Developing a Vision for Immunization Supply Systems in 2020

Landscape analysis summaries

June 2011

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Background

The next decade will be one of unprecedented growth for immunization programs. With the introduction of new vaccines and the expansion in the populations they target come new challenges. However, along with the challenges come opportunities to re-examine the systems trusted with delivering these vaccines in order to ensure that we are actively seeking out and developing innovative solutions for the future.

A key part of preparing for the coming changes involves long-term thinking and planning around supply chains. Consensus on a vision for 2020 will allow all key stakeholders to agree on what the supply chains of the future should enable, and will provide countries, manufacturers, donors, and partners with a clear direction to strive toward.

Shared vision for the future

Under the auspices of the Cold Chain and Logistics Task Force led by the United Nations Children's Fund (UNICEF), a group of partners and stakeholders including nongovernmental organizations, industry, UNICEF, World Health Organization (WHO), and others is working to develop a common vision for the future of immunization logistics. This vision will form a platform behind which all key partners at country, regional, and global levels can align their work and efforts.

This work is being facilitated by project Optimize, which is serving as a temporary secretariat for the visioning group. Optimize—a collaboration between the World Health Organization (WHO) and PATH with financial support from the Bill & Melinda Gates Foundation—has been given a unique mandate to think far into the future. The project aims to employ technological and scientific advances by defining ideal specifications for health products and creating a flexible and robust vaccine supply chain that can handle an increasingly large and costly portfolio of vaccines.

During an 18-month period, a draft vision was developed through workshops, meetings, and teleconferences by a wide range of partners. The vision, which is still in draft form, is composed of two parts: a) what supply chains should enable or be able to do and b) the design characteristics essential for getting there.

Five priority areas for future supply chain design have been defined:

- Vaccine and related products.
- Supply system design.
- Environmental impact.
- Information systems.
- Human resources.

Landscape analyses

Multidisciplinary working groups of experts in each area conducted a landscape analysis of ongoing work in order to define the desired future (2020) state of each priority area and to highlight critical gaps that need to be addressed to get there.

The results of their efforts can be seen in the following pages. The next task for the working groups is to develop a more comprehensive, costed plan of action in order to realize the 2020 vision.

Immunization Innovation Fund

To catalyze work in the above five areas and to start addressing the gaps, an Immunization Innovation Fund will be launched at the Pacific Health Summit in June 2011. The first round of funding from the Innovation Fund will provide small grants of up to US$25,000 for innovative, out-of-the-box approaches and solutions to the gaps identified in the landscaping process.

Future immunization supply systems
Vision statement

By 2020, state-of-the-art supply systems meet the changing needs of a changing world in order to enable the right vaccines to be in the right place, at the right time, in the right quantities, in the right condition, at the right cost.

Priority areas

Tenet 1: Vaccine products and packaging

Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.

Tenet 2: Immunization supply system efficiency

Immunization supply systems are designed to maximize effectiveness, agility, and integration with other supply systems, and to support continuous system improvement through learning, innovation, and leveraging synergies with other sectors.

Tenet 3: Environmental impact of immunization supply systems

The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.

Tenet 4: Immunization information systems

Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.

Tenet 5: Human resources

Human resources policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

Tenet working groups

The following individuals from across disciplines and organizations serve on the expert working groups for each visioning priority area.

Tenet 1: Vaccine products and packaging

Sheila Cattell, GlaxoSmithKline, representing the International Federation of Pharmaceutical Manufacturers & Associations; Gisele Corrêa Miranda, Bio-Manguinhos/Fiocruz, representing Developing Country Vaccine Manufacturers Network; Rudi Eggers, WHO; Ibrahim El-Ziq, UNICEF Supply Division; Shawn Gilchrist, Consultant; Sharma Inderjit, Serum Institute of India, representing Developing Country Vaccine Manufacturers Network; Bertrand Jacquet, UNICEF; Souleymane Kone, WHO; Debra Kristensen, PATH (group coordinator); Tina Lorenson, PATH; Osman Mansoor, UNICEF; Drew Meek, WHO; Jules Millogo, Merck & Co., Inc.; Yalda Momeni, UNICEF Supply Division; Ann E. Ottosen, UNICEF Supply Division; Jonathan Pearman, GAVI Alliance; Olga Popova, Crucell; Raja Rao, Bill & Melinda Gates Foundation; Robert Steinglass, John Snow, Inc. (JSI); Hardeep Sandhu, US Centers for Disease Control and Prevention (CDC); Simona Zipursky, PATH.

Tenet 2: Immunization supply system efficiency

Beatriz Ayala-Ostrom, Freelance Procurement and Supply Chain Consultant; Magali Babaley, WHO; Sarah Bourhill, PHD; Brent T. Burkholder, CDC; Malcolm Clark, Management Sciences for Health (MSH); Ousman Dia, JSI; Modibo Dicko, WHO; Mike Harrigan, PHD; Alexis Heaton, JSI; David Lee, MSH; John Lloyd, PATH; Tina Lorenson, PATH; Patrick Lydon, WHO (group coordinator); Osman Mansoor, UNICEF; Ian McConnell, Clinton Health Access Initiative; Ishmael Muchemenyi, PHD; Kshem Prasad, Apt Progress for Sustainable Development; Rémy Prohom, Consultant; Raja Rao, Bill & Melinda Gates Foundation; Judith Roberts, Development Consultant; Oliver Sabot, Clinton Health Access Initiative; Adama Sawadogo, WHO/Democratic Republic of the Congo; Robert Steinglass, JSI; Xavier Tomsej, US Agency for International Development; David Ulrich, Abbott Laboratories; Prashant Yadav, Massachusetts Institute of Technology.

Tenet 3: Environmental impact of immunization supply systems

Laila Ackhlaghi, JSI; Dave Ausdemore, CDC; Laurent Dedieu, Médecins Sans Frontières; Victoria Gammino, CDC; Andrew Garnett, Consultant; Tom Layloff, MSH; Carla Lee, CDC; Steve McCarney, PATH; Gisele Corrêa Miranda, Bio-Manguinhos/Fiocruz; Francis (Kofi) Nyame, MSH; Jude Nwokeki, MSH; Joanie Robertson, PATH (group coordinator); Bocar Sada Sy, Services de l'énergie en milieu Sahélien; Ruth Stringer, WHO/Health Care Without Harm; Naomi Wasserman, BD.

Tenet 4: Immunization information systems

Anup Akkihal, Logistics for Global Good, Inc.; Richard Anderson, University of Washington; Kyle Duarte, MSH; Marta Gacic Dobo, WHO; Jan Grevendonk, PATH (group coordinator); Leah Hasselback, VillageReach; Susie Lee, GAVI Alliance; David Lubinski, PATH; Hardeep Sandhu, CDC; Jaspal Sandhu, Gobee Group; David Sinegal, Consultant; Allen Wilcox, VillageReach; Justin Yarrow, Clinton Health Access Initiative.

Tenet 5: Human resources

Véronique Brossette, Bioforce; Hamadou Dicko, Agence de Médecine Préventive/Bioforce; Modibo Dicko, WHO; Serge Ganivet, WHO/Regional Office for Africa; Alain Grall, Syskalis; Richard Jabot, Médecins Sans Frontières; Philippe Jaillard, Agence de Médecine Préventive; David Lubinski, PATH; Kshem Prasad (APT-Progress); Claudio Politi, WHO; Kevin Pilz, US Agency for International Development/Commodity Security and Logistics; Pamela Steele, UNICEF; Benoît Silve, Bioforce.

Vaccine products and packaging

Tenet 1: Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.

The visioning process

Over the course of 2010 and 2011, partners have joined forces to develop a shared, long-term vision for immunization supply and logistics systems and technologies. The goal of this vision is to guide key stakeholders at country, regional, and global levels in their work to strengthen supply and logistics systems. This process is being facilitated by project Optimize, a collaborative project of the World Health Organization and PATH.

Certain features of vaccine products can help to address constraints in under-resourced countries. Decreased product volumes can ameliorate cold chain capacity limitations. Clear labeling and minimal steps required for product preparation can facilitate ease of use for overburdened health workers and increase immunization safety. Increased product stability can help keep vaccines effective even in extreme climate conditions or areas where electricity to provide refrigeration is unreliable.

Landscape analysis

A landscape analysis was conducted to better understand the activities under way by all global stakeholders that currently influence the characteristics of vaccine products and packaging for developing countries.

Developing vaccine products with the desired attributes requires close collaboration between national immunization programs, the global health sector, and vaccine manufacturers. The landscape analysis reviewed ongoing work that is contributing to each of the following objectives:

- Ensure vaccine products meet internationally recognized standards of quality and safety.
- Institutionalize mechanisms for dialogue between the public sector and manufacturers to reach consensus about product attributes.
- Provide guidance on product attributes preferred by developing countries for vaccine and device manufacturers.

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Landscape analysis focus areas

Quality and safety

Public- and private-sector dialogue

Guidance and specifications

Streamlined tools and processes

Innovation and facilitation

The vision

By 2020, state-of-the-art supply systems meet the changing needs of a changing world in order to enable the right vaccines to be in the right place, at the right time, in the right quantities, in the right condition, at the right cost.

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- Make streamlined tools and processes available to assess trade-offs in product profiles and inform purchase decisions.
- Continue innovation in vaccine technologies and facilitate manufacturers' efforts to provide products with the desired attributes.

Preliminary gaps

The goal of the landscape analysis was to identify gaps that need to be addressed in order to realize the vision of future immunization supply systems. The gaps identified to date are as follows:

- Increased involvement by national immunization programs in research and feedback to inform vaccine product profiles.
- Availability of appropriate tools and information for countries to strengthen national decision-making to help ensure that the vaccine products purchased have attributes that meet country needs.
- Movement toward a situation where vaccine purchasers value innovation by basing purchase decisions on systems' costs rather than on price alone.
- Ways to encourage industry to continue to improve vaccine products and packaging.

Landscape analysis summary table

By 2012, the vision statement will reflect evidence found through the following landscape analysis and other analyses. For more information, please contact optimize.who@path.org.

Vision of future immunization supply and logistics systems: Core tenets

1. Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.
2. Immunization supply systems are designed to maximize effectiveness, agility, and integration with other supply systems, and to support continuous system improvement through learning, innovation, and leveraging synergies with other sectors.
3. The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.
4. Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.
5. Human resources policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

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Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Quality and safety	**Internal industry quality and safety standards**	Industry (vaccine producers/developers), product development partnerships	Vaccine producers and developers test vaccines for efficacy, quality, and safety using three testing phases—preclinical, clinical, and surveillance.	Global	good manufacturing practices
Quality and safety	**NRA oversight** www.ifpma.org www.gsk.com/policies/Technology-Transfer-Vaccines.pdf	NRAs, industry (vaccine producers)	All vaccines must be licensed by an NRA. Core NRA functions: issuing marketing authorizations, inspecting and licensing vaccine production and distribution facilities, ensuring post-marketing surveillance (and responding to adverse events), verifying consistency or safety/quality of vaccines, assessing national control laboratories that test vaccines, and authorizing/monitoring clinical trials with vaccines.	Global	clinical trials, NRAs
Quality and safety	**WHO prequalification of vaccines and immunization equipment**	WHO, NRAs, UNICEF, PAHO	WHO provides a service to UNICEF and other United Nations agencies that purchase vaccines and immunization equipment to determine the acceptability, in principle, of products from different sources for supply to these agencies. The prequalification process also ensures that the vaccine-producing country has a functioning WHO-accredited NRA.	WHO Headquarters (Geneva)	NRAs, prequalification
Quality and safety	**WHO fast-track mechanisms for licensing of vaccines through United Nations agencies**	WHO, NRAs	Registration and licensing procedures in countries that procure their vaccines mainly through United Nations agencies may follow a fast-track procedure. This procedure follows product evaluation steps undertaken in the WHO prequalification process.	WHO Headquarters (Geneva)	NRAs, prequalification
Quality and safety	**Guidelines for regulatory oversight of cold chain**	WHO, NRAs	Best practices have been compiled, as a gold standard, into guidelines for country oversight of the cold chain and vaccine distribution.	WHO Headquarters (Geneva)	cold chain
Quality and safety	**African Vaccine Regulatory Forum**	WHO, NRAs, Bill & Melinda Gates Foundation	This forum may be considered an ad hoc scientific advisory body of experts invited by WHO to make presentations and assist regulators. Information sessions and sessions only for regulators led by WHO staff and external experts provide a non-threatening environment for regulators to discuss concerns and ask questions of experts and colleagues.	WHO Headquarters (Geneva)	NRAs
Quality and safety	**Global Health CEO Roundtable**	Bill & Melinda Gates Foundation, Industry (vaccine producers) chief executive officers	Annual forum to bring together the world's leading pharmaceutical companies and the Bill & Melinda Gates Foundation to leverage respective areas of strength and expertise in the pursuit of global health priorities.	Bill & Melinda Gates Foundation	public/private sector
Quality and safety	**Various activities supported by the Bill & Melinda Gates Foundation**	Bill & Melinda Gates Foundation, WHO, PATH, Aeras Foundation, Agence de Médecine Préventive, PAHO	Support from the Bill & Melinda Gates Foundation is provided to SAGE, Expert Committee on Biological Standardization, Immunization Practice Advisory Committee, TechNet21, WHO Prequalification, various product development partnerships, the SIVAC Initiative, and the ProVac Initiative.	Bill & Melinda Gates Foundation	prequalification
Quality and safety	**Developing Country Vaccine Regulators' Network**	WHO and NRAs from Brazil, China, Cuba, India, Indonesia, Republic of Korea, Russia, South Africa, and Thailand	The network's mission is to promote and support the strengthening of the regulatory capacity of NRAs of participating and other developing countries for evaluation of clinical trial proposals (including preclinical data and product development processes) and clinical trial data through expertise and exchange of relevant information.	WHO Headquarters (Geneva)	clinical trials, NRAs
Public- and private-sector dialogue	**Vaccine Presentation and Packaging Advisory Group**	WHO, UNICEF, GAVI Alliance, PATH, CDC, IFPMA, DCVMN, JSI	The purpose of the VPPAG is to: 1) Provide a forum for industry and public-sector dialogue on vaccine product presentation and packaging and respond to industry requests for guidance as well as proactively engage industry where appropriate; 2) Continue to facilitate improvements in presentation and packaging of vaccine products that are available or near market readiness, to maximize their appropriateness for public-sector use in developing-country markets, through specification of preferred product profiles; 3) Continue generic work to establish optimal vaccine presentation and packaging guidelines in conjunction with different vaccination strategies in order to maximize the appropriateness of vaccine packaging and presentations for the settings in which products will be employed.	Global	product profiles, public/private sector

