

TechNet21 Consultation Report Dakar, Senegal



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Introduction

The thirteenth TechNet21 consultation was held in Dakar, Senegal, on 5–7 February 2013. One hundred and ninety-one delegates attended the conference and included a large contingent of manufacturers (the *Objectives of the Consultation* documents includes detailed participant profiles). The consultation was declared open by a representative of the Senegalese health ministry, who highlighted the importance of such a meeting for Senegal, the African region and the world. He also commended Project Optimize’s work in Senegal.

The sessions were broadly categorised under six topics: Introduction; Vaccine Characteristics and Delivery Systems; Equipment System Management; Information Management Systems; Human Resources for Supply Chain Management; and Future Directions. Debra Kristensen, PATH, and Philippe Jaillard, AMP, chaired the Day I sessions. Oya Afsar, UNICEF, and Yann LeTallec, CHAI, chaired the Day II sessions and Day III sessions were chaired by Diana Chang Blanc, WHO, and Robert Steinglass, JSI.

There were also three break-out sessions at the end of Day 1: How to improve the ability of country stakeholders to influence future vaccine products; Market innovations to impact existing and new cold chain equipment; and Considerations for cold chain equipment selection.

Some of the presentations were followed immediately by a discussion, which sometimes covered two presentations when the topics were interlinked, such as *Labelling for true temperature stability and the controlled temperature chain* and *Benin: Delivering Meningitis A vaccine (MenAfriovac) in a controlled temperature chain*.

Over the last few years, the marketplace has been an integral part of TechNet21 consultations. This year, 22 manufacturers showcased their products (15 private companies and 7 information systems or other products from the non-profit or government sector organizations, including Village Reach, University of Pittsburgh, Govt. of Albania, etc.).* The stalls exhibited products like refrigerators and freezers, cold boxes and carriers, temperature monitoring devices, etc. They attracted a reasonable number of visitors daily. TechNet21 also had a stall and more than 10 new member registered with the forum over three days. This year also featured Project Optimize’s travelling exhibition, which showcased supply chain innovations that have been developed and tested in various countries. The marketplace and the exhibition enabled participants to learn more about new products and logistics systems, to ask questions directly to manufacturers, and to offer stakeholder feedback.

This report covers the presentations and the discussions over the three days. It includes links to the presentations, summaries of the presentations (provided by the presenters) and discussion highlights. The subjects that attracted in-depth discussion included Logistics Management Information Systems (LMIS), product barcoding, solar energy, building a supply chain workforce, transportation and outsourcing, and Effective Vaccine Management (EVM).

* Invitations were sent to all companies with PQS-approved equipment.

Some of the key issues that came into focus over the three days were:

- Part of the funding for vaccines should be allocated to infrastructure development.
- As new vaccines are introduced, waste management must be planned for and no one at WHO is currently leading waste management.
- The importance of transporting and storing vaccine in the cold chain has been reiterated over the thirty years of the Expanded Programme of Immunization (EPI). We are now suddenly talking about the Controlled Temperature Chain (CTC) and taking the vaccine out of the cold chain. It is difficult for people in the field to understand these conflicting messages.
- The total costs need to be calculated, including the handholding. Ensuring that feedback and maintenance are kept in the loop is part of the challenge of programme designing. Countries need to be helped to manage this change and this help should be provided long before the funds are received. The technology transfer will succeed only if local managers want the technology. Finally, success with solar refrigeration requires planning and budgeting for the long-term, purchasing prequalified equipment, professional installation, good maintenance and systematic monitoring.
- An important PQS activity that has remained weak is post-market monitoring. It is critical to obtain information on the suitability of the equipment in the field in order to ensure that PQS specifications are relevant to field conditions. Another issue relates to the sustainability of the WHO PQS programme.
- Getting embedded champions for the desired change is paramount to successfully improving management information systems (MIS). When it comes to new technology, these champions encourage country-level engagement and ownership.
- In Madagascar, the District Vaccine Data Management Tool (DVDMT) has improved the accuracy of the data and the quality of the EPI monitoring system. GAVI data quality assessments conducted in 2003 and 2005 reveal that the verification factor, which measures data accuracy, improved significantly, as did the index quality monitoring. Completeness of reporting also improved considerably. To improve DVDMT, it should be divided into two parts: a workbook for data entry and another for analysis. To ensure data security, DVDMT OpenOffice should be developed and it would then be less vulnerable to viruses. Tools cannot be just 'parachuted' into a country. People need to be motivated for successful implementation.
- Software is a public good, like a vaccine, and if the public sector does not have access to an overview of the tools, then the Bill and Melinda Gates Foundation (BMGF) can help in making it available.
- The effect of wVSSM in Iran has been positive because managers at each level can now access records at other levels. There have been no major implementation problems. In Tunisia, in-store stock management improved during 2012. The relative stock balance between stores has also improved.
- There was a specific suggestion to create a linkage between wVSSM and Immunization Information System (IIS), the software being developed by PATH

in Albania. Critical indicators that are built into both VSSM and the Stock Management Tool (SMT) should be built into *all* stock management systems.

- Barcoding is successfully being implemented in Turkey and Botswana. The extra cost for 2D barcoding equipment and running costs represents less than 0.01\$ per dose in Turkey.
- EVM assessments serve no purpose if the problems that were revealed by the assessments are not addressed. EVM assessors do not have the power to implement improvement plans. Therefore, improvement-planning processes must include in-country institutions like the national NRA, who have the power to ensure implementation. Though EVM cannot currently be run using Open Office, we could consider moving it to another platform in the future. EVM needs to be both an assessment and a capacity building exercise. The benefits of building local capacities and institutions to conduct EVM were considered. Both the ideas of integrating the immunization supply chain with an increasingly efficient public health supply chain and keeping it separate were discussed.
- A rapid increase in assistance from multilateral and bilateral donors has resulted in huge increases in the quantity, value, and complexity of supplies flowing through public health supply chains. However, the health supply chains of middle- and low-income countries are often unable to respond reliably to existing demands. This puts both health supplies and health outcomes at risk. There is need to train human resources specifically for supply chain management and logistics management and this function cannot be seen as an extension of the store manager's scope of work.
- Health products should be further segmented to understand which products offer the highest potential for integration. Integration relieves the constraint on the supply chain human resources. This needs to be incorporated into the decision framework. Again, governance structure and political economy are important when thinking about integration. Often, various programme managers want to manage their own products and are unwilling to give up their sovereignty. Integrating these different interests and objectives is challenging. Furthermore, diversity of funding sources may cause conflicts. Managerial functions need to be integrated as well as just products.
- Outsourcing can be a good solution, but it can fail if there is lack of coordination between parties. Poor choices are made on what to outsource, contracts are drafted with no service level agreement or there is little oversight or regular monitoring of key performance indicators. Gambia offers an example of successful outsourcing and has been able to improve immunization coverage through outsourcing transport. Countries cannot wait until outsourcing infrastructure develops. They need to approach the industry in a proactive way. Private companies will be interested in a market if it is presented on a wider basis, for instance, if it is presented on a PAN-African scale. There are also cost efficiencies in larger markets. Another area that needs attention is capacity building in contract management.
- The presence of such an expert is currently rare and her/his deployment in the field from WHO HQ, which is for now the best option, takes time and is not appropriate for a rapid response. Integrating outbreak response logistics into the TechNet21 platform is probably a very efficient means to extend the skills of the health logisticians specialized in EPI/ vaccination logistics.
- TechNet21 subscribers are spread over 50 countries worldwide and total over 2000. The composition of the subscribers has diversified to include journalists

and students in addition to immunization personnel. TechNet21 uses the latest CMS Joomla version to run its website and forum. Today, the TechNet21 communications toolkit has an online discussion forum and a weekly newsletter; TechNet21 is also on Twitter (@TechNet21Mod) and has a YouTube channel (<http://www.youtube.com/user/TechNet21>).

- HERMES, a software platform that can rapidly generate an interactive discrete event simulation model of any supply chain, was utilized to redesign supply chains to save warehousing costs and improve vaccine availability in Senegal and Benin. (<http://hermes.psc.edu/>)
- Vision 2020 for immunization supply chains focuses on five priority goals: 1) Vaccine products and packaging design to meet country needs; 2) Immunization supply systems to maximize performance through continuous improvement; 3) The environmental impact of immunization supply systems is minimized; 4) Information systems drive better immunization activities; and 5) Human resource policies effectively support immunization supply systems.

In the closing session, Modibo Dicko's contribution to immunization was acknowledged as he was retiring from the World Health Organization (WHO). Modibo Dicko thanked his parents, teachers and mentors, and co-workers who played a role in shaping him as an individual and helped him achieve his career goals. He expressed his sorrow that the polio agenda remained unfinished, expressing his feelings through a moving poem titled *Polio Zero* (see Appendix III). In the words of Michel Zaffran, "Modibo delivered a wonderful, extremely eloquent and moving closing address, which participants received with tears in their eyes and a standing ovation!"

It is appropriate to conclude with a comment made by Dr Zaffran during one of the discussions: 'It is true that the immunization scenario has changed but what do we do? Do we sit by and watch or should we be open to change?'

List of Acronyms

AMP	Agence de Médecine Préventive
ARO	Alert Response Operations
BCG	Bacillus Calmette Guerin
BMGF	Bill and Melinda Gates Foundation
BOBS	Botswana Bureau of Standards
CC	Cold Chain
CCCCM	Collaboration Centre for Cold Chain
CCL	Cold Chain Logistics
CHAI	Clinton Health Access Initiative
CMS	Central Medical Stores
CTC	Controlled Temperature Chain
DVDMT	District Vaccine Data management Tool
EPI	Extended Programme of Immunization
EVM	Effective Vaccine Management
EVSM	Effective Vaccine Store Management
GSK	GlaxoSmithKline
HPV	Human Papilloma Virus
HR	Human Resources
HSS	Health System Strengthening
ICT	Information Communications Technology
IIS	Immunization Information Systems
IIS	Immunization Information Systems
IPC	Infection Prevention and Control
IRSP	Institut Régional de Santé Publique
ITA	International Technical Assistant
MIS	Management Information Systems
MoH	Ministry of Health
MoHSW	Ministry of Health and Social Welfare
MSD	Medical Supplies Division
NIP	National Immunization Programme
NRA	National Regulatory Authority
PATH	Programme for Appropriate Technology in Health
PCV	Pneumococcal Vaccine
PIS	Product Information Systems
PNA	National Supply Pharmacy
PPP	Public-Private Partnership
PQS	Performance Quality and Safety
PtD	People that Deliver
RMSD	Regional Medical Supply Division
SCM	Supply Chain Management
SDD	Solar Direct-Drive
SDP	Service Delivery Point
SMT	Stock Management Tool
SOP	Standard Operating Procedures
SPC	State Pharma Cooperation
TAM	Transport Asset Management
UNICEF	United Nations International Children's Emergency Fund
VHF	Viral Hemorrhagic Fever
VSSM	Vaccination Supplies Stock Management
VVM	Vaccine Vial Monitor
WHO	World Health Organization
WMS	Warehouse Management System

DAY 1

Section I: Introduction and context

Consultation objectives: Jhilmil Bahl

The presenter welcomed the guests and briefly summarized the purpose of the consultation: sharing the latest technological innovations, strategies and practices that impact logistic systems management in national immunization programmes (NIPs). The consultation also became a platform for sharing experiences in the areas of vaccine storage and transport, vaccine management, cold chain and equipment performance, introduction of new vaccines or immunization technologies and overall information systems monitoring in developing countries. It also aimed to stimulate dialogue and debate on the development and implementation of best practices.

Immunization logistics in the WHO African region: Hailu Kenea

The vaccine supply chain in the African region operates in a scenario where country-specific initiatives focus on maintaining polio-free status, stopping polio transmission, increasing coverage, and immunizing against a larger number of vaccine-preventable diseases. Thirty-four countries conducted Effective Vaccine Management (EVM) assessments and developed improvement plans. Storage temperature and capacity, and distribution management remain the weakest indicators across countries. The cold chain (CC) capacity projection for the next five years indicated that today's infrastructure gap today is an urgent matter and needs a long-term investment. Thirty-two countries used the WHO Stock Management Tool in 2012; this was achieved through the commitment of logisticians and store managers working on a national level and the strong technical support provided by World Health Organization (WHO).

Some of the challenges include:

- Having an advanced e-platform for remote technical support, information-sharing and updating
- Bridging the funding gap in infrastructure investment
- Committing to continuous improvement, capacity building and motivation

The key focus areas are: improving the vaccine supply chain; building human resource capacity; enhancing existing tools to meet the changing environments; providing support for the qualitative and quantitative analysis of infrastructure needs; and providing support for resource mobilization efforts.

