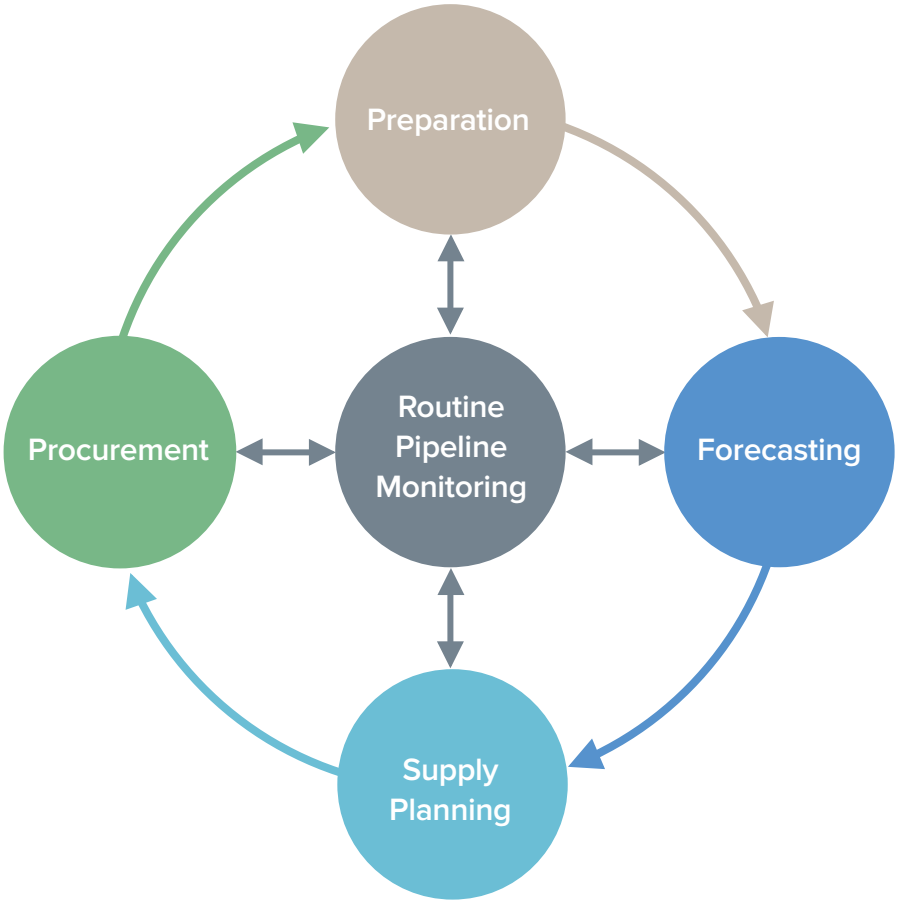
QUANTIFICATION OF HEALTH COMMODITIES

A GUIDE TO FORECASTING AND SUPPLY PLANNING FOR PROCUREMENT



JANUARY 2017

JSI

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ABOUT JSI

John Snow, Inc. (JSI) is a U.S.-based health care consulting firm committed to improving the health of individuals and communities worldwide. Our multidisciplinary staff works in partnership with host-country experts, organizations, and governments to make quality, accessible health care a reality for children, women, and men around the world. JSI's headquarters are in Boston, Massachusetts, with U.S. offices in Washington, D.C.; Atlanta, Georgia; Burlington, Vermont; Concord, New Hampshire; Denver, Colorado; Providence, Rhode Island; and San Francisco, California. JSI also maintains offices in more than 40 countries throughout the developing world.

RECOMMENDED CITATION

John Snow, Inc. 2017. Quantification of Health Commodities: A Guide to Forecasting and Supply Planning for Procurement. Arlington, Va.: John Snow, Inc.

ABSTRACT

This updated guide to quantification of health commodities will assist technical advisors, program managers, warehouse managers, procurement officers, and service providers in (1) estimating the total commodity needs and costs to support successful implementation of national health program strategies and goals, (2) identifying the funding needs and gaps for procuring the required commodities, and (3) planning procurements and shipment delivery schedules to ensure a sustained and effective supply of health commodities.

The step-by-step approach to quantification presented in this guide is complemented by a number of product-specific companion pieces that include detailed instructions for forecasting consumption of antiretroviral drugs, contraceptives, community case management products, HIV test kits, antimalarial drugs and rapid diagnostic tests, underused RMNCH commodities, and laboratory supplies.

Cover graphic: High Level Steps in Quantification

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ACRONYMS

3TC	lamivudine
ABC	abacavir
AIDS	acquired immunodeficiency syndrome
ANC	antenatal care
ART	antiretroviral therapy
ARV(s)	antiretroviral (medicine(s))
ATV/r	atazanvir/ritonavir
AZT	zidovudine
CHAI	Clinton Health Access Initiative
CPR	contraceptive prevalence rate
CYP	couple-years of protection
EID	early infant diagnosis
EFV	efavirenz
FPLM	Family Planning Logistics Management (project)
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
HIV	human immunodeficiency virus
HMIS	health management information system
LMIS	logistics management information system
LPV/r	lopinavir/ritonavir

max-min	maximum-minimum (type of inventory control system)
M&E	monitoring and evaluation
MOH	Ministry of Health
MOS	months of stock
NGO	nongovernmental organization
NVP	nevirapine
OI	opportunistic infection
ORS	oral rehydration salts
PITC	provider-initiated testing and counseling
PMTCT	prevention of mother-to-child transmission (of HIV)
RH	rifampicin/isoniazid
RHZE	rifampicin/isoniazid/pyrazinamide/ethambutol
SOW	scope of work
STG	standard treatment guideline
TB	tuberculosis
USAID	U.S. Agency for International Development
VCT	voluntary counseling and testing (HIV and AIDS)
VEN	vital, essential, non-essential

ACKNOWLEDGMENTS

This publication is dedicated to the many individuals from communities, nongovernmental organizations (NGOs), faith-based organizations, ministries of health, and other organizations that have consistently fought for access to essential medicines and health services. The publication is also dedicated to friends and counterparts who have worked with the USAID | DELIVER PROJECT and its predecessor projects, the John Snow, Inc. DELIVER project, and the Family Planning Logistics Management (FPLM) I, II, and III; Supply Chain Management System (SCMS); Supply Chains for Community Case Management (SC4CCM), and other JSI Center for Health Logistics projects; and to the thousands of committed professionals in ministries of health and NGOs who work daily to supply their customers and programs with essential public health commodities. Sincere thanks go to the extended core team of dedicated technical staff from the field and from the JSI office in Arlington, Virginia, who developed and wrote parts of this guide. The lessons in this guide are drawn from their experience conducting quantification exercises, in multiple countries, across commodity categories.

Photo courtesy of A. Makulec, Ethiopia

PURPOSE

WHO SHOULD USE THIS GUIDE?

This practical guide for quantification of health commodities is a reference for technical advisors, program managers, procurement officers, commodities/logistics/warehouse managers, service providers, government officials, implementing partners, donor agencies, and others on how to conduct a national-level quantification exercise. Individual members of the quantification team will find the output from the quantification useful for program planning, budgeting, and mobilizing resources for procuring commodities.

WHAT IS THE PURPOSE OF THIS GUIDE?

This guide is designed to assist users in applying a systematic, step-by-step approach to quantifying health commodity requirements and costs. It should be used when conducting a national-level quantification exercise and includes specific guidance on how to use the results of the quantification to do the following:

- Identify the funding needs and gaps for procuring the required commodities
- Coordinate procurements and shipment delivery schedules to ensure a sustained and effective supply of commodities
- Implement a process for reviewing and updating the results of the quantification to maintain and improve the validity, accuracy, and usefulness of current and future quantifications

The step-by-step approach to quantification of health commodities presented in this guide will enable users to:

- List the specific data required at each step of the quantification
- Collect and analyze the available data
- Identify and obtain consensus on the forecasting assumptions needed to account for missing data and to estimate the effect of key programmatic and environmental factors expected to influence the demand for commodities
- Organize forecasting data and assumptions, and structure the forecasting tree for demographic-/morbidity-based forecasts
- Utilize the forecasting data and assumptions to calculate the quantity of each product expected to be dispensed or consumed during each year of the quantification
- Identify the key supply chain parameters required to estimate the total commodity requirements and costs for the country or the program

- Identify and obtain consensus on the supply planning assumptions needed to account for missing data and to estimate the effect of the key supply chain factors expected to influence the supply of health commodities
- Calculate the total commodity requirements and costs for each year of the quantification
- Plan shipment quantities and delivery schedules to ensure continuous supply for each year of the quantification
- Compare the amounts and timing of funding commitments for procurement with the total commodity costs and required shipment delivery dates as the final step in the quantification
- Explain the benefits of using the PipeLine software to obtain the final outputs of the quantification
- Monitor the supply plan
- Review and update the results of the quantification to maintain and improve the validity, accuracy, and usefulness of current and future quantifications

A NOTE ABOUT SOFTWARE TOOLS: Several software programs are available to complete the forecasting and supply planning steps in a quantification exercise, but there is no single tool that does it all. This guide is not intended to train users how to use any specific software tool, but rather to guide users through the process of conducting a quantification. Based on more than 20 years working with a wide range of commodities, the supply planning process as explained in this guide is linked to the PipeLine software. Please see appendix B: Software Programs for Quantification of Health Commodities.

Photo courtesy of A. Makulec, Ethiopia

HOW TO USE THIS GUIDE

This general guide should be used with the companion pieces that have been developed for different categories of commodities. This guide describes the overall quantification process from start to finish, provides instructions for each step in the quantification process, and cites challenges and examples from actual quantification exercises.

Please refer to the product-specific companion pieces produced by JSI and others for detailed guidance on forecasting consumption for antiretroviral (ARV) medicines; HIV test kits; laboratory supplies; antimalarial medicines and rapid diagnostic tests; contraceptives; and select reproductive, maternal, neonatal, and child health commodities. Companion pieces include information on the products; how they are prescribed, dispensed, and used; the types of data required; and the common assumptions that should be incorporated into the forecasting step for these commodities.

INTRODUCTION TO QUANTIFICATION

WHAT IS QUANTIFICATION?

Quantification 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.

Quantification takes into account the expected demand for commodities, unit costs, existing stocks, stock already on order, expiries, lead time, minimum and maximum stock levels, and shipping costs. Using this information, the total commodity requirements and costs for the program can be calculated and compared with the available financial resources to determine the quantities to procure.

FORECASTING is the process of estimating the quantities of products that will be dispensed or used.

SUPPLY PLANNING involves determining the product quantities required to fill the supply pipeline, scheduling shipments, and estimating costs.

Quantification includes forecasting and supply planning. Forecasting is the process of estimating the quantities of products that will actually be dispensed or used to meet the health needs of the targeted population during a specific future period of time. Forecasting can be based on historical consumption (quantities dispensed or used), services, morbidity and/or demographic data, and assumptions about future demand, program plans, and performance. When historical data are unavailable or unreliable, assumptions will also be needed to estimate program performance and product consumption.

Supply planning involves determining the total product quantities and costs required to fill the supply pipeline to ensure optimal procurement and delivery schedules, taking into account forecasted consumption, minimum and maximum stock levels, order and shipping lead times, and desired arrival dates of shipments.

ROLE OF QUANTIFICATION IN THE SUPPLY CHAIN

The approach to quantification developed by the JSI Center for Health Logistics under the USAID | DELIVER PROJECT and its predecessor projects and used across projects, countries, and commodity categories, is based on more than 20 years of experience conducting quantifications for a wide range of public health commodities. Quantification is a critical supply chain activity that links information on services and commodities from the facility level with the program policies and plans at the national level; it is then used to inform higher-level decision-making on the financing and procurement of commodities. The results from a quantification can be used to help

maximize the use of available resources for procurement, advocate for mobilization of additional resources when needed, and inform manufacturer production cycles and supplier shipment schedules.

Quantification is not a one-time exercise, but it is an iterative process, which includes reviews and updates required year-round.

Quantification is not a one-time, annual exercise that ends when the final quantities and costs of the commodities have been determined. Rather, the outputs from the exercise should drive an iterative process of reviewing and updating the quantification data and assumptions; and recalculating the total commodity requirements and costs to reflect actual service delivery and consumption, as well as changes in program policies and plans over time. To avoid supply imbalances—both shortages as well as overstocks and wastage—the supply plan should be monitored routinely and the results of a quantification should be reviewed and updated at least every six months; more frequently for rapidly growing or changing programs. The Reviewing and Updating the Quantification section in this document provides more detail on monitoring and updating quantifications.

Please see the References section of this guide for other JSI and partner documents and software products related to quantification of health commodities in resource-constrained settings.

WHO SHOULD CONDUCT A QUANTIFICATION?

For a quantification exercise to be useful and effective, the right people need to be involved in each step of the process, from data collection and analysis to presenting the final results to the Ministry of Health (MOH) and other relevant authorities. Logistics managers, policymakers, program managers, technical experts, procurement officers, warehouse managers, and service providers are the people most often involved in quantification. The policies determining the selection and use of the products being quantified are also specific to each program, type of service, and type of commodity being used. Therefore, it is important to consult with clinical, pharmacy, and laboratory staff who are closely involved in providing these services and managing the commodities throughout the quantification process.

Institutionalizing local skills and capacity in quantification requires resources and a commitment by all key players.

One or more members of the quantification team should have significant software database management skills to structure the quantification database(s), enter the forecasting and supply planning data and assumptions into the database, calculate the final drug quantities and costs, and plan the required shipment quantities and schedules to meet the total program or country requirements.

Depending on the capacity of in-country program managers and staff, external technical assistance is often required for national programs that want to apply a proven approach to quantification. The success of capacity-building efforts and institutionalization

of local capacity in quantification of health commodities will depend on the level of investment in the process and the commitment of local staff to make quantification part of their job responsibilities. See the Reviewing and Updating the Quantification section for detailed information on the level of effort, specific activities, and the staff skills and experience required to conduct, review, and update national quantifications.

STANDARDIZATION AS A PREREQUISITE TO QUANTIFICATION

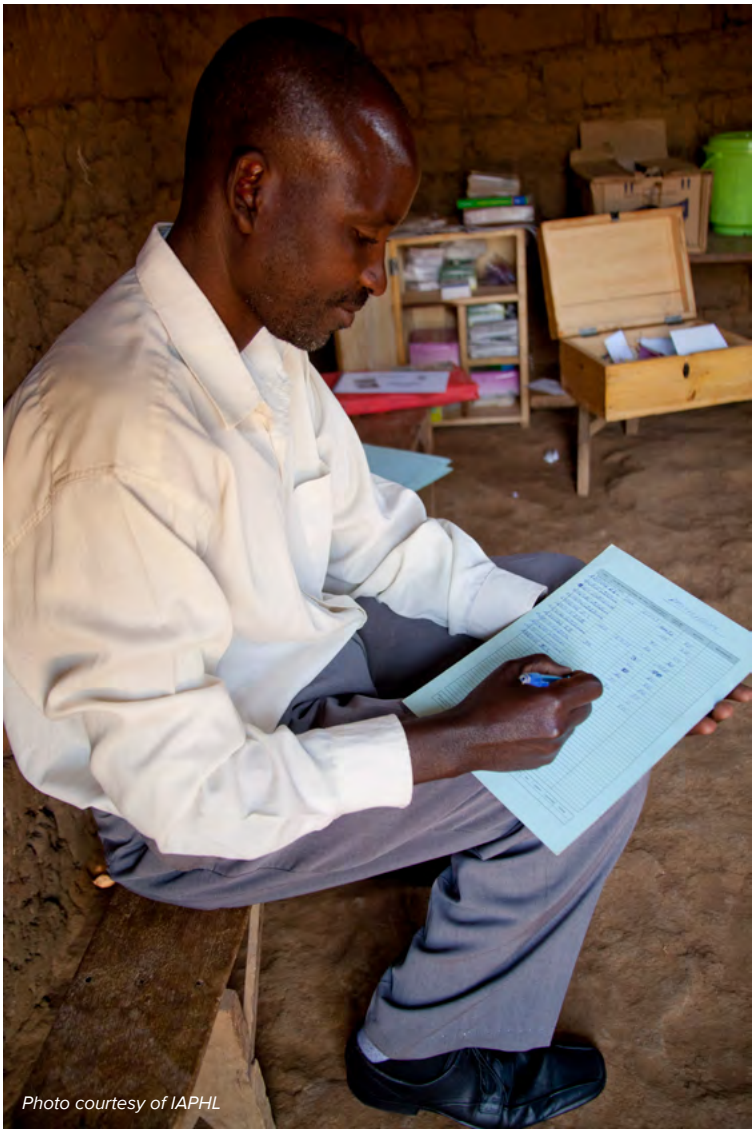
A prerequisite for conducting quantification for any health commodity is clear, well-defined, and disseminated standard treatment guidelines (STGs), testing protocols, and laboratory testing menus for defining how specific products should be administered for treatment or used for testing. This is especially true when reliable consumption data are not available. A critical assumption when using demographic data, morbidity data, and services data is that service providers are following established standard guidelines. Therefore, standardization should precede quantification, as these guidelines are the basis for the assumptions in the forecasting step of the process.

In the case of new, rapidly expanding programs, the importance of STGs and testing protocols is magnified, because sufficient quantities of commodities must be procured to allow for expansion. In addition, many health services require multiple products to be available at the same service delivery point (SDP) at the same time.

Sometimes, when conducting a national-level quantification, which could encompass programs run by the MOH and others, there can be more than one set of STGs. For example, an NGO-run treatment program may use its own guidelines and will not adhere to national STGs. In this case, the programs would need to calculate their forecasts separately.

Adherence to STGs can help ensure that products are used as intended and can also enhance the accuracy in the forecasting step of the quantification. Noncompliance with STGs may compromise the validity of the forecasting results and can lead to procurements that result in overstocking and wastage of some products and stockouts of others.

It is also essential to consult the essential medicines list and/or list of medicines previously procured to ensure the forecast inputs and outputs are standardized with the approved and registered medicines in the country.



