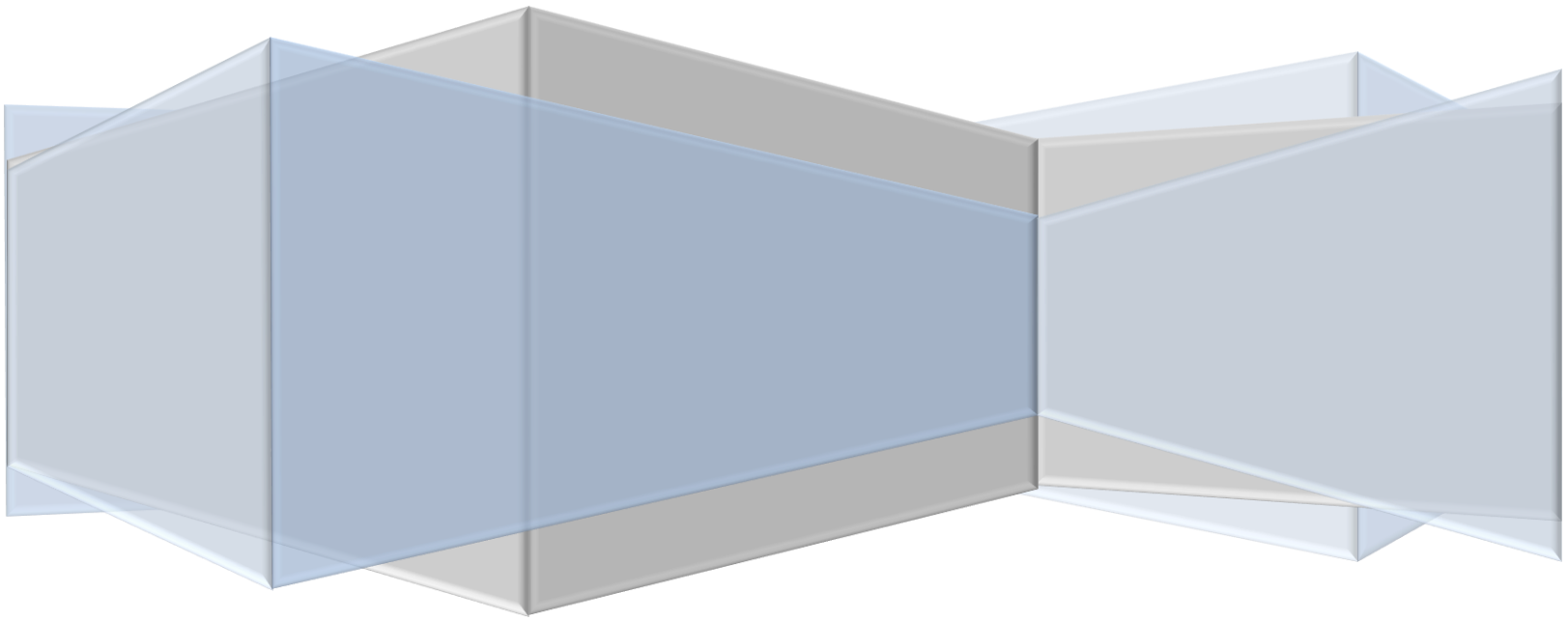
Considerations for the Integration of HMIS and LMIS



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ACKNOWLEDGMENTS

The development of this toolkit has been part of the efforts led by the UN Commission on Life-Saving Commodities ("the Commission") for Women and Children, which aims to increase access to life-saving medicines and health supplies for the world's most vulnerable people. As part of the *Every Woman, Every Child* movement and efforts to meet the health-related Millennium Development Goals and beyond, the Commission leads efforts to reduce barriers that block access to essential health commodities. As part of the working group on Supply and Awareness, the development of this paper was spearheaded by the subgroup working on the documentation of promising practices in supply chain management.

