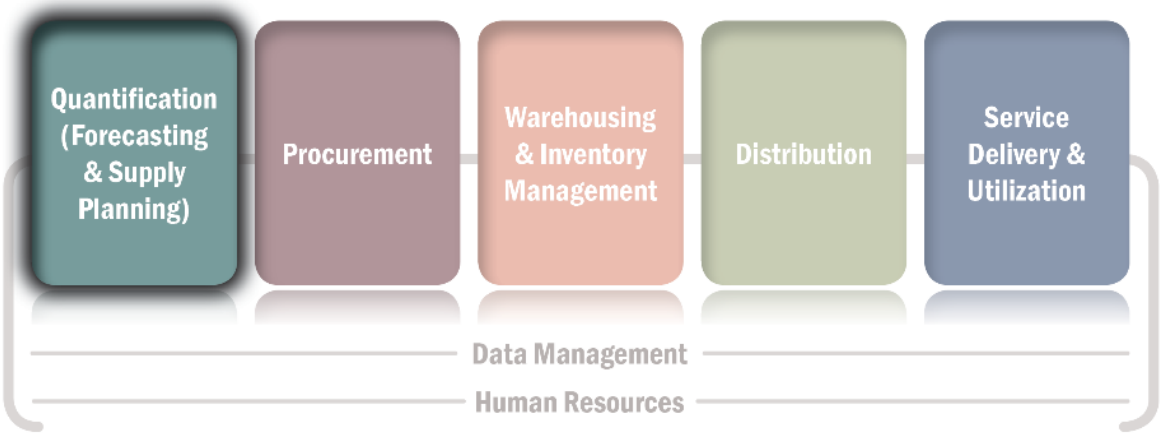
Promising Practices

Quantification: Forecasting and Supply Planning

Brief #1 in the *Promising Practices in Supply Chain Management* Series



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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Quantification: Forecasting and Supply Planning.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

CCC	commodity coordinating committee
HIV	human immunodeficiency virus
HMIS	health management information system
JSI	John Snow, Inc.
LMIC	low- and middle-income countries
LMIS	Logistics Management Information System
MNCH	maternal, neonatal, and child health
MOH	Ministry of Health
MOH-HTSS	MOH Health and Technical Support Services
NGO	nongovernmental organization
SCMS	Supply Chain Management System
SDP	service delivery point
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
STG	standard treatment guidelines
TRT	Technical Reference Team
UNCoLSC	United Nations Commission on Life-Saving Commodities for Women's and Children's Health
USAID	US Agency for International Development

Background

The quantification of commodities relies on access to good data, knowledgeable personnel, and the coordination of key stakeholders. Without these three key components, quantification exercises often lead to inadequate forecasts of commodity needs, resulting in an under- or oversupply of life-saving commodities.

As defined for this brief, quantification incorporates both forecasting and supply planning. There is often confusion about the definition of these terms, with quantification and forecasting sometimes used interchangeably. To address this confusion, the Supply and Awareness TRT uses the following definitions[1]:

Term	Definition
Quantification	Quantification answers the question: "How much will be procured and when will it be delivered?" It includes both *forecasting* and *supply planning*. It is the process of estimating the quantities and costs of the products required for a specific health program (or service), and determining when the products should be delivered to ensure an uninterrupted supply for the program. It takes into account the expected demand for commodities, unit costs, existing stocks, stock already on order, expiries, freight, logistics and other costs, lead times, and buffer stocks. Using this information, the total commodity requirements and costs are calculated and compared with the available financial resources to determine the final quantities to procure.
Forecasting	Forecasting answers the question: "How much is needed, in quantities and cost, to meet the health demand of the population?" It is the process of estimating the expected consumption of commodities based on historical consumption, service statistics, morbidity and/or demographic data or assumptions when data are unavailable, to calculate the quantities of commodities needed to meet demand during a particular time frame.
Supply Planning	The final output of quantification, supply planning details the quantities required to fill the supply pipeline, costs, lead times, and arrival dates of shipments to ensure optimal procurement and delivery schedules.

Forecasting and supply planning are two distinctly different tasks that require unique resources and skill sets. In some locations, forecasting and supply planning may occur separately, using different personnel with expertise in each of these areas. More often, the reality is that the same quantification personnel conduct both activities, making it even more important for the quantification personnel to have a combined knowledge of both.

In addition to knowledgeable personnel, forecasting requires access to accurate data and a high level of programmatic knowledge. It also needs a solid foundation in quantification methodology, the ability to apply programmatic considerations to morbidity and consumption data, and the ability to make educated assumptions about commodity utilization and need. Forecasting functions best when there is a high level of coordination among supply chain personnel, program staff, commodity coordinating committees, and other relevant stakeholders.

[1] Supply and Awareness Technical Reference Team, UN Commission on Life-Saving Commodities for Women's and Children's Health. *Definitions Related to Quantification, Forecasting and Supply Planning.* Washington, D.C.: np; 2013.

Standard treatment guidelines (STG) and national essential medicines lists are critical tools used in the quantification of commodities. These protocols provide evidenced-based guidance for health providers to use when treating patients. For commodities that have no historical consumption data or where these data are inadequate, STGs may be used to estimate expected needs using demographic, morbidity, and services data. However, this approach is best used when there is a reasonable expectation of high adherence to the protocols by providers. Lower levels of adherence make it more difficult to gain accurate estimates of need and impact the accuracy of the overall forecast.

Once the forecast is finalized, the supply plan is developed from it. The supply plan is the link between forecasting and procurement in that it defines what products will be procured, how much it will cost, how much to procure, and how long it will take. Supply planning is best carried out by logistics staff with knowledge of the entire supply chain as they must be able to factor in the capabilities and limitations of each supply chain function. Once finished, the supply plan should be shared with key stakeholders, including ministry of health (MOH) personnel, supply chain personnel, program managers, policy makers, and funders.

Following the development of the forecast and corresponding supply plan, regular review and revision of both are necessary to ensure that new data and other key factors are incorporated into the quantification plan on an ongoing basis. Ideally, forecasts are reviewed and revised on a quarterly basis. At a minimum, forecasts should be reviewed and revised annually. Once updated, the forecasts should then be used to update the supply plan.

There are many barriers that inhibit accurate forecasting and effective supply planning in low- and middle-income countries (LMIC). Countries often lack the necessary staff and technical expertise to conduct the right forecasting activities or to develop accurate supply plans. Inaccessible or non-existent policies and poorly defined or misunderstood methodologies further inhibit the effective implementation and success of forecasting and supply planning. Countries also struggle to find appropriate tools to help them with their quantification activities, applying one-size-fits-all approaches to address gaps in quantification capacity and knowledge that are often inappropriate. While the tools themselves are important to quantification, ultimately, it is adequate and accessible data that make for an accurate forecast and effective supply chain.

The following promising practices may mitigate barriers to effective functioning and lead to improved forecasts and supply plans:

Barriers	Description	Promising Practice(s) that Address the Barriers
Lack of coordination between quantification and technical units	Quantification relies on the collaboration and coordination of various stakeholders, including MOH officials, program staff, supply chain personnel, and service delivery staff. Without coordination among these stakeholders, the forecasts and supply plans are likely to be inaccurate and have limited impact.	• Coordinate stakeholders through Commodity Coordinating Committees • Develop a multi-disciplinary quantification team
Lack of capacity in quantification	Quantification, and particularly forecasting, may be a highly technical process. Without sufficient training in this area, it may be difficult for staff to conduct the activities properly, leading to inaccurate forecasts and supply plans.	• Develop a multi-disciplinary quantification team • Build local capacity in quantification
Poor, inadequate, or inaccessible data	Forecasts are only as good as the data used to inform them. Whether using consumption or morbidity data, missing and/or poor quality data inhibit the accuracy and impact of the forecasts and supply plans.	• Link logistics and service delivery data to forecasts

Coordinate Stakeholders through Commodity Coordinating Committees

To address the lack of coordination between quantification and technical units

Every domain of the supply chain relies on the coordination of key stakeholders to provide valuable support and assistance. The development and maintenance of a commodity coordinating committee (CCC) may be an effective way to improve coordination among stakeholders. CCC is a general term that refers to groups or committees that work to improve the availability of commodities in health supply chains. Technical working groups, reproductive health coordination committees, advisory panels, and task forces are all examples of CCCs. Membership often includes stakeholders from government, nongovernmental organizations (NGO), the private sector, and technical and donor agencies.

CCCs have been a longstanding practice for improving access to reproductive health supplies in LMICs, although their applicability spans across all types of health commodities. CCCs fulfill a variety of roles, including policy development and advocacy, working as a part of the multidisciplinary forecasting and supply planning teams, and collaborating with international donors and aid agencies. In addition, CCCs may be convened to help advocate for key legislative changes, create standard operating procedures, publish reports, and provide technical assistance, where appropriate. Among other activities, CCCs work to improve access to commodities at all levels of the supply chain and improve their use at the service delivery point (SDP) or in the community.

In addition to participating in quantification activities, these committees may also work to ensure greater collaboration and coordination among the various stakeholders who are involved in quantification, particularly at programmatic and service delivery levels. Furthermore, CCCs often work with donors to negotiate each stakeholder's commitments and to provide accountability. For example, a CCC may monitor the implementation of the supply plan and conduct follow-up if the plan is not adhered to.

The characteristics of these committees vary depending on the scope of work. CCCs may be formally established and situated in a specific part of the government or MOH. They may also be informally established or separate from the government. Regardless of where they are located, CCCs are most effective when they meet regularly (anywhere from monthly to at least twice per year), maintain meeting minutes, have a defined terms of reference, and "promote sustainable, effective and efficient service delivery and supply chain systems."[2]

When should commodity coordinating committees be considered?

Every country should have a CCCs or similar body to coordinate and strengthen quantification activities. To be effective, CCCs need strong leadership at the national level (and regional level, if the health system is decentralized), access to dedicated funding, and a supportive policy and regulatory environment.

[2] MEASURE Evaluation PRH, Family Planning and Reproductive Health Indicators Database Website. Existence of an active national coordination committee that works on contraceptive or RH commodity security. Accessed November 18, 2013 from: http://www.cpc.unc.edu/measure/prh/rh_indicators/crosscutting/commodity-security-and-logistics-1/existence-of-an-active-national-coordination-committee-that-works-on-contraceptive-or-rh-commodity-security.

To learn more:

- Guidance and Resources for Inclusion of Maternal, Newborn, and Child Health (MNCH) Commodities in National Commodity Supply Coordination Committees/Mechanisms
- Contraceptive Security Committee Toolkit
- Procurement and Supply Chain Management Working Group
- Central-Level Stewardship for Reproductive Health Commodity Security in a Decentralized Setting

HONDURAS

The Inter-Institutional Contraceptive Security Committee, a CCC, has been active in Honduras since 2005. Consisting of a multidisciplinary group of advocates from the MOH, NGOs, supply chain personnel, and financial representatives, among others, the Committee has worked to improve access to contraceptives in Honduras. Key quantification achievements of the Committee include aligning the procurement of family planning commodities with the country's most significant family planning needs and attaining a higher level of financial support from the government for the procurement of contraceptives. In addition to these activities, the Committee has worked to increase awareness of contraceptive issues in Honduras and improve inventory management practices for contraceptives.

As donor funding decreased and the Honduran government assumed a greater financial role in the procurement of these commodities, the Committee was instrumental in the development of a national contraceptive security strategy. This strategy was prepared using maternal and child health and logistics data and financial projections for future contraceptive needs, and was essential to ensuring uninterrupted access to family planning commodities in the country.

To learn more:

- Contraceptive Security Committees: Their Role in Latin America and the Caribbean
- Using Data and Information to Advance Contraceptive Security in Latin America and the Caribbean

Develop a Multidisciplinary Quantification Team

To address the lack of coordination between supply planning and technical units and the lack of capacity in quantification

While CCCs are mainly involved in policy development and advocacy, a quantification team is responsible for producing the actual forecast and supply plan. Since forecasts, by definition, are estimations and include some informed guesswork (especially for new and underutilized commodities with unclear demand), the people involved in forecasting are a vital success factor for the process.

As discussed in the background section of this brief, forecasting and supply planning require separate skill sets and resources. If the team is responsible for both components, appropriate expertise in both areas is needed. In the absence of reliable, up-to-date, and complete data, the program and commodity experts responsible for forecasting must make critical assumptions regarding the supply, demand, and use of key commodities. The team should include people who can answer detailed questions about the logistics and service delivery data available, who can explain future program plans for reproductive, maternal, neonatal, and child health (RMNCH) commodities, and who understand the STGs and how they are implemented. Such experts include logisticians, representatives from the central warehouse, ministry staff in charge of RMNCH programs, procurement officers, and service providers who can provide insight into commodity needs at the SDPs. Members of CCCs, if available, may also be participants on the multidisciplinary quantification team.

If the team is also responsible for the supply plan, logistics and procurement staff should also be involved as they are the ones responsible for turning the forecast into a comprehensive supply plan. The quantification team may vary in size and composition, depending on the scope of commodities under review, but should be managed by a convener and facilitator. If quantification is done by commodity type, only those individuals with relevant expertise in that commodity or program need to participate. In countries where quantification activities may be divided by location (such as at the district or regional level) instead of by commodity or program, the number of people required for the quantification team is likely to increase. In this situation, it may be helpful to divide the larger group into subgroups who manage specific aspects of the activity, and then convene the larger group for final approval of the forecasts or supply plans.

When should a multidisciplinary quantification team be used?

A multidisciplinary quantification team should always be used for quantification. The expertise that various programs, ministries, health facilities, and individuals bring to the quantification process is necessary to develop appropriate assumptions, identify data for forecasts, and review forecast results.

To learn more:

- Quantification of Health Commodities: Who Should Conduct a Quantification? (pages 3–4)

MALAWI

Until 2013, Malawi conducted quantification exercises at the central level, with limited input from district staff. Given the wide variation in needs across the districts, these exercises often led to incorrect forecasting and supply planning estimates for a given area or district. As a result, some facilities received too much stock of certain commodities, leading to expiration and wastage, while other facilities experienced stock-outs of the same commodities.

To address these issues and ensure that the voice of the districts was included in the quantification, the MOH's Health and Technical Support Services (MOH-HTSS) Pharmaceutical Unit conducted the first district-based quantification in 2013. Relying on the expertise and collaboration of a multidisciplinary quantification team to provide the district-level perspective, the HTSS invited knowledgeable individuals from all levels of the health system to participate. These participants included supply chain personnel, data management personnel (such as Health Management Information System [HMIS] staff), the district health officer and/or district medical officers, health center staff (medical practitioners and pharmacy staff), and key stakeholders with expertise in specific diseases (such as HIV or malaria) from the central, district, and health center levels. Altogether, the multidisciplinary National Quantification Committee included 25 participants.

The National Quantification Committee was divided into subgroups and assigned to complete the quantification activities in a specified set of districts. Each of the subgroups included key personnel from the districts as well as central-level participants. The knowledge of the district and health center staff was used in conjunction with the knowledge of the central-level participants to inform the assumptions and justification for the quantification activities. For example, when quantification activities occurred centrally and without the diverse experience of the districts and health center staff on the committee, the resulting quantifications were not adjusted for specific factors in each district. As a result, districts that were along the Malawian border did not have estimates tailored to their diverse population needs. Since large influxes of people across borders may not be accounted for in national or regional population estimates, these districts frequently experienced stock-outs. Key personnel from these districts contributed meaningful information about unique population needs during the exercises. Following the creation of district-level estimates, the quantification subgroups reconvened to develop the national quantification plan.

The inclusion of staff from multiple disciplines at the health facility level also helped inform the development of morbidity estimates, particularly in locations where data were lacking. In addition, the inclusion of individuals from a variety of disciplines and levels helped to inform each other of the challenges experienced at each level. Central-level staff noted these benefits, stating that they gained a new appreciation and deeper knowledge of the challenges of data management and record keeping at the service delivery level.

Build Local Capacity in Quantification

To address the lack of capacity in quantification

Supply chain staff involved in quantification exercises frequently cite the need for better tools to improve the accuracy of their forecasts. Although many tools exist, a team that understands the forecasting and supply planning processes is essential for the tools to be used appropriately. Data availability may vary greatly in both quantity and quality, and local context may influence delivery methods, the staff available to administer or dispense commodities, and local demand for certain products. As a result, having staff appropriately trained in developing long-term forecasts enables the efficient and effective use of existing tools for quantification.

To complete and conduct periodic reviews of forecasts, the following are needed:

- Expertise in the specific program area for each commodity, including knowledge about the commodities, their recommended use, and how they are actually used in practice.
- Ability to conduct ongoing monitoring, data collection, and updating of the forecasting data and assumptions and supply planning data.
- Knowledge of the local context that may influence supply and demand for commodities.
- Ability to use the knowledge and data available to develop and justify assumptions.
- Strong communication skills and the ability to prepare and present quantification data, the methodology, and final quantification results to key stakeholders and implementers.

In addition, key members of the team need to be proficient in data management spreadsheets or other software programs that are used to create and manage the forecasting data. Once the forecasting activity is complete, technical staff turn the agreed-upon forecast into a supply plan, likely using additional software tools. The Quantification of Health Commodities: A Guide to Forecasting and Supply Planning, Appendix B. Software Programs for Quantification of Health Commodities provides a list of software tools being used for forecasting and supply planning. It should be noted, however, that these tools are not intended to act as a substitute for a knowledgeable and well-trained quantification team.

In addition to a lack of sufficient personnel to do the work, local quantification staff often lack the knowledge needed to select and implement the appropriate forecasting methodologies. In-country staff may also lack knowledge on how to turn forecasts into supply plans and on how to use quantification software and database management programs. Limited capacity in these areas may lead to the preparation of inaccurate forecasts and supply plans, which then perpetuate under- or overstocking, funding gaps, and disbursement delays.

Few countries have reliable means of developing this capacity locally. Some countries are developing diploma or certificate programs in quantification or supply chain management, but such educational programs are not yet available in all countries. To address gaps in quantification capacity, many countries have solicited external technical assistance to build the capacity of the quantification team. This often involves the use of consultants who travel to the country, provide training on various quantification exercises, and leave after the training has been completed. The use of external consultants is a helpful practice so long as a commitment is made to transfer knowledge of the quantification process to local experts to carry out the necessary updates and reviews of the forecasts on a regular basis. As such, long-term capacity building exercises are often more successful at transferring knowledge than short-term engagements.

While capacity building is important, and training is a vital component, simply offering "more training" is not necessarily a solution. This is especially true in the case of workshops, conferences, and other short-term training opportunities. For training to sufficiently build the capacity of quantification staff, ongoing support, on-the-job learning, and supportive supervision are also required.

A further description of the challenges and promising practices in capacity development may be found in the *Promising Practices in Human Resources* brief.

When should building local capacity in quantification be considered?

Improving local capacity for quantification should always be a priority. Ongoing efforts to develop staff capacity are necessary to ensure that quantification staff can fulfill the responsibilities of their jobs in an effective and sustainable way. Each country should consider the various means outlined above and determine which would be most appropriate given their capacity development needs, financial resources, and availability of technical expertise.

BOTSWANA

As a high HIV prevalence country, Botswana uses condom promotion and distribution as a major HIV prevention initiative. With a changing health care infrastructure and diminishing financial support from international development organizations, it is working to optimize its condom program to ensure that there is sufficient availability and use of quality condoms in the country. Recognizing that the technical capacity to fully quantify the demand for and use of condoms was limited, the Government of Botswana reached out to the Supply Chain Management System (SCMS) for assistance. In 2012, SCMS conducted a situational analysis of condom quantification, procurement, and use. Using information gained during the assessment, SCMS hosted a three-day workshop to oversee the quantification activities for national condom requirements for a three-year period.

As a critical component of the workshop, supply chain personnel were trained in the preparation activities that should occur prior to quantification, as well as in forecasting methodology and supply planning techniques. These personnel were also trained in the use of demographic, morbidity, and service data for forecasting activities and the use of quantification software. They were also provided guidance on how to collect distribution and consumption data. Participants learned how to develop and validate assumptions, develop a draft supply plan, identify key issues in the condom supply chain, and develop a set recommendations to address the issues. Following the workshop, the supply chain personnel were able to use the new knowledge to conduct ongoing monitoring of the condom pipeline and to finalize the National Condom Strategy in 2013.

To learn more:

- Botswana Condom Programming: National Condom Quantification and Supply Chain Strengthening

Link Logistics and Service Delivery Data to Forecasts

To address difficulties in forecasting and supply planning due to poor, inadequate, or inaccessible data

The foundation of a good forecast is reliable and accurate data. In most countries, data come from a Logistics Management Information System (LMIS), which tracks the demand for and use of commodities over time. This is supplemented with information from a HMIS. If complete and accurate, these two data sets together provide the full picture of product information and service delivery in the country. Other sources of data for forecasting include demographic data, national program policies and expansion plans, and morbidity or disease prevalence data to inform assumptions in the forecast. Data sources likely include large demographic studies, census activities, and surveillance data.

Depending on the type and source of data available, the quality and accuracy may vary greatly. There are many challenges that affect the data available for forecasting. Delays in getting the data from the collection point to decision makers (particularly those involved in quantification) may limit what data are available when the forecasting exercises take place. Although forecasts are meant to be updated regularly, the timely dissemination of the various types of data used in forecasting helps to ensure that assumptions are as up-to-date as possible during forecasting activities.

In addition, duplicative and burdensome data collection by supply chain staff and last-mile health workers may lead to burnout, loss of motivation, and difficulties in completing the data collection and reporting requirements. Data may also be difficult to access—whether it is electronic or paper-based— leading to limited use and dissemination.

The forecasting team needs to have an understanding of the quality of the data available. Prior to beginning the forecast, the data should be reviewed thoroughly by supply chain staff, program personnel, HMIS officers, and any other personnel who work with HMIS or LMIS data. Any inconsistencies in reporting, unexpected findings (such as data points that are significantly under or over their expected values), and any other major factors that could have affected the data should be noted. For example, national shortages of certain commodities, such as contraceptives, could have limited the number of people who accessed them from a service provider, leading to lower consumption levels in the HMIS and LMIS data. Thus, consumption data would not accurately reflect the actual demand for the country. When HMIS data are linked with LMIS data, these types of situations may be noted and accounted for in future forecasting and supply planning exercises. Based on these findings, the assumptions used during forecasting may need to be adjusted. Many countries are working to strengthen both their LMIS and HMIS systems to provide more accurate data for a variety of reasons beyond just forecasting. Efforts to strengthen both sources of data will have an impact on forecasting processes moving forward.

A detailed discussion on integrating these two systems may be found in “Considerations for the Integration of HMIS and LMIS” listed below. A more in-depth analysis of data quality issues is provided in the *Promising Practices in Data Management* brief.

When should logistics and service delivery data be linked?

While this strategy can help improve the data used in forecasting, the implementation of this practice can be difficult when the quality and reliability of the data sets are poor. If the forecasting

team does not have confidence in the data, they will have a difficulty knowing what data to use when there are discrepancies or inconsistencies between the two data sets. Where effort has been put into maintaining quality routine data in both systems, using both data sets for quantification is always recommended. When HMIS or LMIS data are known to be unreliable or problematic, it may be best to identify another data source for use in forecasting.

To learn more:

- Considerations for the Integration of HMIS and LMIS
- *Promising Practices in Data Management* brief

Conclusion

Quantification relies on having an accurate forecast that is updated regularly with timely data, and a well-managed supply plan that is continuously monitored and managed. Problems with quantification create gaps in product availability throughout the supply chain. Although challenging to achieve, efforts to improve these processes reap great rewards. As highlighted in the promising practices and examples, there are a variety of ways to make improvements in quantification, with the ultimate goal of harmonizing capacity and technical expertise, data management, and financial resources. Investments in any of these areas lead to more accurate and dependable forecasts, resulting in the creation of better supply plans.

In addition to the promising practices in this brief, there are several complementary training packages and guidance documents that may be helpful in making improvements to quantification. Moreover, the Commission has produced guidance documents for forecasting each of the 13 life-saving commodities. Intended to be used in conjunction with the USAID|DELIVER PROJECT Quantification Guide, the guidance documents provide a solid foundation for continued investment and improvements in quantification.