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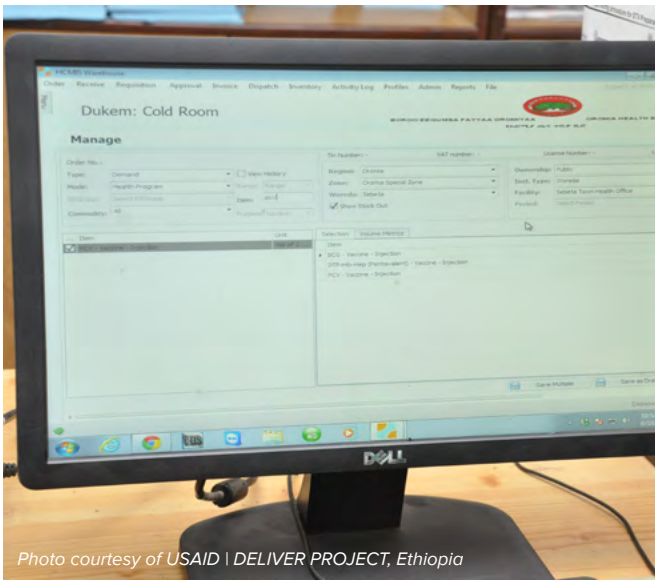

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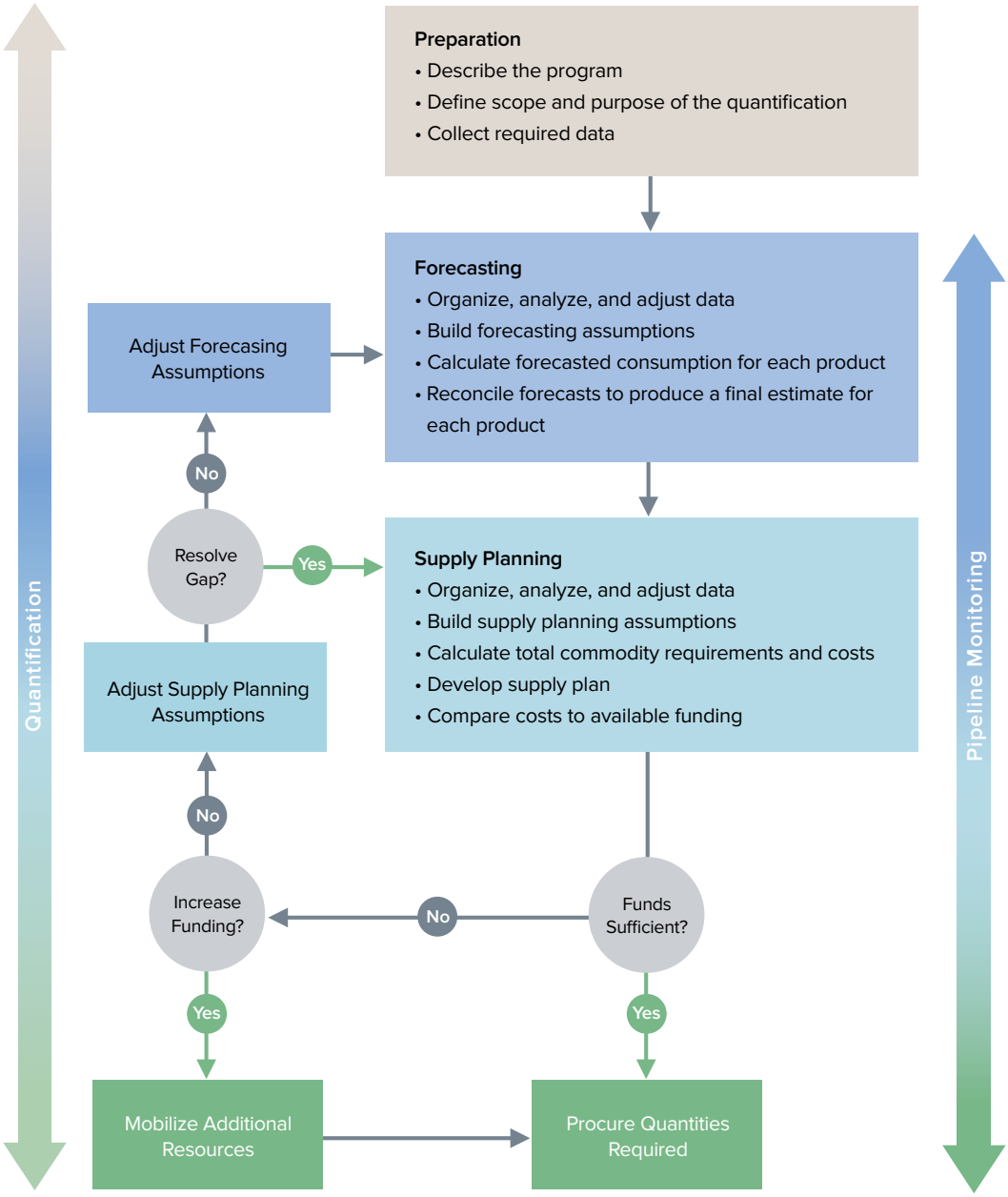
STEPS IN QUANTIFICATION

This section offers a standardized, step-by-step approach to quantification. It follows the steps outlined in figure 1. The three basic steps are preparation, forecasting, and supply planning.

FIGURE 1.
STEPS IN QUANTIFICATION



PREPARATION

Prior to collecting data, two initial steps should be taken: (1) describe the program; and (2) define the scope, purpose, and timeframe of the quantification.

Preparation
- Describe the program
- Define scope and purpose of the quantification
- Collect required data

DESCRIBE THE PROGRAM

Summarize the background, current status, and performance of the program for the commodities being quantified. The summary should include a review of program goals, strategies, and priorities, and any expansion plans or change in policies that could significantly influence the uptake of services and demand for commodities. It should also include a brief description of the service delivery model, supply chain (i.e. the flow of products and information), level of political commitment, and financial support for services and for commodities. It should note any challenges the program has encountered in ensuring the supply of commodities for the program and the availability of products at SDPs.

DEFINE THE SCOPE, PURPOSE, AND TIMEFRAME OF THE QUANTIFICATION

SCOPE OF THE QUANTIFICATION

It is necessary to define which programs and which commodities will be included in the quantification exercise. Quantification of one category of commodities, such as ARV medicines, may include commodity requirements for the public-sector antiretroviral therapy (ART) program or it could include the NGO and faith-based sectors as well. A quantification could also be conducted for a particular funding agency, implementing partner, geographical region, or specific population group. Best practices in supply chain management have shown that a national-level quantification of commodity requirements to cover all demands for a particular category of commodities is the most useful. A national-level quantification enables key stakeholders to know the full extent of the commodity needs and to coordinate mobilization of resources for procurement.

The specific list of commodities to be quantified should be agreed upon in defining the scope of the quantification, which could include a combination of branded and generic products; products procured by governments and local institutions and donated by different funding agencies; or products procured from multiple suppliers.

PURPOSE OF THE QUANTIFICATION

It is important to identify the purpose of the quantification and how it will address the program's needs. Examples of quantification purposes include the following:

- Provide data on specific commodity requirements and costs for the government's annual budget allocations

- Inform donors about funding requirements and advocate for resource mobilization for commodity procurement
- Estimate commodity needs and assess stock status of the in-country supply pipeline to identify and correct supply imbalances
- Support an estimate of commodity procurement, storage, and distribution costs

TIMEFRAME OF THE QUANTIFICATION

The future time period covered in a quantification exercise needs to be long enough to facilitate timely procurement, identification of funding gaps, and adjustment of shipment schedules, while acknowledging that prediction uncertainty increases with the time horizon into the future. A two-year forecast can be effective for procurement planning, while a longer-term (e.g. five-year) forecast may be useful for strategic planning and budgeting purposes. To allow program managers time to adjust future procurement quantities, supply plans tend to be one to two years, as purchasing commitments are not typically made much more than a year in advance.

Since the supply plan should include not only the actual quantities of each product to be procured and when, but also a shipment delivery schedule based on funding available, established program stock levels, and procurement and supplier lead times, if products included in the quantification have long lead times the supply plan timeframe may need to be extended. For instance, a five-year forecast may not be appropriate for malaria products because the epidemiology of the disease can change rapidly, but lead times for some of the commodities can be 12 months, so a two-year forecast and supply plan, monitored monthly, would be appropriate.

A NOTE ON FORECASTING CONSIDERATIONS FOR ESSENTIAL MEDICINES

Forecasting for essential medicines can be challenging:

- Many countries manage hundreds of essential medicines, so preparing a thorough forecast for each can be time consuming. VEN or ABC analysis can be used to identify the vital and essential commodities.
- Products may be used for multiple indications, thus demographic- or morbidity-based forecasts should cover all indications for each formulation.
- Product use may not adhere as strictly to SDGs as use of program commodities, thus services data may inadequately capture product utilization.
- Many essential medicines are already financed and procured by countries; given financial constraints, they may not always be available in sufficient quantities, which means historical consumption data may be an underestimate of actual need
- Some essential medicines may be available to clients via multiple distribution channels or sectors; when developing estimates for public sector provision, it may be difficult to estimate what proportion of need is to be satisfied by the public sector.

COLLECT REQUIRED DATA

The importance of available and quality data cannot be underestimated. These data include services data on the number and type of health services being provided and logistics data on the consumption and stock levels of commodities for informing the quantification. A well-functioning health management information system (HMIS) and logistics management information system (LMIS) are central to improving the accuracy and usefulness of health commodity quantifications. In addition, morbidity data, demographic data, information on national program policies, strategies, and expansion plans should be used to inform the assumptions in the forecasting step of the quantification.

Different types of data and information will be required at each step in the quantification. The data and information can be collected through interviews and consultative meetings with key stakeholders, including program managers, policymakers, donors, implementing partner organizations, procurement officers, warehousing managers, and clinical and other technical experts, as well as from direct service providers.

Specific data on the number and type of health services provided can be collected through the existing HMIS reports. The consumption and stock levels of individual commodities can be collected through the existing LMIS reports. In some cases, it may be necessary to directly collect data at health facilities. In addition, current policy and technical documents and reports, and any epidemiological surveillance data, demographic health surveys, census data, or special survey studies should be reviewed to collect morbidity and demographic data that can be used in the quantification.

DATA FOR FORECASTING

CONSUMPTION DATA: Quantity of each product dispensed or consumed during past periods

Consumption data are historical data on the actual quantities of a product that have been dispensed to patients or consumed at SDPs, within a specified period, which can be reported monthly, bimonthly, or quarterly. Ideally, the quantification team can examine multiple years' worth of data, available at as granular a level as possible (i.e. monthly totals are preferable to annual totals). Daily consumption data can be found in pharmacy dispensing registers or other point-of-service registers. Where a well-functioning LMIS captures and aggregates these data from SDPs, aggregated consumption data can be found in monthly facility-level and annual program-level reports. When consumption data are used, the forecast is based on the quantities of products consumed in the past. Consumption data are most useful in mature, stable programs that have a full supply of products and reliable data.

EXAMPLE: From February to March, 50,000 tablets of co-trimoxazole were consumed.

SERVICES DATA: Number of visits, number of services provided, lab tests conducted, disease episodes treated, or number of patients on treatment during past periods

EXAMPLE: In 2013, 76,000 cases of TB were treated.

Services data are historical program-level or facility-level data on the number of patient visits to facilities, the number of services provided, the number of disease (or fever) episodes, or the number of people who received a specific service or treatment within a given period. Services data can be found in program monitoring reports, HMIS data, facility-level data on service utilization and attendance rates, or patient records.

MORBIDITY AND DEMOGRAPHIC DATA: Total population, population growth rates, incidence and prevalence of specific diseases/health conditions

These data may be available by population group or through surveillance or research study group, and extrapolated to estimate national-level incidence and prevalence of specific diseases/health conditions.

EXAMPLE: The overall HIV prevalence rate is 12%.

EXAMPLE: The population of a country is 12

Demographic data include the data on the number and characteristics of the population targeted for services, i.e., age breakdowns. Morbidity data are estimates of the number of episodes of a specific disease or health condition that will occur in a common denominator of the population (e.g., number of episodes per 1,000 or per 100,000 population).

Demographic and morbidity-based estimates are often used to estimate the total unmet need for a service or treatment in a program or country; and, therefore, it would represent the uppermost bounds of the potential drug requirements for a program.

INFORMATION ON CURRENT PROGRAM performance, plans, strategies, and priorities, including specific program targets for each year of the quantification.

EXAMPLE: During the next program year, the proportion of pregnant women giving birth in facilities will increase by 2%.

EXAMPLE: During the next program year, the number of CHWs trained to offer ORS and zinc will double.

The quantification team may be able to use target data. In some situations, program targets are also political targets that do not relate to the actual number of patients being served, or who can be served by a program. Broad program targets of this type are best used for advocacy and resource mobilization, and should not be used for quantification of products for procurement. Sources of program target data include program planning documents, national policy and strategy documents, and materials published for dissemination and advocacy.

See figure 2 for more information on each type of data for forecasting.

DATA FOR SUPPLY PLANNING

Data for the supply planning step are not the same as the data for the forecasting step. However, data for both steps can be collected at the same time, such as during meetings or consultative workshops with stakeholders. For example, a quantification is being conducted for a national ART program and there are multiple donors, and each has its own recordkeeping system. The easiest approach may be to gather data on both the past program performance and any shipments on order at the same time.

The monthly forecasted consumption of each product for each year of the quantification is the major output of the forecasting step, and is the key input data to the supply planning step. Other data that are required for the supply planning step include:

- National- or program-level stock on hand (preferably from physical inventory) of each product to be quantified (including losses and adjustments)
- Expiration dates for the products in stock to assess whether they will be used before expiration
- Any shipment quantities of product(s) already on order, but not yet received
- Established shipment intervals and current shipment delivery schedule
- Established national – or program-level maximum and minimum stock levels
- Product information – patent status, registration status, prequalification status, if applicable, status of products on the National Essential Medicines List, specific product characteristics (formulations, dosages, number of units per pack size, unit cost, and others)
- Supplier information – prices, packaging information, lead times, shipping and handling costs
- Funding information – all funding sources for procurement of commodities, amount and timing of funding commitments, by funder, funding disbursement schedules to determine when funding will be available for procurement from each source
- Procurement information – all procurement mechanisms—e.g., competitive international bidding/tendering, donor procurement, or local procurement—for all products to be quantified, procurement lead time for each procurement mechanism
- Distribution information – customs clearance fees, in-country storage and distribution costs, if applicable, in-country sampling/quality testing costs

INFORMATION ON PROGRAMMATIC, ENVIRONMENTAL, SOCIETAL, AND BEHAVIORAL FACTORS expected to influence the magnitude or timing of demand for services and commodities

The following are examples of programmatic and environmental factors that may affect demand for services and commodities, and that may need to be considered in the forecasting and/or supply planning assumptions:

- Changes in policies and STGs mandating product selection, and how products are to be prescribed, dispensed, and used
- Emergence of new products and formulations on the market
- Changes in amounts and timing of financing available for commodity procurement
- Changes in program priorities, strategies, and goals, particularly targets for coverage–e.g., provider-initiated testing and counseling (PITC), emphasis on early infant diagnosis (EID), pediatric ART, laboratory diagnostics and monitoring, increased focus on home-based care and nutritional support–that result in demand for new commodities, or may create variations in the consumption of existing commodities
- Seasonality in incidence of specific diseases/health conditions
- Geographical variation in incidence of specific diseases/health conditions
- Changes in political, legal, or regulatory environment–e.g., community-based distributors have been recently authorized to distribute injectable contraceptives, second-line ARV medicines are rolled out to the intermediate levels, or products are now available free of charge
- Societal and behavioral factors–e.g., reduction in stigma affects demand for ARVs, wider use of bed nets reduces incidence of malaria

Photo courtesy of USAID | DELIVER PROJECT, Ethiopia

FORECASTING

As stated in the introduction, forecasting is the process of estimating the quantities of products that will be dispensed or used to meet the health needs of the targeted population during a specific future period of time. Forecasts can be prepared based on historical consumption (quantities dispensed or used), services, morbidity and/or demographic data, and assumptions about future demand, program plans, and performance–the types of data described in the preceding section. When historical data are unavailable or unreliable, assumptions will also be needed to estimate program performance and product consumption.

Forecasting

- Organize, analyze, and adjust data
- Build forecasting assumptions
- Calculate forecasted consumption for each product
- Reconcile forecasts to produce a final estimate for each product

Methods for calculating forecasted consumption using consumption or services data include trend projection, regression, moving average, and various more sophisticated statistical approaches.

Forecasts are by definition estimates; in predicting the future, there will always be some error. Thus, the quantification team should not be preoccupied with overly precise estimates. In addition, forecasts are more accurate in aggregate. For instance, generating forecast estimates by district will by and large be less accurate than an aggregated national forecast. Similarly, monthly or quarterly forecasts are likely to be less accurate, on the whole, than annual ones.

Forecast error also increases the further into the future the prediction. Routine monitoring and updating of forecasts and supply plans, following a maximum-minimum inventory control system, and reviewing forecast accuracy are strategies that help country programs to minimize the impact of forecast error.

FIGURE 2.

TYPES OF DATA FOR FORECASTING CONSUMPTION OF HEALTH COMMODITIES

Historical Consumption Data
Quantity of each product dispensed or used (when data are available or can be estimated)

Historical Services Data
No. of visits, services provided, tests conducted, episodes of a disease or health condition treated, or no. of patients on continuous/chronic treatment (when data are available or can be estimated)

Demographic/Morbidity Data
Data on population growth and demographic trends

Estimated incidence or prevalence rates of specific disease/health condition occurring within a defined population group. (May be used/extrapolated to define total estimated need, then refined to set targets or percentage of total need to be reached.) Typically tends to overestimate commodity needs. Need to compare to forecasts using consumption and services data.

