8

Data analysis and interpretation

The survey data can be used for many different types of analyses at both national and international levels. This chapter shows how to examine, summarize and print your survey data, and makes suggestions on how to interpret and report your findings. It focuses on national-level analysis, while Chapter 10 provides guidance on international comparisons. The workbook automatically generates summary tables that provide the evidence base for your report. You should have the workbook open as you read this chapter.

8.1 OVERVIEW OF DATA ANALYSIS

Data collected during the survey can be used for different types of analyses:

- medicine availability: per cent availability of individual medicines; mean (average) per cent (%) availability across a group of medicines; and variations between product types (originator brand vs generic), sectors and geographical areas;
- medicine prices: median prices of individual medicines; ratios of median local price to international reference price (median price ratio or MPR); median MPR across a group of medicines; and variations between product types (originator brand vs lowest-priced generic), sectors and geographical areas;
- treatment affordability in relation to the daily wage of the lowest-paid unskilled government worker; and
- components of the prices of medicines paid by purchasers and consumers (covered in Chapter 9).

The workbook simplifies the process of analysing data by conducting calculations automatically and producing summary results.

To carry out data analysis you will need to complete the steps below.

- Look at the availability, price and price variation for *individual medicines* in each sector.
- Examine and compare *summary results* on medicine availability, MPR and price variation:
  - — for each sector, including comparison between originator brands and lowest-priced generics;
  - — across sectors; and
  - — across regions or survey areas.

- Examine overall treatment cost and affordability of standard treatments for important clinical conditions in the sectors for which patient price data were collected.
- Compare the add-on costs at each stage of the supply chain for medicines tracked in the price components survey, and compare final purchase prices in different sectors with import or manufacturers' prices when these medicines entered the market (see Chapter 9).

Price and availability results are analysed for individual medicines, as well as for overall 'baskets' of medicines surveyed.

8.1.1 Within-sector analysis of medicine prices and availability

For each sector surveyed, availability and prices can be examined for individual medicines, as well as for the sector as a whole – both are important elements of data analysis. Analyses of data from a single sector include comparisons between originator brand and generically equivalent products.

For individual medicines, the workbook calculates the following:

- Per cent availability: percentage (%) of outlets where an individual medicine product was found. Bear in mind that the availability data only refers to the day of data collection at each particular facility and may not reflect average monthly or yearly availability of medicines at individual facilities.
- Median price of each medicine in local currency.
- Median prices in relation to international standard prices (MPR).
- Variations in price across medicine procurements or medicine outlets, including 25th/75th percentiles and maximum/minimum values.

In addition to results for individual medicines, the workbook also generates summary data for each sector. The following summary results are provided for originator brands and lowest-priced generics:

BOX 8.1

Median Price Ratio (MPR)

Medicine prices found during the survey are not expressed as currency units, but rather as ratios relative to a standard set of international reference prices:

$$\textit{Medicine Price Ratio (MPR)} = \frac{\textit{median local unit price}}{\textit{international reference unit price}}$$

The ratio is thus an expression of how much greater or less the local medicine price is than the international reference price, e.g. an MPR of 2 would mean that the local medicine price is twice that of the international reference price. Median price ratios facilitate cross-country comparisons of medicine price data.

Since averages can be skewed by outlying values, median values have been used in the price analysis as a better representation of the midpoint value. The magnitude of price variations is presented as the interquartile range. A quartile is a percentile rank that divides a distribution into four equal parts. The range of values containing the central half of the observations, that is, the range between the 25th and 75th percentiles, is the interquartile range.

- Mean (average) % availability across a basket of medicines (this can be all survey medicines, or a subset such as EML medicines only, 'Global core medicines only' (see Section 8.2.1)).
- Median of the MPRs for a basket of medicines (again, this can be all survey medicines, or a subset such as EML medicines only).
- Comparison of MPRs for originator brands and lowest-priced generics, whereby analysis is limited to those medicines for which both product types were found (matched pair analysis).

8.1.2 Cross-sector comparisons

Medicine availability and prices can be compared between the different sectors for which price data were collected in the survey (e.g. public sector procurement prices vs public sector patient prices; public sector availability vs private sector availability). Cross-sector comparisons can be made for individual medicines, as well as for summary results (baskets of medicines) in each sector – both are important elements of data analysis. The workbook enables comparisons of summary results between two sectors by limiting the analysis to medicines found in both sectors.

8.1.3 Treatment affordability

The affordability of treating key health problems using standardized treatment regimens is calculated using the median prices collected during the survey. The treatment cost for an episode of illness is compared to the daily wage of the lowest-paid unskilled government worker to determine the number of days' wages needed to pay for the cost of treatment.