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Public- and private-sector dialogue	**GAVI Alliance Supply Strategy Task Team (time limited)**	WHO, USAID, PAHO, Developing Countries, Bill & Melinda Gates Foundation, UNICEF, PATH/Accelerated Vaccine Initiative, GAVI Alliance, Médecins Sans Frontières	The team's purpose is to revise the GAVI Alliance's overarching supply and procurement strategy, where the supply strategy refers to the determination of: 1) how the market should evolve and the associated objectives that should be pursued to achieve that evolution and 2) short- versus long-term approaches and mechanisms for interacting with manufacturers to shape the market, while the procurement strategy refers to the approach used to buy vaccines within the context of the supply strategy.	Global	procurement, supply
Public- and private-sector dialogue	**Roundtable discussions or bilateral consultations on specific products between individual manufacturers and public-sector stakeholders**	Vaccine producers, UNICEF, WHO, VPPAG, PAHO	Roundtable discussions are hosted by vaccine producers or device manufacturers for exchange of information on appropriate attributes and presentations for specific products. Similarly, bilateral consultations with non-industry VPPAG members and a single vaccine producer can be arranged by the vaccine producer or device manufacturer to discuss a specific product.	Global	product profiles, public/private sector
Public- and private-sector dialogue	**Dialogue between the private sector and countries**	Industry (vaccine producers and developers)	Dialogue with decision-makers in countries on the appropriate attributes for vaccines and packaging.	Global	product profiles, public/private sector
Public- and private-sector dialogue	**Research for development study on new vaccine adoptions in low- and middle-income countries**	Research for Development, Bill & Melinda Gates Foundation, GAVI Alliance, WHO, UNICEF, IFPMA, DCVMN, WHO Regional Office for the Eastern Mediterranean, PAHO, CDC, Netherlands Vaccine Institute	This study aimed to identify factors that play an important role in the decision-making process and outcomes for adoption of new and under-used vaccines in low- and middle-income countries. The goal was to identify practical interventions to address issues to positively impact new vaccine adoption in low- and middle-income countries. The study's finding that price and pricing are one of the top factors influencing vaccine decision-making led to the Vaccine Price and Pricing Information Meeting, convened by WHO.	Global	pricing, procurement
Guidance and specifications	**Generic Preferred Product Profile**	VPPAG—WHO, UNICEF, GAVI Alliance, PATH, CDC, IFPMA, DCVMN, JSI	This document provides guidance to vaccine developers on preferred presentations and packaging for vaccines intended for public-sector use in developing countries.	Global	product profiles
Guidance and specifications	**Specific product profiles**	NGOs	Development of specific vaccine product profiles for developing-country markets early in the product development process can help to ensure that developing-country requirements and preferences are taken into consideration.	Global	product profiles
Guidance and specifications	**Programmatic Suitability of Vaccine Candidates for WHO Prequalification**	WHO and PSPQ Standing Committee	The characteristics that determine programmatic suitability for WHO prequalification of vaccines are defined, as well as the process for assessing compliance with these characteristics.	WHO Headquarters (Geneva)	prequalification
Guidance and specifications	**Immunization Practices Advisory Committee**	Advisory committee members—academia, NRAs, USAID, NGOs	The Immunization Practices Advisory Committee supports and advises the Director of the Department of Immunization at WHO, Vaccines and Biologicals with the review and/or formulation of immunization practices, operational standards, tools, and technologies to strengthen and improve the delivery of immunization programs at the country level in order to realize the Global Immunization Vision and Strategies goals. Some recommendations may influence PSPQ requirements.	WHO Headquarters (Geneva)	policies
Streamlined tools and processes	**Vaccine Presentation Assessment Tool**	Malaria Vaccine Initiative (PATH), Optimize project (WHO/PATH)	The Vaccine Presentation Assessment Tool is designed to model the logistical and financial impact of adding a new vaccine to an immunization schedule. The tool output will provide an analytical basis to support collaborative evidence-based discussions on these impacts internally within the public sector and externally with vaccine manufacturers and target countries.	Global	cold chain volume, pricing, tool, vaccine wastage

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Streamlined tools and processes	**National Immunization Technical Advisory Groups**	National academia, technical institutes, research institutes, Ministry of Health and Medical Education, vaccine manufacturers, national Expanded Programme on Immunization staff	National Immunization Technical Advisory Groups are expert advisory committees that provide recommendations to guide a country's national immunization programs and policies. They consist of independent experts with the technical capacity to evaluate new and existing immunization interventions. The group's premise is to facilitate a systematic, transparent process for developing immunization policies by making evidence-based technical recommendations to the national government. NITAGs can play a critical role in ensuring that evidence is generated to support decisions about ideal product attributes and packaging to meet country-specific demand.	National	policies, process, public/private sector
Streamlined tools and processes	**WHO regional offices Technical Advisory Groups on Immunization**	WHO regional offices	Advise WHO regional offices on immunization/vaccines at the regional level (like SAGE for the global level), review the technical and programmatic strategies adopted by WHO member states in the region, review the progress made toward disease control targets, and make technical and programmatic recommendations for introduction of new vaccines in national immunization systems.	WHO regions	policies, process
Streamlined tools and processes	**Interagency Coordinating Committees**	National ministries of health, ministries of finance, WHO, UNICEF, NGOs, bilaterals	The Interagency Coordinating Committees are a partnership between United Nations agencies, embassies, and NGOs that include a subcommittee for immunization. The immunization subcommittee serves as a partnership between the ministry of health, WHO, UNICEF, foreign government donor partners (e.g., USAID, Government of Japan, European Union), their technical subcontractors, NGOs/private voluntary organizations (e.g., BASICS, SANRU), and missionary groups (e.g., Rotary, Catholic Relief Services, Médecins Sans Frontières). The existing infrastructure could play a greater role in recommendations about vaccine product attributes.	National	process
Streamlined tools and processes	**ProVac cost-effectiveness tool**	PAHO, Latin American countries	ProVac's basic cost-effectiveness tool allows countries to calculate the incremental costs of new vaccine introductions. New functionality includes new program costing tool (to cost full program) and budget impact analysis.	Latin America	tool
Streamlined tools and processes	**WHO/UNICEF cMYP Tool**	WHO, UNICEF, GAVI Alliance countries	The comprehensive multiyear plans for immunization costing tool allows countries to cost programs and quantify resource needs for specific vaccines.	GAVI Alliance-eligible countries	tool
Streamlined tools and processes	**List of United Nations prequalified vaccines** www.who.int/immunization_standards/vaccine_quality/PQ_vaccine_list_en	WHO/UNICEF	The online list provides specifications to countries on product attributes including product price, vaccine vial monitors, and size of container.	Global	cold chain volumes, pricing, tool
Streamlined tools and processes	**Logistics forecasting tool** www.technet21.org/index.php/tools/view-document-details/1139-immunization-supply-chain-planning-tool.html	TechNet21 and countries	Excel spreadsheet tool designed to guide the process of forecasting the needs for vaccines and safe injection equipment as well as cold chain and ambient storage capacities for national immunization programs.	Technet21	cold chain volumes, tool
Streamlined tools and processes	**New Vaccine Post-Introduction Evaluation Tool**	WHO/Countries	Provides a systematic method for evaluating the impact of the introduction of a vaccine on the existing immunization system in a country.	WHO Headquarters (Geneva)	tool
Streamlined tools and processes	**Vaccine Introduction Guidelines** www.who.int/vaccines-documents/DocsPDF05/777_screen.pdf	WHO	These decision and implementation guidelines for introducing a new vaccine include information on product format selection.	WHO Headquarters (Geneva)	tool

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Streamlined tools and processes	**Vaccine Volume Calculator** www.who.int/immunization_delivery/systems_policy/logistics/en/index4.html	WHO	Allows countries to compare vaccine storage requirements between vaccine types and brands.	WHO Headquarters (Geneva)	cold chain volumes, tool
Streamlined tools and processes	**Vaccine Store Volume Calculator** www.technet21.org/index.php/tools/view-document-details/1116-vaccine-store-volume-calculator-vsvc-program-files.html	WHO/TechNet21	This tool is designed to calculate the required storage volume for specific vaccines.	TechNet21	cold chain volumes, tool
Streamlined tools and processes	**Large Store Analysis Tool** www.technet21.org/index.php/tools/view-document-details/1101-the-large-store-analysis-tool-lsat-progam-files.html	WHO/TechNet21	This tool assists with the preliminary sizing of larger vaccine freezer rooms, cold rooms, and controlled ambient stores. The tool can also be used to size the associated dry stores used for storing bundled syringes and safety boxes.	TechNet21	cold chain volumes, tool
Innovation and facilitation	**Advanced Market Commitments**	Donor governments/ industry (vaccine producers)	A fund of US$1.5 billion, donated by five donor governments and the Bill & Melinda Gates Foundation, is intended to guarantee purchase of pneumococcal conjugate vaccine, in a co-payment arrangement with GAVI Alliance. This involves purchasing at a high (US$7.00) price for a limited period of time against a binding commitment of the manufacturer to subsequently supply at a low price (US$3.50) indefinitely.	Global	procurement, pull mechanism, supply
Innovation and facilitation	**Meningitis Vaccine Project**	PATH, Bill & Melinda Gates Foundation, WHO, Serum Institute of India, Syncho Bio Partners BV, US Food and Drug Administration Center for Biologics Evaluation and Research, National Institute for Biological Standards and Control	Partnership for development, testing, introduction, and widespread use of conjugate meningococcal vaccines through a ToT to a developing-country manufacturer for large-scale production and low-price sale of vaccine.	Global	pricing, push mechanism, supply
Innovation and facilitation	**Statens Serum Institute Transfer of Technology Division**	Statens Serum Institute	For over a decade the Statens Serum Institute provided ToTs to developing-country manufacturers and the ToT unit was prized by researchers. But ToTs were conducted without generating any revenue for the institute and the program is now, for all intents and purposes, close to bankrupt.	Denmark/ Global	push mechanism, technology transfer
Innovation and facilitation	**Branded ACTs for sale in the private market**	The Global Fund to Fight AIDS, Tuberculosis and Malaria; Drugs for Neglected Diseases Initiative	ACTs for malaria have been developed in two forms: un-branded for sale at a low cost to public markets in poor countries and branded for sale into private markets. This model could be replicated for vaccines.	Global	pricing, supply
Innovation and facilitation	**Push funding—product development partnerships**	Bill & Melinda Gates Foundation, PATH, Aeras Foundation, and others	Three product development partnerships are ongoing with push funding.	Global	product development partnerships, pricing, push mechanism
Innovation and facilitation	**Pull funding**	Bill & Melinda Gates Foundation	Advanced Purchase Commitments to be funded for the GAVI Alliance.	Global	pricing, pull funding

Abbreviations used: ACT, artemesinin combination therapies; CDC, US Centers for Disease Control and Prevention; DCVMN, Developing Countries Vaccine Manufacturers Network; IFPMA, International Federation of Pharmaceutical Manufacturers & Associations; JSI, John Snow, Inc.; NGO, nongovernmental organization; NRA, national regulatory authority; PAHO, Pan American Health Organization; PSPQ, Programmatic Suitability of Vaccine Candidates for WHO Prequalification; SAGE, Strategic Advisory Group of Experts; SIVAC, Supporting National Independent Immunization and Vaccine Advisory Committees; ToT, transfer of technology; UNICEF, United Nations Children's Fund; USAID, US Agency for International Development; VPPAG, Vaccine Presentation and Packaging Advisory Group; WHO, World Health Organization.

Immunization supply system efficiency

Tenet 2: Immunization supply systems are designed to maximize effectiveness, agility, and integration with other supply systems and to support continuous system improvement through learning, innovation, and leveraging synergies with other sectors.

The visioning process

Over the course of 2010 and 2011, partners have joined forces to develop a shared, long-term vision for immunization supply and logistics systems and technologies. The goal of this vision is to guide key stakeholders at country, regional, and global levels in their work to strengthen supply and logistics systems. This process is being facilitated by project Optimize, a collaborative project of the World Health Organization and PATH.

The following proposed attributes characterize the vision, or desired state, of future supply systems.

- Supply systems are designed to maximize their effectiveness and agility:
  - o Streamlined design and supply chain processes.
  - o Demand driven and flexible to meet different needs in different situations.
  - o Quality planning, quality control, and quality assurance are embedded as routine practices throughout supply systems.

- Vaccines and supplies are integrated with wider health supply systems when relevant:
  - o Integration is considered during the design of a more effective and agile supply system.
  - o Different approaches to integration are examined to choose the most relevant one for each context.
  - o The potential impact of integration is modeled and tested prior to full implementation.
  - o Information systems are integrated into the architecture of the overall national logistics management information systems.

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Landscape analysis focus areas

Capacity-building

Improving systems

Integration

Outsourcing

Streamlining

The vision

By 2020, state-of-the-art supply systems meet the changing needs of a changing world in order to enable the right vaccines to be in the right place, at the right time, in the right quantities, in the right condition, at the right cost.

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- Vaccine supply systems continually improve with ongoing monitoring, learning, and innovation:
  - Continuous monitoring of key performance indicators and regular analyses are conducted to identify the need for corrective actions.
  - Assessments are undertaken regularly to ensure that effective vaccine management practices remain at desired levels.
  - Regular training and supportive supervision are provided to ensure that supply systems management best practices are kept.
  - Innovation in vaccine supply systems, technologies, and practices continue to ensure improved performance within changing environments.

- Vaccine supply systems leverage synergies with other sectors including the private sector:
  - Public-private partnerships are built where appropriate.
  - Identification and mapping of weaknesses in the existing supply systems processes and workflow take place.
  - Existing projects involving the private sector are identified.
  - Different outsourcing possibilities are evaluated.

Landscape analysis

The landscape analysis of immunization supply system efficiency was conducted to better understand the work underway by all global stakeholders in this area. We looked at the systems component of vaccine supply chains with a view to optimize their design, management, and operational function. The goal is to enable more effective and efficient management of a growing number of vaccines being introduced today, as well as those in the pipeline, which will result in a greater volume of throughput in the system. Relevant initiatives and collaboration with the private sector have also been reviewed in this regard.

Preliminary gaps

The goal of the landscape analysis was to identify gaps that need to be addressed to realize the vision of future immunization supply systems. Preliminary analysis indicates key gaps in the following areas:

- Supply systems that maximize effectiveness and agility including:
  - Regional distribution hubs to manage the growing pipeline of vaccines.
  - Innovative last-mile transport solutions for health workers.

- Guidance on how and when to integrate with wider health supply systems including:
  - Review of successful integrated health commodity supply chains in the world and lessons learned on best practices.
  - Guidance on optimal design and management oversight of an integrated supply system.

- Further investigation in ways to continually improve supply systems, with ongoing monitoring, learning, and innovation:
  - Technological and management solutions for temperature monitoring as part of required quality control processes during in-country transport of vaccines.
  - Innovative funding mechanisms to ensure that recurrent expenses for vaccine transportation are covered.

- Ways to leverage synergies with other sectors including the private sector, such as:
  - o Analysis and feasibility of transport back-loading and/or reverse logistics options.
  - o Innovative maintenance solutions for cold chain equipment.

Landscape analysis summary table

By 2012, the vision statement will reflect evidence found through the following landscape analysis and other analyses. For more information, please contact optimize.who@path.org.

Vision of future immunization supply and logistics systems: Core tenets

1. Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.
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3. The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.
4. Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.
5. Human resources policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

June 2011

Focus area	Project/concept	Partners involved	Description	Location	Keywords
Capacity-building	**Capacity Development Initiative** Private-Sector Role in Health Supply Chains	Transaid-DHL Partnership	This initiative trains public-sector actors in supply chain issues. It includes professional training to commercial vehicle drivers and development of relevant legislation in Malawi and Zambia.	Malawi, Zambia	private sector, transport
Capacity-building	**Transport Management Systems** www.transaid.org	Transaid	Transaid Transport Management System empowers everyone who has responsibility for transport, from the driver to the transport manager. The system has been used to make dramatic improvements to service delivery across ministries of health in Africa and has also been utilized to improve the supply chain of health commodities.	Bangladesh, Democratic Republic of Congo, Ghana, Kenya, Malawi, Mozambique, Nigeria, Sierra Leone, South Africa, Sri Lanka, Uganda, Zambia	private sector, transport
Capacity-building	**Improving transport systems in low-income settings** www.riders.org	Riders for Health	Riders for Health manages and maintains vehicles used in the delivery of health care in Africa. Health workers have the reliable transport they need so they can deliver regular health care to the most isolated communities.	Democratic Republic of Congo, Gambia, Ghana, Kenya, Lesotho, Nigeria, Tanzania, Uganda, Zambia, Zimbabwe	private sector, transport
Improving systems	**Cabo Delgado Project** www.villagereach.org/where-we-work/mozambique/	VillageReach, Mozambique Ministry of Health	VillageReach developed a pilot program to reach poor, underserved populations in remote areas. The pilot combines delivery of liquid propane gas for refrigeration, waste disposal, and household needs with delivery of vaccine and medical supplies.	Mozambique	last mile, product delivery
Improving systems	**Increasing the availability of essential health supplies through supply-chain expertise** www.crownagents.com/Projects/Increasing-availability-supply-chain-expertise.aspx	USAID | DELIVER Project, Crown Agent	DELIVER ensures that in-country supply systems have the capacity to effectively manage and distribute commodities for malaria prevention and treatment programs. It also addresses the availability and supply of malaria commodities at the global level, and for the long term.	Angola, Malawi, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia	product delivery, storage and transport
Improving systems	**Supply and distribution of affordable drugs in Nigeria** www.crownagents.com/Projects/Supply-distribution-affordable-drugs-Nigeria.aspx	DFID Health Commodities Project, Crown Agent	The Health Commodities Project is a four-year program designed to ensure the sustainable supply of medical equipment, essential drugs, and consumables to primary and secondary health care facilities to key states in Nigeria. Target recipients are the poorest of the poor and the project inputs focus on safe motherhood, emergency obstetrics care, and common illnesses such as diarrhea, malaria, and pneumonia.	Nigeria	product delivery, storage and transport
Improving systems	**Strengthening procurement and supply chain management in Kenya** www.crownagents.com/Projects/Bed-nets-to-save-70000-lives-in-Kenya.aspx	Global Fund, Crown Agent	Crown Agents, part of the Global Fund's Procurement and Supply Chain Management Consortium working with the Kenya Ministry of Health, bought and delivered 3.4 million long-lasting insecticide-treated nets. Distribution went smoothly with most districts achieving 95% coverage of targeted populations and increased bed net ownership by 50% to 10.6 million.	Kenya	product delivery, storage and transport
Improving systems	**Building efficient, demand-led medical supply systems in Zambia** www.crownagents.com/Projects/Building-demand-medical-supply-systems-Zambia.aspx	Management of Medical Stores Ltd., Crown Agent	Medical Stores Limited is viewed as a key institution in the delivery of Zambia's health services. Crown Agents played a major role in convincing other health-sector partners to work through Medical Stores Limited as the existing national drug supply system, thereby ensuring the pooling of resources maintaining parallel vertical logistics structures.	Zambia	demand driven, product delivery