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Recommended Citation
Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. 2014. *Considerations for the Integration of HMIS and LMIS*. Arlington, VA: Management Sciences for Health.

INTRODUCTION

In many countries and contexts, health management information systems (HMISs) and logistics management information systems (LMISs) and their data are managed separately. They are often housed in separate organizations or management hierarchies. Even if data collection at the community or facility level is compiled on one form and handled by one person for both logistics and service delivery information, service delivery program managers often do not have access to aggregate logistics data, reports, and statistics. Likewise, logisticians do not have access to aggregate service delivery data, reports, and statistics.

As a result of these silos, decision makers do not have all the data they need to effectively understand performance of their areas. Accurate forecasts for commodities often cannot be completed by logisticians and forecasting teams without reliable access to service delivery data from an HMIS. Similarly, service delivery managers struggle with understanding the root causes for patterns seen in service delivery. Overburdened health workers are forced to collect duplicate data to try to close the information gap that decision makers face on both sides.

Integrating these systems or routinely linking the data for analysis by decision makers has been proposed as a solution to many of these challenges. Therefore, the objective of this subgroup working on the documentation of best practices in supply chain management was to review cases where HMIS and LMIS data have been combined on an ad hoc basis or routinely linked and to determine the benefits that can come from such linking or integration of data, as well as challenges to achieving such integration.

Definitions

A ***logistics management information system*** **(LMIS)** is an information system that is used to collect, organize, and present logistics data gathered from all levels of the health system. An LMIS collects data about health products, such as quantities dispensed, stock on hand, losses, and adjustments. An LMIS enables logisticians to collect the data needed to make informed decisions that will ultimately improve product availability and customer service. One immediate decision that is made based on logistics data is the quantities of products that should be resupplied to health facilities.[1]

A ***health management information system*** **(HMIS)** collects and reports program information, such as incidence of disease, client/patient information, and health services rendered. HMIS data can be used to determine disease patterns or to track health services use, as well as to monitor and evaluate health service delivery.[2]

[1] USAID | DELIVER PROJECT, Task Order 1. 2011. *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities*. 2nd ed. Arlington, VA: USAID | DELIVER PROJECT, Task Order 1.

[2] World Health Organization Regional Office for the Western Pacific. 2004. *Developing Health Management Information Systems: A Practical Guide for Developing Countries*. World Health Organization 2004. Manila, Philippines: World Health Organization. http://www.wpro.who.int/publications/docs/Health_manage.pdf.

For the purpose of this paper, integration and linking of data denote being able to report on HMIS and LMIS data side by side, over the same time horizon, to compare and use data from both systems, giving LMIS and HMIS managers access to both data sets together for decision making and analysis.

We have identified three primary ways that LMIS and HMIS data can be linked:

1. **Ad hoc comparison of data:** Gathering data from both the LMIS and HMIS independently at a single point in time and manually comparing or linking the data for comparison and analysis

2. **Capturing LMIS and HMIS data in one system:** Either creating a single system that acts as both an HMIS and an LMIS or capturing a subset of data from one system in the other

3. **Electronic integration of separate HMIS and LMIS:** Two separate, independent HMIS and LMIS systems that are integrated externally so that relevant data from each system is available to users of both systems

In conducting interviews to prepare this report, we determined that although substantial interest exists in linking LMIS and HMIS data, very few examples are in place where countries are successfully implementing links of the three types mentioned. Therefore, the considerations outlined in this report are based on the expertise of the interviewees rather than specific country examples.

BENEFITS OF INTEGRATING HMIS AND LMIS DATA

Individuals working in both logistics and health service delivery have identified several benefits of linking HMIS and LMIS data. Beyond improving logistics systems and service delivery, validating data, reducing data collection burdens and data duplication, improving monitoring and evaluation, and enhancing communication have also been cited as benefits of integrating the two systems.