Discussion Highlights

- There is no direct link between the cold chain inventory and EVM, especially at a national level. However, the EVM improvement plan can lead to the implementation of the cold chain replacement plans in five years' time. EVM recommends a national level inventory.
- Less than 2.5% of vaccine costs are allocated towards strengthening the cold chain. Even if that percentage was bundled and put into a fund, it would go a long way towards improving the cold chain. In other words, 90% of the investment goes into

buying the product and no thought is given to distribution. The private sector is a different matter altogether. Everyone should consider whether WHO and partners have strategies to invest in bundling, distribution, etc. to strengthen the supply chain. The EVM improvement plan helps define the areas that require financial support.

- Countries do have the resources to invest in systems instead of just vaccines. This needs to be a priority in national plans. However, there are many competing priorities. EVM gives us the opportunity to ensure that countries prioritize CC logistics.
- Regarding the imbalance between commodities and infrastructure, GAVI is unsure whether we should specify how funds are to be used or prioritized under Health System Strengthening (HSS). GAVI is exploring how it can improve coordination in these areas. An infrastructure fund is also being considered.
- We often end up discussing how we can find more money. However, we should, in fact, be thinking about how we can use the money we have more effectively and efficiently (this was the line used by a breakout group to attract participants to its session).

Section II: Vaccine characteristics and delivery systems

Introduction of new vaccines: the readiness of the vaccine supply and logistics systems and their impact: Souleymane Kone

When new vaccines such as Hib, PCV and Rotavirus, are introduced, the vaccine presentation creates new challenges for the supply chain.

These challenges are in the form of:

- Diverging vaccine temperature sensitivity profiles. For example, Penta has a maximum of three pre-qualified vaccines with different types of vaccine vial monitors (VVM)
- An increase in packed volumes
- An increase in product disparities. Today, there are different available vaccines with different serotype coverage as well as different temperature sensitivity and packaging characteristics for the same disease.

Therefore, the task of assessing the impact of a new vaccine introduction becomes very complex. Nevertheless, a new vaccine introduction has a big impact on the supply chain. The number of doses and injections per child almost doubles and this will impact the following four areas:

1. Storage and transport due to the increasing volume of vaccines and ancillary items to be supplied and delivered
2. The workforce, which will have to handle and deliver more vaccines and an increasing workload. The complexity of products will also require a more skilled workforce
3. Injection safety
4. Immunization waste, which will increase

Proper planning in the above areas is essential to ensure that the NIP is ready to introduce the desired vaccine. The following assessments need to be undertaken to strengthen the supply chain:

- Cold chain capacity assessment, leading to a CC expansion and rehabilitation plan
- EVM assessment, leading to the development and implementation of an EVM plan

We also need to determine the status of LMIS in the countries and ensure that data/information flows for real-time tracking of supplies and achievements.

Generally, the central store will have the most significant impact with regard to storage capacity compared to the district and the service delivery levels.

The expansion of cold storage capacities could be undertaken either as:

- a moderate successive scaling-up
- a one-time big expansion, or
- successive big expansions

However, in most cases, cold storage expansion alone is insufficient to cope with the needs of countries. Countries may have to actively implement additional measures, including changing vaccine presentation, to reduce the need for cold storage capacity. However, this is limited by the global availability of vaccines with the desired characteristics.

The impact of new vaccine introduction on waste management will depend on the vaccine formulation and presentation.

Two parameters need to be assessed regarding the workload when it comes to service delivery:

- The distance to a service point, i.e. the geographical access, which will determine whether fixed, outreach or mobile strategy is used to deliver services.
- The size of the catchment population, presented as the number of annual births per service point

Essentially, the workload for health workers increases in correlation with the size of the population per service point.

Most countries are far from the desired 80/80 target (80 annual births per service point within 80km²), as seen in Tunisia. For countries with the 5km distance to a service point, the large size of the catchment population (up to 1000 annual births per service point) remains a bottleneck for smooth implementation of services.

Comprehensive tools are required to undertake all these analyses to support informed decision-making. WHO has been working to develop the relevant tools.

Discussion Highlights

- We have information on central-level capacity but there may still be a need for information on peripheral-level requirements.

- The higher the VVM stages, the more sensitive the vaccine is to temperature change. The VVM categories are listed on the WHO website.
- In Tunisia, the coverage is 83 children per year, i.e. around 6 children every month. To determine where this is cost-effective, we need to consider not only the number of children but also the number of different vaccine doses covered. Ultimately, it is a question of saving a child's life.
- Waste management is a problem area and there has been no global support since Yves Chartier passed away. Immunization personnel in the field need to define the magnitude of the waste generated in order to handle it.
- Regarding the ban on mercury and its use in the form of thimerosal in vaccines, the UNEP treaty exempts vaccines from the purview of the ban.
- There can be no universal advice on which cold chain expansion type a country should choose. It is better to go ahead with moderate expansion, otherwise large investments may be made, leading to extra space as a result of future innovations in vaccine packaging. In Sudan, huge cold rooms have been built at considerable costs and they have remained empty for 5-7 years.
- We are moving into an era where the use of private services will increase. The private sector is participating more, for instance, in transportation, outsourcing of maintenance, and also LMIS. Our financial mechanisms should address not just buying of capital goods, but also other services like transport.
- Health logistics are complex and they can be managed using very well-developed tools. These need to be used. Again, we address the need for physical resources but not human resources. The supply chain can only be as efficient as the people who manage it. LOGIVAC is providing some of the answers through training.
- Improvement plans should focus on maximizing the use of existing storage capacity. Very often, our work is based on theoretical numbers rather than practical numbers. At a global level, decision-making can only be based on average figures. Unfortunately, the various databases are not interlinked. LMIS needs to be integrated and country-level managers should be able to access immunization data.

Beyond the cold chain: Taking advantage of the true heat stability of vaccines: Simona Zipursky

Many vaccines are more stable than their current licences indicate. The Controlled Temperature Chain (CTC) approach takes advantage of existing vaccine stability. Without requiring any reformulation, it enables the use of vaccines outside the standard 2–8°C range, endorsed through regulatory processes.† Many countries have already been taking advantage of this stability, using certain antigens outside the cold chain for limited periods of time by relying on the VVM. However, this use is 'off-license', though field studies have confirmed the potency of vaccines used in this way.‡

† The regulatory approval will allow for 'on-license' use and is important for ensuring that vaccines remain potent and safe throughout their lifecycle.

‡ Filed studies like the following: Sutanto A, Suarnawa IM, Nelson CM, Stewart T, Indijati Soewarso T. Home delivery of heat-stable vaccines in Indonesia: outreach immunization with a prefilled, single-use injection device. *Bulletin of the World Health Organization*. 1999; 77(2): 119–126.

The benefits of a CTC approach include the ability to reach more people, especially in remote areas; reduced programmatic costs and constraints, including ice pack-freezing challenges and surge capacity needs; lower human resources investment; and reduced risk of freeze damage to vaccines.

In 2012, the license for Serum Institute of India's Meningitis A vaccine, MenAfriVac®, was changed based on a thorough review of scientific data by regulatory authorities and WHO. The vaccine was allowed to be used for a period of up to four days, at temperatures of up to 40°C in CTC.

Key initiatives to enable the use of vaccines in the CTC include the development of guidelines for regulators on how to license vaccines for CTC use and development of guidance and training materials for countries and collaborations with several vaccine manufacturers on Hepatitis B, Yellow Fever, and HPV.

Benin: Delivering Meningitis A vaccine (MenAfrivac) in a Controlled Temperature Chain (CTC): Bassabi Alladi & Claude Lodjo

During the Meningitis A campaign in Benin, the vaccine was used at an ambient temperature of 40° C for up to four days following its removal from the +2° C to +8° C cold chain.

The **advantages** of CTC include:

- Reduction of transportation costs
- Reduction of cold chain equipment
- Reaching out to a larger target in a shorter time
- Vaccine wastage comparable to when using cold chain (0.06%)
- Vaccinators and supervisors prefer the CTC mode
- No vaccine wastage due to VVM stage 3

The **challenges** include:

- Management of larger quantity of vaccines
- Unpredictable target population in certain areas, hence the need to avoid taking out large quantities of vaccines for the same day
- Reading of indicators (when defining how many days old)
- Avoiding direct exposure to sunlight

A few **questions**:

- Why discard the vial after four days when the VVM is still in good condition?
- What can one do if the ambient temperature is higher than 40° C?
- Are there other studies being planned for temperatures greater than 40° C or for a period more than four days?

Discussion Highlights

- The vaccine is discarded after four days because the reviewers, after reviewing the data and looking at the worst-case scenario, have arrived at the conclusion that, to avoid taking a risk, it is better to discard the vaccine, which may or may not work on the fifth day. It is better to be safe than sorry. In Benin, the stocks were managed in such a way that the 4-day limit was not extended.
- Where the cold chain is available, CTC may not be the best approach.
- The process of obtaining marketing authorization for these vaccines was discussed, as well as the cooperation between the National Regulatory Authority (NRA) and the manufacturers. The manufacturers confirmed through their patent that the vaccine retained its efficacy at 40 °C. Every new batch was put through rigorous laboratory studies to confirm that the “vaccine release specifications” were met. The Benin Ministry of Health (MoH) did not carry out a clinical trial but was authorized by the manufacturer and NRA. The vaccine had already passed the clinical tests.
- If the VVM label is fine but the expiry date has passed, the vaccine needs to be discarded.
- There is no plan to test the vaccine at temperatures higher than 40 °C.
- The Expanded Programme of Immunization (EPI) has reiterated a single message for thirty years and suddenly we are now discussing CTC. This could be a little precipitous. There is so much new information related to vaccines that it is getting difficult to process. Consequently, it may be difficult for people in the field to understand these conflicting messages.
- We need to be cautious. CTC is not mandatory; it only offers additional flexibility. It is true that immunization has changed. However, it is debatable whether it is best to observe the situation or endeavour to change it. Countries such as Mali and Chad, where vaccines have been taken out of the cold chain and where CTC can offer additional flexibility, should adopt it.

[Minimizing freezing of vaccine: Indonesia: Lulu Dewi \(the presentation was given by Ticky Raubenheimer\)](#)

In Indonesia, in 2005, the use of icepacks was replaced by cold-water packs when transporting all freeze-sensitive vaccines.

The strategies to protect vaccines include:

- Use of cold water packs
- Use of VVM for all vaccines except BCG
- Conducting Effective Vaccine Store Management (EVSM) annually in selected provinces to assess storage management. Lately, EVM assessment has been adopted.
- Cold chain training, which includes a session on vaccine freezing

A temperature monitoring study was undertaken in 2011 (DPT-HB vaccine) in East Java and Banten. It was found that vaccines were, indeed, exposed to sub-zero temperatures, but for less than an hour. No alarms were triggered and no vaccine expired based on the VVM reading. In other words, vaccine freezing had been reduced. The study highlighted some areas for improvement, especially to protect vaccines from

higher temperatures. It also concluded that cold-water packs were functioning effectively.

The EVM assessments in 2011 and 2012 have revealed that the implementation of cold-water packs and VVM management has been strengthened. *A Study on Diphtheria Outbreak Investigation East Java, 2012* further revealed that the outbreak was not related to cold chain failure but, in fact, related to unimmunized or incomplete immunization.

Discussion Highlights

- The specification of maintaining water from 2-8 °C must be defined. It was asked whether the cool-water pack was stored in the same refrigerator as the vaccine. A challenge was raised regarding how packs should be cooled during power outages.
- Volume-wise, no additional space was required and it was not the freezer space that was being used but the refrigerator space. There was no vaccine freezing and, thereby, no vaccine loss: this was a major gain. Rigorous training enabled institutionalizing the switchover to cold-water packs. The ambient temperatures were between 23 °C–37 °C. The required temperatures could be maintained for a span of 49–53 days.
- The high turnover of personnel made it a little more difficult to manage the change, but it was supported by intensive refresher training.

