monitor for accidental vaccine freezing</li> </ul>	After presentation, small groups will discuss ILR refrigerators, domestic refrigerators, transport, and the shake test	PowerPoint slides, refrigerators, vaccine carriers, ice packs, materials for shake test
10:00-10:15-	= Break =		

	<b>Topic</b>	<b>Description</b>	<b>Materials</b>
10:15-12:30	<b>Cold Chain Equipment and Using Vaccine Volume Calculator to Make Management and Purchasing Decisions</b> <ul style="list-style-type: none"> <li>➤ Introduction to types of cold chain equipment</li> <li>➤ What are the critical features of equipment</li> <li>➤ Specifications for vaccine boxes and carriers</li> <li>➤ How to use available tools to prepare adequate cold chain capacity</li> </ul>	Presentation, discussion, exercises, answers, and worksheets	
12:30-13:00	<b>Equipment Inventory: An Example from Peru</b>	Presentation	
13:00-14:00	=Lunch=		
14:00-14:30	<b>Strategies to Extend Vaccine Coverage Through a Flexible Cold Chain</b>	Presentation followed by group discussion	PowerPoint slides and article reprints
14:30-16:00	<b>Equipment Repair Systems</b> <ul style="list-style-type: none"> <li>➤ Training</li> <li>➤ Techniques</li> <li>➤ Materials</li> <li>➤ Maintenance</li> <li>➤ HC vs. HFC</li> </ul>	Presentation and discussion	PowerPoint slides, refrigerators
16:00-17:00	<b>Discussion on Equipment Selection, Inventory, and Repair</b>		
17:00-17:30	<b>Identification of Highlights of the Day</b>	Facilitated discussion with a volunteer	Volunteer and cards for posting on walls
<b>DAY 3</b>			

	<b>Topic</b>	<b>Description</b>	<b>Materials</b>
8:00-8:30	<b>TTM Temperature Monitor Introduction and Practicum</b> Demonstration of how to: ➤ Run software ➤ Download data from data logger	Presentation and practical exercise	Data loggers, software, computers for each table
8:30-9:45	<b>EVSM and Cold Rooms</b> ➤ Characteristics of good cold room management ➤ Cold room equipment options and requirements ➤ EVSM: How to conduct a self-assessment of cold room practices	Presentation	PowerPoint slides and EVSM materials
9:45-10:00	= Break =		
10:00-10:45	<b>Post-Workshop Questionnaire and Discussion</b>		
10:45-12:00	<b>Country Group Work to Develop Cold Chain Improvement Recommendations</b>	Country groups will outline recommendations on posters to be posted around the room	Posters, markers
12:00-12:30	=Lunch=	Lunch is 30 minutes followed by a tour of the canal	
12:30-14:30	Panama Canal Visit	<b>Bus leaves at 12:30</b> to take the entire group to see the canal. There we will take a group photo of all the workshop participants	
14:30-15:15	<b>Viewing of Country Group Cold Chain Recommendations</b>	View posters on walls	
15:15-15:30	<b>Brief Discussion of Country Cold Chain Recommendations</b>	Guided discussion directed by facilitators	

	<b>Topic</b>	<b>Description</b>	<b>Materials</b>
<b>15:30-16:30</b>	<b>Workshop Conclusions</b>	Guided discussion directed by facilitators	
<b>16:30-17:00</b>	<b>Closure</b> <ol style="list-style-type: none"> <li>1. USAID Country Representative: <b>Christopher Cushing</b></li> <li>2. PATH Representative: <b>John Lloyd</b></li> <li>3. UNICEF Immunization Plus Representative: <b>Paulo Froes</b></li> </ol>		