Improving the Logistics System

Routinely linking LMIS and HMIS data and providing easy correlation and analysis of the combined aggregated data can be useful in supporting functions of the logistics system in a number of ways, including quantification, disease surveillance, and planning.

Quantification

"Quantification is a critical supply chain management activity that, once the outputs have been produced as a result of the exercise, should drive an iterative process of reviewing and updating quantification data and assumptions, and recalculating the total commodity requirements and costs to reflect actual service delivery and consumption of commodities, as well as changes in program policies and plans over time. The results of quantification should be reviewed and updated at least every six months, and more frequently for rapidly growing or changing programs."[1]

Linkages improve the quantification process by providing up-to-date, on-demand service delivery and disease prevalence data alongside consumption data to support quantification exercises on a regular basis throughout the year. Particularly for new programs, where not much historical consumption data are available, service delivery and morbidity data are essential in combination with consumption data to effectively forecast supply needs. The 13 commodities identified by the Commission are a good example of a case in which service delivery data in combination with consumption data are essential in the quantification process, because the commodities are currently underused and consumption data alone are not sufficient for accurate quantification.

Overall, routine linking of HMIS and LMIS data enables quantification exercises to be performed more frequently than the typical annual process.

Disease Surveillance

In cases in which timely disease surveillance data exist in the HMIS, linking this information with the logistics system can improve responsiveness of the logistics system to disease outbreaks. For example, disease surveillance data can help drive vaccine delivery to where the need is highest in outbreak situations.

[1] USAID | DELIVER PROJECT, Task Order 1. 2008. *Quantification of Health Commodities: A Guide to Forecasting and Supply Planning for Procurement.* Arlington, VA: USAID | DELIVER PROJECT, Task Order 1, p. 3.

Because timely disease surveillance data are not always readily available, historical morbidity data in an HMIS can be used to plan for seasonal variability and disease trends in supply planning. Linking such data to an LMIS can help ensure that the logistics system is responsive when demands for medicines and commodities are higher. For instance, malaria outbreaks are often seasonal. Historical malaria case data from the HMIS can be used to determine trends in seasonal variability of malaria transmission and effectively plan for distribution of rapid diagnostic tests and treatment. Taking seasonality into account on the larger, national scale can help ensure that appropriate shipment quantities arrive at the right time, so that countries are not overstocked when demand is low (e.g., dry season) and understocked when demand is high (e.g., rainy season).

Planning

Linking HMIS and LMIS data can also help logisticians effectively identify mismatches between availability and distribution of commodities. In the case that facilities are experiencing regular stock-outs, service delivery data can be used to more accurately plan for supply needs beyond the typical consumption data that are available in an LMIS. For example, if HMIS data show low rates of immunization in the community, linking this knowledge with stock information from the LMIS can help identify whether such rates are caused by stock-outs and issues in the logistics system or by an issue that is unrelated to the logistics system. Furthermore, when the LMIS includes days out of stock, this information can be translated into cases not served by comparing it to HMIS case data.

HMIS data linked to the logistics system can also help identify cases where usage is falling much lower than forecasted levels, resulting in oversupply. The logistics system can identify the oversupply, but linking it to the HMIS can help identify whether the oversupply is caused by lower-than-expected service delivery numbers or lack of adherence to treatment protocols. Similarly, having service delivery data available alongside logistics data can help identify issues of leakage (the loss, theft, or diversion of public health commodities from their established distribution channels or beneficiaries). If consumption data are far exceeding service delivery data, reports linking the two metrics could easily flag potential ratios indicating leakage so they can be investigated more fully and any issues can be addressed.

Improving Service Delivery

Just as routinely making HMIS data available to logistics managers in a way that allows them to easily correlate it with LMIS data can improve the logistics system, making LMIS data routinely available with HMIS data to managers responsible for service delivery at all levels of the hierarchy can help improve service delivery.

