= Summary
The methods and strategies described in this chapter can be used as tools to:

- prepare and justify a drug budget;
- plan for new and expanding programs;
- optimize drug budgets based on priority health problems to be treated and the most cost-effective treatment approaches;
- calculate emergency needs for disaster relief and epidemics;
- resupply an existing supply network that has become depleted of products;
- compare current drug consumption with public health priorities and usage in other health systems.

The quantification method selected must be chosen in light of the resources and information available.

The consumption method, which uses data on drug consumption, gives the most accurate prediction of future needs. Large, well-established drug supply systems rely primarily on the consumption method. To be reliable, the consumption data must come from a stable supply system with a relatively uninterrupted supply and a full supply pipeline. Consumption data may or may not reflect rational prescribing and use of drugs.

The morbidity method forecasts the theoretical quantity needed for the treatment of specific diseases. This method requires reliable data on morbidity and patient attendances (visits to health facilities) and uses standard treatment guidelines to project drug needs. This is the most complex and time-consuming method, and there can be major discrepancies between projections and subsequent utilization. Still, this method is often useful and may be the most convincing approach for justifying a budget request.

If there is no reliable information on past consumption or morbidity, it is possible to extrapolate utilization from other facilities, regions, or countries. The adjusted consumption method is flexible enough to apply to various situations and can be either population or service based. Service-level quantification of budget requirements can be applied when only budget requirements, and not specific drug quantities, are needed. It provides a clear, logical, one-page justification of drug financing requirements.

There are several critical issues common to all methods. The drug list is the central component and must be produced in a format suitable to the type of quantification. In a new supply system, or one in which shortages have been widespread, quantification estimates must be adjusted because the supply pipeline must be filled. The lead time has a major impact on quantities required for safety stocks. In virtually all supply systems, it is necessary to adjust for losses due to wastage and theft.

Quantification estimates can be cross-checked by combining different methods. No matter which method is used, there may be a gap between the initial estimates of drug needs and the allocated budget. The quantification process itself may help justify an increase in the budget, but often the quantification estimates have to be adjusted and reconciled to fit available funds.

The choice between manual and computerized quantification may be dictated by circumstances, but the process is much easier with computer assistance. Quantification can be centralized, or it can be decentralized to staff of peripheral warehouses and health facilities. The personnel and time requirements depend on the quality and accessibility of source data and on the type and scope of quantification. A large-scale quantification often requires several months to carry out.

== 14.1 Methods of Quantification
Drug needs can be quantified by using one or a combination of four standard methods. Quantification involves estimating the quantities of specific drugs needed for a procurement. Most quantification exercises also estimate the financial requirements to purchase the drugs. The quantification methods described in this chapter are normally used to forecast needs for an annual or semiannual procurement. They are not usually used to calculate routine order quantities in an established supply system that uses scheduled purchasing (periodic orders) or perpetual purchasing (orders placed whenever need arises). In such situations, one of the reorder formulas presented in Chapter 15 is used to calculate the optimal order quantity and order interval for each item. The goal is to maintain the most cost-effective balance between service levels and inventory costs.

Major Options for Quantification
The four general methods discussed in this chapter are:

1. consumption method
2. morbidity method
3. adjusted consumption method
4. service-level projection of budget requirements

The consumption method uses records of past consumption of individual drugs (adjusted for stockouts and
projected changes in drug utilization) to project future need (see Section 14.4).

The morbidity method estimates the need for specific drugs based on the expected number of attendances, the incidence of common diseases, and standard treatment patterns for the diseases considered (see Section 14.5).

The adjusted consumption method uses data on disease incidence, drug consumption or utilization, and/or drug expenditures from a "standard" supply system and extrapolates the consumption or utilization rates to the target supply system, based on population coverage or service level to be provided (see Section 14.6).

Service-level projection of budget requirements uses the average drug procurement cost per attendance or bed-day in different types of health facilities in a standard system to project drug costs in similar types of facilities in the target system (see Section 14.7). This method does not estimate quantities of individual drugs.

**Relative Predictive Accuracy of Quantification Methods**

Quantification of drug requirements is inherently imprecise, due to the many variables involved. Useful results depend as much on art as on science.

The most precise method for forecasting drug usage is the consumption-based approach, provided the source data are complete, accurate, and properly adjusted for stockout periods and anticipated changes in demand and use. This method does not normally address the appropriateness of past consumption patterns, which may or may not correspond with public health priorities and needs. Thus, irrational drug use may be perpetuated by total reliance on the consumption method. If stockouts have been widespread for long periods, it may be impossible to apply this method accurately.

Morbidity-based quantification is the most complex and time-consuming. In many countries, it is very difficult to assemble valid morbidity data on more than fifty or so diseases; therefore, some needs will be overlooked in the quantification. Data on patient attendance are often incomplete and inaccurate, and it is difficult to predict what percentage of prescribers will actually follow the standard treatment regimens used for quantification. Despite these constraints, this method may still be the best alternative for planning a procurement or for estimating budget needs in a supply system or facility in which a limited range of health problems accounts for virtually all drug consumption, such as a small primary care system or a special-purpose hospital.

Adjusted consumption is the method generally used if neither the consumption-based nor the morbidity method is feasible. This method is most likely to yield accurate projections when used to extrapolate from one set of facilities to another set that serves the same type of population in the same type of geographic and climatic environment. If the method is applied by drawing standard data from another country (such as the Nordic utilization data), the results will be only a rough estimate of need. Even when target and standard facilities are closely matched, quantification estimates are suspect, because it is a big leap to assume that disease incidence, utilization patterns, and prescribing habits will be essentially the same in both settings. Still, this method may be the best alternative in the absence of suitable data for the consumption- or morbidity-based method. It is also useful for cross-checking projections made with other methods.

Service-level projection of budget requirements produces a rough estimate of financial needs for drug procurement. The method relies on two assumptions: that the "standard" system (used for comparison) and the target system are comparable in terms of patient attendance and bed-days per type of facility, and that the patterns of drug use are roughly the same in both systems. Despite its limitations, this method can be useful in predicting drug costs in a new system or in a system in which no data are readily available. Figure 14.1 summarizes the applications and limitations of the four major quantification methods.

**14.2 Applications of Large-Scale Quantification**

Large-scale quantification is normally appropriate for

*Forecasting for large-scale procurement:* Formal quantification is mandatory before each annual or semiannual procurement. These estimates need to be accurate to avoid stockouts, emergency purchases, and overstocks and to maximize the impact of procurement funds. The consumption method is the first choice, cross-checked to assess the appropriateness of usage patterns. When consumption data are unreliable, it may be necessary to apply the morbidity and/or adjusted consumption methods for an initial quantification, switching to the consumption method once reliable data can be compiled (see Country Study 14.1).

*Estimating budget requirements:* In many countries, the annual pharmaceutical procurement budget is determined by adding a fixed percentage to last year's request or allocation to allow room for expected cuts by the ministry of finance. Both budget requests and cuts are frequently prepared without reliable estimates of actual
needs. This cycle can be broken with rational, well-documented quantification.

Although consumption-based quantification is the best guide to probable expenditures, the morbidity-based method may be the most convincing documentation for a budget request. Adjusted consumption is useful for checking and justifying either consumption or morbidity methods.

For some budgeting purposes, quantification may not need to specify individual drug quantities but only estimated financial requirements. This can be done by projecting costs using the service-level method.

**Forecasting for new programs:** When drugs are needed for a new full-service health system or vertical program (such as family planning or control of diarrheal disease), large-scale quantification serves two purposes: to establish funding requirements for procurement and to develop the initial procurement list. In most situations, the consumption-based method is not feasible, and some combination of morbidity-based and adjusted consumption methods must be used for the initial quantification.

**Forecasting for assistance projects:** A donor organization may undertake ad hoc quantification studies to plan procurement needs in the context of a development project. When local consumption data are not sufficiently reliable for quantification, the morbidity or adjusted consumption methods are required, either singly or in combination.

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**Figure 14.1 Comparison of Quantification Methods**

<table>
<thead>
<tr>
<th>Method</th>
<th>Uses</th>
<th>Essential Data</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>First choice for procurement forecasts, given reliable data</td>
<td>Reliable inventory records</td>
<td>Must have accurate consumption data</td>
</tr>
<tr>
<td></td>
<td>Most reliable predictor of future consumption</td>
<td>Records of supplier lead time</td>
<td>Can perpetuate irrational use</td>
</tr>
<tr>
<td>Morbidity</td>
<td>Estimating need in new programs or disaster assistance</td>
<td>Data on population and patient attendances</td>
<td>Morbidity data not available for all diseases</td>
</tr>
<tr>
<td></td>
<td>Comparing use with theoretical needs</td>
<td>Actual or projected incidence of health problems</td>
<td>Standard treatments may not really be used</td>
</tr>
<tr>
<td></td>
<td>Developing and justifying budgets</td>
<td>Standard treatments (ideal, actual)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Projected drug costs</td>
<td></td>
</tr>
<tr>
<td>Adjusted consumption</td>
<td>Procurement forecasting when other methods unreliable</td>
<td>Comparison area or system with good per capita data on consumption, patient</td>
<td>Questionable comparability of patient populations, morbidity, and treatment</td>
</tr>
<tr>
<td></td>
<td>Comparing use with other supply systems</td>
<td>attendance, service levels, and morbidity</td>
<td>practices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of local health facilities by category</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Estimation of local user population broken down by age</td>
<td></td>
</tr>
<tr>
<td>Service-level projection</td>
<td>Estimating budget needs</td>
<td>Utilization by service levels and facility type</td>
<td>Variable facility use, attendance, treatment patterns, supply system</td>
</tr>
<tr>
<td>of budget requirements</td>
<td></td>
<td>Average drug cost per attendance</td>
<td>efficiency</td>
</tr>
</tbody>
</table>

**Estimating drug requirements in emergency relief situations:** In emergencies such as floods or earthquakes, the first step is to provide emergency kits quickly (Chapter 27). As local health problems become clear, a morbidity-based method can be used to project requirements in the short and medium term, until the regular supply system can resume services. Country Study 14.2 describes quantification for a cholera epidemic in a Latin American country.

**Comparing actual drug consumption with theoretical need:** In most functional supply systems, the regular procurement quantification is based on past consumption. However, it is useful to periodically compare consumption with theoretical need based on public health priorities. The morbidity-based method provides the most informative comparison, but simply comparing consumption data from different systems is worthwhile.