Estimate the no. of visits, no. of services to be provided, no. of tests to be conducted, no. of episodes of each disease/health condition to be treated, or no. of patients that will be on continuous/chronic treatment for each year of the quantification

- Analysis of historical trends
- Analysis of factors expected to influence demand ➔ change in program targets/coverage

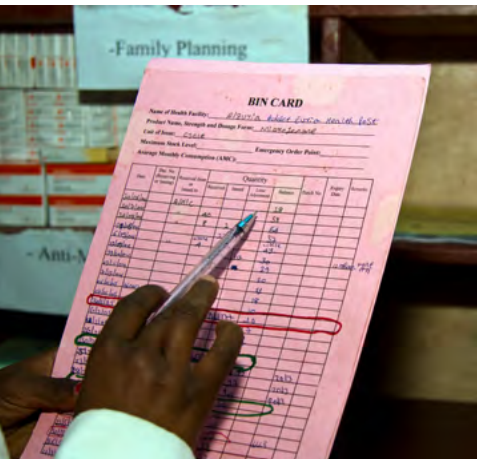
Estimate future consumption of each product for each year of the quantification

- Analysis of historical consumption trends
- Analysis of factors expected to influence demand ➔ change in consumption

Convert the estimated number of visits, services, lab tests, treatment episodes, or patients to the quantities of products that will be needed for each year of the quantification

- Using established STGs, dispensing protocols, or lab testing procedures, multiply the quantity of each product required per visit/service/test/treatment episode/patient by the estimated total number of visits, services, lab tests, treatment episodes, or patients per year to calculate the quantity of each product that will be dispensed or used for each year of the quantification

Estimated quantity of each product that will be dispensed or used during each year of the quantification



Photos courtesy of IAPHL

ORGANIZE, ANALYZE, AND ADJUST THE DATA

Multiple types and sources of data may have been collected, ranging from LMIS reports to number of patients treated or clients served, to incidence and prevalence rates of disease. After the forecasting data have been collected, they should be organized by type–either consumption, services, or demographic/morbidity (see figure 2). Program targets for the two-year quantification period should also be included, if available.

It can be helpful to organize the data into a table and/or graph. Table 1 shows data that could be collected for conducting a quantification of HIV tests. Graphing data can help the quantification team to identify patterns or trends in the data.

TABLE 1.

EXAMPLE DATA FOR SAMPLE QUANTIFICATION OF HIV TESTS

TYPE OF DATA	DATA	QUALITY OF DATA	OTHER NOTES
Consumption data	Central-level issues data Central-level stock on hand	Complete monthly issues data for the past 12 months	No stock on hand at facilities available Site-level consumption data not available
Services data	Number of clients tested, according to MOH monitoring and evaluation reports, including number of people tested for voluntary counseling and testing (VCT) and prevention of mother-to-child transmission Number of antenatal care visits	75 percent reporting rate for the past 3 months	No data available on number of tests used for blood safety No data available on number of tests used for training
Morbidity data	HIV prevalence rate	one year old	Adult prevalence rate only; no prevalence rate available for under 15 years old
Demographic data	Total population	three years old	No population growth rate available

When data are missing or are of questionable quality (unreliable, outdated, or incomplete), the quantification team will need to formulate assumptions on current program performance. After all historical data have been evaluated and adjusted, the quantification team will need to formulate and ensure consensus on all assumptions about future program growth and any increase or decrease in demand for services and commodities. This will be used to forecast quantities of each product that will be needed during each year of the quantification.

When using consumption data, the quantification is based on quantities of products historically consumed. These historical consumption trends need to be analyzed and assumptions made about factors that are expected to influence the demand for individual products during the period of the quantification.

When using services data, the number of patients or clients served or number of treatment episodes is the starting point. Similar to consumption data, these historical trends need to be analyzed and assumptions made about the future number of patients or clients served or the number of treatment episodes. These must be converted into quantities of products.
When using morbidity or demographic data, the starting point is population-based figures. As with services data, these data on people must also be converted into quantities of products expected to be consumed. See the Calculate Forecasted Consumption for Each Product section for more information about converting the total number of episodes/clients/population into numbers of products.

Regardless of which types of data are used, the final outcome will be the quantity of each product expected to be dispensed or consumed during the quantification period.

ASSESSING DATA QUALITY

A critical step for the quantification team is to assess the quality of the data to determine if they can be used for the quantification. The most common data quality issues are inaccurate, incomplete, or outdated data. When data quality is lacking or weak, the quantification team will need to use calculations and/or agree on assumptions to account for the missing or unreliable data.

When using morbidity, demographic, or services data, the estimated number of people or episodes of a disease that are expected to be treated must be translated into the number of products expected to be consumed.

In general, to assess data quality, determine the:

- Facility reporting rate. How many facilities that should be reporting did report? Of the facilities that reported, how representative are they of the non-reporting facilities? The lower the reporting rate, the less reliable the data. Adjust the data to account for non-reporting facilities. With very low reporting rates, it is not likely that data can be extrapolated to represent a national picture.
- Stockouts. Did facilities have stockouts at any time? If there have been stockouts, past

consumption data will underestimate what consumption would have been if the product had been continuously available. Adjust the data to cover the stockout period(s).

- Timeliness of data. How recent are the data? This is critical for all types of data, whether consumption, services, morbidity, or demographic. The older the data, the less representative and predictive of future consumption it will be. It is important to document the dates of the data sources used.
- Other factors that might affect future demand: Are historical data predictive of future need? Is current program performance an accurate reflection of the demand for services that will be provided or quantities of medicines that will be dispensed in the future? Are there policy or programmatic changes anticipated that could affect the quantities to be dispensed in the future? For new or expanding programs, the rate of increase in services to be provided or products to be dispensed should consider past performance and historical growth rates. Make assumptions to estimate how expected changes will influence future demand for products.

Various adjustment techniques can be used to address incomplete or incorrect consumption or services data. The following are suggestions for adjustments that can be made to the most common data quality issues.

ADJUSTING FOR INCOMPLETE REPORTING

Reports are often missing or incomplete, and reporting rates are rarely 100 percent. To adjust for missing reports, you need to know the following:

- Which facilities' reports are missing? Are those facilities different in any way from the facilities that submitted reports?
- You may assume that clients at all the missing facilities consume products at the same rate as other facilities, but this assumption can result in significant errors. For example, if the missing facilities are in a densely populated area, you could underestimate consumption by using consumption rates from facilities located in sparsely populated areas.
- If geographic location, population, seasonality, or another factors can affect consumption at the missing facilities, you can make an additional adjustment up or down to reflect the unique characteristics of the missing facilities.
- Sometimes too many reports are missing to make consumption data useful, even with adjustments. If reporting rates are routinely low, seriously consider using issues data as a proxy. But remember that issues data may also be affected by less-than-perfect reporting; therefore, it is also important to verify reporting rates if you decide to use issues data.

ADJUSTING FOR AGGREGATED DATA

Depending on the LMIS or availability of historical data, consumption data may be aggregated into annual quantities; therefore, you may not be able to divide them into smaller units of time for analysis. Remember that two assumptions are implicit in data organized this way:

- All facilities consume products at the same rate
- Consumption is the same for all the time periods covered (e.g., it does not show an increasing or decreasing trend)

You could make adjustments to correct for data aggregation if you have information that indicates facilities consume products at different rates (see the earlier discussion of incomplete reporting), or information that indicates the consumption trend during the year was not flat.

Reports can also consolidate groupings of products, such as various brands of oral contraceptives grouped together under pills. To create a forecast and a supply plan, you will need to sort the product by brand. This can happen with any type of data—consumption, services, or demographic—but it occurs most often with demographic data, where progestin-only pills and combined oral pills are rarely separated.

If any available surveys indicate the breakdown percentage of brands among users, to estimate each brand's use, apply those percentages to the total number of pills consumed. Issues data can also be used by taking the percentage of each brand issued over a period of time and applying it to the consumption data to estimate the consumption by brand.

ADJUSTING FOR STOCKOUTS

Forecasting of health commodity requirements should be based on a reasonable estimate of actual demand. Even when logistics records accurately reflect true consumption, they may not reflect true demand. This can happen when some products are out of stock for extended periods. The period of stockout can potentially mask the true demand for the commodity because this demand is not met during the stockout and so will not be reflected in the consumption data.

If data on days out of stock are collected in the LMIS, the daily consumption rate for the days in stock can be applied to the number of days out of stock:

$$\frac{\text{quantity reported consumed during the month}}{\text{days in stock}} = \text{“daily” consumption rate}$$

number of days out of stock x “daily” consumption rate = missing consumption

monthly consumption if stockouts had not occurred = reported consumption + missing consumption

This calculation assumes that days out of stock are “like” days in stock. It might also misrepresent true demand if days out of stock are much more common than days in stock–a shortage situation that might discourage clients from appearing to collect product even when it is available.
In another example, if facilities reported that 850,000 tablets of albendazole were dispensed last year, and it is known they were stocked out, on average, 25 percent of the time, then:

Consumption adjusted for 25 percent stockout rate = 850,000 tablets/0.75 =
1,133,333 tablets dispensed if the stockout had not occurred

This calculation assumes that all facilities were stocked out, which may or may not be true. If stockouts affect consumption data, ask the following questions: Were all the facilities stocked out at the same time, or only a certain percentage of facilities? How long was the stockout? What caused the stockout?

This formula may also misrepresent true demand if consumption trends varied from a steady, straight-line increase. If consumption was rapidly rising until the stockout, the formula assumes the same rate of increase as the period when stocks were available.

Facilities may be stocked out even if their inventory records do not show zero-stock balances. It is common for staff to hoard quantities for emergency use or other reasons, especially if a stockout is imminent. If consumption of a method suddenly stops or drops off significantly, you may suspect hoarding or rationing. Because of hoarding or rationing, you may need to further adjust your data to account for a period when consumption was below normal.

ADJUSTING FOR OUTDATED DATA

Adjusting for outdated data is often necessary when using demographic data to forecast, especially to obtain current population estimates. The quantification team may need to make assumptions about trends in many variables, not just population growth. No single demographic data source will provide all the data points needed; demographic data are often bundled from multiple data sources that represent different time periods, some or all of which may need to be adjusted so they reflect the same period of time. These additional assumptions may cause significant errors in the forecast. To minimize the number of adjustments for the base or starting year of the forecast, select the date of the survey that was used as the major data source for the projection.

For example, if the last time contraceptive prevalence (CPR) was measured was four years ago, the quantification team may believe it has increased since then. One option is to examine the historical trend(s) in CPR increase, discuss whether this trend might continue, and apply it in annual increments to the latest measurement to estimate the trend up to present day and into the quantification period.

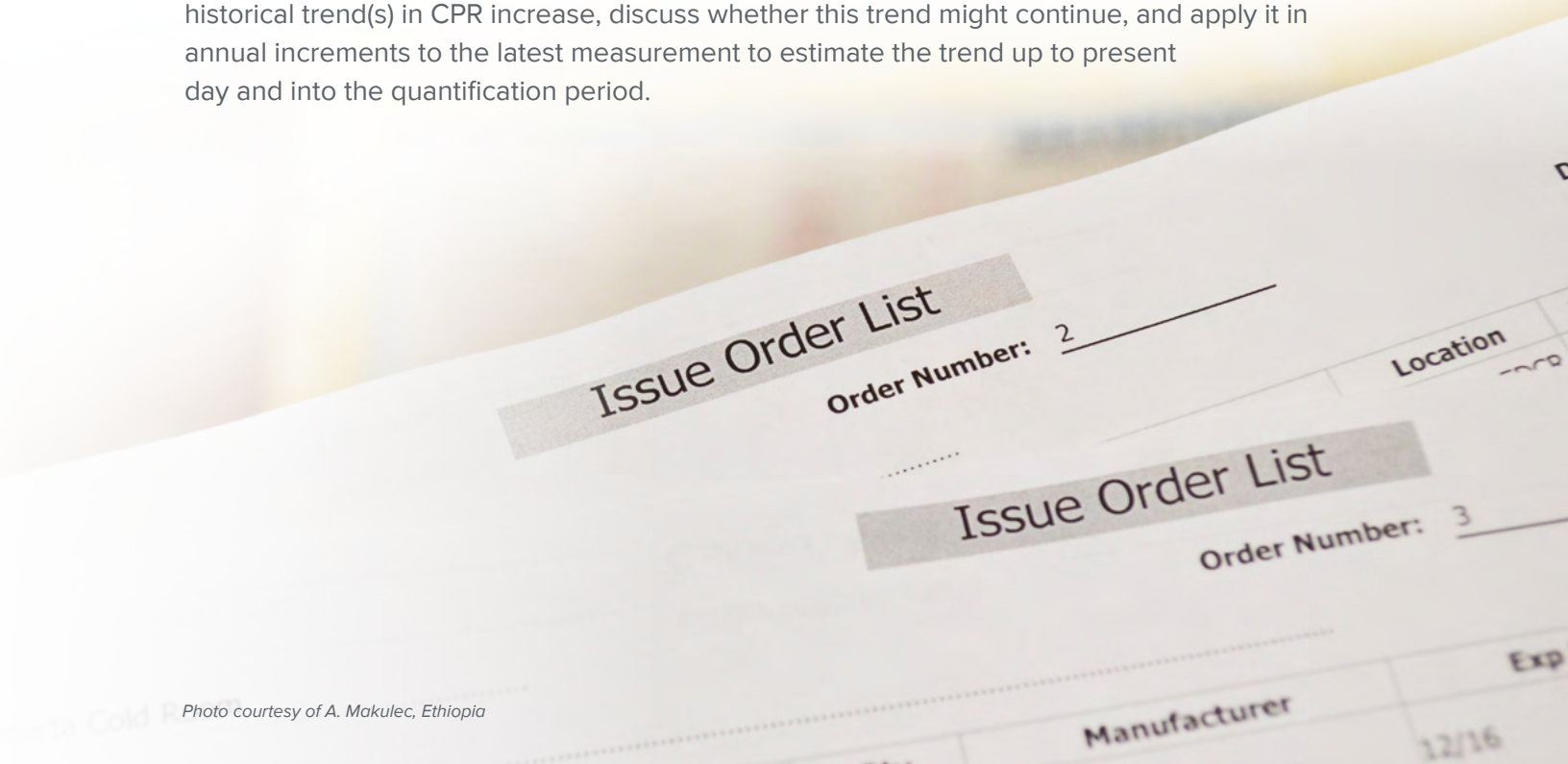


Photo courtesy of A. Makulec, Ethiopia

BUILD THE FORECASTING ASSUMPTIONS

Two kinds of assumptions need to be made during the forecasting step:

1. Assumptions on adjustments made to historical program data when data are missing, unreliable, outdated, or incomplete
2. Assumptions on future program performance based on factors influencing demand for services and commodities

Most often, complete data are not available for a particular quantification. The most critical point in making assumptions is to document clearly and specifically which assumptions were made and on what basis. If there are few or no data, the forecast will rely heavily on assumptions. Assumptions may include changes in STGs, products, program strategies, priorities, and expansion plans, and when these changes will be implemented; service capacity (infrastructure, human resources availability, and capacity); client awareness of and access to services; and timing and amount of funding commitments for procurement, seasonality, or geographical differences in disease incidence and prevalence.

It is critical for the quantification team to reach consensus on the forecasting assumptions. A quantification workshop is often an effective forum to achieve consensus, and should include dedicated time for clarifying, agreeing on, and documenting assumptions. This should be a consultative process with a wide range of program implementers, including program planners, procurement specialists, clinical experts, pharmacists, and warehouse managers. It is important to document the sources of data, information, and input from key informants used in making the forecasting assumptions. The quantification should be revised if any of the forecasting assumptions change.

SAMPLE assumptions for a national quantification of HIV test kits for prevention of mother-to-child transmission for 2017–2019

- Number of women receiving an HIV test as part of prevention of mother-to-child transmission (PMTCT) services will grow by 10 percent, corresponding to an average of antenatal care (ANC) attendance growth rates observed during 2015 and 2016.
- HIV prevalence rate for PMTCT is 18 percent, based on 2016 MOH monitoring and evaluation (M&E) reports.
- 2,000 individuals are expected to be trained in rapid HIV test use, according to MOH training plans.

Photo courtesy of USAID | DELIVER PROJECT, Ethiopia

After the data have been collected, analyzed, evaluated, and adjusted, a forecasting tree can be a helpful tool to organize and utilize morbidity or demographic data and to determine and/or structure the forecasting assumptions–to estimate future consumption. A forecasting tree is not needed for a consumption-based forecast because the starting point is already quantities of products.

The forecasting tree is a diagram of patient groups or health conditions and the products required to treat one patient or one episode (see figure 3). It can be completed with a pencil and paper; no software is needed. Data required to conduct a forecasting tree are:

- STGs, treatment regimens, testing protocols, or lab testing procedures, including the list of products and specific product characteristics (e.g., formulations, dosages, and pack sizes)
- Specific patient groups or health conditions

There are four steps for constructing a forecasting tree:

1. Identify the specific disease or health condition, such as ART, malaria treatment, or tuberculosis (TB) treatment.
2. Separate the logical patient groups or health conditions to be treated. For instance:
    a. For antimalarial medicines, the patient groups could be adults versus children, further separated into severe versus uncomplicated malaria.
    b. For ARV medicines, the patient groups could be adults versus children, further separated into first-line versus second-line patients.
    c. For TB medicines, the patient groups could be adults versus children, further separated into Category I versus Category II patients.
3. List all the possible treatment regimens for each patient group.
4. Assign the specific medicines required for each of the possible treatment regimens within each patient group.

FIGURE 3.