Section III: Equipment system management

Solar stories: Avoiding the same mistakes: Dmitri Davydov

Ever since the first solar refrigerator was developed in 1935, management issues have often overshadowed technical challenges. It is important to remember lessons of the past as we work towards improving performance management. For example, NASA tested PV powered fridges in 24 countries from 1981 to 1985. It was estimated that they would last for 20 years however many failed within just a few years. The lessons we have learned from this incident were:

- Technical:
 - Field-proven PV components and systems that are capable of operating in similar environments must be used
 - Site-specific weather data must be obtained and used where possible
 - Minimal instrumentation and simple controls must be used in order to provide user-orientated product engineering
- Institutional
 - Field service capability must be established and repair capability should be equal to or better than what is available for conventional systems
 - Training should be provided at all levels so that all involved understand the PV system.
 - Activities should be coordinated with those of local end-users
- Financial

- Viability should be evaluated using life-cycle costing and high initial costs should be taken into account
- Financing mechanisms for developing countries should be utilized to minimize said high initial costs

It is important to use country performance feedback in order to understand root-causes of issues. For example, in Haiti in 2009, 170 solar fridges were procured and stored for 2 years. 85 were installed and 20% of these showed freezing temperatures. It was discovered that thermostats had been damaged due to unsuitable storage (high temperatures) amongst other challenges. The malfunction led to significant monetary costs but also damaged public confidence, giving good technology a bad name.

There is a need to find a model that can sufficiently and efficiently support EPI in countries with limited funds. There has been a successful community engagement model in Sierra Leone where costs have been shared with other commodities. In order to build sustainable systems, we need to explore models that promote:

- Recognition of underlying motivations of users and owners
- Local entrepreneurship in vaccine delivery
- Incentives for existing businesses to expand into vaccines
- Revenue generation opportunities (solar electricity, micro-grids)
- Integration with other commodities
- Partnerships with health agencies and NGOs

The key to success is firstly to commit to sustainable success as failures happen when maintenance funding is neglected. Systems must be built on local ownership. Secondly, we must also collaborate with the industry to ensure quality products and delivery. There is a need to give the industry and procurement agencies feedback on equipment performance in order to improve products. Thirdly, the need to monitor performance using data monitoring systems and generating quantifiable data has been apparent since the 80s. This enables us to predict and prevent failures in areas where malfunctions occur frequently. Site visits and evaluations of user perceptions and operation of equipment are equally useful. This can reveal critical cost-saving information.

[Haiti: Experience in the use of the solar refrigeration system: J. Francois](#)

The first solar refrigerators were introduced in Haiti in the 1990s through the French Technical Cooperation. A second lot of Seafreeze solar refrigerators were introduced in the EPI by the end of the 1990s. Thus, by early 2000, 200 out of a total of 600 refrigerators were solar-powered. However, by 2007, most of these were non-functional for the following reasons:

- Theft of solar panels
- Maintenance issues
- Non-availability of spares

In 2009–2010, solar power-based equipment was reintroduced due to problems related to gas supply. In 2010, with support from UNICEF, 170 Solar Chill direct-drive units

were procured. However, due to the earthquake, these stayed in the warehouse for a whole year. Half of them (85) were installed between 2011 and 2012.

The majority of these refrigerators faced the problem of temperature instability, including excursion beyond the safe/recommended range, particularly below 0° C. In March 2012, Vestfrost identified that the problem was caused by damaged thermostats due to the overheating during storage in containers. However, the refrigerators continued to operate outside the +2° C to +8° C, even after the thermostats were changed. A second inspection by the manufacturer in January 2013 linked the problems to fuses, the fan, cabling and incorrect installation, including wrong orientation and inclination of solar panels.

During the second visit, 10 local technicians were trained in installing and maintaining the refrigerators as well as setting the thermostats. For now, the MoH has decided to observe the functioning of these refrigerators and not to use them for vaccine storage.

Discussion Highlights

- It is necessary to find out who replaced the spares in Haiti and whether the non-working thermostats were set by the factory.
- The senior technicians, who are present during the second inspection, have undergone longer training and they can install and rate the equipment. The results are awaited.
- In an earlier session, it was indicated that we need approximately 50,000 solar refrigerators to make the transition from kerosene. The Haiti experience is challenging and it is yet uncertain whether manufacturers can cope with the demand. In DRC, 3000 to 4000 units are needed. Some manufacturers have confirmed that they can satisfy the demands if there are well-defined plans.
- Countries are shifting to solar but do not have an HR and maintenance set up. It is unsure what capacity building support can be expected from the manufacturers. It is also questionable whether we have enough experience with solar refrigerators for installation of equipment on a larger scale.
- The country should train a group of competent people with the help and participation of equipment suppliers and manufacturers. In the present case, the material was defective.
- Data from solar refrigerators reveals that they are not performing efficiently. We need to ascertain whether equivalent data has been collected on absorption technologies.
- There is a danger of overselling solar technology prematurely. Technology has evolved but we have not necessarily evolved enough to use this technology. Donors need to know UNICEF's plans for systematic monitoring and sharing so that they can also learn and decide.
- The units in Haiti have not yet been used to store the vaccines. The temperature study is still underway. The solar refrigerators are part of an experiment and not part of the cold chain system as of yet.

- The total costs need to be calculated, including the handholding. Ensuring that feedback and maintenance are kept in the loop is part of the challenge of programme designing. Countries need to be helped to manage this change and this help should be provided long before the funds are received. The local national managers should want this technology. It is much safer and more environmentally friendly than kerosene-run refrigerators. Systematic data monitoring is very important. Installation and training should be built into the costs.
- The Haiti experience should not be treated as a representative one. The Sundanzer solar direct-drive (SDD) refrigerators in Senegal did not pose any problems. Temperatures in all units had been monitored continuously for a year and showed good temperature control. The reasons for good performance were as follows:
 - A professional team assessed all the sites before installation
 - Systems were sized and designed for actual site conditions
 - The refrigerator manufacturer trained local national installers and jointly installed the first three systems
- Successful solar refrigeration requires long-term planning and budgeting; purchase of prequalified equipment; professional installation; good maintenance; and, finally, systematic monitoring.
- Solar refrigerators are often the first step in rural electrification. *UNICEF-SD* confirmed that the real cause of the Haiti SolarChill problem was incorrect long-term storage causing permanent damage to the thermostats, combined with incorrect installation of PV panels.

Break-out sessions

How to improve the country stakeholders' ability to influence future vaccine products: Debra Kristensen and Simona Zipursky

Today, there is a recognized need to improve connections with those who handle and administer vaccines, to seek their opinions and address their concerns about vaccine products, delivery devices, and cold chain equipment. Vaccine and equipment developers/manufacturers and public sector stakeholders need this information in the early stages of product development to ensure that products are designed with characteristics that best suit the national needs and constraints.

The world is a much smaller place due to increased Internet and telecommunications connectivity. However, there are still large gaps between in-country health workers and logisticians and vaccine and equipment manufacturers. The voices of immunization programme managers, health care workers and logisticians should be included in the public/private sector dialogue. Their needs and concerns need to be taken into account when developing product profiles. In order for this to occur, means for more regular and efficient communication must be established.

The discussion areas were:

- Current means of gathering feedback from end-users to inform product profiles (e.g. market research, end-user studies, marketplace exhibit at TechNet21, queries through the TechNet21 website)

- Current means of influencing product profiles (e.g. Vaccine Presentation and Packaging Advisory Group, Immunization Practices Advisory Committee recommendations, WHO prequalification specifications, feedback from Cold Chain and Logistics Task Force)
 - Barriers to engaging immunization programme stakeholders at all levels of the health system
 - Ideas to engage end-users in a more cost-effective manner and learn their opinions
1. Market innovations to impact new and existing cold equipment: James Cheyne

The Bill & Melinda Gates Foundation supported a study by McKinsey and Company during 2012, which reviewed the opportunities for 'shaping the market' for the principal items of cold chain equipment. In summary, this project aims to do for cold chain equipment what UNICEF did for the vaccine market in the 1980s. That is to encourage more strategic buying by UNICEF and others to get the best value for their money.

This activity has become one of the Bill & Melinda Gates Foundation's priorities for 2013.

Considerations for cold chain equipment selection: Souleymane Kone, Sophie Newland, Tina Lorensen and Dereje Haile

The cold chain is the backbone of the immunization supply chain. Today, the introduction of new vaccines requires the cold chain in many countries to be upgraded to accommodate additional quantities of bulky and expensive vaccines. In addition to the capacity expansion, there is a need to ensure a reliable energy source and refrigeration type. At a national level, there is an ongoing phasing out of absorption and kerosene/gas-based equipment. Therefore, the rehabilitation of the cold chain is an urgent process, based on which the size and specifications of the cold chain equipment must be adjusted.

The process of rehabilitating the cold chain should be undertaken to improve the quality of service, increase efficiency of the system and reduce operational costs. Managers will need appropriate guidance for making decisions regarding:

- The choice of energy sources of powering cold chain equipment
- Setting norms for vaccine stores at different levels.

Objectives of the session:

- Provide an update on the cold chain inventory methods and tools
- Present and discuss criteria for selecting cold chain equipment
- Explain the life cycle concept

DAY 2

Section III: Equipment system management

Update on the WHO PQS prequalification of equipment and devices for immunization: Denis Georges Maire

Performance Quality and Safety (PQS) continues to focus on three areas:

- Development and revision of performance specifications
- The prequalification of devices
- Post-market monitoring

The transitioning from the previous Product Information Sheets (PIS) system has been achieved and the PQS web-based database has now been running for two years. It allows for a more efficient way of managing the programme through its three registers (Companies, Laboratories and Products), a document management facility and a user-feedback function. The website gives access to a large variety of information and, thereby, provides the necessary transparency to the programme. It produces an up-to-date, easily accessible PDF catalogue that includes guidance notes. It will, however, require further development in its layout and functionality.

To date, 11 laboratories have been PQS-accredited for prequalification of products. Over the last four years (2008–2012), the number of prequalified products has increased four-fold (216). These products belong to eight active categories with 34 sub-categories, each having its set of performance specifications and verification protocols.

One critical activity to keep information up-to-date is the implementation of annual reviews. PQS held its sixth annual review in April 2012, examining 184 dossiers from 50 manufacturers.

Incorporating innovations into PQS has been translated by the creation of 9 sub-categories, which cover 7 of the 8 active categories. Other forthcoming innovations include a sub-category under the traditional cold box and vaccine carrier with a “freeze-free” characteristic and a sub-category “solar-powered direct-drive” freezer.

Post-market monitoring is an important PQS activity that has remained weak. It is critical to obtain information on the suitability of the equipment in the field in order to ensure that PQS specifications are relevant to field conditions. This is even more important for innovative solutions, where the lack of field experience obliges PQS to question and revise its minimum requirements according to the feedback received from the various players in countries. Two examples of new sub-categories where feedback will be essential are “centralized temperature monitoring systems” and “solar direct-drive appliances”.

To address the lack of feedback, PQS has incorporated a feedback function on its website. For more complex equipment, PQS has created a quality assurance form to be filled out by the sub-contracted company making the installation. However, these two initiatives can work only if there is a commitment from all stakeholders.

Another issue relates to the sustainability of the WHO PQS programme. External funding sources have become scarce and the cost recovery system is generating only

half of the minimum cost of the programme. Increasing the charges of dossier submissions and fund raising are the two possible solutions.

Discussion Highlights:

- Logging in and keying in a password pose problems though the download process which is not user-friendly. However, it is necessary to key in a password to download the catalogue as login details avoid spamming and determine site usage data. Nevertheless, this process could be reconsidered.
- Fee increases should be avoided because this would discourage small manufacturers and those with low-value products from participating. The issue of prices remains to be discussed, but PQS currently has a funding gap that has to be filled.
- It was suggested that more comprehensive guidelines are needed on the use and selection of temperature monitoring equipment. This will be considered.
- The catalogue should include emergency helpline numbers for all manufacturers/products.
- With regard to updating product prices every year, it is done as part of the annual review process.
- Equipment that has been withdrawn from the list should remain in the catalogue, with information about the reasons for withdrawal.
- A simpler and more precise process is needed to capture national feedback.
- There needs to be consistent, standardized descriptions for similar equipment.
- Feedback is very important and there are many useful things that people in the field can report but there are no proper feedback system is in place.

It would be very useful:

- to know how many countries have procured each prequalified product
- to send a targeted annual feedback questionnaire to countries, based on the equipment that they actually have.

Steve McCarney (Solar Electric Light Fund and PQS team member) made an addition to the main presentation, pointing out that the Haiti SolarChill experience (reported on Day 1) should not be seen as representative of all solar refrigerators. PQS has prequalified a total of 12 different models, of which half, like the SolarChill, are SDD. The Senegal Optimize team were invited to comment on the performance of the 12 SDD units installed in Senegal.