To learn more:

- Quantification of Health Commodities
- Quantification of Health Commodities: RMNCH Supplement. Forecasting Consumption of Select Reproductive, Maternal, Neonatal and Child Health Commodities
- Quantification of Health Commodities: Community Case Management Products Companion Guide

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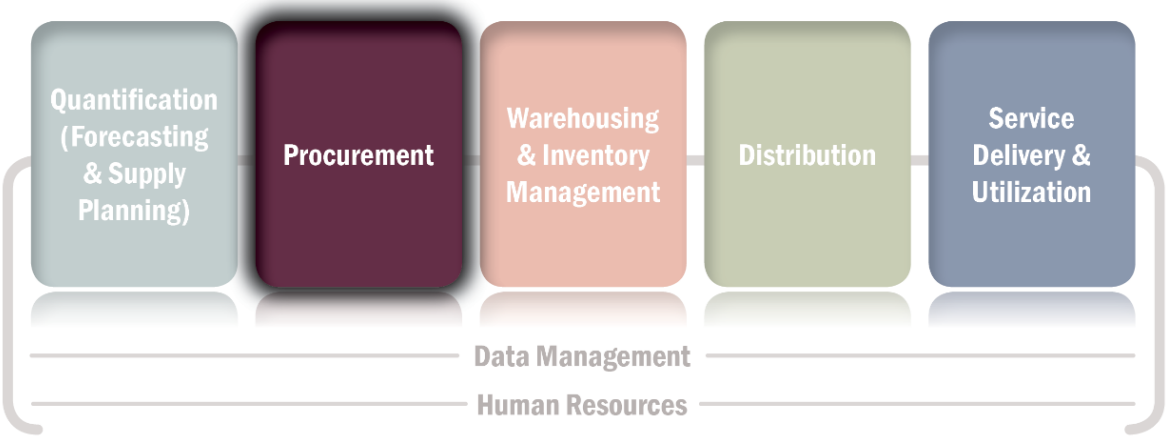
Promising Practices
PROCUREMENT

Brief #2 in the Promising Practices in Supply Chain Management Series



INSIDE

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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Procurement.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

AIDS	acquired immune deficiency syndrome
ARV	antiretroviral
DCP	Disease Control Program
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
HIV	human immunodeficiency virus
JSI	John Snow, Inc.
LMU	logistics management unit
PAHO	Pan American Health Organization
PEPFAR	President's Emergency Plan for AIDS Relief
PMU	procurement management unit
PPA	Public Procurement Authority
PPB	Public Procurement Board
PPS	Pharmaceutical Procurement Service
PROMESE/CAL	Programa de Medicamentos Esenciales/ Central de Apoyo Logístico (Program for Essential Medicines/Central Logistics Support)

RHSC	Regional Health Service Center
SCMS	Supply Chain Management System
SDP	service delivery point
SEAM	Strategies for Enhancing Access to Medicines
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
SOP	standard operating procedure
SPE	strategic procurement entity
SUGEMI	Suministros Generales y Mantenimiento Industrial (Single System for Managing Medicines and Medical Supplies)
SPS	Strengthening Pharmaceutical Systems
TRT	Technical Reference Team
UNFPA	United Nations Population Fund
UNOPS	United Nations Office of Project Services
USAID	US Agency for International Development
VEN	vital, essential, nonessential
VMI	vendor-managed inventory

Background

Procurement is the process of turning forecasts and supply plans into purchased products that are delivered to a point of entry. Typically divided into several steps, procurement focuses mainly on the management of the tendering, bidding, and contracting process. The length of the procurement process for new goods varies significantly and, in many cases, may take more than one year from start to finish. Procurement benefits most from well-defined and accountable processes, which work to ensure that commodities are obtained through fair, consistent, and reliable means. Without efficient mechanisms to manage procurement processes, the acquisition of commodities may easily become disorganized and costly, resulting in stock-outs of products or the placement of emergency orders to fill anticipated supply gaps.

Compared to other domains of the in-country supply chain, procurement is most likely to entail significant relationships and activities at the global level. Since few countries have local manufacturing capacity, particularly for the 13 life-saving commodities identified by the Commission, procurement relies on the satisfaction of in-country commodity needs through the combination of both global and local procurement strategies. In light of this, the case studies in this brief cover promising practices in local, regional, and global procurement.

Countries struggle with a variety of procurement challenges. Many challenges result from the lack of coordination and communication among the multiple entities and donors involved in the procurement process. The lack of coordination leads to: unclear or poorly defined processes; parallel procurement systems among the various entities; a lack of transparency in all aspects of the process (including tendering, bidding, receipt of donated goods, etc.); a lack of published and reliable lead times; and a lack of published standard operating procedures (SOP). Other challenges include donor or governmental funding mechanisms that do not align with the procurement schedules for the recipient country or program. When this happens, delays in the release of funds may occur, leading to further delays in procurement, the use of loans to procure the required commodities, or the redistribution of funds earmarked for other services.

Limited resources and bureaucratic constraints may cause procurement processes to become dominated by short-term and reactive action instead of long-term planning and preparation. The lack of comprehensive long-term planning may cause procurement delays and bottlenecks further down the supply chain, leading to unfilled orders at the service delivery point (SDP). Ultimately, these challenges lead to inefficient, expensive, and untimely procurement of commodities and affect the ability of programs and SDPs to provide effective health care.

To respond to these procurement challenges, many countries find themselves over-utilizing emergency orders, which reinforces short-term planning and increases overall costs. Emergency orders are commonly used by programs or SDPs to ensure faster delivery of goods than is possible through normal procurement channels. Emergency orders create additional bottlenecks by preventing the procurement department from filling routine orders, and increase the cost of goods procured.

To address these challenges and barriers, this brief proposes several promising practices as examples of how the procurement process may be improved.

Barriers	Description	Promising Practice(s) that Address the Barriers
Lack of coordination in the supply chain	Procurement is dependent on coordination with both quantification personnel and warehousing personnel. Without coordination between them, procurement is forced to make assumptions about the needs and capacity of the other supply chain functions, leading to procurement of goods that may not be timely, cost-effective, or appropriate to meet the needs and capacity of the supply chain.	• Strategic procurement entities • Pooled procurement • Outsourced procurement • Framework contracts • Prime vendor contracts • Published lead times
Unclear procurement processes	Procurement relies on processes that occur in a timely, coordinated, and accurate fashion. When processes are not standardized or accessible, they may be difficult to follow due to a lack of training on how to use them, confusing language, or missing information.	• Strategic procurement entities • Category/commodity management
Bureaucratic and cumbersome procurement practices	Many public and private entities and individuals may have influence on the procurement of various products. With so many invested parties, procurement may easily become bogged down in unnecessary or duplicative processes that provide little additive value. Bureaucratic delays may further exacerbate the dysfunction among the parties by preventing timely completion of key procurement activities.	• Strategic procurement entities • Outsourced procurement • Framework contracts • Prime vendor contracts
Limited use of procurement flexibilities	Procurement flexibilities enable greater control over the possible variations and changes that may occur in procurement. However, too often countries end up with rigid and unfavorable contracts with vendors. The contracts often limit the number of modifications or adjustments that may be made in response to changing needs and may prove more difficult to manage and more expensive.	• Framework contracts • Prime vendor contracts
Lack of product standardization	Procurement entities are responsible for ordering a wide variety of products of various quantities, dosages, sizes, etc. When similar products are ordered in smaller quantities, the prices or procurement time associated with these smaller quantities may be prohibitive and time-consuming. Moreover, the management of multiple contracts for multiple vendors may be cumbersome in instances of limited personnel resources and capacity.	• Category/commodity management • Pooled procurement
Unpredictable and long lead times	There may be significant variation in the amount of time it takes to procure commodities, particularly if they are new. This leads to lengthy and unpredictable ordering and delivery times for commodities.	• Published lead times
Unplanned, unsolicited, and unspecified donations	Many countries rely on the receipt of donations to help fill gaps in health-related commodities. Occasionally, donations will be offered for products that are not needed, do not follow country-specific guidelines, are expired or about to expire, or are of poor quality/limited use.	• Policies for the donation of medical commodities

Strategic Procurement Entities

To address the lack of coordination in the supply chain, unclear procurement processes, and bureaucratic and cumbersome procurement practices

One way that procurement may address disparate processes is by consolidating responsibility for procurement in a strategic procurement entity (SPE), such as a procurement management unit (PMU), procurement office, or as a function of a logistics management unit (LMU). Although these entities are often situated in various governmental ministries, they can also be nongovernmental and function alongside government. These entities are responsible for keeping a broad picture of the entire procurement process. They are formally established, multi-disciplinary committees or units, tasked with the management and oversight of procurement for a particular country, region, or program. Procurement entities, particularly those for health commodities, work to coordinate the efforts of supply chain personnel, programs, ministries of health, health facilities, and other relevant personnel to ensure proper consideration for all up- and downstream effects that stem from or influence procurement. In addition, they are responsible for establishing and updating key procurement SOPs and helping to establish a consistent, fair, accountable, and transparent procurement process. There may be separate units or groups in these entities that manage the tendering and bidding processes, secure and manage funding for procurement, support quality assurance processes, and provide monitoring and evaluation support.

One of the main benefits of procurement entities is that they help to avoid duplicative or parallel procurement processes between programs. In countries where this strategy has been used, the procurement of medications and supplies has been streamlined, thereby helping to avoid the unnecessary procurement of commodities in quantities or dosages that are not in accordance with standard treatment guidelines. In turn, this helps to avoid wastage of funds, space, and personnel time, and allows such resources to be devoted to other needs. SPEs may also work to ensure that there is greater alignment between the funding mechanisms and procurement schedules.

When should strategic procurement entities be considered?

SPEs may be used in most situations, provided that political will for reform in the procurement domain exists as well as supportive legislation, as well as procurement expertise on which to base the reform. Procurement entities, such as PMUs or LMUs, are meant to be a permanent part of the procurement process. Given the changes that should occur to bring procurement under the purview of a SPE, there should be long-term commitment to reform. Moreover, procurement entities work most efficiently when experts from other parts of the supply chain are willing to work together and share their areas of expertise to improve the supply chain as a whole.

To learn more:

- Procurement Strategies for Health Commodities: An Examination of Options and Mechanisms within the Commodity Security Context: Section 4.0 Procurement Mechanisms (page 19)
- Logistics Management Units: What, Why, and How of the Central Coordination of Supply Chain Management
- Managing Access to Medicines and Health Technologies: Managing Procurement: Organization and Management of the Procurement and Distribution Functions (section 18.6)

GHANA

Enacted in 2003, the Public Procurement Act enabled the Government of Ghana to begin making important improvements in its procurement processes. One of the first changes was the establishment of the Public Procurement Board (PPB), which oversees the Public Procurement Authority (PPA). In Ghana, the PPB is the SPE in charge of streamlining procurement processes and increasing the transparency of the entire process. The PPA manages the actual procurement of goods, including the tendering, bidding, and contracting processes. To maintain transparency and ensure accountability, tender review boards assess the contract recommendations and provide approvals after a thorough review.

These reforms have helped reduce fraud and corruption and have led to increased transparency in all aspects of procurement. Key accomplishments of the PPB include the standardization and documentation of procurement procedures, and the development of diploma and Bachelor's degree programs in procurement as a means of increasing professional capacity in Ghana.

To learn more:

- Ghana's Comprehensive Approach to Public Procurement Reform

DOMINICAN REPUBLIC

Beginning in 2011, the Strengthening Pharmaceutical Systems (SPS) Program partnered with the Dominican Republic's Ministry of Public Health to address problems in the procurement of medicines and medical commodities. The problems—namely frequent stock-outs, parallel procurement processes, and poor planning—limited the ability of the health system to provide care and treatment for illnesses. Although there was a central medical store, called Programa de Medicamentos Esenciales/Central de Apoyo Logístico (Program for Essential Medicines/Central Logistics Support [PROMESE/CAL]), which managed the procurement of larger quantities or more generic categories of goods, many programs and health facilities also procured commodities using their own means. Goods procured through PROMESE/CAL were typically purchased at reasonable prices, but procurements made by individual programs or facilities were up to 2000% higher than the PROMESE/CAL purchase prices.

Initially tasked with addressing procurement issues in disease-specific programs, SPS' scope of work was expanded to tackle the broader issues plaguing all aspects of procurement. To deal with the issues of parallel procurement systems, uncoordinated purchasing, and higher purchase prices, the Single System for Managing Medicines and Medical Supplies (SUGEMI, in Spanish) was created. This SPE was designed to integrate the procurement of health-related commodities by acting as the sole manager of purchases for medicines and supplies for the Regional Health Service Centers (RHSC) and Disease Control Programs (DCP). While the decisions on what products to procure and the quantities needed remained with the RHSCs and the DCPs, the procurement of these commodities is managed by SUGEMI and PROMESE/CAL.

As a result of greater integration in procurement, the Dominican Republic has benefitted from fewer stock-outs, less wastage of expired or unused commodities, and lower procurement prices due to greater purchasing power with vendors.

To learn more:

- Integrated Pharmaceutical Supply Management as a Strategy for Strengthening the National Health System in the Dominican Republic
- Planning the Purchase of Medicines and Medical Supplies for the Ministry of Health for 2012 and Its Implications for Improving Supply in the Dominican Republic

Pooled Procurement

To address the lack of coordination in the supply chain and lack of product standardization

Pooled procurement is the joint procurement of specific commodities or groups of commodities by one procurement agent on behalf of a group. The group may consist of a variety of entities, including facilities, programs, bilateral and multilateral organizations (such as USAID or UNFPA), regions, or countries. Larger procurement groups have greater negotiating power with a vendor, allowing them to have greater flexibility in the contracting process, and facilitating the purchase goods at lower prices than when ordered individually. In return, these joint entities agree to purchase products from a particular vendor only.

This strategy is especially useful in settings where individual countries or programs need to procure a smaller quantity of goods, but the purchase price or the shipping logistics prevent them from doing so in a cost-effective and sustainable manner. The joint tenders allow for the procurement of larger quantities of products at one time, may help reduce the number of orders placed, and may also reduce the procurement time. When properly implemented, pooled procurement helps reduce costs, minimizes stock-outs of key commodities, and increases capacity.

Pooled procurement may be implemented in two ways, using either group contracting or central contracting, depending on the procurement needs of the country and the feasibility of implementation. Group contracting involves the selection of vendors and negotiation of prices jointly between the pooled procurement participants, but then allows each member state or country to make their own purchases. With central contracting, a central procurement unit oversees the vendor selection, price negotiation, and purchasing for the participants using pooled funds. This strategy requires a greater level of collaboration and integration among the participants, but may also lead greater rewards through higher levels of savings or more favorable contract terms.

When should pooled procurement be considered?

Participants who want to retain control of purchasing benefit most from the implementation of group contracting. Although group contracting still relies on some degree of communication and coordination among the participants, this method does not require as much as central contracting.

Central contracting is best used when there is a high level of communication and agreement among the partnering entities (NGOs, programs, regions or states, or countries) so that coordinated and informed procurement may occur. Central contracting also requires a greater investment of both financial and personnel resources than group contracting, and may be less feasible in locations with limited capacity.

Regardless of the type of pooled procurement implemented, personnel knowledgeable about the selected strategy are required to guarantee effective and correct implementation. When pooled procurement occurs across programs, warehousing and distribution entities also need to be involved to ensure that there is sufficient capacity to store and deliver larger quantities of goods.

Pooled procurement may work against building local manufacturing capacity, since pooled procurement agreements consolidate orders with a small number of manufacturers. A ministry in one country might place priority on local manufacturers when making procurement decisions, while pooled procurement will likely target larger manufacturers without concern for building local capacity. Lastly, pooled procurement requires a certain level of transparency and scrutiny throughout the procurement process to ensure fairness and accountability of all participants.

When pooled procurement occurs across countries or semiautonomous states, several additional factors should be taken into consideration. Namely, each country or state is subject to its own set of legal requirements, in addition to separate tendering, bidding, and contracting processes. To function optimally, pooled procurement requires that each party be flexible or willing to modify its existing procurement structure to suit the details of the pooled procurement agreements. Given the need to work across boundaries, whether physical, organizational, or governmental, pooled procurement is best thought of as a long-term investment.

To learn more:

- World Health Organization: Multi-country Regional Pooled Procurement of Medicines Meeting Report
- Regional/Multi-country Pooled Procurement of Pharmaceuticals
- A Situational Analysis and Feasibility Study on Regional Pooled Bulk Procurement of Essential Medicines and Other Health Supplies in the East African Community Partner States

NIGERIA

Recognizing the need to coordinate procurement across multiple implementing partners of the President's Emergency Plan for AIDS Relief (PEPFAR), the Supply Chain Management System (SCMS), in conjunction with the United States Government/PEPFAR Procurement and Supply Management Team, implemented pooled procurement strategies for antiretroviral (ARV) medications in Nigeria. Once procured by PEPFAR, the ARVs were then distributed to the PEPFAR implementing partners for use in various HIV programs. This approach helped to reduce the fragmented procurement processes currently in place through the use of improved quantification exercises, coordinated product selection, and the pooled procurement of two high-volume ARVs. The pooled procurement of the ARVs led to significant reductions in stock-outs and procurement costs by allowing for greater coordination among the various HIV programs, as well as improved budgeting and forecasting methods, and lower costs through larger purchases. Specifically, the coordination among pooled procurement participants helped promote the redistribution of commodities from implementing partners with excess stock-on-hand to programs and facilities facing stock-outs. The sharing of commodities among participants helped save money by mitigating the need for emergency orders and reducing wastage and expiry of excess stock. In just over one year, participants transferred more than $2 million worth of goods among themselves. The achievements of this strategy led to the inclusion of other first-line ARVs and HIV-related commodities in the pooled procurement activities at PEPFAR-supported facilities in Nigeria. The larger procurement volumes gave the procurement team greater negotiating power with suppliers, leading to better contract terms and delivery dates.

While there is an ongoing need for better matching of consumption data with forecast projections and for better coordination among health facilities that receive commodities from multiple sources, SCMS plans to expand its activities in Nigeria and to pilot test the inclusion of other products in the pooled procurement activities.

To learn more:

- In Brief: In Nigeria, a PEPFAR-wide strategy for procurement
- On the Road with SCMS, Part 1: In Nigeria, PEPFAR partners pool procurement of live-saving commodities

THE CARIBBEAN

Initially formed in 1986, the Pharmaceutical Procurement Service (PPS) for the Organisation of Eastern Caribbean States manages regional pooled procurements for nine member states. After the introduction of pooled procurement schemes, procurement prices for medications dropped by more than 25% over individual country prices. Annually, the PPS is responsible for procuring almost 700 items, 70% of which are pharmaceuticals. Altogether, this accounts for 80% of the public sector need for pharmaceuticals. Benefiting from stronger bargaining power, information sharing processes, regional cooperation, enhanced emphasis on quality control, the development of a common regional formulary, and ongoing staff training, the members have experienced a measurable increase in access to essential medicines.

Critical to the success of this partnership was the development and management of a credible procurement agency with professional staff and transparent processes, timely/full payment from members, harmonization of medicines policies across members, and administrative and political commitment in the form of signed member agreements.

To learn more:

- Organisation of Eastern Caribbean States

THE PAHO STRATEGIC FUND

Consisting of 17 countries, two social security agencies, and five Principal Recipients of the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund), the Pan American Health Organization (PAHO) Strategic Fund was founded in 2000 to assist PAHO members with the procurement of key public health commodities. By managing the procurement of these commodities, the PAHO Strategic Fund leverages its greater resources to purchase large quantities of goods at low prices and manages the storage and distribution to each member state, thereby ensuring a consistent supply of affordable commodities. For example, the PAHO Strategic Fund uses pooled financing to purchase large quantities of vaccines at lower prices than the member states could procure independently.

Under the guidance of the PAHO Strategic Fund, a single procurement plan was instituted for all Global Fund beneficiaries in Haiti and led to the elimination of all vertical procurement and supply management programs in Venezuela. Negotiations undertaken by the PAHO Strategic Fund have helped ensure regional price referencing for more than 14 ARVs procured by Brazil, Guatemala, Haiti, and Nicaragua. Additional accomplishments include the procurement of more than 41 items for six member countries totaling tens of millions of dollars' worth of goods.

To learn more:

- Regional/Multi-country Pooled Procurement of Pharmaceuticals

Outsourced Procurement

To address the lack of coordination in the supply chain, and bureaucratic and cumbersome procurement practices

Similar to pooled procurement, outsourced procurement is a separate procurement strategy that leverages power in numbers to achieve process improvements and reduced costs of procurement. This strategy works by partnering with third party agents from either the public or private sector to manage the procurement process in a particular region, country, state, or program. The third party agents may be responsible for a variety of activities, including planning, contracting, and/or purchasing of goods. These procurement agencies may charge service fees that are between 5% and 10% of the procurement costs.

Procurement agents typically have greater resources and capacity to ensure that manufacturers or suppliers adhere to Good Manufacturing Practice guidelines and are well situated to obtain the highest quality commodity at the lowest price possible. This expertise helps ensure that countries or programs are not overcharged for the procurement of goods and provides an important service for locations with limited technical capacity in specific procurement activities. In addition, greater enforcement and adherence to established policies by the third party agents may help to ensure that the procurement process functions as intended and that the number of emergency orders needed is kept to a minimum.

When should outsourced procurement be considered?

Governing bodies should consider outsourced procurement when they have a sufficient level of technical expertise to oversee the procurement agent. To function most efficiently, it is important that the procurement team and the contracted partner have a clear and well understood statement of work. Local procurement personnel need to be able to manage the outsourced contracts to ensure that the vendors are delivering high quality products that meet procurement expectations. It is critical that these the procurement team defines and enforces adherence to the contract terms by the procurement agent through the use of key performance indicators and explicit descriptions on the frequency and level of detail required in reporting.

In addition, governments need to be willing to increase the transparency and visibility of their budgeting and procurement processes when they bring in a third party to manage them. The selection of the procurement agent needs to be fair, impartial, and ensure that the good of the country and its needs are placed over profit. To achieve this, countries may consider requiring that the outsourcing agent allow a review of their pricing formulas to foster a greater sense of transparency and accountability, which may help the country make informed decisions when choosing the agent. Countries that have strong programmatic representation and a reliable quantification and forecasting process are also most likely to benefit from this type of procurement reform.

To learn more:

- Exploring Supply Chain Augmentation for Malaria Commodities
- Managing Access to Medicines and Health Technologies: Chapter 39. Contracting for Pharmaceuticals and Services (pages 39.1–39.20)

INDIA

Beginning in 2007, the Government of India contracted out the procurement of selected health sector goods to the United Nations Office of Project Services (UNOPS). This partnership was created to help address delivery and funding issues in procurement, and focused on HIV and AIDS, malaria, tuberculosis, and maternal health commodities. In 2009, UNOPS expanded its scope to include the tendering of more than 50 commodities across additional disease and diagnostic specific commodities. Annually, UNOPS is responsible for procuring more than $100 million worth of goods for the Government of India using funding from the government, the United Kingdom, the Global Fund, and the World Bank.

By outsourcing procurement services to UNOPS, the government was able to purchase needed commodities at reasonable costs and with timely delivery. In addition, UNOPS provides valuable assistance during emergency situations. When the national immunization program faced a looming stock-out of syringes, UNOPS was able to use its resources to help the Government of India place an emergency order for this commodity. Not only did UNOPS manage to procure enough syringes to avoid a stock-out, they were also able to procure the syringes without paying higher prices and to facilitate delivery within a record-setting 30-day timeline.

To learn more:

- India Operations Center: Health Sector Procurement for the Indian Government

Framework Contracts

To address the lack of coordination in the supply chain, bureaucratic and cumbersome procurement practices, and limited use of procurement flexibilities

Sometimes called framework agreements or national framework agreements, framework contracts are a more recent procurement strategy for the public sector. They have been used by the private sector for a long time. Framework contracts allow countries or programs to directly negotiate with the vendors of particular commodities and then purchase a defined set of commodities in variable quantities at a fixed price for the duration of the agreement. Often lasting two to three years, these contracts are established with prequalified or prime vendors and may help countries plan in advance for the procurement of a fixed set of goods. In addition to benefiting the country, these contracts also provide important information to the manufacturers on projected needs and delivery schedules, allowing them to plan manufacturing and distribution schedules accordingly.

When should framework contracts be considered?

Given the longer term commitment, these contracts are best used when countries have dedicated funding sources for the commodities and when they have reliable forecasting and supply planning numbers. Procurement entities should work to ensure that there is regulatory support for the use of this type of procurement strategy. The use of framework contracts may be particularly beneficial to countries that procure commodities with unstable pricing, as some of the risk of market variations is then assumed by the manufacturer or vendor.

To learn more:

- Improving Procurement Practices in Developing Country Health Programs (pages 17–26)
- Addressing Procurement Bottlenecks
- Supply Chain Management of Antiretroviral Drugs: Considerations for Initiating and Expanding National Supply Chains (page 23)

CHILE

ChileCompra, a strategic procurement entity, is a decentralized public procurement department run by the Chilean Department of Treasury. It was created to improve the national procurement process for all government-related goods, services, and activities. Since its establishment in the early 2000s, ChileCompra has been successful in implementing standardized policies, increasing transparency, and using fair bidding and tendering practices. To achieve these improvements, ChileCompra uses multi-year framework agreements to procure health commodities and other public sector goods. As a recipient of these contracts, the vendors are placed into a national catalog that procurement entities in Chile may use to make purchases without having to carry out a lengthy tendering and bidding cycle.

Not only did ChileCompra help to consolidate the procurement of most health sector commodities under one entity and establish transparent and fair procurement policies for Chile, it also helped to develop capacity and management expertise in the administration of framework agreements and catalog development.