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### 14.3 Critical Issues in Quantification

Several issues must be addressed in any large-scale quantification:

- preparing an action plan for quantification;
- using centralized or decentralized quantification;
- using manual or computerized methods for quantification;
- estimating the time required;
- developing the drug list;
- filling the supply pipeline;
Country Study 14.1 Large-Scale Quantification in Zimbabwe

The Zimbabwe Essential Drugs Action Programme (ZEDAP) was established in 1986. In 1987, quantification was done to predict the real national drug requirements and the costs in foreign and local currency terms. The drug purchase was expected to cover all public health care facilities, and the sources of supply would likely be both local and foreign.

A WHO team consisting of a physician, a pharmacist, and an economist worked with Zimbabwean staff to produce the estimates, using a computer spreadsheet program to facilitate the calculations.

The vast majority of the estimates were made using the morbidity method, since standard treatment guidelines had already been developed and published. Data for health problem frequency (morbidity) were not available for all facilities but were extrapolated using standard facilities at four different levels to represent health problem frequency for (1) central hospital inpatients, (2) general and district hospital inpatients, (3) all hospital outpatients, and (4) rural health center patients. The common denominator used was patient cases for the hospitals and population coverage for the health centers. Standard treatment guidelines and health problem frequency were differentiated for patients under five years old and those aged five years or older.

Intravenous solutions and drugs for psychiatric patients were estimated using the consumption method.

The team estimated requirements and costs for 159 essential drugs. The estimated cost was combined with costs for other essential drugs not included in the quantification to prepare a budget proposal, which was approved by the Ministry of Finance.

Since this exercise, annual quantification exercises continue, with regional and provincial stores managers meeting for three days a year to prepare an annual procurement list. The consumption method is now the basis for calculations, although population figures, morbidity data, and prescribing practices are considered in the decisions.

- Form a working group to coordinate activities of the offices, departments, and facilities involved;
- Define the objectives and coverage of the quantification;
- Examine the availability of data and choose the best quantification method in light of objectives and available data and resources (personnel, funding, computer capacity);
- Develop drug lists and data collection forms;
- Develop standard treatment guidelines (if applicable);
- Train staff in the applicable quantification method and in data collection and analysis;
- Develop a workplan and timeline for quantification, with realistic deadlines for each phase;
- Manage quantification according to plan (adjusting for inevitable delays and unexpected constraints);
- Adjust estimated quantities as needed;
- Evaluate the quantification process and plan improvements to resolve problems encountered.

The World Health Organization (WHO) manual Estimating Drug Requirements (WHO/DAP 1988) discusses how to develop a good action plan and manage the quantification process.

Using Centralized or Decentralized Quantification

Most supply systems have traditionally managed large-scale quantification at the central level. The increasing trend toward decentralizing this responsibility adds significantly to ownership of the results at health facilities and, if managed properly, can improve the accuracy of the results. However, a centralized approach is generally more efficient when the supply system is in equilibrium, with adequate supply to all levels.

A common approach to decentralizing quantification is to have each responsible office or facility compile its own estimates, based on a common list of approved drugs. The list can be sent directly to the procurement office, which compares the list with past consumption, clarifies any questions directly with the client, and compiles the master list for procurement. Reviews at the district and province levels before submission to the procurement office may increase the validity and ownership of estimates, at the cost of adding time to the process.

It is important to make sure that consumption is not double counted: that is, if all drugs come to facilities through a central warehouse, and a needs estimate is submitted by both the central warehouse and the client facilities that order from the warehouse, the total estimate for
Country Study 14.2 The Morbidity Method and a Cholera Epidemic in a Latin American Country

In 1991, a cholera epidemic in Latin America spread rapidly to most regions of one country within six months. A quantification was carried out to determine drug supply needs to treat cholera patients.

**Target Coverage.** All cholera patients requiring treatment through hospitals, clinics, and community health workers were to be covered.

**Drug List.** The drugs to be included were not clear, since average treatment practices were not known and standard treatment guidelines had not yet been developed. A team collected data from sample patient charts and focused surveys to determine current treatment practices.

**Source of Supply.** Products were to be purchased from both local and international suppliers. All cost estimates were converted to US dollars for purposes of consistency.

**Data.** Since demand had increased dramatically for drugs used to treat cholera, stockouts were common and consumption data were not reliable. Fairly accurate morbidity data were readily available, reported weekly via fax to the central level.

**Resources for Quantification.** A team of local and international specialists collected and analyzed data on disease incidence and current treatments and developed a computer spreadsheet for forecasting.

The morbidity method was used to calculate supply needs based on current epidemiological data, with two alternatives for treatment: current average treatment practices, and WHO treatment guidelines. The accompanying graph illustrates the projected annual supply costs for both calculations. Note the huge difference in total costs of the alternative treatment regimens. Total drug costs were more than two times higher with current treatment practices, with the excess almost exclusively due to overuse of lactated Ringer’s IV solution when oral rehydration solution (ORS) could be safely substituted.

The results of calculations were presented to the national cholera committee, which agreed to a switch to WHO guidelines.

Policy-makers used the comparative cost information in educational activities to improve prescribing practices.

**Annual Drug Costs**

<table>
<thead>
<tr>
<th>Current Treatment Practices</th>
<th>WHO Standard Treatment Practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Oral rehydration solution</td>
<td>Lactated Ringer’s/tubing</td>
</tr>
<tr>
<td>Tetracycline</td>
<td>Doxycycline</td>
</tr>
<tr>
<td>Cotrimoxazole suspension</td>
<td>Drugs total</td>
</tr>
</tbody>
</table>

Note: Costs in millions of U.S. dollars.

Each drug should be either the total of all facility estimates (plus central warehouse safety stock) or the central warehouse estimate, whichever is deemed more accurate.

**Using Manual or Computerized Methods for Quantification**

It is possible to conduct an accurate drug quantification without computerization. However, computers using spreadsheet or database software make the process much easier. The examples of quantification tables in this chapter were constructed with a standard spreadsheet program.

Computerized quantification has three major advantages: speed, accuracy, and flexibility. The process is much faster because the formulas can be programmed into the software, and once the data for basic assumptions are entered, the calculations are done automatically. The computer itself will not make errors in computation; if the data are entered correctly and the formulas are correct, the calculated answer will be correct. Finally, it is much easier to do “what-if” analysis by making changes to quantities of various items to see what happens to the total procurement costs. Tables constructed manually need to be retyped or rewritten, and all sums need to be recalculated each time a change is made. With a computer, the recalculation and reprinting are done at the touch of a key. Once a computerized drug list and quantification model have been developed, they can be reused repeatedly.

**Estimating the Time Required for Quantification**

Large-scale quantification is time-consuming, and a realistic time frame must be established for all the steps in the quantification plan. The time frame depends largely on
how many levels of the supply system are involved and the type of data available. In multilevel systems in which data are incomplete, it will almost certainly require several months to produce a useful quantification.

Organizing the Drug List
The drug list is the central component of any quantification process. It is not possible to calculate quantities needed until it is known which products are needed. Specifications for each drug on the list should include

- drug description, generic name, or international nonproprietary name (INN);
- a local trade name, if any, in addition to the generic name;
- dosage form, such as tablet, suppository, ampoule for injection;
- strength—for example, 250 mg, 95 percent;
- basic unit, such as tablet, tube, mL, bottle;
- package size in basic units;
- projected purchase price per basic unit or per package.

In computerized quantification, data management is easiest when a separate field is provided for each of these specifications (see Chapter 46).

The drugs on the list need to be sorted according to the type of quantification and the type of facilities and personnel that will be recording data. The list must be provided in a form useful for retrieving information quickly and correctly. For example, if drugs are stored and records are arranged by dosage form (all tablets and capsules together, all injections together), the list should be organized by dosage form. If items are stored by therapeutic class, the list should be organized by therapeutic class, and so on. If the process involves decentralized data collection, the list should be distributed on data collection forms to each level and facility responsible for quantification at least three months before the estimates are needed for procurement.

For decentralized quantification, all facilities should submit estimates directly on the list (or a computerized facsimile). This allows the compilation of one master list in a reasonable time, comparison of estimated quantities among facilities, and verification and adjustment of estimates. Dosage forms and strengths should match those included in standard treatment guidelines and those available from likely sources of supply. If 500 mg tablets are quantified but suppliers offer only 300 mg tablets, it will be difficult to make a conversion.

Drug lists for quantification are often derived from past procurement or formulary or essential drugs lists. Procurement lists from previous purchases may contain specifications and the last prices paid, but they may not represent rational drug selection nor comply with the formulary or essential drugs list. Essential drugs lists or drug formulary lists that have been regularly updated should be the basis for the quantification list, since they reflect drugs needed for current morbidity patterns (see Chapters 10 and 11).

Filling the Supply Pipeline
The supply pipeline refers to stock levels within the supply system and the number of supply points at each level, as discussed in Chapter 21. The number of levels, the frequency of requisition and delivery, and the amount of safety stock at each level all influence the amount of drugs needed to fill the pipeline and, hence, the amount that must be procured when a program is started or expanded. Underestimation of stock in the pipeline is a common cause of program failure, particularly when a revolving drug fund has been planned (see Chapter 44, Box 44.1).

Considering the Impact of Lead Time
The procurement order quantity should be sufficient to last until the next procurement cycle is completed. The steps of the procurement process needed to place an order may take several months. In addition, once an order is placed, several more months are often required for the drugs to arrive in the country, clear customs, and reach the central warehouse. The waiting period from the time an order is prepared until it arrives in the country is the lead time (Chapter 15). When lead times are underestimated, the likely results are shortages and more expensive emergency purchases.

Adjusting for Losses and Program Growth
Inevitably, some drugs will be lost due to damage, spoilage, expiration, and theft. If such losses are not considered in quantification and procurement, stockouts are likely to result. To prevent shortages, a percentage can be added to allow for losses when quantifying requirements. Many systems need to allow at least 10 percent for losses.

Not all drugs are equally at risk for loss—for example, some are more attractive to thieves than others. The drugs that are most at risk may vary from country to country. If it is possible to identify them, it may be feasible to adjust the quantities for those items by a higher percentage rather than applying the same adjustment to all items. One strategy is to allow a loss percentage only for vital items, accepting the risk of stockouts for other items.