SAMPLE FORECASTING ALGORITHM FOR ZINC TABLETS FOR TREATMENT OF DIARRHEA IN CHILDREN UNDER 5 IN THE PUBLIC SECTOR (INCLUDING CHWs)

Assumptions

A1 Incidence of diarrhea in children under 5 (episodes/child/year)
A2 Children/care givers who seek care for diarrhea from the public sector, %
A3 Children/care givers who seek care for diarrhea from the private sector, %
A4 Children/care givers who do not seek care for diarrhea, %
A5 Children with diarrhea/care givers who will seek care from a public sector facility, %
A6 Children with diarrhea who will seek care from a public sector CHW, %
A7 Children 2–6 months with diarrhea, %
A8 Children 6–59 months with diarrhea, %
A9 No. of tablets needed for course of treatment for children 2-6 months
A10 No. of tablets needed for course of treatment for children 6-59 months
A11 Total number of tablets

CALCULATE FORECASTED CONSUMPTION FOR EACH PRODUCT

Forecasts based on consumption data and services data can be calculated using time series models that "predict" the future based on the historical data that were adjusted in the previous step. Such models can be useful when demand appears to follow repeating patterns; they are most effective when many periods of data are available and patterns are more evident. Quantification teams may believe that more recent data points are more reliable–for instance, because of LMIS improvements –or indicative of future needs. Thus, in using time series models, quantification teams need to consider the trade-offs between creating projections that emphasize more recent data point(s) versus less recent historical data. Time series approaches include:

- **Trend projection.** Historical consumption data and services data are analyzed for historical trends by plotting monthly, quarterly, bi-annual, or annual values on a graph. The implicit assumption is that historical trends seen in previous data will continue into the future. The growth trend functionality in MS Excel can be used to project the forecast. However, the disadvantage of this method is that it does not account for program growth that may occur in the future as a result of expansion of services. The trend analysis function in PipeLine uses the trend projection method for forecasting consumption based on historical consumption data.
- **Regression methods.** MS Excel functions, including Linest, can fit a line to past data in order to project future values.
- **Moving average.** A moving (or "rolling") average uses a series of averages of historical data to forecast the demand for the next period–month, quarter or year. A moving average approach is used when demand is fairly constant; it mitigates the effect of random variation.
- **Weighted moving average.** In this approach, more value, or weight, is placed on data from more recent periods. For instance, LMIS improvements might lead the quantification team to deem more recent data more reliable or predictive of the future.
- **Exponential smoothing.** This approach uses both past forecast and past actual data to project future needs in a way that reduces variability. It is in effect a way of assessing forecast error and incorporating it into the new forecast. It requires only one past period of forecast and actual data and uses a "smoothing" constant between 0 and 1 to assign weight to the past actuals and past forecast data. Exponential smoothing software can be used for forecasting, including a function in MS Excel. Types of exponential smoothing calculations include Simple Exponential Smoothing and Damped Trend.

As logistics management information systems improve and produce consumption data that are closer to "real-time," more sophisticated statistical methods may become increasingly relevant for forecasting consumption of health commodities.

Forecasts based on consumption data result in the quantity of product estimated to be consumed in the forecast period. Forecasts done using services, morbidity, demographic, or program target data must be converted from number of

patients, visits, or episodes treated into estimates of quantities of products consumed. This conversion requires assumptions about the application of and adherence to current STGs, dispensing protocols, testing algorithms, or lab testing procedures. These assumptions should include information on product characteristics and how products should be prescribed and dispensed.

The following example demonstrates how this can be presented and calculated:

> Number of basic units of product (tablet, capsule, ampoule, bottle, test strip, ml of liquid, etc.) that should be dispensed or consumed per visit, per service, per treatment episode, or per patient, and the quantities of each product required per day or per year if forecasting for a chronic health condition
>
> *multiplied by*
>
> Total estimated number of visits, services, lab tests, treatment episodes, or patients expected to be treated/receive services for each year

This will yield the quantity of each product expected to be dispensed or consumed (i.e., the forecasted consumption). For programs that are new, scaling-up services, or planning to implement significant changes in polices or strategies that will affect the demand for products, the forecasted quantity of each product to be dispensed or consumed should be estimated monthly for each year of the quantification because an "average monthly consumption" figure would not properly reflect the expected increase in use over the course of the year.

This is also relevant for new products that will be introduced or products that will be substituted or replaced with others during the year and for which there are no historical data. Table 2 shows the conversion factors that should be applied for the different types of forecasting data.

This is also relevant for new products that will be introduced or products that will be substituted or replaced with others during the year and for which there are no historical data. Table 2 shows the conversion factors that should be applied for the different types of forecasting data.

EXAMPLE: Calculating TB medicines for adult Category I patients

- Each TB case requires 60 tablets of rifampicin/isoniazid/ pyrazidamine/ ethambutol (RHZE) and 180 tablets of rifampicin/isoniazid (RH)
- There are an anticipated 20,000 adult Category I TB cases each year
- This yields a yearly total of 1,200,000 tablets of RHZE and 3,600,000 tablets of RH
- Because TB is not seasonal, the annual number of tablets can be divided by 12 to calculate a monthly estimation of consumption.

TABLE 2.

CONVERSION FACTORS FOR FORECASTING

TYPE OF DATA	CONVERSION FACTOR			FORECASTED CONSUMPTION	
Consumption	Estimated quantity of product to be dispensed/used	X		=	Quantities of product
Services	Estimated # of patients, # of episodes of disease, or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	
Demographic/ morbidity	Estimated # of patients, # of episodes of disease or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	
Program targets	Targeted # of users, # of patients, # of episodes of disease or health condition, # of lab tests	X	STGs, testing algorithm, lab procedure	=	

At this point in the quantification process, software can be utilized to calculate the total estimated quantity of each product to be dispensed or consumed for each year of the quantification.

Various software tools are available for forecasting. Quantimed can be used for forecasting medicines and health supplies using consumption, proxy consumption and morbidity methods; PipeLine can be used for forecasting medicines and health supplies using consumption method; and ForLab can be used for forecasting laboratory commodities using consumption, services and demographic/morbidity data. See appendix B for a summary of available software programs.

RECONCILE FORECASTS TO PRODUCE FINAL ESTIMATE

Ideally, multiple types of data should be used to calculate one or more forecasts, and the results compared to arrive at the final forecast consumption figures. For example, a quantification team could conduct one forecast with demographic data, another with services data, and another with consumption data. When reconciling the forecasts, assess the following factors:

- Quality of the each data type–completeness, accuracy, timeliness, and availability
- Reliability of intermediate variables, such as dispensing protocols, CYP conversion factors, population covered or reached by program, contraceptive method mix, disease prevalence, population growth rate, adherence to STGs or testing protocols, and scale-up plans based on current and accurate local data

- Local, political, economic, or programmatic events that may have had an impact on consumption or service utilization, such as commodity shortages or stockouts, strikes, or civil unrest that may cause forecasts based on consumption and service data to be artificially low

Based on the above considerations, one of the forecasts can be selected as the final forecast, or adjusting, weighting, or averaging the different forecast quantities can reconcile the forecasts. If data quality is particularly poor for one of the data types, the team may decide not to base a forecast on that data. For example, if no consumption data exist, the quantification team may elect to use morbidity data instead. The reconciliation stage should preferably be held as part of the multi-stakeholder quantification workshop to allow a collaborative process in assessing the quality of the data and strength of the assumptions.

At this stage in the quantification, the monthly forecasted consumption for each product should have been calculated, and the team will then move on to supply planning. Output from the forecasting step is a major input to the supply planning step. Figure 4 describes the flow of data throughout the quantification process.

A NOTE ON SEASONALITY: Some products show clear seasonal consumption patterns. So that the supply chain can ensure product is available in accordance with seasonal needs, monthly forecast quantities that reflect this seasonality – rather than standard "average monthly consumption" figures – are required to plan shipments in the supply planning step. One option for arriving at monthly forecast consumption quantities that reflect the seasonal nature of demand is to develop a seasonality index that relates consumption for each month to a reference month based on patterns observed in historical data. This index is applied to the annual forecast quantity. Please see *Factoring Seasonality into Supply Planning* for details.

Other methods that may be used to estimate forecasted consumption using data that show seasonal patterns include double and triple exponential smoothing methods.

FIGURE 4

FLOW OF DATA IN QUANTIFICATION

Phases	1. Forecast Product Consumption	2. Estimate Total Commodity Requirements and Costs	3. Develop Supply Plan	4. Compare Funding Available to Total Commodity Costs
Inputs	• Program policies, strategies, and priorities • Product characteristics and use • Program expansion plans; policy changes • Historical data on consumption, services, morbidity, demographics • Forecasting assumptions (quantify factors affecting demand for services/ commodities)	• Forecasted consumption for each year of the quantification • Stock on hand at the time of the quantification • Product unit cost at time of quantification • Lead times by product and supplier • Max-min stock levels • Quantities on order • Shipping/handling costs	• Funding sources for each product • Suppliers for each product • Shipment intervals	• Timing and amounts of funding commitments for each product, for each year of the quantification
Outputs	• Forecasted consumption for each year of the quantification	• Total estimated quantity required of each product • Total estimated cost per product • Total estimated cost of all products required	• Shipment quantities • Shipment delivery schedules for each year of the quantification	• Total funding gap • Funded shipments • Unfunded shipments

Photo courtesy of A. Makulec, Ethiop

Photo courtesy of C. Keddem, Myanmar

SUPPLY PLANNING

To identify funding sources and to mobilize additional resources to meet funding gaps, if needed, national quantification exercises typically produce a commodity forecast for a two-year period. Although the forecast can be generated for two to five years, the supply plan should cover one to two years, outlining orders that need to be placed and shipment delivery schedules. To ensure a continuous supply of products, and to maintain stock levels between the established maximum and minimum levels, developing the supply plan entails coordinating the timing of funding disbursements from multiple funding sources with procurement lead times and supplier delivery schedules.

Supply Planning

- Organize, analyze, and adjust data
- Build supply planning assumptions
- Calculate total commodity requirements and costs
- Develop supply plan
- Compare costs to available funding

ORGANIZE AND ANALYZE THE DATA

At this stage in the quantification, monthly forecasted consumption of each product for each year of the quantification has been calculated. To determine the total quantities to procure, other data must be used. During the preparation stage, data should be collected for the supply-planning step. These data, which should now be organized and analyzed, include:

- National/program-level stock on hand (physical inventory) of each product to be quantified
- Expiration dates for products in stock, to ensure they will be used before expiration
- Quantity on order–any shipment quantities of product(s) on order, but not yet received
- Established program-level maximum and minimum stock levels
- Supplier information
  - prices
  - packaging information
  - lead times
  - shipping and handling costs
- Funding information
  - all funding sources for procurement of commodities
  - amount and timing of funding commitments, by funder
  - disbursement schedules to determine when funding will be available for procurement, from each source
- Procurement information
  - All procurement mechanisms (e.g., government or international bidding/tendering, donor procurement, or local procurement) for all products to be quantified

  - Procurement lead time for each procurement mechanism
- Distribution information
  - in-country storage and distribution costs, if applicable
  - in-country sampling/quality testing costs
  - customs clearance fees

As with the forecasting step, where data are unavailable, incomplete, unreliable, or outdated, assumptions must be made.

BUILD THE SUPPLY PLANNING ASSUMPTIONS

As previously mentioned, the most critical point in the assumptions-building process is to document clearly and specifically the sources of information and the key informant inputs on the assumptions. And, as in the forecasting step, consensus must be reached by the quantification team on the supply planning assumptions. For the supply planning step, assumptions may need to be reached on introduction of new commodities and utilization of existing stocks to avoid expiries, the timing of available funds, lead times for each supplier, exact amounts of funding available, and estimates on arrival dates of supplies.

If a maximum-minimum inventory control system has not been formally established, the quantification team will need to make assumptions about the maximum and minimum stock levels at each level of the logistics system, such as facility and central levels.

EXAMPLE: Assumptions from HIV test kit quantification for 2017–2018

- Central-level minimum stock level is four months, and maximum is nine months.
- Donor funding will be available for procurement until beginning of February 2017.
- MOH will have $700,000 available for HIV test kits procurement in March 2017.

ESTIMATE THE TOTAL COMMODITY REQUIREMENTS AND COSTS

Estimating the total commodity requirements consists of determining the quantity of each product needed to meet the forecasted consumption, and to ensure that the in-country supply pipeline has adequate stock levels to maintain a continuous supply to SDPs.

The estimate of the total commodity requirements for the forecast period is the sum of 1) the quantities required as determined by the forecast, 2) additional quantities of product needed to cover procurement and supplier lead times and buffer stocks, and, as needed, 3) any significant quantities that will be removed from inventory due to expiry before usage, and then subtracting 1) the quantity of each product already in stock in the country (stock on hand) and 2) any quantities that have been ordered but not yet received (quantity on order). In some cases, shipment delivery

schedules need to be adjusted to accommodate constraints in the storage and distribution capacity of the logistics system (i.e., scheduling more frequent shipments of reduced quantities rather than scheduling larger shipments).
At this point in the quantification, regardless of the forecast method used, PipeLine software is strongly recommended to facilitate the preparation of a supply plan. In cases where PipeLine is not used, staff can use the following formula to estimate the quantities required:

Forecast consumption quantities

+

[(Forecast consumption quantities/12) × Maximum stock level for the entire pipeline]

It is important to use the maximum stock level for the entire pipeline, which is calculated by adding the established maximum stock levels for each level of the system. This formula is an estimate of the quantities required and does not take into account all the variables included in the PipeLine database. PipeLine was specifically developed to address the unique considerations of supply planning and pipeline monitoring for public health programs in resource-limited settings. Using it is recommended as a best practice.

If a PipeLine database is being created for the first time, the quantification team should enter program, product information (including pack sizes and prices), and supplier data. Please see the *PipeLine User's Manual* for specific guidance on how to use the software.

If a PipeLine database already exists, the quantification team should update all data inputs, including the timing and quantities of any shipments received and entered into inventory, the actual consumption of each product, and any losses and adjustments to inventory that have occurred since the last update.

Whether a new PipeLine database is being created or an existing PipeLine database is being updated, the following data should be entered:

- National stock on hand of each product at the time of the quantification, whether from a physical count, routine LMIS data, or review of stock card entries
- All shipments on order, by supplier, with the expected arrival date
- All planned shipments by supplier, with the expected arrival date
- Monthly forecast consumption for each product

(If Quantimed was used in the forecasting step, the forecast consumption can be directly imported into PipeLine. See appendix C for more information on how to export data from Quantimed and import it into PipeLine.)

At this step in the quantification, an assessment of the in-country stock status is needed to calculate the quantities of each product to be ordered, which can reasonably be expected to be

stored, distributed, and used before expiration. Assessment of the in-country stock status, that is, months of stock (MOS) for each product, estimates how long the existing stocks of each product are going to last.

DEVELOP THE SUPPLY PLAN

A shipment should be scheduled to arrive when the national MOS reaches the established minimum stock level. The quantity of product to order should bring the national MOS back up to the established maximum stock level. Round the quantity to order up to the nearest whole unit of supplier packaging.

The next step is to estimate the cost of the total commodity requirements.
Updated sources of information on drug prices and supplier rates are needed to estimate the cost of the quantities of medicines to be ordered. In addition, information on the cost of insurance and freight, customs clearance and duties, and in-country storage and distribution costs may need to be added to the cost of the quantities of medicines to be procured, if it is not included in supplier rates or budgeted for through other mechanisms or waiver agreements.

If price data have already been entered into PipeLine, the costs associated with a shipment will automatically be calculated.

Flexible procurement contracts with suppliers are recommended so that shipment quantities can be adjusted to respond to an uptake in services, and fluctuations in patient demand, existing stock levels, and rates of consumption. Agreements with suppliers may also need to include flexibility in delaying shipments into the year following the year of the forecast, if uptake of services does not meet expected demand.

Photo courtesy of A. Makulec, Ethiopia

COMPARE FUNDING AVAILABLE TO TOTAL COMMODITY COSTS

The final decision on the quantities to procure will be determined by the amount of funding available for procuring the products. As a result of the quantification, where sufficient funding is available, the final quantity to procure of each drug will be the same as the quantity to order.

If funding is insufficient, the quantification team will need to determine whether additional resources can be mobilized. An effective mechanism for this can be presenting the quantification results, illustrating what the funding gap is in order to ensure all stakeholders are aware of the funding gap and if possible can provide additional resources for procurement of the required quantities of products.

In situations of non-full supply, when it is impossible to mobilize additional resources to procure the full quantities of products required, the supply plan may need to be adjusted, or forecasted quantities of products expected to be dispensed will need to be reduced. This is done by returning to the relevant step in the quantification and engaging in further consultation and consensus building to adjust the assumptions.

For example, for ARV medicines, the total number of patients expected to start treatment each month will need to be reduced; for antimalarial medicines, the number of malaria episodes to be treated will need to be reduced. Adjusting the forecasting assumptions will reduce the total quantities of products expected to be consumed.

After adjusting the assumptions, the quantification team will need to repeat the steps in the quantification process by calculating the forecasted monthly consumption of each product to the final calculation of the actual quantities of each product to procure, or by adjusting the supply plan to reconcile the results of the quantification with the funding constraints.

If resources are insufficient and there is a funding gap, it is critical that the required reduction in quantities be calculated after revisiting and adjusting the forecasted quantities, instead of reducing the quantities needed to fill the in-country supply pipeline. Shortchanging quantities to fill the pipeline will result in stockouts and will undermine program goals.

Photo courtesy of Midwife from Taunggyi Township Public Health Department

USING THE RESULTS OF THE QUANTIFICATION

The quantification team should formally present the results of the quantification to stakeholders. This enables the team to receive feedback about the assumptions that were made during the forecasting step, as well as the data sources used. By presenting the results of the quantification, the team can present, to all stakeholders, the national stock status levels for commodities and outline the actions required to maintain adequate stock levels.

By presenting the quantification results to policymakers, program managers, procurement managers, funders, and commodity managers, the following decisions and actions can be facilitated:

- Program planning and budgeting decisions
- Mobilization and allocation of funding for commodity procurement
- Coordination of multiple sources of funding for procurement
- Informing procurement actions on which products to procure, how much to procure, and when to procure
- Adjusting timing of procurements and shipment delivery schedules to ensure continuous supply while avoiding stockouts and overstocking

When conducting a presentation, the quantification team should explain each step of the quantification, including:

- Scope, purpose, and timeframe of the quantification
- Review of all data sources used and challenges in data collection
- Summary of the major forecasting assumptions and description of what data sources were used to make those assumptions
- Summary of supply planning assumptions (especially if assumptions about amounts and timing of funding commitments will affect procurement and delivery)
- Total quantities of each product required for each year of the quantification
- National stock status (MOS on hand) for each product (PipeLine stock status graphs are very useful to convey this information); highlight products that are about to expire, stocked out, or overstocked, based on stock status analysis (MOS on hand)
- Summary of shipments, by supplier
- Total funding gaps for the next 24 months
- Specific actions required to address any critical stock imbalances and to maintain stocks at the established levels

Photo courtesy of USAID | DELIVER PROJECT, Zambia

REVIEWING AND UPDATING THE QUANTIFICATION

Quantification does not end when the final quantities and costs have been determined. It is an ongoing process of pipeline monitoring: reviewing and updating the forecasting and supply planning data and assumptions, which, in turn, may require a recalculation of the total commodity requirements and costs. For the quantification exercise to be useful and effective, the forecasting assumptions and the supply plan should be reviewed and updated at least every six months, and more often for rapidly growing or changing programs. Routine pipeline monitoring should take place monthly unless new data are available more frequently. Ongoing monitoring and updating of the quantification is critical to keeping program managers, donors, and other stakeholders informed on the availability of medicines. It is a vital precondition for timely decision making on product selection, financing, and delivery of commodities.