8.1.4 Price components

Price composition analysis includes both qualitative analysis of policy data collected at the central level (e.g. official mark-up rates), and quantitative analysis of the prices of selected medicines as they move through the distribution chain. Central level data are not entered into the workbook but rather are summarized as a case study. Data for individual medicines are entered into the workbook and analysed by:

- examining the cumulative per cent (%) mark-up that occurs at each stage of the supply chain; and
- examining the per cent (%) contribution of mark-ups at each stage of the supply chain to the final patient price.

Chapter 9 provides instructions on data analysis and interpretation of price components.

8.2 CONDUCTING DATA ANALYSIS

Data analysis should only be conducted after data have been entered twice, and checked both manually and using the workbook's data checker function (See Chapter 7). Survey managers should be confident that the data in the workbook are accurate prior to initiating analysis.

CAUTION

Errors in data collection, processing or entry may cause substantial errors in summary results.

If the prices for one or several medicines appear to be suspicious, you should first check to be sure that the difference is not due to error. One common error is incorrect calculation of the unit price. For example, the price of an entire 200-dose inhaler may have been entered in the workbook instead of the price of a dose. Ideally, most errors will be caught during data processing, but surprising findings should be checked once again for errors during data analysis.

Once data have been verified, data analysis can be started. As described above, many different types of results can be obtained from the survey. Some results are standard and are included in most survey reports (see Chapter 12). However, if all of the possible results were reported, the most relevant findings would be lost. Therefore, survey managers need to generate the full range of survey results and, together with the advisory committee, select the most significant findings for inclusion in their report. It is only in conducting a complete analysis of the survey data that it can be assured that important findings have not been overlooked. Following data analysis, a meeting with the advisory committee should be held to assist in interpreting results and developing recommendations.

The rest of this chapter explains how to use the workbook to perform several different analyses of medicine prices, availability and affordability, and how to interpret and report the results. Data analysis should be conducted using a systematic approach to avoid oversights. A framework for conducting data analysis is provided in Table 8.1. Detailed information on generating and interpreting results is provided in the sections that follow. Before starting analysis, you should prepare a time schedule for outputs to prevent delays in writing up and releasing results. In countries with inflation, fluctuating currency exchange rates or unstable prices, data need to be analysed and presented quickly to ensure their relevance.

Printing summary tables

All summary pages in the workbook are set up so that the relevant sections will print in a convenient format when you use the Excel print functions. To see how a printed page will appear, first go to the page using the buttons on the *Home* page. For a *Field Data Consolidation* page, be sure that the summary table and not the data grid is displayed.

To preview how the page will look, you can:

- Press the Print Preview icon ( ) if it appears in the toolbar on the top of your Excel screen or
- Select File → Print from the Excel main menu, and press the **PREVIEW** button when the print pop-up window appears.

Depending on your paper size and printer setup, you may need to adjust page margins so that all columns in a summary table appear together on the same page. Once you are satisfied with the layout, you can print the table by:

- Using the Excel print icon ( ) or
- Pressing **OK** from the Print pop-up window.

Table 8.1 Systematic approach to data analysis for medicine prices, availability and affordability

PUBLIC SECTOR PROCUREMENT PRICES		
Question	**Source of information**	**Location of information**
How do purchase prices compare with international reference prices (purchasing efficiency)?	1) Median price ratios (MPRs) for individual medicines; 2) and median MPRs for baskets of medicines.	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.
Where multiple procurement orders have been surveyed, does purchasing efficiency vary significantly across orders?	25th and 75th percentiles, and minimums and maximums, for MPRs of individual medicines.	*Field Data Consolidation* page, 'data view, 'Ratios On'.
Does purchasing efficiency vary significantly between medicines? Are some types of products much more expensive compared to reference prices?	25th and 75th percentiles, and minimums and maximums, for median MPR.	*Field Data Consolidation* page, 'summary' view.
If the public sector is purchasing originator brands (OB), what is the difference in price between these and lowest-priced generic equivalents (LPG) (originator brand premium)?	1) MPRs for the OB and LPG of individual medicines; 2) Median MPRs for all medicines found as both product types (matched pair analysis).	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.
Optional, where central and regional orders have been reported. How do prices vary between central procurement and regional procurement agencies?	Restrict analysis to central and regional orders by including/excluding the appropriate orders (Data page); look at difference in median MPRs.	*Field Data Consolidation* page, 'summary' view.
Optional, where both EML and non-EML medicines are procured: Are procurement prices closer to international reference prices for EML medicines?	Use switch on data summary page to switch between all medicines/EML medicines only; look at difference in median MPRs.	*Field Data Consolidation* page, 'summary' view.
PUBLIC, PRIVATE AND OTHER SECTOR PATIENT PRICES		
Question	**Source of information**	**Location of information**
How do patient prices compare with international reference prices?	1) MPRs for individual medicines; 2) and median MPR for basket of medicines.	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.
Do prices vary significantly across medicine outlets?	25th and 75th percentiles, and minimums and maximums, for MPRs of individual medicines.	*Field Data Consolidation* page, 'data' view, 'Ratios On'.
Do prices vary significantly between medicines?	25th and 75th percentiles, and minimums and maximums, for median MPR.	*Field Data Consolidation* page, 'summary' view.
What is the difference in price between originator brand medicines (OB) and their lowest-priced generic equivalent (LPG) (originator brand premium)?	1) MPRs for the OB and LPG of individual medicines; 2) Median MPRs for all medicines found as both product types (matched pair analysis).	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.
What is the availability of medicines in the sector?	1) Per cent (%) availability of individual medicines; 2) Average % availability across all medicines.	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.
Does availability vary significantly between medicines?	1) Differences in % availability for individual medicines; 2) 25th and 75th percentiles for average % availability.	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.
Does availability vary significantly between OB and LPG medicines?	1) Difference in % availability for OBs and LPGs of individual medicines; 2) Difference in average % availability for all OBs and LPGs.	1) *Field Data Consolidation* page, 'data' view, 'Ratios On'. 2) *Field Data Consolidation* page, 'summary' view.