To learn more:

- Getting Products to People without a Traditional Medical Store

Prime Vendor Contracts

To address the lack of coordination in the supply chain, bureaucratic and cumbersome procurement practices, and limited use of procurement flexibilities

Prime vendor contracts are contracts awarded to specially designated vendors that have gone through an assessment in which they are evaluated for their ability to provide high quality, reliable, and cost-effective procurement services. Once approved for prime vendor status, procurement entities may work with these vendors to procure commodities from them without having to go through a competitive bidding and tendering process for each individual procurement. The ideal time frame for these contracts is somewhere between one and five years, with the majority lasting two to three years. This ensures that the contract is long enough to promote sufficient benefits while allowing for the revision, cancellation of prime vendor status, or addition of new vendors over time. Prime vendor contracts help shorten the procurement lead time, and reduce costs and minimize stock-outs by avoiding lengthy tendering, bidding, and contracting processes. Using prime vendor contracts may help ensure greater product quality and consistency in delivery schedules. In addition to procuring commodities, prime vendor contracts may also include components of quality assurance, capacity development, and technical assistance with quantification and supply planning.

One major benefit of having prime vendor contracts is that countries may establish these contracts with multiple vendors, thereby ensuring competitive pricing between manufacturers and the availability of back up resources should the manufacturing capabilities or quality of a particular vendor be compromised. This process may be used as a stand-alone strategy or as a first step in the process of developing framework contracts, which are described in detail above. Additionally, some countries may implement a prime vendor model system that includes a combination of procurement, warehousing, and distribution support. This practice is sometimes referred to as “vendor-managed inventory” (VMI). For a further description of this practice, refer to the VMI section of the *Promising Practices in Distribution* brief.

When should prime vendor contracts be considered?

Prime vendor contracts are best used when procurement officials are willing to consider and fairly evaluate all potential vendors for a particular product, category, or group of commodities. To be most effective, countries should ensure that the prices are reasonable and the quality offered by the vendor meets minimum standards, as determined by the country. In places where there may be local production of products, contracts should only be awarded to these manufacturers if they are truly the best source for the acquisition of the specified products.

Prime vendor contracts may also be used when framework contracts are not feasible due to the longer length of commitment required, funding shortages, and untrustworthy quantification estimates, or if there are legal or other regulatory restrictions that prevent them from being enacted.

To learn more:

- Improving Procurement Practices in Developing Country Health Programs

TANZANIA

Tanzania is a country that uses a variety of procurement strategies, as demonstrated by its partnership with SCMS. Responsible for procuring HIV commodities, SCMS recently implemented a prime vendor model strategy to secure a local supplier of medicines to prevent opportunistic infections in HIV-positive patients. Under this model, SCMS was able to evaluate the ability of local manufacturers to meet the need for quality, affordability, and greater product consistency by conducting a thorough assessment of the facilities, providing recommendations to improve adherence to good storage and distribution practices, and providing follow-up visits to monitor progress. The use of a prime vendor contract not only helped ensure that high quality products were delivered to the people of Tanzania, but that important technical assistance and capacity development of the local manufacturer were also provided. The lessons learned from these activities have been shared with other manufacturers and the Tanzanian Food and Drugs and Authority to inspire similar reforms.

To learn more:

- SCMS Supply Lines Newsletter May 2013
- Six Years of Saving Lives Through Stronger Public Health Supply Chains

Category/Commodity Management

To address unclear procurement processes and the lack of product standardization

Category/commodity management involves the appointment of an individual or group to oversee the procurement of a specific set of products that share similar characteristics or uses. These appointments contribute to the development of deep expertise in that category and facilitate the establishment of long-term relationships with the vendors. This may help minimize inefficiencies in procurement, particularly in the bidding, tendering, contracting, and quality assurance components. While long considered a best practice in private sector industries, such as aerospace, this approach has not been widely used in the procurement process for public sector health supply chains.

To successfully use category/commodity management, several processes should occur. First, key procurement officials need to develop a thorough understanding of all of the commodities procured and their uses. From there, the commodities should be grouped into categories and analyzed to determine prioritization needs, as described later in this brief. Procurement strategies should then be developed for each category to ensure that streamlined, transparent, and consistent procurement processes are in place. Once the commodities have been categorized, dedicated procurement staff are assigned to manage the specific relationships associated with that category. This helps build local procurement expertise for the commodities in the category and facilitates the development of strong relationships with the clients (typically the SDPs or program) and the vendors.

Using category analyses to inform category/commodity management

One of the most important aspects of a well-functioning procurement process is having a thorough understanding of how commodities are used by the health system. This knowledge enables intelligent and effective decision making related to commodity procurement. To achieve this understanding, a category analysis, or segmentation analysis, may be used to obtain information on the need, specifications, and use of the products and to help countries determine where (i.e., which category or segment) to invest the majority of their supply chain time, expertise, or resources.

As defined by JSI, a segmentation analysis is simply "an approach that can help identify opportunities in supply chains where products or customers can be grouped together or combined in such a way that improves product availability and decreases costs and functional redundancies."[1] One key feature of a segmentation analysis is that it is flexible and may be tailored to a country-specific situation. The segments, as determined by the analysis, are typically grouped together based on common logistics requirements, operating procedures, and the needs of the end users (in this case, the SDPs).

The segmentation analyses may take a variety of forms. Some common methods include the ABC analysis and the vital, essential, and nonessential (VEN) analysis. ABC analysis is an assessment and prioritization process for countries to use when they have limited time, resources, and personnel for medicine procurement. Under category A, the most expensive items or those with the highest utilization rates are given higher priority over medicines assigned to category B (medium priority for medium cost or medium utilization items) and category C (lowest priority given to the lowest cost or

[1]Allain L, Goentzel J, Bates J et al. *Reengineering Public Health Supply Chains for Improved Performance: Guide for Applying Supply Chain Segmentation Framework*. Arlington, VA: USAID | DELIVER PROJECT, Task Order 1; 2010.

least utilized items). Category A commodities offer the greatest possibility for cost savings and may provide an important starting place for the investment of limited resources.
VEN analysis uses similar categorization principles, with commodities designated as: vital (potentially life-saving or crucial to the provision of basic health services); essential (important for the treatment of significant illness, but not vital); or nonessential (not used for life-saving purposes or have a low therapeutic advantage and high costs).

When should category/commodity management be considered?

Personnel with sufficient procurement expertise should determine which of the analyses to implement and the resulting categorization of commodities. Dedicated procurement personnel are also needed to assist with the development and cultivation of good working relationships with the suppliers to ensure the efficient and cost-effective procurement of the desired commodity or commodities.

To use this strategy effectively, the procurement personnel should have a good understanding of the supply and commodity needs of their country, from rural to national levels. Poor, incomplete, or untimely data impair the development of the necessary expertise and may lead to reductions in cost savings, efficiency, and product availability.

This strategy may be more feasible in countries that do not participate in pooled procurement (especially across countries) or that use outsourced procurement strategies. When procurement is outsourced, the commodity expertise resides with the outsourcing agent and may not transfer well to in-country procurement staff.

To learn more:

- Drug and Therapeutics Committees: A Practical Guide
- Drug and Therapeutics Committee: Identifying Problems with Medicine Use: Aggregate Methods
- KEMSA Support Program Inventory Analysis Report
- Managing Access to Medicines and Health Technologies: Chapter 40. Analyzing and Controlling Pharmaceutical Expenditures
- Putting Integration into Perspective: Proven Practices to Strengthen Public Health Supply Chains (page 7)

NIGERIA

In Nigeria, the existence of separate national, state, and local procurement regulations and activities led to difficulties in understanding commodity demand, flow, and utilization. While managed nationally, programs often conduct their procurement and warehousing activities together. These activities are further complicated by local and state entities that separately manage the procurement of goods for hospitals, primary health care facilities, and other SDPs.

USAID recently piloted a segmentation analysis in the Nigerian states of Edo and Kano to better understand the flow of commodities throughout the supply chain. The information gained during this analysis showed that there were clear differences in the procurement volumes of different commodities, with some commodities purchased often and in large quantities. As a result of this analysis, procurement personnel focused their efforts on improving procurement processes for these high frequency, large quantity goods. These reforms have not only enabled the development of expertise for these goods, but they have also supported the development of better contractual terms for longer periods of time. The reforms are helping to save time and money and are increasing the capacity of procurement personnel in Edo State.

To learn more:

- Getting Products to People: The JSI Framework for Integrated Supply Chain Management in Public Health
- Nigeria: Segmentation of the Supply Chain for Essential Medicines

Published Lead Times

To address the lack of coordination in the supply chain and unpredictable and long lead times

Many procurement problems stem from the lack of knowledge about the process outside of the procurement team. In particular, many programs or departments often place orders with limited or no knowledge about when the order will be fulfilled. As described earlier, this lack of knowledge may lead to the placement of emergency orders to ensure that products arrive in a shorter and more desirable time frame. Key to addressing this issue is the development of and commitment to regularly publishing and disseminating lead times to all relevant parties.

Lead times cover a variety of activities that are managed in the procurement process, including: the time it takes to place the order with the vendor (which includes tendering, bidding, and contracting, if needed); the time it takes for the product to be manufactured, shipped and delivered; and the time it takes for the product to be received by the SDP. Failure to adequately account for and communicate each of these steps may to lead to stock-outs. Especially important is the amount of time that should be factored in if tenders need to be issued, bids received, and contracts awarded. The lead time for procurement varies based on the number of steps required to complete the entire cycle. In countries where processes such as framework agreements or prime vendor contracts are used, the procurement process may be shorter.

When should published lead times be considered?

This strategy is most effective when used as a part of a package of procurement reforms, including the implementation of national framework agreements and prime vendor contracts. All of these strategies help create consistent procurement processes and standards that may be referenced and adhered to, thereby enabling the creation of reliable lead times.

UNFPA

UNFPA currently publishes the lead times for a number of key reproductive health commodities. Sometimes used as an outsourced or pooled procurement entity by countries or programs, UNFPA helps ensure that valuable reproductive health commodities are accessible to those who need them. The lead times for the reproductive health commodities may be found on the AccessRH website, an easily accessible resource that may be used during the supply planning process. In addition to publishing general lead times for commodity acquisition, the website allows recipients to get tailored estimates of lead times based on the manufacturer, quantity procured, and individual country or program needs.

To learn more:

- Lead Time for Reproductive Health Supplies
- AccessRH

Policies for the Donation of Medical Commodities

To address unplanned, unsolicited, and unspecified donations

In addition to improving the procurement of commodities through planned, regular purchases or acquisitions, countries are also subject to offers of unplanned, unsolicited, or unspecified donations. Such offers may come from a variety of places, vary in quality and applicability, and may be politically problematic for countries.

Country- or program-specific policies help ensure that there are transparent and well-defined processes for the acceptance of donated medical supplies, medicines, and equipment. To this end, countries should have SOPs that clearly define the types of products accepted, the minimum quality standards, expiry restrictions, quantity limits, and who assumes liability for any fees, taxes, or other charges that may be incurred. To ensure that the donations also follow current treatment recommendations, countries should be prepared to share their standard treatment guidelines, essential medicines list, or other appropriate documentation for the donor to review. To ensure proper receipt and tracking of the donated goods, the SOPs should also specify the reporting requirements that the recipient should follow. Information on the consequences of non-adherence to these policies should also be considered for inclusion in the SOPs.

Countries should be prepared to decline donations that do not fit in their currently defined needs or that would lead to a breach of contract in other areas. For example, if a country has already begun the procurement process and accepted bids for certain products from another source, they may be legally required to honor the contract or face significant penalties. If a country is also given the same product as a donation, it may experience issues with wastage, storage, and under-consumption.

When should a policy for the donation of medical commodities be considered?

Always! All procurement entities should have clearly defined processes on the acceptance of donated goods. Countries that do not currently have well-defined policies for the management of donations or that do not address the minimum standards as described above should consider revising their donation policies.

To learn more:

- Guidelines for Drug Donations
- World Health Organization Guidelines for Medicine Donations
- Supply Chain Management of Antiretroviral Drugs: Considerations for Initiating and Expanding National Supply Chains (page 27)

Conclusion

Procurement is a complicated process that requires relationships across ministries, with vendors, and with the end customers. While there are many barriers that impede successful procurement processes and activities, there are also many promising practices that address the challenges. The practices described in this brief rely on collaboration, transparency, and standardization of processes. Political will, procurement capacity, and a flexible environment are also important for their successful implementation. Taking the time and effort to assess the specific needs and areas for improvement bring significant rewards in the long term. Some of the practices described above, like publishing lead times, are helpful for all procurement entities to implement. Others require analysis and consideration to determine whether they are appropriate for the context. Strategic improvements in the procurement process help ensure that the right products are available at the right time. With the right investments in improving this aspect of the supply chain, countries, programs, and SDPs will continue to ensure that the necessary commodities are available when needed.

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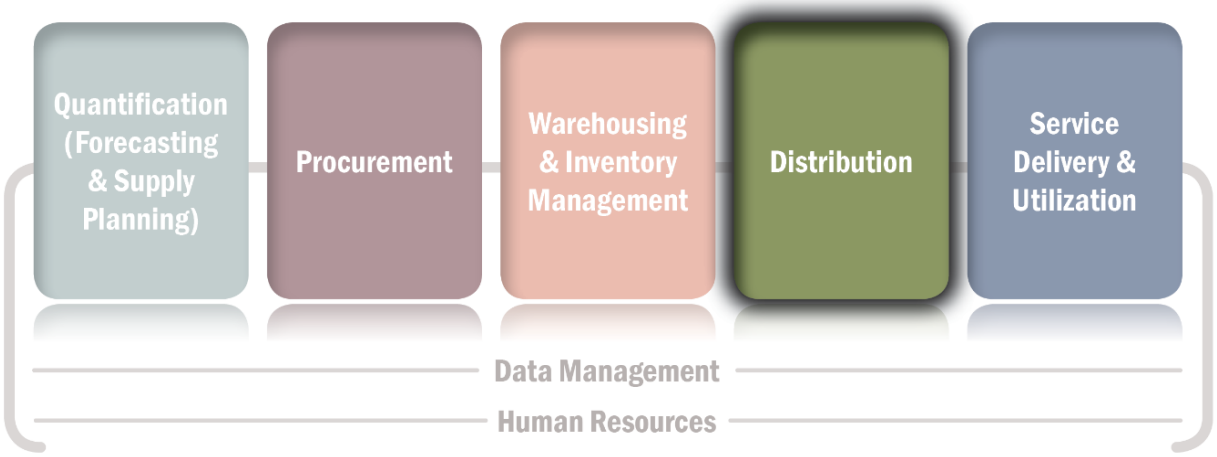
Promising Practices
DISTRIBUTION

Brief #4 in the *Promising Practices in Supply Chain Management* Series



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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Distribution.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

ADP	Accenture Development Partners	LMU	logistics management unit
ARV	antiretroviral	MSD	Medical Stores Department
DLS	Dedicated Logistics System	NACA	National Agency for the Control of AIDS
DTTU	Delivery Team Topping Up	NDoH	National Department of Health
EWEC	Every Woman Every Child	R&R	reporting and requisition
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria	SDP	service delivery point
IP	implementing partner	SIAPS	Systems for Improved Access to Pharmaceuticals and Services
JSI	John Snow, Inc.	TRT	Technical Reference Team
LMIS	Logistics Management Information System	USAID	US Agency for International Development
		VMI	vendor-managed inventory

Background

Having efficient and reliable processes to distribute appropriate commodities from central warehouses to service delivery points (SDPs) is a critical part of effective supply chain management, yet many low- and middle-income countries face numerous challenges with their commodity distribution systems. To increase access to the underutilized commodities prioritized by the UN Commission on Life-Saving Commodities, distribution bottlenecks throughout the in-country supply chain should be addressed to ensure that commodities reach the points of service delivery.

When working properly, distribution ensures the delivery of commodities from the highest level of the supply chain to the locations where the commodities are distributed directly to those who need them. This involves multiple methods of transportation, from refrigerated trucks moving commodities from central medical stores, to district warehouses, to community health workers transporting commodities from rural health centers to community clinics by foot or by bicycle. But distribution is not only about the delivery of commodities to SDPs. Effective distribution is highly dependent on other functions of the supply chain working in an efficient and integrated manner. For example, supply chain managers should receive reliable logistics data to procure an appropriate amount of each commodity, plan delivery cycles, and ensure an adequate supply is delivered to each SDP.

Effective distribution is dependent on reliable transportation, cold chain capacity, timely flow of information for planning, adequate human resources, and sufficient financial resources to support distribution-related costs. Every Woman Every Child (EWEC) countries currently experience a number of barriers and challenges to improving commodity distribution, including the lack of reliable transportation, long distances to health centers, changing commodity demand, poor distribution planning, and lack of reliable and timely data. These barriers are not easy to overcome, as many of them are complex and interrelated. Furthermore, the sheer volume of commodities that the health system distributes is growing exponentially, often far beyond the management capacity of the public health system. Such barriers, and the corresponding promising practices that address them, are described in the table below. For more information on the cross-cutting issue of data management, please see the *Promising Practices in Data Management* brief.

Barriers	Description	Promising Practices that Address the Barriers
Limited transportation infrastructure	Availability, reliability, and quality of transport infrastructure and services, especially at the last mile as well as maintenance of cold chain during distribution for temperature sensitive and cold chain dependent commodities.	• Level jumping • Distribution outsourcing • Vendor-managed inventory
Long distances to resupply points	Distance between health centers and resupply points and between community health workers and health centers. This problem is exacerbated when systems are set up according to administrative boundaries/reporting lines rather than by distance, topography, or population density.	• Level jumping • Distribution outsourcing • Vendor-managed Inventory
Poor distribution planning	Ad-hoc distribution strategies and poor distribution planning with limited incentives for timely distribution.	• Level jumping • Distribution outsourcing • Vendor-managed inventory • Top-up or informed push system with direct delivery to health facilities
Changing commodity needs	Constantly changing environments, including commodity demand that changes with seasonal peaks and lulls in disease incidence, create complications in accurately determining commodity needs.	• Vendor-managed inventory • Top-up or informed push system with direct delivery to health facilities
Poor data access	Poor data management and/or lack of sufficient stock at higher levels of distribution leading to inadequate stock distributed.	• Top-up or informed push system with direct delivery to health facilities

Some of the most promising practices in distribution are described below. No single solution will work for every country or for most countries. Simple variations to the current models will not be enough to create substantial change or keep up with the ever-growing distribution needs of most countries. Many countries have successfully experimented with ways to adapt best practices from other sectors to address their distribution challenges and are redesigning their distribution systems in innovative ways, some of which are highlighted as examples.

Top-Up or Informed Push System with Direct Delivery to Health Facilities

To address barriers in distribution planning, data access, and changing commodity needs

A top-up or informed push system is a method whereby commodities are distributed on predetermined delivery schedules without an order from the lower levels of the supply chain. Unlike a pull system, in which the lower levels must determine their commodity needs and have a way of notifying the higher levels of the supply chain of their order, this system "tops-up" or "pushes" commodities to the health facility. Delivery trucks are often loaded with a pre-determined quantity of commodities based on population or previous usage information. For this system to work well, it often includes a direct delivery component whereby health facilities are visited at regular intervals to count stock levels and top-up the commodities needed. The specific quantity of commodity left at (or removed from) each facility is usually based on a number of factors, including stock on hand, losses and adjustments, and days of stock-out since last delivery. For countries struggling with information flow, a "top-up" or informed push process eliminates reliance on the SDP to order the correct amount of stock.

The advantages of this system often include improving the schedule or regularity of distribution, reductions in stock-out rates, and improvements in reporting rates. Because the top-up or informed push system relies on trained delivery teams to collect data on consumption and stock levels, it does not require extensive training and supervision of health facility staff in tasks, such as data entry and resupply calculations. However, the top-up or informed push system requires a large amount of up-front investments in reliable vehicles, drivers and technical staff, and does not eliminate the need for ongoing costs, such as vehicle maintenance, fuel, and ongoing training of delivery teams. Despite these investments, costing studies have found the system is more cost-effective, in many cases less expensive than the current common model of having each administrative layer of the supply chain responsible for delivering commodities to the level below.

When should a top-up or informed push system be considered?

A top-up or informed push system works best for a limited number of commodities that have relatively steady demand and when adequate stock is available to meet that demand. The exact number of commodities that can be effectively managed with an informed push system is unknown, but some suggest using 55 commodities or less. The top-up or informed push system often uses minimum and maximum stock requirements, which are set in advance. The distribution team then tops up SDPs that are below the stock minimum and removes stock from SDPs that are above the stock maximum. This works well with preventative health commodities, such as vaccines or family planning supplies where the need is fixed and can be predicted based on population data. Commodities with variable demand are less conducive to a system with predetermined minimum/maximum stock levels. Moreover, in a top-up or informed push system, decisions on how much stock an SDP receives are made on site. Therefore, situations where rationing decisions must be made at higher levels of the supply chain because there is not adequate supply to meet demand may not be conducive to a top-up or informed push system. However, the system may be modified to include rationing, if needed.

Like all practices described in this brief, a top-up or informed push system cannot function properly in the midst of a broken system. A combination of improvements in delivery, human resources, data

collection, and management are all needed to make the informed push or top-up system successful. All examples described below include direct delivery to SDPs. It is possible to have an informed push system without changing how commodities are delivered. However, without distribution directly to the SDP, other distribution barriers, such as lack of transport at the lower levels of the supply chain, may continue to hinder product availability. Combining an informed push supply model with distribution directly to the SDP helps to holistically address data access challenges, human resource constraints, and transport limitations. In addition, the highlighted examples employ dedicated logistics personnel who are responsible for planning the distribution of commodities, collecting commodities from the warehouse, conducting physical counts on arrival at the SDP, and collecting data on stock levels and consumption of commodities. In many cases, these staff are also trained to provide supervision at the health center or they may travel with a supervisor when they conduct distributions. This integration of specialized logistics personnel—and the impact that they can have on the overall efficiency of the supply chain—is explored in more depth in the *Promising Practices in Human Resources* brief.

ZIMBABWE

In 2002, USAID (through the USAID | DELIVER PROJECT) conducted an assessment to determine why HIV and AIDS-related commodities were unavailable at rural SDPs despite adequate stock in central warehouses. After concluding that the problem derived from the health system's inability to successfully carry out necessary supply chain functions, the USAID | DELIVER PROJECT recommended implementing a "Delivery Team Topping Up" (DTTU) system. Under the system, delivery trucks are filled with a fixed quantity of commodities, usually based on past consumption data, which are delivered directly to the SDP. The drivers, or other staff members, use on-site data to determine resupply quantities and help reconcile inventories. They then top-up stock at each SDP to meet demand until the next scheduled delivery. A 2007 evaluation showed that the DTTU system had achieved 95% coverage of all SDPs for condoms and contraceptives, with stock-out rates below 5% for these products. Based on this success, the DTTU has added more commodities (it now manages 21) and is currently computerized. Initially, the SDP order quantities were documented on a paper delivery/receipt voucher. In 2008, software called AutoDRV was implemented to automate data capture and order calculations. AutoDRV also uploads directly to the central level top-up system, minimizing data entry and transmission errors.

DTTU can be implemented despite challenging contexts that hinder operation of an effective public health supply chain. Implementation of the DTTU system in Zimbabwe has been carried out by six partners that have distinct roles and responsibilities essential to the successful execution of the distribution system. Partners have made special investments to ensure that reliable vehicles, drivers, technical staff members, or a combination of them directly provide facilities with the health products they need to serve clients. The DTTU system has been duplicated in Zimbabwe for other commodities, as ZIP (Zimbabwe Informed Push). Similar systems are being rolled out in Liberia and Nigeria.

To learn more:

- Delivery Team Topping Up: Bringing About Reliable Distribution in Difficult Environments
- Zimbabwe: Supply Chain Costing of Health Commodities
- Measuring Cost to Optimize Health Commodity Delivery in Zimbabwe
- 10 Years of Delivery Team Topping Up (pages 9-10)

MOZAMBIQUE

In 2002, the Foundation for Community Development, VillageReach, and the Mozambican Ministry of Health launched the Dedicated Logistics System (DLS) for vaccines and related supplies to improve the availability of vaccines in Northern Mozambique. Similar to the DTTU system, the DLS is run by the Provincial Health Departments. It is organized around provincial-level logistics teams of three to four people, called Field Coordinators, who manage the distribution system and are responsible for delivering vaccines to all health centers in a delivery zone. Using provincial vehicles and provincial staff, the delivery teams transport vaccines, propane, medicines, and other essential commodities directly to SDPs. During the delivery, field coordinators collect data on vaccine supplies, stock-outs, vaccines administered, and cold chain maintenance to inform forecasting and logistics management. The DLS now operates in four provinces of Mozambique, serving just over 400 health centers, and is staffed and managed by provincial government personnel.