Section IV: Management Information Systems

Management Information System for immunization: an overview: Yann Le Tallec

There is a need to invest in better MIS to improve the performance of EPI through data-driven management for the following reasons:

- There is a dramatic increase in immunization resources. This makes the system more complex and, thus, calls for better management systems.
- Even in EPI programmes with high coverage, there can be major inefficiencies that remain unaddressed, especially regarding

management's 'blind spots'.

The Clinton Health Access Initiative's (CHAI) work in that area has taught us that:

1. A well-designed and used electronic MIS can and should dramatically increase the effectiveness and efficiency of immunization programmes.
2. Adoption barriers and costs of Information Communications and Technology (ICT) solutions are rapidly diminishing; thus enabling electronic MIS in an increasing number of areas.
3. Technology is only one of several enablers of the desired change: good management processes and people remain key.
4. Getting embedded champions for the desired change is paramount to successfully improving MIS.

Discussion highlights:

- It is necessary to find out whether the manager at the district-level felt supported by those at higher levels. Data management would probably be one among the thirty tasks that were her/his responsibility. Experience seems to suggest that it is easier to motivate staff at lower levels since they are closer to the field.
- The level of skill development needed at a district level for the professionalization of the supply chain needs to be ascertained.
- It is important to use champions to encourage national-level engagement. It is also important to inform the authorities about the available options. The key pieces of data that need fixing should be identified and prioritised. The basic rule is garbage in garbage out.
- The IT industry can work in almost all conditions. The availability of funds is essential and cannot be over-emphasized. Clearly identifying the role of MoH at the early stages of the project is one of the keys to success if the process is being outsourced.
- Human resource capacity is inadequate in Kenya. This renders stock management challenging.
- It is possible that one segment of the supply chain could be focused on to determine what works, instead of the entire supply chain.
- Wherever projects are implemented, human resource development should be given utmost priority.
- Sustainability of data collection and analysis and data management tools can be used to track the number of used vaccine vials and know the number of vaccinated children.
- Existing tools should be used and refined wherever possible, rather than inventing and developing new tools.
- Standard operating procedures (SOPs) are well developed for all cold chain equipment. Indicators should be consistent with the EVM Assessment Tool and standard indicators should be used for all tools; these indicators can be expressed as percentages and can be applied to multiple facilities. The warning provided by the

tools should be like traffic lights and not just presented as absolute numbers in order to understand data faster.

- It is undeniable that a multitude of tools are available for different purposes. The challenge is to create demand and to change the mindset of the MoH staff. For instance, in Kenya, a new tool was used because the government wanted one.
- The usual perception is that the health worker is recruited only to collect data for the managers to satisfactorily perform their jobs. The person entering the data should also be the person benefiting from it, for instance the store manager.
- The advantages of WHO District Vaccine Data Management Tool (DVDMT) were brought forward.

Successes and challenges of the use of the vaccination data management tool – DVDMT (Madagascar): Razanadraibe Seth

The DVDMT is a tool to manage and analyse EPI data in order to improve the monitoring system. It consists of an Excel workbook with multiple sheets for configuration parameters, monthly data entry, trend analyses and performance indicators.

In 2004, Madagascar adapted the tool and deployed it in 45 health districts. By 2005, it was extended to all health districts. Follow-up training was conducted from 2006 to 2008.

DVDMT has improved the accuracy of the data and the quality of the EPI monitoring system as seen from the data quality assessments conducted by GAVI in 2003 and 2005. The verification factor, which measures the accuracy of the data, improved significantly from 58% to 100%. Even the index quality monitoring, which was 49% in 2003, has improved to 70% in 2005. Completeness of reporting has also improved from 90.5% in 2002 to 97.6% in 2011.

Despite these successes, there were some constraints like obsolete equipment and inadequate skills to use the Windows operating system. Obtaining or updating the antivirus software was also a problem.

There are numerous benefits from using the tool, including reduction or absence of miscalculations of indicators since all calculations are automated which enables prompt decision making. EPI managers thus have more time for supervision.

The challenges are to:

- Extend DVDMT to all the health districts
- Train all district-level EPI officers to handle Windows OS
- Equip the districts with more efficient computers
- Interlink regions and districts to improve the central information system and health data management

To improve DVDMT, it should be divided into two parts: a workbook for data entry and another for analysis. To ensure data security, DVDMT OpenOffice should be developed and it would then be less vulnerable to viruses.

Discussion highlights:

- DVDMT is customized to suit country needs. It is used in most African countries, including Nigeria, and is designed with the participation of national personnel. Often, tools are just 'parachuted' in; this should be avoided. If people are not motivated, it is not easy to implement a tool.
- Organizational aspects of the tool and investment needed in terms of human resources need to be considered. In Madagascar, DVDMT is implemented by the EPI officer and one manager per district.
- Report files are sent from the district to higher levels, either by email or as a hard copy when email is not available. Those without access to email send them via SMS.
- Evidence in the presentation clearly shows that data quality has improved. However, this has not necessarily been the case for the supply chain. The supply chain used to function smoothly; but, since the introduction of PCV10, there have been issues. The situation is now beginning to improve. One on-going problem is that DVDMT reports are sent through the postal service and their receipt is delayed. Therefore, it is not possible to have a real-time appraisal of the situation in the field.

1. [Information and Communication Technology \(ICT\) toolkit](#): Jan Grevendonk

As new ICT emerges, more and more programme managers take an interest in the potential of major improvements in immunization information systems. However, sometimes, public health staffs lack the knowledge and skills required to adequately plan and implement complex ICT projects. "The ICT Toolkit" is a framework providing guidance and tools that will enable non-technical decision makers to think through the challenges of such projects and plan for scalability and sustainability. This toolkit is currently under development and will be posted on TechNet21 in the near future. Questions and comments may be directed to: jgrevendonk@path.org

Discussion highlights:

- There is a lack of information at the country level; the toolkit is intended to help countries to make the right decision.
- The way governments are approached for provision of information is a sensitive issue.
- Adequate information was unavailable when designing the ICT tool kit. Feedback from the field is important for further development and improvement. The toolkit can help countries to proceed in the right direction when developing their information systems.
- Software is a public good, like a vaccine, and if the public sector does not have access to an overview of the tools, then the Bill and Melinda Gates Foundation (BMGF) can help in making it available.
- It is important to know who is creating the tools we use in order to avoid the risk of creating parallel systems. There is not a lot of information available on other software and whatever is available tends to be anecdotal. Therefore, it is important to document past experiences and find a way to use this material. The private sector could also contribute to the 'public good' aspects of software.

Use of information technology and mobile communication tools for immunization programme management in Sri Lanka: Sudath Peiris

EPI commenced in Sri Lanka in 1978 and is supported by a manually driven information system. But the MIS does not produce reliable data and only covers the public sector and some private institutions. Also, the task of tracking immunization coverage is becoming increasingly difficult due to more parents seeking private services; absence of parents at their homes during the health worker's visit; and some households becoming inaccessible to health workers due to affluence and social barriers.

The Epidemiology Unit of the MoH recently initiated a project to create a Web-based National Immunization Registry and Immunization Management Information System to overcome the obstacles. The objectives and functionalities of this information system are as follows:

- Register all child births at the place of occurrence
- Track every vaccine encounter at the place of immunization
- Provide access to the immunization history of an individual without geographic barriers
- Record and track all AEFI information
- Use an SMS-based immunization alerting and default tracking system
- Maintain a comprehensive web-based supply chain and inventory system for vaccines and other logistics
- Maintain a national database of all human resources in EPI
- Make available real-time data and information to managers of the immunization programme
- Provide a comprehensive EPI database for research

Various stakeholders of the NIP spelt out their needs with regard to the MIS. Based on the requirements, a blueprint of the new MIS was created and agreed upon by the software developer and the Epidemiology Unit. The Web-Based Immunization Information System is currently being piloted in one district of Sri Lanka.

Reluctance to change, limited IT literacy among field health staff, capital and recurrent expenditure for IT equipment, poor mobile data connectivity, equipment maintenance and software troubleshooting and data security threats are the main challenges in wider implementation of the system.

Discussion highlights:

- It is necessary to ascertain whether the vaccine used by the private sector in Sri Lanka is supplied by the government, and the quality of vaccine management in the private sector (in India it is very poor). Government vaccines are given to the private sector providers free of charge. They then levy a service charge on patients. However, there are some vaccines, such as the hexavalent vaccine, which are used in the private sector but are not yet available in the public sector. The availability of hexa, PCV and rotavirus vaccines has shifted the advantage to the private sector for those who can afford these vaccines. It is currently difficult to impose standards

(including cold chain) on the private sector, but new legislation (the National Immunization Policy) is being drafted to overcome the problem; the legislative requirements will be mandatory for the private sector and will also force them to use the Immunization Information System.

[Iran: Web-based Vaccination Supplies Stock Management \(wVSSM\): Seyed Mohsen Zahraei](#)

The Iranian EPI adopted VSSM in 2010 at a central level and in a few of the regional stores. In 2011, with financial support from WHO and UNICEF country offices in Tehran, a web-based VSSM was developed. Since then, 328 vaccine stores at three levels (central, regional and district) were gradually connected to the MoH & Medical Education (MOH & ME) server and approximately 538 users were trained in using wVSSM. This presentation shared the achievements and challenges of using wVSSM.

The following steps were taken to introduce wVSSM:

- wVSSM was installed on the MOH & ME website
- No particular hardware was added for wVSSM
- Half-day cascade training was conducted for users at all levels
- Gradually, bugs were removed from the application and new functions and reports were added to satisfy the specific financial and programme requirements
- An offline wVSSM version was also developed for users, particularly at the lower levels. This option enables users to work without an Internet connection and data is synchronized when Internet connectivity is resumed.

There was a live demonstration of the wVSSM. The focus was on the supply request process that lower levels need to go through when requesting supplies from higher levels and the consequent process of dispatching supplies from a national level to lower levels.

[Improving vaccine LMIS: Tunisian experience with wVSSM: O. Ramzi](#)

In November 2011, the Tunisian Ministry of Health began field-testing wVSSM in Tunisia in collaboration with Project Optimize. The overarching goal was to:

- Enable the exchange of real-time data on key vaccine forecasting, stock management, and order status information, thus ensuring that the right quantities are distributed to the right place at the right time
- Track and trace vaccines throughout the supply chain to mitigate the risks of overstocking, expiry, and high vaccine wastage. As Tunisia begins to introduce new and more expensive vaccines, mitigating these risks became increasingly important.
- Adapt an existing open-source LMIS that could be integrated within the overall e-health MIS and linked to other immunization information systems (coverage)

wVSSM was selected based on user feedback and was modified to suit Tunisia. Some Arabic and French text was specifically modified to make it more easily understood by Tunisians. Relevant forms for ordering vaccines were also added.

Once the wVSSM tool was updated, a series of induction and refresher workshops were conducted in 2011. The hardware was purchased and installed in parallel with the training activities. A wVSSM server was set up in Tunis and computers and printers were installed at the ten pilot sites. It was ensured that the pilot sites had Internet connectivity to communicate with the wVSSM server.

Field-testing took place in 2012 and the results were very positive. Currently, the national, regional and district levels of the system have all been linked, and complete stock management information for vaccines can be seen in real time at each level.

But it has not been without challenges. In the more remote areas of Tunisia, where connectivity cannot be guaranteed, health workers have found it difficult to use the new system. It has also taken time for them to adapt to the new tool.

Discussion highlights:

- The effect of wVSSM in Iran has been positive because managers at each level can now access records at other levels. There have been no major implementation problems. In Tunisia, in-store stock management improved during 2012. The relative stock balance between stores has also improved.
- wVSSM is a stock management application and its present form (version 2.01) stops at the delivery level. Therefore, it was suggested that wVSSM might be linked to other computer applications for data collection at the service delivery sites. This could be done by linking wVSSM to Immunization Information System (IIS), the software being developed by PATH in Albania. It was noted that Mongolia and some other countries are using the VSSM stand-alone successfully.
- Some developing countries face the problem of Internet connectivity, which can hamper the use of a web-based application. To resolve this problem an off-line version of wVSSM is being developed with technical and financial support from WHO/PATH Project Optimize.
- The highlights of the workshop on wVSSM held in October 2012 in Chisinau (Moldova) were summarized. wVSSM was scheduled to be installed in Moldova in February 2013.
- Countries trying to develop their own applications should build on the existing experience and knowledge gained from developing VSSM stand-alone and wVSSM. Wherever possible countries should handle their own IT requirements in a sustainable manner. However, country-developed systems do not always include the critical indicators that are built into both VSSM and the Stock Management Tool (SMT). It is vital that these indicators are built into *all* stock management systems. wVSSM is able to output the critical indicators that are important for avoiding stock out and being over-stocked. Systems development demands a great deal of effort and there is a need to share experiences. It is possible to integrate wVSSM with other software for instance related to immunization coverage, but the challenge is the cost.
- NRAs should be approached and informed about the availability of such computer applications.
- In terms of funding required for training, installation and hardware for the utilization of wVSSM, the Iranian presentation showed that there were no extra hardware costs down to district level, and that existing computers and printers

could be used. However, computers and printers are not necessarily available in the lower levels. Therefore, expansion requires a certain amount of budget.