Reviewing and updating the quantification involves the following activities:

- Updating the actual consumption for each product and comparing the actual consumption against the forecast consumption to determine the quality of the forecast or the degree of error/forecast accuracy
- Reviewing and updating the forecasting data and assumptions
- Calculating or recalculating the forecasted consumption. The updated forecast data and assumptions should be computed to generate a new forecast, which is entered into the supply planning tool (e.g. PipeLine)

- Updating the stock on hand for each product. At the end of every physical inventory count or removal of expired products from the existing stock, the stock on hand information as well as any adjustments should be updated in the supply planning tool so that the stock on hand in the tool reflects the most up-to-date stock on hand data in the country
- Assessing national stock status for each product, based on product consumption and stock levels
- Reviewing and updating shipment delivery schedules to ensure continuous supply and to maintain desired stock levels
- Updating the amounts and the timing of funding commitments
- Recalculating the commodity requirements and costs, over time
- Estimating and updating funding needs and gaps for procurement

A NOTE ABOUT FORECAST ACCURACY: As described in the forecasting section, no forecast can be entirely accurate; alternate forecasting methods and/or assumptions will yield different forecast accuracy results. Tracking forecast accuracy will help the quantification team to understand which methods or assumptions yielded more accurate results. There are several methods for calculating forecast accuracy. All of the methods compare the past forecast with the actual demand or consumption over the same period of time.

One of the simpler and more common methods is called the Mean Absolute Percentage Error or MAPE. It is calculated by taking the absolute difference between the forecast and the actual (absolute means without regard to direction) and dividing it by the actual demand or consumption.

$$\frac{|\text{actual} - \text{forecast}|}{\text{actual}} \times 100 = \text{forecast error \%}$$

Other methods for determining forecast accuracy include Mean Deviation (MD), Mean Absolute Deviation (MAD), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and Mean Percent Error (MPE).

KNOWLEDGE AND SKILLS REQUIRED

Ideally, the same core team of people who conducted the initial quantification should conduct routine updates. The knowledge and skills required to complete a quantification for health commodities include the following:

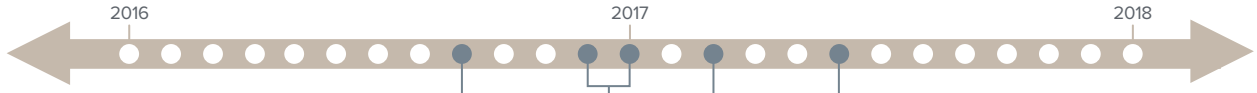
- For each commodity category, expertise in the specific program area and knowledge about the commodities and how they are used
- Computer literacy and proficiency in using Microsoft Excel spreadsheets or software programs to create and manage databases
- Commitment to conduct ongoing monitoring, data collection, and updating of the forecasting data and assumptions, and supply planning data, to update the PipeLine database
- Preparation and presentation of quantification data and methodology and final quantification results to key stakeholders and implementers. Figure 5 shows the activities that need to be done routinely to update a national quantification.

Photo courtesy of IAPHL

Photo courtesy of IAPHL

Photo courtesy of A. Makulec, Ethiopia

FIGURE 5.
TIMELINE FOR UPDATING AND REVIEWING FORECAST AND SUPPLY PLAN



September 2016

Collect data from LMIS regarding consumption, stock on hand, and losses and adjustments. Check and validate accuracy and completeness of data.

Update stock on hand in PipeLine as of 30 Sept 2016.

Update status of any planned or ordered shipments in PipeLine.

Update suppliers, prices, and other product data in PipeLine.

Update forecasted consumption in PipeLine with actual consumption for the last three months.

Assess national stock status and take action as necessary.

Dec 2016 / Jan 2017

Collect data from LMIS regarding consumption, stock on hand, and losses and adjustments. Check and validate accuracy and completeness of data.

Update stock on hand in PipeLine as of 31 Dec 2016.

Update status of any planned or ordered shipments in PipeLine.

Update suppliers, prices, and other product data in PipeLine.

Update forecasted consumption in PipeLine with actual consumption for the last three months.

Organize data from the last six months and analyze any trends to verify or update assumptions made in Sept 2016.

As required, review and update the forecast for Jan 2016 to Dec 2017 according to last six months' data.

Adjust supply plan in PipeLine.

Assess national stock status and take action as necessary.

March 2017

Collect data from LMIS regarding consumption, stock on hand, and losses and adjustments. Check and validate accuracy and completeness of data.

Update stock on hand in PipeLine as of 28 Feb 2017.

Update status of any planned or ordered shipments in PipeLine.

Update suppliers, prices, and other product data in PipeLine.

Update forecasted consumption in PipeLine with actual consumption for the last three months.

Assess national stock status and take action as necessary.

June 2017

Collect data from LMIS regarding consumption, stock on hand, and losses and adjustments. Check and validate accuracy and completeness of data.

Update stock on hand in PipeLine as of 31 May 2017.

Update status of any planned or ordered shipments in PipeLine.

Update suppliers, prices, and other product data in PipeLine.

Update forecasted consumption in PipeLine with actual consumption for the last three months.

Organize and analyze data from the last 12 months. Identify gaps in data.

Conduct major review of previous forecast, update and complete a forecast for the period Jun 2017 to May 2019. Assess forecast accuracy.

Input new forecasted requirements into PipeLine.

Create supply plan for the next two years in PipeLine.

Adapted from Ghana NACP/NTP Quantification and Supply Planning Team

Photo courtesy of USAID | DELIVER PROJECT, Indonesia

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APPENDICES

APPENDIX A

EXAMPLE MATERIALS FOR A CONSENSUS FORECAST EXERCISE

The following are sample handouts detailing the data available and assumptions to be developed or agreed upon for a malaria forecast. These are examples of how a quantification team might prepare in advance of a multi-stakeholder consensus forecast exercise.

I. PART 1 – CONSUMPTION

CONSUMPTION-BASED FORECAST

Approach:

1. Review our previous forecast and compare to actual consumption.

2. Review historical consumption data and determine if there is a trend

3. Agree on how to project trend into the future

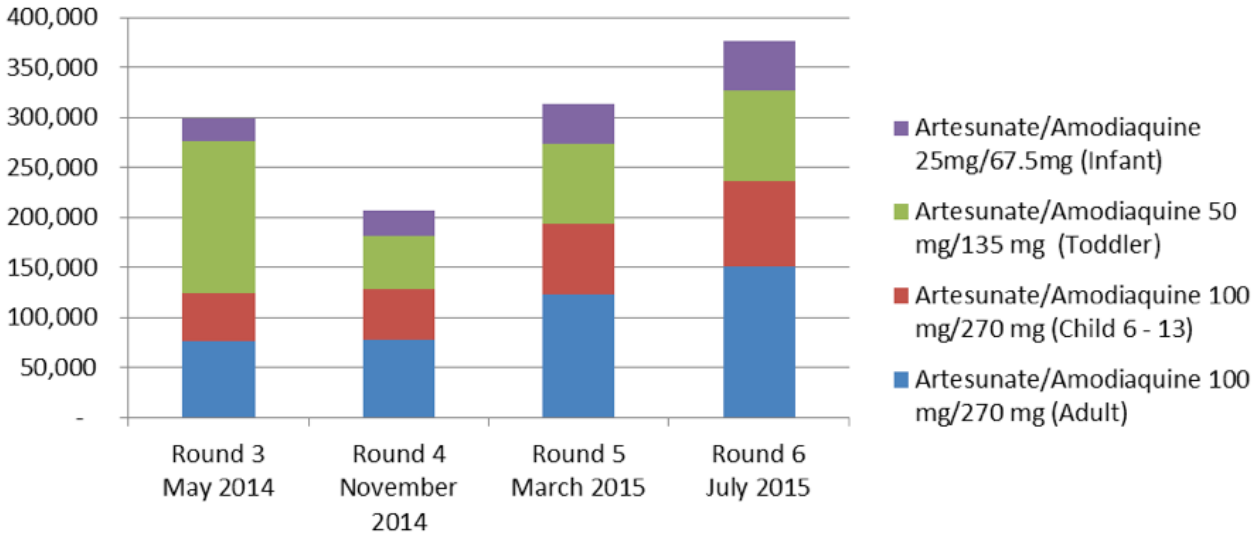
1. REVIEW OUR PREVIOUS FORECAST AND ACTUAL CONSUMPTION AND SEE HOW WE DID

	2014 AVERAGE ROUNDS 3 & 4	2014 FORECAST	2014 FORECAST ACCURACY	2015 AVERAGE ROUNDS 5 & 6	2015 FORECAST	2015 FORECAST ACCURACY
Artesunate/ Amodiaquine, 100 mg/270 mg (Adult)	81,544	70,245	14%	149,499	74,409	50%
Artesunate/ Amodiaquine, 100 mg/270 mg, (Child 6 - 13)	51,646	54,879	-6%	88,433	58,132	34%
Artesunate/ Amodiaquine, 50 mg/135 mg (Toddler)	104,920	59,269	44%	94,014	62,782	33%
Artesunate/ Amodiaquine, 25 mg/67.5 mg (Infant)	24,581	35,123	-43%	50,058	37,204	26%
Artesunate 60mg. inj.	19,240	19,756	-3%	26,110	17,091	35%
Sulfadoxine 500mg / Pyrimethamine 25mg (SP)	74,162	56,521	24%	185,024	68,026	63%
Malaria RDTs	123,907	215,151	-74%	224,650	242,157	8%
Artemether 20 mg/ml	16,108	8,781	45%	9,857	7,234	27%
Artemether 80 mg/ml	23,186	34,025	-47%	43,823	28,032	36%
Quinine 600mg/ml	6,264	19,756	-215%	14,127	10,851	23%
Quinine sulphate 200 mg Tablets	30,274	-	100%	7,341	-	100%
Quinine sulphate 300 mg Tablets	131,510	723,916	-450%	387,331	686,212	77%

2. REVIEW HISTORICAL CONSUMPTION DATA AND DETERMINE IF THERE IS A TREND

- Round 3 data is from the partner 1 counties only, adjusted by 30%
- Round 4 data is the sum of Round 4 from the partner 1 counties, and round 3 from the partner 2 counties
- Round 5 data is from the partner 1 counties only, adjusted by 30%
- Round 6 data is the sum of Round 6 from the partner 1 counties and round 4 from the partner 2 counties

AMC	Round 3 May 2014	Round 4 November 2014	Round 5 March 2015	Round 6 July 2015
Artesunate/Amodiaquine 100 mg/270 mg (Adult)	76,962	78,229	122,797	150,977
Artesunate/Amodiaquine 100 mg/270 mg (Child 6 - 13)	47,432	50,653	71,200	85,622
Artesunate/Amodiaquine 50 mg/135 mg (Toddler)	151,850	53,031	79,006	89,801
Artesunate/Amodiaquine 25mg/67.5mg (Infant)	22,264	24,745	40,352	49,392
Artesunate 60mg. inj.	15,938	19,150	24,327	21,469
Sulfadoxine 500mg / Pyrimethamine 25mg (SP)	86,559	56,815	138,757	175,955
Malaria RDTs	133,267	105,180	148,032	231,901
Artemether 20 mg/ml	21,642	12,067	9,954	10,956
Artemether 80 mg/ml	22,942	20,780	64,583	22,947
Quinine 600mg/ml	7,373	4,797	7,696	17,192
Quinine sulphate 200 mg Tablets	54,561	6,181	4,136	8,133
Quinine sulphate 300 mg Tablets	201,216	95,606	313,394	371,114


400,000
350,000
300,000
250,000
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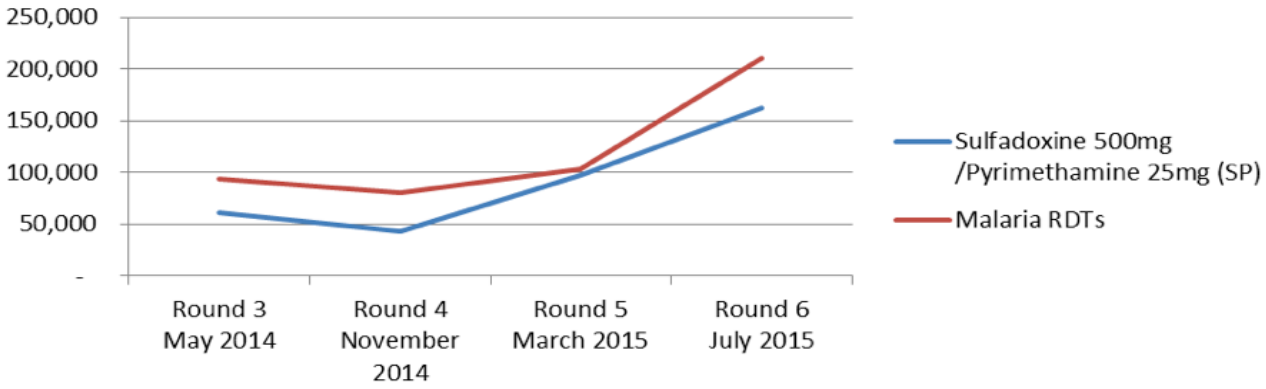
50,000
-
Round 3 May 2014
Round 4 November 2014
Round 5 March 2015
Round 6 July 2015
Artesunate/Amodiaquine 25mg/67.5mg (Infant)
Artesunate/Amodiaquine 50 mg/135 mg (Toddler)
Artesunate/Amodiaquine 100 mg/270 mg (Child 6 - 13)
Artesunate/Amodiaquine 100 mg/270 mg (Adult)


250,000
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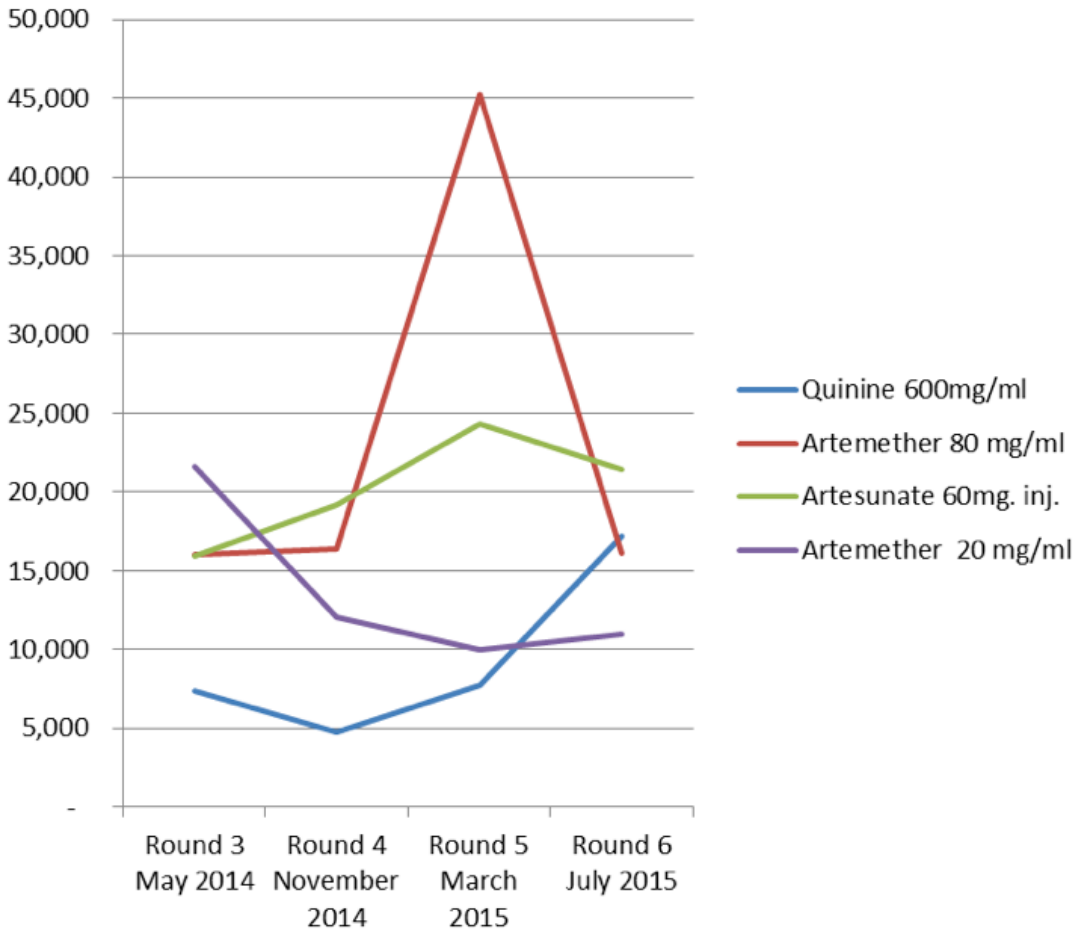
Round 3 May 2014
Round 4 November 2014
Round 5 March 2015
Round 6 July 2015
Sulfadoxine 500mg /Pyrimethamine 25mg (SP)
Malaria RDTs