Clearly, it is in the best interests of the health system to make every effort to control loss and wastage. Options for
controlling theft are discussed in Chapter 39; Chapter 41 offers tips for analyzing expiry dates in a large drug inventory; and Chapters 23 and 24 provide suggestions for managing stock to avoid wastage.

In a supply system in which patient utilization or the number of facilities is growing, it is reasonable to assume that drug consumption will increase. In such situations, estimated quantities can be increased by a percentage corresponding to the rate of growth.

Cross-Checking the Results of Quantification
Since there will be some imprecision in the estimates no matter how rigorously the appropriate quantification methods are followed, it is always useful to check the estimates with a different quantification method. The two sets of data can then be compared to see which appears to be more realistic, considering the reliability of source data used for the two estimates. Figure 14.2 illustrates how three different forecasting methods produced different estimates for the same supply system in a Latin American country.

Cross-checking is a fundamental step to reconcile procurement quantities with available funds. It is also useful to cross-check consumption with theoretical need to get an idea of the rationality of drug therapy in the system. For example, if the supply system usually bases purchases on past consumption, cross-checking for high-volume, high-cost drugs using another method may reveal targets for interventions to promote more rational drug use.

Estimating Total Procurement Costs
When estimating the cost of drugs on a quantified list, the critical issue is determining the next purchase prices. It is not adequate to use the last purchase prices, because in most cases, doing so results in an underestimate of the actual next purchase prices, leading to insufficient funds when it comes time to place orders.

There are two basic ways to estimate the next purchase price of a drug: both are usually needed to estimate the cost for the full list of drugs.

The first option is to obtain data on current drug prices in the market where the drugs will be purchased. As discussed in Chapter 16, sources for price data include local suppliers, international procurement agencies, and references such as the International Drug Price Indicator Guide (MSH 1995).

The other option for estimating next purchase price is to adjust the last purchase price for factors such as

- international inflation for products bought internationally;
- devaluation of local currency for products purchased internationally (if relevant)—this percentage is added to the price for drugs purchased on the international market;
- local inflation for products purchased on the local market, adding the appropriate percentage based on the current local situation.

Once price estimates are obtained, it is necessary to add percentages for shipping and insurance for drugs obtained from international sources (usually 15 to 20 percent) and any known fees, such as those paid to a tender board or for local customs duties.

Adjusting and Reconciling Final Quantities
Difficult decisions must often be made to reduce the number of drugs and/or the quantities of drugs until the estimated quantities and costs correspond with the available budget. These reductions may require policy decisions regarding priority diseases, priority age groups, priority facilities for supply, selection of less expensive therapeutic alternatives, and changes to standard treatment guidelines. Chapter 41 discusses several approaches to making reductions rationally, using specific tools such as VEN (vital, essential, nonessential) categories, ABC analysis, and therapeutic category analysis. Another way to provide a foundation for reduction is to cross-check the quantification with another method to find out where the quantified estimate is much higher than necessary based on known morbidity and attendance data or much higher than that in a comparable health system.

It may be tempting to eliminate adjustments for expected losses as the first step in reducing quantities, but this is a false economy unless losses will in fact be eliminated. If the losses are likely to occur, they must be incorporated into the final quantification, or stockouts will almost certainly result. It may be possible to cut the overall percentage allowed for losses by targeting the allowance to those items most at risk and/or eliminating the adjustment for nonvital drugs, with the expectation that some stockouts will result for drugs that are not covered.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Consumption Estimate</th>
<th>Morbidity Estimate</th>
<th>Adjusted Consumption Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORS 1 L pkg</td>
<td>11,290,000</td>
<td>18,650,000</td>
<td>14,650,000</td>
</tr>
<tr>
<td>Chloroquine 300 mg tablet</td>
<td>1,230,000</td>
<td>2,233,000</td>
<td>2,005,000</td>
</tr>
<tr>
<td>Paracetamol 500 mg tablet</td>
<td>20,960,000</td>
<td>14,010,000</td>
<td>22,320,000</td>
</tr>
</tbody>
</table>
SUCCESSFUL DRUG QUANTIFICATION REQUIRES A TEAM EFFORT AND A MIX OF METHODS
14.4 Consumption Method

In the consumption method, a list is prepared of all drugs eligible for procurement, and the most accurate inventory records of past consumption are used to calculate the quantities needed for each drug.

Consumption during a recent period of six to twelve months is adjusted for stockouts to obtain the average monthly consumption. Then the average monthly consumption is multiplied by the number of months to be covered by procurement, and safety stock levels (in months) are also multiplied by the average monthly consumption. These two figures are added to get the gross needs during the period, with the stock on hand and any stock on order subtracted from the gross estimate, to derive the quantity to purchase. This quantification formula is the same as the consumption-based reorder formula described in Chapter 15.

The anticipated unit cost for each drug (but not the last unit cost) is multiplied by the number of units to be purchased to obtain the expected purchase value for the entire quantity. All purchase values for individual drugs are added to obtain the total expected procurement cost. If this cost is greater than the budget, adjustments are made, as described in the previous section.

Example

Figure 14.3 shows a sample consumption-based quantification from an eastern Caribbean country in the early 1990s. This is not the complete quantification list, but it illustrates the estimates for nineteen drugs. Box 14.1 provides a summary of calculations used in consumption-based quantification.

Steps in the Quantification

Step 1. Prepare a List of Drugs to Be Quantified. The drug list should be prepared as described in Section 14.3, sorted into the order that will best facilitate data collection, and distributed to those officials and facilities that will enter consumption data.

Step 2. Determine the Period of Time to Be Reviewed for Consumption. If the procurement is to cover a twelve-month period, the consumption data for the past twelve months should be reviewed (if a full year’s useful data are available). A twelve-month review may also be used for a procurement covering six months, but if there are significant seasonal variations, it may be better to use the same six-month period from the preceding year. A short review period such as three months is inadequate to plan a procurement to cover twelve months, unless the three months reviewed reflect a steady state of consumption for the entire year.

Step 3. Enter Consumption Data for Each Drug. For each drug on the list, enter

- the total quantity used during the review period, in basic units;
- the number of days in the review period that the drug was out of stock (if it is impossible to determine the number of days out of stock with accuracy, the estimated number of months out of stock during the period can be entered);
- the lead time for the last procurement (or the average from the last several procurements).

It is important to use the most accurate and current records available. The likely sources for consumption and lead-time data are

- stock records and distribution reports from a central distribution point;
- stock records and reports from regional or district warehouses;
- invoices from suppliers;
- dispensing records from health facilities.

If projected pricing data are available at this stage, it may save time to enter prices while entering consumption data (see step 10).

Step 4. Calculate the Average Monthly Consumption. The average monthly consumption is a key variable in the quantification formula and should be as accurate as possible. The simple approach is to divide total consumption by the number of months reviewed. If there were stockouts during that period, the average must be adjusted to include the consumption that would have occurred if stock had been available.

There are two ways to account for stockouts when computing average monthly consumption. The recommended method is illustrated in Box 14.1 as formula number one. Enter the total consumption and divide this by the number of months in the review period minus (the total number of days out of stock in the same period divided by 30.5 to convert to months). For example, consider the entry for ampicillin 250 mg capsules (the second item) in Figure 14.3. The total consumption for a six-month review period was 89,000 capsules. The drug was out of stock for thirty-four days in the six-month period. Therefore the average monthly consumption is:

$$C_A = 89,000 \div [6 - (34 \div 30.5)], \text{ or } 89,000 \div 4.8852 = 18,218$$