Institutionalizing a new delivery system like the DLS has not been easy and has required significant leadership to be successful. The position of field coordinator is a not an established post in the provincial health system, so provincial immunization staff have had to change their job duties to make time to participate in monthly delivery routes for two weeks per month. Vehicles are shared across multiple programs at the provincial office, making it difficult to find vehicles that can be dedicated to vaccine distribution for long periods. Some provinces rely on shared vehicles, which may delay distribution each month, while others have worked with partners and donors to secure specialized transport for vaccine distribution. Budgets for fuel and per diems to support the delivery teams were not initially factored into provincial budgets, since responsibility for the distribution of vaccines was, by policy, allocated across multiple levels of government. In some cases provinces have been able to start incorporating these costs into their budgets, while in other cases they rely on partners to help support the distribution expenses.

The system has also had to adapt to address specific management and policy concerns. For example, districts initially felt left out of the DLS. It is their mandate to be responsible for vaccine distribution but the DLS takes away the delivery aspect of their role. To address this, district vaccine managers are picked up during the delivery route and participate in distributions to ensure that district-level supervision and data collection are completed. A 2008 evaluation showed that the DLS dramatically improved coverage rates, resulting in a 93% coverage rate for all vaccinations given to children age 24 to 34 months in the intervention province.

To learn more:

- Evaluation of the Project to Support PAV (Expanded Program on Immunization) in Northern Mozambique, 2001-2008: An Independent Review for VillageReach with Program and Policy Recommendations.
- Comparison of Costs Incurred in Dedicated and Diffused Vaccine Logistics Systems

SENEGAL

From 2009 to 2012, Project Optimize and the Senegalese Ministry of Health partnered to undertake a number of supply chain improvements and demonstration projects, including an informed push system for vaccine delivery known as "moving warehouse." Prior to this project, vaccine distribution happened from the bottom up, with nurses from health posts responsible for traveling to district headquarters to pick up supplies and, in turn, district teams responsible for going to regional warehouses to collect supplies. Funds for transportation and per diems were not always available, leading to frequent missed trips and stock-outs.

The moving warehouse was established to deliver vaccines, essential medicines, reproductive health commodities, and HIV, malaria, and tuberculosis medicines directly to SDPs. In addition, the moving warehouse was responsible for numerous other transportation activities, such as collecting full safety boxes from SDPs, distributing monitoring forms, records, etc. to SDPs, transporting supervisors from higher levels to the SDPs, and transporting cold chain equipment.

The decision on which commodities to include in the project came partly from concerns that eliminating the district store would pose a threat to the district's income, which comes in part from a cost recovery model. In this model, patients are charged for certain commodities and the district is reimbursed by the SDP based on how many commodities are sold. Because the commodities are predominately donated, the cost reimbursed is used to fund other programs. To mitigate this challenge, it was decided that moving warehouse would deal only with commodities that are provided to patients for free and thus not affect the cost recovery model.

The moving warehouse (made of up of one large truck and one pickup) delivers on three separate delivery circuits; completing the delivery circuits takes from two days to one week. During the shorter delivery circuit (up to three days), vaccines are stored in a 170-liter Aircontainer Bigbox that can keep commodities cold for two and one-half days. On the longer delivery circuit (up to one week), a Dometic RCW 4/30 is used in addition to the Aircontainer Bigbox, which can keep commodities cold for four and one-half days. Delivery trucks were also equipped with laptop computers and an internet connection allowing staff to access the Logistics Management Information System (LMIS) and update vaccine stock information.

The moving warehouse improved its reliability in completing delivery circuits throughout the pilot, nearing 100% by the end of 2012. As a result, general vaccine availability was at the appropriate level in four out of five pilot districts. In addition, the pilot was successful in maintaining a consistent cold chain; vaccines were kept between 2°C and 8°C 84% of the time in the RCW 4/30 containers, and 89% of the time in the Bigbox containers. During the pilot, overall annual supply chain costs increased, but cost per vaccine remained steady.

In 2012, Senegal also piloted an informed push system for family planning commodities, using similar principles to the moving warehouse for vaccines. During the six-month pilot program, stock-outs were eliminated and there were marked increases in the use of intrauterine devices, injectables, pills, and implants. The Government of Senegal is now scaling up the distribution system.

To learn more:

- Optimize Senegal Report

Level Jumping: Direct Delivery and Cross-Docking

To address difficulty with transportation infrastructure and long distances at the lower levels of the supply chain as well as poor distribution planning

The informed push system highlighted in this brief includes a concept that is sometimes called "level jumping" or "level skipping." In many countries, supply chains follow the administrative structure of the health system, with each administrative level storing commodities and taking responsibility for delivering supplies to the level below. Yet the resources available for commodity distribution tend to decrease at each level of the health system, meaning that the system becomes more and more ad-hoc and commodity availability may decrease. To address this, many countries have adopted level jumping, which involves determining which levels actually need to hold and manage stock and bypassing those that do not create a more efficient system. Level jumping helps address challenges with availability, reliability, and quality of transport infrastructure and services, especially at the last mile.

The promising practices highlighted below include direct delivery (where commodities are delivered directly from central level warehouses to SDPs) and cross-docking (where orders are filled and packed for SDPs at the central level, then sent to a collection or redistribution point before being sent to SDPs). Both direct delivery and cross-docking have the potential to reduce delivery times and increase stock availability, but neither are without trade-offs. For examples, when levels are eliminated, the remaining levels need to increase their order processing and delivery capacity.

When should level jumping be considered?

When considering a level jumping approach, it should not be assumed that less is always more or that fewer levels is always more efficient. Instead, clear processes should be used to determine which levels actually add value to the distribution process, ideally through supply chain modeling or network optimization. Through modeling analyses, supply chain decision makers can evaluate potential distribution networks by creating scenarios with varying system tiers, number of facilities, location of facilities, and service areas to determine the most cost-effective network.

TANZANIA

Prior to 2010, commodities in Tanzania were transported from the Medical Stores Department (MSD) to District Medical Offices. District Medical Offices were then responsible for delivering commodities to the health facilities in their districts. Due to delayed deliveries, stock wastage, and stock-outs, the Ministry of Health and Social Welfare instructed the MSD to conduct a pilot study in Tanga Region to test changing to a direct delivery system. In this new model, health centers were still responsible for submitting reporting and requisition (R&R) forms to the district to determine how much of each commodity was needed. The MSD then packed each order per health facility and delivered the order directly to the health center instead of sending it to the district. To plan the optimal distribution route for this pilot, MSD worked with Accenture Development Partners (ADP) to develop a distribution planning tool to assist with the budgeting, planning, and business case for this new direct distribution model.

The pilot was successful in creating only a slight improvement in delivery times and order fulfillment. MSD maintained a 65% fulfillment rate during the pilot. In many cases, the challenges did not have anything to do with direct delivery, but were indicative of zonal-wide stock-outs or shortages of certain commodities during the pilot period. Moreover, commodity budget allocations at health facilities were not reflective of the population served by the facilities. In other cases, the challenges were due to a shortage of human resources or transport available during the pilot period. Despite these challenges, the pilot did increase MSD's ownership, accountability, and insight into the situation at lower levels of the supply chain. For example, once MSD was responsible for delivery, it was discovered that budget was being allocated and orders fulfilled for 45 non-operational facilities (facilities that were not yet built, facilities that were not staffed, etc.). In addition, health center staff felt a more direct connection to the MSD, which helped them understand the importance of submitting their R&R forms on time.

Overall, the direct delivery pilot was received positively, and the Government of Tanzania approved the expansion of direct delivery across the country. The first phase included rolling out direct delivery to just one region in each of the nine MSD zones, with full rollout to all facilities after testing in the first nine regions. To make this move from a pilot in one region to a national rollout, the Government of Tanzania again enlisted a number of partners. The USAID | DELIVER PROJECT helped to do supply chain modeling with MSD to help them plan the most cost-effective rollout of the direct delivery system and to build capacity for route planning. ADP brought in the Coca-Cola Company, with support from Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) and the Bill & Melinda Gates Foundation, to address the change management, human resource, and supply and demand planning needed to optimize the system during national expansion. Although this project has had some major successes—such as reducing lead time for deliveries by as much as 25 days and improving the relationship and connection between MSD and its customers—a complete systems approach is needed to increase the impact on overall commodity availability. The project continues to work on forecast demand and accuracy, human resource performance, and additional route planning and optimization to bring further improvements to Tanzania's medicines supply chain.

To learn more:

- Medical Supply Solutions in Tanzania Overview
- MSD Direct Delivery Tanga Pilot
- Coca-Cola and the Global Fund Announce Partnership to Help Bring Critical Medicines to Remote Regions

ZAMBIA

In Zambia, distribution from the district level to the health centers is challenging because of small orders needed at numerous facilities, long distances, and roads that require off-road vehicles to navigate. In addition, districts have historically had the responsibility for ordering, storing, and managing commodities for the health centers in their area. In 2009, in order to address the bottlenecks associated with distribution, the Ministry of Health, Crown Agents, and the USAID | DELIVER PROJECT implemented the Essential Drugs Public Pilot program. As part of the pilot, eight districts implemented a model in which storage and management of commodities for health facilities at the district level were eliminated. Instead, the district store became a "cross-dock" or point of transit where it received pre-packaged shipments from the central level warehouse that were then delivered to health facilities without any changes to the order. Health facilities were responsible for filling out commodity orders and sending them to the district. The district again acted as a point of transit for orders, sending them to the central warehouse without making any changes.

Although the districts were still responsible for making sure that health facilities received the commodities, they were no longer responsible for managing how many commodities the health facility received. The research done during the pilot period showed that even this small change of "level jumping" without direct delivery made a significant difference in commodity availability. The districts where cross-docking was implemented showed large improvements over the control districts in the reduction of stock-outs for all commodities. For example, pediatric artemisinin-based combination therapy was stocked-out an average of 29 days in comparison districts while only stocked-out for an average of five days in the districts where cross-docking was implemented. Similar patterns were true for other tracer commodities. Other measures of supply chain effectiveness, such as storage and reporting rates, also improved in the implementation districts. Finally, researchers estimate that if the model were to be implemented district wide, under-five mortality would decrease by 21% and over-five mortality would decrease by 25%.

To learn more:

- World Bank Policy Note: Enhancing Public Supply Chain Management in Zambia
- Tanzania: 2020 Supply Chain Modeling

Distribution Outsourcing

To address difficulty with transportation infrastructure, long distances, and poor distribution planning

For countries struggling to find the transport and personnel capacity to run a successful distribution system, outsourcing distribution to a private provider that specializes in transport may be an option. Outsourcing distribution does not eliminate the government's role in distribution but rather shifts it from managing transportation to monitoring, evaluation, and actively managing a relationship with a third party provider. Sufficient capacity in the government is needed to manage contracts, provide oversight and quality assurance, and ensure adequate financing and regular payments. This requires upfront investment in training and capacity building. Some governments have chosen to outsource multiple functions of the supply chain, such as warehousing and distribution, to the same third party provider.

A major advantage of outsourcing distribution is gaining the expertise and infrastructure of a company that specializes in transportation and distribution. In addition, private sector companies may have more resources to make upfront investments in equipment and infrastructure that the government cannot afford. Multi-year agreements allow private sector companies to make these investments by ensuring their return on investment through guaranteed business and contracts.

Distribution outsourcing, however, cannot solve all distribution challenges. Private transport companies may not have the capacity or interest to deliver to rural and hard-to-reach areas due to the costs and investments needed, leaving the health sector responsible for finding ways to reach these sites. The local private sector is often fragmented and disorganized, making it hard for governments to identify appropriate partners to meet their needs at a reasonable cost.

When should distribution outsourcing be considered?

Outsourcing distribution only works when there is a high level of trust and transparency between the government and the third party provider. When entering into an agreement for outsourced distribution, private transport companies are often worried about receiving guaranteed and regular payments. In return, governments are concerned about holding the third-party provider accountable for reliable and timely delivery. Addressing these concerns and building a relationship upfront are critical for success. Transparency in selecting the third party provider is also essential to avoid corruption or favoritism (or the perception thereof) in the selection of third party providers.

In addition, outsourced distribution only works if the rest of the supply chain is functioning well. Private sector companies rely on proper procurement and supply planning to distribute the correct amount of commodities in a timely manner. The government should ensure that orders are ready on schedule and provide clear direction on where and what to transport. Without such preconditions in place, many private sector transport companies may not be willing or able to provide a high level of service. Despite these challenges, distribution outsourcing is gaining popularity in many low- and middle-income countries, with large corporate partners like Coca Cola, United Parcel Service, and others looking for ways to support governments with the transition from government-run transport networks to partnerships with the private sector.

SOUTH AFRICA

South Africa's National Department of Health (NDoH) operates the largest antiretroviral (ARV) treatment program in the world, with more than two million patients on treatment at more than 3,000 public health facilities across the country. The previous model for pharmaceutical storage and transport was decentralized and managed by each of the nine Provincial Depots, which were responsible for delivering stock to district stores and facilities. The system experienced significant challenges with delayed deliveries, expired stock, and stock-outs at the lower levels.

The NDoH applied for and receive a grant from the Global Fund to pilot an outsourcing model through a public-private partnership. In this partnership, ARVs procured by the NDoH through the Global Fund are managed from a central stockholding point by a private provider and are distributed directly to health facilities, with replenishment to the Provincial Depots, as needed. Imperial Health Sciences (Imperial) was selected after a competitive tender process to take responsibility for inventory and stock management, order processing, cold chain storage, and normal and emergency deliveries to health facilities from November 2012 to October 2014. All the medicines (currently 26 first- and second-line ARVs) are stored at Imperial's warehouse and are distributed throughout the nine provinces. During this pilot, Imperial has met a number of key performance indicators, including normal orders dispatched within three working days, emergency orders dispatched within 24 hours, and timely submission of stock and delivery reports to the NDoH. The program has faced challenges getting started. Some facilities are located in rural or high-risk areas making unplanned deliveries unfeasible. For these facilities, a weekly order and delivery schedule was created to ensure that facilities receive their stock on time. There have also been instances where suppliers sent short-dated stock that facilities did not accept, and times where miscommunications led to incorrect orders, and occasionally to stock returns.

Overall though, the system has increased ARV availability at the health facility level, and the NDoH has made all payments within 30 days of being invoiced. The success of this program is due in part to the availability of outside funding specifically for this purpose, strong political will and commitment from NDoH, and pre-established capacity of Imperial that has reduced the time and resources needed for successful startup.

NIGERIA

Nigeria is the most populous country in Africa. The country presents one of the most challenging environments for effective distribution due to its population size, lack of infrastructure, and a high proportion of rural and hard-to-reach areas. The Supply Chain Management System team in Nigeria procures rapid test kits and Cotrimoxazole centrally on behalf of the President's Emergency Plan for AIDS Relief's 12 in-country implementing partners (IPs). Prior to July 2012, commodities were delivered to a local distribution center and each IP collected and distributed stock through a separate supply chain. The result was a fragmented system that was difficult to manage, expensive to operate, and plagued by high wastage and poor stock availability. In 2012, a pilot was implemented to consolidate the supply chains into a unified system. In this system, warehousing and distribution services from regional zonal warehouse to health facilities were outsourced to several local logistics contractors. As of September 2013, this distribution model has been rolled out to four zonal distribution centers and more than 1,500 SDPs. The system has been successful in achieving a 95% on-time delivery and order fill rates, and reducing ARV stock-outs from 25% to 7%. The system has also made substantial progress toward coordinated procurement, integrated stock management, and coordinated information management. As a result, the program has been fully endorsed by the Federal Ministry of Health and the Global Fund, with the potential of scaling up the program nationwide.

Though highly successful, the system still faced numerous challenges. Major challenges include: the lack of LMIS tools at the health facility level to track data on stock usage and needs; inaccurate and/or late reports and orders from health facilities; multiple sources of supplies to the same facilities; stock imbalances at health facilities; insufficient supply of certain commodities at higher levels of the supply chain; and inaccurate descriptions of facility locations.

Vendor-Managed Inventory

To address stock limited transport infrastructure, long distances, poor disruption planning, and changing commodity needs

Vendor-managed inventory (VMI) systems are systems in which the supplier, or vendor, manages the stock and replenishment decisions for the customer. In VMI systems, the vendor is responsible for determining when the sites need to be replenished, and is also responsible for maintaining adequate stock levels. This is very rare in public health supply chains in EWEC countries. Most countries instead determine the schedule for ordering commodities, the amount needed, and then take responsibility for storing and distributing the commodities themselves or through their partners. In true VMI systems, all these decisions would instead be made by the vendor and not by the customer or purchaser of the commodities.

VMI has many potential benefits, including cost savings, quicker turnaround of commodities, reduced stock-outs, and relieved ordering and transportation burden on government. However, like distribution outsourcing, VMI does not remove the government's role in distribution but rather shifts the focus from tracking orders and making deliveries to overseeing contracts with vendors. The government needs to work with the vendor to establish payment terms, inventory requirements (minimum/maximum stock levels, replenishment frequency, etc.), and determine and monitor performance targets.

When should vendor-managed inventory be considered?

There are a few cases where true VMI systems are used by governments to manage a limited number of commodities, but these commodities usually meet very specific criteria. Commodities currently managed by VMI are: often locally manufactured; have very specific storage conditions or short shelf lives that are better managed outside of government warehouses; move in and out of the supply chain quickly; or require long lead times to acquire raw materials, making the vendor more able to predict product availability than the public sector. For example, the case studies highlighted below deal solely with laboratory equipment and supplies. There are several factors that make laboratory commodities particularly viable for VMI systems. One, laboratories are a specialized service available at a fairly limited number of SDPs, making it feasible for a vendor to take on direct delivery to each lab. Two, laboratory reagents often have a short shelf life (often a month or less) and therefore do not have time to travel through the public health supply chain. Lastly, some laboratory commodities are specific to certain machines allowing for the opportunity to contract with vendors to both supply the commodities and regularly maintain the equipment. There is a built-in incentive for the vendor to keep the equipment working to create demand for the commodities (i.e., reagents) that are used with the equipment.

Moving to a VMI requires a high level of confidence in the supplier's ability to maintain adequate stock levels, conduct quality assurance, and deliver commodities when needed and in the right quantity. The government and vendor must be willing to be transparent and share logistics data with each other. VMI works best when the supplier has access to automated, real time consumption data. As a result, examples of true VMIs are rare in the public health sector.

VMI is not a solution for many commodities, but it may be a way to increase access to specific high-priority underutilized commodities of interest to EWEC countries and the UN Commission on Life-Saving Commodities. For example, resuscitation equipment—one of the critical commodities for

saving newborn lives—may be best managed by the vendor who understands the lifespan of the product, its usage, and how often it needs to be replaced or maintained. When a select subset of commodities are moving through a VMI system, it is important to still maintain integrated information systems so that decision makers from the public health system know what is moving through the system even when they are not directly in charge of its distribution.

MALAWI

In Malawi, VMI is used by the laboratory at the National Blood Transfusion service to manage laboratory equipment. The vendor is responsible for placing equipment in the laboratory, maintaining the equipment, and supplying reagents. The lab uses the reagents to run tests, and provides the vendor with information about how many tests are run. The vendor uses this information to correctly resupply the laboratory with reagents at the appropriate time.

To learn more:

- Selecting and Implementing Vendor Managed Inventory Systems for Public Health Supply Chains: A Guide for Public Sector Managers

NIGERIA

The National Agency for the Control of AIDS (NACA) selected and sub-contracted with a number of local private sector suppliers of laboratory equipment, reagents, and test kits to deliver these items directly to SDPs. Initially, the suppliers visited SDPs to assess their stock status for HIV and AIDS laboratory items and to set minimum stock levels, maximum stock levels, and review periods. At the end of each review period, suppliers visited each SDP, determined the types and quantities of test kits and reagents that needed to be replenished, and then delivered the supplies. They also determined if any equipment needed servicing. The suppliers then prepared an invoice for the quantities supplied to each SDP; the invoice was sent to NACA for verification and payment.

To learn more:

- Selecting and Implementing Vendor Managed Inventory Systems for Public Health Supply Chains: A Guide for Public Sector Managers
- Vendor Managed Inventory: Is it Right for your Supply Chain?

Conclusions

Improving in-country distribution may have an impact on overall product availability and product quality at SDPs in EWEC countries. The examples in this brief demonstrate how countries are currently working on new models to address distribution challenges. Implementing distribution changes requires leadership, resources, and some flexibility to manage the up-front investments needed to make long-lasting and sustainable changes in distribution practices.

All examples mentioned in this brief required significant changes to the country's distribution models and, in most cases, significant changes to other functions of the supply chain. Change may be welcomed by some stakeholders, particularly those interested in being associated with a successful innovation, or when the change is a part of an initiative with strong political backing (i.e., improvements to distribution of family planning commodities in a country with a strong push to improve reproductive health). However, resistance is likely to come from stakeholders at all levels, including prominent politicians who fear that changes, such as outsourcing, will reflect negatively on the government's capacity, to district level employees who fear losing the opportunity to receive allowances if they are no longer included in the distribution process. With adequate planning, communication, political will, and advocacy, such examples of resistance can be moderated. As mentioned in the moving warehouse example, some resistance was mitigated against by ensuring that the system included only free products that would not negatively affects districts' abilities to receive income through cost recovery from the SDPs.

Changing distribution models may also change the visibility and accountability of a supply chain system. In some cases, this may cause apprehension among stakeholders. For example, changing to a direct delivery model may cause regional or national warehouses to be concerned that the system will highlight an insufficient capacity to fulfill orders. Asking the regional or national level to take on responsibility for commodity distribution when it was previously the responsibility of a lower level of the health system may raise political concerns about taking on problems that otherwise would be the responsibility of a different level of the system. Despite these challenges, there may also be very positive outcomes from this increased visibility. As seen in the Tanzania example, delivering directly to SDPs gave the MSD more insight into what was happening at the health facility level and showed it that they had previously fulfilled orders for non-functional health centers, thereby allowing it to decrease waste and create a more efficient system. It also gave the SDPs an opportunity to better understand the role of the MSD as an entity that provides a direct and valuable service to its customers.

Changes to delivery systems may also lead to changes in the financing needed at various levels of the system. As seen in the examples from Tanzania, Mozambique, and elsewhere, systems that include direct delivery to health centers may uncover hidden costs that have been under-resourced in the past or may require budgets to be moved from one level to another. Consolidating costs at a higher level may make delivery systems appear more expensive, even when data show that, in reality, the full costs of the system across all levels are less.

As mentioned throughout, these examples either rely on a functioning supply chain at all levels or require improvements to other functions of the supply chain. Improving the distribution system in isolation will not lead to the desired outcomes when bottlenecks in other functions inhibit progress. In addition, most of these examples rely on the collection and analysis of data in some form, the importance of which is explored more deeply in the *Promising Practices in Data Management* brief. As these country examples have shown, change is possible and within reach for many EWEC countries.

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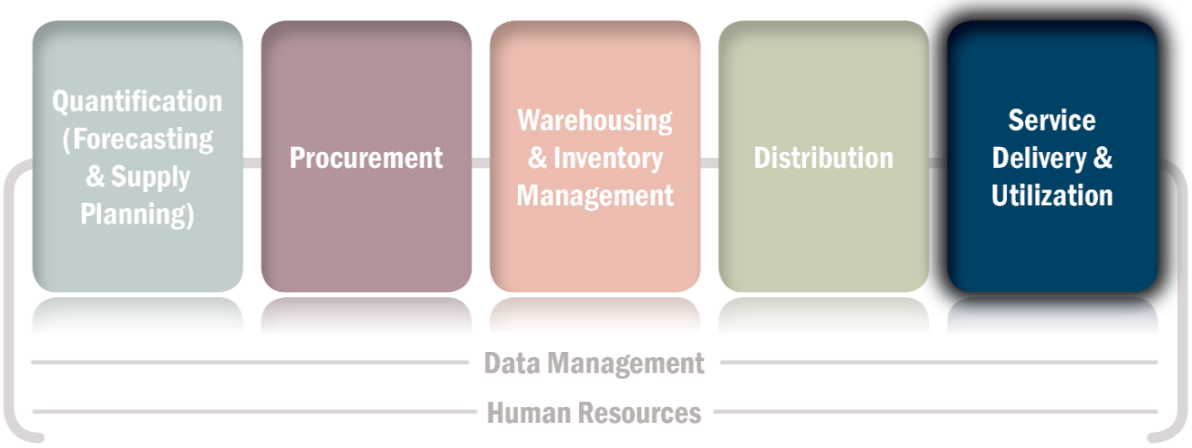
Promising Practices
Service Delivery and Utilization

Brief #5 in the *Promising Practices in Supply Chain Management* Series



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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Service Delivery and Utilization.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

ACT	artemisinin-based combination therapy
AL	artemether/lumefantrine
AMFm	Affordable Medicines Facility-malaria
CBD	community-based distribution
CHW	community health worker
CORDAID	Catholic Organisation for Relief and Development Aid
DMPA	depot medroxyprogesterone acetate
DRC	Democratic Republic of the Congo
Global Fund	Global Fund to Fight AIDS, Tuberculosis, and Malaria
HSA	Health Surveillance Assistants
JSI	John Snow, Inc.
LMIC	low- and middle-income country
MOH	Ministry of Health
NGO	nongovernmental organization
PBF	performance-based financing
SDP	service delivery point
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
SMS	Short Message Service
TRT	Technical Reference Team
UNICEF	United Nations Children's Fund
USAID	US Agency for International Development

Background

Service delivery and utilization is the last step in the supply chain, where all the inputs at higher levels of the chain, such as procurement and distribution, become the output to be consumed by the beneficiaries of the health system. Without effective service delivery, none of the commodities moved through the supply chain reach the people who need them.