Table 8.1 ***Continued***

PUBLIC, PRIVATE AND OTHER SECTOR PATIENT PRICES		
Question	**Source of information**	**Location of information**
How do medicine availability and price vary between regions (survey areas)?	For each survey area, restrict analysis by including only medicine outlets in the area (data page). Print summary data for each survey area and look at differences in average % availability and median MPR across areas.	*Field Data Consolidation* page, 'summary' view.
Optional, in public sectors where medicine availability is limited to medicines on the national EML: What is the availability and price for EML medicines only?	On the Data summary page, select EML medicines only; look at average % availability and median MPRs.	*Field Data Consolidation* page, 'summary' view.
CROSS-SECTOR COMPARISONS		
Question	**Source of information**	**Location of information**
What is the difference in the availability and price of individual medicines between different sectors?	1) Difference in per cent (%) availability of individual medicines across sectors; 2) Difference in MPR for individual medicines across sectors.	*Medicine Availability And Price Summary* page.
How does average % availability vary across sectors? How does the relative availability of OBs and LPGs vary across sectors?	Average % availability of OBs and LPGs across sectors.	*Sector Availability And Price Summary* page.
What is the difference in median price for the same basket of medicines across two sectors (e.g. public procurement vs public patient; public patient price vs private patient price)?	Median MPRs and % difference for all medicines found in two sectors (matched pair analysis) – OBs and LPGs.	*Sector Availability And Price Summary* page.
Where patients pay for medicines in the public sector, what is the total public sector mark-up from procurement to final price?	Median MPRs for all medicines found in public procurement and public patient price sectors (matched pair analysis); % difference between final price and procurement price.	*Sector Availability And Price Summary* page.
TREATMENT AFFORDABILITY		
Question	**Source of information**	**Location of information**
How many days' wages does the lowest-paid unskilled government worker need to spend to purchase a standard course of treatment for common conditions?	Days' wages = (Median medicine price found in facilities * # of units in a standard course of treatment)/Daily wage of lowest-paid government worker.	*Standard Treatment Affordability* page.
In each sector, how does treatment affordability vary between OBs and LPGs?	Difference in days' wages between OBs and LPGs for the same treatment course, coupled with % availability of each product.	*Standard Treatment Affordability* page
How does treatment affordability vary between sectors?	Difference in days' wages for the same treatment course across different sectors, coupled with any available data on the contribution of different sectors to the pharmaceutical market.	*Standard Treatment Affordability* page

In Row 116 of the sector summary for each *Field Data Consolidation* page, you are asked to describe the procurements/outlets in the summary. It is important to describe the data contained in the summary clearly, particularly if subgroup analyses are being conducted or if different sets of procurement data are being analysed. Once several data summary pages are printed it is easy to confuse them if they are not clearly labelled!

8.3 WITHIN-SECTOR ANALYSES

Each survey can accommodate price data from up to five sectors: procurement prices, public sector patient prices (where medicines are free or provided for a fixed fee, availability can still be analysed), private sector retail prices, and patient prices in up to two other sectors. The workbook automatically produces analyses, both within and between whichever sectors have been surveyed. Although entry of price data from all five sectors is quite similar (see Chapter 7), the analysis of medicine procurement price data differs somewhat from the analysis of patient price data. The following subsections describe both types of analysis.