- The idea of approaching NRA for utilization of wVSSM needs to be explored as NRA has the authoritative power. It was also argued that funds are usually available but they are not prioritized. One of the responsibilities of UNICEF and WHO is to raise the awareness of the relevant government staff.
- The WHO SMT is more user-friendly than VSSM, but VSSM produces more actionable information.
- wVSSM is implemented using the Microsoft .net and SQL Server platform. The software is available from Mojtaba Haghgou (mojtaba05@hotmail.com) and (mojtaba@wvssm-demo.com)

Barcoding in pharmaceutical inventory management – Botswana experience: Muhammad Chohan

Central Medical Stores (CMS) is the public sector entity that is responsible for procurement, storage and distribution of pharmaceuticals and other health commodities to public health facilities. It has four departments: Procurement, Warehouse (Technical Operation), Quality Assurance and Corporate services, with 166 personnel and an operating budget of ± USD 95 million/year.

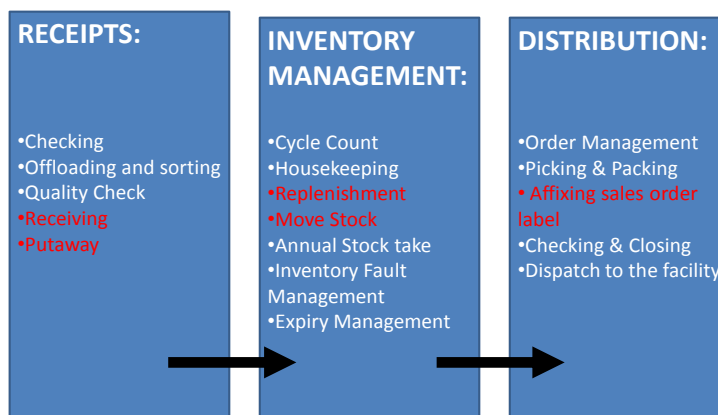
CMS has 1,544 commodity lines (stockable products on the CMS catalogue) plus special orders (non-stockable), distributing commodities to over 700 health facilities, processing approximately 10,000 items per month (Schedule Orders & Emergency Orders).

CMS was ISO 9001:2008 certified by the Botswana Bureau of Standards (BOBS) in November 2012.

It operates a fully automated warehouse using Warehouse Management System (WMS, Pulse) in inventory processing, from receipt of commodities to the service delivery point (SDP). The current WMS was introduced in 2003.

The CMS warehouse process is summarized in the figure below.

CMS Warehouse Processes:



Automation and barcoding

CMS uses an **alpha-numeric coding** system for products and locations identification.

- The product code consists of three letters and three numerical characters and the supplier of the product is identified by adding three additional numerical characters.

For example Store Keeping Unit (SKU) SOD008005:

SOD = Sodium Chloride

008 = 0.9% irrigation solution, 3000 ml

005 = the 5th registered supplier for this product.

- Stock locations are where the stock is kept and are identified by Zone, Aisle, Bay, Level and Slot

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The barcodes are used to identify products, suppliers, pallets, cartons, product storage locations and the processes within the warehouse. It contains critical information, e.g. transaction date, time, and reference number.

- The system generates six different barcode labels:
 - **Receiving:** store keeping unit (SKU) label, pallet label, & putaway label.
 - **Inventory Management Unit:** Replenishment and move labels
 - **Distribution:** Sales order label

Benefit of barcoding in warehouse operations:

- Uses barcodes and radio frequency devices to provide a seamless, automated and accurate inventory management system
- Rapidly processes large amounts of data (real-time data processing)
- Produces efficient and reliable reports
- Reduces human error
- Ease of transactions as well as fast and accurate processes
- Traceability of products up to facility level

Challenges:

- Unable to track products up to end-user (patient)
- Manual picking
- Unable to see the stock while processing the customer order
- System requires upgrading and on-going training of staff
- System does not automatically convert the unit of measure if the item comes in different unit from the standard unit
- Unable to print some reports in the excel format, making it difficult to analyse data for decision making

Using barcodes for managing vaccines stocks: Ahmet Ozlu

Turkey is a large country with 1.26 million births each year. The MoH implements a Health Transformation Programme that has increased availability of health resources and services and improved health financing. The 10-fold growth of investment in immunization in last decade increased the number of NIP antigens from 6 in 1995 to 13 in 2012.

Turkey has a government-owned, 4-level central vaccine distribution system, comprising one national vaccine store, 81 province stores, 950 district stores and about 22,000 public and private immunization service delivery sites. This chain has to handle an increasing portfolio of vaccine products; accommodate one-dose presentations requiring higher storage capacity; and deliver a large number of doses (about 30 million in 2011). Seven refrigerated trucks transport vaccines every quarter to 81 provinces, followed by a monthly distribution to subsequent levels.

Using a web interface, a web-based Vaccine Information System (Aşı-net) interconnects a stock management module using 2D barcodes, a real-time temperature control module, an immunization registry from the Family Medicine Information System, Hospital Information System and a Decision Support System.

The 2D barcodes on the vaccines are integrated with the "Pharmaceutical Tracking System", which defines an infrastructure to trace all pharmaceuticals in Turkey and became mandatory in 2010. The 2D barcode scanning operates at each point where the vaccine has passed and generates notifications to the central database, thus allowing the vaccines to be tracked.

2D barcodes are generated using Data Matrix Symbology: "ISO/IEC 16022 International Symbology Specification-Data Matrix ECC 200 Version" specifications. Each barcode includes: global trade item number of vaccine, serial number, batch number, expiry date, type of the vaccine, and number of doses per package. Specific 2D barcodes are produced per parcel, package, box and vial. Their application on packages requires secondary labelling of products, which is performed manually by suppliers.

Implementation of the system required cascade training for over 1,240 people. The extra cost for 2D bar-coding equipment and running costs represents less than \$0.01/dose.

The system aims to strengthen patient safety and immunization surveillance, and improve stock management and reporting.

Discussion highlights:

- When questioning how vaccine damage at the periphery is dealt with so that stocks remain adequate in Botswana, it was stated that, at the facility level, there is only a manual system of bin cards, apart from five facilities that have an integrated management system. Also, regarding expired and damaged vaccines, they are removed from the stock and the national guidance is that an official write-off instruction must be issued before final disposal is allowed.

In Turkey, no concrete evaluation of health worker behaviour has been conducted following the availability of barcoding technology, but the system has been well

received. A formal evaluation is needed. Measles vaccine coverage was already high before the introduction of the single-dose. The dissipated fear of vaccine wastage does not seem to have had an impact.

- A baseline assessment was not done. However a post-introduction evaluation will be carried out in order to assess the benefits of barcoding in Turkey.
- The list of benefits is impressive. An impact evaluation would be useful though a baseline evaluation may be too late because the system is now applied countrywide.

[The Effective Vaccine Management Initiative: Past, present and future:](#) Paul Colrain

After three years of the EVM improvement process, it is time to reflect on whether vaccine management systems are improving. After a brief description of the EVM improvement process and the EVM assessment in particular, the scores of all 65 assessments carried out so far were presented along with the status of implementation of their improvement plans. The results show that, in general, the vaccine management systems of GAVI eligible countries do not meet the minimum standard and that progress of system improvement is slow. The EVM improvement planning and implementation processes need review.

Discussion highlights:

- The new release of EVM does not take into account questions relevant to other (non-immunization) programmes, but the next iteration could probably incorporate ideas from other tools.
- It is under discussion whether the EVSM certification process, which was very motivating, could be re-introduced for EVM.
- Though the EVM software cannot currently be run using Open Office, moving the EVM to another platform could be considered in the future.
- The tool has a translation option, which countries can use to create local language versions.
- EVM assessments serve no purpose if the problems revealed by the assessments are not addressed. EVM assessors do not have the power to implement improvement plans. Improvement plans should address country needs, and need to be given the capacity to implement these plans.
- It is essential to ensure that the improvement planning process includes in-country institutions like the national NRA, who have the power to ensure implementation. However, there often is no functioning NRA. EVM has no legal standing, but NRAs do. EVM can contribute towards regular auditing, but legal support would greatly strengthen the process.
- EVM should be both an assessment and a capacity-building exercise. There is a definite need to devise a legal framework for EVM assessments. This could extend to other CC drugs that are much bulkier than vaccines. EVM certification would help give visibility to the programme at the country level.
- The benefits of building local capacities and institutions to conduct EVM were considered.
- Posting EVM datasets on the WHO database remains a problem because some countries will not allow it. This could potentially be solved by turning data-sharing

into a GAVI requirement. It is uncertain whether we would get to see the datasets if NRA undertakes the assessments.

- EVM is now a requirement for GAVI funding. We need to ensure that it is also seen as a tool for improvement; this can only be done by building local ownership and capacity. Assessors need to be aware that the EVM reports are for the country and not just for GAVI.
- Stock control was particularly bad 20 years ago in 1993. Modibo Dicko and John Lloyd engaged in an effort to improve the situation. After two years of effort, they discovered that the root of the problem was related to the cold chain. Fundamentally, we are looking at structural problems; we are facing a systematic manpower problem. The question is whether we should integrate with an increasingly efficient public health supply chain or keep the immunization supply chain separate.
- The EVM is not a perfect tool and we need to improve it as we implement it.

Section V: Human Resources for Supply Chain Management

Improving health outcomes by promoting sustainable workforce excellence in health supply chain management: Benoît Silve

People that Deliver (PtD) is a coalition of organizations from around the world that strives to improve the health supply chain workforce in developing countries.

A rapid increase in health assistance from multilateral and bilateral donors has resulted in huge increases in the quantity, value, and complexity of supplies flowing through public health supply chains. However, the health supply chains of middle- and low-income countries are often unable to respond reliably to existing demands, putting both health supplies and health outcomes at risk.

PtD improves the impact of its member organizations by:

- Coordinating and aligning activities of member organizations in support of countries
- Endorsing and promoting relevant technical solutions developed in collaboration with its member organizations
- Facilitating advocacy and information sharing

PtD's focus countries include Burkina Faso, Ethiopia, Liberia, Mozambique, Namibia, Dominican Republic, and Indonesia.

Its future plans are to:

- Develop a fundraising plan and secure donor funding for identified programmes
- Raise the profile of HR for supply chain management (SCM) internationally, regionally and locally
- Advocate the need for well-qualified HR for SCM personnel with clear career paths
- Develop HR for SC Profession Map

- Construct a model for transferring skills into competency framework for SC professionals
- Assess the contents of current PtD evidence and resource sites

At the last mile, it is the human resources that will deliver and make the supply chain effective and reliable.

Health logistics capacity building: LOGIVAC: Benjamin Schreiber

Efficient health logistics are essential to ensure effective immunization services that can save lives. However, logistic systems in sub-Saharan Africa suffer from a lack of skilled health supply chain managers. Solutions to overcome this lack must involve:

- Recognition of the supply chain management profession, especially within Ministries of Health
- Creation of a pool of supply chain managers through training programmes and integration of these professionals into the health care system

LOGIVAC, a project of the Agence de Médecine Préventive (AMP) and WHO, provides technical support to countries in sub-Saharan Africa to improve health logistics.

This is achieved through:

- Vocational and degree training programmes
- Professional certification of health supply chain managers
- Implementation of a regional reference and resource centre

The target population for the training includes:

- Health personnel whose duties require knowledge and skills in logistics
- Private sector supply chain managers wishing to develop their skills

Such training provides innumerable benefits both for the sponsoring institutions and for the participants themselves:

- Recognition of expertise in health logistics, validated by a diploma degree from a recognized regional institution
- A common language and terminology
- Knowledge and skills developed from best practices
- Training delivered by Institut Régional de Santé Publique (IRSP) faculty, Institut Bioforce, WHO, UNICEF, AMP, and technical structures such as central medical stores
- Employment and career development opportunities in the field of health logistics

Discussion highlights:

- Training will not deliver the expected outcomes unless it has a systematic approach and includes supervision.
- Several training centres are needed because there are thousands of personnel to be reached and this cannot be done by a single donor.
- We need more women in logistics posts because they tend to be more reliable.
- Funding will have to be a step-by-step process.
- A one-person (training) secretariat has been established at UNICEF.