## Annex C: Workshop Participant List

Name	Country/ Organization	Email
Amelia Collie	Bahamas	<a href="mailto:alcollie@hotmail.com">alcollie@hotmail.com</a>
Enrique Borda	Bolivia	<a href="mailto:haguila@sns.gov.bo">haguila@sns.gov.bo</a>
Erick Machicao	Bolivia	<a href="mailto:emachicao@ops-oms.org">emachicao@ops-oms.org</a>
Graciela Quiroga	Bolivia - UNICEF	<a href="mailto:rquiroga@unicef.org">rquiroga@unicef.org</a>
Luz M. Alfonso Dutra	Brasil	<a href="mailto:luz.dutra@saude.gov.br">luz.dutra@saude.gov.br</a>
Eudemberg Pinheiro	Brasil	<a href="mailto:eudemberg.silva@saude.gov.br">eudemberg.silva@saude.gov.br</a>
Carmen Miranda Silvera	Brasil	<a href="mailto:carmen.silvera@saude.gov.br">carmen.silvera@saude.gov.br</a>
Leonor Astroza	Chile	<a href="mailto:lastroza@minsal.cl">lastroza@minsal.cl</a>
Patricia Gatica	Chile	<a href="mailto:patricia.gatica@asrm.cl">patricia.gatica@asrm.cl</a>
Miguel A. Galindo	Cuba	<a href="mailto:marlen.valcarcel@infomed.sld.cu">marlen.valcarcel@infomed.sld.cu</a>
Odalys Rodriguez	Cuba - UNICEF	<a href="mailto:orodriguez@unicef.org">orodriguez@unicef.org</a>
Maria Grijalva	Ecuador	<a href="mailto:cgrijalva@msp.gov.ec">cgrijalva@msp.gov.ec</a>
Nancy Vasconez	Ecuador	<a href="mailto:pai_ecu@rdyec.net">pai_ecu@rdyec.net</a>
Mara E. Vargas	Guatemala	<a href="mailto:deleonmara@yahoo.com.mx">deleonmara@yahoo.com.mx</a>
Alvaro Ramirez Reyes	Guatemala	<a href="mailto:archiry007@yahoo.com">archiry007@yahoo.com</a>
Jean-Claude Mubalama	Haiti - UNICEF	<a href="mailto:jcmubalama@unicef.org">jcmubalama@unicef.org</a>
Jose Trinidad Martinez	Honduras	<a href="mailto:epihon@ns.paho-who.hn">epihon@ns.paho-who.hn</a>
Ida Berenice Molina	Honduras	<a href="mailto:epihon@ns.paho-who.hn">epihon@ns.paho-who.hn</a>
Omar Malespin	Nicaragua	<a href="mailto:prog-pai@minsa.gob.ni">prog-pai@minsa.gob.ni</a>
Alejandro Ortega	Nicaragua	<a href="mailto:prog-pai@minsa.gob.ni">prog-pai@minsa.gob.ni</a>
Nelly Quiroz	Panama	<a href="mailto:minsadgi@ihpanama.com">minsadgi@ihpanama.com</a>
Itzel de Hewitt	Panama	<a href="mailto:minsadgi@ihpanama.com">minsadgi@ihpanama.com</a>
Zenaida Vergara	Panama	<a href="mailto:zvergara23@hotmail.com">zvergara23@hotmail.com</a>
Ivan Medina	Panama	<a href="mailto:ivan_m@amen-amen.net">ivan_m@amen-amen.net</a>
Luis Carlos Ureña	Panama	<a href="mailto:powergospel@hotmail.com">powergospel@hotmail.com</a>
Ivan Valdés	Panama	<a href="mailto:minsadgi@ihpanama.com">minsadgi@ihpanama.com</a>
Maria M. Gaitan	Panama	<a href="mailto:mayela194@hotmail.com">mayela194@hotmail.com</a>
Liliana Alarcon	OPS/OMS Panama	<a href="mailto:alarconli@pan.ops-oms.org">alarconli@pan.ops-oms.org</a>
Jaime M. Robles	Peru	no tiene
Maria A. Mendoza	Peru	<a href="mailto:mmendoza@minsa.gob.pe">mmendoza@minsa.gob.pe</a>
Fabiola Quiroz	Peru - UNICEF	<a href="mailto:fquiroz@unicef.org">fquiroz@unicef.org</a>
Andres Franco	Peru - UNICEF	<a href="mailto:afranco@unicef.org">afranco@unicef.org</a>
Soekirman Sabiran	Suriname	<a href="mailto:nipsur@yahoo.com">nipsur@yahoo.com</a>
Ernie Lienga	Suriname	<a href="mailto:erniefiett@hotmail.com">erniefiett@hotmail.com</a>
Lev Nuñez	Venezuela	<a href="mailto:vigepipai@msds.gov.ve">vigepipai@msds.gov.ve</a>
John Lloyd	PATH	<a href="mailto:jlloyd@path.org">jlloyd@path.org</a>
Carib Nelson	PATH	<a href="mailto:cnelson@path.org">cnelson@path.org</a>
Sophie Newland	PATH	<a href="mailto:snewlan@path.org">snewlan@path.org</a>
Sarah McGray	PATH	<a href="mailto:smcgray@path.org">smcgray@path.org</a>
Ahmed Magan	UNICEF HQ	<a href="mailto:amagan@unicef.org">amagan@unicef.org</a>
Boris Tolstopyatov	UNICEF HQ	<a href="mailto:btolstopyatov@unicef.org">btolstopyatov@unicef.org</a>
Paulo Froes	UNICEF TACRO	<a href="mailto:pfroes@unicef.org">pfroes@unicef.org</a>
Oswaldo Legon	UNICEF TACRO	<a href="mailto:olegon@unicef.org">olegon@unicef.org</a>
Terry J. Hart	UNICEF Consultant	<a href="mailto:tjh@itpi.co.in">tjh@itpi.co.in</a>
Fernando Perez	UNICEF Consultant	<a href="mailto:fperez77@gmail.com">fperez77@gmail.com</a>