50,000
45,000
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25,000
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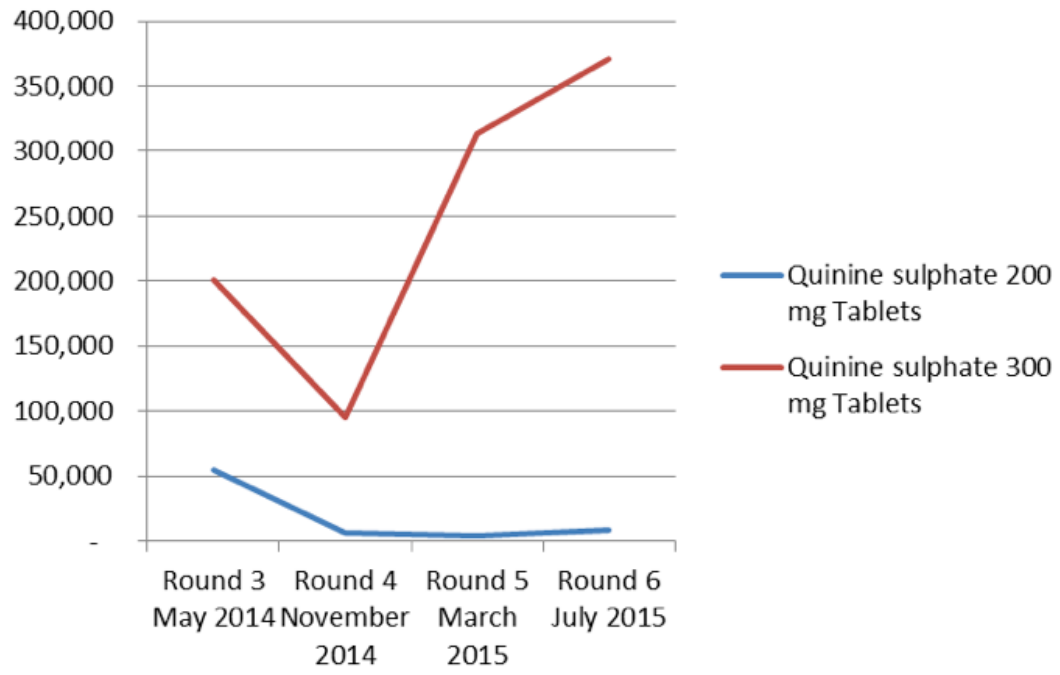
-
Round 3 May 2014
Round 4 November 2014
Round 5 March 2015
Round 6 July 2015
Quinine 600mg/ml
Artemether 80 mg/ml
Artesunate 60mg. inj.
Artemether 20 mg/ml


400,000
350,000
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-
Round 3 May 2014
Round 4 November 2014
Round 5 March 2015
Round 6 July 2015
Quinine sulphate 200 mg Tablets
Quinine sulphate 300 mg Tablets

% OF TOTAL CONSUMPTION COMPARING PARTNER 1 AND PARTNER 2 COUNTIES

	Oct/Nov 2014		June/July 2015	
Product	% partner 1 counties	% partner 2 counties	% partner 1 counties	% partner 2 counties
Artesunate/Amodiaquine 100 mg/270 mg (Adult)	77%	23%	82%	18%
Artesunate/Amodiaquine 100 mg/270 mg (Child 6 - 13)	77%	23%	86%	14%
Artesunate/Amodiaquine 50 mg/135 mg (Toddler)	77%	23%	85%	15%
Artesunate/Amodiaquine 25mg/67.5mg (Infant)	76%	24%	85%	15%
Artesunate 60mg. inj.	82%	18%	91%	9%
Sulfadoxine 500mg / Pyrimethamine 25mg (SP)	76%	24%	92%	8%
Malaria RDTs	76%	24%	91%	9%
Artemether 20 mg/ml	61%	39%	62%	38%
Artemether 80 mg/ml	79%	21%	70%	30%
Quinine 600mg/ml	75%	25%	84%	16%
Quinine sulphate 200 mg Tablets	68%	32%	91%	9%
Quinine sulphate 300 mg Tablets	45%	55%	87%	13%

Comparing malaria cases and consumption data

3. AGREE ON HOW FORECAST FOR NEXT 2 YEARS

- Take the consumption numbers from round 6
- Take the consumption numbers from round 5
- Take an average of round 5 and 6
- Other options?

II. PART 2 – SERVICES

SERVICES-BASED FORECAST

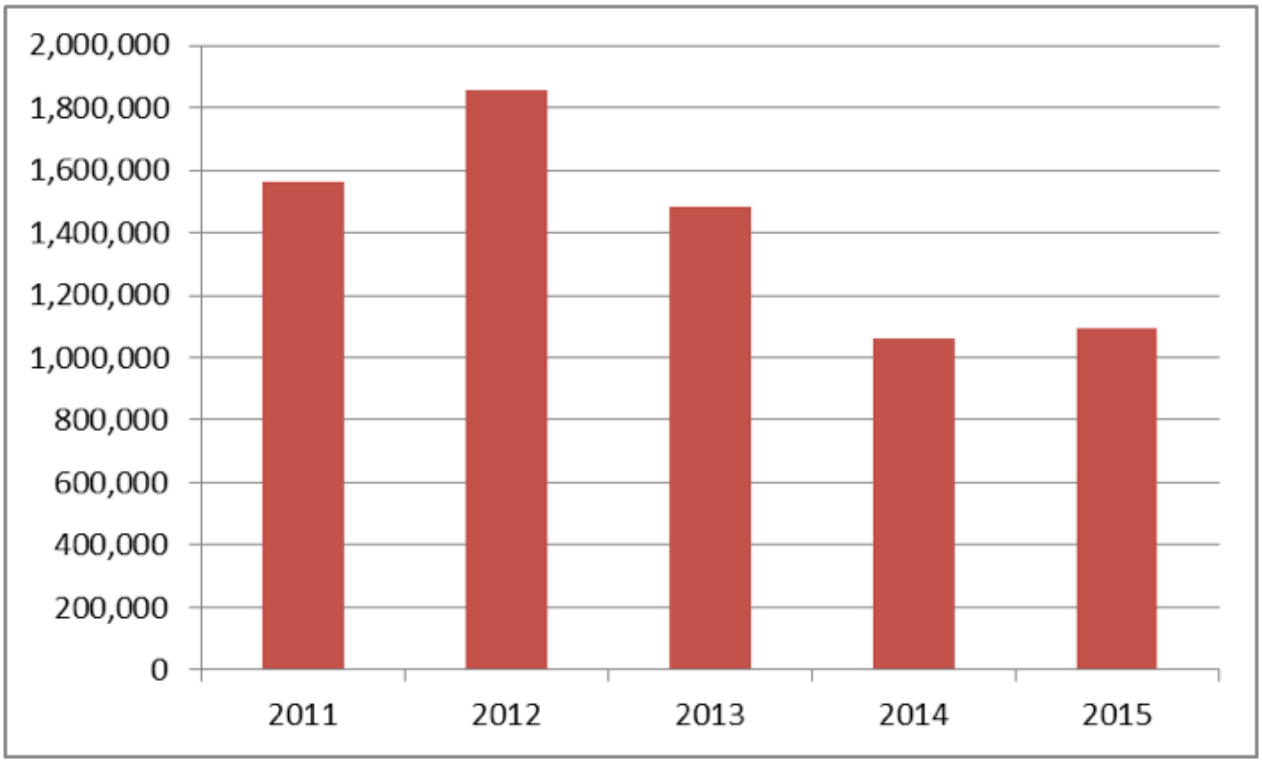
1. NUMBER OF MALARIA CASES, ALL AGES, SIMPLE + SEVERE, CLINICAL + CONFIRMED (PUBLIC SECTOR)

From the 2014 quantification: total malaria cases	
2014	2,100,000
2015	2,200,000
2016	2,000,000

Source	Year	Number	% change
HMIS – total malaria cases	2011	1,565,412	
	2012	1,858,373	19% increase
	2013	1,483,408	20% decrease
	2014	1,061,217	28% decrease
	2015	1,091,403	3% increase

FIGURE 1.

TOTAL MALARIA CASES (HMIS)



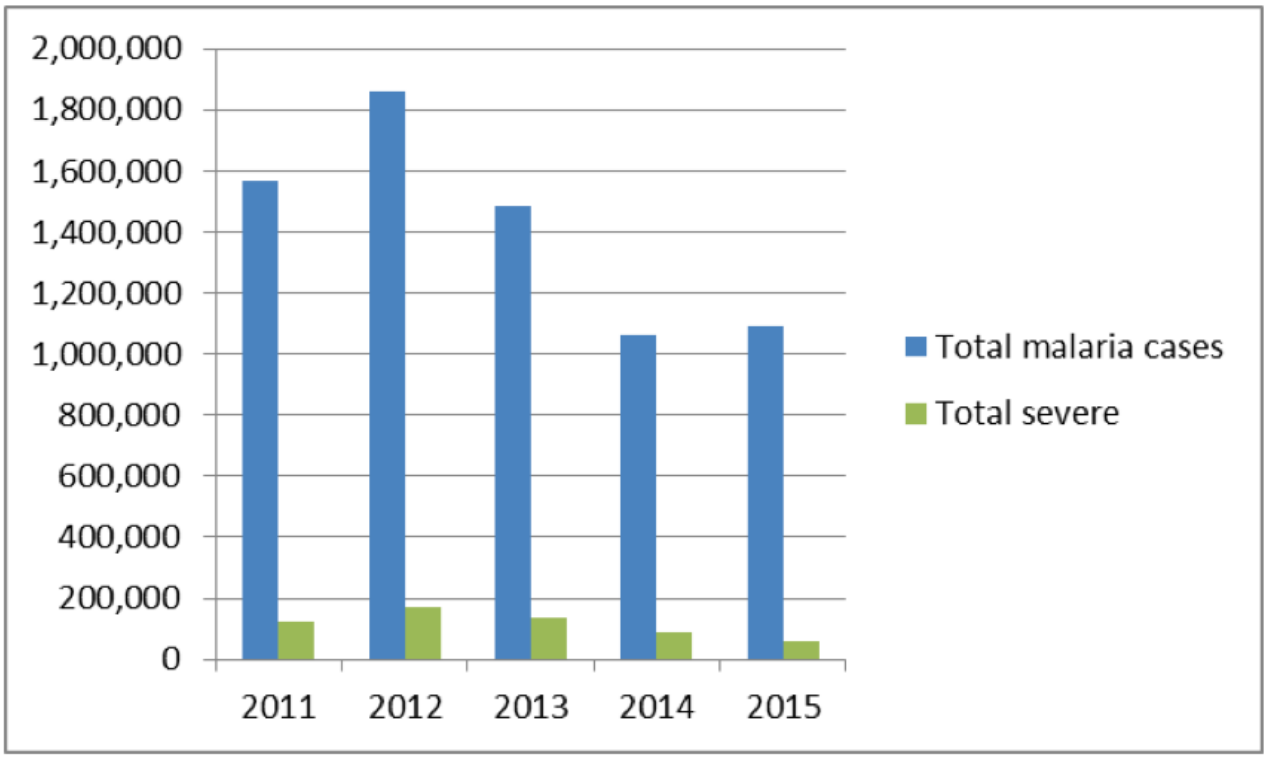
GROUP CONSENSUS			
	2016	2017	2018
Number of cases			

2. PERCENT OF CASES THAT REQUIRE SEVERE MALARIA MEDICINES

From the 2014 quantification: Percent of cases that require severe malaria medicines	
2014	9%
2015	7%
2016	5%

Source	Year	Severe malaria cases	% of total cases
HMIS – assumed that severe = those given quinine IV + those given artemether inj.	2011	122,079	8%
	2012	172,381	9%
	2013	138,261	9%
	2014	91,193	9%
	2015	62,400	6%

FIGURE 2.
SEVERE CASES AS % OF TOTAL CASES



GROUP CONSENSUS			
% of malaria cases that require severe malaria medicines	2016	2017	2018

3. PERCENT OF CASES REQUIRING QUININE (PREGNANT WOMEN IN THEIR FIRST TRIMESTER WITH MALARIA, UNDER 5KG, OTHERS)

From the 2014 quantification: percent of cases requiring quinine	
2014	10%
2015	10%
2016	10%

From the 2014 quantification: breakdown cases requiring quinine	
Pregnant women	4%
Children <5kg	2%
Others	4%

Source	Year	Number	As a % of all cases
HMIS – number of cases receiving quinine PO	2011	221,539	14%
	2012	217,288	12%
	2013	181,873	12%
	2014	96,837	9%
	2015	73,529	7%

GROUP CONSENSUS			
	2016	2017	2018
% of all malaria cases that require quinine			
% of all malaria cases that require ACTs			

Group Consensus	
Pregnant women	
Children <5kg	
Other	

4. BREAKDOWN OF A/L AND AS/AQ

From the 2014 quantification: breakdown by treatment bands			
	2014	2015	2016
AS/AQ	0%	20%	50%
A/L	100%	80%	50%

GROUP CONSENSUS			
	2014	2015	2016
AS/AQ			
A/L			

5. AS/AQ: BREAKDOWN BY TREATMENT BANDS

From the 2014 quantification: breakdown of AS/AQ bands	
% AS/AQ 2-11 mo	16%
% AS/AQ 1 – 5 years	27%
% AS/AQ 6 – 13 years	25%
% AS/AQ 14+ years	32%

LMIS data – SBRR data	AS/AQ 2-11 mo	14%
	AS/AQ 1 – 5 years	24%
	AS/AQ 6 – 13 years	31%
	AS/AQ 14+ years	32%
Data from rounds 3-6 (partner 1 counties only) average	AS/AQ 2-11 mo	11%
	AS/AQ 1 – 5 years	31%
	AS/AQ 6 – 13 years	22%
	AS/AQ 14+ years	36%

GROUP CONSENSUS	
	% on each weight band
% AS/AQ 2-11 mo	
% AS/AQ 1 – 5 years	
% AS/AQ 6 – 13 years	
% AS/AQ 14+ years	

6. A/L: BREAKDOWN BY TREATMENT BANDS

From the 2014 quantification: breakdown of A/L	
% 1 x 6 <3 years	30%
% 2 x 6 3 – 9 years	25%
% 3 x 6 9-12 years	10%
% 4 x 6 12+ years	35%

GROUP CONSENSUS	
	% on each weight band
% 1 x 6	
% 2 x 6	
% 3 x 6	
% 4 x 6	

7. SEVERE MALARIA: % TREATED WITH QUININE VS. % TREATED WITH ARTESUNATE INJ VS. % TREATED WITH ARTEMETHER INJ.

From the 2014 quantification: percent of severe on each medicine			
	2014	2015	2016
% quinine	30%	20%	10%
% artemether inj.	50%	50%	50%
% artesunate inj.	20%	30%	40%

GROUP CONSENSUS			
% on each medicine	2016	2017	2018
% on each medicine			
% artemether inj.			
% artesunate inj.			

8. QUININE INJ: ASSUMPTIONS

Assume:

- Medicine: 600mg/vial
- Dosing: 10mg/kg
- Duration of treatment: 3 doses/day for one day = 3 total doses/treatment.
- Since vial must be thrown out once reconstituted, round up each time a vial is opened; assume 3 vials/treatment (regardless of weight of patient)

9. ARTEMETHER INJ: WEIGHT BAND BREAKDOWNS (SEE TABLE)

ASSUME:

- Medicine: 20mg and 80mg
- Dosing: initial dose is 3.2mg/kg; continuation dose is 1.6mg/kg
- Duration of treatment: 2 doses
- Since vial must be thrown out once reconstituted, round up each time a vial is opened.
- Patients less than 10kg will take 20mg; more than 10kg will take 80kg
- Patients up to 10kg need 4 vials of 20mg; 11-29kg need 3 vials of 80mg; 30 – 59 need 4 vials of 80mg; 60+kg need 7 vials of 80mg

From the 2014 quantification: percent of cases in each weight band	
5-10kg	20%
11-29kg	40%
30-59kg	30%
60+kg	10%

GROUP CONSENSUS	
5-10kg	
11-29kg	
30-59kg	
60+kg	

10. ARTESUNATE INJ. WEIGHT BAND BREAKDOWNS (SEE TABLE)

Assume:

- Medicine: 60mg
- Dosing: 2.4mg/kg
- Duration of treatment: initial dose + 1/day for 2 days: 3 days total
- Since vial must be thrown out once reconstituted, round up each time a vial is opened.
- Patients 5 – 29kg need 3 vials; 30 – 59kg need 6 vials; 60+kg need 9 vials

From the 2014 quantification: percent of cases in each weight band	
5-10kg	20%
11-29kg	40%
30-59kg	30%
60+kg	10%

GROUP CONSENSUS	
5-10kg	
11-29kg	
30-59kg	
60+kg	

III. PART 3 – DEMOGRAPHIC/MORBIDITY

DEMOGRAPHIC BASED FORECAST

1. POPULATION AND POPULATION BREAKDOWN

From the 2014 quantification: Population Taken from 2008 census; 2.1% population growth rate applied		
2014	2015	2016
3,952,432	4,034,433	4,120,177
% artesunate inj.	20%	30%

From the 2014 quantification: population breakdown Population breakdown taken from DHS 2007	
<5 years	18.0%
5-14 years	29.5%
>14 years	52.5%

	DHS 2013	MIS 2011	DHS 2007
<5 years	16.1%	18.3%	18.0%
5-14 years	29.7%	28.5%	29.5%
>14 years	54.2%	53.2%	52.5%

GROUP CONSENSUS				
	% of population	2016	2017	2018
Total population				
<5 years				
5-14 years				
>14 years				

2. FEVER EPISODES BY AGE GROUP (SUSPECTED MALARIA CASES)

FROM THE 2014 QUANTIFICATION: NUMBER OF FEVER EPISODES PER AGE GROUP
Used population figures and breakdowns, and data from MIS (% of each age group experiencing fever in the four weeks prior to the survey). To calculate an annual figure, the monthly figure was multiplied by 12 (there are approximately 12 four-week time periods per year). Finally, this figure was divided by the respective population to arrive at the average number of fever episodes per person per year.