The most direct and obvious way that LMIS data can be used to improve service delivery is to help measure adherence to treatment guidelines and standard operating procedures by service providers. One reason that consumption data may not correlate as expected with service delivery data is issues relating to adherence to treatment protocols. For example, as the USAID | DELIVER PROJECT found when comparing malaria program HMIS and LMIS data in Zambia, one of the reasons that consumption data did not match case data may have been a lack of adherence to the

guideline that every suspected malaria case needed to be confirmed by a rapid diagnostic test or microscopy before providing treatment with artemisinin-based combination therapy.[2]

Validating Data

The most immediate and obvious benefit of linking LMIS and HMIS data is for data validation and quality checks. Because the two data sources are relatively independent but capture data that should often correlate with each other, linking the two sources permits cross validation of the quality of data in each system.

Though simply linking and comparing the data does not identify the reasons for any discrepancies, it does bring to the surface potential data quality issues for further investigation. Linking LMIS and HMIS data for data validation purposes does not necessarily require routine linking of the data or integration of the two systems in an automated way; however, doing so allows consistent validation of the two sources regularly to identify data quality issues as they arise and address them immediately.

Reducing Data Collection Burden and Duplicate Data Collection

In many countries and programs, separate health management information and logistics management information systems exist in parallel, each capturing a subset of duplicate data. HMISs often capture logistics indicators (such as consumption and stock on hand) for some key commodities, and similarly, LMISs sometimes capture select service delivery data.

This type of parallel and duplicate data capture of HMIS data in the LMIS and of LMIS data in the HMIS exists in many countries and programs because of the lack of integration between systems and organizational separation between logistics and service delivery organizations. The waste of effort in capturing duplicate data can be eliminated if an external integration of the LMIS and HMIS can be maintained or if data can routinely and easily be linked for reporting purposes.

In cases where HMIS data are collected in the LMIS and vice versa, the duplicate data collection can be eliminated in favor of integrating the systems or linking the data at the national level, allowing decision makers across the health system to analyze both LMIS and HMIS data as needed, without requiring duplicate data collection in either system.

Certain practical realities that cannot be ignored have resulted in programs choosing to collect duplicate data, such as issues of data ownership, reliability, trust, and managing risk of relying on data from an external source of information. However, addressing these issues and working toward routinely linking the systems and beginning to reduce duplicate data collection can benefit the health system and the individuals responsible for data collection.

[2] USAID | DELIVER PROJECT, Task Order 3. 2011. *Digging into Malaria Data: Comparing HMIS and LMIS Data to Improve Program Management in Zambia*. Arlington, Va.: USAID | DELIVER PROJECT, Task Order 3.

Monitoring and Evaluation of Health Programs

Indicators needed for monitoring and evaluation of health programs can require data elements from both the HMIS and LMIS. In family planning, for instance, a needed indicator for program monitoring and evaluation is couple years protection (CYP). This indicator, which estimates the number of couples that are protected from pregnancy using any method of contraception, is calculated using data from both the HMIS (number of tubal ligations, vasectomies, and IUD insertions performed) and the LMIS (quantity of condoms, birth control pills, and spermicides that are distributed to clients).

CYP can then be used to calculate an estimate of the Contraceptive Prevalence Rate (CPR), by dividing the calculated CYP by the estimated number of women of reproductive age, which can be obtained from population census data. Another source for the calculation of CPR is the Demographic and Health Survey (DHS). Although the DHS is considered the "gold standard" for the estimation of CPR, it is only calculated for the year of the survey (usually every five years) and is only reliable for national and broad regional estimates (regional/provincial estimates, not district or below). CPR can be estimated through the use of CYP and census information on an annual basis and at more detailed levels in the health system (district level and below). Thus, for monitoring and evaluation, data from these four sources (HMIS, LMIS, DHS, and census) should be linked.[3]

Enhancing Communication between Service Delivery Program Managers and Supply Chain Managers

As indicated earlier, in many countries, staff who manage service delivery data and logistics data are separated from the facility level all the way up the supply chain to the central level. Routinely linking HMIS and LMIS data and the analysis that comes from the linked data would not only enable managers on both sides to understand and improve the functions they are responsible for, it may also enhance the communication across organizational boundaries. To properly analyze and interpret the linked data, service delivery and supply chain program managers would need to work together regularly to fully understand the situation that the data represent.