Focus area	Project/concept	Partners involved	Description	Location	Keywords
Improving systems	**To develop and link supply chain management services to lower levels of health care** www.samasha.com	Supply Chain Management Services for Health for Africa	SAMASHA is currently implementing a project in Uganda's Mityana District that is working with public-health facilities to strengthen inventory management. The project provides technical assistance in assessing and improving efficient management of stock in any organization including private clinics.	Uganda	demand driven, product delivery
Integration	**Commodity Security and Supply Chain Management** Reference document: Mozambique_WorldBank_Commodity Security and SCM_July2010	World Bank, Mozambique Ministry of Health	The project will contribute to averting a crisis faced by Mozambique by providing gap-filling financing for core health care commodities, including those related to HIV/AIDS treatment. The project will also address the commodity security of essential medicines and medical supplies by contributing to the strengthening of supply chain systems for the delivery of these drugs, especially to rural areas.	Mozambique	product delivery, storage and transport
Integration	**Scaling up and integrated health logistics system** http://www.jsi.com/Managed/Docs/Publications/ScalingUpSeries/nepal.pdf	USAID, JSI	In 1993, Nepal had no integrated health logistics system. By 2005, Nepal's health logistics system had been developed, scaled up, and become a model of integration and effectiveness. In part because medicines and other supplies are now available, the quality of health services and access to basic health services by poor, underserved, and marginalized populations has dramatically improved.	Nepal	product delivery, storage and transport
Integration	**Integrated Child Health Campaign** www.malariajournal.com/content/7/1/73	International Federation of Red Cross and Red Crescent Societies, Togo Ministry of Health	The Togo Integrated Child Health Campaign in 2004 represented the first campaign on a national scale in which various health interventions, including the distribution of a long-lasting insecticide-treated bed net as well as measles vaccination, were delivered to households with at least one eligible child aged 9 to 59 months.	Togo	product delivery
Integration	**Child Survival and Development** Reference document available on Optimize project SharePoint: "Synergy between Health and Integrated Child Development Services (ICDS) in GUJARAT"	UNICEF, Indian Institute of Public Health	The synchronization of Health and Integrated Child Development Services in Valsad is a successful capacity development initiative. It provides a strong foundation on which further gains can be built to promote child survival and development. It demonstrates the value of two sectors collaborating, so they can facilitate more meaningful outcomes than could have been generated individually.	India	synergy, systems
Integration	**Integration of Public Health Supply Chains** deliver.jsi.com/dlvr_content/resources/allpubs/logisticsbriefs/InteProvPrac.pdf	USAID | DELIVER Project, Ministry of Health	For over 20 years, the goal of USAID's health supply chain strengthening efforts has been to maximize customer service based on the resources available. As part of this quest, the DELIVER PROJECT has engaged in supply chain integration efforts across a variety of countries, programs, and situations, although these were rarely labeled as supply chain integration interventions. The project has also undertaken product integration efforts in a number of countries, usually in response to national strategies and policies in which integration of this kind is a priority.	Ghana, Kenya, Malawi, Tanzania, Zambia, Zimbabwe	product delivery
Outsourcing	**Outsourcing the vaccine supply chain** Reference document available on the Optimize SharePoint: "CDC Outsourcing the US Vaccines for Children Program SCM"	CDC, McKesson Corporation	CDC revolutionized the way vaccines are delivered in the United States. By outsourcing the supply chain management of vaccines to a private company and adopting best practices from the private sector, the Vaccines for Children program improved considerably the overall immunization coverage and the vaccines delivery system.	United States	private sector, storage and transport
Outsourcing	**Improving transport using private sector** Private-Sector Role in Health Supply Chains	Sample Transportation, DHL	Early infant HIV diagnosis requires complex and expensive tests with significant logistical requirements, such as blood refrigeration and transportation. By collecting infant blood on dried blood spots, samples can be created that are both easy to transport and stable for relatively long periods without refrigeration. Samples were transported by DHL, testing was done at a national HIV reference laboratory, and results were returned by fax. In 2005, 930 infant infections occurred in Botswana compared to the 4,650 infections that would have occurred without this program.	Botswana	private sector, storage and transport

Focus area	Project/concept	Partners involved	Description	Location	Keywords
Outsourcing	**Regional Distribution Centers** Frequently Asked Questions: Regional Distribution Centers	PEPFAR, PHD	Regional distribution centers are state-of-the-art warehousing facilities that operate in Ghana, Kenya, and South Africa and which store and distribute the most frequently requested essential medicines and other health products. The centers provide shorter delivery times than ordering directly from the manufacturer, reducing the turnaround time from three to four months to approximately two to six weeks for planned orders.	Ghana, Kenya, South Africa	regional hub, storage
Streamlining	**Seamless supply chain in reproductive healthcare in Zimbabwe** www.crownagents.com/Projects/Seamless-supply-chain-healthcare-Zimbabwe.aspx	DFID Delivery Team Topping Up Project, Crown Agents	From 2003 to 2006, Crown Agents was subcontracted to JSI Europe as an implementing partner on the Delivery Team Topping Up Project. The project is a continuing success and the benefits to date have included: A seamless and efficient operation of logistics/supply chain. Reproductive health commodity security for all men and women of Zimbabwe. Reduced stockout rates of reproductive health commodities at all public-health centers from above 40% to below 5%. Logistics management information for all stakeholders.	Zimbabwe	product delivery
Streamlining	**Streamlining Immunization Logistics** www.path.org/files/IMM_strmln_lgstcs_Indonesia.pdf	PATH, Indonesia Ministry of Health	The ultimate aim of the Streamlining project is to replicate its methodology in other Indonesian provinces. Within the context of a PUSH+ system of vaccine distribution (a system of health center visits to distribute vaccines, collect sharps waste, and provide supervision), the project was targeted to achieve specific objectives in the categories of immunization services, vaccine distribution chain, injection safety and sharps disposal, supervision, and monitoring.	Indonesia	product delivery, transport

Abbreviations used: CDC, US Centers for Disease Control and Prevention; DFID, UK Department for International Development; JSI, John Snow, Inc.; PEPFAR, US President's Emergency Plan for AIDS Relief; SAMASHA, Supply Chain Management Services for Health for Africa; USAID, US Agency for International Development.

Environmental impact of immunization supply systems

Tenet 3: The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.

The visioning process

Over the course of 2010 and 2011, partners have joined forces to develop a shared, long-term vision for immunization supply and logistics systems and technologies. The goal of this vision is to guide key stakeholders at country, regional, and global levels in their work to strengthen supply and logistics systems. This process is being facilitated by project Optimize, a collaborative project of the World Health Organization and PATH.

The following proposed characteristics serve as working hypotheses to help characterize the vision, or desired state, of an environmentally rational supply chain:

- Vaccine thermal stability is increased and true stability utilized in order to raise storage temperatures where permitted, reduce cooling capacity requirements, and enable alternatives to air transport.

- Packaging requirements are minimized to reduce natural resources consumed and minimize storage space requirements.

- The reduction of distances and time for shipping are considered a critical criterion for determining where vaccine and related products are sourced.

- Distribution vehicles are carefully selected, driven, and maintained for journeys that have been optimally planned to minimize energy requirements while maximizing service life.

- Energy efficiency strategies, beginning with informed product selection and continuing through ongoing maintenance, are implemented to reduce energy requirements.

- Renewable energy sources are used to replace fossil fuels to reduce resource depletion and decrease pollution.

- Innovative product development in the field of refrigeration and transportation provide purchasers with more efficient,

PATH/Carib Nelson

Landscape analysis focus areas

Energy and resource efficiency

Green energy and cold storage

High-efficiency cold storage

Product volume reduction & improved packaging

System-wide energy management

Transportation efficiency

Vaccine stabilization

Waste reduction and management

Harm reduction in waste management

Improved waste management

Non-incineration disposal

Recycling or value reclamation waste management

The vision

By 2020, state-of-the-art supply systems meet the changing needs of a changing world in order to enable the right vaccines to be in the right place, at the right time, in the right quantities, in the right condition, at the right cost.

For more information

PATH
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www.path.org/projects/
project-optimize.php

World Health Organization
vaccines@who.int
www.who.int/immunization_delivery/
systems_policy/optimize

OPTIMIZE

PATH **World Health Organization**

reliable, and durable equipment choices for vaccine cold chain.

- Countries have clear policies, strategies, and funded plans for waste management that include disposal of immunization and daily medical wastes as well as repair, reuse, and recycle provisions for packaging and equipment.

Landscape analysis

The landscape analysis of environmental impact of immunization supply systems was conducted to better understand the work under way by all global stakeholders in this area.

We looked at the immunization system as a continuum and considered the environmental impacts along the way. For example, we included considerations of packaging and shipping modes at the manufacturer's level; in-country transport, cold chain, and health system energy use; and waste management at the end of the process.

Preliminary gaps

The goal of the landscape analysis was to identify gaps that need to be addressed to realize the vision of future immunization supply systems. The gaps identified to date are as follows:

- There is a lack of concrete information about the economic value of making environmentally sound decisions in logistics system design. To address this, economic research that quantifies the intangibles, shows the balance between up-front investment and savings in running costs, and possibly takes into account the carbon credit value could be useful.

- A number of innovative software tools utilize newly digitized global location information to optimize logistics transport legs. However, up to now, these tools have been used primarily in the private sector and multinational companies. There are likely to be costs in developing-country immunization logistics that could be removed by optimizing delivery routes while at the same time reducing the environmental impact of these programs. More work is needed to utilize available, innovative geographic information system tools to increase the efficiency of developing-country logistics systems.

- Much of the global work on medical waste in developing countries has been focused on general medical waste. There may be opportunities to apply lessons learned about managing medical waste in the curative health sector to immunization logistics.

- A holistic approach to reducing waste in logistics systems can start with making sure that the right quantity and quality of product is accepted into the system in the first place. Excess waste can result from over-ordering, moving product to locations where it cannot be stored or used properly, and accepting product with inadequate remaining shelf life. Work on product optimization through raising capacity for accurate quantification, product redistribution, and proper acceptance procedures can strengthen logistics systems and ultimately reduce the amount of waste for disposal.

- Globally, there have been recent advances in low-emission, hybrid, and electric vehicles. Knowledge is needed about how these new classes of vehicles could help increase the overall efficiency of logistics systems, and if favorable, understanding the steps toward opening procurement mechanisms.

- Also related to transportation efficiency, there is a lack of work on light-weighting loads that are carried in the immunization logistics system. Reducing weight and volume of vaccine loads could result in overall cost savings and reduced environmental impacts. Two approaches for accomplishing

this are streamlining packaging to reduce volumes and redesigning vaccine carriers and cold boxes to reduce the refrigerant-to-vaccine ratio by increasing insulation efficiency.

- The difficulty of collecting the highly distributed waste in the logistics system is a huge barrier to being able to efficiently treat and dispose of it. How can the exhaustive infrastructure for vaccine delivery be better used for waste management collection? Further work on reverse logistics for waste collection and centralized treatment could be valuable to improving the environmental impact of immunization.

- To facilitate the movement to reduce and optimize packaging of vaccines and supplies, it would be helpful to ensure there is a feedback loop about cold chain conditions all the way back to manufacturers. Generating better information about product conditions during shipping and upon arrival and sharing this information with manufacturers could result in improved packaging by reducing manufacturers' tendency to over pack.

- Advocacy is needed to ensure that environmentally responsible technologies have a path into the developing-country immunization marketplace. Consideration of other factors beyond purchasing cost should be encouraged. The current quality regulation and purchasing mechanism systems should be examined to see what opportunities exist to broaden decision-making in this area. This applies to different categories of technologies including cooling technologies, vehicles, and power systems.

Landscape analysis summary table

By 2012, the vision statement will reflect evidence found through the following landscape analysis and other analyses. For more information on this landscape analysis, please contact optimize.who@path.org.

Vision of future immunization supply and logistics systems: Core tenets

1. Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.

2. Immunization supply systems are designed to maximize effectiveness, agility, and integration with other supply systems, and to support continuous system improvement through learning, innovation, and leveraging synergies with other sectors.

3. The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.

4. Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.

5. Human resources policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

June 2011

	Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Energy and resource efficiency	Green energy	**Decrease dependence on diesel-generated electricity at clinic/hospital level by using renewable energy** www.haitilibre.com/en/news-1254-haiti-energy-1-million-in-solar-energy-for-the-commune-of-boucan-carre.html	Partners in Health, Solar Electric Light Fund, Clinton Bush Haiti Fund, NRG Energy, SolarWorld, 11th Hour Project	Boucan Carre, Haiti health facilities relied 100% upon diesel fuel to generate electricity until a 10,000 watt solar electric power system was installed by the NGO Solar Electric Light Fund. Fuel costs have now been cut by 64%. Diesel generators are subject to high costs, high maintenance, unexpected breakdowns, and produce a variety of environmental impacts. A solar-diesel hybrid can reduce cost, increase reliability, and reduce environmental impact.	Haiti, Lesotho, and Rwanda have all employed solar diesel hybrids designed and installed by the Solar Electric Light Fund for facilities operated by Partners in Health	environmental impact, power systems, solar power, solar-diesel hybrid
	Green energy and cold storage	**Project Optimize battery-free solar vaccine refrigeration challenge and field demonstrations**	PATH, Dyna-Tek, Inc., Vestfrost, Sunfrost, Sundanzer, True Energy	Solar-powered vaccine refrigeration has been used to extend immunization to remote areas for nearly 30 years. Field experience indicates that the majority of equipment failures have involved the battery system, which is often expensive and difficult to replace. Battery-free solar refrigerators provide green cold storage without problematic batteries.	Senegal, Vietnam	cooling technology, environmental impact, solar power
	Green energy and cold storage	**SolarChill Consortium**	World Bank, PATH, Greenpeace, others	The consortium is working on advancing the technology of battery-free solar refrigerators for developing-country vaccine storage.	Various	cooling technology, environmental impact, solar power
	High efficiency cold storage	**Improved refrigerator for vaccine storage**	PATH, Global Cooling/ Twinbird	A battery-free solar powered stirling cooler refrigerator is being developed to further improve and expand vaccine storage in remote health clinics with no grid power.	Japan, United States	cooling technology, environmental impact, solar power
	High efficiency cold storage	**SEEDR L3C/CDC passive cold chain equipment**	CDC, CDC SEEDR L3C bilaterals	Three passively cooled vaccine transport carriers of different sizes. The carriers are made using recycled materials and designed to be fully recyclable. Engineering models demonstrate improved temperature stability, increased cold life, and no freezing. Carbon-negative insulation reduces the overall CO_2 footprint. Boxes are lighter, requiring less fuel for transport.	United States	cold boxes, cooling technology, environmental impact, freeze prevention, passive cooling, supply systems, vaccine carriers
	Product volume reduction and improved packaging	**Global Packaging Project**	Consumer Goods Forum, ECR Europe, EUROPEN, Grocery Manufacturers Association, Sustainable Packaging Coalition, AIM (the European Brands Association)	This project delivers to the consumer-products industry a language and simple metrics to enable more informed dialogue between trading partners about the relationship between packaging and sustainability.	Global view	environmental impact, packaging
	Product volume reduction and improved packaging	**Intradermal adapter for standard needles**	PATH, West Pharmaceuticals, SID Technologies	Intradermal delivery of vaccines could decrease the volume of vaccines needed to confer immunogenicity.	India, United States	environmental impact, intradermal delivery, reduced vaccine dose, vaccines and delivery devices
	Product volume reduction and improved packaging	**New plastics for packaging**	Various	New packaging materials are being developed; for example, plastics for secondary packaging that include recycled content and plastics designed for safer burning disposal to replace glass syringes.	Global view	environmental impact, packaging

	Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Energy and resource efficiency	Product volume reduction and improved packaging	**Repackaging of Zithromax**	Pfizer Pharmaceuticals, International Trachoma Initiative of the Task Force for Global Health, JSI Logistics Services	This group is repackaging donated Zithromax to reduce shipment volume. The most significant change is a move from bottles containing 30 tablets to 500 tablets. The change has not yet been rolled out; they are finalizing production and anticipate shipping the newly configured bottles and cartons in spring 2011.	Global view	environmental impact, packaging, shipping
	Product volume reduction and improved packaging	**Tools for minimizing or optimizing packaging**	Sustainability Packaging Alliance, Sustainable Packaging Coalition, Greener Package	Various tools are being developed to help industry make sustainable choices in packaging. Examples are Sustainable Packaging Coalition's COMPASS web application, Greener Packaging's database, and Sustainability Packaging Alliance's Packaging Impact Quick Evaluation Tool. These tools may be used by vaccine and injection device manufacturers to improve their packaging choices with regard to environmental impact.	Global view	environmental impact, packaging
	Product volume reduction and improved packaging	**Uniject^{TM} injection system projects (Uniject is a trademark of BD)**	PATH, the Bill & Melinda Gates Foundation, USAID, FHI, Marie Stopes International, IPPF, UNFPA, WHO, Pfizer	Working to advance the availability of Uniject presentations of Depo-Provera® for contraception and oxytocin for management of bleeding in the third stage of labor. This project involves a reduction of materials, lowering shipment, storage, and waste disposal costs.	Honduras, India, Indonesia	environmental impact, packaging, vaccines and delivery devices
	Product volume reduction and improved packaging	**Pentavalent vaccine in Uniject**	Crucell, BD, PATH	Crucell is working toward using Uniject as the primary packaging and optimizing secondary packaging for Uniject to reduce shipment, storage, and waste costs through the cold chain and distribution channels.	Global view	environmental impact, packaging, vaccines and delivery devices
	Product volume reduction and improved packaging	**Reusable pallet shippers**	Technical University of Denmark, UNICEF	This project is examining air-freight pallet packaging (e.g., insulation, coolants, cladding, pallet base) used by vaccine manufacturers to develop ideas for how pallet shippers could be used to take products beyond the traditional termination point at the national level. One idea involves creating low-impact materials with highly desirable characteristics to encourage reuse at the final destination.	Global view	environmental impact, packaging, shipping
	System-wide energy management	**Health in the Green Economy**	WHO	WHO's *Health in the Green Economy* series is reviewing the evidence about expected health impacts of greenhouse gas mitigation strategies in light of options considered in the Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.	Global view	environmental health, environmental impact
	System-wide energy management	***Powering Health:* A USAID resource**	USAID	*Powering Health* is a 30-page resource for health centers in low-resource settings, including guidance on how to assess energy needs, determine and select from available options, and find sustaining resources. Though not focused exclusively on reducing environmental impact, it enables and facilitates selection of cleaner energy sources.	Global view	environmental impact, power systems
	System-wide energy management	**Project Optimize: Zero energy cold chain**	PATH and Tunisian government partners in immunization, electric power, product testing, solar industry, and electric vehicle industry	This holistic approach starts with an energy audit, and reducing energy consumption through program streamlining/integration, energy efficiency retrofit measures, and the switchover to using all electric vehicles for vaccine distribution/outreach. New refrigerators with lower energy consumption will replace older, less reliable models. Electric power will be produced on each site with a grid-connected photovoltaic solar electric power system.	Tunisia	electric vehicles, energy efficiency, environmental impact, integration, power systems, solar power, supply systems
	System-wide energy management	**Training courses in renewable energy**	Solar Energy International, the Pan American Health Organization, NGOs, governments, universities	Through the Renewable Energy Education Program, Solar Energy International offers hands-on workshops and online courses in solar photovoltaics, wind, micro-hydro, solar hot water, and natural home building. Though not specific to logistics, governments could tap into this resource to benefit their logistics systems.	Africa, Americas, Caribbean, Micronesia	environmental impact, power systems, renewable energy

	Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Energy and resource efficiency	Transportation efficiency	**Distance reduction or route optimization for vaccine delivery routes**	JSI, CDC, ESRI, Llamasoft	These are geographic information system software tools that can assist with route optimization. For example, ESRI's ArcGIS software has the capacity to develop optimized "static" routes. Supply Chain Guru from Llamasoft is another example of such a tool that includes a carbon footprint analysis module. ESRI and Llamasoft recently announced plans to join their tools.	Global view	environmental impact, GIS, route optimization, supply systems, transport
	Vaccine stabilization (decrease cooling needs)	**Vaccine stabilization**	PATH, various government and private-sector, industrial and developing-country agencies, vaccine manufacturers, and technology companies	PATH is advancing technologies that help ensure vaccine performance and effectiveness under the toughest temperature conditions. Using advanced vaccine formulation designs and stabilization technologies, PATH is researching methods to improve the thermostability of both new and existing vaccines.	India, United States	environmental impact, thermostability, vaccine technology
	Vaccine stabilization (decrease cooling needs)	**Vaccine stabilization grand challenge grants**	Bill & Melinda Gates Foundation, Tufts University School of Medicine, TransForm Pharmaceuticals, Endo Pharmaceuticals	In 2005 the Bill & Melinda Gates Foundation launched the first Grand Challenge grants, with one category being the development of heat-stable vaccine. Three current projects at three different organizations are focusing on three different approaches to stabilization: the use of bacterial spores to protect antigens, high throughput formulation screening method, and polymerization.	United States	environmental impact, thermostability, vaccine technology
Waste reduction and management	Harm reduction in waste management	**Needle hub cutter**	BD	The hub cutter reduces the volume of environmental waste resulting from multiple safety boxes or injection waste that is improperly disposed. One hub cutter will hold the injection waste of five safety boxes or 400 to 600 needles.	India, United States	environmental impact, health care waste management, needle remover
	Harm reduction in waste management	**Needle-free vaccine administration**	PATH, various private-sector technology companies	Several companies are developing alternative vaccine delivery technologies that offer alternatives to sharps, such as jet injectors, intranasal delivery, and sublingual gel.	Dominican Republic, India, United States	environmental impact, needle-free delivery, vaccines and delivery devices
	Harm reduction in waste management	**Proper approach to disposal of sharps**	Government of Rwanda, USAID Maternal and Child Health Integrated Program	These collaborators provided the principal technical assistance to help Rwanda become the first country in Africa to introduce the new vaccine against pneumonia (in 2009). They provided support on proper approaches to manage and dispose of sharps, especially important since the vaccine was supplied in practically indestructible glass single-dose prefilled syringes.	Rwanda	environmental impact, health care waste management
	Improved waste management	**Transporting, Storing, and Handling Malaria Rapid Diagnostic Tests at the Peripheral Storage Facilities, 2009; and in Health Clinics, 2009.** www.finddiagnostics.org/export/sites/default/resource-centre/reports_brochures/docs/malaria_rdt_central_manual_may09.pdf (pages 21-30) deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/TranStorRDT_Clinic.pdf (pages 20-29)	USAID | DELIVER PROJECT, WHO, WHO-WPRO, Foundation for Innovated Diagnostics, Roll Back Malaria Partnership, President's Malaria Initiative, and UNICEF	These publications are intended for staff at health clinics that use malaria RDTs. They describe the basic principles for management and storage of RDT stock, and they outline practical solutions for protecting RDTs against high temperatures during storage and transport. They also describe how to manage waste generated from RDT use.	USAID | DELIVER countries: Angola, Benin, Ghana, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia	environmental impact, health care waste management, malaria diagnostics

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Improved waste management	**Booklet for the community health worker on health care waste management**	USAID | DELIVER PROJECT	The project has produced a *Guide for Health Care Waste Management* for use at the facility level. With recent increases in community-based distribution of injectable contraceptives and other products with potentially hazardous waste material, waste management for community-based health workers will become a more important issue. The project plans to produce an illustrated booklet for community-based health workers on safe handling and disposal of hazardous waste.	USAID | DELIVER countries: Angola, Benin, Ghana, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia	environmental impact, health care waste management
Improved waste management	**Global Healthcare Waste Project** www.gefmedwaste.org/article.php?list=type&type=3	UNDP, WHO, Health Care Without Harm	This project is assisting seven countries in developing and sustaining best health care waste management practices in a way that is both locally appropriate and globally replicable. In one country, the project is testing and disseminating non-incineration health care waste treatment technologies.	Argentina, India, Latvia, Lebanon, Philippines, Senegal, Tanzania, Vietnam	health care waste management, environmental impact
Improved waste management	**Guidelines for the Storage of Essential Medicines and Other Health Commodities. 2003.** apps.who.int/medicinedocs/en/d/Js4885e/ pages: 81-86; available in English, Spanish, French, Urdu, Bangla, Arabic, and Russian	JSI/DELIVER, WHO	*Guidelines for the Storage of Essential Medicines and Other Health Commodities* is a practical reference for setup and management of a storeroom or warehouse. The guide contains written directions and illustrations on receiving and arranging commodities, special storage conditions, tracking commodities, maintaining the quality of the products, constructing and designing a medical store, waste management, and resources. It was written to meet the needs of district-level facilities; however, it applies to any storage facility, of any size or setting.	USAID | DELIVER countries: Angola, Benin, Ghana, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia	environmental impact, health care waste management, medicines storage
Improved waste management	**Internal standard operating procedures**	SCMS, JSI, Management Sciences for Health	SCMS has developed a number of internal standard operating practices for the disposal of unusable medical items; disposal of unusable pharmaceutical products; and disposal of damaged, refused, or unusable pharmaceutical products.	USAID | DELIVER countries: Angola, Benin, Ghana, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia	environmental impact, health care waste management
Improved waste management	**Landscape of non-incineration disposal methods**	UNDP—Global Environment Facility, JSI, Health Care without Harm, various others	UNDP and the Global Environment Facility facilitated technology visits for stakeholders of eight facilities in the New York and Washington, DC, areas using innovative non-incineration medical waste disposal technologies.	United States	environmental impact, health care waste management, non-incineration waste disposal
Improved waste management	**Logistics of Health Care Waste Management: Information and Approaches for Developing Country Settings. 2009.** deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/LogiHealtWastMgmt.pdf	USAID | DELIVER PROJECT	Medical or health care waste refers to all waste generated by health care facilities, research facilities, and laboratories. Health care waste management is a major health and environmental concern. Hazardous waste, including sharps and other infectious waste, pose a serious risk to human health and the general environment. In many developing countries, disposing of this waste is complicated by limited financial and human resources. This document considers the reality of health care waste management practices in resource-limited settings. Solutions offered are based on developing-country experience and presented as practical solutions to logistics problems in health care waste managment.	USAID | DELIVER countries: Angola, Benin, Ghana, Liberia, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania, Uganda, Zambia	environmental impact, health care waste management

Waste reduction and management

	Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Waste reduction and management	Improved waste management	**Medical Waste Improvement Implementation** www.noharm.org/global/issues/waste/	Health Care Without Harm, World Bank, JSI, CDC, WHO	Health Care Without Harm helps countries implement health care waste management guidelines developed with other funding.	proposed or active in Nepal, Vietnam, Tanzania, Argentina, Philippines, Bangladesh	environmental impact, health care waste management
	Improved waste management	**Making Medical Injections Safer**	JSI, URC, PATH, others, USAID, CDC	This PEPFAR project aimed to improve injection safety in initial PEPFAR countries from 2004 to 2009. It included work to improve waste management practices, including waste segregation practice and safe disposal of sharps. Lessons learned and materials developed during these projects could be applied to immunization programs.	Botswana, Cote d'Ivoire, Ethiopia, Guyana, Haiti, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Vietnam, Zambia	environmental impact, health care waste management
	Improved waste management	**Support Establishment and Sustainability of Medical Waste Management Systems in Kenya**	PATH, Kenya government agencies, PEPFAR partners, local NGOs, and other donors	This project will support improved and sustainable medical waste management systems in Kenya by implementing a three-pronged approach. PATH will work to strengthen the health care waste management system, increase capacity in procurement and commodity management systems, and encourage healthy behaviors among health workers and the community.	Kenya	environmental impact, health care waste management
	Non-incineration disposal	**Encapsulation**	Management Sciences for Health	Management Sciences for Health is working on encapsulation or inertization for products that are dangerous to burn, such as pharmaceuticals that may contain sulphurous or mercuric compounds.	Global view	environmental impact, expired drug disposal, health care waste management
	Non-incineration disposal	**Syringe melters**	Past projects by PATH, others, IT Power, New Paradigm Automation, Los Alamos Technical Associations, Sigma-K Corp, PATH	Syringe melters melt syringes to encapsulate needles and reduce volume for safer disposal.	India	environmental impact, health care waste management
	Non-incineration disposal	**Performance, quality, and safety (PQS) specifications for medical waste autoclaves**	WHO	WHO is working to create specifications and test protocols for medical waste autoclaves. This would be a new category in the WHO PQS Program.	Global view	autoclave, environmental impact, health care waste management, PQS
	Non-incineration disposal	**Sustainable Waste Management** www.noharm.org/global/issues/waste/resources.php	Health Care Without Harm	Tools and resources for program managers interested in environmentally responsible health care waste management, with an emphasis on non-incineration methods. Tools include catalogs of technologies, recommendations for improving health care waste managment, and tools to aid evaluation of waste management technology choices.	Global view	environmental impact, health care waste management
	Non-incineration disposal, recycling, or value reclamation waste management	**Medical Waste Processing and Value Recovery**	SEEDR L3C, CDC	Custom-built medical waste processing machines use microwave technology for disinfecting waste, and then allow for municipal treatment and/or recycling of plastic content enabling some value recovery from the waste stream.	United States	environmental impact, health care waste management

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Non-incineration disposal, recycling, or value reclamation waste management	**BD ecoFinity system for recycling plastic from sharps waste** www.bd.com/ecofinity	BD, Waste Management Company	The BD ecoFinity Life Cycle Solution provides a system for processing used sharps and reusing the resulting raw plastic material to make new sharps boxes. They expect to enable recycling of 70% of the sharps waste stream where it is employed.	United States	environmental impact, health care waste management, recycling
Recycling or value reclamation waste management	**Mosquito net recycling pilot project**	USAID | DELIVER, WHO, UNEP	This first-of-its-kind recycling pilot project was carried out in six districts in southern Madagascar in November 2010. Over 13 tons of expired mosquito nets were collected and are currently being shipped to Baltimore where they will be tested and processed by Trex in Winchester, Virginia.	Madagascar, United States	environmental impact, malaria nets, recycling, reverse logistics

Abbreviations used: AIM, European Brands Association; CDC, US Centers for Disease Control and Prevention; ECR, Efficient Consumer Response; EUROPEN, European Organization for Packaging and the Environment; GIS, geographic information system; IPPF, International Planned Parenthood Federation; JSI, John Snow Inc.; NGO, nongovernmental organization; PQS, performance, quality, and safety; RDT, rapid diagnostic tests; SCMS, Supply Chain Management System; UNDP, United Nations Development Programme; UNFPA, United Nations Population Fund; UNICEF, United Nations Children's Fund; URC, University Research Corporation; USAID, US Agency for International Development; WHO, World Health Organization; WPRO, WHO Western Pacific Regional Office.

Immunization information systems

Tenet 4: Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.

The visioning process

Over the course of 2010 and 2011, partners have joined forces to develop a shared, long-term vision for immunization supply and logistics systems and technologies. The goal of this vision is to guide key stakeholders at country, regional, and global levels in their work to strengthen supply and logistics systems. This process is being facilitated by project Optimize, a collaborative project of the World Health Organization and PATH.