An alternative method, which is simpler but less precise, is shown as formula number two in Box 14.1. It uses the estimated number of months out of stock for adjusting
<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>500 mg</td>
<td>capsule</td>
<td>1,000</td>
<td>59,500</td>
<td>0</td>
<td>9,917</td>
<td>32,000</td>
<td>42,000</td>
<td>29,750</td>
<td>45,000</td>
<td>50,737</td>
<td>51</td>
<td>69.30</td>
<td>3,534.30</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>250 mg</td>
<td>capsule</td>
<td>1,000</td>
<td>89,000</td>
<td>34</td>
<td>18,218</td>
<td>81,000</td>
<td>58,000</td>
<td>54,654</td>
<td>79,616</td>
<td>89,766</td>
<td>90</td>
<td>35.10</td>
<td>3,159.00</td>
</tr>
<tr>
<td>Ampicillin sodium injection</td>
<td>500 mg</td>
<td>ampoule</td>
<td>100</td>
<td>3,879</td>
<td>0</td>
<td>647</td>
<td>111</td>
<td>7,600</td>
<td>1,940</td>
<td>47</td>
<td>53</td>
<td>1</td>
<td>29.95</td>
<td>29.95</td>
</tr>
<tr>
<td>Ampicillin suspension 100 mL</td>
<td>125 mg/5 mL</td>
<td>bottle</td>
<td>1</td>
<td>4,128</td>
<td>0</td>
<td>688</td>
<td>1,513</td>
<td>3,000</td>
<td>2,064</td>
<td>3,743</td>
<td>4,220</td>
<td>4,220</td>
<td>0.75</td>
<td>3,165.00</td>
</tr>
<tr>
<td>Antihistamine decongestant elixir</td>
<td>250 mL</td>
<td>bottle</td>
<td>1</td>
<td>853</td>
<td>29</td>
<td>169</td>
<td>351</td>
<td>929</td>
<td>507</td>
<td>747</td>
<td>843</td>
<td>843</td>
<td>1.57</td>
<td>1,323.51</td>
</tr>
<tr>
<td>Antihistamine decongestant</td>
<td>(any)</td>
<td>tablet</td>
<td>500</td>
<td>50,000</td>
<td>0</td>
<td>8,333</td>
<td>0</td>
<td>62,500</td>
<td>25,000</td>
<td>37,500</td>
<td>42,281</td>
<td>85</td>
<td>12.00</td>
<td>1,020.00</td>
</tr>
<tr>
<td>Bacitracin antibiotic ointment</td>
<td>—</td>
<td>tube</td>
<td>1</td>
<td>2,414</td>
<td>31</td>
<td>484</td>
<td>3,400</td>
<td>100</td>
<td>1,453</td>
<td>2,313</td>
<td>2,608</td>
<td>2,608</td>
<td>0.54</td>
<td>1,408.32</td>
</tr>
<tr>
<td>Bendrofluazide</td>
<td>5 mg</td>
<td>tablet</td>
<td>500</td>
<td>141,500</td>
<td>30</td>
<td>28,208</td>
<td>142,000</td>
<td>50,000</td>
<td>84,623</td>
<td>146,490</td>
<td>165,168</td>
<td>330</td>
<td>1.90</td>
<td>627.00</td>
</tr>
<tr>
<td>Benzathine benzylpenicillin injection</td>
<td>2.4 M.U.</td>
<td>ampoule</td>
<td>50</td>
<td>1,318</td>
<td>0</td>
<td>220</td>
<td>1,486</td>
<td>0</td>
<td>659</td>
<td>1,150</td>
<td>1,297</td>
<td>26</td>
<td>25.00</td>
<td>650.00</td>
</tr>
<tr>
<td>Cephradine injection</td>
<td>500 mg</td>
<td>ampoule</td>
<td>100</td>
<td>2,695</td>
<td>0</td>
<td>449</td>
<td>2,300</td>
<td>1,100</td>
<td>1,348</td>
<td>1,990</td>
<td>2,244</td>
<td>22</td>
<td>75.00</td>
<td>1,650.00</td>
</tr>
<tr>
<td>Chlorhexidine gluconate solution (Hibitan)</td>
<td>5%</td>
<td>liter</td>
<td>5</td>
<td>302</td>
<td>0</td>
<td>50</td>
<td>433</td>
<td>0</td>
<td>151</td>
<td>171</td>
<td>192</td>
<td>38</td>
<td>17.95</td>
<td>682.10</td>
</tr>
<tr>
<td>Chlorhexidine/ cetrimide (Savlon)</td>
<td>5 liter</td>
<td>liter</td>
<td>5</td>
<td>438</td>
<td>0</td>
<td>73</td>
<td>418</td>
<td>250</td>
<td>219</td>
<td>209</td>
<td>235</td>
<td>47</td>
<td>14.70</td>
<td>690.90</td>
</tr>
<tr>
<td>Chlorpropamide</td>
<td>250 mg</td>
<td>tablet</td>
<td>1,000</td>
<td>162,000</td>
<td>0</td>
<td>27,000</td>
<td>169,000</td>
<td>81,000</td>
<td>155,000</td>
<td>174,763</td>
<td>175</td>
<td>175</td>
<td>8.99</td>
<td>1,573.25</td>
</tr>
<tr>
<td>Cimetidine (Tagamet) injection</td>
<td>200 mg</td>
<td>ampoule</td>
<td>10</td>
<td>1,090</td>
<td>0</td>
<td>182</td>
<td>2,580</td>
<td>0</td>
<td>545</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.36</td>
<td>0.00</td>
</tr>
<tr>
<td>Cimetidine</td>
<td>400 mg</td>
<td>tablet</td>
<td>1,000</td>
<td>24,000</td>
<td>0</td>
<td>4,000</td>
<td>23,500</td>
<td>25,000</td>
<td>12,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>42.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Cloxacillin suspension 100 mL</td>
<td>125 mg/5 mL</td>
<td>bottle</td>
<td>1</td>
<td>882</td>
<td>0</td>
<td>147</td>
<td>1,446</td>
<td>0</td>
<td>441</td>
<td>318</td>
<td>359</td>
<td>359</td>
<td>1.00</td>
<td>359.00</td>
</tr>
<tr>
<td>Cotrimoxazole suspension 100 mL</td>
<td>200/40 mg/5 mL</td>
<td>bottle</td>
<td>1</td>
<td>1,152</td>
<td>0</td>
<td>192</td>
<td>374</td>
<td>1,930</td>
<td>576</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.75</td>
<td>0.00</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>400/80 mg</td>
<td>tablet</td>
<td>1,000</td>
<td>81,000</td>
<td>0</td>
<td>13,500</td>
<td>82,000</td>
<td>0</td>
<td>40,500</td>
<td>80,000</td>
<td>90,200</td>
<td>90</td>
<td>21.00</td>
<td>1,890.00</td>
</tr>
<tr>
<td>Dextrose in saline (IV) 1,000 mL</td>
<td>5%/0.9%</td>
<td>bottle</td>
<td>1</td>
<td>1,525</td>
<td>32</td>
<td>308</td>
<td>0</td>
<td>2,288</td>
<td>924</td>
<td>1,408</td>
<td>1,588</td>
<td>1,588</td>
<td>1.35</td>
<td>2,143.80</td>
</tr>
</tbody>
</table>

Total order cost: $23,906.13

Note: BU = basic unit.
Box 14.1 Consumption-Based Calculations

<table>
<thead>
<tr>
<th>Formula Number</th>
<th>Objective of Formula</th>
<th>Calculations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Adjusted average monthly consumption (preferred)</td>
<td>$C_A = C_T + [R_M - (D_{OS} + 30.5)]$</td>
</tr>
<tr>
<td>2</td>
<td>Adjusted average monthly consumption (alternative)</td>
<td>$C_A = C_T + (R_M - M_{OS})$</td>
</tr>
<tr>
<td>3</td>
<td>Basic safety stock requirements</td>
<td>$C_A \times LT$</td>
</tr>
<tr>
<td>4</td>
<td>Quantity to order</td>
<td>$Q_O = C_A \times (LT + PP) + SS - (S_I + S_O)$</td>
</tr>
</tbody>
</table>

$C_A$ = Average monthly consumption, adjusted for stockouts
$C_T$ = Total consumption during review period, in basic units
$D_{OS}$ = Number of days an item was out of stock during the review period
$LT$ = Average lead time (for projected supplier or worst case), in months
$M_{OS}$ = Estimated number of months an item was out of stock during the review period
$PP$ = Procurement period (number of months to be covered by order)
$Q_O$ = Quantity to order in basic units, before adjustment for losses or program change
$R_M$ = Review period in months (number of months of data reviewed for forecasting)
$S_I$ = Stock now in inventory, in basic units
$S_O$ = Stock now on order, in basic units
$SS$ = Quantity needed for safety stock

consumption, omitting the step of converting days to months. Using the same drug from Figure 14.3, the drug was in stock for about five of the six months, leaving about one month out of stock. Therefore, the average monthly consumption is:

$$C_A = 89,000 \div (6 - 1) = 89,000 \div 5 = 17,800$$

**Step 5. Calculate the Safety Stock Needed for Each Drug.** Safety (buffer) stock is needed to prevent stockouts, although high levels of safety stock increase inventory holding costs and should be avoided (see Chapter 15). In some supply systems, the safety stock is set for each item at a fixed quantity or a fixed number of months’ worth of consumption. However, the preferred method is to calculate the safety stock based on the average consumption and the expected lead time (see formula number three in Box 14.1). The average monthly consumption from step 4 is multiplied by the average lead time. This safety stock level should avoid stockouts, assuming that the item is reordered when only the safety stock remains, the supplier delivers within the projected lead time, and consumption is no greater than average. Using this formula, the safety stock for ampicillin 250 mg capsules in the example is 18,218 x 3 months = 54,654.

For vital items, it may be necessary to adjust the safety stock to cover variations in consumption or lead time. There are several options for adjusting safety stock levels (see Chapter 15). The simplest method multiplies the basic safety stock by an adjustment factor. For example, an adjustment factor of 1.5 would increase the safety stock of ampicillin 250 mg capsules in Figure 14.3 to 81,981 capsules. If this sort of adjustment is done for all items, the cost of safety stock will increase substantially; therefore, adjustments should be made only when there is true uncertainty about the lead time or consumption.

**Step 6. Calculate the Quantity of Each Drug Required in the Next Procurement Period.** The suggested formula for calculating the quantity to order is shown as formula number four in Box 14.1. The calculation is done in three main steps. First, the average consumption is multiplied by the sum of the lead time and the procurement period, yielding the total needs before considering safety stock, stock on hand, or stock on order. The second step is to add the quantity needed for safety stock. Finally, the quantity of stock on hand and the stock on order are added together, and then subtracted from the previous total. Using the example of ampicillin 250 mg capsules from Figure 14.3, the quantity to order is:

$$Q_O = 18,218 \times (3 + 6) + 54,654 - (81,000 + 58,000) = 79,616$$

Since the ampicillin capsules are purchased in bottles of 1,000, this means that eighty bottles should be ordered.

**Step 7. Adjust for Expected Changes in Consumption Pattern.** Using the example of ampicillin 250 mg capsules from Figure 14.3, if it is expected that utilization will increase by 5 percent in the coming year, it would be reasonable to adjust the six-month forecast by 2.5 percent; this would raise the expected need by 1,990 capsules, bringing the total to 81,606 capsules (or eighty-two bottles of 1,000).
Some changes in consumption may be independent of trends in overall patient utilization. One example is predictable seasonal variation in the consumption of cough and cold remedies. A potential spike in an epidemic disease such as cholera is another example. If this is anticipated, it would be sensible to increase estimates for drugs such as ORS, parenteral solutions, and some antibiotics; this does not mean that the need for all drugs will increase by the same factor.

If it is known that a new formulary drug will replace an older drug by a substantial proportion, the estimate for the older drug should be reduced. If there are major efforts to alter prescribing patterns, it would be reasonable to anticipate at least some success by reducing the expected need for affected drugs by a small percentage. When there is a turnover in prescribing staff, the new prescribers may have different ways of treating common conditions that would substantially affect drug needs in some therapeutic categories. If such changes can be anticipated, it is wise to adjust the forecasts to avoid spending resources on drugs that will not be as popular as in the past.

Step 8. Adjust for Losses. To avoid stockouts, it is necessary to adjust quantification estimates to allow for losses, as discussed in Section 14.3. If the supply system from Figure 14.3 averaged 10 percent per year in losses, and this was applied to ampicillin 250 mg capsules, the allowance would add 8,160 capsules to the estimate from step 7, bringing the total purchase quantity to 89,766, or ninety bottles of 1,000 capsules.

Step 9. Compile Decentralized Quantifications (if Applicable). In a decentralized quantification, staff at each facility or storage point enter their own consumption quantities and stockout information, and the estimates of the individual facilities are totaled and compiled on the master quantification list.

Step 10. Estimate Costs for Each Drug and Total Costs. In order to estimate procurement costs, multiply the quantities estimated for each drug by the most accurate prediction of the expected next purchase price (not the last one), as discussed in section 14.3.