[3] Inglis, Andrew. 2013. Getting products to people: The impact of contraceptive supply on use. Presentation at the International Family Planning Conference, Addis Ababa, Ethiopia, November.

CHALLENGES OF LINKING HMIS AND LMIS DATA

Individuals working in logistics and health service delivery have also identified challenges involved in linking HMIS and LMIS data. These challenges include adjusting organizational structures to accommodate linkages, data quality issues, and technical challenges.

Organizational Challenges

The most consistently cited challenges from both HMIS and LMIS managers when discussing the topic of integrating the two systems were related to organizational structure. The issue was identified at the country-level health system and at the international level with donor organizations and international nongovernmental organizations (NGOs).

In many countries, a distinct organizational separation exists between logistics and service delivery groups. The two groups operate independently from the national level all the way down to the service delivery level. As a result, very little data is shared and coordination across organizational boundaries to begin planning an integration effort across systems is challenging. Below the surface, deeper issues of data ownership and exposing data quality issues may also exist, creating additional barriers to collaboration beyond the previously mentioned challenges.

The separation between logisticians and service delivery program managers in ministries of health around the world is further reinforced by donors and global health NGOs. Donor funding and technical assistance from international NGOs often follows a similar pattern of segregation, with entirely separate funding streams going toward logistics and service delivery programs, very little coordination and collaboration between programs, or minimal commitment to integration of data and management information systems between the two groups.

Without reference implementations that demonstrate actual versus theoretical benefits, convincing donors and senior government leadership to work across organizational boundaries and prioritize an effort to routinely link HMIS and LMIS data is difficult.

Data Source Issues

Another key challenge to consider is related to the quality, timeliness, and reporting rates of each system. If the data quality is suspect in either system and efforts have not been made to validate and improve the quality of the data in each system separately, the value of linking the data decreases substantially.

Similarly, if reporting rates for one or both systems are particularly inconsistent or low, this can also reduce the value of linking the systems.

Finally, the largest barrier in data source issues is related to timeliness. Data quality issues are often perceived to be a reason not to link data; however, the timeliness issue is often considered a

stronger reason. If data from either system are not available in a timely fashion, then the value of routine linking of the data can also be minimized, because it may not be usable for regular and routine decision-making and analytics.

Technical Challenges

Though organizational and data quality and reliability issues can often be larger barriers to successfully linking LMIS and HMIS data, several non-negligible technical issues may also need to be addressed to successfully implement routine linkage of the two systems for reporting and analysis. The primary technical challenges that exist, regardless of the actual systems used for the HMIS and LMIS, involve ensuring that the data sets match up and can be reliably linked in a manner that allows for comparison and correlation of the data.

Often, standards for describing the data may not be consistent between systems. For example, domain data, such as the codes used to describe facilities or geographical regions, may not be consistent across the two systems. To reliably link the data across systems, common standards for domain data being used to link the system must be agreed upon and adhered to.

Aggregation of data in each system may also not be consistent. If data are aggregated using different time frames or geographical groupings, then successfully linking and analyzing the data is difficult. As an example, the Dedicated Logistics System for Vaccines in Mozambique has excellent data for key logistics indicators, such as stock-outs. However, these data are collected during site visits that do not always correlate with the monthly reporting periods for service delivery. The snapshots for logistics indicators and aggregate service delivery data are taken at different times, and correlating the two data sets for decision making could be problematic. Therefore, consideration must be given to rethink and optimize reporting periods for system links.