In developing a vision for the future of information systems for immunization, the following characteristics serve as working hypotheses to help describe the desired state of future information systems:

- *Integrated:* Vaccines and other health commodities are managed through an integrated information system, meaning that subcomponents of this system are interoperable. Furthermore, information for planning and performance management of logistics is accessible by other health information systems.

- *Decision-making is supported:* Staff have the capacity to analyze and use information that is routinely available for evidence-based decision-making.

- *Data is captured at its origin:* Data about individual records (e.g., vaccines, immunization records, and cases) is accurately captured and digitized at the place where these events occur, and aggregated or disaggregated information is made directly available to appropriate users at all levels.

- *Flexible:* Logistics management information systems have robust core capabilities, yet can accommodate health system variations based upon the local context. The design is adaptable to different contexts, programs, and changes over time as needs evolve.

- *Design is driven by user needs:* Logistics management systems are designed to meet the broad requirements of end-users, managers, planners, recipients of health services,

PATH

Landscape analysis focus areas

Logistics management software

Integrated software solutions

Software modules for specifc purposes

Targeted projects

Design standards

Hardware solutions

Development platforms and components

The vision

By 2020, state-of-the-art supply systems meet the changing needs of a changing world in order to enable the right vaccines to be in the right place, at the right time, in the right quantities, in the right condition, at the right cost.

For more information

PATH
optimize.who@path.org
www.path.org/projects/
project-optimize.php

World Health Organization
vaccines@who.int
www.who.int/immunization_delivery/
systems_policy/optimize

OPTIMIZE **❊PATH** **World Health Organization**

and other stakeholders.

- *Affordable and sustainable:* The total cost of ownership of logistics management systems is easily understood so decision-makers can evaluate the wider cost implications of adopting an information system across the health system. Logistics management information systems are designed for implementation and use in low-resource settings.

- *Reliable and secure:* Logistics management information systems are designed to be maintained and supported effectively and must always be available within the environmental constraints. They are also designed to protect data from unauthorized use and disclosure with varying levels of user access.

- *Consistent design framework:* Logistics management information systems take advantage of standards, common data, common software applications and technologies, and are properly supported by clear design and user documentation.

Landscape analysis

A landscape analysis was conducted to better understand what global stakeholders are currently doing to make sure that vaccine supply systems are supported by better information systems.

The working group first identified a number of software systems that are commonly used in global public health, both specific to logistics and integrated solutions. Overall, the main limitation of these software systems seems to be that most well-established systems have so far not been successfully deployed in a different context than the one for which they were designed.

In addition, some specific projects (implementation of a system in a specific setting) are included. These are notable because of their scale or approach. We also included projects that explore the development of standards or hardware. Finally, a special category comprises the platforms that allow for the use of mobile phones in health information systems (mHealth).

Preliminary gaps

The goal of the landscape analysis was to identify gaps that need to be addressed to realize the vision of future immunization supply systems. The preliminary gaps identified are as follows:

Generic last-mile logistics information systems

Many applications exist to control stock at central and regional levels, but there are few "last-mile solutions" suitable to be deployed affordably and sustainably at the service level and also integrated into central systems. Furthermore, most last-mile applications are designed for a specific type of commodity and lack the level of abstraction required to make them useful for all commodities (such as immunization, antiretrovirals, essential medicines, etc.) in use at the service level.

A challenge lies in demonstrating an innovative, low-cost, low-maintenance solution that would meet the basic logistics information needs for at least two health commodities (one of which should be vaccines) at the intermediate and lowest levels of a supply chain for a low-income country. Basic information needs include:

- The ability to register receipts, issues, and physical on-hand stock.

- The ability to reorder based on historical consumption data.

- The ability to keep track of stock at all nodes in the system (and have upward, downward, and lateral visibility of stock).

With additional valuable features providing:

- The ability to access and analyze historical data.
- The ability to report immunization coverage.

Plan for the scalability and sustainability of a logistics management information system in a specific country setting

There is a lack of in-country skills to plan for, design, implement, and sustain information systems projects. A challenge exists in demonstrating how a logistics management information system could be scalable and sustainable at the national level in a large country (with a population of 20 million or more). This may include exploring the following parameters:

- Skills and profiles that would be needed.
- Total cost of ownership model.
- Five-year plan and budget.
- Funding mechanisms.

Hardware

Many of the small-scale projects we documented rely on the use of personal mobile phones. While these provide excellent opportunities for fast and flexible development and deployment because they are so cheap and ubiquitous, there seems to be little effort spent on developing devices that are built specifically for their intended purpose. In the for-profit world, these devices (e.g., point-of-sales equipment) are very common, rugged, and reliable. Exploration is warranted regarding whether the public health world would also benefit from similar designs or solutions.

Landscape analysis summary table

By 2012, the vision statement will reflect evidence found through the following landscape analysis and other analyses. For more information, please contact optimize.who@path.org.

Vision of future immunization supply and logistics systems: Core tenets

1. Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.
2. Immunization supply systems are designed to maximize effectiveness, agility, and integration with other supply systems, and to support continuous system improvement through learning, innovation, and leveraging synergies with other sectors.
3. The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.
4. Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.
5. Human resources policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

June 2011

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Development platforms and components	**EMIT** www.emitmobile.co.za	Cell-Life	EMIT is a cloud-based service that provides the ability to gather text data via Java-based handsets. A web-based console allows for the conducting of surveys and extracting data. Forms are created and administered with the aid of the Cell-Life team. The software resides on Cell-Life servers and interfaces with software on client's cell phones.	Not applicable	mHealth
Development platforms and components	**EpiCollect** www.epicollect.net	Imperial College London supported by Wellcome Trust	EpiCollect is a cloud-based service that enables the collection of rich content via Android and iPhone phones. A web-based console allows for form development, conducting of surveys, and data management.	Not applicable	mHealth
Development platforms and components	**EpiSurveyor** www.datadyne.org/episurveyor	DataDyne	EpiSurveyor is a cloud-based service that enables collection of text and global positioning system data using a variety of mid-ranged handsets. Software resides on EpiSurveyor servers and interfaces with client software on handset. The web-based console allows for form development, conducting of surveys, and data management.	Not applicable	mHealth
Development platforms and components	**FrontlineSMS** www.frontlinesms.com spreadsheets.google.com/ccc?key=0Akj5_3vVWZ8tdGk4czI4eHcycGo2Y1NnWmhsUjdBTXc&hl=en#gid=0	FrontlineSMS	FrontlineSMS is an open-source platform that allows for data collection using basic phones and collects data only via SMS. The software enables management of users and deployment of SMS-based surveys. FrontlineForms, an add-on module for FrontlineSMS, allows users to leverage more advanced Java-based software to use forms for data collection.	Not applicable	mHealth
Development platforms and components	**Mobile Researcher** www.populi.net/ mobileresearcher	Clyral	Mobile Researcher is a cloud-based service that enables data collection via SMS, wireless application protocol, and/or HTML. Data types vary with implementation. Software resides on Clyral servers and interfaces with client software on mobile handsets. A web-based console offers users the ability to develop forms, deploy surveys, manage field workers, and analyze responses.	Not applicable	mHealth
Development platforms and components	**Mobitop** http://mobisy.com/mobitop.html	Mobisy Samhita	Mobitop is a platform which allows applications to run across different mobile handset operating systems (OSs) including Android, Blackberry, iPhone, J2ME, Symbian, and Windows Mobile. Applications designed to run on this platform are therefore accessible to a wide range of mobile phones, saving development time required for customization of the application to each OS. Applications have been developed on this platform relating to preventative and curative health care and disease management.	Not applicable	mHealth
Development platforms and components	**Nokia Data Gathering Toolkit** www.nokia.com/corporate-responsibility/society/nokia-data-gathering/english	Nokia	Nokia Data Gathering allows for text and global positioning system data collection via handsets. Client (mobile) and server software are free to download and install. Server software allows for the development of customizable questionnaires, dissemination of forms to mobile phones, data collection on mobile phones, and data submission from mobile clients.	Not applicable	mHealth
Development platforms and components	**Open Data Kit** www.opendatakit.org	University of Washington, Google	Open Data Kit is a set of free tools used all over the world to make data collection and information delivery easier. Open Data Kit provides an out-of-the-box solution for users to build a data collection form or survey, collect the data on a mobile device and send it to a server, and aggregate the collected data on a server for extraction to useful formats.	Not applicable	mHealth
Development platforms and components	**OpenXdata** www.openxdata.org	OpenXdata Consortium	OpenXdata is an open-source platform for data collection via Java-based phones. A wide variety of data types can be collected, including global positioning systems. A user-hosted server allows for the management of groups, users, form creation, and conducting surveys.	Not applicable	mHealth
Development platforms and components	**RapidSMS** www.rapidsms.org	UNICEF	RapidSMS is the underlying framework used to build enterprise-level, SMS-based applications for data collection, logistics, and communication. The software provides the built-in functionality to help users create and customize SMS-based applications. Third-party developers have created applications built on RapidSMS which are also available out of the box.	Not applicable	mHealth
Development platforms and components	**Voxiva** www.voxiva.com	Voxiva	Voxiva is a cloud-based service that allows for data collection via a number of mobile platforms and channels. Voxiva provides a number of sector-specific services built around a core set of technologies allowing users to conduct surveys and collect data. Implementation, development, and form creation is done with the aid of Voxiva.	Not applicable	mHealth

Vision of future immunization supply and logistics systems: Tenet 4 landscape analysis summary—Immunization information systems

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Hardware solutions	**SmartConnect** www.cs.washington.edu/affiliates/meetings/talks1011/orourke2010.pdf	University of Washington, Inveneo, PATH	This refrigerator-based device will be used to measure refrigerator temperature and keep track of stock transactions through barcode readers and SMS gateways.	Nicaragua, Vietnam	last mile
Integrated software solutions	**ACSiS** www.accesstec.ca	Accesstect Inc.	ACSiS is an integrated health-sector management system. The hub of ACSiS is the electronic health record, a prerequisite for all other functional modules. The supply chain management module is designed to track the inventory of pharmaceuticals and medical supplies at each facility. Inventory is tracked in a first-expiry first-out manner.	Belize, Bhutan, Canada, Guyana, Saint Lucia, Somalia	integrated health information system, stock management system
Integrated software solutions	**OpenMRS** www.openmrs.org	OpenMRS Consortium (Partners in Health)	OpenMRS is a community-developed, open-source, enterprise electronic medical record system platform.	Global	medical records
Integrated software solutions	**Sage** www.sage.co.uk/software_and_services/business-wide_solutions/sage_erp_x3-1-1.aspx	WHO/Essential Medicines and Pharmaceutical Policies	Sage is an enterprise, resource-planning system that was jointly implemented by a group of West African Francophone national pharmacies for stock control.	22 West African countries	warehouse management system
Logistics management software	**CCEM 2** www.path.org/publications/detail.php?i=1569	PATH	CCEM 2 is a Microsoft Access-based software tool to manage cold chain equipment and forecast equipment needs for multiyear country plans according to new vaccine schedules, energy availability, and equipment selection policies.	Kenya	equipment inventory management
Logistics management software	**District Health Information Software 2 (DHIS 2)** www.dhis2.org/functionality	University of Oslo www.hisp.uio.no	DHIS 2 is a tool for collection, validation, analysis, and presentation of aggregate statistical data tailored to integrated health information management activities. It is a generic tool rather than a pre-configured database application. DHIS 2 is a modular web-based software package built with free and open-source Java frameworks. It has a multi-language graphical-user interface.	19 projects ranging from national implementation to pilot testing in Africa and Asia	data analysis tool, health information system
Logistics management software	**GpTürk** www.gpturk.com	GpTürk	The GpTürk integrated system covers temperature control, medical records, and logistics for vaccines.	Turkey	immunization registration, reporting, stock management system, temperature monitoring
Logistics management software	**iDART** www.cell-life.org/idart	Cell-Life, The Desmond Tutu HIV Foundation	iDART is a free software solution designed to support the dispensing of ARV drugs in the public health-care sector. It supports in the management of ARV stocks and can produce reports and manage collection of drugs by patients. The software is also designed to address the reporting requirements of government, international funders, and internal clinical data such as identifying patients who have not collected their medication for an extended period of time.	Implemented by a number of ARV-dispensing sites in South Africa	stock management system
Logistics management software	**IQSMS** www.iqstrategy.net/frmiqsms.shtml	Futures Group International	IQSMS is a mobile application that enables data to be sent to a central computer server which aggregates the inputs for data export to Microsoft Excel. The application also has reporting capabilities. Available in English and Swahili.	Currently used in a number of health facilities in Tanzania	mhealth
Logistics management software	**Logistimo** www.samaanguru.org	Logistics for Global Good	Logistimo offers a simple and scalable solution without the need for expensive hardware. It uniquely provisions low-end mobile phones to capture transactional data, track inventory, place orders, forecast demand, optimize inventory, and generate demand analytics.	India	integration, last mile, mHealth

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Logistics management software	**Mobilisr** www.open-mobile.org/technologies/mobilisr-enterprise-open-source-mobile-messaging	Open mobile consortium, Cell-Life, Praekelt Foundation	Mobilisr is an open-source mobile messaging platform. It is a web-based system that allows management of communications via a mobile phone using a range of mobile technologies: broadcast SMS, interactive keyword SMS, SMS subscribe and unsubscribe, static USSD, and interactive USSD. Future releases will include IVR, location-based services, WAP, and voicemail push (where a recorded voicemail is sent to people's phones). Examples of how these can be used include: bulk SMSs sent to patients at an ARV clinic reminding them to take their medication, and interactive USSD used to gather patient feedback on service quality.	South Africa	mhealth
Logistics management software	**PipeLine Monitoring and Procurement Planning** www.deliver.jsi.com/dhome/resources/tools/softwaretools/pipeline	JSI, USAID | DELIVER	PipeLine Monitoring and Procurement Planning software helps program managers gather critical forecasting information, ensure that products arrive on time, maintain consistent stock levels at the program or national level, and prevent stockouts.	Global	forecasting
Logistics management software	**ProQ** www.deliver.jsi.com/dhome/resources/tools/softwaretools/proq	JSI, USAID | DELIVER	ProQ is a software tool that quantifies HIV test requirements based on realistic forecast demand, assessment of existing supply chain capacity, and availability of resources for procurement.	Global	forecasting
Logistics management software	**Quantimed** www.msh.org/projects/sps/Resources/Software-Tools/Quantimed.cfm	Management Sciences for Health	Quantimed is designed to improve the accuracy of order planning and budgeting by providing a systematic approach to organizing and analyzing data. Quantimed facilitates the calculation of commodity needs using either a single or combination of three primary quantification methods: past consumption, morbidity patterns, and proxy consumption.	Global	forecasting
Logistics management software	**SIGMED and SIGMED Lite** www.medict.nl/SigmedLite/content_001.htm	medICT	SIGMED is a computerized drug management information system designed for central and regional warehouses. Functions include: forecasting and planning, procurement and purchasing, warehousing and distribution, and inventory management and sales. SIGMED Lite is designed for health facilities and pharmacies. It encompasses all functions of SIGMED described above except warehousing and distribution.	Pharmacie Populaire du Mali in Mali (fully integrated with the accounting software package) and at central medical stores in Malawi	stock management system
Logistics management software	**Stock Management Tool/District Vaccine Data Management Tool** www.who.int/immunization_delivery/systems_policy/logistics/en/index5.html	WHO	The Stock Management Tool and District Vaccine Data Management Tool are Microsoft Excel-based and control immunization supply stock (receipts, levels, buffer, issues) at the central and district levels.	Global	stock management system
Logistics management software	**Supply Chain Manager** www.deliver.jsi.com/dhome/resources/tools/softwaretools/supplychainmanager	JSI, USAID | DELIVER	Supply Chain Manager supports integrated supply chains by enabling health organizations to track the large variety of products used by their diverse programs. It also enables logistics managers to export data for use by other software applications in logistics or public health.	Global	stock management system
Logistics management software	**Vaccination Supplies Stock Management** www.technet21.org/index.php/documents/view-document-details/926-vaccination-supplies-stock-management-vssm.html	WHO	VSSM is a computer tool to assist vaccination program managers and storekeepers to organize and manage the stock of vaccines and other related supplies. VSSM's focus is on vaccines and diluents; however, it also caters to all other supplies. VSSM is open-source software based on Microsoft Access and all source codes are provided to users. Anyone familiar with Access can modify VSSM, add new fields, and manipulate reports to suit specific programmatic purposes.	Global	warehouse management system