Service delivery and utilization are complex because they occur at several levels of the public health system and also in the private sector. Basic commodities and care are delivered at health centers (public and private). More specialized commodities and care are administered at hospitals. With increasing frequency, individuals are able to receive health services and consume commodities at the community level through such mechanisms as public sector community health workers (CHWs) or volunteers, community-based distribution agents, and private sector shops and pharmacies.

There are numerous barriers at the level of the service delivery point (SDP) that inhibit successful service delivery and utilization. The barriers are presented in the table below. While the practices highlighted in this brief are a good starting point for addressing common barriers to service delivery and utilization, creating demand for commodities that successfully make it through the supply chain is a larger issue that is addressed in greater detail by the UN Commission on Life-Saving Commodities for Women's and Children's Health's Demand and Utilization Technical Reference Team. In addition, because service delivery happens in so many locations throughout a country, insufficient human resources to staff and support each SDP may be a significant barrier. Detailed information on addressing human resource issues is available in the *Promising Practices in Human Resources* brief.

Barriers	Description	Promising Practice(s) that Address the Barriers
Competing priorities for health center staff	Health workers in low- and middle-income countries are often overworked and under-resourced. Health workers are often responsible for multiple jobs, including clinical care, reporting, ordering and managing commodities, and cleaning and maintenance of equipment and the facility.	• Performance-based financing at the SDP
Difficulty accessing hard-to-reach communities	For individuals living in remote and rural areas, the time, money, and effort it takes to reach the nearest health facility may be prohibitive and limit access to care.	• Community-based distribution • Subsidizing underutilized commodities
Lack of community engagement	Inadequate information provided to the community on service delivery and product availability issues, leading to low or nonexistent community engagement and limited accountability.	• Increase community participation in service delivery accountability
Unfavorable pricing for the private sector	Private sector entities face challenges when trying to supply products at a price that is affordable for the consumer while still profitable for the entity. This is sometimes exacerbated in an environment where the public sector secures donated commodities and provides products at no cost.	• Subsidizing underutilized commodities

Performance-Based Financing at the SDP

To address competing priorities for staff

Performance-based financing (PBF)—also known as "pay for performance" or "results-based financing"—involves the provision of incentives (monetary or non-monetary) in return for meeting well-defined and measurable targets. The incentives may be given to individuals or to groups and institutions. PBF has long been used in private sector supply chains but used in a more limited capacity in public sector supply chains.

PBF has the potential to improve health worker performance and strengthen health systems. It has been used to improve quality, timeliness, and accuracy of reporting and increase commodity availability. While PBF may lead to positive outcomes, it may also lead to unintended negative consequences. For example, a program that incentivizes health workers based on the number of commodities distributed could unintentionally encourage health workers to focus on regions where demand for products is high, providing a disincentive to work in rural and hard-to-reach regions or areas where demand is low. In some cases, health workers may even inflate or falsify records to earn incentives. There is also concern about whether PBF is sustainable, particularly at scale, when resources are needed both for incentives and for ongoing monitoring and verification of targets.

When should performance-based financing be considered?

Countries that are struggling to manage their supply chains may also face challenges implementing a successful PBF scheme because it requires reliable systems to ensure accountability, monitoring and verification of performance, and timely distribution of incentives. However, a successful PBF scheme has significant potential to improve the very factors that contribute to struggling supply chains, such as poor information exchange and low productivity. The main issue to consider when contemplating the introduction of PBF is whether the resulting benefits justify the resources put into funding implementation and incentives.

Incentives that are well-designed are large enough to affect behavior, desired by the majority of recipients, foster team work, and may be adjusted to reflect the level of performance and replicable elsewhere. Incentives designed without input from stakeholders, with unexplained or complicated rules, unmeasurable or unreachable targets, implemented without consideration for system capacity, or are poorly monitored, are unlikely to work.

RWANDA

In the early 2000s, user fees for health services were re-introduced in Rwanda, leading to a significant decline in service utilization. Adding to the problem, health workers had fixed low salaries that were not tied to performance. Many public sector health workers left for the private sector where working conditions were better and salaries higher. In 2002, two PBF initiatives were introduced, one by HealthNet TPO, a Dutch aid agency, and one by the Catholic Organisation for Relief and Development Aid (CORDAID) and its Memisa fund. A third scheme was introduced in 2005 by Belgian Technical Cooperation. Based on the success of these initiatives, a national PBF scheme was introduced countrywide in 2006. The scheme incentivized progress on 14 maternal and child output indicators. Some indicators were based on visits (such as prenatal care visits or facility-based births) while others were based on services provided during visits (such as delivering the tetanus vaccine during antenatal care visits). Facilities reported monthly to a district steering committee that was responsible for authorizing payments. Payments were issued based on the facility's structural measures (such as having adequate medicines, supplies, and human resources to provide services) and process measures (such as the content of care provided during visits). The committee conducted unannounced quarterly visits to verify records and conduct interviews with patients. Very little false reporting was discovered. Incentives could be used at the discretion of the facility. Approximately 20% went to increasing facility spending while about 80% went to increasing staff salaries.

The scheme was effective in spurring progress on some indicators. Not surprisingly, indicators less in the control of the provider (such as timing of a woman's first antenatal visit) were less likely to show improvement than those more directly in the power of the provider (such as providing tetanus vaccination during antenatal care). Facility-based births, however, were so highly incentivized that providers not only encouraged women to deliver at the facility during prenatal visits but also sent CHWs on outreach visits to encourage pregnant women to deliver at the facility. Building on the success of the PBF system at the community level for clinical outcomes, in 2011 the Ministry of Health (MOH) and the Supply Chains 4 Community Case Management Project tested the introduction of nine supply chain indicators to improve product availability with CHWs. After a year of implementation and a midline assessment, three of the tested indicators were seen to have significant improvement across all quarters in all three test districts. Based on these results, a supply chain indicator (stock card accuracy) has been added to the national community PBF scheme to help draw attention to the importance of supply chain tasks and improve supply chain data recording practices at the community level.

To learn more:

- Rwanda: Performance-Based Financing in the Public Sector
- Rwanda: Community Health Supply Chain Midline Evaluation

DEMOCRATIC REPUBLIC OF THE CONGO

The Democratic Republic of the Congo (DRC) is one of the poorest countries in the world. Recently, the DRC was deemed a "failed state" due to political instability, lack of functioning public services, and criminality and corruption. In some parts of the country, the public health system has disintegrated, leaving people to rely on an informal private sector for medicines and health services. In 2005, the Health Authority of South Kivu, the Bureau des Oeuvres Médicales (a local nongovernmental organization [NGO]), and CORDAID partnered to launch a PBF scheme with an experimental design to test its effectiveness. Two intervention districts (Katana and Idjwi) and two control districts (Kalehe and Kabare) were chosen to participate. The control districts received essential medicines and supplies and fixed staff bonuses but no performance-based payments.

The PBF scheme entitled health facilities in the intervention districts to cash subsidies for progress on 16 indicators, including the number of outpatient visits, number of women using modern contraceptives, and number of fully-immunized children by 12 months. Monthly payments to facilities varied from $200 to $4,000 depending on progress on the indicators. Progress was verified by district authorities on a quarterly basis as well as by community groups. In addition to payments for providing predetermined health services, health facility managers in the intervention districts were invited to develop business plans, analyze revenues, and improve their decision-making process for spending. Managers were also allowed to negotiate user fees with their communities while control districts had user fees set by higher-level health system authorities or by supporting NGOs. Intervention facilities were also given cash support to directly purchase commodities from competitive distributors in their district while control facilities relied on the traditional system of receiving distributions from the central-level health system.

Between 2005 and 2008, stock availability was significantly better at the intervention facilities compared to the control facilities. There were also statistically significant improvements in the intervention districts compared to the control districts for the following indicators:

- 21 percentage point increase in childbirth at a health facility
- 10 percentage point increase in the use of a modern health facility or pharmacy
- 37 percentage point increase in patient-perceived medicine availability
- 15 percentage point increase in patient-perceived quality
- 12 percentage point increase in respect for patients by facility staff

This progress was seen despite the fact that the intervention districts actually received less external support than the control districts (approximately $2 per capita compared to $9-12 per capita in the control districts). The intervention districts saw a 25% increase in revenues from user fees during the study period whereas the control districts saw a 45% decrease. This is likely due to the fact that intervention facilities could determine their own user fees. Also, an increased perception of quality at intervention facilities led to increased use (and therefore payment of user fees) at those locations. Household surveys found that user fees were most likely to affect relatively wealthy households (which saw an increase in health spending) but not the poorest quartile, which actually saw a 14% decrease in household health expenditure during the study period.

To learn more:

- Performance-Based Financing Experiment Improved Health Care in the Democratic Republic of Congo
- Review of the Results-Based Financing Experiences in the Democratic Republic of the Congo

Community-Based Distribution

To address poor access to care among hard-to-reach communities

Community-based distribution (CBD) relies on community-based individuals (often non-professionals) to distribute commodities directly to people who use them. CBD agents are often responsible for increasing demand and providing education about the commodity as well as distribution. Some programs use unpaid volunteers, some use salaried workers, and others allow CBD agents to keep profit from the sale of commodities. Some programs charge consumers for the commodities and others provide commodities at no-cost to the consumer. Some CBD agents are also CHWs trained in health education, prevention, and community-based care for common health issues. CBD has the potential to drastically improve access and use of vital medicines. This is particularly true in hard-to-reach areas and among underserved populations.

When should community-based distribution be considered?

CBD is designed to increase convenience and accessibility of commodities for the end user. It may also be used in conjunction with demand generation and social marketing, simultaneously increasing supply and demand. Because CBD is designed to increase demand and consumption, over-consumption of commodities needs to be considered. For this reason, some would argue that CBD is best for preventative commodities (such as insecticide-treated bed nets or family planning commodities) that everyone needs and where there are not concerns about over-consumption. When CBD is done by paraprofessionals and/or lay individuals, it works best for commodities that require limited diagnosing and dispensing expertise. When CBD agents are well-trained or serving dual roles as CHWs, they may safely and effectively dispense commodities, such as injectable contraceptives and essential medicines, used in community case management.

CBD does not address any higher-level supply chain barriers and is only effective when supplies are available at the SDP.

UGANDA

Living Goods supports networks of CBD agents who go door-to-door teaching families how to improve their health and economic status by selling products, such as simple treatments for diarrhea and malaria, fortified foods, safe delivery kits, clean cook stoves, and solar lights. Similar to the "Avon" direct-sales model, the CBD agents bring the market straight to consumers' doors, and capitalize on existing local networks in the communities where Living Goods operates. By delivering essential health education and selling essential health products, Living Goods agents improve the health and productivity of poor families while earning a modest income from the sale of goods.

Living Goods works to create a sustainable distribution platform for a wide spectrum of products designed to improve the health and lives of poor individuals and families. Living Goods aims to not only grow its own sustainable networks but also help global NGOs and businesses replicate the model throughout the developing world. To that end, Living Goods created an Advisory Services Division in 2012.

Living Goods engaged the Poverty Action Lab to conduct a randomized controlled trial focused on Living Goods impact on reducing mortality and morbidity of children under five. Final results will be available in 2014. However, a qualitative study in 2012 found that competitive pressure from Living Goods actually helps improve local markets by improving quality and reducing price. When Living Goods and its partner, BRAC, enter a community, the broader market responds with a 20% reduction in fake medicine sales and 18% lower prices, leading to a 39% increase in antimalarial medicine use.

To learn more:

- LivingGoods

MALAWI

In Malawi, fewer than half of married women use any kind of contraception. The contraceptive prevelance rate is 46%, with 42% of women using modern contraception (pills, sterilization, injectables, etc.) and 4% using a traditional method (rhythm method, withdrawl, etc.) In 2008, the Malawi MOH, supported by the USAID | DELIVER PROJECT, started a CBD pilot to distribute depot medroxyprogesterone acetate (DMPA), also known as Depo-Provera. In this pilot, Health Surveillance Assistants (HSA) were trained in DMPA administration as well as product management. During the six-day training, only four hours were dedicated to supply chain management. Although there was initially some resistance to the pilot among clinicians, pharmacists, and regulatory bodies, who were unsure whether paraprofessional HSAs were qualified to dispense DMPA, it was eventually well-received. The Reproductive Health Unit of the MOH, numerous NGOs, and other stakeholders were involved in advocating for and implementing the pilot. The MOH also released a written policy directive stating that anyone trained in DMPA may provide it, opening the door for CBD and allowing HSAs or any other trained CBD agents to distribute DMPA.

Problems at other levels of the supply chain greatly affected DMPA availability and thus the success of the pilot. HSAs were supposed to report to their MOH health center once per month to meet as a group, access supervision, and resupply. In practice, the frequency of supervision and restocking varied and stock-outs were common.

Despite implementation challenges, the program was well-received by the community, which cited the ease of access to DMPA as one of the biggest benefits of the program. Program records reveal that between December 2008 and January 2010, HSAs served over 2,000 new DMPA users, an estimated 7% of whom had never used family planning until receiving DMPA from an HSA. The pilot also demonstrated that DMPA could be safely administered by HSAs. Observations of HSAs administering DMPA showed that, on average, HSAs successfully followed 13 of 16 recommended safety guidelines. Guideline adherence ranged from 100% adherence (for opening the package to get a new sterile syringe) to only 47% adherence (for washing hands with soap and water).

To learn more:

- Evaluation of Community-based Distribution of DMPA by Health Surveillance Assistants in Malawi
- Malawi: Distribution of DMPA at the Community Level—Lessons Learned

Subsidizing Underutilized Commodities

To address poor access to care among hard-to-reach communities and unfavorable pricing for the private sector

A commodity subsidy is financial support (usually in the form of decreased price) given to individuals or institutions to promote the purchase and use of the commodity. Health commodities may be subsidized at multiple levels of the supply chain, from global subsidies that reduce costs for first-line buyers (those who buy directly from manufacturers) to subsidies at the SDP that reduce costs for the end user. Subsidies may be distributed as purchase subsidies (reducing the cost of the product) or as sales subsidies (increasing the revenue made from each sale by giving the distributor a subsidy payment for each commodity sold or distributed). Subsidies really address the cross-cutting issue of supply chain financing, but are discussed here due to their impact on access and use of commodities at the SDP.

When should subsidies for underutilized commodities be considered?

Increasing low-cost medicine availability may increase consumption of important live-saving treatment. However, it runs the risk of driving up demand for commodities without also driving up demand and supply for diagnostics. Therefore, similar to CBD, subsidies are best used for commodities that are needed by most people and that may be safely dispensed by lay individuals, otherwise there is a risk of dispensing to those who do not need the commodity. In addition, subsidies that require consumers to pay a fee, even a small fee, as highlighted in the examples below, may be unaffordable to very poor families.

The examples listed below highlight subsidies for artemisinin-based combination therapies (ACT) for malaria treatment that increased access at private sector shops as part of the Affordable Medicines Facility-malaria (AMFm), a financing mechanism of the Global Fund to Fight AIDS, Tuberculosis and Malaria. These examples were chosen because they meet the criteria for a proven practice and have significant evidence of their effectiveness. The AMFm program, however, has not been without controversy. While presumptive treatment of malaria for individuals presenting with fevers is common practice in many low- and middle-income countries (LMICs), in 2010 the World Health Organization recommended moving toward parasitological diagnosis before treatment, calling into question the practice of encouraging ACTs purchased in the private sector without diagnosis.

While AMFm is highlighted here due to strong evidence that it increases access to and use of an underutilized commodity, there is emerging evidence that subsidies for other commodities are also effective. For example, Bayer HealthCare and Merck have recently agreed to halve the price of their contraceptive implants for qualifying LMICs.

TANZANIA

ACTs are the recommended treatment for malaria because they are highly effective and have the potential to quell the development antimalarial resistance. In some LMICs, as many 60% of individuals seek treatment for malaria outside the public health system, buying medication at private sector shops where ACTs are sold at higher prices than alternate treatment regimens, making them less attractive for consumers. In 2008, the Global Fund launched AMFm, which offers first-line buyers highly subsidized ACTs, with the goal of making low-cost ACTs more widely available. In anticipation of its rollout, a pilot was conducted in Tanzania from 2007 to 2008 to test the effectiveness of subsidies on ACT availability and utilization. In this intervention, the project managers procured artemether-lumefantrine (AL), which is the recommended first-line ACT, and sold the commodity to a pharmaceutical wholesaler at the highly subsidized price of $0.11 per dose (88% below the price offered to public buyers). The wholesaler received no instructions or restrictions other than to sell the ACTs to medicine shops in the two intervention districts according to standard practices. It was made clear that the project managers would not monitor or hold the wholesaler accountable for pricing, stocking, or other practices.

The pilot was successful in increasing access to ACTs. During the pilot, the number of private shops stocking ACTs in the treatment group went from 0% at baseline to 72% at endline, while the control districts saw negligible changes. The proportion of antimalarial consumers purchasing ACTs (versus other products) rose from 1% to 44% in the treatment districts, while no change was seen in the control districts.

To learn more:

- Piloting the Global Subsidy: The Impact of the Subsidized Artemisinin-Based Combination Therapies Distributed Through Private Drug Shops in Rural Tanzania

UGANDA

From 2007 to 2010, the Uganda MOH and Medicines for Malaria Venture provided a 95% subsidy for AL as a first-line ACT treatment. Subsidized ACTs were branded during the pilot to differentiate them from the non-subsidized brands available in the public sector. The subsidized product had a leaf on the packaging and was known as "ACT with a leaf." A comprehensive communication campaign (community mobilization, community events, radio spots and talk shows, posters, point of sale advertising) was conducted to increase brand recognition in the community. A third party was responsible for supply chain management of "ACT with a leaf" in intervention districts, although the supply chain was designed to replicate existing supply chains for antimalarial commodities. However, to ensure availability at rural shops, licensed medicine shops received their "ACT with a leaf" directly from the distributor or sub-distributor. To properly dispense "ACT with a leaf," medicine shop attendants received comprehensive training in malaria case management, safety monitoring, and supply logistics.

Exit surveys done with consumers leaving private shops at baseline and endline found that consumers in the treatment district experienced a six-fold increase in ACT purchase within 24 hours of fever onset relative to the comparison district. Subgroup analysis found an even greater effect (tenfold increase relative to the comparison district) when ACTs were purchased for children under five.

To learn more:

- Closing the access barriers for effective anti-malarials in the private sector in rural Uganda: Consortium for ACT private sector subsidy (CAPSS) pilot study

Increasing Community Participation in Service Delivery Accountability

To address the lack of community engagement

Community participation in service delivery accountability is the process of engaging communities in holding service delivery providers accountable for providing quality services. For the process to work, communities should be knowledgeable about the services to which they are entitled and have a mechanism to ensure that those services are provided. In cases of corruption or blatant incompetence, the community may serve as a watchdog over service delivery providers. However, in many cases, the relationship between communities and service providers is a collaborative one in which both parties agree on their priorities, determine the biggest barriers to quality service delivery, and how, when, and by whom those barriers may be addressed.

When should community participation in service delivery accountability be considered?

Community participation in service delivery accountability works best when the service delivery problems are within the control of service delivery staff. For example, holding staff accountable for stock availability may improve such issues as poor stock management, inaccurate or late requisitions, and commodity loss or theft. However, if stock-outs are caused by commodity shortages at higher levels of the supply chain, an accountability intervention at the SDP level will be ineffective. Community participation in service delivery accountability also requires community engagement and works best when addressing issues the community cares about. Issues visible to patients accessing services, such as long wait times, rude treatment by health staff, and commodity availability, are much more likely to be important to the community as compared to behind-the-scenes issues, such as on-time reporting.

UGANDA: UREPORT

Funds for development, including cash and commodity donations for maternal and child health, are usually distributed in a top down fashion, leaving communities with limited knowledge of what is supposed to be reaching their community and few mechanisms to hold the public sector or NGOs accountable. In 2010, the United Nations Children's Fund (UNICEF)/Uganda introduced an initiative called Ureport, which gives communities a mechanism to report on the development of their communities. The program started by training Boy Scouts across the country as "social monitors" to report on issues important to their community via Short Message Service (SMS). Since then, more organizations have become involved, helping to recruit over 130,000 social monitors. Social monitors receive weekly polls and are updated on their results. Data collected from Ureport are shared with the public health sector as well as government officials, civil society groups, social media, and local media. Here are some examples of Ureport messages sent to social monitors:

- "Hello Ureporters! We want to know if the health center near your home is stocked with medicine? Please respond with YES or NO. It's FREE! UNICEF"
- "25% of U-reporters say service at their local health center is bad. We shall share this with the Ministry of Health and ask for a response. I will update you."

Ureport covers a wide range of development issues, however, reducing stock-outs, particularly for ACTs, is a key aspect of the program. Data collected from Ureport are used to check official data and hold the public sector accountable for addressing supply chain and stock-out issues in a timely manner.

To learn more:

- Ureport Poll Results
- Ureport: Community empowerment via RapidSMS-Uganda

UGANDA: COMMUNITY-BASED MONITORING OF PRIMARY HEALTH CARE PROVIDERS

To determine whether community-based monitoring of primary health care providers is effective in improving service delivery, a randomized field experiment was conducted in 50 communities in Uganda. Leaders from local NGOs facilitated meetings in each community to share "report cards" on the community's health facility, including service quality and utilization, and comparisons to other facilities. During the meeting, the community compiled suggestions for improvements into an action plan that could be enacted without additional resources. The plans varied by community, but the most common complaints raised dealt with absenteeism, long wait times, lack of attention from health workers, and differential treatment. Health workers had a separate meeting where facilitators highlighted differences in reported service delivery from the providers and the community. Finally, a meeting with community representatives and health workers was held and created a "community contract" in which community members and health workers agreed on what needed to be improved, how, when, and by whom. Six months later, health workers and community members were brought back together to discuss progress in the implementation of the community contract.

The intervention improved service utilization and health outcomes. Of particular relevance to this brief, intervention facilities saw statistically significant improvements in stock-outs for three of four tracer commodities. There was no systematic difference in the supply of medicines between the treatment and control group. The control facilities actually served fewer patients, therefore, the authors hypothesize that the observed difference in stock-outs was due to decreased leakage of medicines at the treatment facilities.

To learn more:

- Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda

Conclusion

Effective service delivery and utilization rely heavily on all aspects of the supply chain to ensure that medicines and supplies are ready for the health workers and patients who need them. But service delivery and utilization also go beyond the supply chain, relying on qualified clinical and pharmacy personnel to diagnose and treat illnesses, clean and comfortable facilities with enough space to see patients and store commodities, appropriate packaging and formulation of medicines to make them easy to dispense and easy to adhere to, proper community education on medication adherence, demand generation, and SDPs that are accessible to people living in rural and remote areas. While some of these factors are beyond the scope of this brief, interventions that take an integrated approach, including those addressing supply issues and broader care and demand issues, are more likely to be successful.

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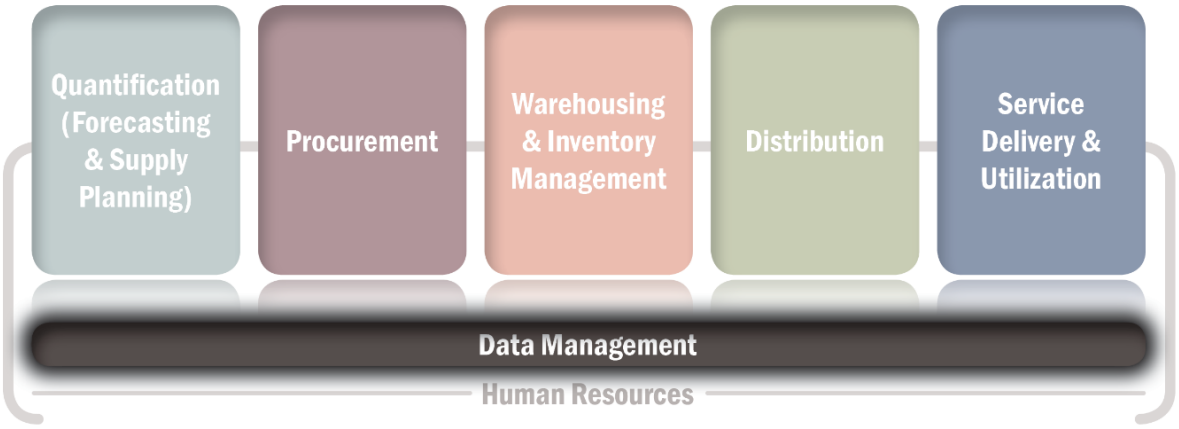
Promising Practices
Data Management

Brief #6 in the *Promising Practices in Supply Chain Management* Series



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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Data Magement.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

AL	artemether/lumefantrine
DPAT	District Product Availability Teams
HSA	Health Surveillance Assistants
ICT	information and communications technology
ILS	Integrated Logistics System
JSI	John Snow, Inc.
LMIC	low- and middle-income countries
PRISM	Performance of Routine Information System Management
RHIS	routine health information systems
SC4CCM	Supply Chains for Community Case Management
SDP	service delivery point
SIAPS	Systems for Improved Access to Pharmaceuticals and Services
SMS	Short Message Service
SOP	standard operating procedure
TRT	Technical Reference Team
USAID	US Agency for International Development

Background

Data management is intrinsic to all aspects of running the supply chain. It is essential for managing the ongoing operations of the supply chain, assessing performance over time, and identifying problems and opportunities for improvements.