8.3.1 Within-sector analyses: medicine procurement price data

Procurement price data represent the amounts paid by large purchasing agencies to obtain medicines from suppliers. *The Field Data Consolidation: Medicine Procurement Prices* page is generally used to enter medicine procurement price data from the public sector. Usually, the purchasing agency will be the central ministry of health purchasing unit although, in some countries, there are regional public purchasing units. In public sectors where medicines are distributed to patients at no charge or for a fixed fee per medicine or per visit, procurement data will be the only public sector price data available. If the fee that patients pay varies by medicine or type of medicine, those variable fees should be entered in the *Field Data Consolidation: Public Sector Patient Prices* page and analysed separately.

Public procurement price data can be based on a single medicine order or on multiple sets of procurement data from different points in time or from different purchasing agencies. For this reason, procurement data analysis is restricted to medicine prices and does not include availability. In your report, remember to identify clearly the purchasing agency or agencies and the period of time over which the procurements took place.

In addition to public sector procurement data, procurement data may also be collected from the private sector or an NGO sector such as mission hospital clinics. This may represent, for example, pooled purchasing systems that supply medicines to mission hospitals. Procurement data from other sectors are also entered into the *Field Data Consolidation: Medicine Procurement Prices* page; however, **data from each sector must be analysed separately**.

Row 10 of the data entry grid is used to include/exclude different procurement orders from the analysis. Begin by analysing public sector procurement data. Keep row 10 as '1' (include in analysis) for each column representing public sector procurement data, and enter '0' in all other columns (so they are not included in analysis). After conducting your analysis for public procurement (see below), include procurement orders from a different sector, exclude all other procurement orders and conduct the analysis for this sector again. In this way, you will obtain separate procurement results for each sector for which procurement data were collected.

Procurement data from different sectors, although entered into the same data entry table, must be analysed separately.

Examining summary statistics on procurement prices for individual medicines

Begin the analysis of procurement prices by examining the summary data for individual medicines. These appear on the *Field Data Consolidation* page in Columns E–EI. If they are not visible, press **RATIOS ON/OFF** to reveal them. The MPR for individual medicine (originator brand and lowest-priced generic), contained in Column E, is the median procurement price observed for each medicine divided by its international reference price. The MPR for procurement data is a measure of purchasing efficiency.

Also provided are the 25th and 75th percentile MPRs (Columns F and G) and the minimum and maximum MPRs (Columns H and I), which show the variation in medicine prices across orders. The number of orders where a price was found is provided in Column J, and the median unit price in local currency, used to calculate the MPR, is contained in Column EI.

In general, procurement prices for the lowest-priced generically equivalent products should be fairly close to the MSH international supplier/buyer prices (that is, ratios up to 1.00). MPRs of 1.00 or less indicate that the procurement system is working very efficiently, while MPRs above 1.00 raise questions about purchasing efficiency. The MPRs for originator brand products may be much higher, since the MSH international reference prices are prices for multi-source products. The difference between the MPR for an originator brand product and the MPR for its lowest-priced generic equivalent is a measure of the 'brand premium' paid for purchasing originator brand products.

Begin the analysis by examining the MPRs:

- across different medicines; and
- across product types (originator, lowest-priced generic) for the same medicine.

Fig. 8.1 shows an example of the MPRs for a few medicines after all procurement data have been entered. The MPR for originator brand and lowest-priced generic amitriptyline cap/tab are 4.76 and 2.40 times the international reference price, respectively, which is a sign that this procurement system is not obtaining very competitive prices for this medicine. Other generics are being procured more competitively at less than international reference prices. For albendazole, the MPR for the originator brand version is more than five times that of the lowest-priced generic (that is, there is a high brand premium); for other medicines the originator brand and lowest-priced generic prices are somewhat closer.

When there are multiple procurement prices for each medicine (the number of orders for each medicine is shown in Column J), you should also examine the range between the 25th and 75th percentiles and between the minimum and maximum to see if there are wide variations in procurement prices across orders. In the example, the ratios across orders are reasonably stable. However, for some products (e.g. generic albendazole and generic amoxicillin cap/tab), the price on at least one order was substantially lower than the typical price. You should examine such outliers carefully to see if they are errors. If not, finding out how a low price was obtained in one order may point to ways to make the procurement process more efficient.