Once the expected price has been entered for each drug, multiply the price by the estimated quantity needed to obtain the total procurement value for each drug. Figure 14.3 uses the package price as the basis for making these projections, but in many cases it is preferable to use the basic unit price, because there is more flexibility in combining information from different sources to arrive at an average. The basic unit price is also preferable if it is unclear what package sizes will be ordered or if projections are based on average international prices from a source such as the annual International Drug Price Indicator Guide (MSH 1995).

After the estimated procurement value has been calculated for each drug, the final step in the basic quantification process is to add up the estimated procurement values for all drugs to obtain the total expected cost for the procurement.

Step 11. Compare Total Costs with Budget and Make Adjustments. If the total expected procurement cost exceeds the available budget, there are really only two choices: either obtain more funds or reduce the number of drugs and/or the quantities ordered. Section 14.3 discusses rational ways to adjust the estimates.

14.5 Morbidity Method
The morbidity method uses data on patient utilization (attendances at health facilities) and morbidity (the frequency of common health problems) to project the need for drugs based on assumptions about how the problems will be treated. Readers who plan to undertake a morbidity-based quantification are strongly advised to obtain the WHO manual Estimating Drug Requirements (WHO/DAP 1988), which provides a more detailed discussion of the steps in this type of quantification.

The morbidity method requires a list of common health problems, an essential drugs list that includes therapy for the problems, and a set of standard treatments for quantification purposes (based on either average current practices or "ideal" treatment guidelines). For most health problems there are at least two alternative treatments, and a percentage must be assigned based on how frequently each regimen is used. Then, the expected incidence (number of treatment episodes) of each health problem must be estimated.

The quantification formula involves multiplying the quantity of each drug included in standard treatments for each health problem by the number of treatment episodes expected for the health problem. The expected total need for each drug is the sum of the estimates from all treatment regimens in which the drug is included. Then the estimates are adjusted to fill the supply pipeline, allowing for losses to theft and wastage. Finally, the expected cost is calculated based on the expected purchase price of each drug, and estimates are reconciled with available funds.

Given the limited data likely to be available on morbidity patterns and the difficulty in defining standard treatments that are meaningful for quantification, it is difficult to apply this method to more than fifty to one hundred health problems. This limits the method's utility for a complex health system with many types of health prob-
problems and several levels of health facilities. In general, the morbidity method is most useful when a relatively small number of different health problems are seen, such as in primary care and special-purpose facilities and programs.

Since a limited number of health problems are likely to be addressed in most morbidity-based quantification procedures, the resulting estimates for each drug must be adjusted to cover health problems not considered in the quantification, usually using some variant of adjusted consumption (see Section 14.6). Adjustments may also be required to fill the supply pipeline, to account for losses, and, in most cases, to reconcile the quantities needed with the funds available.

In a simple quantification for one health problem, such as cholera (see Country Study 14.2), or for a small group of health problems and drugs, the process can be done manually (although it is easier with a computer). A computer is virtually required to conduct a large-scale morbidity-based quantification covering a large number of health problems and drugs.

Figure 14.4 is a flow diagram that illustrates how the data inputs on population, percentage of coverage, health problems, standard treatments, and unit costs are used to calculate the quantities needed and projected procurement costs.

Example

Figure 14.5 is an example of morbidity-based quantification. This includes a health problem list using International Classification of Diseases (ICD) codes, sample standard treatment regimens for the same health problems, and morbidity estimates for a one-year period. All this information is combined to project drug requirements and to produce a procurement list.

Steps in the Quantification

**Step 1. Specify the List of Problems.** List the major specific health problems encountered (see Figure 14.5). If there is an existing information system that reports on diseases, those disease codes should be used; if there is no existing coding system, the ICD system should be used.

The health problem list should not be broken down into too much detail but should be defined according to the diagnostic capacity and health problems treated at each type of health facility. At the lowest level of the system, only a limited number of problems are recognized and treated; the range of problems diagnosed and treated normally increases at the health center, district hospital, and referral hospital levels.

Since treatments differ markedly for adult and pediatric patients, it is important to include at least two categories (under five years and over five years) for most problems. Although it may be tempting to provide several categories (under five, five to twelve, thirteen to sixty-five, and over sixty-five), it is best to avoid overcomplicating the development of treatment guidelines (see below) and the process of compiling data on treatment episodes.

**Step 2. Establish the List of Drugs to Be Quantified.** The objective here is a list of essential drugs that covers the major health problems and forms the basis for standard treatment schedules. A current and appropriate national or health system formulary or essential drugs list should be used when available. If there is no official list, one needs to be developed (see Chapter 10); it may grow out of the process of developing standard treatments.

The drug list must be available in two formats—one organized in alphabetical order by generic name (INN) and one by therapeutic categories. The therapeutic category list is most useful in developing standard treatment
### Figure 14.5 Drug Needs Based on Morbidity

<table>
<thead>
<tr>
<th>Problem</th>
<th>Age Group</th>
<th>Severity</th>
<th>Episodic Contacts per 1,000 Contacts</th>
<th>Estimated Number of Episodes</th>
<th>Projected Number of Episodes</th>
<th>No. of Regimen</th>
<th>% Cases Treated with Regimen</th>
<th>Drug Product</th>
<th>Drug Formulation</th>
<th>Basic Unit</th>
<th>Doses per Day</th>
<th>Number of Days</th>
<th>Basic Units per Episode</th>
<th>Total Basic Units Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria</td>
<td>&lt;5</td>
<td></td>
<td>364</td>
<td>1,136,921</td>
<td>1,193,767</td>
<td>1</td>
<td>100%</td>
<td>Chloroquine</td>
<td>150 mg base</td>
<td>Tablet</td>
<td>0.50</td>
<td>1</td>
<td>2</td>
<td>2.50</td>
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<tr>
<td></td>
<td>&gt;5</td>
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<td>278</td>
<td>868,307</td>
<td>911,723</td>
<td>1</td>
<td>100%</td>
<td>Chloroquine</td>
<td>150 mg base</td>
<td>Tablet</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>60.00</td>
</tr>
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<td>&lt;5</td>
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<td>2</td>
<td>203,022</td>
<td>213,173</td>
<td>1</td>
<td>100%</td>
<td>Quinene injection</td>
<td>300 mg/mL</td>
<td>Tablet</td>
<td>0.50</td>
<td>3</td>
<td>1</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>&gt;5</td>
<td></td>
<td>2</td>
<td>190,528</td>
<td>200,054</td>
<td>1</td>
<td>100%</td>
<td>Quinene injection</td>
<td>300 mg/mL</td>
<td>Tablet</td>
<td>1.50</td>
<td>4</td>
<td>10</td>
<td>60.00</td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>&lt;5</td>
<td></td>
<td>53</td>
<td>165,541</td>
<td>173,818</td>
<td>1</td>
<td>100%</td>
<td>Tetracycline</td>
<td>1% eye ointment</td>
<td>5 g tube</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&gt;5</td>
<td></td>
<td>38</td>
<td>118,690</td>
<td>124,624</td>
<td>1</td>
<td>100%</td>
<td>Tetracycline</td>
<td>1% eye ointment</td>
<td>5 g tube</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Otitis media</td>
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<td></td>
<td>106</td>
<td>331,081</td>
<td>347,635</td>
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<td>100%</td>
<td>Cotrimoxazole</td>
<td>suspension</td>
<td>mL</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>100.00</td>
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<tr>
<td></td>
<td>&gt;5</td>
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<td>29</td>
<td>90,579</td>
<td>95,108</td>
<td>1</td>
<td>100%</td>
<td>Cotrimoxazole</td>
<td>800/160 mg</td>
<td>Tablet</td>
<td>1</td>
<td>2</td>
<td>10</td>
<td>20.00</td>
</tr>
<tr>
<td>Acute tonsillitis</td>
<td>&lt;5</td>
<td></td>
<td>72</td>
<td>224,885</td>
<td>236,130</td>
<td>1</td>
<td>100%</td>
<td>Penicillin VK</td>
<td>125 mg/5 mL liquid</td>
<td>mL</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>100.00</td>
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<td></td>
<td>&gt;5</td>
<td></td>
<td>33</td>
<td>103,072</td>
<td>108,226</td>
<td>1</td>
<td>100%</td>
<td>Procaine penicillin</td>
<td>3 MU injection</td>
<td>vial</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>Gastritis, heartburn</td>
<td>&lt;5</td>
<td></td>
<td>11</td>
<td>34,357</td>
<td>36,075</td>
<td>1</td>
<td>100%</td>
<td>Antacid suspension</td>
<td></td>
<td>mL</td>
<td>5</td>
<td>4</td>
<td>5</td>
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<tr>
<td></td>
<td>&gt;5</td>
<td></td>
<td>77</td>
<td>240,502</td>
<td>252,528</td>
<td>1</td>
<td>70%</td>
<td>Antacid suspension</td>
<td></td>
<td>mL</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>200.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>30%</td>
<td>Clometidine 300 mg</td>
<td>Tablet</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>20.00</td>
<td>1,515,165</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Based on 3,123,408 contacts in the past year; 5 percent expected rate of increase.
schedules, and the list organized by generic name is used for the procurement list.

**Step 3. Establish Standard or Average Treatments.** Standard or average treatment regimens are required for each health problem to forecast drug needs, as in Figure 14.5. This is the most complicated part of the method. There are two basic options for developing standard treatments: *average actual treatments* or *ideal standard treatments*. The components are the same, but there is an important difference between the approaches: *average* regimens are based on observed or reported practices and are more likely to predict what will actually happen, whereas *ideal* regimens define what should happen if prescribers follow the ideal guidelines. Country Study 14.2 illustrates how different the results can be between average current treatments and standard treatments.

Which should be used? Perhaps both, in a combination approach. For example, if one treatment regimen is viewed as ideal but another is commonly used, include both regimens in the guidelines for quantification and estimate the percentage of treatment episodes that will receive each of the two regimens.

In most quantification exercises, it is necessary to develop (or modify) the treatment guidelines (see Chapter 11). Ideal standard treatment guidelines should be developed by expert committees (with expert assistance, if needed). Unless there is reliable information on drug utilization and prescribing patterns, a special study may be needed to determine average actual treatment patterns; this can be combined with a study to determine morbidity patterns and incidence of health problems (see step 4).