Data management encompasses identifying, collecting, validating, storing, analyzing, and applying information to make decisions and, most importantly, to take action. Depending on the scope and sophistication of the supply chain operations, useful data may include:

- Detailed stock information, such as initial stock on hand, quantity received, consumption, remaining stock on hand, wastage/spoilage, transfers, stock-outs, etc.
- Lead times to replenish individual facilities
- Seasonal variations in consumption and accessibility of facilities
- Stock levels at warehouses that, at times, may indicate the need to ration available supplies
- Demographic data on the target population
- Disease prevalence, which will affect demand for medications and commodities used to treat the disease

Unfortunately, the supply chain often has to settle for imperfect data, or rather, data that are inaccurate, incomplete, delayed and/or not specific to the situation. Even when high quality and timely data are collected, many countries struggle to use data to inform supply chain decision making. The reasons for these data management challenges are widespread, including the lack of technical capacity of personnel and the lack of suitable data collection and management tools.

Human resource capacity is likewise a cross-cutting issue affecting all supply chain functions, including data management. Training may be used to successfully address capacity for data collection, however, the bigger challenge is to build capacity for data analysis and use in decision making. For additional information on improving human resource capacity for supply chain management outside of data management, please refer to the *Promising Practices in Human Resources* brief.

Designing effective data management solutions consists of three primary activities:

- An **assessment of supply chain information needs** should be conducted, including who needs the information, how it will be used, and the potential actions that may be taken in response to the data. Second, the platform best suited to supporting data collection should be selected. This may range from paper-based systems to mobile phones to sophisticated software programs.

- **Standard operating procedures** (SOPs) should be developed, with staff trained in how to adhere to the SOPs. Staff need to be trained on how to use the selected tool(s) and, equally importantly, on how to analyze and use the results.

- **The collected data should be made available in a format that enables decision making.** The format will depend on the resources available and the audience, but the data should be accessible and easy to use to answer key supply chain performance questions.

The table below presents the most common barriers to effective data management and lists the promising practices that address each barrier. The promising practices, when looked at holistically, encompass all three primary activities of effective data management solutions.

Barriers	Description	Promising Practice(s) that Address the Barriers:
Delayed, inaccurate, and incomplete data	Data that are not accessible for decision making within a reasonable timeframe after collection will not reflect current levels of need or supply. Inaccurate data may lead to under- or overestimating commodity needs. Incomplete data means that guesswork must be used to determine the current level of need or supply.	• Focused data collection • Use information and communications technology (ICT) tools for data collection and management • System design to improve data quality and use
Insufficient use of data for decision making	Data are often collected, but are rarely used to the fullest extent possible in decision making. Exacerbating the problem is the over-collection of unnecessary data. Not only does this use up valuable personnel time, it makes it difficult to see and understand the data that are actually important for decision making. Streamlining data collection activities to focus only on data that will be used helps address this barrier.	• Focused data collection • Create and use a logistics information portal • Use information and communications technology (ICT) tools for data collection and management
Insufficient human resource capacity for appropriate data collection and use	Human resource limitations at all levels of the system significantly impact data management. Inadequate training, incentives, and feedback result in poor data collection quality and inadequate use throughout the supply chain.	• System design to improve data quality • Incentivize data completeness and accuracy
Lack of easily accessible and shareable information	In many locations, there is a wealth of data collected. Too often, data are inaccessible because: they are paper-based; decision makers are located far away; the data are locked up in a secure setting; or the data are located on a computer to which few people have access.	• Use ICT tools for data collection and management • Create and use a logistics information portal

Focused Data Collection

To address barriers related to delayed, inaccurate, or incomplete data and the insufficient use of data for decision making

In most low- and middle-income countries (LMICs), significant amounts of data are collected at all levels of the health system, with the majority of data being created and compiled at the service delivery point (SDP). Countries should work to ensure that the amount and type of data collected are appropriate for the intended use. Regular review of data collection practices should occur to ensure that the right kind, amount, and frequency of data collection are performed. Because the supply chain is so heavily dependent on data at all levels, the temptation is often to place emphasis on collecting *more* data. This places an enormous burden on lower level health workers and supply chain personnel, and limits their ability to complete other aspects of their work. This burden also reduces employee motivation for the timely or accurate completion of the data collection requirements. Rarely are all the data collected used to make decisions for the improvement of the supply chain or commodity procurement. Ensuring that only the right data are collected helps reduce the amount of human and financial resources that are needed to complete these activities and improves motivation for the timely and accurate completion of data collection.

When should focused data collection be considered?

It is often best to err on the "less is more" side of data collection. One approach is to itemize the supply chain data elements that are available and *potentially* of interest and then, using supply chain analysts or knowledgeable personnel, determine which are truly necessary to drive decisions at each level of the supply chain. This approach resembles a "reverse engineering" process, where each data element is evaluated against answers to the questions: "What do we use this for?" and "What decision does it drive?" If there is no quick answer, the data element should be considered for removal from the data collection process. An alternative and more circumspect approach is to start with a list of the activities that must be supported and the decisions that need to be made, and then identify data elements that will truly inform these needs. This approach resembles a cost-benefit analysis, where the collection of each data element is justified based on its contribution to efficiently running the supply chain. Either approach should include: stock data necessary for the algorithm(s) used to calculate optimal replenishment amounts; triggers for identifying looming stock-outs; key indicators that may be used to identify performance problems (e.g., product shrinkage, recurring stock imbalances, repeated late reporting); statistics to support long-term forecasting for procurement; and more, as suits the specific supply chain.

Collecting minimal data creates a streamlined process that requires less training and less staff effort. In many cases, collecting a small amount of data may be surprisingly effective. In addition, the relative simplicity and expedience of this approach increases the frequency in which data are available. For example, requiring a facility to submit only stock-on-hand counts on a weekly basis increases visibility into consumption patterns, making it easier to identify impending stock-outs. At the same time, there are potential risks to this approach. Only submitting stock-on-hand data may mask details, such as spoilage and wastage or stock transfers between facilities, and limit the ability of the supply chain to respond to problems in these areas.

While there are times when collecting the least amount of data necessary is valuable, there are also times where a greater amount of data collection and reporting are necessary. This is particularly true

during the start-up phase of a program, to identify problems and inefficiencies and to fine tune processes, procedures, and supply chain infrastructure. This approach may also be useful in situations where an organization is evaluating new forecasting algorithms or during a detailed audit of ongoing supply chain operations. The challenge, therefore, is to be disciplined in identifying how each piece of data will be used in supporting or improving the supply chain, before designating it as a required indicator.

KENYA

Despite national recognition of their importance, antimalarial medications and diagnostic supplies are often stocked-out at health facilities in Kenya. To address this issue, Novartis Pharma AG, in partnership with the Government of Kenya, piloted a mobile application, called SMS for Life, in 87 public health facilities over a 26-week period from August 2011 to February 2012. The objective was to determine whether this application was effective at reducing stock-outs.

The application, which consists of a Short Message Service (SMS) management tool and a web-based reporting tool, had previously been successful at addressing commodity stock-outs in Tanzania and Ghana. SMS for Life allows health workers at rural health facilities to submit simple "stock-on-hand" counts at the end of each week via SMS messages. The application uses mobile phones already available at the health facility and focuses data collection and reporting activities on only the most important information. In this case, SMS for Life was responsible for tracking four dosages of artemether/lumefantrine (AL) and one type of rapid diagnostic test.

At a designated time each week, participating health facilities received a standardized SMS message requesting information on the current stock status of the five commodities. If health workers did not respond within 24 hours, a reminder SMS was sent the following day. District-based staff accessed the web-based interface to view the data, helping them determine which facilities were overstocked and which were understocked. They could then use this information to redistribute the commodities and avoid stock-outs.

Weekly participation by the health facilities averaged 97%, with the majority responding within the first 24 hours after the SMS was sent. By the end of the intervention period, stock-outs of one or more dosages of AL were reduced by 38%. District managers were able to redistribute commodities to facilities showing stock-outs 44% of the time.

To learn more:

- Reducing Stock-Outs of Life Saving Malaria Commodities Using Mobile Phone Text-Messaging: *SMS for Life* Study in Kenya

Use ICT Tools for Data Collection and Management

To address barriers related to delayed, inaccurate, or incomplete data, the insufficient use of data for decision making, and the lack of easily accessible and shareable information

Historically, paper-based data collection and reporting tools have been the main data collection and management tools used across the supply chain. Traditional paper-based methods cause long delays in getting data to decision makers (up to six months in some cases). Yet, in isolated or low-resource settings, paper-based tools may be the only option. Steady improvements in information and communications technology tools, such as computers, mobile devices, and the software that run on these devices, have dramatically expanded the options for collecting and managing supply chain data. In many cases it is now practical and cost effective to deploy an assortment of ICT tools for collecting data.

When should ICT tools be considered?

A number of issues need to be considered when deciding whether ICT tools are feasible and which are most appropriate. Some issues to consider include:

- Communications and power infrastructure: ICT tools are inherently dependent on access to communications infrastructure and the availability of electrical power. The data rate or "bandwidth" provided by the communications infrastructure will determine which software applications can be deployed in each community, and therefore the viable electronic devices that may be used. The rapid expansion of cellular networks is making SMS, general packet radio service, and even second-generation and third-generation mobile telecommunications services widely available. In some cases, ICT tools are designed to operate on battery power or to switch between "online" and "offline" modes of operation to be more compatible with environments where communications and/or power services are intermittent.

- Complexity of gathering and submitting data: ICT tools have significant impact in situations where the supply chain involves hundreds of commodities (e.g., a regional hospital) and therefore large amounts of data. In these situations, well-designed ICT tools provide structure to the user's workflow, validate certain data as the user enters it, and may dynamically adapt to ongoing changes in operations (e.g., the list of commodities to order is always up-to-date, based on current inventory status, as managed in the back end of a logistics system). In settings where the replenishment process entails very few commodities (e.g., a small community clinic) but geographic barriers or resources barriers limit communication between the SDP and the managers responsible for replenishing stock, ICT tools may still have equally significant impact by enabling rapid submission of data.

- Initial and recurring costs: Adoption of ICT tools involves upfront costs to purchase and install equipment, procure software licenses, as needed, migrate data from the current system, and provide user training. Ongoing operational costs should also be taken into account, including maintenance and repair of equipment, support for applications, user help desk, anti-malware software for computers, recurring charges for communications services (both wired and cellular), and refresher training. The effort and cost needed to define and apply an organizational policy regarding misuse or loss of equipment should also be considered.

- Staff skillsets: Staff familiarity with ICT and staff comfort levels with using new tools and technologies varies across any organization. ICT tools and staff training in how to use them needs to be tailored to the knowledge and experience of the various groups of users. Refresher training is also essential whenever new features, functionality, or systems are rolled out.

TANZANIA

Deployed in 2010, Integrated Logistics System (ILS) Gateway was designed to supplement the existing paper-based reporting and requisition process. ILS Gateway allows health center staff to report stock on hand for 20 commodities via text message. These data are automatically entered into a web-based dashboard that visually displays data for district, central, and national-level stakeholders. In reviews of the system's impact, over 90% of surveyed health center users reported that the tool improved their compliance with conducting stock counts on time and submitting their related report and requisition forms on time. In addition, 80% of district users felt that ILS Gateway improved their visibility into stock levels at the facilities. Overall, 45% of participating facilities indicated an increase in stock availability of the tracked commodities.

District medical officers also reported that use of the system improved the timeliness with which they received the regular report and requisition forms. Perhaps most important, a significant number of facilities reported an increase in the availability of tracer products through the use of ILS Gateway.

To learn more:

- The ILS gateway: mobile phones improve data visibility and lead to better commodity availability in Tanzania
- ILSGateway: A project in partnership with the Ministry of Health and Social Welfare and USAID | DELIVER Project

MALAWI

In Malawi, community health workers, known as Health Surveillance Assistants (HSA), provide health services at the community level. The HSAs provide community case management, preventative services, and manage up to 19 different commodities. In partnership with JSI and the Supply Chains for Community Case Management (SC4CCM) project, in 2010 Malawi identified problems in the HSA supply chain that led to the frequent unavailability of commodities at the community level. The baseline assessment identified two key bottlenecks: stock-outs at HSA resupply points and difficulty transporting commodities between the resupply point and HSA catchment areas. To address these bottlenecks, transportation and management interventions were introduced in parallel with a logistics information portal called cStock. cStock is a web-based reporting and resupply system that collects stock data from HSAs via SMS messages. This information is used to start a SMS-based workflow that calculates the quantity of stock needed, assesses availability at the resupply point, and notifies the HSA when his/her package of commodities is available for pick up. In addition, these data are made available on an interactive dashboard that presents real-time stock levels and other metrics to districts and partners. In many districts, the cStock dashboard has been paired with the Enhancement Management approach. This approach creates District Product Availability Teams (DPAT), composed of district management, health facility staff, and HSAs, who work together on identifying and solving problems. A 2013 midline evaluation showed that districts using cStock plus the Enhanced Management approach had higher reporting rates and had reduced lead times by half compared to districts using cStock alone. The evaluation also reported that DPAT meetings reduced tension, promoted trust, increased coordination among team members, encouraged problem solving, and improved performance.

To learn more:

- cStock: Using Data Visibility to Improve Community Supply Chain Performance in Malawi

System Design to Improve Data Quality

To address delayed, inaccurate, and incomplete data, and insufficient human resource capacity for appropriate data collection and use

Data quality is paramount to successfully managing the supply chain, yet assessing quality is a complex undertaking. Quality encompasses the timeliness, completeness, and accuracy of the data. Data are useless if they cannot be relied upon. High quality data improve visibility into the operating conditions at each health center. They also provide a better determination of optimal replenishment amounts, better allocation of commodities and related resources across the health system, improved long-term forecasting, and identification of opportunities for improvements.
Specific interventions to improve data quality may be categorized as technical, organizational, and behavioral:

- Technical interventions work to address the technical barriers that hinder the collection of high quality routine data and encourage the use of information at all levels of the supply chain. Technical interventions may also include streamlining the amount and types of data that get collected, integrating disparate or overlapping reporting systems into one system, standardizing data collection forms, or developing data entry and analysis software and databases. Examples of technical interventions include:

    - Defining expected values (or tolerance ranges) for data entries and asking the user to confirm suspect or unusual entries.
    - Enforcing (via software) a requirement that a form be completed before it can be submitted.
    - Checking for arithmetic consistency among values entered by a user.
    - Providing predefined lists for a user to pick from to reduce chances of entering incorrect information.
    - Having consistency in the layout of screens and functionality across screens.

- Organizational interventions encompass rules, processes, values, or systems that allow organizations to better use data. Examples of organizational interventions include:

    - Establishing review teams as a forum to discuss performance indicators.
    - Developing guidelines on how to use information, along with clear roles and responsibilities for individuals.
    - Creating an environment that specifically focuses on helping different levels of the supply chain collaborate, to improve sharing of information and raise the collective attention paid to the quality of data.
    - Performing periodic (and unannounced) audits of submitted data.

- Behavioral interventions focus on developing behaviors in individuals and groups that lead to better and more consistent use of information. These interventions include:

    - Training staff in skills and habits that encourage improved use of the data.
    - Feedback mechanisms, particularly from routine supportive supervision, to encourage use of information.
    - Making documentation readily available.
    - Providing periodic refresher training.

When should system design to improve data quality be considered?

Data quality should always be prioritized because the use of data for decision making and optimizing supply chain functions is only as good as the quality of the data captured. At the same time, data quality should be prioritized in tandem with efforts in the areas of data promotion and data visibility.

CÔTE D'IVOIRE

Although not directly designed for supply chains, the Performance of Routine Information System Management (PRISM) framework and tools focus on assessing the quality of data collected for routine health information systems (RHIS) and assessing the use of information for decision making. As a part of the PRISM framework, four assessment tools were created to assess RHIS performance, including data quality, information use, data collection and transmission, staff competence and motivation, training, and supervision. By the end of 2012, 23 countries had used the tools to assess their RHIS performance. In most of these countries, the assessment led to the adoption of RHIS interventions to strengthen the system and improve performance.

Between 2008 and 2012, the Côte D'Ivoire Ministry of Health implemented the PRISM framework and worked with the National School of Statistics and Applied Economics to evaluate the performance of HIV and AIDS information and the Health Management Information System. The government implemented several complementary interventions, including: combining parallel reporting systems into an integrated RHIS; reducing the amount of data collected; developing, testing, and distributing new data collection tools; developing RHIS courses for health workers as part of pre-service training; and training decision makers on data demand and information use. Following the intervention, data quality at health facilities increased from 43% in 2008 to 60% in 2012. At the district level, data quality doubled from 40% to 81%. However, the increase in the availability of quality data did not lead to an increase in data use. At the health facility level, data use rates remained at 38% between 2008 and 2012.

To learn more:

- Inventory of PRISM Framework and Tools: Application of PRISM Tool and Interventions for Strengthening Routine Health Information System Performance

Incentivize Data Completeness and Accuracy

To address insufficient human resource capacity for appropriate data collection and use

When designing data management systems, it is important to consider what incentives and disincentives (intentional and unintentional) the end user experiences. For example, a health worker may be incentivized to avoid criticism from her supervisor for a late requisition, but that same motivation also incentivizes her to hurry through the requisition without concern for accuracy. If the supply chain operates such that the delivered quantity has little relation to the requested quantity, there is no incentive for the requestor to report stock on hand or to request the quantity accurately.

Once the existing incentives and disincentives have been identified, the next step is to consider how to adjust the incentive structure to align with supply chain goals. Incentives may need to be introduced and disincentives decreased to achieve data completeness and accuracy targets. Many incentives may be modified via system adjustments, however, an additional strategy to consider is introducing performance-based financing. Refer to the Performance-Based Financing section of the *Promising Practices in Service Delivery and Utilization* brief for approaches to incentivizing the timely submission of accurate data.

Create and Use a Logistics Information Portal

To address insufficient use of data for decision making and the lack of accessible and shareable information

Logistics data are often siloed and difficult to access. Frequently, data exist in various paper and electronic forms in different locations. This problem is compounded when there are numerous vertical programs and supply chains. A logistics information portal addresses this problem by creating a centralized website that displays key logistics information (such as stock-outs on tracer commodities) to all stakeholders in a flexible, easy to read, and easy to update format. Portals increase transparency and ensure that data are available to all who need them. They may also be used to improve communication between various actors in the supply chain. For example, portals may include forecasting, procurement, and distribution data, creating one location for viewing the performance of the end-to-end supply chain.

Equally important to the portal itself is the development of continuous improvement teams responsible for reviewing the portal and taking corrective action. Portals provide a common data source that serves as a basis for issue identification/response and logistics system performance evaluation. For example, monthly supply chain performance teams may be created who are responsible for reviewing portal data and conducting root cause analysis on issues, such as stock-outs. The same portal data may be used by national stakeholders to view current stock levels throughout the country. Having a common system that all stakeholders at all levels use increases confidence in the data and builds a common base of data for decision making.

Logistics information portals may be part of a nationwide logistics system, or a stand-alone website that receives data from multiple systems. The portal should be easy to use, presenting key information in graphical format with the ability to drill-down to more details. Different stakeholders may be interested in different data. The portal may effectively target specific end user roles with the content and format that are most useful to them.

When should a logistic information portal be considered?

A logistic information portal should always be considered. Unfortunately, the same factors that drive the need for shared data are also those that make its implementation difficult. When particular interests have historically controlled specific supply chain information, it may be difficult to mount the political will to drive open information access. In this situation, international funding or a mandate for the portal, in concert with other data capacity building initiatives, may be required.

Often the implementation of a new information system is an opportunity to introduce a data portal. In this scenario, it is important to consider whether to implement a program-specific portal or attempt to create a national logistics portal. Program- or technology-specific portals may serve a short-term need, however over time, having multiple portals with different logistics data merely continues the practice of siloing data. When possible, a goal for logistic information portals should be to centralize information from multiple programs and information systems.

Portals should only be introduced with process changes and human resource capacity building that will support the portal's use. For example, national or sub-national teams responsible for specific aspects of supply chain performance may be established. These teams may be trained on using the portal as a daily, weekly, or monthly input into their supply chain management activities. Creation of

organizational processes for *use* of the portal is essential for achieving impact because without it, the data portal will languish unused.

BANGLADESH

In 2010, the SIAPS program worked in collaboration with the Ministry of Health and Family Welfare in Bangladesh to develop the Supply Chain Management Portal for family planning procurement and distribution. Prior to the project, electronic tools were deployed unevenly at the upazila (sub-district) level. Paper requisitions from 483 sub-districts had to be keyed in manually at the central level, and it took two months to produce a logistics report and supply chain plan. In addition, problems with procurement led to chronic stock-outs.

The goal of the project was to improve the monitoring, transparency, and efficiency of the family planning commodity tracking system. The centralized portal was implemented in parallel with an upazila-level system for electronic submission of stock on hand and consumption data. Central, regional, and upazila-level managers enter data into the system, which is then consolidated and uploaded into the portal.

The portal serves as an electronic dashboard for communicating real time supply chain and procurement data. A key feature of the portal is an interactive dashboard that presents easy-to-understand charts, maps, and tables on stock levels throughout the country to foster effective and efficient decision making. The portal is published on the Internet and anyone may request access to the system.

A 2013 evaluation of the project concluded that between 2009 and 2013, potential stock-outs (defined as less than 18 days of stock on hand) in districts and at SDPs were reduced by 85%. Actual stock-outs were also reduced. For example, there were no stock-outs of oral contraceptive pills since the project began in 2010. Procurement lead time was reduced by an average of 32.8 weeks. The portal has also enabled data-based decision making. At the national level, the portal enables regular interactive discussions among partners to prepare, review, revise, and update the national needs for contraceptives to revise forecasting, fund-gap analysis, and supply planning.

To learn more:

- DGFP Supply Chain Information Portal
- Innovation Supported by the Project in Bangladesh Receives Award

Conclusion

When reliable, timely and accurate data are a powerful tool to use for managing each of the supply chain functions. Streamlining data collection procedures to improve data quality is a vital part of the improvement process. However, enhancing the quality of data without making corresponding improvements in the existing capacity to analyze data or use them to drive decisions limits the effectiveness and reach of these activities. Systematic and appropriate attention to making improvements in these areas leads to increased efficiency and effectiveness in the whole supply chain, from quantification all the way to the SDP.

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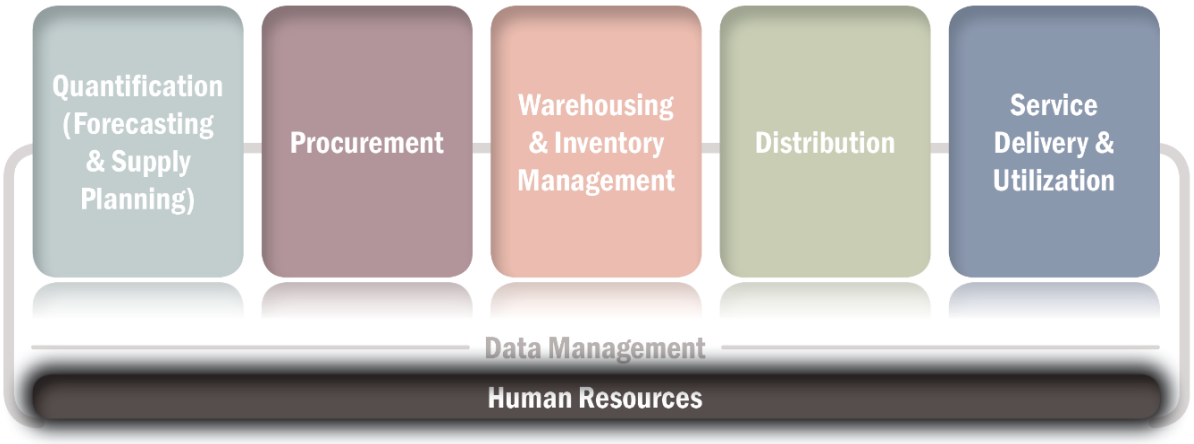
Promising Practices
Human Resources

Brief #7 in the *Promising Practices in Supply Chain Management* Series



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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Promising Practices: Human Resources.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

CP	Commodity Planner
DMPA	depot medroxyprogesterone acetate
DPT	District Pharmacy Technician
HR	human resources
HRH	human resources for health
LMIC	low- and middle-income countries
LMIS	Logistics Management Information System
LMU	logistics management unit
MCHS	Malawi College of Health Sciences
MOH	Ministry of Health
NHTC	National Health Training Center
SCM	supply chain management
SDP	service delivery point

Background

Human resources (HR) is a cross-cutting issue, touching every function in the supply chain from quantification to service delivery. Without motivated and competent staff that have the skills and capacity to operate the supply chain effectively and efficiently, no individual element of the chain functions.