Number of fever episodes	2014	2015	2016
<5 years	4.5	4.5	4.5
5-14 years	3	3	3
>14 years	2	2	2

MIS 2011 Fever Episodes All Ages

AGE	2011 % WITH FEVER 4 WEEKS BEFORE SURVEY
0-4	55.7
5-9	40.4
10-14	26.4
15-19	24.4
20-29	34.5
30-39	38.0
40-49	41.1
50-59	38.7
60+	48.0

Had fever preceding survey

Age in months	DHS 2007 % with fever 2 weeks before survey	DHS 2013 % with fever 2 weeks before the survey	MIS 2009 % with fever 2 weeks before survey	MIS 2011 % with fever 2 weeks before survey
<6	18.4%	18.7%	40.1%	47.8%
6-11	39.9%	38.1%		
12-23	35.7%	33.7%	51.9%	55.3%
24-35	35.5%	28.5%	48.4%	54.6%
36-47	26.7%	27.3%	41.7%	43.2%
48 – 59	25.4%	23.6%	35.8%	44.6%

Malaria drug quantification Sept 2011 updated Dec 2011

Age group	Fever Episodes	Source
Pregnant women (5% of population)	2	--
Under 5 years	2	Updated Dec 2011 to align with community based distribution
5-14 years	2	Taken from the assumptions for hyper-endemic areas used in the WHO Technical Working Paper Methodology for Estimating the Costs of Global Malaria Control (2006-2015)" - May 2007
Others	1	Taken from the assumptions for hyper-endemic areas used in the WHO Technical Working Paper Methodology for Estimating the Costs of Global Malaria Control (2006-2015)" - May 2007

3. FEVER EPISODES WHO SOUGHT TREATMENT

From 2014 quantification: fever episodes that sought treatment			
	2014	2015	2016
Percent of fever episodes who sought treatment	80%	82%	85%

% of <5s with fever in the two weeks preceding the survey who sought treatment

Age in months	DHS 2007	DHS 2013
<6	64.0%	67.2%
6-11	54.7%	58.7%
12-23	61.0%	61.9%
24-35	55.3%	52.0%
36-47	55.4%	56.1%
48 – 59	53.5%	53.3%

MIS 2011 Fever episodes who sought treatment

Age	% with fever who sought treatment
0-4	79.3
5-9	79.4
10-14	80.3
15-19	76.5
20-29	74.6
30-39	75.6
40-49	75.0
50-59	74.1
60+	72.8

GROUP CONSENSUS			
	2016	2017	2018
% Public			
% Private			

4. Public vs. Private

From the 2014 quantification: public vs private			
	2014	2015	2016
% Public	67%	72%	75%
% Private	33%	28%	25%

MIS – among those with fever in the 4 weeks before the survey who sought treatment for the fever, % distribution by place of treatment

	2009	2011	Public	Private
Government Hospital	6.8%	11.8%	X	
Government health center	6.7%	5.1%	X	
Government health clinic	25.8%	23.5%	X	
Private hospital/clinic	20.2%	22.9%	X	
Mobile clinic	0.2%	0.5%	X	
Pharmacy	12.2%	5.6%		X
Medicine store/ shop	11.8%	17.4%		X
Traditional practitioner	1.0%	0.9%		X
Black bagger/ drug peddler	11.4%	8.0%		X
Other	1.5%	0.8%		
TOTAL	Public: 59.70% Private: 36.40%	Public: 63.80% Private: 31.90%		

GROUP CONSENSUS			
	2016	2017	2018
% Public			
% Private			

5. SUSPECTED MALARIA CASES TESTED

From the 2014 quantification: % tested Used HMIS data as the base			
	2014	**2015**	**2016**
% tested	90%	92%	95%

Source	Year	% tested
HMIS data: assumed that suspected cases tested = RDT positive + RDT negative + MS positive + MS negative over clinical + RDT positive + RDT negative + MS positive + MS negative	2011	71%
	2012	84%
	2013	89%
	2014	88%
	2015	81%

End Use Verification

Data point	March 2014	August 2014	Jan 2015	May 2015
Clinical	20.3%	10%	12%	14%
RDTs and Blood slide	79.7%	73%	65%	82%
Diagnosis not mentioned		17%	19%	4%

GROUP CONSENSUS			
	2016	**2017**	**2018**
% Tested			

6. NOT TESTED AND STILL TREATED

From the 2014 quantification: not tested and treated			
	2014	**2015**	**2016**
% not tested and treated*	65%	65%	65%

*The group found it difficult to come to consensus on this point- 65% is the average of the 2 view points- 30% and 100%

GROUP CONSENSUS			
	2016	2017	2018
% not tested and treated			

7. TESTED POSITIVE

From the 2014 quantification: positivity rate			
	2014	2015	2016
% tested positive	60%	56%	52%

Source	Year	% tested positive
HMIS data: positivity rate	2011	70%
	2012	69%
	2013	63%
	2014	62%
	2015	65%

8. TESTED POSITIVE AND TREATED

From the 2014 quantification: tested positive and treated			
	2014	**2015**	**2016**
% tested **positive** receiving treatment	99.5%	100%	100%

GROUP CONSENSUS			
	2016	**2017**	**2018**
% tested **positive** receiving treatment			

9. TESTED NEGATIVE AND STILL TREATED

From the 2014 quantification: tested negative and still treated			
	2014	**2015**	**2016**
% tested **negative** receiving treatment	12%	11%	10%

GROUP CONSENSUS			
	2016	**2017**	**2018**
% tested **negative** receiving treatment			

APPENDIX B

SOFTWARE PROGRAMS FOR QUANTIFICATION OF HEALTH COMMODITIES

Different software tools facilitate the completion of the forecasting step: collection, organization, and analysis of the forecasting data and assumptions, and using data to calculate the quantity for each product needed. These tools include Microsoft Excel spreadsheets, and ForLab. The PipeLine software can be used to calculate consumption-based forecasts. Regardless of the forecast method used, PipeLine is also used for the supply planning step: aggregating the total commodity requirements and costs, determining funding needs and gaps, and planning timing of procurements and shipment delivery schedules.

I. FORECASTING TOOLS

The following software tools can be used to assist in completing the forecasting step of the quantification.

QUANTIMED

Quantimed, a tool developed by Management Sciences for Health, calculates the forecast quantities and costs of medicines and medical supplies needed to provide services for health programs. Quantimed offers three methods for forecasting medicines and medical supplies: (1) consumption, (2) proxy consumption, and (3) morbidity (including scaling-up patterns). Quantimed can be used to forecast needs for a single health facility, a national program, or a group of geographic or administrative areas; and for a variety of essential medicines or medical supplies, including antiretrovirals and medicines to treat opportunistic and sexually transmitted infections, malaria (bed nets and medicines), and tuberculosis medicines. To obtain Quantimed, email quantimed@msh.org or via http://siapsprogram.org/tools-and-guidance/quantimed/

FORLAB

ForLab is a multi-method forecasting tool that measures laboratory service delivery and supply chain performance. To identify gaps between patient need and existing service capacity, the tool uses data from multiple sources (demographic, usage, and tests) to compare expected demographic/morbidity estimates with actual usage and service statistics. To establish instrument capacity over time, the tool provides an overview of instrument coverage, platform diagnostic contribution, and instrument utilization at current uptake levels versus forecast estimates. This functionality can also assist in instrument procurement planning and modeling various coverage and instrument transition scenarios. (https://www.k4health.org/sites/default/files/forlab_brief.pdf)

EXCEL SPREADSHEETS FOR FORECASTING

Microsoft Excel spreadsheets can be used to organize data and make calculations for any of the types of forecasts mentioned in this guide (consumption-, demographic/morbidity-, or services-based); functions within Excel can also be used to forecast using time series models. Spreadsheets will vary from user to user, but can be formatted to follow the steps in quantification outlined in this guide.

II. SUPPLY PLANNING AND PIPELINE MONITORING TOOLS

PIPELINE SOFTWARE

The PipeLine software for procurement planning helps program managers enter and track critical forecasting data, plan and ensure timely procurement and delivery of products, and maintain stock levels between established maximum and minimum levels at the program or national level to prevent stockouts and overstocking. Policymakers, product suppliers, and donors can generate reports, monitor the status of shipments, and use the software as a key tool in program planning. PipeLine can be used for any type of health commodity.

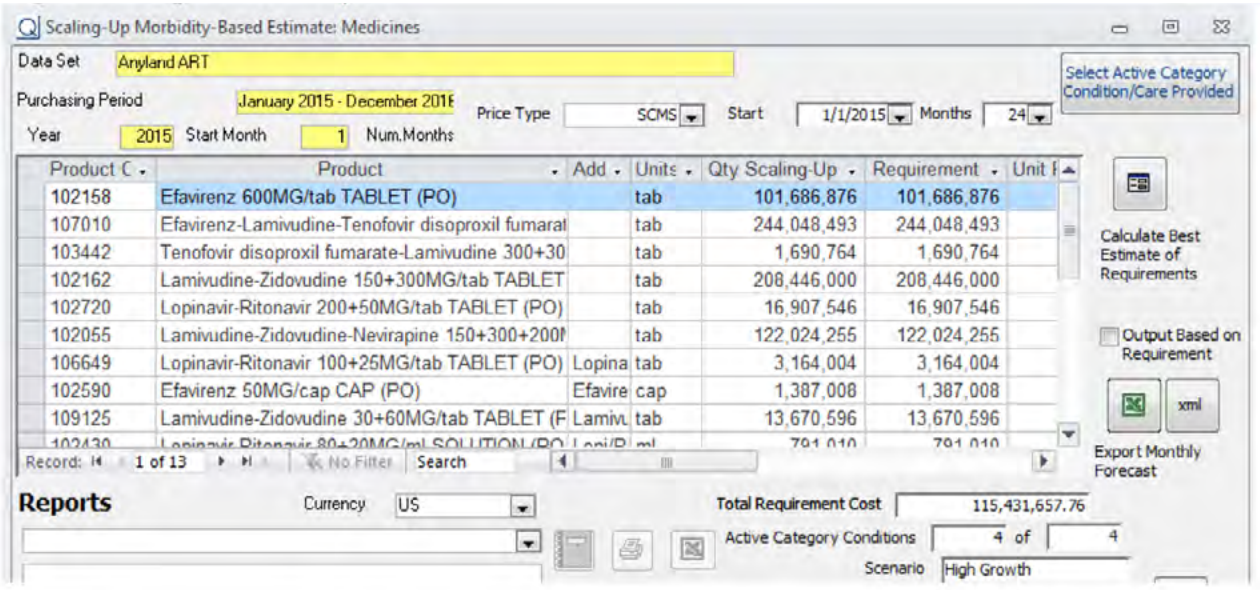
To access the PipeLine software and user's manuals, contact jsiinfo@jsi.com.

APPENDIX C

INSTRUCTIONS FOR EXPORTING MONTHLY FORECAST DATA FROM QUANTIMED INTO AN XML FILE FOR SUBSEQUENT IMPORT INTO PIPELINE

Verify that the version has two buttons on the right-hand side above script Export Monthly Totals to Excel File, as in figure 1.

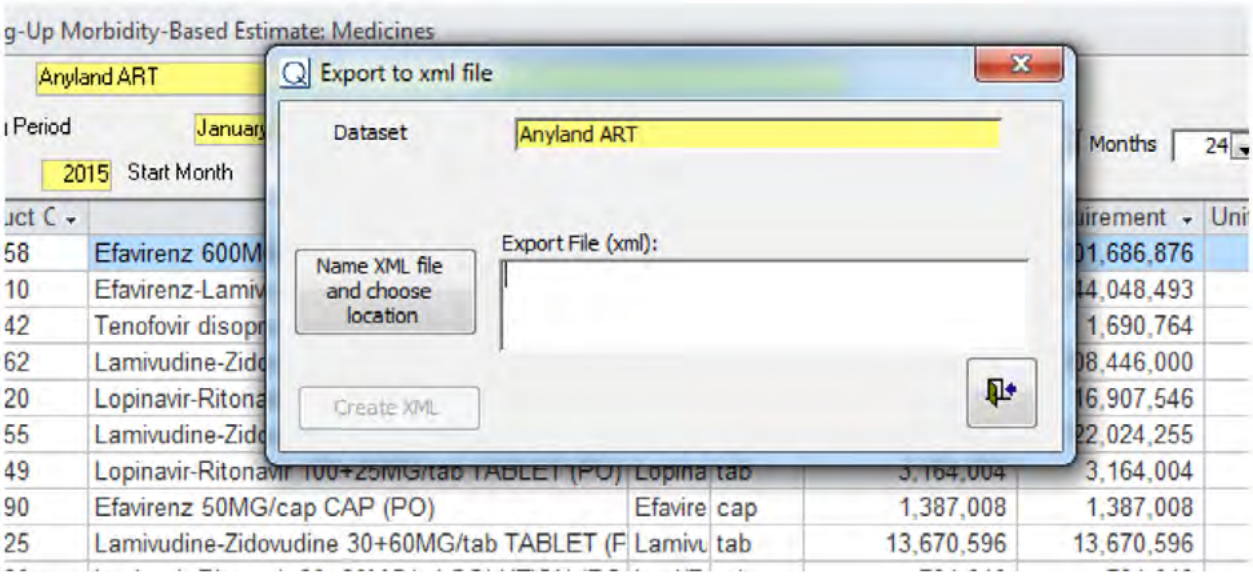
FIGURE 1.
EXPORT MONTHLY TOTALS TO EXCEL FILE



Ensure that the quantities displayed in the Analysis and Reports>Scaling-up Morbidity-Based Estimate: Medicines screen meet the required parameters for the Price Type, PP Date, and Months, and include all the Condition/Care Provided needed in the calculation.

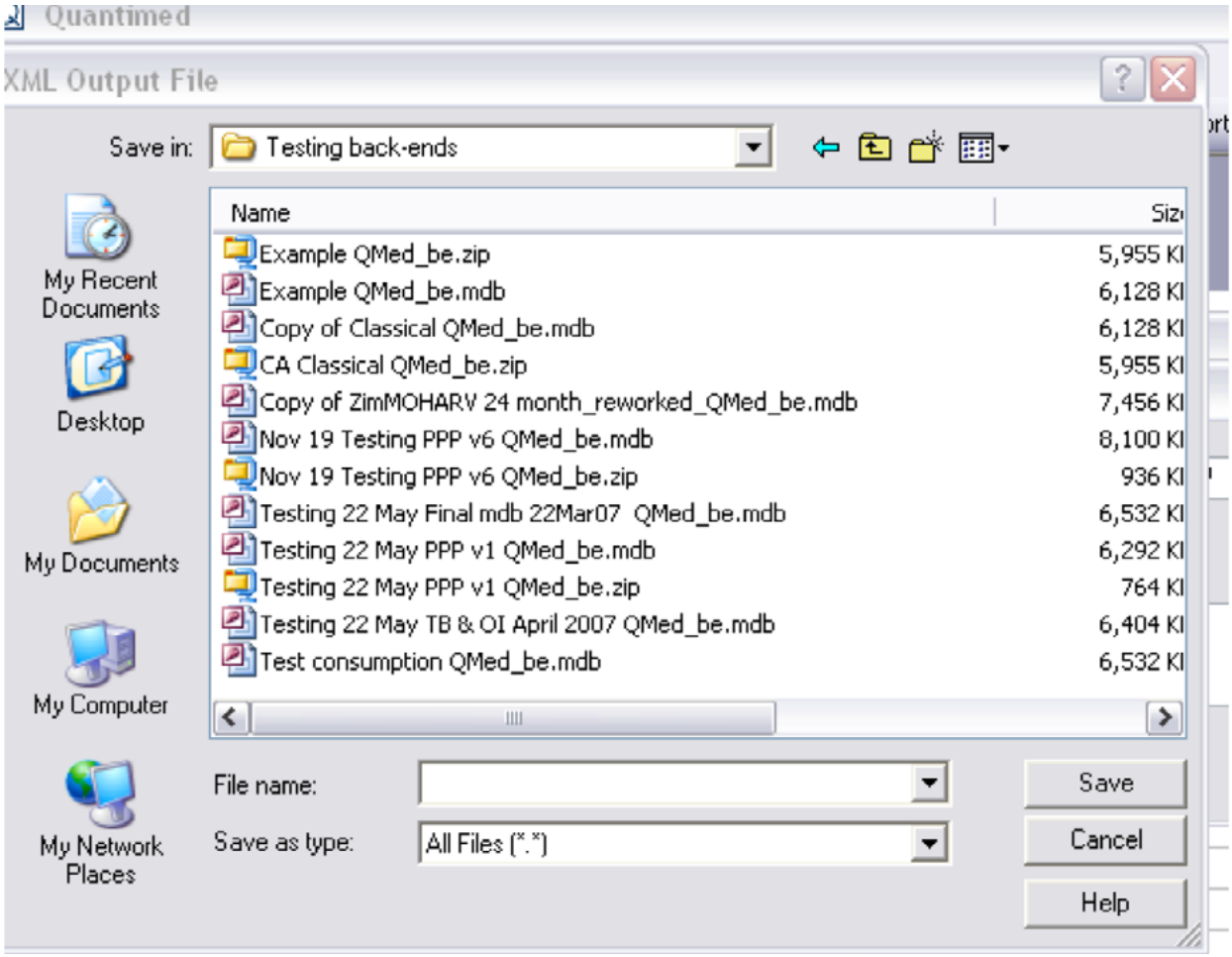
Click on the button marked “XML,” and the screen “Export to XML file” appears (see figure 2).

FIGURE 2.
EXPORT TO XML FILE



Note: The field Recipient should be displayed with the name of the active dataset.
Click the button Select XML file for Export; the box in figure 3 appears.