Whichever option is used, the same information must be compiled:

- the percentage of treatment episodes in which the drug will be prescribed;
- the name of each drug and strength (see Section 14.3), with separate treatments listed for age level, as appropriate;
- the basic unit (see Section 14.3);
- the number of basic units in each average dose for the health problem in question;
- the average number of doses of each drug per day for the problem;
- the average number of days of treatment for each drug per episode.

These components are combined to project the quantity of each drug needed for each treatment episode ($Q_L$) in each standard treatment regimen. This projection is made by multiplying the basic units per dose ($D_{CU}$) by the number of doses per day ($N_D$). This result is multiplied by the length of treatment per episode, in days ($L_D$). The entire formula is:

$$Q_L = D_{CU} \times N_D \times L_D$$

In the example from Figure 14.5, three different drug products are prescribed for otitis media for both age groups; the drugs are the same, but the dose and dosage form differ. The quantity of cotrimoxazole suspension needed to treat otitis media in patients under five years old is calculated as:

$$Q_L = 5 \text{ mL} \times 2 \text{ doses/day} \times 10 \text{ days} = 100 \text{ mL}$$

This calculation is done for all drugs in all the standard treatment regimens.

If different treatment regimens (perhaps with multiple drugs) are used for the same disease according to its severity, separate standard regimens must be developed and assigned for each. This is illustrated by the malaria treatment guidelines in Figure 14.5.

For each regimen, the proportion of patients with each disease who will be treated with each different therapy is estimated. From Figure 14.5, in patients over five years old with gastritis, 70 percent are expected to be treated with antacid and 30 percent with cimetidine. In some situations, depending on treatment practices, it might be appropriate to allot 70 percent for antacid and 50 for cimetidine (because some patients will receive both drugs). Thus, the cumulative percentage may exceed 100 for a particular health problem.

If there are major differences in the way common problems are treated by different levels of prescribers, it may be useful to estimate how many (or what percentage of) treatment episodes of each disease will be managed by each category of prescriber, and then specify separate treatment regimens common for each prescriber category.

It is important that practitioners involved in developing standard treatment guidelines for quantification understand that the guidelines are only for quantification, and that a prescriber’s freedom will not necessarily be curtailed as a result. In one West African country, a committee was formed to develop standard treatment guidelines for quantification, with the assistance of an outside expert. The committee met but decided that standard treatment guidelines would restrict doctors’ freedom to choose a therapy and instead produced a simple therapeutics manual. When the external quantification team arrived in the country, there were no lists of common diseases with guidelines for quantification, and the process ultimately failed to produce a useful list for procurement.
Step 4. Collect Morbidity Data for Each Health Problem Treated. This step estimates the expected number of treatment episodes for each health problem from step 1. A treatment episode is "a patient contact for which a standard course of drug treatment is required" (WHO/DAP 1988, 6.1). Figure 14.5 shows one way to organize morbidity data for the health problems from step 1 and to estimate the number of treatment episodes.

Information from the regular health information system on morbidity patterns and treatment episodes can be used for quantification. In many cases, however, this information is not available, and a special study is needed in sentinel facilities, from which data can then (with caution) be extrapolated. The study can take two forms: a retrospective review of records in selected facilities (if those records are relatively accessible, complete, and accurate), or a prospective study in a sample of health facilities. The study must be completed prior to actually starting the quantification. There are some key issues in conducting these studies:

- Both the number of contacts and the number of treatment episodes must be obtained in the study of sample facilities.
- Only patient contacts that normally result in drug treatment should be counted, separate from those that do not (such as well-child programs).
- The sample data should specify the frequency of each health problem in terms of a common denominator, such as 1,000 inpatients or 1,000 outpatient visits (for example, number of acute diarrhea cases per 1,000 outpatient contacts).
- Separate frequencies must be developed for all age groups specified in the standard treatment guidelines. Figure 14.5 shows one format for doing this.
- It may be impossible to separate curative from non-curative contacts in a retrospective review of records. Even for curative contacts, not all patients who come to facilities with health problems receive drug therapy (although the vast majority do if there are drugs in stock). If this is thought to be important, the proportion of cases that will be treated with drugs can be estimated.
- If discrete types of prescribers (such as doctors versus paramedical staff) use different treatment regimens, the number of treatment episodes must be compiled separately for each prescriber type.
- The sample data should also specify the number of patient contacts per total population in the area served by the sample facilities. For example, if the total population in the sample area was 3.9 million, and there were 3,123,408 patient contacts per year (as in Figure 14.5), on average there were 0.8 patient contacts per inhabitant. This average could be used to project the number of contacts in another area, as described in Section 14.6 on the adjusted consumption method.


Step 5. Calculate the Number of Treatment Episodes for Each Health Problem. There are two options for calculating the number of treatment episodes. If the number of expected patient contacts (outpatient contacts, inpatient admissions, or both) can be estimated directly in the target facilities, the calculations are done in one step based on the number of contacts. If the information on contacts is not reliable, it must be estimated from the population in the area served and the frequency of contacts per inhabitant in the target population.

The estimated total number of patient contacts for the past year is divided by 1,000, so that the denominators of contacts and treatment frequency are the same. (The frequency of treatment episodes is usually expressed in treatment episodes per 1,000 contacts.) Next multiply the expected total number of contacts in thousands \(N_c\) by the expected frequency of the problem \(F\) to obtain the number of treatment episodes \(E_p\) based on last year’s data. This must be done separately for each discrete age range used in the process. If there are multiple levels of treatment, the number of treatment episodes at each level must also be estimated.

In the Figure 14.5 example, there were 3,123,408 contacts, separated into two categories: under five years old and over five years old. Since the frequency of health problems is estimated per 1,000 contacts, the total number of contacts is divided by 1,000, yielding 3,123.4 groups of 1,000 contacts. Next, the number of treatment episodes must be adjusted for expected changes in patient utilization; in Figure 14.5, a 5 percent increase is expected. Therefore, the estimated number of treatment episodes for each age group and each health problem is multiplied by 1.05.

Step 6. Calculate the Quantity of Drugs Needed for Each Health Problem. For each health problem, the projected number of treatment episodes from step 5 \(E_p\) is multiplied by the quantity of basic units \(Q_d\) specified in the guidelines for each age group (and each level of disease severity from step 3). This result is then multiplied by the
percentage of cases that are expected to be treated \( (P_T) \). The full formula is:

\[
Q_T = E_T \times Q_E \times P_T
\]

In Figure 14.5, 80 percent of patients under age five with malaria, severity level one, are expected to be treated with paracetamol solution. Therefore, the calculation is:

\[
Q_T = 1,193,767 \times 60 \text{ mL} \times 0.8
\]

This calculation yields a total of 57,300,816 mL needed for this treatment regimen.

**Step 7. Combine the Estimates for Each Drug from the Various Health Problems into a Master Procurement List.** This step combines the estimated quantities from different treatment regimens into one master list for procurement. For example, in Figure 14.5, paracetamol solution is included in four different treatment guidelines (malaria, severity one and severity two, otitis media, and tonsillitis). For the master procurement list, the four separate estimated quantities must be added to yield the total number of mL of paracetamol needed. Master list quantities usually then need to be adjusted to cover factors such as health problems not considered in the basic estimates, shortages in the supply pipeline, and losses due to theft and wastage.

**Step 8. Adjust Quantities to Cover Other Health Problems.** The reliability of morbidity-based quantification increases as the number of health problems addressed increases, but it is rarely feasible to get reliable data or estimates for all major health problems. In this situation, the morbidity-based quantification cannot predict total drug needs, and it is necessary to adjust for drug needs not addressed in the quantification. Otherwise, there will be stockouts.

Since reliable consumption data from the target system are not available for comparison (or that method would probably have been used for the quantification), the adjusted consumption method described in Section 14.6, or “expert opinion,” may be used to estimate what percentage adjustment should be made to the morbidity-based estimates.

If data on drug utilization are available from another similar health system, it might be possible to extrapolate requirements for twenty or thirty commonly used drugs and determine the average percentage difference between the estimates produced by each method. For example, if the extrapolated method produces estimates that average 10 percent higher than those produced by the morbidity method, the quantities of all drugs could be increased by 10 percent.

An alternative is to survey local experts to determine what percentage of overall patient contacts have been captured in the list of health problems used for morbidity quantification. For example, if local experts agree that about 90 percent of the drug needs are covered in the standard treatments, estimated quantities could again be increased by 10 percent.

**Step 9. Adjust for Filling the Pipeline and Current Stock Position.** So far, the calculations assume that the supply pipeline (see Section 14.3) is relatively intact and that the procurement is only replacing drugs that are being consumed. If there have been major stockouts that need to be corrected, additional stock will be necessary to fill the pipeline.

If applicable, make adjustments for stock on hand, stock on order, and lead time as described in the consumption method (see Section 14.4, step 6) to finalize the preliminary estimates.

**Step 10. Adjust Quantities for Expected Losses.** This procedure is discussed in section 14.3. In most supply systems, losses are a reality, and unless they are considered in the quantification process, stockouts will be unavoidable.

**Step 11. Estimate Costs for Each Drug and Total Costs.** With adjustments made to cover needs for additional health problems, losses, and filling the pipeline (if necessary), the total estimated quantity can be divided by the purchase pack size to determine the number of packs to be ordered. For example, in Figure 14.5, 236,129,644 mL of penicillin UK solution are the estimated need. If this drug is produced in 100 mL bottles, 2,361,296 bottles should be ordered.

If the basic unit price is used as the basic estimate of cost, multiply it by the expected package size to determine the expected package price. If the available prices are based on package price, enter it directly.

To calculate the estimated procurement value, multiply the expected pack price by the estimated number of packages to be purchased. The prices used in the estimate should be the expected next purchase price, not the last purchase price (see Section 14.3).

**Step 12. Compare Total Costs with Budget and Make Adjustments.** Reduce the estimated quantities and/or the number of drugs to conform with budget realities, if necessary. The morbidity-based method lends itself to considering the relative therapeutic value of drugs on the list. In the example illustrated by Figure 14.5, it might be determined that since pseudoephedrine has not been proved to be useful in otitis media, the percentages allotted for this drug could be reduced. The important point is that when reductions are required, they should be made rationally, with the goal of maximizing the therapeutic benefit of expenditures.
14.6 Adjusted Consumption Method

Many supply systems face a severe information deficit, which limits accurate quantification. When neither consumption nor morbidity methods are feasible, the best option is extrapolating from consumption data from another region or health system. The adjusted consumption method uses known consumption data from one system, called the standard, to estimate the drug needs in a similar or expanded system, known as the target.