Many low- and middle-income countries (LMIC) are experiencing a crisis in human resources for health (HRH). The factors affecting this crisis are also key contributors to challenges countries face addressing HR for the supply chain. Not only are there simply not enough workers, the workers that exist are overworked, undertrained, and often deployed in ways that do not best use their skills or meet the needs of the people they serve. These problems are exacerbated by the "brain drain" of workers from LMICs to higher-income countries, the difficulty of retaining workers (particularly in rural areas), lack of consistent investment in HR, and inadequate and infrequent training. Finding well-trained professionals to support effective supply chain management (SCM) is particularly problematic because logistics tasks are often shifted to health personnel who are not adequately trained in SCM. Assigned health personnel do not know how to carry out logistics tasks such as how to quantify and procure needed medicines and supplies, receive and store commodities, and track inventory. In addition, health workers are mainly responsible for providing services, making logistics tasks a secondary priority. Despite a clear overlap between HRH and SCM, leaders from these two groups often do not have formal mechanisms for communicating and strategizing together.

There is increasing recognition of the need for workforce planning in SCM to: estimate appropriate system-wide HR needs; recruit and deploy staff competent in supply chain and logistics tasks; and increase the professionalization of these cadres. What is less clear is who should be tasked with these duties—dedicated logistics staff or health care staff (particularly pharmacy personnel) that have long been responsible for logistics tasks as part of their larger role in the health system. In this brief, both options are presented as promising practices—the use of dedicated logistics personnel and increased supply chain capacity for health workers. Defining the SCM tasks that need to be completed at various levels of the health system, understanding the competencies necessary for implementing SCM tasks, and assigning SCM tasks to personnel trained to complete them are the essential components of creating a well-functioning supply chain. Having competent, well-trained personnel with clear roles in SCM is critical regardless of whether or not those personnel have other duties. Similarly, a supply chain workforce is needed irrespective of whether some, or all, aspects of the supply chain are outsourced. Outsourcing may change the supply chain competencies needed (i.e., the need for effective contract managers rather than distribution planners), but does not eliminate the need for a well-trained well-supported workforce.

Trained staff is only one element of an effective HR management strategy. For example, staff need to be supported by strong HR policies and plans, and supervised using performance management designed specifically to support them and build their capacity in SCM. A systematic approach is therefore needed. The four promising practices highlighted in this brief address the most common barriers countries face in HR for SCM.

Barriers	Description	Promising Practice(s) that Address the Barriers
Lack of training and capacity in SCM	Health personnel often have inadequate training (or sometimes no training) to prepare them for the logistics tasks they are expected to perform.	• Dedicated logistics personnel • Increased SCM capacity for health personnel at the service delivery point
Outdated or non-existent standard operating procedures	In many places, standard operating procedures for SCM are outdated or non-existent. This problem occurs at all level of the health system. Furthermore, job descriptions of health personnel often do not include logistics tasks.	• Create and use systematic HR plans and policies to support SCM • Performance management and supportive supervision for supply chain activities
Lack of a systematic approach to HR for SCM	HRH and supply chain planning often lie in separate silos, lacking a coordinated, systematic approach to HR for SCM.	• Create and use systematic HR plans and policies to support SCM
Lack of performance support and motivation for logistics tasks	Overburdened and under-resourced staff are often unsupported and unmotivated to perform logistics tasks. Supervision methods that exist are often performed sporadically and/or focus on clinical duties only, ignoring SCM.	• Performance management and supportive supervision for supply chain activities
High staff turnover and mobility	High staff turnover and mobility of health personnel cause barriers to keeping staff trained and experienced in required logistics tasks.	• Dedicated logistics personnel • Increased SCM capacity for health personnel at the service delivery point
High workload among health personnel	Many countries have human resources shortages among health workers increasing the number of patients each provider sees and their workload.	• Dedicated logistics personnel

Dedicated Logistics Personnel

To address the lack of training and personnel and high workload among health personnel

Dedicated logistics personnel are any staff that work solely on supply chain and logistics tasks. They work at any level of the supply chain and include supply chain managers, commodity planners, and distribution teams. The informed push system highlighted in the *Promising Practices in Distribution* brief describe examples of dedicated logistics personnel deployed to support the resupply of service delivery points (SDPs).

When should dedicated logistics personnel be considered?

There are a number of advantages of dedicated logistics personnel. Complex logistics tasks that require extensive training may be best performed by a well-trained and dedicated logistics staff person. The tasks may include managing central-level warehousing, customs clearance, and managing distribution and distribution data. In addition, places where clinical staff are overburdened and are forced to reduce time spent with patients to perform logistics tasks may benefit from dedicated logistics personnel. However, due to HR shortages and financial constraints in many LMICs, dedicated logistics personnel may need to be confined to higher levels of the system, where fewer personnel are needed. For example, hiring several logistics personnel at the central level and/or ten or twenty personnel at the provincial/district levels is more feasible than the thousands of personnel that would be needed to staff all SDPs.

ZAMBIA: LOGISTICS MANAGEMENT UNIT

Prior to 2006, there was no fixed ordering schedule or standardized reporting for medical commodities. Instead, district staff travelled to Lusaka on an ad hoc basis to pick up supplies. As a result, there was a lack of consumption data for forecasting, inadequate supply, and high rates of stock expiring. In 2006, the Ministry of Health (MOH) led a system redesign and launched a dedicated logistics management unit (LMU). From 2006 to 2009, the LMU was supported by the USAID|DELIVER PROJECT; post-2009, it has been fully managed by Medical Stores Limited.

The LMU is composed of logistics officers, logistics advisors, an administrative/financial officer, and an information technology person. The LMU manages HIV commodities, laboratory commodities, and essential medicines, acting as the link between health units and the central warehouse. At the central level, the LMU is responsible for managing and analyzing Logistics Management Information System (LMIS) data, approving reports and orders, calculating resupply quantities, providing feedback to facilities, generating reports on logistics performance, creating supervision schedules, and providing data for quantification. At the provincial level, the LMU provides supervision, on the job training, and logistics support to facilities.

Each LMU logistics officer is responsible for supporting a number of health facilities. If a health facility does not submit an order or has made errors in its order, the responsible LMU logistics officer follows up with the health center staff to correct mistakes or ensure that orders are received. The LMU is credited with improving product availability. Following its establishment, stock-out rates for five tracer HIV commodities decreased from 50% to under 5% and reporting rates for facilities reached 100%.

To learn more:

- Logistics Management Units: What, Why, and How of the Central Coordination of Supply Chain Management.
- USAID | DELIVER PROJECT Helps Zambia Reduce ARV Stockouts, Create Model Logistics System

ZAMBIA: COMMODITIES PLANNER

To address bottlenecks associated with distribution at the district level, in 2009, the Zambia MOH, Crown Agents, and the USAID | DELIVER PROJECT implemented the Essential Drugs Public Pilot program. As part of the pilot, eight districts implemented a model in which a Commodity Planner (CP) was added at the district level. The CP was responsible for coordinating orders from SDPs and managing stock at the district level. This included summing requisitions from SDPs, matching them against stock available in the district, and adjusting orders, as necessary, to create one requisition from the district to Medical Stores Limited. When orders arrived, the CP was responsible for packing the stock for the districts. In districts with pharmacy technicians, the role of the CP was filled by them. In districts with a vacant pharmacy technician position, an external CP was hired. Results from the pilot's evaluation showed statistically significant improvements in access to some tracer commodities, including Depo-Provera (DMPA), Ceftriaxone, and adult artemisinin-based combination therapy. Storage conditions, reporting rates, and other measures of effectiveness also improved. When looking at the duration of stock-outs, however, the pilot made only marginal improvements over the comparison districts.

To learn more:

- Enhancing Public Supply Chain Management in Zambia

Increased Supply Chain Management Capacity for Health Personnel at the Service Delivery Point

To address the lack of training and high staff turnover and mobility

At the SDP level, heath workers are often responsible for several logistics tasks, such as quantifying the amount of medicines needed for future use, conducting inventories and physical counts of supplies, and keeping accurate records of supply on hand and of dispensed commodities. In many countries, community health workers are now responsible for treating disease or distributing health supplies at the community level, adding to the complexity of the information that needs to be managed at lower levels of the supply chain. Due to HR shortages and the lack of SCM personnel, health facilities often need to shift logistics tasks to anyone who is available, including clinical staff, pharmacists, drivers, and cleaning staff. For clinical and pharmaceutical staff, managing patients takes precedence over administrative duties, leaving the management and tracking of medicines and supplies to untrained staff. While task shifting is often an advantageous strategy, those who have logistics duties shifted to them need to be adequately trained and supported.

When should a strategy of increasing capacity of existing supply chain personnel be considered?

As previously mentioned, defining the SCM competencies needed and assigning them to staff who are adequately prepared to perform the duties is critical, regardless of whether staff are dedicated logistics personnel or have other duties. That being said, there are many considerations to use in deciding whether logistics tasks can be performed by health staff. Tasks that happen at the SDP level, such as data collection, facility-level storage, and reporting occur in numerous locations, making it challenging to afford dedicated personnel at each location. Furthermore, such tasks may be successfully managed by existing health personnel provided that they have adequate support and training.

NAMIBIA

Like many LMICs, Namibia has experienced shortages in pharmaceutical personnel, causing problems not only in clinical pharmacy services, but also in effective SCM, since logistics tasks are often the responsibility of pharmacy personnel. Pharmacy assistants are an important cadre of pharmacy personnel who are trained in dispensing medication and SCM, freeing up pharmacists to focus on more advanced pharmaceutical management. In 2004, Namibia's National Health Training Center (NHTC) was training about seven pharmacy assistants per year. With the support of USAID, SIAPS revitalized the program by: supporting additional tutors; improving infrastructure at the NHTC; supporting improvements in teaching materials; providing technical assistance for basic pharmacy practice research; and strengthening experiential learning through rotations in a community pharmacy, hospital pharmacy, the pharmaceutical quality control laboratory, private sector pharmaceutical distributors, and the public sector central medical store. To address the historic problems of attrition in the pharmacy assistant cadre, SIAPS worked with the Ministry of Health and Social Services to develop a career ladder for pharmacy assistants by allowing them to apply their previous learning to enroll in the Pharmacy Technician program after meeting a minimum standard of service in the public sector.

Successes of the program include:

- The number of pharmacy assistants graduating annually quadrupled, from six graduates in 2006 to 28 students graduating in 2013.
- More pharmacy assistants are being posted in rural facilities. In 2012, more pharmacy assistants were working in rural facilities than pharmacists.
- Stakeholders from the public and private sectors have praised pharmacy assistants on their work performance.
- The program has led to better delivery of pharmaceutical services, especially in rural areas.

To learn more:

- MSH Trains Pharmacy Assistants in Namibia to Support HIV & AIDS Service Delivery
- Technical Report: Exploring the Establishment of a Pharmacy Course at the University of Namibia March 12–27, 2009
- U.S. Government Supports Health in Namibia by Upgrading the National Health Training Centre
- Q&A with Jude Nwokike: Building the Capacity of the Government of Namibia to Train Pharmaceutical Staff

RWANDA

Rwanda suffers from high turnover among health professionals. SCM training has historically been done in-service, using such methods as on-the-job training and workshops. Training done this way needs to be repeated with each new employee, which becomes unfeasible in areas with high turnover and the lack of continuous resources to conduct (and re-conduct) training. In 2009, the USAID | DELIVER PROJECT partnered with the Rwanda MOH, the National University of Rwanda, and the Kigali Health Institute to introduce university-level pre-service SCM training for nurses and pharmacists. In this way, the burden of retraining new employees is reduced. Because pharmacists and nurses are already instructed in supply chain tasks as part of their academic training, new employees coming in to replace an employee who is leaving are already trained in SCM.

To implement the pre-service training program, the USAID | DELIVER PROJECT prepared formal agreements with both universities outlining their responsibilities for providing logistics training to students. The faculty was introduced to the basics of SCM during a week-long training and also received another week-long training in how to deliver the curriculum effectively. The faculty also assisted in the development of course objectives and in achieving consensus on the content of the curriculum.

Similar pre-service training projects are currently being implemented in Malawi, Zambia, Zimbabwe, and Ethiopia.

To learn more:

- Initiating In-Country Pre-Service Training in Supply Chain Management for Health Commodities: Process Guide and Sample Curriculum Outline
- Lessons Learned: Sustainable Training Programs Ensure Access to Health Commodities in Rwanda

MALAWI

In Malawi, the pharmaceutical workforce is responsible for managing the public health supply chain and overall medicines management. According to the 2011 Health Sector Strategic Plan, there were only five pharmacists in the country's public health sector to fill an estimated 90 positions, and only 24% of the established positions for pharmacy technicians are filled. The vacancies leave clinical and frontline health workers responsible for managing pharmacy and logistics duties. In 2012, with support from the Barr Foundation and the USAID | DELIVER PROJECT, VillageReach, the Malawi MOH, the Malawi College of Health Sciences (MCHS), and the University of Washington Global Medicines Program started implementation of a Pharmacy Assistant Training Program. The Program trains and deploys a low-level cadre of pharmacy personnel, aiming to improve quality dispensing of medication, data management, and reporting of logistics data at health centers.

The Malawi MOH established a target of training and deploying at least 650 Pharmacy Assistants, thereby enabling every health facility in the country to have trained pharmacy personnel on staff. The training program is a two-year certificate designed to maximize the time that students spend in a practical setting, with a strong emphasis on SCM. After receiving ten weeks of orientation in pharmaceutics, pharmacology, and medicines and medical supplies management, students alternate between classroom instruction and practical placements in district hospitals (first year) and health centers (second year). The students are supervised monthly by MCHS faculty and program staff.

The University of Washington Global Medicines Program is conducting a two-year evaluation to determine the program's effect on malaria, pneumonia, and diarrhea morbidity and mortality in children under five. Results are expected in 2016. Meanwhile, the practical training component has resulted in improved performance at district hospitals:

- Improved storeroom conditions: 80% of district hospitals with students are now adhering to "first expired, first out" guidelines, compared to 75% at baseline.

- Increased on-time reporting: 92% of district hospitals with students submitted LMIS reports on time for the last reporting period, compared to 81% at baseline.

- Improved dispensing and patient counseling: 0% of dispensing personnel observed at baseline adhered to all six dispensing standards, compared to 54% of the students. On average, students adhere to five out of six standards, compared to an average of three standards of dispensing at baseline.

To learn more:

- Malawi Pharmacy Assistants Program

Performance Management and Supportive Supervision for Supply Chain Management

To address low motivation for logistics tasks and lack of performance support and outdated or non-existent standard operating procedures

Performance management includes clearly articulating performance expectations, observing staff in their roles and providing feedback, and recognizing staff when they perform well. Supportive supervision, a tactic of performance management, is a process that involves helping staff to continuously improve their own work performance. Supportive supervision is carried out in a respectful and non-authoritarian way, with a focus on using supervisory visits as an opportunity to improve knowledge and skills of SCM staff. During supportive supervision, supervisors work with staff to set goals, monitor progress toward goals, increase knowledge, build on previous training and skills, and identify and solve problems. Performance management and supportive supervision have not only been shown to improve job performance, motivation, and important indicators, such as rational medicine use, but are also critical to job satisfaction, which leads to higher rates of staff retention. While supportive supervision is common for health workers, staff with supply chain and logistics-related duties need to receive supervision tailored to SCM. Staff with multiple roles should receive supervision for SCM as well as for patient-centered or clinical tasks. For example, supervisors of pharmacy staff who are responsible for inventory management at the SDP may check stock cards, answer questions about logistics forms, and modify supervision checklists to include questions about supply chain tasks.

When should performance management and supportive supervision for SCM be considered?

Always! Unlike some of the promising practices listed in this document, supportive supervision is always recommended regardless of supply chain strategy or commodity use. Performance management and supervision for SCM require financial resources and HR. They are a cornerstone of an effective system.

ZIMBABWE

Zimbabwe's Essential Drugs' Action Programme was established in 1986 with the goal of ensuring appropriate availability, accessibility, affordability, and use of medicines. A major component of this program was training related to stock management and rational medicine use. The training was initially effective, but over time, stock management achievements declined. In response, pharmacists or pharmacist technicians from each province were required to attend a two-week national training on medicines management supervision. The training included information on communication, principles of stock management, the use of standard treatment guidelines, organization of supervision, use of checklists, report writing, and interpretation of indicator studies. There were also practical components, including role plays and visits to health facilities. Before ending, attendees were asked to complete an examination and a plan of action.

To determine the impact of supervision on stock management, health facilities were randomized to receive supervision in either stock management (intervention) or adherence to standard treatment guidelines (control), and there was an independent comparison group. The intervention and control facilities each received two supervision visits, held approximately three months apart. During each visit, supervisors initiated a discussion with staff, focusing on areas of weakness identified in the baseline survey. Together, staff and supervisors agreed on ways to improve going forward.

More than six months after the final supervision visit, the intervention group showed statistically significant improvements in the following:

- Physical counts recorded: 47% at baseline; change +17 percentage points; p-value 0.020
- Correct minimum stock: 21% at baseline; change +14 percentage points; p-value 0.022
- Use of stock book: 67% at baseline; change +20 percentage points; p-value 0.014
- Correct use of stock book: 13% at baseline; change +38 percentage points; p-value 0.002

To learn more:

- The Impact of Supervision on Stock Management and Adherence to Treatment Guidelines: A Randomized Controlled Trial

MALAWI

With support from CHAI and the USAID|DELIVER PROJECT, the Health Technical Support Services Department of the MOH launched an integrated supportive supervision and peer mentoring program for pharmacy technicians. Its main aim was to strengthen the district pharmacy technicians' (DPTs) role in supervising health facility in-charges and health surveillance assistants (HSA) on logistical matters to ensure improved LMIS reporting from facilities, better storage practices, and better management of health commodities across all programs (HIV, essential medicines, malaria, tuberculosis, and family planning). A total of 168 facilities are visited in a quarter, with each of the 14 teams visiting six facilities per district.

Pharmacy Technicians from districts that demonstrate a high level of performance in LMIS reporting are selected as mentors. The mentors, along with pharmacy technicians from other programs (malaria, Integrated Management of Childhood Illness, etc.), pharmacists from the MOH, as well as program staff from CHAI and USAID | DELIVER, make up the supervision teams that conduct site visits to district-based pharmacy technicians. The supervision team identifies knowledge and skill gaps in the mentee (pharmacy technician) and facility-level staff (in-charges and HSAs) and collaboratively model best practices in such areas as storage guidelines and inventory management. Both the mentor and the supervisor are provided with checklists that they complete during the visits. The mentors complete the mentor checklist form to evaluate the mentee's performance, and the supervisors complete the supervisor evaluation checklist to evaluate the mentor's performance. At the end of the mentorship and supervision exercise at each facility, the supervision team provides feedback to facility staff and draws up an action plan for the facility to address areas requiring improvement.

Outcomes/Observations

- Demonstrated proficiency of DPTs in using the district logistics monitoring and supervision tool to work with the health facilities.
- Improved capacity of DPTs in modeling best practices at facilities and with adherence to storage guidelines and inventory management.
- Improved reporting of LMIS data.
- Increased visibility of systemic logistics issues occurring at facilities.

In general, the pharmacy mentorship program has contributed to capacity building and increased appreciation of the LMIS by health workers.

Create and Use Human Resource Policies and Plans to Support Supply Chain Management

To address outdated or non-existent standard operating procedures and the lack of a systematic approach to human resources for supply chain management

Robust policies and plans to support SCM are critical elements to effectively use HR to strengthen supply chains. Actions range from relatively simple changes, such as updating job descriptions to make sure that they include SCM tasks and updating manuals and procedures at the SDP level to include standard operating procedures for logistics tasks, to more involved work, such as creating and enacting national-level strategic plans for HR in SCM and budgeting for HR for SCM.

Creating policies that support the professionalization of SCM is another key consideration. For example, providing continued learning opportunities and a career ladder for SCM personnel may help attract and retain employees. The Namibia example highlighted above is an illustration of an effort to create a career ladder by allowing pharmacy assistants to count their training toward becoming pharmacy technicians.

In addition, for supply chains to function at an optimal level, key supply chain personnel need to have appropriate influence and access to managers across the health system. For example, in the private sector, the person in charge of SCM often works with the heads of sales, marketing, and finance to discuss needs across these business disciplines and to ensure that the supply chain is responsive to those needs. The public health sector equivalent would be elevating SCM to the directorate level or ensuring that the appropriate directorate in charge of SCM is prioritizing and representing this discipline at the leadership level.

When are HR policies and plans to support SCM needed?

Always! Due to the multitude of barriers countries are facing in HRH generally, and for supply chain specifically, it is likely that most countries have room to strengthen HR policies and procedures for SCM. Conducting an assessment of a country's capacity in HR for supply chain is a good place to start gaining a better understanding of baseline SCM capability and identifying gaps. Documents such as the Human Resource Capacity and Development in Public Health Supply Chain Management: Assessment Guide and Tool can be used for assessments. The assessment is only the first step. Once gaps are identified, countries need to work toward a systematic approach to HR for SCM, including engaging all relevant stakeholders, creating and revising HR policies, and planning and recruiting the appropriate workforce.

BURKINA FASO

In Burkina Faso, SCM is mostly carried out by pharmacists and pharmacy technicians who work at all levels of the health system. However, the country's public health supply chain struggles with weak logistics management, poor management capacity, and challenges coordinating procurement, warehousing, and distribution. To address these challenges, Burkina Faso's MOH has been working to create a systematic approach to HR for SCM since 2005. This process has included working with numerous partners and steadily making progress in changing policies and procedures over time. For example, in 2007, the Bioforce Institute founded the Center of Expertise, Research, and Development in Health Logistics in the western region of the country to support a systematic approach to HR for SCM across all health programs, regardless of health focus. In 2011, a working group was created to aid the MOH with creating policy aimed at professionalizing health logistics managers. Most recently, Burkina Faso has spent 18 months drafting and working to implement its Strategic Action Plan for Human Resources in SCM. The country's plan endeavors to professionalize logistics personnel. This includes pre-service and in-service training of logistics personnel, the addition of a logistics curriculum at the National School of Public Health, and the creation of a health logistician position in the country's legislation. In addition, at the district level, manuals and procedures are being revised and appropriate staff identified and trained to become health logisticians.

To learn more:

- Professionalizing Health Logistics in Burkina Faso: Challenges, Implementation and Sustainability

Conclusion

The practices highlighted in this brief are in some ways quite straightforward. To make any progress in addressing supply chain weaknesses, a systematic approach to HR management is needed, including competent, well-trained personnel who are supported in their logistics work by supervisors, clear procedures, and strong policies. Mobilizing the resources and political will to enact these practices, however, takes the engagement of stakeholders, consistent advocacy, and time. As is illustrated in the Burkina Faso example, work toward revamping a country's HR strategy is a multi-player, multi-year process. However, with a systematic approach and consistent effort, health systems may effectively recruit, train, and deploy a workforce to meet their supply chain needs and increase the professionalization of these personnel. The People that Deliver Initiative focuses on advocacy and tools needed for HR in SCM in the health field and is a good resource for further information on promising practices in HR, including the Human Resource Capacity Development in Public Health Assessment Guide and Tool and the Competency Compendium for Health Supply Chain Management.

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Proven Practices
A Systematic Review

Brief #8 in the *Promising Practices in Supply Chain Management* Series

INSIDE

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This brief is part of the *Promising Practices in Supply Chain Management* series, developed by the Supply and Awareness Technical Reference Team (TRT) of the UN Commission on Life-Saving Commodities for Women's and Children's Health (the Commission or UNCoLSC). As part of the Every Woman Every Child movement and efforts to meet the health-related Millennium Development Goals by 2015 and beyond, the Commission is leading activities to reduce barriers that block access to essential health commodities. The Supply and Awareness TRT developed this set of briefs on promising practices in supply chain management to guide countries in identifying and addressing key bottlenecks in the supply and distribution of the Commission's 13 life-saving commodities across the reproductive, maternal, neonatal, and child health continuum of care.

This series of briefs has been developed for use by in-country stakeholders. The briefs provide both *proven* and *promising* practices that may be used to address specific supply chain barriers faced by each country.

- *Proven practices* are defined as interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs. Examples of proven practices are identified by this symbol throughout these briefs.

- *Promising practices* are defined as interventions showing progress toward improving health commodity supply chains in low- and middle-income countries.