Fig. 8.1 Example of medicine-specific procurement price data

	A	B	C	D	E	F	G	H	I	J	EI
1		Field Data Consolidation:									
2		Medicine Procurement Prices									
4		Go To Home Page	Data/Summary								
5		Ratios On/Off	Double Entry								
6											
7	Procurement ID				Summary Comparisons to Reference Prices and Number of Orders per Medicine						
8	Procurement Agency										
9	Date (Mon-YY as in Jan-02)										
10	Include order in analysis (1=yes, 0=no)?				(Blank if med. has < 1 orders)						
11											
12	No.	Medicine Name	Medicine Type	Include in analysis?	Median Price Ratio	25%ile	75%ile	Min	Max	# orders	Median Price
13	1	Albendazole	Brand	1	3.20	2.95	3.33	2.70	3.45	3	0.0291
14	1	Albendazole	Lowest Price	1	0.58	0.46	0.73	0.37	0.90	4	0.0053
15	2	Amitriptyline	Brand	1	4.76	3.78	6.09	3.45	7.49	4	0.0266
16	2	Amitriptyline	Lowest Price	1	2.40	1.99	2.75	1.65	2.94	4	0.0134
17	3	Amoxicillin cap/tab	Brand	1	1.60	1.55	1.70	1.50	1.80	3	0.0448
18	3	Amoxicillin cap/tab	Lowest Price	1	0.80	0.55	0.88	0.30	0.95	3	0.0224
19	4	Amoxicillin suspension	Brand	1	2.30	1.95	4.02	1.50	8.59	4	0.0131
20	4	Amoxicillin suspension	Lowest Price	1	0.99	0.90	1.10	0.80	1.20	3	0.0056
21	5	Atenolol	Brand	1	1.95	1.73	2.33	1.50	3.00	4	0.0209
22	5	Atenolol	Lowest Price	1	0.75	0.68	0.88	0.60	1.10	4	0.0080

In your report, you may want to comment about overall procurement price efficiency and highlight examples where there are large differences observed between the MPRs for different types of products or where the range of procurement prices varies widely across orders.

Producing a summary table of procurement price data

While data on the prices of individual medicines can be revealing, the survey's main purpose is to analyse the 'typical' prices paid for an entire set of medicines, both within and across sectors. Each *Field Data Consolidation* page in the workbook automatically creates summary tables that contain statistics calculated across medicines from the MPRs in Column E. The five summary measures calculated for procurement are:

- median (mid-point) of the MPRs for individual medicines
- 25th percentile MPR
- 75th percentile MPR
- minimum MPR
- maximum MPR.

To produce and print the summary table on the *Medicine Procurement Prices* page, carry out the following steps:

1. If the data entry grid is displayed on the page, click on the **DATA/SUMMARY** button to make the summary table visible (as shown in Fig. 8.2).
2. In Cell D116, enter a description of the procurements that are included in this analysis, including the procurement agency and range of dates.
3. Decide on the group or basket of medicines for which you would like to display summaries. In the top left-hand corner, you can select between:
   - All: all the medicines that you have studied in the survey (global, regional and supplementary)
   - Global: the global survey medicines only (i.e. the set of 14 global medicines recommended for international comparisons)

— Regional: the regional survey medicines only (i.e. the set of 16 regional medicines recommended for regional comparisons)

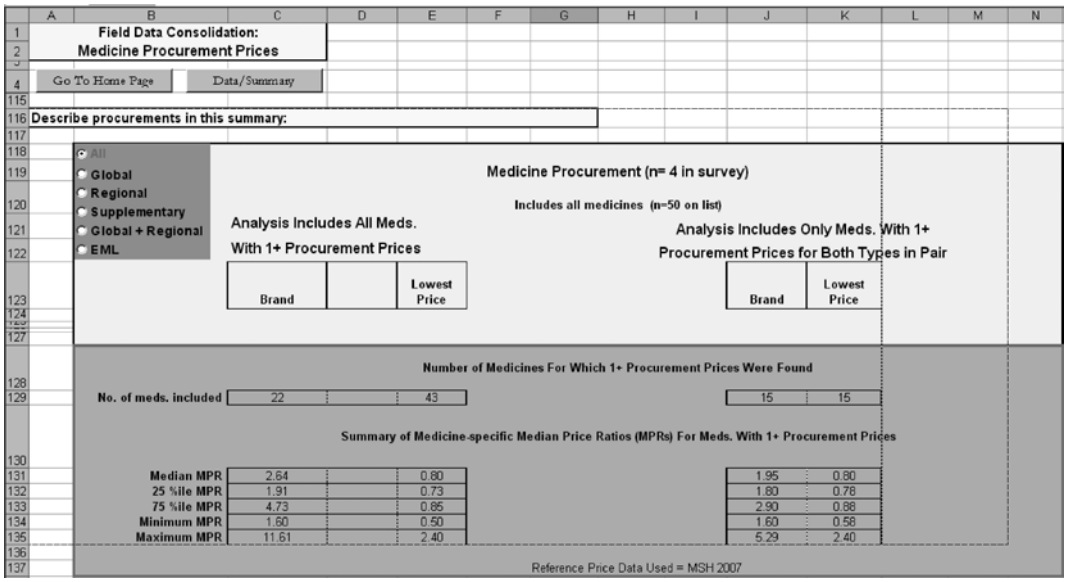
— Supplementary: the supplementary medicines selected at national level

— Global + Regional: the 30 global and regional medicines

— EML: Medicines on the national Essential Medicines List only (as entered in Column H of the *International Medicine Reference Price Data* page).

