A project in Tanzania is exploring how best to implement barcodes on vaccine packaging. By adding barcodes to the shipping containers and secondary packaging used to transport vaccines, project organizers hope to learn how barcode technology can improve supply chain management and vaccine safety in developing countries.

Over the last 40 years, barcodes have transformed global supply chains in the packaged food and consumer products industries. Most supermarket chains around the world use barcode scanners at the checkout counter, and most smartphones can now scan barcodes. Barcodes make it easy to track the flow of goods from their point of origin to their final destination, to recall products that may pose a safety hazard, to detect counterfeit or fraudulent goods, and to link a product with information such as where it was made, where it has been, ingredient lists, and instruction manuals in multiple languages.

The global immunization community has recently started to explore the potential of using barcodes in vaccine supply chains. In fact, some countries have already begun to establish and mandate their own barcode standards. But with developing-country immunization programs lacking the infrastructure required to scan and use barcode information, and without a global barcode standard to follow for vaccine products, the use of barcodes on vaccine products destined for developing countries is happening much more gradually.

Electronic health information systems are becoming increasingly pervasive in developing countries, especially at the central warehouse level. This has reduced some of the barriers to the use of barcodes and at the same time made the need to establish global standards more pressing than ever. Such standards would make it much easier to correctly implement and interpret barcodes coming from different suppliers around the world.
In March 2013, a working group of the Vaccine Presentation and Packaging Advisory Group (VPPAG) met in Brussels, Belgium, to identify the challenges and set out a long-term vision for the adoption of barcode technology in developing-country vaccine supply chains. The meeting was hosted by GS1, the nonprofit global supply chain standards organization, and was attended by representatives from the United Nations Children’s Fund, the World Health Organization (WHO), PATH, the GAVI Alliance, and several vaccine manufacturers. The group concluded that:

- There are no longer any major obstacles to the introduction of barcodes on secondary packaging and packaging containing secondary packaging.
- Adding barcodes with lot number and expiry date information to primary packaging (the vaccine vial or ampoule) poses a technical challenge that may take several years to overcome.
- Overall agreement exists on standards for the type of information that should be included in barcodes, the type and format of barcode to use, and the levels of packaging on which it should be included.
- Online databases need to be established where barcode information can be retrieved (for example, for a logistician to find out that the item he has just scanned is a box of 25 vials of measles, mumps, and rubella vaccine that needs to be stored between 2°C to 8°C). An existing WHO vaccine product database can potentially be adapted to serve this purpose.
- The planned project in Tanzania presents a great opportunity to evaluate the benefits of using barcodes on vaccine packaging.

For the project in Tanzania, collaborating manufacturers will add barcodes to the shipping containers used to transport vaccines to Tanzania. Encoded in each barcode will be a serial shipping container code, an 18-digit number used to identify individual containers and provide dispatch information. In parallel to the shipment, an advanced shipping notice will be sent. Upon arrival, the barcodes will be scanned by logisticians to automatically generate key sections of the vaccine arrival report.

Collaborating manufacturers will also add barcodes to secondary packaging to enable staff to keep track of vaccines as they move further down the supply chain from the national to the regional and then to the district level. Encoded in these barcodes will be the product’s global trade item number, as well as the lot number and expiry date of the vaccines contained in the secondary packaging. This will enable Tanzanian logisticians to keep better track of vaccine stock movements.

1. Secondary packaging includes the primary packaging (the vaccine vial or ampoule), the packet containing the vaccine vial, and any intermediate packaging.
Because the benefits of barcodes to vaccine supply chains is becoming increasingly evident, and interest among developing-country governments in barcodes continues to grow, it will be critical for vaccine products with barcodes to be ready in the public-sector supply chain. For this to happen, both global- and national-level decision-makers can take positive steps toward a future where barcodes are an essential component of vaccination programs.

To learn more about the work of the VPPAG barcode working group, please contact Daniel Thornton (dthornton@gavialliance.org), Henry Mwanyika (hmwanyika@path.org), Drew Meek (meekd@who.int), or Ulrike Kreysa (ulrike.kreysa@gs1.org).

To read more about the need for global barcode standards and the readiness of developing countries to introduce barcodes, please read the article “Is it time to start barcoding vaccine labels” in the July 2011 edition of the Op.timi.zie newsletter.

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Traveling exhibit highlights supply system innovations
by Heidi Lasher, consultant, and Kathleen Tiffay, PATH

Much of the knowledge generated by project Optimize and its partners is being shared in reports and presentations published on the PATH and World Health Organization (WHO) websites. However, it is not always easy to reach national-level audiences in this way. This has prompted Optimize to create an interactive “traveling exhibit” to share evidence of potential solutions that are being developed and tested in different countries around the world.