This method can be population based, defining drug use per 1,000 population, or service based, defining drug use per specified patient case, inpatient admission, or rural health center. A complete quantification may use a combination of the two methods, with different denominators for different products.

Example

Figure 14.6 illustrates the adjusted consumption method of extrapolating consumption of outpatient drugs from a standard health system to the target health system. The data in Figure 14.6 do not represent any particular country.

Steps in the Quantification

Step 1. Select the Standard System for Comparison and Extrapolation. The standard facilities should, if feasible, closely resemble the region or country for which the estimate is made in terms of geography and climate, patient population served, morbidity patterns, prescribing practices, and drug supply status. Representative standard facilities should be selected at each level of health care that has a different drug list, morbidity patterns, or prescribing practices. They should have an adequate and uninterrupted drug supply (but not greatly overstocked), fairly rational prescribing practices, and complete and accurate records of patient contacts and drug inventory movement. Of course, it may not be possible to find an ideal standard, but an effort should be made to select the best standard data available.


Step 3. Establish the Time Period to Be Covered in Review. Determine the number of months' worth of data to be reviewed in the standard system.

Step 4. Review Records from the Standard System to Compile Contact or Population Data. Use available reports on patient contacts in the standard system; if reports are not already compiled with suitable data, a survey of standard facilities can be done to determine the number of patient contacts during the time period established. A similar survey might be carried out in the target system, but if the target system has had a severe problem with stockouts, the attendance data may not reflect the number of contacts that can be expected once drugs are available.

Step 5. Establish the Denominator for Extrapolation. The denominator used to extrapolate consumption can be either population in the area served or number of patient contacts, depending on the data obtainable through step 4. Whichever one is used, the denominator is usually thousands of patient contacts or thousands of inhabitants in the region (as in Figure 14.6). In very large systems, it might be preferable to use tens of thousands or even millions of contacts or inhabitants.

Step 6. Determine the Consumption Rate in the Standard System. For each drug, produce an adjusted average monthly consumption (see Section 14.4). The average monthly consumption is multiplied by twelve to obtain the adjusted annual consumption. Then divide the adjusted annual consumption by the number of thousands of contacts or inhabitants to establish the consumption rate.

Step 7. Extrapolate the Standard System's Consumption Rate to the Target System. Multiply the standard consumption rate for each drug by the estimated number of thousands of contacts or inhabitants in the target system to yield the projected requirements in the target system.

Step 8. Adjust for Expected Losses. Because these are very rough estimates, and because it may be unclear what percentages of losses were experienced in the standard system, it may not be realistic to adjust for losses. However, if there are known losses, add a percentage allowance, at least for vital drugs (see Section 14.3).

Step 9. Estimate Costs for Each Drug and Total Costs and Make Adjustments. Multiply the projected quantities for each drug by the most accurate prediction of the next procurement cost and reconcile that with available funds, as discussed in section 14.3.

14.7 Service-Level Projection of Budget Requirements

This method is used to estimate financial requirements for drug procurement based on costs per patient treated at various levels of the same health system or, with great caution, based on data from other health systems. It does not forecast needs for specific drugs. It is more reliable to generalize from one region in a country to another region in the same country than it is to extrapolate to a different country.

Like the adjusted consumption method, this method produces rough estimates because there may be significant, but not always apparent, variations between the target health system and the system used as a source of standard data. Possible sources of error include prescribers in the
### Figure 14.6 Adjusted Consumption

<table>
<thead>
<tr>
<th>Drug</th>
<th>Strength</th>
<th>Basic Unit</th>
<th>Total Usage in 6-Month Period (BU)</th>
<th>Days Out of Stock</th>
<th>Adjusted Average Monthly Usage (BU)</th>
<th>Adjusted Annual Usage (BU)</th>
<th>Usage per 1,000 Outpatient Contacts</th>
<th>Projected Requirements in BUs Based on 80,000 Inhabitants</th>
<th>Order Quantity (Packs)</th>
<th>Order Pack Price (US$)</th>
<th>Proportion of Proposed Order (US$)</th>
<th>Value of Proposed Order (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ampicillin</td>
<td>500 mg</td>
<td>Capsule</td>
<td>59,500</td>
<td>0</td>
<td>9,917</td>
<td>119,000</td>
<td>2,380</td>
<td>3,662</td>
<td>190,400</td>
<td>100</td>
<td>190</td>
<td>69.30</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>250 mg</td>
<td>Capsule</td>
<td>89,000</td>
<td>34</td>
<td>18,218</td>
<td>218,617</td>
<td>4,372</td>
<td>6,727</td>
<td>349,788</td>
<td>100</td>
<td>350</td>
<td>35.10</td>
</tr>
<tr>
<td>Ampicillin suspension 100 mL</td>
<td>125 mg/5 mL</td>
<td>Bottle</td>
<td>4,128</td>
<td>0</td>
<td>688</td>
<td>8,256</td>
<td>165</td>
<td>254</td>
<td>13,210</td>
<td>1</td>
<td>13,210</td>
<td>0.75</td>
</tr>
<tr>
<td>Antibiotic decongestant 250 mL</td>
<td>—</td>
<td>Bottle</td>
<td>853</td>
<td>29</td>
<td>169</td>
<td>2,027</td>
<td>41</td>
<td>62</td>
<td>3,244</td>
<td>1</td>
<td>3,244</td>
<td>1.57</td>
</tr>
<tr>
<td>Bacitracin antibiotic ointment</td>
<td>—</td>
<td>Tube</td>
<td>2,414</td>
<td>31</td>
<td>484</td>
<td>5,813</td>
<td>116</td>
<td>179</td>
<td>9,300</td>
<td>1</td>
<td>9,300</td>
<td>0.54</td>
</tr>
<tr>
<td>Bendrofluazide</td>
<td>5 mg</td>
<td>Tablet</td>
<td>141,500</td>
<td>30</td>
<td>28,208</td>
<td>338,490</td>
<td>6,770</td>
<td>10,415</td>
<td>541,584</td>
<td>500</td>
<td>1,083</td>
<td>1.90</td>
</tr>
<tr>
<td>Benzathine benzylpenicillin injection</td>
<td>2.4 MU</td>
<td>Ampoule</td>
<td>1,318</td>
<td>0</td>
<td>220</td>
<td>2,636</td>
<td>53</td>
<td>81</td>
<td>4,218</td>
<td>50</td>
<td>84</td>
<td>25.00</td>
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<tr>
<td>Chlorpropamide</td>
<td>250 mg</td>
<td>Tablet</td>
<td>162,000</td>
<td>0</td>
<td>27,000</td>
<td>324,000</td>
<td>6,480</td>
<td>9,969</td>
<td>518,400</td>
<td>1,000</td>
<td>518</td>
<td>8.99</td>
</tr>
<tr>
<td>Cimetidine</td>
<td>400 mg</td>
<td>Tablet</td>
<td>24,000</td>
<td>0</td>
<td>4,000</td>
<td>48,000</td>
<td>960</td>
<td>1,477</td>
<td>76,800</td>
<td>1,000</td>
<td>77</td>
<td>42.00</td>
</tr>
<tr>
<td>Cotrimoxazole</td>
<td>400/80 mg</td>
<td>Tablet</td>
<td>81,000</td>
<td>0</td>
<td>13,500</td>
<td>162,000</td>
<td>3,240</td>
<td>4,985</td>
<td>259,200</td>
<td>1,000</td>
<td>259</td>
<td>21.00</td>
</tr>
<tr>
<td>Erythromycin</td>
<td>250 mg</td>
<td>Tablet</td>
<td>80,500</td>
<td>0</td>
<td>13,417</td>
<td>161,000</td>
<td>3,220</td>
<td>4,954</td>
<td>257,600</td>
<td>500</td>
<td>515</td>
<td>20.95</td>
</tr>
<tr>
<td>Ferrous salt/folic acid 60/1 mg</td>
<td>1 mg</td>
<td>Tablet</td>
<td>353,000</td>
<td>0</td>
<td>58,833</td>
<td>706,000</td>
<td>14,120</td>
<td>21,723</td>
<td>1,129,600</td>
<td>1,000</td>
<td>1,130</td>
<td>5.35</td>
</tr>
<tr>
<td>Fluphenazine decanoate injection 10 mL</td>
<td>25 mg/mL</td>
<td>Vial</td>
<td>324</td>
<td>0</td>
<td>54</td>
<td>648</td>
<td>13</td>
<td>20</td>
<td>1,037</td>
<td>1</td>
<td>1,037</td>
<td>2.70</td>
</tr>
<tr>
<td>Indomethacin</td>
<td>25 mg</td>
<td>Capsule</td>
<td>167,000</td>
<td>0</td>
<td>27,833</td>
<td>334,000</td>
<td>6,680</td>
<td>10,277</td>
<td>534,400</td>
<td>1,000</td>
<td>534</td>
<td>8.50</td>
</tr>
<tr>
<td>Insulin Lente</td>
<td>100 IU/mL</td>
<td>Vial</td>
<td>4,504</td>
<td>0</td>
<td>751</td>
<td>9,008</td>
<td>180</td>
<td>277</td>
<td>14,413</td>
<td>1</td>
<td>14,413</td>
<td>3.91</td>
</tr>
<tr>
<td>Methylprednisolone</td>
<td>500 mg</td>
<td>Tablet</td>
<td>191,000</td>
<td>32</td>
<td>38,579</td>
<td>462,954</td>
<td>9,259</td>
<td>14,245</td>
<td>740,726</td>
<td>500</td>
<td>1,481</td>
<td>30.00</td>
</tr>
<tr>
<td>Nyctinycin skin cream 30 gm</td>
<td>100,000 IU</td>
<td>Tube</td>
<td>1,815</td>
<td>0</td>
<td>302</td>
<td>3,630</td>
<td>73</td>
<td>112</td>
<td>5,808</td>
<td>1</td>
<td>5,808</td>
<td>0.80</td>
</tr>
<tr>
<td>Oral rehydration salts</td>
<td>—</td>
<td>Sachet</td>
<td>6,820</td>
<td>0</td>
<td>1,137</td>
<td>13,640</td>
<td>273</td>
<td>420</td>
<td>21,824</td>
<td>1</td>
<td>21,824</td>
<td>0.09</td>
</tr>
<tr>
<td>Paracetamol elixir 150 mL</td>
<td>120 mg/5 mL</td>
<td>Bottle</td>
<td>2,934</td>
<td>0</td>
<td>489</td>
<td>5,868</td>
<td>117</td>
<td>181</td>
<td>9,389</td>
<td>1</td>
<td>9,389</td>
<td>0.94</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>500 mg</td>
<td>Tablet</td>
<td>319,000</td>
<td>0</td>
<td>53,167</td>
<td>638,000</td>
<td>12,760</td>
<td>19,631</td>
<td>1,020,800</td>
<td>1,000</td>
<td>1,021</td>
<td>6.95</td>
</tr>
<tr>
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<td>Bottle</td>
<td>1,447</td>
<td>0</td>
<td>241</td>
<td>2,894</td>
<td>58</td>
<td>89</td>
<td>4,630</td>
<td>1</td>
<td>4,630</td>
<td>0.75</td>
</tr>
<tr>
<td>Salbutamol liquid 150 mL</td>
<td>2 mg/5 mL</td>
<td>Bottle</td>
<td>1,063</td>
<td>0</td>
<td>177</td>
<td>2,126</td>
<td>43</td>
<td>65</td>
<td>3,402</td>
<td>1</td>
<td>3,402</td>
<td>0.99</td>
</tr>
<tr>
<td>Tetracycline HCl</td>
<td>250 mg</td>
<td>Capsule</td>
<td>67,000</td>
<td>0</td>
<td>10,333</td>
<td>124,000</td>
<td>2,480</td>
<td>3,815</td>
<td>198,100</td>
<td>1,000</td>
<td>198</td>
<td>12.00</td>
</tr>
<tr>
<td>Vitamins, multiple</td>
<td>—</td>
<td>Tablet</td>
<td>259,000</td>
<td>0</td>
<td>43,167</td>
<td>518,000</td>
<td>10,360</td>
<td>15,938</td>
<td>828,800</td>
<td>1,000</td>
<td>829</td>
<td>3.20</td>
</tr>
</tbody>
</table>