For national analyses, it is most useful and accurate to analyse the full list of survey medicines. For international comparisons, the global and/or regional lists should be selected. You may also wish to limit your analysis to those medicines on the National Essential Medicines List, particularly in the public sector (procurement and patient prices).

Fig. 8.2 Example of summary table containing procurement price data



4. Examine the summary table to be sure that the data look sensible. Investigate any values that look unusual to check they are not based on errors. After previewing the printed version of the summary table, print the table and use it as the basis for your report.

Interpreting the procurement price data summary table

First, note the table headings. The first heading contains data on the number of different sets of procurement orders included in the survey. If prices from only one set of orders have been entered, this heading would read 'Medicine Procurements (n=1 in survey)'. If you have entered procurement data from multiple sectors into the *Procurement Prices* page, double-check to make sure that the appropriate number of procurement orders has been included in the analysis (e.g. if n = 7 and you have 8 procurement orders from the mission sector, you may have forgotten to include one order in the analysis).

The next heading describes the medicines that are included in the table, either All, Global, Regional, Supplementary, Global + Regional or EML medicines only. The heading calculates the number of medicines listed on the *International Medicine Reference Price* page that fall into whichever of these six categories has been selected. Note that the set of reference prices used for comparisons (MSH or an alternative set of prices) is indicated at the bottom of the table.

The third row of headings describes the two different types of summary data contained in the table. On the left of the table are two columns of data summarizing the MPRs for medicines that had the minimum number of procurement prices (usually 1). These two columns are for the two product types (originator brand and lowest-priced generic) surveyed. The first row of data in this section shows how many medicines of each product type had the minimum number of procurement prices reported. In the example table, of the 50 medicines in the survey, 22 originator brand products had at least one procurement price, while 43 lowest-priced generic equivalents had at least one price.

The bottom section on the left calculates the five different summary measures from the MPRs for individual medicines. In the example table, the median of the MPR across the 22 originator brand products for which prices were found was 2.64, while the 25th and 75th percentiles of the MPRs for these medicines were 1.91 and 4.73 (meaning that 50% of the 22 originator brand medicines found had MPRs in this range). For lowest-priced generics, the median of the MPR across the 43 medicines found was 0.80. The 75th percentile was 0.85, meaning that the MPR of 75% of the medicines found was 0.85 or less. Thus, for the majority of medicines the government is obtaining procurement prices less than international reference prices.

For individual medicines, the 25th/75th percentiles and maximum and minimum values show the range of prices across *medicine outlets*. For summary data the 25th/75th percentiles and maximum and minimum values show the range of prices across *medicines*.

If prices were found for nearly all of the medicines within each product type, the summary data on the left side of the table will be fairly representative and comparable across the two product types. However, if prices for all medicines were not found, and especially if different medicines were found for each product type, data will not be comparable. That is, summary data for originator brand products and lowest-priced generics will be based on two different baskets of medicines.

To compare summary data for originator brands and lowest-priced generics accurately, only those medicines for which both product types were found should be included in the analysis (i.e. based on the same basket of medicines). The results of this 'matched pairs' analysis are presented on the right side of the table. In this analysis, only medicines that match are included; that is, each pair of columns limits analysis to medicines where prices were found for both of the product types in the pair. In the sample (Fig. 8.2), 15 matching medicines were found for the comparison between originator brand and lowest-priced generic equivalent. The matched pairs analysis shows that where the government is procuring medicines as both originator brands and lowest-priced generics, it is paying about 2.4 times (1.95/0.80) more for the brand product.

If few pairs of prices are found in a particular survey, the comparisons are less likely to be representative of the broader procurement prices in this sector. For government procurement data, it may well be that a high percentage of prices are found only for generic products, since the government may purchase few or no originator brands.

Reporting summary results on procurement prices

The data in this table can be used to explore how efficiently a procurement system is working. Results from surveys conducted to date have shown that many countries are able to obtain procurement prices less than MSH international reference prices. If the median of the MPR is lower than 1.00, then (after checking your data for errors), congratulate your procurement officer. If the median of the MPR for generic products is high, you should investigate the reasons. Reasons for high price ratios in comparison to international reference prices may include:

— Patent protection on originator brand items

— Lack of generic competition

— Generic medicines priced by suppliers only slightly below the originator brand

— Small quantities being procured

— Lack of transparency in procurement

— Procurement process excludes low-price suppliers

— Inefficiency in procurement

— Lack of price regulation.