The “Supply Systems for Today and Tomorrow” traveling exhibit was piloted at the TechNet Consultation in Dakar, Senegal, in February 2013 and was also facilitated at two EPI managers’ meetings in Africa in March.

The station on preventing freezing in vaccine coolers.

The exhibit currently includes four stations, with plans to develop two additional stations by June. These stations are:
1. **Preventing freezing in vaccine coolers.** This station shows live temperature readouts of four vaccine carriers: the first filled with frozen ice packs, a second filled with conditioned ice packs, a third filled with cool water packs, and a fourth left unfilled to represent a controlled temperature chain. It shows how temperature conditions are maintained over time and elaborates on the advantages and disadvantages of each approach.

2. **Vaccine presentation game and hippo poster.** This station helps participants understand the difference between vaccine price and cost per dose delivered. The game highlights costs considerations for nine different presentations of pentavalent vaccine at each level of the supply chain.

3. **Mock immunization session.** This station allows participants to prepare and deliver several different vaccine presentations. It reiterates the message that not all vaccine presentations are alike when it comes to training and human factors.

4. **Information systems overview.** This station includes a live demonstration of two software systems supported by project Optimize: a stock management system used in South Sudan and an immunization registry system used in Albania. These demonstrations help countries get a sense of what is possible and provide information on how to embark on their own information system projects.

5. **Temperature monitoring technologies.** This station shows WHO performance, quality and safety prequalified temperature monitoring devices and how they are used.

6. **Solar refrigeration (to be developed).** With many countries now purchasing solar refrigerators for health posts with little or no electricity, there is a need for more information on these new technologies and why they are superior to gas/kerosene models. This exhibit will focus on what it takes to build a successful solar refrigeration program.

7. **Supply system integration (to be developed).** This station will examine the many ways in which integration can take place and proposes a set of questions that should be considered before embarking on an integration project.
The purpose of the exhibit is to actively engage and involve participants in the discoveries and unanswered questions relating to vaccine supply and logistics systems. We hope the exhibit will provoke discussion, new ways of thinking, and new solutions to old (and new) challenges.

Click to see our Flickr slideshow about the exhibit.

In April, the exhibit is traveling to the World Health Organization for World Immunization Week in Geneva and then to a logisticians training event in Harare, Zimbabwe. To inquire about bringing the exhibit and facilitators to a relevant meeting or event, please contact Kathleen Tiffay (ktiffay@path.org).

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GAVI Alliance develops end-to-end strategy to strengthen supply chains
by Daniel Thornton and Stefano Malvolti, GAVI Alliance

The GAVI Alliance will spend $7 billion on lifesaving vaccines from 2011 to 2015, supporting countries to immunize an additional quarter of a billion children. Until now, although members of the Alliance have worked on particular parts of the vaccine supply chain, there has not been an end-to-end approach to the supply chain. And there has tended to be a focus on the flow of goods through the supply chain and less of a focus on the flow of information and money. Yet as powerful new vaccines are being introduced, and as vaccines have gone from costing cents per dose to dollars per dose, the demands on the vaccine supply chain are increasing.

For these reasons, the GAVI Secretariat has agreed with its partners to establish a task force that will develop an end-to-end supply-chain strategy. This strategy will look at the entire supply chain from the decision by manufacturers to produce or allocate a vaccine for GAVI-eligible countries to the point where a child is immunized and that immunization is recorded. A consultation on the strategy will be launched later in the year and presented to the GAVI Board meeting in November.

As a first step in developing the strategy, a landscape analysis was commissioned to map the players and processes in the current supply chain. The objectives were to:

• Map the key players engaged in the vaccine supply chain.
• Analyze the end-to-end processes of the vaccine supply chain, highlighting the steps from forecasting to immunization and including the vaccine investment and market-shaping strategies, supply and demand forecasting, applications, approvals, tendering, production, delivery to countries, and delivery to the point of vaccination.
• Identify and analyze challenges in the current system.