Finally, once consistent standards for describing and aggregating the data have been agreed upon, maintaining the external links and domain data used across systems can often pose a challenge. Particularly in contexts where separate organizational hierarchies exist for logistics and service delivery, determining exactly who is responsible for maintaining this link (such as the facility list) and ensuring the ongoing reliability of the linked data can be challenging.

RECOMMENDATIONS FOR ROUTINELY LINKING HMIS AND LMIS DATA

The benefits that can come from working through the identified challenges to successfully link the two systems might make this a valuable undertaking in many countries and programs. In this vein, several recommendations have been made to help guide the process.

Encourage Communication across Organizational Boundaries

To build a sustainable linkage or effectively compare the data manually, trust and good communication are needed between the groups managing the HMIS and LMIS. Many of the potential barriers to regularly comparing the data or maintaining a sustainable linkage involve communication and coordination issues. Logistics and health program managers should convene regularly to discuss the linked data, iron out issues, and discuss decision-making based on the data. A joint working group comprising LMIS and HMIS stakeholders could be created, including both technical and programmatic staff, so that the technical and organizational aspects of the linkage can be addressed with equal priority. To help drive a systems integration effort, this working group can develop shared use cases and goals focused on how the end product will not just produce more data, but rather help improve decision making in the health system.

An non-traditional method for fostering communication is a human resources role swap program between the respective boundaries handling the LMIS and HMIS components. To avoid falling captive to superficially collaboration, it may be wise to have organizational staff members take on an immersive deep dive experience through formalized role swaps. This approach is an adaption of a practice used in some private sector companies of conducting regular role swaps between departments that are inter-linked. In effect, by allowing staff members to role sway, it allows the organization greater potential to become immune to silo-like activities and the natural build-up of communication barriers over time. The segregated working environment is naturally overcome by leveraging off the human relationship developed through the immersive deep dive experience creating potential for a bridge of trust to be created.

Create Data-Sharing Agreements

Creating data-sharing agreements early on can provide a concrete place to start the collaboration process when working across organizational boundaries. Not only will it help encourage communication between the two groups, it can also help build trust and address concerns each party might have about making their data available externally.

Agree upon Data Standards

Ensure stakeholders for both logistics management information and health management information systems agree upon standards for key domain data that are required for comparing and linking the two data sources, such as facility identifiers and organizational hierarchy. Data

dictionaries describing the metrics that are being shared should also be discussed and mutually understood.

Test Linkage of Data

Try manually comparing or linking the two data sources for a limited data set (time frame and set of facilities). This "proof of concept" will help identify and uncover potential issues that may arise when the linking of the data sets is automated. Conducting a proof of concept early on can demonstrate the benefits of potential linkage to stakeholders quickly.

Resolve Data Quality Issues

Identify and focus on resolving issues with data quality, timeliness, and reporting rates for the HMIS and LMIS. Such issues in either system reduce the value of the investment put into linking/integrating the two systems. However, also recognize that improving data quality is a continuous process and the absence of near-perfect data quality should not prevent moving forward with regularly comparing the data or linking the systems in an automated way. Rather, the linking/integration process should be used as an opportunity to continue improving data quality and an additional means of identifying data quality issues.

Evaluate Technology Options

First, evaluate whether linking the data in an automated way is appropriate for the context. Although there is undoubtedly value in regularly comparing the data from the two systems, cases may exist where routinely linking the systems in an automated way (e.g., system integration) will provide a high return on investment and cases where it will not. In cases where automated comparison it is not appropriate or feasible, the preceding recommendations will still help with regular communication and coordination to compare data from the two systems to yield some of the benefits discussed in this paper.

For cases where an automated solution is appropriate, considerations should be made on how to best link the two data sources based on the technology used for each system. The assessment should examine the current operational context and the long-term strategic goals of each system. Two methods for linking the systems include the (a) integration of the two systems and (b) collecting all LMIS and HMIS data in one system. Depending on the context, one option may be more appropriate than the other.