Your survey will give you data to start such an assessment. Remember that occasionally an MPR may be low because the international reference price is high. Relatively new medicines can have high reference prices. You need to check these as part of your data analysis.

In your report, you should try to describe the overall situation regarding the number of medicines procured and the levels and variability of the MPRs that you found for each product type. To the extent that product types have enough common medicines to be compared, you should also compare MPRs across product types. The standard report template (Chapter 12) provides guidance on reporting procurement prices, which can be adapted and/or expanded as appropriate.

To compare the prices of originator brand and lowest-priced generic products, you should use the data on the right 'matched pairs' side of the table since these provide fairer comparisons. You interpret these paired summaries in a similar way as the unpaired ones on the left side, but you should explain that the statistics are for matched pairs.

8.3.2 Within-sector analyses: patient price and medicine availability data

Four *Field Data Consolidation* pages are used to summarize patient price data gathered from the different types of facilities or medicine outlets that you included in your survey. You can use the same approaches to summarize and analyse data from each of these pages. The analysis process will be described in detail below using example data from a set of 30 private sector medicine outlets. Simply adapt and repeat this approach to analyse data from the *Public Sector Patient Prices* or the *Other Sector Patient Prices* pages.

Examining summary statistics for individual medicines

As with the procurement price data, begin the analysis of patient prices by examining the summary data for individual medicines. These appear on the *Field Data Consolidation* page in Columns E–EI. If they are not visible, press **RATIOS ON/OFF** to reveal them. The MPR for individual medicines, contained in Column E, is the median price to patients across four or more outlets surveyed divided by the medicine's international reference price. Also provided are the 25th and 75th percentile MPRs (Columns F and G), the minimum and maximum MPRs (Columns H and I). Availability is reported as the percentage of medicine outlets in which the medicine was found (Column J). The median unit price in local currency, used to calculate the MPR, is contained in Column EI. Fig. 8.3 shows an example of these summary data after price data for a sample of 30 private sector medicine outlets have been entered.

Fig. 8.3 Example of summary data for individual medicines

	A	B	C	D	E	F	G	H	I	J	EI
1		Field Data Consolidation:									
2		Private Sector Patient Prices									
3											
4		Go To Home Page	Data/Summary								
5		Ratio On/Off	Double Entry								
6											
7	Medicines Outlet Study ID				Summary Comparisons to Reference Prices and Percent Availability in Outlets						
8	Region										
9	Distance From Population Centre										
10	Include outlet in analysis (1=yes,0=no)?				(Blank if found in < 4 outlets)						
11											
12	No.	Medicine Name	Medicine Type	Include in analysis?	Median Price Ratio	25%ile	75%ile	Min	Max	% with med.	Median Price
13	1	Albendazole	Brand	1	6.00	5.00	10.00	3.00	12.00	83.3%	0.0546
14	1	Albendazole	Lowest Price	1	3.85	3.00	5.00	1.30	10.00	60.0%	0.0350
15	2	Amitriptyline	Brand	1	15.00	12.00	24.00	10.00	29.00	83.3%	0.0840
16	2	Amitriptyline	Lowest Price	1	9.00	8.80	11.10	5.00	12.00	76.7%	0.0504
17	3	Amoxicillin cap/tab	Brand	1	2.70	2.00	3.20	1.00	5.00	73.3%	0.0756
18	3	Amoxicillin cap/tab	Lowest Price	1	1.90	1.30	2.45	1.00	3.50	66.7%	0.0532
19	4	Amoxicillin suspension	Brand	1	10.00	9.00	14.00	5.00	15.00	90.0%	0.0570
20	4	Amoxicillin suspension	Lowest Price	1	2.55	2.10	3.00	1.50	4.50	33.3%	0.0145
21	5	Atenolol	Brand	1	24.00	14.00	26.00	10.00	30.00	80.0%	0.2568
22	5	Atenolol	Lowest Price	1	22.84	17.31	23.48	5.00	30.00	70.0%	0.2444

Begin the analysis by examining the MPRs and per cent availability:

- across different medicines; and
- across product types (originator, lowest-priced generic) for the same medicine.

Note that the summary price for a medicine will be blank if fewer prices than the minimum number specified in Cell H10 were found (prices in less then four private sector outlets in the example). However, the per cent availability of each medicine will still be reported (no minimum required), and in fact, the low availability of such medicines is an important finding to be highlighted. Remember, medicines have been included in the calculation of per cent availability even if they were available free of charge or for a fixed fee.