- The LOGIVAC course is a one-year course leading to a degree.
- There is a lot of demand in Asia for this type of training centre, although the multi-language context would be a challenge. WHO has a key role in taking these initiatives out into the regions. LOGIVAC is intended to be a transferrable proof of concept. The material can be piloted and tested and then scaled up.
- It is encouraging to hear that GlaxoSmithKline (GSK) has agreed to partially fund the course. This opens up the possibility that cold chain equipment manufacturers could also fund specific training. In other words, if a country was asking for cold chain equipment, funding for training could be part of the demand.

DAY 3

Section VI: Future Directions

Integrating vaccine and health product supply chains: Prashant Yadav

Integrating the supply chain for vaccines with other health products is often presented as a way to increase efficiency. A framework was developed to understand the costs, benefits and ease of implementation of integrating different parts of the supply chain. Preliminary results show that integration offers significant benefits to components including transport and warehousing at the last mile and information systems. This would be relatively easy to implement.

Ensuing discussion concluded that health products should be further segmented to understand which products offer the highest potential for integration. Integration relieves the constraint on the supply chain human resources. This needs to be incorporated into the decision framework.

Managing an integrated supply chain for vaccines with other pharmaceuticals, Sri Lankan experience: Sudath Peiris

Integrated supply chain management for pharmaceuticals, including vaccines, is an integral part of health service management in Sri Lanka. Prior to the establishment of EPI in 1978, supply and distribution of EPI vaccines was under the preview of the Medical Supply Division (MSD). However, vaccine storage was then brought under the preview of the Central Epidemiology Unit, which is in charge of the EPI programme. This allows for the central cold room for EPI to be managed better.

The State Pharmaceutical Cooperation (SPC) was established in 1971 as the procurement arm of the MOH, procuring pharmaceuticals based on annual orders placed by the MSD. The Epidemiology Unit places its annual vaccine request with MSD with a lead period of one year, and the latter forwards it to the SPC, who delivers the vaccine consignments directly to the EPI cold rooms. From these stores, vaccines are delivered to the Regional Medical Supply Division (RMSD) in every district every two months.

Other pharmaceuticals are delivered to RMSD by MSD in 3-month cycles and vaccines in monthly cycles. From thereon, RMSD stores and supplies both vaccines and other pharmaceuticals to the medical institutions.

EPI is responsible for training of health workers at all levels and monitoring of the vaccine cold chain from the time of arrival to use in the field.

Up to now, this arrangement has been working well without any major vaccine stock-outs and wastage.

Discussion highlights:

- Speaking about integration does not necessarily imply that everything is to be integrated. Some items, such as requisitioning, may be easier to integrate. Also, some products may be easier to integrate than others. Furthermore, some countries are more ready for integration than others. Governance structure and political economy are important prerequisites when thinking about integration.
- Supply chains in the private sector are very different from those in public health. There are more complexities in the private sector so the comparison is unwarranted. The framework is useful, but the HR skills are different.
- It is necessary to determine how skills and expertise are accounted for, whether the cost of activities is considered when deciding on distribution costs and whether the cost is 10% of the commodity prices. The complexity of orders must also be considered.
- We are examining which products lend themselves to integration. We cannot blindly follow integration. Skill and expertise is a weak area of the framework. We can create a common platform for skills. We are not yet at a point where we can estimate the total cost of the supply chain. Framework limitations identify needs for skills and resources. The public sector does not have the ability to demonstrate the cost implications of integrating or not integrating supplies.
- In Sri Lanka, there are 2000 pharmaceutical products and EPI has only 11.
- We assume that all items are fully controlled by MoH. Often, different agencies are involved and integration is difficult when there are divergent objectives. This could hamper successful integration. Furthermore, various programme managers want to manage their own products and not give up their sovereignty. Integrating these different interests and objectives is challenging. Also, diversity of sources of funding may cause conflicts.
- Both presenters emphasized the complex nature of integration. Behavioural change is a prerequisite.
- In Sri Lanka, all the different programmes go through the same channel. Each programme makes its own estimates a year earlier. Tenders are then prepared. Tender evaluation then takes place at a higher level. It is a very unified process. National policy dictates the procedure. Vaccines are monitored and distributed differently from other commodities, i.e. more frequently and requires temperature monitoring. Most pharmaceutical products have a quarterly supply cycle; vaccines are supplied more frequently.
- The structure of the country will greatly influence integration. In Nigeria, the federal vaccine store is in Lagos and the pharmaceutical store is in Abuja, so integration is already falling apart. The government is not interested in efficiency.

It is not always clear how to identify where to start integrating. Decentralization offers more opportunities for efficient integration.

- Professionalization supports integration. It is not only the physical products that need to be integrated but also the managerial aspects. Currently, those who manage supply chains only devote 20% of their time to it.

Private sector role in vaccine supply chains: Emerging trends and implications: P. Lydon

There are clear benefits from outsourcing immunization supply chain functions to the private sector. However, decision makers, managers and logisticians in developing countries have limited information to guide them through decision-making and implementation. Moreover, while there is ample anecdotal evidence of failures, there are some well-documented examples highlighting the costs and benefits of outsourcing parts of a national vaccine supply chain system.

With the increasing challenges for Government-run supply chains are facing increasing challenges regarding coping with expanding immunization systems due to new vaccine introduction. Therefore, more countries recognize the benefits of outsourcing storage and handling of vaccines to private sector logistics operators. Unfortunately, little is known regarding the advantages and disadvantages and the conditions needed for successful outcomes or how to determine whether it is a viable option for a country.

The session included key findings from the Western Cape Province case study under Project Optimize and the Collaborating Centre for Cold Chain Management (CCCCM). The lessons highlight many considerations that should be carefully weighed before deciding to outsource. Outsourcing can be a good solution. However, it can fail if there is lack of coordination between parties, poor choices are made on what to outsource, contracts are drafted with no service level agreement, or there is little oversight or regular monitoring of key performance indicators.

The Gambia: Success with full service vehicle leasing: Dawda Ceesay

Previously Gambia's MoH and Social Welfare (MoHSW) used to have an in-house health transport unit to manage and maintain its vehicles, which were mostly donated. This system faced many problems, such as lack of reliability, budget, tools and spare parts, asset replacement plan, and availability of vehicles. These challenges were felt acutely within the health system, as more than 50% of the Gambia's health services at the peripheral level are delivered on a mobile basis. These challenges led to a public expenditure review and this eventually led to outsourcing of non-core activities such as fleet management and maintenance.

In addition to hospitals, major and minor health centres, Gambia's health system comprises 546 village health posts at a primary level, where a lot of interventions, including immunization clinics, are held. Transport to reach these health posts is necessary.

Riders for Health have been operating in the Gambia since 1989 and maintaining MoHSW's fleet of vehicles. However, in 2009, the MoHSW's vehicles were ageing and so Riders suggested a full-service leasing model in public-private partnership with the government. The upfront capital of \$3.5 million was financed through the Nigerian-based Guaranty Trust (GT) Bank and the loan was secured by the Skoll Foundation.

This enabled Riders to purchase a new fleet of 90 motorcycles, 36 ambulances, and 27 trekking vehicles, which was leased to the MoHSW for outreach health services, patient referrals, and monitoring and supervision across the country.

The full-service leasing, or Transport Asset Management (TAM) programme, was launched in February 2009. The vehicles are not designated to any disease or programme. Their activities include transporting clinical teams who hold outreach clinics and mobilizing outreach health workers to visit communities.

The outcomes include:

- No outreach clinic cancelled due to transport or fuel constraints
- A third of the health centres (32%) holding more outreach clinics each month
- Sustained high levels of immunization coverage

There have been challenges, mostly concerning changing the behaviour and mindset of health workers who were not used to vehicles being closely monitored; the preference for more expensive vehicles; and the health centre managers who had to improve monitoring the use of the vehicles.

The next steps include deploying the third lot of vehicles (which will have to include a financing agreement) and sale of the current fleet preceding replacement.

Discussion highlights

- New thinking takes maybe 10 years to filter through. One should consider what WHO/UNICEF can do to facilitate the process.
- Change takes a long time. It is up to the MoH to make the decision. WHO has worked very hard to give out this message to various individuals and organizations and has been calling for greater private–public partnership (PPP) in immunization. We are doing research and gathering evidence, but we cannot yet say what is the best model for the different scenarios. Some decisions are made to solve a problem, such as in South Africa; some are not evidence-based, such as in Thailand, but they seem to work. However, some outsourcing decisions can also go horribly wrong.
- Outsourcing often means contracting multiple small companies. There is no answer as to what the right model for transport is. However, this should be addressed on a case-by-case basis. We need to identify the right outsourcing model when the transport provider market is so segmented.
- In Gambia, the leased vehicles were fixed with odometers. There was a very modest fixed rate of 1 or 2 cents per km when it started. The payments are now made every month in Gambian Dollars. MoH hires its own technicians to monitor the fleet. Gambia has a database with details about each vehicle. But the MoH has failed to build the capacity to manage the database. For Gambia, outsourcing transport was a good step in providing access and quality care.
- Methods to accelerate the adoption of the trend to privatize transport should be considered.
- MoH ultimately makes the decision whether or not to lease in the PPP scheme.
- Contracts and managing contracts are very important in service-level agreements and governments are particularly bad at managing contracts. Therefore, there needs to be a way of building the capacity for contract management.

- In the case of the cold chain, we have instances where part of the training is done with the government and another part is done with the private sector. We need to ascertain whether systematic monitoring data is in place and whether efficiency is improving. There is very little documentation to confirm if this training is effective and if there is a systematic monitoring of data. It is important to have reliable data to monitor the outcomes of integration.
- Often there is a lack of flow of operational funds. Insourcing could be considered as there is a lot of staff within the government to undertake the job.
- It is important to have contracts with rewards and punishments.
- It is disappointing to think that the solution is to wait until outsourcing infrastructure develops. We need to consider where we want to go and how we can get there. We need to approach the industry in a proactive way. In Africa, for instance, there are very few Third Party Logistics companies. The Riders of Health are from the UK and came to Africa as a consequence of a discussion that happened in a side-room at a conference in London. WHO needs to become more proactive.
- Private companies would be interested in the market if it was presented on a wider continental basis, for instance, if it was presented on a PAN-African scale. There are also cost efficiencies in larger markets. Spare parts would cost six times more if bought by each country rather than globally. Also, international agreements would be more economically viable. We should consider what we can do internationally rather than waiting for development to happen locally.

Outbreak response logistics: Jean-Christophe Aze

Outbreak Response Logistics applies the purpose of health logistics to an emergency context. Additionally, they include more specific responsibilities, knowledge and know-how, such as the safe and rapid transport of samples, rapid deployment of personal protective equipment, the provision of related training, the deployment of mobile laboratories and organization of safe burials in the context of viral hemorrhagic fever (VHF), Ebola, Marburg. Outbreak response logistics support investigation activities at the very early stage of an outbreak. It provides immediate support to MoH and its partners in installing or organizing isolation areas and implementing Infection Prevention & Control (IPC) measures. This enables the outbreak response logistician to play a life-saving role in preventing or decreasing the spread of the epidemic, particularly among health workers.

The presence of such an expert is currently rare and her/his deployment in the field from WHO HQ, which is for now the best option, takes time and is not appropriate for a rapid response. We know from experience that EPI logisticians are the ones who are mobilized during outbreaks in the front line and they are often exposed to contexts that they are not technically equipped for.

WHO Alert and Response Operations (ARO) Logistics seeks to increase the number of logisticians who are able to support emergency operations by giving health logisticians, who are already involved in vertical programmes, the opportunity to be trained and to acquire these specific skills.

Integrating outbreak response logistics into the TechNet21 platform is probably a very efficient means of extending the skills of the health logisticians, who are specialized in EPI/vaccination logistics. By ricocheting the efficiencies, we can increase outbreak response capacities at the country level.

Discussion highlights:

- NGOs may be involved but usually emergencies are handled by medical specialists and so it is debatable whether there is space for a less specialised NGO in this field. Social mobilization organizations may be involved, especially in burials. The MoH is the authority responsible for decision making. Epidemic and natural disaster response has the same fundamental logistics and, in both cases, the ministry should be able to take the required action.
- In developing countries, outbreak response teams normally do not have logisticians. We should establish standards at the country level. We need frontline capacity.