More than 50 global-level supply chain experts, as well as immunization professionals in Ethiopia, Tanzania, and India, were interviewed as part of the analysis. Now that the landscape analysis has been completed, the task force has begun to develop the strategy to:

• Establish a common language and agreed set of objectives and indicators for the supply chain. The emerging objectives are related to supporting immunization coverage and cost per dose provided (through maximizing utilization of vaccines) and ensuring that vaccines are viable at the point of use.
• Achieve an Alliance-wide consensus on the roles and responsibilities within and beyond the supply chains of GAVI-eligible countries through the recognition of institutional strengths and competencies of partners.
• Define a mechanism for the identification and scale-up of promising technologies and pilot projects.
It is hoped that the strategy will build and strengthen synergies with partners working on improving vaccine supply chain systems (and including other health commodities) as well as build on existing frameworks for the future of supply chain systems (for example, the 2020 vision of immunization supply and logistics systems developed by a large number of partners with the facilitation of Project Optimize, and the work of the UNICEF-coordinated Cold Chain and Logistics group).

The strategy will consider what support can be provided through the Alliance to strengthen vaccine supply, either through GAVI's health systems strengthening support, specific in-country supply chain training, or other mechanisms. It will also consider how the supply chain can be considered more systematically in relation to applications for GAVI support. Finally, it will provide the context for funding supply chain activities under the GAVI Business Plan.

For more information on GAVI's supply-chain strategy, please contact Daniel Thornton (dthornton@gavialliance.org) and Stefano Malvolti (smalvolti@gavialliance.org).

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**Project Optimize in transition**

*by Bjørn Melgaard, Judy Roberts, Prashant Yadav, Anup Akkihal, Robert Steinglass, and Gisele Corrêa Miranda, Optimize Project Advisory Group members*

Following the 2013 TechNet Consultation in Dakar, Senegal, members of the Optimize Project Advisory Group (PAG) met for the last time to discuss progress made over the past five years and to learn about plans going forward as key areas of work on vaccine supply chains begin to transition to partners.

**Looking back**

The meeting began with a presentation by Optimize staff to summarize the results and achievements of the last five years. What became clear as the presentation unfolded was that many of the goals Optimize set out to achieve have now been realized. For example, new pathways to innovation have been established through the Vaccine Presentation and Packaging Advisory Group and through product-development “challenges” for cold chain manufacturers. These efforts have resulted in the development of new vaccine presentations and formulations, new cold chain equipment, and vaccination policies better suited to developing-country contexts. In addition, new equipment, information systems, technologies, and operational models have been demonstrated, generating case studies and evidence that are sorely needed in the field. Last, but not least, Optimize and its partners have successfully elevated the discussion of vaccine supply systems to the global stage, and consensus is beginning to emerge on the priorities for supply chain enhancements over the next decade.

**Looking forward**

To partially answer the question of what comes next, PAG members and relevant partners were invited to speak about their core competencies and plans for improving vaccine supply and logistics systems over the next five to ten years. These presentations are available for viewing and downloading on TechNet-21.org.

Perhaps the most significant change in the supply chain landscape is the emergence of the GAVI Alliance as a major influencer in the area of vaccine supply chain and logistics work. As GAVI continues its work to introduce new and underused vaccines in eligible countries, it has pledged to develop a supply chain strategy by the end of 2013. This strategy will help clarify ways in which countries can solicit support from the Health Systems Strengthening funding window and how partners can provide tools and technical
assistance to countries that are building more responsive and robust supply chains. The World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) have also started working together on a major project to help countries make informed operational and strategic decisions about their supply chain systems following Effective Vaccine Management assessments. The Bill & Melinda Gates Foundation, too, will continue to help shape the global agenda in this area. Other nonprofit, government, academic, and industry partners, including PATH, Agence de Médecine Préventive, People that Deliver, the Clinton Health Access Initiative, John Snow Inc., the University of Pittsburgh, VillageReach, Logistimo, OpenLMIS, the Developing Countries Manufacturers Network, UNICEF, and WHO plan to continue and grow their work in specific areas of expertise, including vaccine products, supply system design, information systems, human resources, and equipment. In addition to work in specific technical domains, some organizations are also focusing their efforts in specific countries.

Parting thoughts

Clearly, the vaccine supply and logistics field is evolving with many competent partners eager to play a role in the future. The 2020 Global Vision for Vaccine Supply and Logistics Systems Action Plans may provide a starting point for partners as they determine where to direct their efforts. Questions still remain about how various partners can maintain the cohesion and momentum that was enabled by project Optimize. Importantly, there is no clear mechanism to hold institutions accountable and on track. Will major partners like WHO and UNICEF be able to support countries with limited staff? Will eligible national immunization programs be able to access support from GAVI’s Health System Strengthening funding window, and will they spend it on supply system strengthening? Will we see a major change in the way countries manage their vaccine supply systems? Or will countries default to minor repairs of what seems to be a broken system?