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Logistics management software	**VillageReach Management Information System** www.villagereach.org www.villagereach.org/vrsite/wp-content/uploads/2010/07/100723-Mozambique-National-Expansion-Plan.pdf	VillageReach	VillageReach provides technical assistance to provincial government health authorities to operate the dedicated logistics system for the direct distribution of vaccines and related commodities to health posts. Integral to the dedicated logistics system is the use of the VillageReach Management Information System, which produces ongoing routine metrics to enable continuous adjustments to improve health system and/or program performance. Furthermore, VillageReach builds systems to incorporate regular supportive supervision for all aspects of the logistics and supply chain system as well as health center operations.	Mozambique	integration, last mile
Other	**Common Requirements Development Methodology** www.phii.org/resources/doc/CRDM%20LMIS%20Final%20Report%2020101013.pdf	PATH, Public Health Informatics Institute, WHO	This is a methodology to guide the systematic discovery and documentation of user requirements through business process analysis.	Global	user-driven design
Other	**Assessing the National Health Information System** www.who.int/healthmetrics/tools/hisassessment/en/index.html	WHO, Health Metrics Network	This tool provides a broad-based assessment of the system's own environment and organization, responsibilities, roles and relationships, and of the technical challenges of specific data requirements.	Not applicable	health information system, information system assessment tool
Other	**Health Unbound** www.healthunbound.org/technology/applications	Health Metrics Network, mHealth Alliance	Hub is an online forum for the dialogue and exchange of ideas relating to health systems. It is designed to bring together health practitioners, implementers of health information initiatives, government leaders, nongovernmental organization donors, international organizations, the private sector, and system users.	Not applicable	community, landscape
Other	**OpenLMIS** openlmis.org	VillageReach	OpenLMIS is a community-led initiative dedicated to furthering understanding and development in LMIS to support improvements in health system supply chains in low-income countries around the world.	Not applicable	community, repository
Targeted projects or organizations	**12580 service** www.chinamobileltd.com/images/pdf/2011/sr/en/8.pdf www.csap.cam.ac.uk/media/uploads/files/1/mobile-communications-for-medical-care.pdf	China Mobile	12580 is a mobile appointment booking system that enables remote payment for services and appointment booking via call center staff. The system generates a number or two-dimensional barcode which is entered on a self-service terminal on arrival at the hospital. The system covers 93 hospitals and has served 4.25 million patients.	Guangdong, China	hospital information system, mhealth
Targeted projects or organizations	**Care2x** www.care2x.org/node/20	NA	Care2x is an open-source integrated hospital information system developed by a community of volunteers. Functionality includes organizing quick order catalogs, product database management, automatic signaling of reception of orders, product search and archive functions, ordering of pharmaceutical products, and a central depot for medical products and other materials. The system supports multiple languages.	Under development	hospital information system, stock management system
Targeted projects or organizations	**ColaLife** www.colalife.org	ColaLife	ColaLife is working to get Coca-Cola to open up their distribution channels in developing countries to carry "social products" such as oral rehydration salts to save children's lives. The child mortality rate has not changed significantly over the last three decades indicating that we need to explore new options like ColaLife.	Zambia	integration
Targeted projects or organizations	**Epothecary** cs.nyu.edu/~mpaik/pubs/epothecary.pdf	New York University	Epothecary is an authentication system that uses two-dimensional matrix barcodes and mid-level phones with a geographic information system and cameras for authentication and track/trace applications. The system enables the location of consignments to be known whenever the two-dimensional code is scanned or photographed.	United States	drug authentification service, mhealth

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Targeted projects or organizations	**GeoVac** www.path.org/files/ CP_geovac.pdf	Ministry of Labor, Health and Social Affairs of Georgia, Curatio International Foundation, USAID, Partners for Health Reformplus Project	GeoVac is a Microsoft Excel tool designed to quickly process immunization coverage data with output reports providing insight into the use and distribution of vaccines, an assessment of adequacy of supplies as well as major barriers (medical contraindications, parental refusals, etc.) to the functioning of the immunization system.	Georgia	health information system, immunization
Targeted projects or organizations	**Human Resource for Health Information Software (HRHIS)** www.hisptanzania.or.tz/ hris.php	Ministry of Health and Social Welfare, Norwegian Embassy, Japan International Cooperation Agency, University of Oslo, Ifakara Health Institute, Clinton Health Access Initiative, - Muhimbili University of Health and Allied Sciences School of Public Health & Social Sciences	HRHIS is custom-designed open-source human resources management software. Reporting can aggregate data by location, organization, unit, or cadre.	Tanzania	human resources information system
Targeted projects or organizations	**InSTEDD** http://instedd.org/	InSTEDD, Many partners	InSTEDD manages a portfolio of projects designed to make technological innovations accessible to humanitarian and public health organizations. Applications include: structured data reporting through mobile phones, GeoChat for communication and coordination of surveillance and rapid response health teams in disease control management, and an appointment reminder tool which enables home-based care workers to track and remind HIV/AIDs patients to attend appointments.	Cambodia, Thailand	mhealth
Targeted projects or organizations	**Mobile Product Authentication** http://sproxil.com/ technology.php	Sproxil	Mobile product authentication enables consumers to confirm the authenticity of the drug by scratching a label on the drug packaging to reveal a code number. This number is sent for free by SMS, in encrypted form, to a database server. An immediate text reply confirms whether the drug is genuine or fake (or if the secure code has already been used or is not recognized). A pilot project ran in Lagos, Abuja, and Port Harcourt covering 125 participating pharmacies. 735,000 blister packs of BIOFEM's Glucophage used in diabetes treatment were labeled, over 22,000 SMS messages were sent, and 67,612 unique customers were served.	Three-month pilot in Nigeria completed April 2010	drug authentification service, mhealth
Targeted projects or organizations	**Mobile Technology for Community Health** www.mobileactive.org/motech-new-approach-health-care	Columbia University, Grameen Foundation	This is an integrated community-based health information system that is based on openMRS and uses OpenXdata.	Bihar, Ghana	medical records, mHealth
Targeted projects or organizations	**Project Optimize** www.path.org/projects/ project-optimize.php	WHO, PATH	Optimize has specific activities in five countries to demonstrate child immunization registries using mobile phones, last-mile LMIS, moving-warehouse LMIS, and lot-track and trace systems.	Albania, Guatemala, Senegal, Tunisia, Vietnam	integration, last mile

Focus area	Project/concept	Partners involved	Description	Locations	Keywords
Targeted projects or organizations	**SMS for Life** www.rbm.who.int/psm/ smsWhatIsIt.html	Tanzanian Ministry of Health and Social Welfare, Novartis, Roll Back Malaria Partnership Secretariat, Medicine for Malaria Venture, The Swiss Agency for Development, Vodacom, Vodafone, IBM	SMS for Life is an innovative public-private partnership that harnesses everyday technology to improve access to essential malaria medicines in rural areas. It uses a combination of mobile phones, SMS messages, and electronic mapping technology to track weekly stock levels at public health facilities in order to eliminate stock-outs, increase access to essential medicine, and reduce the number of deaths from malaria. SMS for Life was initially piloted across three districts in Tanzania, covering 129 health facilities and 226 villages, representing 1.2 million people. When launched in 2009, 26% of all health facilities did not have any ACTs in stock, but by the end, 99% had at least one ACT dosage form in stock. In addition, 888,000 people in the three pilot districts had access to all malaria treatments at the close of the pilot, versus 264,000 people at the start, which helped to reduce the number of deaths from malaria.	Tanzania	mHealth, stock management
Targeted projects or organizations	**Vaccine Link** www.csap.cam.ac.uk/media/uploads/files/1/mobile-communications-for-medical-care.pdf	China Mobile	Vaccine Link is a vaccine information system targeted particularly at parents of children already registered with immunization stations. This service sends vaccine notices to parents via mobile phones and can also send information on other child health topics such as infant feeding, early education, maternal and child health care, child and parenting classes, etc. Vaccine Link is available in three cities: Shenzhen, Foshan, and Qingyuan. It had 100,000 subscribers as of October 2010.	Guangdong, China	immunization, mhealth

Abbreviations used: ACT, Artemisinin-based combination therapy; ARV, antiretroviral; DHIS 2, District Health Information Software 2; HRHIS, Human Resource for Health Information Software; Hub, Health Unbound; IVR, interactive voice recording; J2ME, Java2 Platform Micro Edition; JSI, John Snow, Inc., LMIS, logistics management information systems; mHealth, mobile health; OS, operating system; SMS, short message service; UNICEF, United Nations Children's Fund; USAID, US Agency for International Development; USSD, unstructured supplementary service data; VSSM, Vaccination Supplies Stock Management; WAP, wireless application protocol; WHO, World Health Organization.

Human resources

Tenet 5: Human resource policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

The visioning process

Over the course of 2010 and 2011, partners have joined forces to develop a shared, long-term vision for immunization supply and logistics systems and technologies. The goal of this vision is to guide key stakeholders at country, regional, and global levels in their work to strengthen supply and logistics systems. This process is being facilitated by project Optimize, a collaborative project of the World Health Organization and PATH.

The following proposed characteristics serve as working hypotheses to describe the desired future state of human resources (HR):

- *Personnel:* Creativity, initiative, and versatility are key factors for performance.
- *Policies:* Specific HR policies develop, recruit, retain, and motivate the necessary workforce of logisticians and the logistics competencies of other health personnel. Recognition, job and development opportunities, salaries, and variety are achieved through appropriate policies.
- *Competency:* Competent personnel meet an agreed upon competency framework as doctors, nurses, or pharmacists.
  - A global competency framework serves both integrated supply systems and vertical supply chain logistics.
  - Sustainability requires synergies between immunization system management and other logistics functions.
- *Motivation:* This is a prerequisite for performance and sustainability and is critical for staff retention.
  - It is important to have resources (equipment, facilities, organization, and procedures) to operate with a minimum level of performance; one single missing link spoils the incentive for involvement and initiative.
  - Supervision is necessary to ensure high staff performance through compliance checks and on-site training on the one hand, and on the other hand to

PATH/Wendy Stone

Landscape analysis focus areas

Global context

Human resource policies

Competency frameworks

Regional initiatives

Country-specific initiatives

Other human resource initiatives

The vision

By 2020, state-of-the-art supply systems meet the changing needs of a changing world in order to enable the right vaccines to be in the right place, at the right time, in the right quantities, in the right condition, at the right cost.

For more information

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project-optimize.php

World Health Organization
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www.who.int/immunization_delivery/
systems_policy/optimize

OPTIMIZE

PATH | **World Health Organization**

sensitize staff members on the importance of what they are doing. Hence it is also a guardian for motivation.

- *Other characteristics:*
  - o Adequate number: The capacity to build up and retain a workforce of supply chain managers in sufficient numbers is a critical factor for success.
  - o Empowerment: Supply chain management (SCM) staff have influence on HR and health system decisions. They process relevant data, inform decisions, and adjust the implementation process.
  - o Every level: The closer the last mile, the more important are multitasking, flexibility, and adaptability. It is important to have a local competency framework with the right mix of specialization versus versatility.

Landscape analysis

The landscape analysis of the efficiency of immunization information systems was conducted to better understand the work underway by all global stakeholders in this area. In order to meet global public health goals—including the Millennium Development Goals for improving maternal health, reducing child mortality, and combating HIV/AIDS, malaria, and other diseases—efficient public health supply chains are key, as is the role of the supply chain manager or logistician. This landscape analysis defines goals, identifies gaps that need to be addressed to achieve them, and serves as a call to action engaging key stakeholders to increase both the supply and demand for professional public health supply chain managers and logisticians.

Preliminary gaps

The goal of the landscape analysis was to identify gaps that need to be addressed to realize the vision of future immunization supply systems. The preliminary gaps identified are as follows:

- *Recognition and motivation:* Supply chain managers are currently not considered a critical factor of success for health operation and lack recognition and incentives. The need for improved logistics expressed at the district/peripheral level is not a seen as a priority at the central/national levels. There are few champions for this field that often remains marginal in most international meetings. Contrary to other technical areas, there is no clear evidence demonstrating the benefits of recognition and incentives in terms of savings and improved staff performance. Furthermore, initiatives promoting the professionalization of supply chain managers often raise concerns on the part of some health workers, such as pharmacists, district administrative officers, and others. In such a context, the poor performance of SCM systems further reduces staff motivation—not only among supply chain managers but among all health care personnel.
- *Competence:* In developing-country public health systems, SCM competencies are not subject to a consensus similar to competency frameworks of other health professionals such as pharmacists or nurses. One of the consequences is that SCM does not have an outline of the profession's key characteristics, notably pre-service training and adequate certifications that are entry points for newcomers and provide recognition and career opportunities. In addition, the individual's capacity to adapt to new models and technologies is limited. Cross-cutting competency frameworks for SCM have been developed that could benefit integrated logistics as well as other areas, but they have not been implemented in developing countries to date. Finally, training opportunities are scarce and have limited impact on the individuals actually in charge of logistics.
- *Numbers:* There are few positions to meet the needs of SCM and logistics and even fewer people to fill the existing positions. A critical mass of trained supply chain managers would be necessary to

address most of the gaps listed here, and to serve as a reference for other health workers in charge of logistics functions, however such a cadre does not currently exist. As a result, it is difficult to find the right individuals to fill positions in the immunization supply systems at all levels. Worse, the closer one gets to peripheral level, the less attention is dedicated to SCM. As a result, last-mile logistics are always a challenge.

- *Synergies:* Health programs are too compartmentalized (split into "silos") to make the best use of the limited available human resources. For example, the GAVI Alliance has no capacity-building program in supply chain management, whereas such a program exists at the Global Fund to Fight AIDS, Tuberculosis and Malaria. At the district/peripheral level, there are often not enough people able to deal with logistics challenges. This is even truer with respect to creating synergies between private and public sectors. Finally, there is a dire lack of networks that would enable individuals in charge of logistics and professional supply chain managers (in public and private sectors) to share experience and learn from each other.

Landscape analysis summary table

By 2012, the vision statement will reflect evidence found through the following landscape analysis and other analyses. For more information on this landscape analysis, please contact optimize.who@path.org.

Vision of future immunization supply and logistics systems: Core tenets

1. Vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.
2. Immunization supply systems are designed to maximize effectiveness, agility, and integration with other supply systems, and to support continuous system improvement through learning, innovation, and leveraging synergies with other sectors.
3. The environmental impact of energy, materials, and processes used in immunization supply systems from the international to local levels is assessed and minimized.
4. Immunization information systems help staff plan and manage immunization activities and resources while ensuring that adequate quantities of vaccines are always available to meet demand.
5. Human resources policies provide immunization supply systems with adequate numbers of competent, motivated, and empowered personnel at all levels of the health system to overcome existing and emerging immunization supply challenges.