The TechNet21 continuum: Padmini Menon

The TechNet continuum has three inter-related components:

- **Policy formulation/ development (IPAC)**, where recommendations made by the advisory committees are translated into recommended practices for implementation
- **TechNet21 Consultation**, where new policy developments and field experiences are discussed, and policy gaps are identified
- **TechNet E-Forum**, where important and current technical updates and field experiences are shared, questions posted and advice sought

The presentation focused on the e-forum. There have been 13 consultations, including the one in Dakar. TechNet21 subscribers are spread over 50 countries worldwide and total over 2000. The composition of the subscribers has diversified to include journalists and even students in addition to immunization personnel. In terms of technology, TechNet21 has come a long way from packet switched data to the current interactive CMS Joomla version. Today, the TechNet21 communications toolkit has an online discussion forum, a weekly newsletter, a website that is updated weekly, a YouTube channel (<http://www.youtube.com/user/TechNet21>) and a Twitter account (@TechNet21Mod).

If one were to evaluate TechNet21 as a knowledge management system and in terms of building communities of practice, it has performed reasonably well on the various performance metrics of usefulness, use and participation. We still need to evaluate how it has impacted health outcomes.

Discussion highlights:

- A post on EVM in the sub-group on the forum elicited nil responses. Subscribers should be asked why this occurred. In future, the weekly newsletter could perhaps be used to elicit responses.
- A recent Google search for the website revealed an unknown site. This was because the domain name was taken over by another company and TechNet21 had to register a new domain name. The new URL is www.technet-21.org. The WHO secretariat is making efforts to regain the old domain name.
- The possibility of renaming TechNet21 and rebranding is being considered.
- TechNet21 can integrate outbreak response logistics discussions and training into its forum and EPI logisticians could be trained to handle this area too.

Moving warehouse distribution system: Thierno Gueye

The aim of the presentation was to evaluate strategies to strengthen the supply chain in the health sector, using the Saint Louis region of Senegal as an example. This will enable us to handle the challenges of more and more increasingly expensive new vaccines in the future.

The region has an old supply system:

- Quarterly trips between the central and the regional vaccine warehouses
- Collection of vaccines by districts from the regional warehouse every 2 months
- Collection of vaccines by health units from districts every month

However, delivery plans are not always followed:

- Districts and health units use all types of vehicles to collect vaccines and they go not when they should but when they can
- National and district-level deliveries were not always complete
- There is often a shortage of stock and not enough trips are made at all levels
- Nurses had to close health units for several days in order to fetch supplies

The moving warehouse (MW) system was established in 2010. It involves health service delivery points ordering vaccines and consumables from districts on a monthly basis. Districts then do the same with regional supply pharmacies. These pharmacies send the products to the moving warehouse who then delivers them to health service delivery points, ensuring there are no stock shortages. The entire process is coordinated, monitored and evaluated by the Medical Region.

Districts, medical regions and vaccination programmes can observe the movement of supplies, existing quantities, conditions (temperature), supervision, monitoring and evaluation. They then have the responsibility of sharing this information with national and regional supply pharmacies and ensuring the quality of the supplies and their correct use. National and regional supply pharmacies have an active role in planning the supply, transport and delivery of products and they ensure that regions and districts give order information in a timely fashion. They also have the responsibility of maintaining the drug and vaccine quality during transport and storage and ensuring everyone's needs are met.

MW has many advantages compared to the basic system:

- Improved vaccine management (minimized risk of supply shortages, continuous temperature monitoring, removal and transfer of stock excess to avoid expiration and precise date on stock and consumption.
- Improved quality of service (health unit nurses have more time and return of supervised training)
- Vaccines delivered monthly to 110 health units since 2011
- Essential drugs and free products delivered to RH, AIDS, Malaria and Tuberculosis programmes since early 2012
- Full safety box collection and delivery of vaccines and consumables during campaigns

- Shared data over the Internet
- Costs reduced by 13% (the price per dose remains the same in both systems (\$0.35). However, this drops by 17% (\$0.29) when RH products are integrated. Then, when new vaccines are integrated, it drops by 43% (\$0.20) with the MW system compared to 34% (\$0.23) in the basic system. (Performance and costs can be estimated using a combination of the HERMES VMI (Vaccine Modeling Initiative) Simulation Model and the supply chain costs that have been broken down by cost of vaccine storage, transport, dry product storage and transport of dry products.)

Given the system's potential, other Medical Regions are currently looking at how they might adopt MW. A strategic plan for a large scale move has been submitted to the MoHSW and partners. Lessons learnt in Senegal need to be shared with other countries. We need to discuss whether Technet members can help.

Discussion highlights:

- The Senegal experience is meaningful and we have to make it sustainable, perhaps by using local internal resources. There may also be a possibility of pooling resources from districts to ensure local funding in order to avoid depending on external grants.
- MoH's position on integration of FP and micronutrients in consolidating product deliveries needs to be defined. The scope to include vaccines in mobile warehousing also needs to be ascertained.
- The level of expertise required to master the model needs to be defined. In Nov-Dec 2013, McKinsey piloted a push-pull model for reproductive health commodities. It is currently under evaluation. The funds are being recovered from the non-free products. The National Supply Pharmacy (PNA) is another source of investment and this involves districts that are making savings in fuel and per diems from services provided by the mobile store.
- Money is centralized at PNA. We need to be clear on what model saves money for the programme.
- Target populations are the basis for calculations of vaccine needs and coverage performance.
- The moving warehouse by-passes the middle stores. We need to define the effect it has on costs.
- The cheaper system must be the more sustainable system and we cannot roll back. We are committed.
- The moving warehouse is currently running and expenses have been reduced. Expenditure is centred at the distributing pharmacy. A system must be facilitated in order to save money for the country.
- The reporting tool did not follow the ease of recovery of funds in the push model. Senegal has also thought about other partners (than USAID) such as the national supply pharmacy. The Ministry can also be involved.

HERMES vaccine supply chain modelling: Senegal and Benin: Bruce

Lee

Modelling and simulation have been used in a wide variety of industries and professions to make decisions (for more information please see: hermes.psc.edu). This is a software platform that can rapidly generate an interactive discrete event simulation model of any supply chain. It can serve as a "virtual laboratory" for decision makers to address a number of questions such as:

- How is the supply chain currently functioning and what are its vulnerabilities?
- What are the effects of introducing new vaccines and other technologies (e.g. cold storage monitoring devices)?
- What are the ideal characteristics for vaccines and other technologies?
- What is the impact of various policies and designs (e.g. changing ordering or vial opening policies, removing locations or levels)?
- Where should one invest or allocate resources?
- How does the supply chain respond to differing conditions/circumstances (e.g. power outages, inclement weather, transport delays, etc.)?
- How can one improve or optimize vaccine delivery?

The HERMES team worked with a number of international partners to develop models of a number of countries in Africa and Asia. These included Senegal and Benin. In Senegal, the team worked with in-country decision makers in tandem with Project Optimize to evaluate the cost and operational effects of several supply chain re-design scenarios. An important discovery was that introducing moving warehouses could save costs, and improve vaccine availability. This is especially true if these warehouses could transport other medical goods in addition to vaccines.

In Benin, HERMES was utilized to evaluate several vaccine supply chain re-design scenarios and it was found that consolidating the Commune Level to much fewer locations resulted in lower capital expenditures and lower operating costs. This provided a compelling business case for the MoH to move forward with such a re-design of their system.

Discussion highlights:

- The expertise that is available in countries needs to be considered in order to decide if running the model locally is realistic. HERMES takes the population in a country and then allocates them to districts, health units and outreach. Also, HERMES is not restricted to vaccines. Hands-on workshops are conducted to improve expertise. The interface is a command line interface and, therefore, not very attractive. However, learning it is very effective. The inputs and outputs are intuitive.
- HERMES's ability to track missed opportunities and help immunization personnel improve health coverage was discussed. HERMES interprets missed opportunities largely in term so non-availability of vaccines, but that is not always the case. For instance, in Zanzibar, during an outbreak of measles, the health worker was hesitant to open a multi-dose vial and an immunization opportunity was missed. In terms of how to model human behaviour, HERMES

has the scope to include this factor if it is important. It can include compliance patterns as well.

- HERMES imported data from mixed data formats (paper/XI/EVM/CCM).
- It was questioned whether HERMES and the moving warehouse could compare efficiencies between the reduced levels of stores versus more levels to find more cost effective solutions. HERMES used the data collected by Project Optimize to populate the model. Electronic data would greatly facilitate the population of the database process. When they simulated some areas by removing levels, they found that, in many instances, it would be costly in other implications.

[Linking plans, actions and results for national EPI systems of today:](#)

Dmitri Davydov

Dmitri Davydov presented common practice Linking plans, actions and results for national EPI systems of today. He screened a UPS advertisement to showcase the need for more effective and efficient supply chains, advocating transparency and solid communication between departments. He stressed that focussing on only one strand cannot work because they are all intertwined. There is power in partnerships and organisations such as WHO and UNICEF should work together, sharing their knowledge and expertise. He explained that evidence should be delivered using data-driven management; governance by optimising diagnostics and redesigning delivery systems; and ownership would be delivered by implementing sustainable equipment.

We should look for opportunity in innovation. This opportunity is a combination of EPI and MCH. Programme and supply support along with institutional capacity building then need to be factored in. With all of these aspects combined, we can devise a common language and achieve together. The vision for 2020 is for HR for logistics, vaccine products and packaging, supply systems optimisation and equipment, environmental impact and information systems and LMIS to all have equal weight.

[Vision 2020: What will it take to achieve it?: Michel Zaffran](#)

Over the course of the last three years, a vision for immunization supply chains in 2020 has been developed by a group of partners and stakeholders. The challenge we now face is how to ensure that the vision is achieved.

The vision focuses on five priority goals:

- 1) Vaccine products and packaging design to meet country needs
- 2) Immunization supply systems maximize performance through continuous improvement
- 3) The environmental impact of immunization supply systems is minimized
- 4) Information systems drive better immunization activities
- 5) Human resource policies effectively support immunization supply systems

Progress has been made in terms of building awareness around the importance of the supply chain and building mechanisms for collaboration and ensuring the availability of resources. However, substantial additional efforts are needed to achieve the vision's full impact.

The presentation called on the audience to examine how they as individuals, agencies,

donors, organizations, companies and, most importantly, countries could commit and contribute to realizing the vision.

Discussion highlights:

- The Cold Chain Logistics (CCL) taskforce was created to boost impetus in the field. CCL is a mechanism to share ideas and also to feed into other groups. Interactions between Optimize and CCL have created opportunities for advancing developments. The iSCLHub is something new and the idea is to support coordination between WHO and UNICEF. We should try to avoid duplication and share learning with the other partners. We need to create an open space where all partners can access the vision.
- We need to define whether there will be a link amongst VPPAG, TechNet21 and Cold Chain Logistics Taskforce. Each one has its own direction. TechNet21 is an old continuum feeding into other groups.
- The presenter discussed unforeseen challenges and gave practical advice regarding building and implementing vision 2020. The answer is that Vision 2020 is moving ahead in many areas, but the gaps are still unaddressed. Some elements of the vision are somewhat looked after, but some elements do not have an owner. One area that is of particular importance is human resources, as there is still a lot to be done in this area. It is also necessary to find a champion. Staff shortage cuts across the public health spectrum and is not specific to EPI.
- There has been a lot of progress when it comes to products, and the industry is attentive to country needs. However, evolution has been less encouraging in other areas.
- During the TechNet21 consultation, we discussed structural issues that we seem to find increasingly difficult to tackle. We need to work with a common operationalizing platform across public health, in order to deliver goods and services to the field. We need to pool resources in a scope that is little bit wider than immunization. We need to collect the data and chase the evidence to document progress and innovations
- We need to focus on strengthening health systems. Moving people around the same time as commodities is progress towards a systems approach.
- We need to expand partnership to areas where the system is fragile, where the fifth child is still left out. There will be a need to come up with solutions that tackle very difficult circumstances that are not represented here.
- The CCL is an evolving mechanism that we are working on. Another step was taken at the 2012 workshop, especially bringing in new concepts and resolving not to repeat the same mistakes. The focus was on defining urgent needs, identifying the areas that need priority action and measuring the changes in performance.
- There is a huge mass of information, tools and knowledge out there. We must consider how this can be brought to the field.
- In Senegal, a part of the vision was adapted and it was a difficult task. Many different new components were being put in place in a completely independent manner. Plans for a pharmaceutical warehouse, waste management, etc. were drawn up separately. Project Optimize put the players into the same room and managed to get the Minister to agree that all should continue to communicate. We need to wait and observe whether these measures will succeed.
- Today, there is a learning attitude; there are more investments and we have the last thirty years' experience to bank on. Also, there are some very encouraging

developments:

- there is awareness of the new and underutilized vaccines and their cost
- immunization is seeing new personnel who have logistics skills
- there is greater dialogue
- there have been innovations not only in technology but also in finance and management.