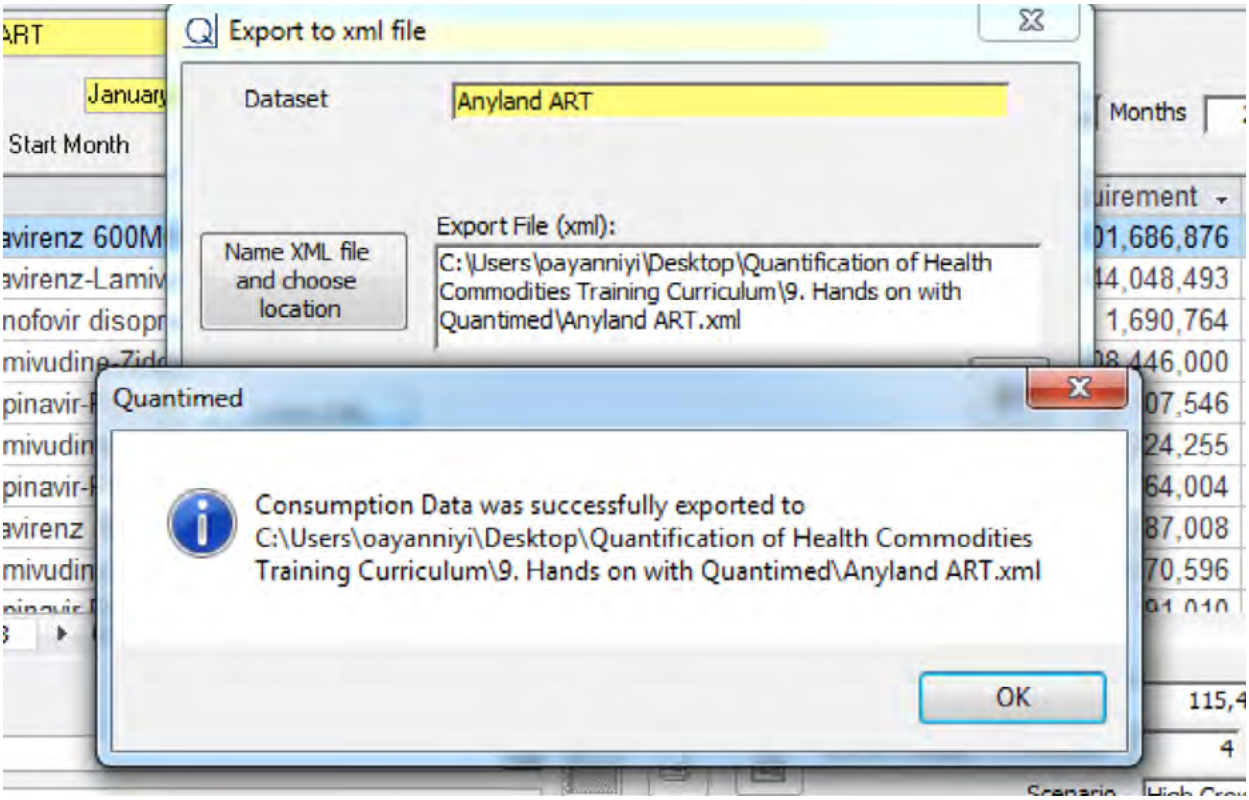
FIGURE 3.
SELECT XML FILE FOR EXPORT



Select the folder to save the XML file in (it could be the relevant folder under PipeLine) in the Save in: field; type a filename in the File name field; click Save. The default filename is the name of the dataset. Remember where this is saved so it can be found easily when importing into PipeLine.

The full path and name for the XML file will appear in the previous screen (figure 3) and the button Create XML is now active. Click on this button. A confirmation screen (figure 4) will appear.

FIGURE 4.
CONFIRMATION SCREEN



Click OK; the system will return to the Analysis and Reports>Scaling-up Morbidity-Based Estimate: Medicines screen and the XML file should be saved in the chosen location.

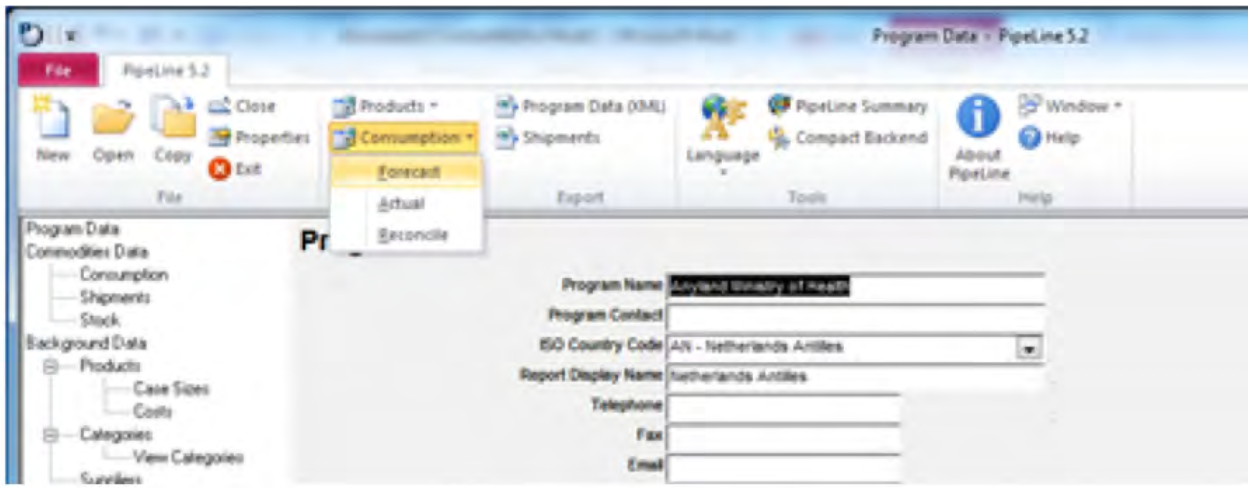
IMPORT FORECAST CONSUMPTION DATA FROM QUANTIMED INTO PIPELINE 5.2

Generic instructions for importing forecast data can be found on pages A-6 through A-10 of the PipeLine 4.0 user's manual.

To import consumption data from Quantimed, two types of files are needed for export. One will be the forecast consumption data generated from Quantimed; the other will be a list of products (see the Supply Chain Management System project for a copy). Both files should be generated in XML format; they will have an .xml extension.

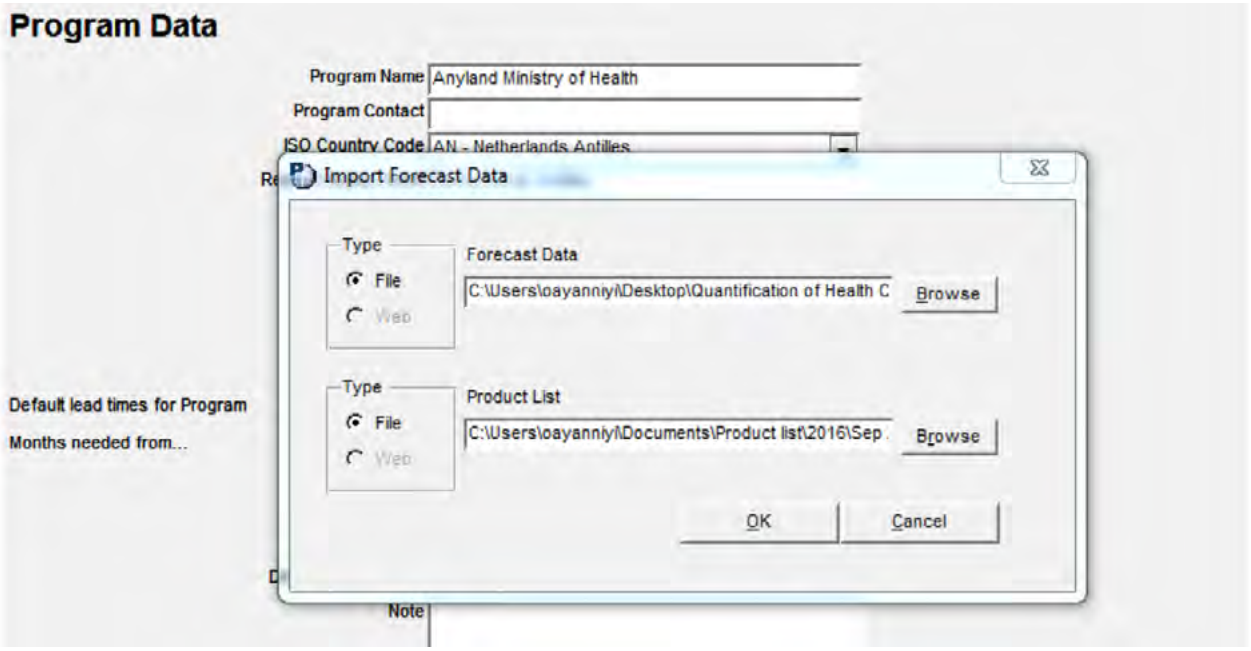
1. From the Import drop-down menu, select Consumption > Forecast as displayed in Figure 5.

FIGURE 5.
CONSUMPTION > FORECAST SCREEN



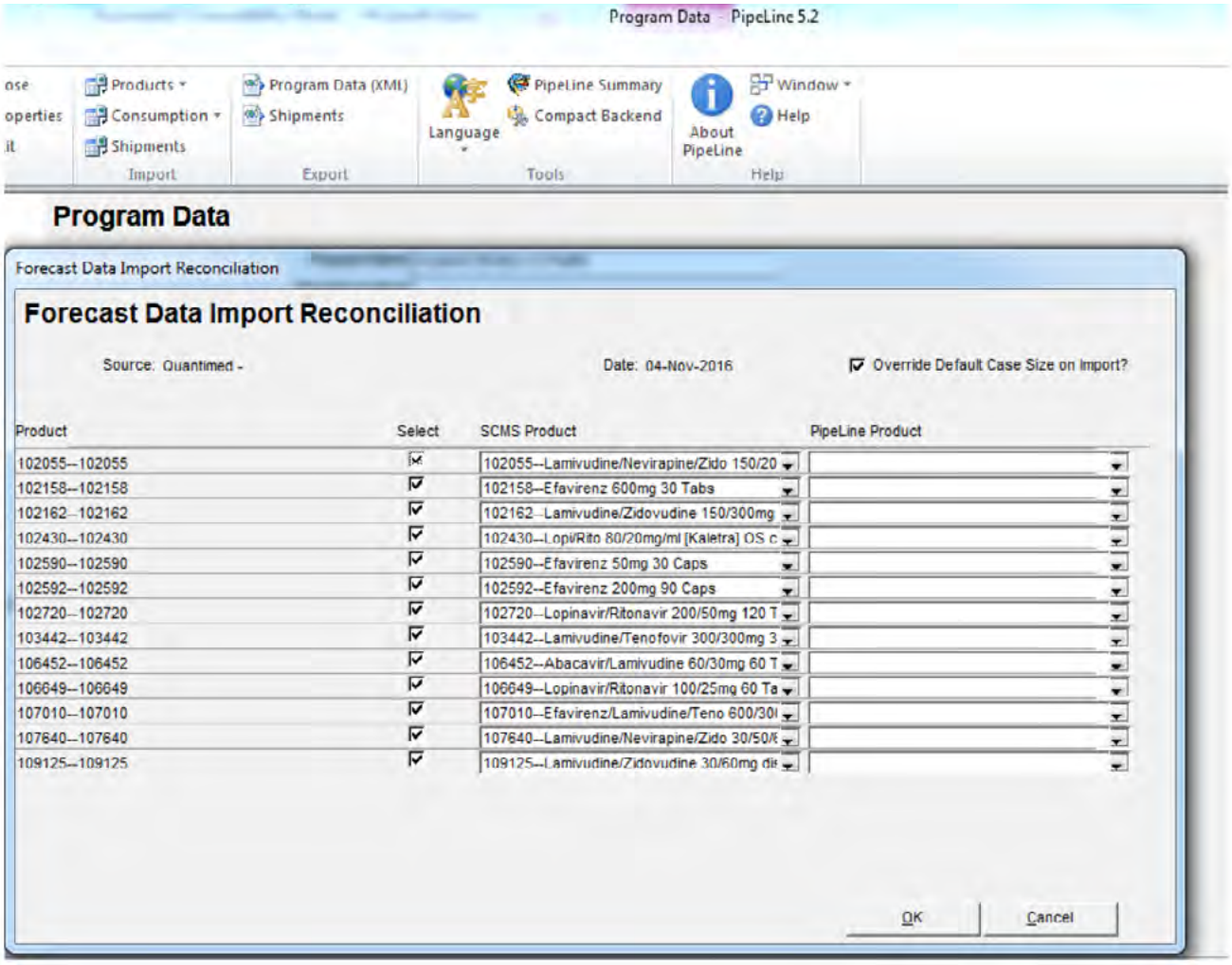
2. Select the locations of the consumption data and product list .xml files, which were generated by Quantimed, in the Import Forecast Data dialogue box. See figure 6.

FIGURE 6.
IMPORT FORECAST DATA



3. When OK is selected, the Forecast Import Reconciliation screen appears (see figure 7). If a product is already in PipeLine, it will appear in the PipeLine Product column on the right.

FIGURE 7.
FORECAST IMPORT RECONCILIATION

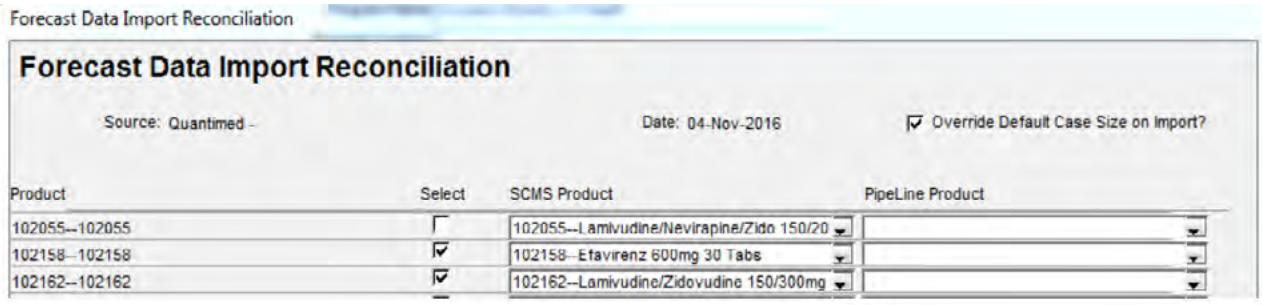


4. In the Forecast Data Import Reconciliation screen, clicking on the checkmark in the select column to deselect any products for which forecast data should not be imported. The checkmark is removed by clicking on it. See figure 8.

FIGURE 8.
SELECTING A PRODUCT NOT TO IMPORT IN THE FORECAST RECONCILIATION SCREEN

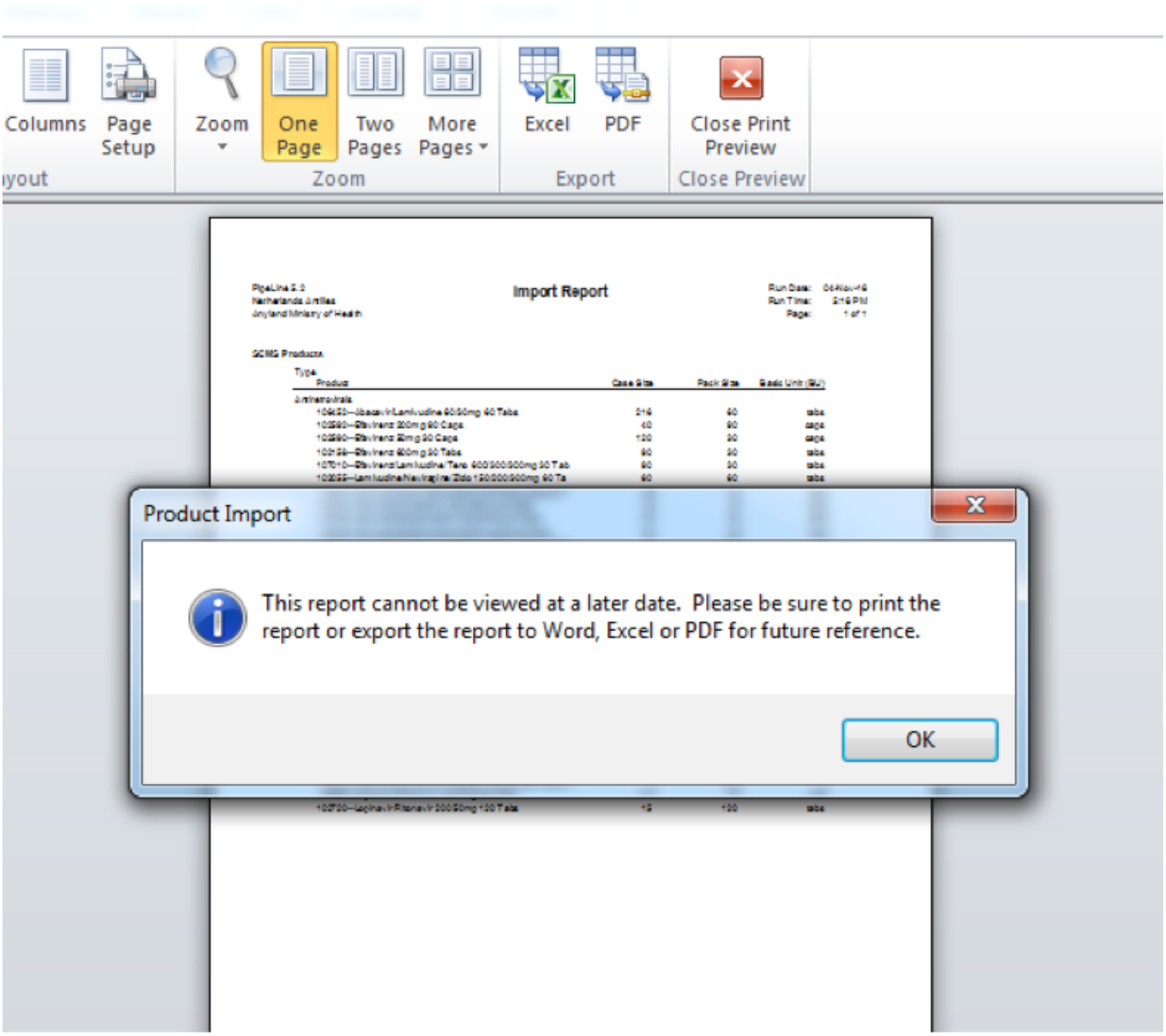
5. To override the default case sizes with the case sizes in the import file already in the PipeLine database (if desired), select the Override Default Case Size on Import? box. See figure 9.

FIGURE 9.
OVERRIDING THE DEFAULT CASE SIZE IN THE FORECAST RECONCILIATION SCREEN



6. After a successful data import, a report will be displayed confirming the data imported. This report is not saved; print it if a copy is needed for records (see figure 10).

FIGURE 10.
PRODUCT IMPORT



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