The answers to these questions will become clearer in the coming years. In the meantime, the PAG wishes to congratulate project Optimize and its partners for strengthening global vaccine supply chains and sharing their insights over the past five years. The PAG also wishes success to those who will continue to work in this area over the next five years. On all counts, the work to improve vaccine supply systems is just beginning, and our collective success will be judged by the number of children that countries are able to immunize with an increasingly powerful set of vaccines.

Gates Foundation conducts landscape analysis of vaccine cold chain equipment market

by Raja Rao, Bill & Melinda Gates Foundation

The Bill & Melinda Gates Foundation recently conducted a landscape analysis of the market for cold chain equipment, in particular vaccine refrigerators and freezers. The analysis was based on extensive interviews with cold chain equipment experts, suppliers, and donors. The objectives were to assess the extent of current cold chain equipment challenges and the cost of fixing them, and to identify market-shaping opportunities and their potential impact on cold chain performance.

The analysis found that many GAVI Alliance countries lack the functional cold chain equipment they require, either because they do not possess the refrigerators and freezers they need, or because the equipment they do have does not function correctly. At national and regional levels, this has created bottlenecks affecting the introduction of new vaccines. The analysis highlights the importance of addressing these problems in order to reach routine immunization coverage targets in GAVI countries.
Other important findings of the report:

- Maximizing the impact of global investments in immunization programs will require a substantial increase in spending on cold chain equipment, from an estimated $70 million per year across GAVI today to around $175 million, based on current technologies and pricing.
- Procurement and funding for cold chain equipment are highly fragmented. This makes it a challenging market to manage for both manufacturers and procurers. Addressing this issue can help to make the market more efficient and can potentially help to reduce the price of some equipment.
- Some innovative cold chain technologies currently being developed could help improve the performance of the cold chain and reduce system costs. However, there is no consensus on the optimal characteristics for these products, nor is there a clear path to scale them up.
- Procurement and technology opportunities described above can help to reduce the total cold chain expenditure required to $125 million per year. However, this will still require an incremental $60 million in annual expenditure to address current cold chain equipment gaps.

The report provides more detail on these findings, as well as a broader analysis. The Bill & Melinda Gates Foundation is now evaluating how to act on these findings and capture the opportunities identified. To do so, the Foundation will continue to seek the insights of a broad set of experts and stakeholders.

To request a copy of the analysis, or to provide your feedback or reflections, please contact Raja Rao (raja.rao@gatesfoundation.org).

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Progress from the Decade of Vaccines Collaboration

by Magdalena Robert and Laurie Werner, Decade of Vaccines Collaboration

In March, the Decade of Vaccines Collaboration produced the final, illustrated version of the Global Vaccine Action Plan (GVAP), with a foreword by the Decade of Vaccines Collaboration Leadership Council and important annexes. The GVAP is a road map to prevent millions of deaths by 2020 through more equitable access to existing vaccines for people in all communities. It builds on the Global Immunization Vision and Strategy 2006–2015, the United Nations Millennium Declaration, and more recently, the United Nations Secretary-General’s Global Strategy for Women’s and Children’s Health.

The GVAP started as a vision for a “Decade of Vaccines”—a world in which all individuals and communities enjoy lives free from vaccine-preventable diseases. The Decade of Vaccines Collaboration was thus formed to pool the collective expertise of vaccine, health, and development experts from around the world to develop a plan to make this vision a reality.

Endorsed by 194 member states of the Sixty-Fifth World Health Assembly in May 2012, the GVAP reiterates existing goals and sets new goals for the decade, proposes six strategic objectives and the actions that will support their achievement, and provides an initial estimate of resource requirements and return on investment. Since the World Health Assembly endorsement, the annual reporting process, key metrics, and indicators for the decade have been refined, and all regions are working on its translation to regional realities.

In April 2013, just prior to World Immunization Week, the journal Vaccine published a special Decade of Vaccines supplement, which presents the body of knowledge collected as part of the Decade of Vaccines
Collaboration. In addition to an article on the GVAP, this supplement includes articles covering vaccine development, the vaccine supply chain, financing, costing and benefits, as well as perspectives from country governments, industry, and civil society. We hope this knowledge will guide vaccine development and delivery and result in lives saved and diseases prevented, controlled, and eliminated.