Note: BU = basic unit.

Total Order Cost: $222,370.22
target system using a different mix of drugs from those in the source system, variability in disease frequency and the number of patient attendances per facility, and differences in the effectiveness of procurement and financial management systems in the two systems.

The main requirement for this method is a fairly reliable estimate of average drug cost per patient attendance and average numbers of patient attendances at various levels of the standard health system. This information may not be readily available, but it can be compiled through a special study in one part of a health system where drug supplies are consistent and where treatment practices are considered to be representative. It is necessary to compile:

- the average number of curative outpatient attendances, noncurative attendances, and inpatient bed-days for each type of facility in the source health system;
- the average cost per outpatient attendance, per noncurative attendance, and per bed-day in each type of facility in the source health system.

**Example**

Figure 14.7 shows the method applied to estimate financial requirements for drug procurement, from Kenya.

**Steps in the Quantification**

**Step 1. Establish the Categories of Facilities and Determine the Number in Each Category.** List each type of facility to be considered in the first column. The number of facility categories used depends on the size and scope of the target health system. In Figure 14.7 there are six significant levels (see column 1). The number of facilities in each category is entered in the second column.

**Step 2. Determine the Patient Contact Denominators for Each Type of Facility, and Compile or Estimate the Average Number of Patient Contacts of Each Type at Each Category.**

### Table 14.7

<table>
<thead>
<tr>
<th>Type of Facility and Patient</th>
<th>Number of Facilities</th>
<th>Average Annual Workload per Facility</th>
<th>Average Cost per Attendance or Bed-Day (US$)</th>
<th>Annual Drug Needs (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial general hospitals</td>
<td>13</td>
<td>176,000 bed-days</td>
<td>0.55</td>
<td>1,258,400</td>
</tr>
<tr>
<td>General outpatients</td>
<td></td>
<td>195,000 attendances</td>
<td>0.55</td>
<td>1,394,250</td>
</tr>
<tr>
<td>Antenatal patients</td>
<td></td>
<td>19,500 attendances</td>
<td>0.15</td>
<td>38,025</td>
</tr>
<tr>
<td>District hospitals</td>
<td>42</td>
<td>57,000 bed-days</td>
<td>0.50</td>
<td>1,197,000</td>
</tr>
<tr>
<td>Inpatients</td>
<td></td>
<td>85,000 attendances</td>
<td>0.50</td>
<td>1,785,000</td>
</tr>
<tr>
<td>Antenatal patients</td>
<td></td>
<td>11,000 attendances</td>
<td>0.15</td>
<td>69,300</td>
</tr>
<tr>
<td>Subdistrict hospitals</td>
<td>35</td>
<td>21,500 bed-days</td>
<td>0.45</td>
<td>338,625</td>
</tr>
<tr>
<td>Inpatients</td>
<td></td>
<td>60,000 attendances</td>
<td>0.50</td>
<td>1,050,000</td>
</tr>
<tr>
<td>Antenatal patients</td>
<td></td>
<td>7,500 attendances</td>
<td>0.15</td>
<td>39,375</td>
</tr>
<tr>
<td>Rural health training centers</td>
<td>38</td>
<td>20,000 bed-days</td>
<td>0.40</td>
<td>304,000</td>
</tr>
<tr>
<td>Inpatients</td>
<td></td>
<td>40,000 attendances</td>
<td>0.45</td>
<td>684,000</td>
</tr>
<tr>
<td>Antenatal patients</td>
<td></td>
<td>5,000 attendances</td>
<td>0.15</td>
<td>28,500</td>
</tr>
<tr>
<td>Health centers</td>
<td>315</td>
<td>1,500 bed-days</td>
<td>0.20</td>
<td>94,500</td>
</tr>
<tr>
<td>Inpatients</td>
<td></td>
<td>32,000 attendances</td>
<td>0.40</td>
<td>4,032,000</td>
</tr>
<tr>
<td>Antenatal patients</td>
<td></td>
<td>4,000 attendances</td>
<td>0.15</td>
<td>189,000</td>
</tr>
<tr>
<td>Dispensaries</td>
<td>1,114</td>
<td>18,000 attendances</td>
<td>0.30</td>
<td>6,015,600</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>18,517,575</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Per capita requirement</strong></td>
<td></td>
<td><strong>0.68</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Subtotals**

- Provincial general hospitals
- District and subdistrict hospitals
- Rural health training centers
- Health centers and dispensaries

**Total**

18,517,575

**Source:** Adapted from Ministry of Health, Workload-Based Annual Budget for Pharmaceuticals and Non-Pharmaceuticals, Government of Kenya, 1992.

**Note:** The exchange rate used is 60 KSh to US$. Population equals 27 million (estimate for 1993).

- This category includes (for all levels) adult and pediatric general outpatients, casualty, and specialty clinics.

**Table:**

- **Type of Facility and Patient:** Provincial general hospitals, District hospitals, Subdistrict hospitals, Rural health training centers, Health centers, Dispensaries.
- **Number of Facilities:** 13, 42, 35, 38, 315, 1,114.
- **Average Annual Workload per Facility:** 176,000 bed-days, 57,000 bed-days, 21,500 bed-days, 20,000 bed-days, 1,500 bed-days, 18,000 attendances.
- **Average Cost per Attendance or Bed-Day (US$):** 0.55, 0.50, 0.45, 0.40, 0.20, 0.30.
- **Annual Drug Needs (US$):** 1,258,400, 1,197,000, 338,625, 304,000, 94,500, 6,015,600.
Assessment Guide

**Availability of Data**
- Which records of drug usage are current and accurate at the medical stores and health facilities?
- What data and reports are maintained centrally (or at other levels of the health system) on outpatient attendances, inpatient bed-days, or other counts of patient contacts?
- For how many diseases is there reliable information on numbers of cases reported or treated annually?
- Are there official standard treatment guidelines for certain diseases? If so, how many diseases are covered, and how is compliance monitored?

**Management of Quantification**
- Is there a formal workplan and schedule for quantification?
- Is quantification done manually or by computer? If computers are used, which offices have computers, and what software program is used for quantification? Which levels of warehouses and facilities have computerized procurement and inventory records?
- Is quantification decentralized or managed centrally? Which offices and levels of the system are responsible for quantification?
- If quantification is decentralized, what training is or has been provided to responsible staff at peripheral facilities?
- Are preprinted quantification forms distributed to the facilities?

**Quantification Methods**
- What quantification methods are used to forecast drug and budget needs?
- Are actual procurement quantities and costs compared at the end of each year against the initial quantification estimates?
- Is the supply system pipeline functioning well, or have there been frequent or widespread drug shortages? If there have been shortages, do only certain drugs present problems, or do shortages exist for many different drugs?
- What information is used to predict procurement costs? If last year’s prices are used, how are they adjusted?
- What standard formulas are used to calculate order quantities?
- Is there an essential drugs list or health system drug formulary that is used for quantification? Is procurement limited to drugs on the list?
- What techniques are used to adjust initial estimates to conform with budget realities?

**of Facility.** These data can be obtained from centrally available information or from a special-purpose survey to determine the average number of patient contacts for each category of facility. For each category, there may be several different types of patient contact that result in drug costs. Minimally, inpatient and outpatient costs and contacts should be separated.

In Figure 14.7 (column 3), in all but the lowest-level facility, contacts were separated into three types: inpatient, with bed-days as the common denominator; and general outpatient and antenatal visits, each with attendances as the denominator.

**Step 3. Calculate the Average Cost per Contact.** The average cost per attendance and or bed-day is derived by dividing the total drug purchases for the facility or facilities in the class by the total attendances or bed-days. In facilities with both inpatients and outpatients, it is necessary to estimate the fraction of total procurement costs attributable to inpatients, outpatients, and noncurative visits. Column 4 in Figure 14.7 shows the average cost data.

**Step 4. Calculate the Total Projected Drug Costs.** Multiply the average number of patient contacts for each facility (column 3 in Figure 14.7) by the number of facilities (column 1). This result is then multiplied by the average drug cost for that type of patient in that type of facility (column 4), which estimates total financial requirements for each type of attendance in each type of facility (column 5). These totals are then summed to produce the total financial requirements. This is an estimate of the probable drug costs, on average, for each type of facility and for the system as a whole. The results are not necessarily applicable to any specific facility.
References and Further Readings

= Key readings.