The hourglass & the waves: Modibo Dicko

Mr Dicko began his presentation by thanking all those who had nurtured and helped him grow: his parents, teachers and professors, and colleagues. He considered himself fortunate to have met so many dedicated and enthusiastic people, but was sad that polio was still an unfinished agenda. He expressed his sorrow through his poem *Polio Zero* (see Appendix III). Unfortunately, polio is not the only unfinished agenda. Despite the significant technological and managerial progress, unfinished agendas still remain, particularly at the district and health facility levels in areas such as computerizing stock and equipment management, recording and transmitting temperature readings, using solar energy, vaccine freezing, etc.

Mr Dicko compared the “Hourglass Model” with the “Waves Model” to explain the unfinished agendas. In the first model (on which most international agencies’ support to developing countries is based), there are many international technical assistants (ITAs) at the top and many frontline workers at the bottom. However, there are very few national logistics managers and technical officers in the middle to link the two groups efficiently. Furthermore, instead of strengthening national institutions, partners prefer to substitute and by-pass them by creating many non-sustainable ad-hoc support mechanisms that disappear at the end of the project. Also, communication in this model is one-way: lessons learned by frontline workers are never shared with those at the top. This model results in demotivation, frustration, duplication and unfinished agendas and exemplifies the principle “Less with More”!

In the “Wave Model”, on the other hand, partners train significant numbers of national logistics managers and technical officers. The transfer of technological and managerial knowledge from ITAs to the frontline workers is faster and lessons from the field are absorbed and valued. This model increases motivation, enthusiasm and productivity and enables cooperation projects to achieve objectives. This model subscribes to the principle of “More with Less”. It is also more sustainable because it strengthens national institutions instead of bypassing them!

To be able to attract young and educated people, the public health sector must change its paradigm about supply chain management. It must be accepted as a profession of its own rather than merely an addition to existing careers of medical doctors, pharmacists, nurses, etc. Considerable advocacy is necessary to make MoH create supply chain management positions at all levels of the health system.

Everybody, representatives from both national government institutions and partner agencies, should strive to make the next decade, not only the “Decade of Vaccines”, but also a decade of unprecedented development of human resources to strengthen immunization services delivery.

Appendix I: Agenda



TechNet Meeting, 5-7 February 2013, Dakar, Senegal

DAY ONE Chairs : Debra Kristensen PATH, Philippe Jaillard AMP (plenary room B/C 12)				
Section 1: Introduction and Context, Chair: Michel Zaffran, WHO				
Start time	Duration	End time	Topic	Presenter
09:00	00:30	09:30	Opening remarks	Dr. Alimata Diarra, WR Senegal and Ministry representative
10:00	00:10	10:10	Objectives of consultation	Jhilmil Bahl, WHO HQ
10:10	00:15	10:25	Update from the host region	Hailu Kenea, WHO AFRO
10:25	00:15	10:40	Discussion	
10:40	00:30	11:10	Tea/coffee break (Rooms B01 and A01)	
Section 2: Vaccine Characteristics & Delivery Systems				
11:10	00:15	11:25	New Vaccines' Introduction: Readiness of and impact on vaccine supply and logistics systems	Solo Kone, WHO HQ
11:25	00:20	11:45	Discussion	
11:45	00:15	12:00	Marketplace teasers (focus on cold chain and temp monitoring equipment and vaccine technologies)	
12:00	01:45	13:45	Lunch (Salon Vert) and marketplace (Rooms B01 and A01)	
13:45	00:15	14:00	Labelling for true temperature stability and the controlled temperature chain (CTC) strategy	Simona Zipursky, PATH
14:00	00:15	14:15	Benin: Delivering Meningitis A vaccine(MenAfrivac®) in a Controlled Temperature Chain (CTC)	Bassabi-alladji, Jean Claude Lodjo, MoH, Benin
14:15	00:30	14:45	Discussion	
14:45	00:15	15:00	Indonesia: Use of cold water packs to minimize freezing of vaccine	Lulu Dewi, MoH, Indonesia
15:00	00:15	15:15	Discussion	
Section 3: Equipment System Management				
15:15	00:15	15:30	Solar Stories: Avoiding the same mistakes	Dmitri Davydov, UNICEF HQ
15:30	00:15	15:45	Haiti: Experience in the use of solar refrigeration system	Jeannot Francois, MoH, Haiti
15:45	00:20	16:05	Discussion	
16:05	00:25	16:30	Tea/coffee break (Rooms B01 and A01)	
Parallel Break-out sessions				
16:30	01:00	17:30	Break-out session 1: How to improve the ability of country stakeholders to influence future vaccine products. Room B05	Debra Kristensen Simona Zipursky, PATH/WHO Optimize
16:30	01:00	17:30	Break-out session 2: Market innovations to impact existing and new cold chain equipment. Room C01	James Cheyne, BMGF Consultant
16:30	01:00	17:30	Break-out session 3: Considerations for cold chain equipment selection. Plenary room B/C12	Solo Kone WHO, Sophie Newland and Tina Lorenson PATH, Dereje Haile UNICEF
Cocktail reception: 18:30 onwards, (Poolside)				

TechNet Meeting , 5-7 February 2013, Dakar, Senegal

DAY TWO Chairs: Oya Afsar UNICEF, Yann LeTallec, CHAI				
Section 3: Equipment System Management (continued)				
08:30	00:15	08:45	Update on PQS prequalification of equipment and devices for immunization	Denis Maire, WHO HQ
08:45	00:20	09:05	Discussion	
Section 4: Information Management Systems				
09:05	00:15	09:20	Immunization Information Systems: motivation and lessons learned	Yann Le Tallec, Clinton Health Access Initiative
09:20	00:15	09:35	Discussion	
09:35	00:15	09:50	Madagascar: Successes and Challenges with Implementing the WHO District Vaccine Data Management Tool (DVD-MT)	Razanadraibe Seth, MoH Madagascar
09:50	00:20	10:10	Discussion	
10:10	00:30	10:40	Tea/coffee break (Rooms B01 and A01)	
10:40	00:15	10:55	Information and Communication Technology (ICT) toolkit: a guide for decision makers	Jan Grevendonk, PATH
10:55	00:15	11:10	Sri Lanka: Managing a "Web Based Immunization Information System"	Sudath Peiris, MoH
11:10	00:30	11:40	Discussion	
11:40	00:20	12:00	Marketplace teasers	
12:00	02:00	14:00	Lunch (Salon Vert) and marketplace (Rooms B01 and A01)	
14:00	00:15	14:15	Iran: Web-based Vaccination Supplies Stock Management (eVSSM)	Seyed Zahraie, MoH Iran
14:15	00:15	14:30	Tunisia: Web-based Vaccination Supplies Stock Management (eVSSM)	Ramzi Ouhichi, WHO Tunisia
14:30	00:20	14:50	Discussion	
14:50	00:15	15:05	Botswana: Barcoding in pharmaceutical inventory management – Botswana experience	Muhammad Chohan, MoH Botswana
15:05	00:15	15:20	Turkey: Using Barcodes for Managing Vaccines Stocks	Ahmet Özlü, MoH Turkey
15:20	00:20	15:40	Discussion	
15:40	00:30	16:10	Tea/coffee break (Rooms B01 and A01)	
16:10	00:15	16:25	Effective Vaccine Management Assessments (EVM): Past, present, future	Paul Colrain, WHO HQ
16:25	00:15	16:40	Discussion	
Section 5: Human Resources for Supply Chain Management				
16:40	00:15	16:55	How to optimize supply chain staff to meet the new challenges	Benoit Silve, People that Deliver
16:55	00:15	17:10	Health Logistics Capacity Building and LOGIVAC project	Benjamin Schreiber, Agence de Médecine Préventive (AMP)
17:10	00:20	17:30	Discussion	
END OF DAY 2				
City visit planned: those interested need to sign-up on Day1				

TechNet Meeting , 5-7 February 2013, Dakar, Senegal

DAY THREE Chair: Diana Chang Blanc WHO, Robert Steinglass MCHIP/JSI				
Section 6: Future Directions				
09:00	00:15	09:15	Integration of Health Commodities Supply Management	Prashant Yadav, Univ. of Michigan USA
09:15	00:15	09:30	Sri Lanka: Managing an Integrated Supply Chain	Sudath Peiris, MoH Sri Lanka
09:30	00:20	09:50	Discussion	
09:50	00:15	10:05	Private Sector Role in Vaccine Supply Chains: Emerging trends & implications	Patrick Lydon, WHO HQ
10:05	00:15	10:20	Gambia: Success with Full Service Vehicle Leasing	Dawda Ceesay, MoH Gambia
10:20	00:20	10:40	Discussion	
10:40	00:30	11:10	Tea/coffee break (Rooms B01 and A01)	
11:10	00:15	11:25	Synergies with Emergency Health logistics	Jean- Christophe Azé, WHO HQ
11:25	00:20	11:45	Discussion	
11:45	00:15	12:00	TechNet Continuum: how to continue the collaboration and dialogue between consultations?	Padmini Menon, TechNet Moderator
12:00	00:15	12:15	Discussion	
12:15	00:15	12:30	Senegal: Lessons Learnt from Implementing a Mobile Supply Warehouse	Thierno Gueye, MoH Senegal
12:30	02:00	14:30	Lunch (Salon Vert) and marketplace (Rooms B01 and A01)	
14:30	00:15	14:45	HERMES Vaccine Supply Chain Modelling: Senegal and Benin	Bruce Lee, Univ. of Pittsburgh
14:45	00:20	15:05	Discussion	
15:05	00:15	15:20	From common sense to common practice: linking plans, actions and results for National EPI systems of today	Dmitri Davydov, UNICEF HQ
15:20	00:20	15:40	Discussion	
15:40	00:20	16:00	Tea/coffee break (Rooms B01 and A01)	
16:00	00:15	16:15	2020 Vision Action Plans: how to close the gaps in each key area?	Michel Zaffran, WHO HQ
16:15	00:20	16:35	Discussion	
16:35	00:25	17:00	Salutations and Closing	Modibo Dicko, WHO HQ
CLOSE OF THE MEETING				

Appendix II: Polio Zero

A la fois perdu, triste et résigné
Le regard du garçon se lève et se noie
Sans me voir
Dans un rêve de stades en liesse et d'écrans crevés :
Eto'o et Ronaldo, Beckham et Zidane, Drogba et...

Hélas !

L'or des médailles a mué
En celui du soleil reflété
Par les gouttes salées
Traçant leurs sillons sur les joues sales !
Rêves à jamais brisé,
Assourdissante et muette accusation :
Sauvage le virus ou sauvage le monde ?

Votes, bottes, bombes et pompes :
Comptes en grossesse et ventres ballonnés
Sous les côtes saillantes !
Rumeurs et humeurs contrent les pourcentages
Et les marchandages accouchent de ratissages
Tandis que le poliovirus raté ou mué
Frappe sans merci les « zéro-doses »
Qui persistent malgré les tours innombrables
Devenus la routine au détriment de la routine.

Quel gâchis !

Nos yeux se rencontrent
Les miens se mouillent
Va mon garçon
Clopinant du pied mais vaillant du cœur
Tu es désormais libre
Car ... tu ne crains plus la polio.

Sad, lost, and resigned
The boy glances up and then turns away
Without seeing me
Caught up in a dream of jubilating crowds in stadiums and
on screens :

Eto'o and Roonaldo, Beckham and Zidane, Drogba and...

Alas!

The gold medal has been transformed
Into the golden reflection of the sun
In the salty sorrow
Tracing their path on dirty cheeks!
The dream is forever broken,
The sound of the silent accusation is deafening,
A wild virus or a harsh and wild world?

Votes, boots, bombs and pumps:
Inflated accounts and swollen bellies
Below protruding ribs!
Rumors and attitudes set against percentages
And the bargaining results in mopping up
While the missed or mutated poliovirus
Strikes without mercy the non-vaccinated
Who persist despite the countless rounds
Which have become routine at the expense of routine

What a waste!

Our eyes meet
Mines get wet
Go my lad
Limping but fearless
You are now free

Because ... you no longer fear polio.