To view all the briefs in the Promising Practices in Supply Chain Management Series, visit http://siapsprogram.org/publication/promising-practices-in-supply-chain-management

The organizations that participated in the development of these briefs are: Systems for Improved Access to Pharmaceuticals and Services (SIAPS), VillageReach, John Snow, Inc. (JSI), United Nations Population Fund, US Agency for International Development (USAID), Imperial Health Sciences, People that Deliver, mHealth Alliance, Merck for Mothers, United Nations Children's Fund, Clinton Health Access Initiative, Population Services International, and PATH.

This document is made possible by the generous support of the American people through USAID, under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government

Suggested Citation: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Proven Practices: A Systematic Review.* Arlington, VA: Management Sciences for Health.

Abbreviations and Acronyms

ACT	artemisinin-based combination therapy	LMIS	Logistics Management Information System
CAPSS	Consortium for ACT Private Sector Subsidy	MeSH	Medical Subject Headings
CP	Commodity Planner	NGO	nongovernmental organization
ICS	inventory control system	SDP	service delivery point
LMIC	low- and middle-income countries	STG	standard treatment guidelines

Objectives and Definitions

The objective of this review was to identify proven practices that improve outcomes for health supply chains in low- and middle-income countries (LMICs). While recognizing that there are numerous practices making observable and significant improvements in supply chains throughout the world, practices that have been tested using experimental or quasi-experimental designs provide the most objective evidence of their effectiveness. The following definition for proven practice was used for this review:

> *Proven practice: Interventions with proven outcomes in improving health commodity supply chains in low- and middle-income countries tested using experimental or quasi-experimental evaluation designs.*

An experimental design includes: (1) pre-post design; (2) an intervention/treatment group and a control group; and (3) random assignment to groups. A quasi-experimental design lacks one or more of the elements of a true experimental design. For the purposes of this review, a quasi-experimental design must include at least an intervention/treatment and control group and a pre-post design but need not include randomization.

Methodology

To identify proven practices, a systematic literature review was conducted using MEDLINE (biomedical research) and SocINDEX (social science research) databases. These databases were chosen because of their comprehensive collections. Selection criteria and search methods were determined before the start of the review to reduce any potential selection bias by reviewers.

Search Methods

The following search terms, and their database-controlled vocabulary equivalents[1] were used. Terms 2-19 were used in combination with the terms “supply chain” and “supply management”:

[1] Medical Subject Headings (MeSH) terms are a controlled vocabulary used to index database sources. When MeSH terms are used, keywords are automatically translated into relevant MeSH terms and synonyms. For example, using MeSH terms “supply chain” becomes “("supply and distribution"[Subheading] OR "supply"[All Fields] AND "distribution"[All Fields]) OR "supply and distribution"[All Fields] OR "supply"[All Fields]) AND chain [All Fields].”

1. supply chain (health or medical) or "supply management"	12. inventory control system or ICS
2. commodity/commodities/product(s)/supply or "health commodity"	13. inventory management
3. vaccines	14. community-based distribution
4. stock outs/stock-out/stockout	15. commodity security
5. distribution	16. evaluation
6. data management	17. intervention
7. warehouse/warehousing	18. lessons learned
8. service delivery	19. best practices
9. utilization	20. developing country/setting
10. logistics	21. low and middle income country/settin
11. logistics management information system or LMIS	

All searches were completed in July and August 2013. A list of the articles found was produced if the initial resulting journal articles could be reduced to a reasonable number. Reasonable was subjective to the searcher's rapid observation of relevant studies. If the bulk of results appeared to fall outside the proposed methodology selection criteria, then limiting search terms (identified by the Boolean term *NOT)* were applied, and in some cases, were further limited by geography to include only LMICs. Duplicate studies appearing in the results of more than one report were omitted in subsequent reports. Through these search methods, 481 abstracts were identified. Annex A provides a complete list of the exact search term combinations used and the resulting number of abstracts.

Selection Criteria

Selection criteria were used to determine the articles to be included as proven practices, as shown in table 1. First, titles and abstracts were examined to remove obviously irrelevant materials. Full text documents were examined when insufficient detail was provided in the abstract to determine whether the article met the selection criteria.

Selection Criteria for Proven Practices

Study design	Experimental or quasi-experimental; meta-analyses may be included if they are of interventions using experimental or quasi-experimental designs
Setting	Low- and middle-income countries
Intervention	Interventions to improve in-country supply chains
Commodity	Any health commodity (medicine, supplies, etc.)
Delivery system	Any (public, private, nongovernmental [NGO], etc.)
Publication/ intervention years	Last 20 years
Outcome measures	Any proven positive outcomes to improve supply chain are acceptable. Examples include: • Increase in product availability (reduction in stock-outs) • Increase in product utilization • Increase in reporting frequency, completeness, or accuracy • Reduction in supply chain costs

Results

Of the 481 abstracts identified, only three articles met the selection criteria. To ensure that all proven practices that met the criteria had been identified, abstracts from a separate systematic literature review conducted by Pamela Steele were also reviewed.[2] Of the 63 results deemed relevant from Steele's review, one additional article met the selection criteria. Finally, during the subsequent search for promising practices, two examples were found that met the definition for "proven practices" and were added to the list.

The qualifying articles are summarized in table 2. Each article is used as an example in the promising practices briefs, marked with to denote that the practice meets the definition for a "proven practice."

Articles Meeting Proven Practice Criteria

Article	Abstract
Citation Talisuna AO et al. Closing the access barriers for effective anti-malarials in the private sector in rural Uganda: Consortium for ACT private sector subsidy (CAPSS) pilot study. *Malaria Journal.* 2012; 11:356. doi:10.1186/1475-2875-11-356.	"**Background:** Artemisinin-based combination therapy (ACT), the treatment of choice for uncomplicated falciparum malaria, is unaffordable and generally inaccessible in the private sector, the first port of call for most malaria treatment across rural Africa. Between August 2007 and May 2010, the Uganda Ministry of Health and the Medicines for Malaria Venture conducted the Consortium for ACT Private Sector Subsidy (CAPSS) pilot study to test whether access to ACT in the private sector could be improved through the provision of a high level supply chain subsidy.
Proven Practice Utilized Subsidizing underutilized commodities **Brief Where Highlighted** *Promising Practices in Service Delivery and Utilization*	**Methods**: Four intervention districts were purposefully selected to receive branded subsidized medicines - "ACT with a leaf", while a fifth district acted as the control. Baseline and evaluation outlet exit surveys and retail audits were conducted at licensed and unlicensed drug outlets in the intervention and control districts. A survey-adjusted, multivariate logistic regression model was used to analyze the intervention's impact on: ACT uptake and price; purchase of ACT within 24 hours of symptom onset; ACT availability and displacement of sub-optimal anti-malarial. **Results:** At baseline, ACT accounted for less than 1% of anti-malarials purchased from licensed drug shops for children less than five years old. However, at evaluation, "ACT with a leaf" accounted for 69% of anti-malarial purchased in the interventions districts. Purchase of ACT within 24 hours of symptom onset for children under five years rose from 0.8% at baseline to 26.2% (95% CI: 23.2-29.2%) at evaluation in the intervention districts. In the control district, it rose modestly from 1.8% to 5.6% (95% CI: 4.0-7.3%). The odds of purchasing ACT within 24 hours in the intervention districts compared to the control was 0.46 (95% CI: 0.08-2.68, p=0.4) at baseline and significant increased to 6.11 (95% CI: 4.32-8.62, p<0.0001) at evaluation. Children less than five years of age had "ACT with a leaf" purchased for them more often than those aged

[2] Steele P. *What in-country public health supply chain factors affect the availability of medical products at the service delivery point in developing countries: A systematic literature review*. Unpublished doctoral dissertation, , Bedfordshire, UK: Cranfield University; 2013.

Article	Abstract
	above five years. There was no evidence of price gouging. **Conclusions:** These data demonstrate that a supply-side subsidy and an intensive communications campaign significantly increased the uptake and use of ACT in the private sector in Uganda."
Citation Sabot OJ et al. Piloting the Global Subsidy: The Impact of the Subsidized Artemisinin-Based Combination Therapies Distributed through Private Drug Shops in Rural Tanzania. *PLoS One.* 2009; *4*(9): e6857. doi:10.1371/journal.pone.0006857. **Proven Practice Utilized** Subsidizing underutilized commodities **Brief Where Highlighted** *Promising Practices in Service Delivery and Utilization*	"**Background**: WHO estimates that only 3% of fever patients use recommended artemisinin-based combination therapies (ACTs), partly reflecting their high prices in the retail sector from where many patients seek treatment. To overcome this challenge, a global ACT subsidy has been proposed. We tested this proposal through a pilot program in rural Tanzania. **Methods/Principal Findings**: Three districts were assigned to serve either as a control or to receive the subsidy plus a package of supporting interventions. From October 2007, ACTs were sold at a 90% subsidy through the normal private supply chain to intervention district drug shops. Data were collected at baseline and during intervention using interviews with drug shop customers, retail audits, mystery shoppers, and audits of public and NGO facilities. The proportion of consumers in the intervention districts purchasing ACTs rose from 1% at baseline to 44.2% one year later ($p < 0.001$), and was significantly higher among consumers purchasing for children under 5 than for adults ($p=0.005$). No change in ACT usage was observed in the control district. Consumers paid a mean price of $0.58 for ACTs, which did not differ significantly from the price paid for sulphadoxine-pyrimethamine, the most common alternative. Drug shops in population centers were significantly more likely to stock ACTs than those in more remote areas ($p<0.001$). **Conclusions**: A subsidy introduced at the top of the private sector supply chain can significantly increase usage of ACTs and reduce their retail price to the level of common monotherapies. Additional interventions may be needed to ensure access to ACTs in remote areas and for poorer individuals who appear to seek treatment at drug shops less frequently."
Citation World Bank. *World Bank policy note: enhancing public supply chain management in Zambia*. Washington, DC: World Bank; 2012. **Proven Practice Utilized** Dedicated logistics personnel **Brief Where Highlighted** *Promising Practices in Human Resources*	*Two models to improve logistics capacity at the district level were designed and tested in this study. Both models were deemed to be effective with Model B proving more effective than Model A.* **Model A:** Eight districts implemented a model in which a Commodity Planner (CP) was added at the district level. The CP was responsible for coordinating orders from Service Delivery Points (SDPs) and managing stock at the district. This included summing requisitions from SDPs, matching against stock available at the district and adjusting orders as necessary to create one requisition from the district to Medical Stores Limited (MSL). When orders arrived, the CP was responsible for packing the stock for the districts. In districts with pharmacy technicians the role of the CP was filled by them; in districts with vacant pharmacy technician position an external CP was hired. Results from the pilot's evaluation showed statistically significant improvements in access to some

Article	Abstract
	trace commodities including DepoProvera, Cotrimoxazole (CTX), and adult ACTs; though when looking at duration of stockouts the pilot made only marginal improvements over the comparison districts. Storage conditions, reporting rates and other measures of effectiveness also improved.
Proven Practice Utilized Level jumping **Brief Where Highlighted** *Promising Practices in Distribution*	**Model B:** Eight districts implemented a model in which storage and management of commodities for health facilities at the district level was eliminated; instead the district store became a "cross dock" or point of transit where it received pre-packaged shipments from the central level warehouse which were then delivered to health facilities without any changes to the order. Health facilities were responsible for filling out commodity orders and sending them to the district. The district again acted as a point of transit for orders, sending them to the central warehouse without making any changes. Although the districts were still responsible for making sure health facilities received the commodities, they were no longer responsible for managing how many commodities the health facility should receive. The research done during the pilot period showed that even this small change of "level jumping" without direct delivery made a significant difference in commodity availability. The districts where cross-docking was implemented showed large improvements over the control districts in the reduction of stock-outs for all commodities. For example, pediatric ACTs were stocked out an average of 29 days in comparison districts while only stocked out for an average of 5 days in the districts where cross docking was implemented; similar patterns were true for other tracer commodities. Other measures of supply chain effectiveness, such as storage and reporting rates, also improved in the implementation districts. Finally, researchers estimate that if the model were to be implemented district wide, under 5 mortality would decrease by 21% and over 5 mortality would decrease by 25%.
Citation Trap B, Todd CH, Moore H et al. The impact of supervision on stock management and adherence to treatment guidelines: A randomized controlled trial. *Health Policy and Planning,* 2001; 16(3): 273-280. **Proven Practice Utilized** Performance management and supportive supervision for supply chain activities **Brief Where Highlighted** *Promising Practices in Human Resources*	"Ensuring the availability of essential drugs and using them appropriately are crucial if limited resources for health care are to be used optimally. While training of health workers throughout Zimbabwe in drug management (including stock management and rational drug use) resulted in significant improvements in a variety of drug use indicators, these achievements could not be sustained, and a new strategy was introduced based on the supervision of primary health care providers. This was launched in 1995 with a training course in supervisory skills for district pharmacy staff. In order to evaluate the impact of the supervision and the effectiveness of the training programme, adherence to standard treatment guidelines (STG) and stock management protocols was evaluated in a randomized controlled trial. The study compared three different groups of health facilities: those that received supervision for either use of STG (n=23) or stock management (n=21) – each facility acting as control for the other area of supervision – and a comparison group of facilities which received no supervision (n= 18). On-the-spot supervision by a specially trained pharmacy staff, based around identified deficiencies, took place at the start of the study and 3 months later. The evaluation compared performance on a variety of drug management indicators at baseline and 6–8 months after the

Article	Abstract
	second supervisory visit. The results of the study showed that, following supervision, overall stock management improved significantly when compared with the control and comparison groups. Similar improvements were demonstrated for adherence to STG, although the effect was confounded by other interventions. The study also showed that supervision had a positive effect on improving performance in areas other than those supervised, and demonstrated that pharmacy technicians with limited clinical skills can be trained to influence primary healthcare workers to positively improve prescribing practices. Allocating resources to supervision is likely to result in improved performance of health workers with regard to the rational use of essential drugs, resulting in improved efficiency and effectiveness."
Citation Soeters R, Peerenboom PB, Mushagalusa P et al. Performance-Based Financing Experiment Improved Health Care in the Democratic Republic of the Congo. *Health Affairs. 2011;* 30(8): 1518-27. **Proven Practice Utilized** Performance-based financing at the service delivery point **Brief Where Highlighted** *Promising Practices in Service Delivery and Utilization*	"In some low-income countries such as Cambodia and Rwanda, experimental performance-based payment systems have led to rapid improvements in access to health care and the quality of that care. Under this type of payment scheme, funders—including foreign governments and international aid programs—subsidize local health care providers for achieving certain benchmarks. The benchmarks can include such measures as child immunizations or childbirth in a health facility. In this article we report the results of a performance-based payment experiment conducted in the Democratic Republic of Congo, which is one of the poorest countries in the world and has an extremely high level of child and maternal mortality. We found that providing performance-based subsidies resulted in lower direct payments to health facilities for patients, who received comparable or better services and quality of care than those provided at a control group of facilities that were not financed in this way. The disparity occurred despite the fact that the districts receiving performance-based subsidies received external foreign assistance of approximately $2 per capita per year, compared to the $9–$12 in external assistance received by the control districts. The experiment also revealed that performance-based financing mechanisms can be effective even in a troubled nation such as the Democratic Republic of Congo."
Citation Björkman M and Svensson J. Power to the People: Evidence from a Randomized Field Experiment on Community-Based Monitoring in Uganda. *The Quarterly Journal of Economics.* 2009; 124(2), 735-69. **Proven Practice Utilized** Increasing community participation in service delivery accountability **Brief Where Highlighted** *Promising Practices in Service Delivery and Utilization*	"This paper presents a randomized field experiment on community-based monitoring of public primary health care providers in Uganda. Through two rounds of village meetings, localized nongovernmental organizations encouraged communities to be more involved with the state of health service provision and strengthened their capacity to hold their local health providers to account for performance. A year after the intervention, treatment communities are more involved in monitoring the provider, and the health workers appear to exert higher effort to serve the community." In addition, the intervention had a statistically significant effect on reducing stockouts.

Conclusion

From the onset, the reviewers knew they were unlikely to find a large number of practices proven to improve health supply chains. The proven practice definition used is most relevant to supply chain interventions that use an academic-style approach to evaluation. Private sector supply chains, for example, may be more likely to use metrics, such as profit margins, cost effectiveness, performance improvements, and accreditation to qualify something as a proven practice. Furthermore, some supply chain interventions do not lend themselves well to an experimental design as they include: numerous components implemented at multiple levels of the health system, thereby making cause and effect difficult to isolate; are employed in complicated, uncontrolled environments; and/or lack the resources to conduct a rigorous evaluation.

More rigorous evaluation of supply chain interventions would greatly benefit the global community by setting the stage for implementers to learn from each other's work, allowing for the allocation of resources to proven practices, and creating a body of evidence needed for global advocacy. While proven practices may be limited in number, the briefs in this series show that there is an emerging body of promising practices already being used for knowledge sharing, advocacy, and most importantly, improving the availability of commodities.

Annex A: Search Term Combinations and Number of Hits

Summary of Terms Used	Exact Terms Used[3]	Resulting Number of Abstracts
MEDLINE		
Supply chain and best practices	1 and 19 (with MeSH terms)	3
	1 and 19 (original terms only)	27
Supply chain and commodities	(1 OR "supply chain" OR "supply management") AND (2 OR commodit* OR product* OR supply* OR "health commodit*") NOT US NOT "United States" Chose Geography from list of hits: China, South Africa, Brazil, India, Uganda, Thailand, Africa, Africa south of the Sahara MesH plus original and additional terms	60
Supply chain and vaccines	(1 OR "supply chain" OR "supply management") AND 3 MesH plus original terms	9
Supply chain and and stockout	(1 OR "supply chain" OR "supply management") AND (4 OR "stock out*" OR stock-out* OR stockout*) MeSH plus original terms	9
Supply chain and distribution	(1 OR "supply chain" OR "supply management") AND (5 OR distribution) NOT US NOT "United States" Chose Geography from list of hits: Uganda, Africa, Brazil, South Africa, Thailand, Zambia, Ethiopia, India, Malawi, Mexico, Niger, Tanzania, Africa south of the Sahara, Argentina, Asia, Asia, southeastern, Benin, Cambodia, China MesH plus original term	37
Supply chain and data management	(1 OR "supply chain" OR "supply management") AND (6 OR "data management") NOT US NOT "United States" Chose Geography from list of hits: India, Burkina Faso, Nepal, Nigeria, Poland, Thailand, Zambia MeSH plus original term	8
Supply chain or supply management and warehouse	(1 OR "supply chain" OR "supply management") AND 7 Original term only	1
Supply chain and service delivery	(1 OR "supply chain*" OR "supply management") AND 8 NOT US NOT "United States" Chose Geography from list of hits: Africa, India, South Africa, Africa south of the Sahara, Brazil, China, Ghana, Guatemala, Kenya, Malawi, Nigeria, Papua New Guinea, Singapore, Thailand, Uganda, Zambia MesH plus original term	19
Supply chain and utilization	(1 OR "supply chain*" OR "supply management") AND 9 NOT US NOT "United States" Chose Geography from list of hits: Uganda, Burkina Faso, Ethiopia, India, Kenya, Morocco, Niger, Peru, Philippines, Senegal, South Africa, Thailand MeSH plus original term	11
Supply chain and logistics	(1 OR "supply chain*" OR "supply management") AND 10 NOT US NOT "United States" Chose Geography from list of hits: Brazil, India, Uganda, Africa, Poland MeSH plus original term	15

[3] Numbers correspond to the terms listed on Page 4. The search terms are summarized in the first column.

Summary of Terms Used	Exact Terms Used[3]	Resulting Number of Abstracts
Supply chain and LMIS	(1 OR "supply chain*" OR "supply management") AND 11 NOT US NOT "United States" Chose Geography from list of hits: Burkina Faso, Ethiopia, Morocco, Philippines, Senegal, Uganda MeSH plus original and additional terms	3
Supply chain and ICS	(1 OR "supply chain*" OR "supply management") AND 12 NOT US NOT "United States" Chose Geography from list of hits: Morocco MeSH plus original and additional terms	1
Supply chain and inventory management	(1 OR "supply chain*" OR "supply management") AND 13 NOT US NOT "United States" Chose Geography from list of hits: India, Burkina Faso, Ethiopia, Morocco, Philippines, Poland, Senegal, Uganda MeSH plus original term	6
Supply chain and community-based distribution	(1 OR "supply chain*" OR "supply management") AND 14 NOT US NOT "United States" Chose Geography from list of hits: Uganda, Africa, Brazil, India, Kenya, South Africa, Tanzania, Asia, Asia, southeastern, Cambodia, China, Hungary, Iran, Malawi, Malaysia, Nepal, Nigeria, Papua New Guinea, Peru, Philippines, Senegal, Singapore, Thailand MeSH plus original term	31
Supply chain and commodity security	(1 OR "supply chain*" OR "supply management") AND 15 MeSH plus original term	2
Supply chain and evaluation	(1 OR "supply chain*" OR "supply management") AND 16 NOT US NOT "United States" Chose Geography from list of hits: Uganda, Africa, Brazil, India, Taiwan, China, Kenya, Thailand, Africa south of the Sahara, Asia, southeastern, Burkina Faso, Ethiopia, Mexico, Morocco, Poland, Singapore MeSH plus original term	53
Supply chained and intervention	(1 OR "supply chain*" OR "supply management") AND 17 NOT US NOT "United States" Chose Geography from list of hits: Zambia, Tanzania, Brazil, Nigeria, Singapore, South Africa MeSH plus original term	11

Summary of Terms Used	Exact Terms Used[4]	Resulting Number of Abstracts
SocINDEX		
Supply chain & LMIC or developing country	(1) AND (20 OR 21) NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* Chose Geography from list of hits: developing countries, Cuba, developing--economic policy, Kenya, Pakistan, Africa, Asia, Bangladesh, Bhopal (India), Ethiopia, India, Indonesia, Iran, Latin America, Nigeria, Philippines, South Africa, Turkey Sociology Thesaurus + Original terms	13
Supply chain and best practices	(1 AND 19) Sociology Thesaurus + Original terms	19
Supply chain and commodity	1 AND 2 Sociology Thesaurus + Original terms Chose Geography from list of hits: 1 AND 2 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm alcohol NOT narcotic* Chose Geography from list of hits: Beijing (China), Hong Kong (China), Lianoning Sheng (China), Panama, Rio de Janeiro (Brazil), Saint Petersburg (Russia) Sociology Thesaurus + Original terms	7
Supply chain and vaccines	1 AND 3 NOT US NOT "United States" Sociology Thesaurus + Original terms	6
Supply chain and distribution	1 AND 4 NOT US NOT "United States" Sociology Thesaurus + Original terms	16
Supply chain and distribution	1 AND 5 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* Chose Geography from list of hits: China, Cuba, Brazil, Czech Republic, Czechoslovakia, Hong Kong(China),India, south, Indonesia, Mexico, Namibia, OECD countries, Panama, Philippines, Russia(federation), South Africa, Thailand Sociology Thesaurus + Original terms	16
Supply chain and warehousing	1 AND 7 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* Sociology Thesaurus + Original terms	4
Supply chain and service delivery	1 AND 8 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* Sociology Thesaurus + Original terms	3
Supply chain and utilization	1 AND 9 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth*NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* Chose Geography from list of hits: Caribbean area, Jamaica ,Malaysia, Melanesia Sociology Thesaurus + Original terms	4
Supply chain and logistics	1 AND 10 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* Chose Geography from list of hits: Africa, Asia, southeastern, Mexico, Singapore Original term only	4

[4] Numbers correspond to the terms listed on Page 4. The search terms are summarized in the first column.

Supply chain and inventory management	1 AND 13 Original term only	6
Supply chain and commodity security	1 AND 15 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth*NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* NOT job* NOT "human resource*" NOT hous* NOT neopopulism NOT educat* NOT oil NOT civic NOT migrat* Chose Geography from list of hits: Asia, Argentina, amazon river region, Africa, sub-Saharan, Africa, east, Singapore, Nigeria, Middle East, Lithuania, Kenya, Czech Republic, Bangladesh, Latin America, soviet union, OECD countries, Mexico, Brazil, India, Russia (federation),Philippines Sociology Thesaurus + Original term	27
Supply chain and evaluation	1 AND 16 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* NOT job* NOT "human resource*" NOT hous* NOT neopopulism NOT educat* NOT oil NOT civic NOT migrat* Sociology Thesaurus + Original term	25
Supply chain and intervention	1 AND 17 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth*NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* NOT job* NOT "human resource*" NOT hous* NOT neopopulism NOT educat* NOT oil NOT civic NOT migrat Original term only	18
Supply chain and lessons learned	1 AND 18 NOT US NOT "United States" NOT environment* NOT agricultur* NOT cloth* NOT invest* NOT food NOT auto* NOT grocery NOT farm NOT alcohol NOT narcotic* NOT job* NOT "human resource*" NOT hous* NOT neopopulism NOT educat* NOT oil NOT civic NOT migrat Original term only	7