The GVAP and the Decade of Vaccines journal supplement in Vaccine are not the only outcomes of the Decade of Vaccines Collaboration. Recognizing the importance to closely monitor the GVAP implementation progress, the World Health Assembly GVAP resolution of May 2012 called for annual reports on the GVAP’s goals and strategic objectives to be presented to all World Health Organization (WHO) Regional Committees, the WHO Executive Board, and the World Health Assembly. The proposed GVAP Monitoring & Evaluation/Accountability Framework was reviewed by the WHO Executive Board and will be reviewed by the World Health Assembly in 2013. Annual progress reports on the Decade of Vaccines and GVAP implementation will be presented to the World Health Assembly every year thereafter.

As part of their commitment to the GVAP implementation, the Leadership Council organizations are now also committed to using the GVAP as a road map for World Immunization Week. The purpose is to foster a solid contribution to the processes and mechanisms strengthened by the Decade of Vaccines Collaboration and the Decade of Vaccines mission to extend, by 2020 and beyond, the full benefits of immunization to all people, regardless of where they are born, who they are, and where they live.

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**In Pictures: The traveling exhibit**

by Beth Balderston, PATH and Heidi Lasher, consultant

To accompany the article “Traveling exhibit highlights supply system innovations” in the May 2013 Optimize newsletter, project Optimize has published a photo set on Flickr of its traveling exhibit at the TechNet Consultation in Dakar, Senegal, and at Expanded Programme on Immunization manager meetings in Harare, Zimbabwe, and Ouagadougou, Burkina Faso.

Project Optimize has been exploring new ways of engaging country-level decision-makers through an interactive exhibit that is traveling to key meetings and events in 2013. The “Supply Systems for Today and Tomorrow” traveling exhibit features supply chain innovations that are being developed and tested in different countries around the world.

The exhibit is designed to actively involve participants in the discoveries and unanswered questions relating to vaccine supply and logistics systems. We are hoping the experience will provoke discussion, new ways of thinking, and new solutions to old (and new) challenges.
Access the photo slideshow directly. You can click “Show info” in the top-right corner to view/ hide photograph descriptions and click the following button in the bottom-right corner to view the slideshow in full-screen mode:

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**Resources**

**WHO releases Immunization Summary app for iPad/iPhone**

Access to immunization data is now easier, thanks to a new app recently released by the World Health Organization (WHO). The Immunization Summary app enables users to visualize data on the policies, activities, and impact of national immunization systems. Immunization summaries can be quickly and easily presented as tables, graphs, and maps and can be instantly downloaded as CSV (comma-separated value) files. Immunization data, which come from the United Nations’ Population Division, the World Bank, and reports from WHO and United Nations Children’s Fund member states, are available for 195 countries or territories and cover the period from 1980 to 2011. Data for 2012 will be released within the next two weeks.

The immunization summary app is available for the iPad and iPhone and can be downloaded from the iTunes app store. An Android version will be released soon.

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**Inventory of supply chain software**

The USAID | DELIVER PROJECT conducted a supply chain software survey in 2012. The survey includes information on 54 different software applications used at different levels of the supply chain in 30 countries. Program managers can use the survey to make decisions about software implementations in their countries, and the information may also be useful for implementing organizations and USAID Missions. The survey results are available on the USAID | DELIVER PROJECT website and can be downloaded as a Microsoft Excel file.
YouTube round-up

A selection of YouTube videos related to immunization logistics is provided below. You can find many more videos on the TechNet-21.org YouTube channel. To share your own or other relevant films on the TechNet-21 channel, please email the TechNet-21 moderator (moderator@technet-21.org) with a link to the film. You can also subscribe to the TechNet-21 channel to watch new videos as they are added.

Now is the Time

This three-minute video examines the growing challenges of maintaining reliable vaccine supply and logistics systems and offers potential solutions toward achieving optimized, efficient systems that reach people with the vaccines they need. The video is available on PATH’s YouTube channel.

The Journey of a Polio Vaccine

What does it take to vaccinate a child against polio? This two-minute video from UNICEF shows us that the journey of a polio vaccine is an incredibly complex process.

The MenAfriVac CTC Experience in Benin

In November 2012, the first immunization campaign to use a controlled temperature chain (CTC) took place in Banikoara in northern Benin. This five-minute video provides a short overview.

Integrated Family Health Program: The Cold Chain and Immunization Services

This ten-minute video examines how the Integrated Family Health Plan (IFHP) successfully ensures the maintenance of the cold chain in delivering lifesaving vaccines to families in even the remotest regions of Ethiopia. IFHP is a five-year (2009 to 2013) USAID-funded program that is implemented by John Snow, Inc. and Pathfinder International-Ethiopia in partnership with the Consortium of Reproductive Health Associations.