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Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Global context	**Global shortage of health workers, brain drain stress developing countries** jama.ama-assn.org/content/298/16/1853.full	WHO	A worldwide shortage of health care workers, coupled with a disproportionate concentration of health workers in developed nations and urban areas, stands in the way of achieving key public-health priorities such as reducing child and maternal mortality, increasing vaccine coverage, and battling epidemics such as HIV/AIDS.	Global	health workforce by density
Global context	**Global Health Workforce Alliance** www.who.int/workforcealliance	Global Health Workforce Alliance	The alliance provides tools to devise and implement HR strategies that can benefit SCM.	Global	policies
Global context	**Health logistics is a profession: improving the performance of health in developing countries** http://factsreports.revues.org/index109.html	Bioforce Institute, Agence de Médecine Préventive (AMP)	This assessment of HR in logistics was conducted in 2005–2006 by the Bioforce Institute with technical support from AMP. The evaluation focused on five French-speaking African countries representing various samples of the AFRO Region: Benin, Burkina Faso, Chad, Democratic Republic of Congo, and Madagascar. This study, as well as many others, shows that the global crisis affecting health workers is even more severe when it comes to personnel taking care of logistics functions. Within health systems, SCM has a major impact on delivery and the sustainability of programs and structures.	Benin, Burkina Faso, Chad, Democratic Republic of Congo, Madagascar	health personnel qualifications
HR policies	**The Capacity Project** www.capacityproject.org/hris	USAID	The Capacity Project (2005 to 2009) developed open-source solutions (HR information systems) to supply health-sector leaders and managers with the information they need to assess HR problems, plan effective interventions, and evaluate those interventions. The follow-on global project, CapacityPlus, builds on the human resources information system strengthening work initiated by the Capacity Project.	Global	capacity reinforcement
HR policies	**Humanitarian Logistics Association** www.humanitarianlogistics.org www.humanitarianlogistics.org/news/wise-humanitarian-logistics-a-career-for-women	Humanitarian Logistics Association	The Association is an individual membership association for humanitarian logistics professionals committed to increase humanitarian logistics effectiveness. The Association and the Women's Institute for Supply Chain Excellence offers "Humanitarian Logistics: A Career For Women," a collection of experiences and impressions of supply professionals and logisticians.	Global	career
HR policies	**Human Resources Development: The Challenge of Health Sector Reform** info.worldbank.org/etools/docs/library/206833/DussaultHRD.pdf	World Bank	This 1999 review of human resources development describes how efficiency increases when a productive work organization is in place which requires an appropriate mix of personnel, good management, and appropriate incentives. This raises the question of what can be done to ensure that sector reform will be facilitated by a workforce with the competencies and tools required; with adequate numbers and mix of skills; distributed geographically and among levels of care and types of institutions and services; and with sufficient motivation and commitment. A review of qualified and unqualified health personnel as well as a complete restructuring of the health task-force structure should be performed urgently. The availability of a "skills mix" health task force is an appropriate answer to the scarcity of the health task force in low-income countries.	Global	health task force restructuring
Competency frameworks	**Professional Development Opportunities for Public-Sector Reproductive Health Commodity Managers**	Gregory Roche, Jennifer Antilla, Erin Hasselberg, Sylvia Ness	"Competency framework" refers to SCM functions or other health functions in a profession. In both cases, SCM is rarely described as related to a specific training and referred qualifications. "Professional Development Opportunities for Public Sector Reproductive Health Commodity Managers," Section V on "Workforce Development" specifically addresses this HR issue. In low-income countries, logisticians charged with implementing, maintaining, or improving commodity management systems typically attain their jobs by rising through the ranks even when they are minimally qualified or minimally trained.	Global	professionalization
Competency frameworks	**HR development for SCM in public health** www.technet21.org/index.php/documents/view-document-details/1036-human-resource-development-for-supply-chain-management-in-public-health.html	Optimize	The need to professionalize the public-health logistician position is increasingly recognized but yet to be implemented at a significant scale. Frequent supply chain system breakdown and poor performance demonstrated by poorly maintained information systems and product stockouts are due to a lack of professional supply chain managers. The supply chain tasks are performed by individuals who are not trained to fulfill those tasks.	Global	professionalization

Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Competency frameworks	**Health logistics is a profession: improving the performance of health in developing countries** http://factsreports.revues.org/index109.html	Bioforce Institute, AMP, WHO/AFRO, UNICEF, USAID | DELIVER, other partners	A competency framework for health logisticians has been established by the Bioforce Institute with the support of AMP and other partners and has been further refined to reach a regional consensus after two seminars organized by WHO/AFRO and UNICEF with the strong involvement of several African countries and USAID | DELIVER. This framework is composed of seven core competences: 1. Plan logistics of health structures and programs. 2. Administer and coordinate logistics of health programs and structures. 3. Manage the supply chain. 4. Coordinate the use and maintenance (including subcontracting) of medical and technical equipment. 5. Coordinate the maintenance of facilities and housing, including water and sanitation of health structures. 6. Ensure effective logistical support of health emergencies and humanitarian operations. 7. Foster intersectoral collaboration and community participation.	Africa	health logisticians
Competency frameworks	**Supply Chain Manager Job Profile** www.cvtips.com/career-choice/supply-chain-manager-job-profile.html	CV Tips	Managing the supply chain refers to strategies and processes of global tactical planning to ensure the availability of commodities. Supply chain managers have abilities in handling complex activities and tasks. Key elements of the role include: • Maintaining product availability. • Managing category stock budget. • Developing reports to ensure targets are met. • Managing the import process. • Working cross-functionally to improve supply chain efficiencies. • Supporting systems development.	Global	supply chain managers
Competency frameworks	**Health logistics** www.bioforce.asso.fr/IMG/pdf/RAPPORT-FINAL-ATELIER-CONSENSUS-FORMATION-LdS-KIN-MAI_2010.pdf	Bioforce	The health logistics field deals with the management of material resources essential to the quality and efficiency of health activities within programs and structures. It calls for managerial skills and techniques related to supply chain, facility management, and health operations.	Global	job descriptions
Competency frameworks	**Capacity Development Plan**	Zambia Ministry of Health	Job descriptions are often based on the international initiatives for health, rarely on a national analysis of health systems. For example, the Zambia Ministry of Health has developed the Capacity Development Plan to strengthen its capacities to take over the Global Fund Principal Recipient role in 2010 to 2011. The plan covers the following areas: 1) program management; 2) sub-recipient management; 3) financial management; 4) procurement and supply chain management; and 5) monitoring and evaluation. The capacity development specialist is expected to facilitate capacity development and institutional strengthening in the Ministry of Health following the activities and milestones set out in the plan.	Zambia	job descriptions
Competency frameworks	**Health logistician institutional training curriculum** www.bioforce.asso.fr/IMG/pdf/referentiel_d_emploi_du_logisticien_de_sante.pdf	WHO, UNICEF, AMP, Fondation Merieux, USAID | DELIVER	A standard job description for the health logistician has been adopted during AFRO Regional seminars.	Africa	job descriptions
Competency frameworks	**Development of the Transport Management Qualification in South Africa** Transaid 2002 report and, "Development of a transport management system guide for self directed learning," Transaid 2009. **Transport Management: A Self-Learning Guide for Local Transport Managers of Public Health Services** http://deliver.jsi.com/dlvr_content/resources/allpubs/guidelines/TMS_Guide.pdf	Transaid	In South Africa, a clear description of the fleet manager position includes daily tasks such as fleet vehicle management, customs clearance, and supply transport. No dedicated staff is in charge at the health structure level.	South Africa	job descriptions

Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Competency frameworks	**Bioforce certifications** www.bioforce.asso.fr/spip.php?rubrique70 www.bioforce.asso.fr/spip.php?rubrique36 www.bioforce.asso.fr/spip.php?rubrique37 *French language*	Bioforce	Bioforce offers diploma and short courses on Humanitarian and Health Logistics, in French and English, in Europe and Africa. Certification can also be obtained through recognition of prior learning. In West Africa, Bioforce is implementing a Francophone subregional SCM course based on the USAID | DELIVER materials, similar to the Anglophone course by ESAMI and the course given in Spanish by PRISMA. In the aid community, Bioforce is considered a leading institution on logistics training and for its achievements in moving from HR field assessments to competency frameworks and job descriptions (four professions to date).	Africa, Europe	human resource networks, training and certifications
Competency frameworks	**Chartered Institute of Purchasing and Supply** www.cips.org/en/trainingevents	Chartered Institute of Purchasing and Supply	The institute is dedicated to promoting good practice. It offers a wide range of courses in the United Kingdom and has been a reference for Kenya.	United Kingdom	job descriptions
Competency frameworks	**ESAMI** www.esami-africa.org/index.php?option=com_content&view=article&id=110&Itemid=124	ESAMI	A learning institution partnering with USAID | DELIVER to offer SCM courses.	Eastern Africa, Southern Africa	human resource networks, training and certifications
Competency frameworks	**Fritz Institute** www.fritzinstitute.org/programs.htm	Fritz Institute	The Institute implements the Logistics and Supply Chain Solutions program to bring best practices, training, and resources to humanitarian logistics.	Global	human resource networks, training and certifications
Competency frameworks	**Global Effective Vaccine Management Initiative** www.who.int/immunization_delivery/systems_policy/EVM-background.pdf	WHO, UNICEF	EVM is developed by WHO and UNICEF to help countries improve the quality of their vaccine and cold chain management from the time the vaccine arrives in their country down to the service delivery point. EVM integrates learning from the former Effective Vaccine Store Management Initiative, used to assess the national or state vaccine stores, and the Vaccine Management Assessment Tool, used to assess levels below the national and state levels. The EVM package can be used as an assessment tool for analysis of the strengths and weaknesses across the supply chain and also as a supervisory tool. A follow-up EVM assessment should be conducted again after about two years. Thus it is a multifaceted capacity-building activity, targeted at strengthening the vaccine management system in order for it to become self-sustainable.	Global	human resource networks, training and certifications
Competency frameworks	**Humanitarian Logistics Association certification** www.humanitarianlogistics.org/about-hla/certification	Humanitarian Logistics Association	This individual membership association for humanitarian logistics professionals offers the Certification in Humanitarian Logistics.	Global	human resource networks, training and certifications
Competency frameworks	**International Association of Public Health Logisticians** my.ibpinitiative.org/public/Default.aspx?c=ca7f45ec-3b4a-400f-a055-b19ed8771066	John Snow, Inc., USAID | DELIVER	The International Association of Public Health Logisticians is a community of practice dedicated to facilitating the exchange of professional experiences and innovations in the areas of public health logistics management and commodity security, supporting continued learning, promoting the use of local and regional expertise, and expanding members' professional network.	Global	human resource networks, training and certifications
Competency frameworks	**John Snow Inc.** www.jsi.com/JSIInternet/ www.jsi.com/JSIInternet/Projects/ListProjects.cfm?Select=Topic&ID=10&ShowProjects=No www.deliver.jsi.com/dlvr_content/resources/allpubs/logisticsbriefs/ZM_WherRoadEndLogCont.pdf	John Snow, Inc.	John Snow, Inc., is a global actor on health programs and logistics and implements various programs in the USAID | DELIVER PROJECT. For example, the project works in all of Zambia's provinces to improve access to health commodities. USAID | DELIVER is partnering with Zambia's Ministry of Health to help bring drugs and medical supplies to patients by strengthening the supply chain. In the Western Province, the project trains health center staff in logistics and provides technical guidance and mentorship to Ministry of Health staff in provinces and districts and at individual health centers.	Global	human resource networks, training and certifications

Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Competency frameworks	**Logistics Learning Alliance** www.logisticslearningalliance.com/programmes/humanitarian-sector	Logistics Learning Alliance, Fritz Institute, Chartered Institute of Logistics and Transport	In conjunction with the Fritz Institute and the Chartered Institute of Logistics and Transport, the Logistics Learning Alliance offers a certification in humanitarian logistics, certification programs, and shorter skills development programs developed with World Food Program, Oxfam, UNICEF, Médecins Sans Frontières (MSF), and Save the Children.	Global	human resource networks, training and certifications
Competency frameworks	**Global Mid-level Management modules** www.who.int/immunization_delivery/systems_policy/training/en/index1.html	WHO	This new series of modules on immunization training for mid-level managers replaces the last version which was published in 1991. The modules aim to provide the immunization manager with up-to-date technical knowledge, explain how to recognize management/technical problems and take corrective action, and how to make the best use of resources. Each module is organized around a series of steps in which technical information is followed by learning activities.	Global	human resource networks, training and certifications
Competency frameworks	**Médecins Sans Frontières Logistique** www.msflogistique.org	Médecins Sans Frontières	This organization described as "one of the supply centres for Médecins Sans Frontières (MSF) [that] supplies MSF missions with medication and equipment for ongoing programs and emergency actions." MSF Logistique handles all the roles in the supply chain from purchases to goods transportation. Recent discussions highlight a few points: synergy between health supply and general purpose supplies, emphasis on the cold chain, and synergy between different professions (logistics, SCM, hospital maintenance). The need for high-level specialists in the field is described as a "tidal wave," considering the increasing complexity of systems such as supply chain managers, communication, energy, and cold chain equipment. But this trend is linked more to the challenge of dealing with emergencies than with capacity-building of local supply systems.	Global	human resource networks, training and certifications
Competency frameworks	**National University of Nicaragua** www.cies.edu.ni	National University of Nicaragua	This university offers training and certification sessions in community and public health.	Nicaragua	human resource networks, training and certifications
Competency frameworks	**Network for Education & Support in Immunisation** www.nesi.be/en/default.php	Network for Education & Support in Immunisation	The network is dedicated to improving the quality and sustainability of immunization programs and services in low- and middle-income countries, in particular through education and training.	Global	human resource networks, training and certifications
Competency frameworks	**PRISMA** deliver.jsi.com/dhome/topics/organizational/osscm www.prisma.org.pe/	PRISMA, John Snow, Inc.	PRISMA, a Peruvian NGO, offers comprehensive courses on supply chain management topics.	Peru	human resource networks, training and certifications
Competency frameworks	**Reproductive Health Supplies Coalition** www.rhsupplies.org/working-groups/systems-strengthening/professional-development-of-supply-chain-managers.html	Reproductive Health Supplies Coalition, USAID/supply chain logistics	The Reproductive Health Supplies Coalition hosts a very active work stream on professionalization of SCM. This initiative has achieved great success in cutting across programs to promote the professionalization of supply chain managers. It has generated a white paper, a literature review on the topic, and tools for an HR in-country survey. The initiative will organize a major international conference at WHO headquarters on June 28 and 29, 2011.	Global	human resource networks, training and certifications
Competency frameworks	**University of Sydney** sydney.edu.au/business/itls/courses/transport_and_logistics	University of Sydney	This university offers a comprehensive program on logistics.	Global	human resource networks, training and certifications
Competency frameworks	**United Nations Development Programme** www.undp.org/procurement/training.shtml	United Nations Development Programme	UNDP offers several logistics courses including a three-day course on SCM in humanitarian organizations and a global competency framework.	Global	human resource networks, training and certifications
Competency frameworks	**World Trade Organization** gtad.wto.org/project.aspx?prjCode=INT/61/105A	World Trade Organization	The World Trade Organization implements an SCM training and professional certification with a spread of 100 countries and specific networks, LearningNet and global portal. It aims to be the leader in supply chain management training issues for developing countries.	Global	human resource networks, training and certifications

Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Regional initiatives	**AFRO Region Initiative**	WHO, UNICEF	WHO, in participation with UNICEF, has been very active in efforts to strengthen the HR of immunization supply systems. The WHO/AFRO initiative takes a bottom-up approach, starting at the health facilities and district while taking into account the supply chain management continuum, providing the basis for a sustainable health system where programs can be implemented, instead of a top-down approach based on international health programs. This initiative also has a fundamental emphasis on synergies between various technical fields and communities, including dealing with the private sector and local communities.	Africa	synergies
Regional initiatives	**Applying cultural understanding and local ways of learning in the development of pharmacy competencies in Pacific Islands Countries** Andrew Brown, Discipline of Pharmacy andrew.brown@canberra.edu.au	University of Canberra	A review has been performed to determine a set of guiding principles to apply cultural understanding and local ways of learning to the development of pharmacy competencies in Pacific Island countries. With pharmacy technician training being fragmented, historically based on western traditions, and without formal involvement from universities, a culturally based approach to training was sought as a starting point for improvement. The aims of the three-year strategy are to improve availability of essential medicines in Pacific Island country clinics and demonstrate improved competencies in the areas of essential medicine supply in the pharmacy technician cadre.	Pacific Islands	competencies
Regional initiatives	**Proposed Harmonized Curriculum for the Training of Pharmacists in Anglophone West Africa**	West African Health Organisation	With this program, the West African Health Organisation aims to produce pharmacy practitioners with the knowledge, skills, and attitude to provide comprehensive pharmaceutical services.	Western Africa	harmonized curriculum
Regional initiatives	**Profile of Human Resources for Health in Ten Countries in the Asia and Pacific region** www.hrhresourcecenter.org/node/3290	Human Resources for Health Knowledge Hub, Burnet Institute	This profile provides benchmarks that can be applied to SCM. The report summarizes the available information on the cadres working at the community level in each country, their diversity, distribution supervisory structures, education, and training. A general human resources for health plan should include: strengthening leadership and management, improving availability, improving quality and ensuring equity, improving workforce size and identifying gaps, improving categories of staff, upgrading staff mix and staff distribution, improving supervision structures to allow a lower-level task force to perform more tasks, using mobile teams to improve the services available at health centers, and offering greater financial incentives for staff in remote areas.	Bangladesh, Cambodia, Fiji, Indonesia, Laos, Papua New Guinea, Philippines, Solomon Islands, Timor Leste, Vanuatu	cadres
Regional initiatives	**Regional Technical Resource Collaboration tool to assist countries to assess their pharmaceutical workforce**	Bill & Melinda Gates Foundation, USAID (Kenya, Rwanda, Tanzania, Uganda) and WHO EMP in collaboration with WHO Department of Human Resources for Health (WHO/HRH)	The Regional Technical Resource Collaboration for Improving the Use of Medicines East Africa is a regional collaborative initiative for capacity-building in pharmaceutical management. Regional human resources are pooled to address common pharmaceutical supply management challenges, resources saved by working together on cross-cutting interventions, and capacity-building activities are linked with specific national needs and initiatives. From each region, 15 public health facilities and 15 private facilities, including 5 pharmacies, were both randomly and purposely selected. HR managers and other senior officials at the Ministry of Health, Pharmacy Council, hospitals, health facilities, pharmaceutical industries, and pharmacy schools were interviewed on their personnel data using various questionnaires. In addition to administrators, individual pharmacists working in the visited facilities were also interviewed.	Kenya, Rwanda, Tanzania, Uganda	assessment of health workforce
Regional initiatives	**Task Force on Immunization in Africa / Regional Committee of Health Ministers**	WHO Regional office for Africa, WHO/HRH, Bioforce	The Task Force on Immunization in Africa (now the African Regional Conference on Immunization or ARCI) has published several strong recommendations on health logistics. For example, Maputo (2006): "Given the recognized need for health logistics officers at district level and the present lack of such officers in the countries, WHO/AFRO, Bioforce and partners should urge countries to create positions of health logistics officers in district health management teams, coordinate their efforts and mobilize necessary resources to initiate adequate training in logistics for health in support of present move toward greater integration of public health interventions." Ouagadougou (2010): "To strengthen logistic and delivery of vaccines, the conference suggested that WHO and partners consider introducing for discussion a document on the creation of logisticians for health during the Regional Committee of Health Ministers." Dr. Djona Avocksouma, AFRO HRH, has formulated a strategy to support the creation of a professional workforce of health logisticians.	Africa	training initiation

Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Regional initiatives	**The World Bank** www.who.int/hiv/amds/SupplyChainManagement.pdf	World Bank	The World Bank has implemented SCM training programs, for example in Lebanon in 2005.	Global	training
Country-specific initiatives	**Rural Expansion of Afghanistan's Community-based Healthcare**	USAID, MSH	REACH supports the expansion of the Basic Package for Health Services in 14 provinces in Afghanistan through a granting mechanism to national and international NGOs that implement health services in 14 provinces of Afghanistan. Reach Drug Management Officers have also provided technical assistance to the grantee NGOs in the field of drug supply management and on-the-job training in the rational use of drugs. By December 2005, the drugs supplied by REACH were used by the grantee NGOs in 326 health facilities and more than 5,000 community health workers with the necessary drugs to implement the Basic Package for Health Services in 14 provinces in Afghanistan. In order to obtain a clear end-of-project status of the drug supply management capacity of the REACH grantee NGOs, a formal assessment has been implemented for each NGO and each grant, both at the warehouse/headquarters level and health facility level.	Afghanistan	drug supply management
Country-specific initiatives	**Strengthening Pharmaceutical Systems**	USAID, MSH	MSH is addressing supply chain management issues for reproductive health commodities. MSH is currently assisting the Directorate General of Family Planning to develop a strategic framework for capacity-building in procurement and supply chain management. As part of this work, MSH is seeking local partners to assist in sustainable capacity development in technical knowledge and skills on procurement and supply chain management. A survey and review have been conducted by MSH in Bangladesh to analyze and characterize structures and processes and selected national institutions and organizations as related to procurement and supply chain management.	Bangladesh	reproductive health commodities
Country-specific initiatives	**Mission report: "Evaluation des besoins de formation en logistique médicale au Tchad" (Assessment of training needs in medical logistics in Chad)**	Bioforce	A 2005 mission report in Chad indicates that at regional and district levels, nurses and doctors without any specific logistic skills have multi-task responsibilities including drug distribution and administrative data reports. At hospital level, non-specialized workers such as electricians are trying to manage water and sanitation aspects as well as cold chain equipment maintenance. A great lack of competencies and a very low level of expertise regarding computer tracking namely for data registration, statistics updating, and equipment/drugs in/out storage and distribution recording, are prevailing in Chad. Consequences related to lack of qualified personnel refer to the strong difficulties to manage the logistics planning cycle and ensure reliable payment conditions. Recommendations refer to adapting short-term training sessions to health personnel inside health facilities; securing financial support on a continuum strategy, and reinforcing competences of health personnel.	Chad	lack of competencies and consequences
Country-specific initiatives	**Assessment of Human Resources for Pharmaceutical Services in Ghana** www.hrhresourcecenter.org/node/3270 www.who.int/medicines/areas/coordination/ghana_assessment_hr_pharmaceutical_services.pdf	Pharmacy Council, Ghana Ministry of Health	This report is a preliminary assessment of the pharmaceutical workforce in Ghana. There has been a steady increase in the number of pharmacists on the Pharmacy Council register from 2006 to 2009. The proportion of pharmacists in the register practicing in the country over the same period increased from 55% to 62%. This indicates a gradual increase in pharmacist retention, due to the introduction of new pharmacy programs in universities. Most pharmacists (75%) work in the private sector. This calls for effective private-public sector cooperation for effective pharmaceutical care delivery for the population. There has also been a recent upward adjustment of salaries in the public sector. The public sector has more clearly defined career progression than the private sector. This apparent stagnation in salary scale for pharmacists in private sector is a risk to retention in that sector.	Ghana	assessment of health workforce

Focus area	Project/concept/publication	Partners involved	Description	Locations	Keywords
Country-specific initiatives	**Access to essential drugs in Guyana: a public health challenge** onlinelibrary.wiley.com/doi/10.1002/hpm.949/pdf	Ohio State University, University of Massachusetts	A study conducted to identify main barriers to drug access proposes alternatives to strengthen Guyana's public health functions. Specific attention has been on focusing supervision to measure human resources capacity and detail gaps and solutions, as well as scope of practice which is not well documented. Regarding midwives, it includes the detection of obstetric complications, health counseling, and education. Recommendations refer to the urgent need of clarification of roles and job descriptions for each category of the health task force. According to the 2009 Health Sector review, around 50% of health centers received at least one supervisory visit from the Provincial Health Office in 2008. The qualifications and motivation of different cadres of private providers are widely different, and interventions to improve their performance have to deal with such diversity. Key points of the review of private health worker performance in low-resource settings have pointed out that performance should be improved and monitored.	Guyana	job descriptions
Country-specific initiatives	**Health Worker Recruitment and Deployment Process in Kenya: an Emergency Hiring Program** www.hrhresourcecenter.org/node/2161	The Foundation for effective HR management—HSLP Institute HR mapping of health sector in Kenya	Available data identify high unemployment of health professionals, while on the other hand only 50% of posts are filled. Moreover, some regions are underserved, which could explain why AIDS patients do not receive antiretroviral care. In order to find a solution, an emergency plan is ongoing but without identifying gaps in the supply chain, which is a clear factor of inadequate health personnel management, supervision, and training. Part of SCM is related to procurement and supply. In order to measure role and specific competence capacity, a study was conducted on the function of procurement. The purpose of the study was to measure the perception of procurement professionals about the status of the profession. The concern is whether procurement is a worthwhile lifelong career. Results indicate that to raise the status of the profession, a national certification exam for entrants into the profession is the most important factor.	Kenya	certification, professionalization
Country-specific initiatives	**Procurement professional training and certification**	Chartered Institute of Purchasing and Supply UK—Kenya Institute of Supplies and Management (KISM)	In order to measure role and specific competence capacity, a study was conducted regarding the function of procurement. To ensure professionalization of the procurement system in Kenya, a professional entry exam is required such as the envisaged Certified Procurement Professional of Kenya. Most of the current procurement practitioners have undergone postgraduate diplomas offered by the Chartered Institute of Purchasing and Supply in the United Kingdom. The government training institutes of Kenya and other examining bodies have also contributed to a pool of trained procurement professionals. The Kenya Institute of Supplies and Management has incorporated SCM into its professional development program. The program leads to an international diploma in supply chain management.	Kenya	certification
Country-specific initiatives	**Training Needs Assessment Medical Logistics**	Bioforce	Human resources capacity is a major problem in Madagascar which faces tremendous difficulties regarding health systems. A 2005 study on needs assessment indicated that to date, there was no reference for logistics. There is no "logistics manager" at any level, therefore no coordination. There was an urgent need to transfer both competence and power to a professionalized trainer group. Partly as a consequence, a large number of physicians were non-functional in their profession.	Madagascar	professionalization
Country-specific initiatives	**Achieving better health through enhanced training of pharmacists in Namibia**	University of Namibia, Tina Brock, Tana Wuliji, Evans Sagwa, David Mabirizi	Namibia has focused on how to create a career pathway from certificate-level pharmacist assistant to pharmacist. A study detailed the roles and competencies of each cadre that should be clearly defined and linked to job descriptions. It has insisted on the value of a multidisciplinary training with a multidisciplinary health professions training institution. A program to enhance training of pharmacists has been conducted in Namibia as a complementary tool to improve system delivery and reinforce human resources. This program was based on the lack of understanding of pharmacy as a profession or career path. An orientation strategy has been proposed to improve the current system through a University of Namibia pharmacy course to achieve better health through enhanced training of pharmacists.	Namibia	career pathways
Country-specific initiatives	**Human resources and logistics** hpaul_2000@yahoo.fr www.who.int/immunization	WHO	The report, "Health Logistics in Lome," details sanitary and logistics conditions of Togo's III District. Human resources capacity is sufficient regarding deployment in Lome and no underserved regions have been identified. Numerous recommendations pertain to the large competency framework for logisticians: management tools, working conditions, internet and information systems skills, and improving sanitary conditions of health structures.	Togo	human resource deployment

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Country-specific initiatives	**Quantifying health workers numbers, distribution and measuring workload in health facilities** **Task sharing in Zambia: HIV service scale-up compounds the HR crisis** www.biomedcentral.com/1472-6963/10/272	The World Bank	In Zambia, considerable attention has been given by policymakers and researchers to the human resources for health crises. However, little attention has been paid to quantifying health facility-level trends in health worker numbers, distribution, and workload, despite growing demands on health workers due to the availability of new funds for HIV/AIDS control scale-up. A survey was conducted in Zambia: "Task sharing in Zambia: HIV service scale-up compounds the human resource crisis." The HR crisis has been compounded by the fact that the Ministry of Health (due to budgetary ceilings) has had fixed staff establishments for all districts and health facilities. By 2008, 23% of Global Fund resources had been committed to human resources, but not to hire or to train new health workers. The focus has been on in-service training and workshops to improve the capacity of existing staff.	Zambia	task sharing
Other HR initiatives	**Center for Global Development** www.cgdev.org	Center for Global Development	HR policies were the focus of the Center for Global Development, which participated in the design of the US Government Global Health Initiative Consultation Draft in March 2010. It was suggested that collaboration between health service personnel could be improved through the systematic rotation of service providers.	Global	policies
Other HR initiatives	**Europhia** www.scexecutive.com/research/career_motivation.pdf www.europhia.com	Europhia	This consulting company has published the results of a survey on HR in SCM to define how private companies could increase their "employability" by offering tailored packages that focus on career opportunities and their policies on employee career track.	Global	private sector
Other HR initiatives	**IntraHealth** www.intrahealth.org www.ispi.org/pdf/suggestedReading/vol19_0199.pdf www.jhpiego.org/whatwedo/comps/pqi.htm	IntraHealth	Training and service delivery organizations have tried for decades to improve the quality of and access to health care services in developing countries by training health care providers. The predominant assumption has been that poor performance is attributable to inadequate knowledge and skills—and therefore, that training is the best solution. Realizing that training is often not the solution, organizations such as IntraHealth International have searched for other ways to improve outcomes between the provider and the client. IntraHealth analyzed both domestic research in human performance technology, as well as the current research on the systems influencing family planning provider performance within developing countries themselves.	Global	performance and system
Other HR initiatives	**Inter-agency Task Team on HIV and Young People** www.unfpa.org/public/iattyp	UNICEF, WHO, UNAIDS	UNICEF and WHO formed the Interagency Task Team HIV and Young People to address the issues of youth in response to HIV/AIDS. The team and other UNAIDS co-sponsors are supporting governments to implement diverse youth programs, build capacity, examine financing and program gaps, as well as exploring synergies, namely capacity-building for government agencies and civil society.	Global	youth programs
Other HR initiatives	**International Pharmaceutical Federation** www.fip.org www.codegnet.org.uk/gbcf	International Pharmaceutical Federation	At the FIP Educational Taskforce's 5th Global Pharmacy Education Consultation, the importance of the education of non-pharmacist pharmacy cadres in improving pharmacy services internationally was emphasized. FIP considers the pharmacy profession to be ideally placed to participate in health care worker education in the area of SCM. Following a literature search (2008) and global survey (2009), FIP is establishing a draft global competency framework.	Global	pharmacy services
Other HR initiatives	**Nordic+ Procurement Group and the OECD/DAC-World Bank Round Table**	OECD, World Bank	The declaration and subsequent policy papers on Joint Procurement by the Nordic+ Procurement Group and the OECD/DAC-World Bank Round Table on Procurement covers all areas associated with procurement supply management. This is one of several international efforts to standardize donor support to public health sectors and promote country ownership of implemented policies and activities.	Global	policy
Other HR initiatives	**Participatory Action Research**	University of Canberra	Participatory Action Research aims to improve health and reduce health inequities through involving the people who, in turn, take actions to improve their own circumstances. The University of Canberra is providing a framework that involves the health workers in improving training methods that will lead to the improved development of the competencies they require for medicines supply management at their level of practice. By the end of 2011, validated pedagogical approaches for the development of medicines supply competencies in the three levels of health care workers in PICs will be completed. In 2012 these pedagogical approaches will be made available to the broader range of academic institutions in the region including universities, tertiary colleges, and ministries of health.	Global	training methods

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Other HR initiatives	**Impact of culture and local needs in developing teaching methods**	WHO, UNESCO, FIP	A new approach and innovative education has been undertaken to support MDGs development through culturally based teaching methods specific to various cadres. The project is informed by the broader framework of the Pharmacy Education Action Plan of WHO, UNESCO, and FIP. This action plan aims to identify locally determined needs and pharmaceutical services to facilitate comprehensive education development and achievement of competencies. The approach considers the impact of culture and local needs in creating novel approaches to competency development using a participation action framework.	Global	culturally based teaching methods
Other HR initiatives	**Logistics modeling**	WHO headquarters	Logistics models adapted from the model developed by AFRO Logistics Team have been used extensively throughout procurement and supply management workshops, seminars, and trainings in the WHO African Region. Recommendations acknowledge that effective supplies and logistics systems require sufficient management capacity, personnel, materials, and money.	Global	management capacity

Abbreviations used: AFRO, WHO Regional Office for Africa; AMP, Agence de Médecine Préventive; CDP, Capacity Development Plan; EMP, WHO Department of Essential Medicines and Pharmaceutical Policies; ESAMI, Eastern and Southern African Management Institute; EVM, Effective Vaccine Management Initiative; FIP, International Pharmaceutical Federation; HR, human resource; HRH, WHO Department of Human Resources for Health; KISM, Kenya Institute of Supplies and Management; MDG, Millenium Development Goals; MSF, Médecins Sans Frontières; MSH, Management Sciences for Health; NGO, nongovernmental organization; PSM, Procurement and Supply Management; REACH, Rural Expansion of Afghanistan's Community-based Healthcare; SCM, supply chain management; UNAIDS, the Joint United Nations Programme on HIV/AIDS; UNDP, United Nations Development Programme; UNESCO, United Nations Educational, Scientific and Cultural Organization; UNICEF, United Nations Children's Fund; USAID, US Agency for International Development; WHO, World Health Organization.