By default, medicines need to be found in at least 4 outlets for their MPR to be calculated, except for procurement prices where a single data point is usually sufficient (unless procurement prices were collected from many public facilities in which case the default should be reset to 4).

BOX 8.2

Availability in the public sector is analysed according to the levels of care where the medicine is expected to be available

The survey medicines list may include some medicines that are only provided at secondary or tertiary care public sector facilities. In such cases, the medicine's availability should be restricted to those outlets where it is expected to be available. For example, primary health-care centres should not be included in the availability analysis of a specialized medicine that is only provided at secondary or tertiary hospitals. The minimum level of care where each medicine is expected to be available should have been entered in Column O of the *International Medicine Reference Price Data* page, and the level of care of each public sector outlet should have been entered in Row 11 of the *Field Data Consolidation: Public Sector Patient Prices* page. Using this information, the workbook calculates availability as follows:

- If a medicine is selected as 'level 1', i.e. available at primary care level, this medicine should also be available at secondary and tertiary levels of care. The availability analysis will therefore include all health facilities in the public sector sample.
- If a medicine is selected as 'level 2', i.e. available at secondary care level, this medicine should also be available at the tertiary level. The availability analysis will include all secondary and tertiary health facilities in the public sector sample, but will exclude primary facilities.
- If a medicine is selected as 'level 3', i.e. available at tertiary care level, this medicine should only be available at tertiary level facilities. The availability analysis will be restricted to tertiary health facilities.

Example:
Let us assume that in the public sector, ceftriaxone injection 1g/vial is only available in level 2 and 3 health facilities. On the *International Medicine Reference Price Data* page, the minimum level of care for which this medicine is available is therefore entered as '2'. The public sector sample is composed of 20 primary health-care centres, 7 secondary hospitals and 3 tertiary hospitals. Ceftriaxone injection 1g/vial is found at 0 primary health-care centres, 3 secondary hospitals and 3 tertiary hospitals. The availability of this medicine is the number of outlets where the medicine is found (3 + 3), divided by the number of outlets where it is expected to be found (7+3), i.e. 6/10 or 60%. Since ceftriaxone injection is not expected to be stocked at primary care facilities, these are not included in the availability analysis.

Unlike procurement prices, there are no easy rules of thumb for determining if the MPRs for patient prices are high, low or about right. An MPR of 2.00 would mean that the final price of the product to a patient (after all intermediate charges and distribution costs) was two times the international reference price. Generally, the MPRs for originator brand products will be higher since the international reference prices are for multi-source products.

It is important to emphasize that MSH reference prices are international not-for-profit (and sometimes for-profit) supplier/buyer prices, not retail prices. While centralized procurement prices or patient charges in public sector facilities may be fairly close to the MSH prices, private retail prices and patient charges in other sectors (e.g. NGO or private hospitals) are likely to be considerably higher. This is due to the charges and profits added on to the procurement price of a medicine as it proceeds through the distribution system. The extent to which these retail prices are higher depends on the country and situation. If a medicine is rarely used, the price differential is likely to be greater. Under some circumstances, medicines sold in private sector outlets may cost as much as 100 times the MSH price or more. For medicines with very large price differentials, your price component analyses may reveal why the prices are so high (high manufacturer's selling price or high add-ons or both).

In the example table, the MPRs are variable; some are high (e.g. 3.85 for lowest-priced generic albendazole) to very high (e.g. 22.84 for lowest-priced generic atenolol). This also indicates that the relative prices charged to patients for different medicines are not uniform when compared to international prices. Examining either high or low prices may uncover interesting medicine-specific factors influencing prices. Very large originator brand premiums like that for amoxicillin suspension (10.00 MPR for originator brand vs 2.55 for the lowest-priced generic equivalent) are worth noting. In this case, the availability of generic amoxicillin suspension is only 33.3%, therefore patients may be spending nearly four times more to purchase the originator brand when the lowest-priced generic is not available.

You should also examine the range between the 25th and 75th percentiles and between the minimum and maximum to see if there are wide variations in patient prices in different outlets. In the example in Fig. 8.3, the price ratios showed considerable variability across the 30 pharmacies included in the survey, with substantial differences between the maximums and minimums. You should examine outliers carefully to see if they are errors. If not, finding out why some outlets charge lower or higher prices may point to strategies to lower prices in this sector.

In your report, you may want to highlight specific examples where there are large differences observed between the MPRs for different types of products or where the range of prices that patients pay varies widely across outlets.

Producing a summary table of patient price data

Focusing too much on the observed availability, price levels and differentials for individual medicines can be misleading. The survey's main purpose is to analyse the 'typical' availability and prices that patients pay, for an entire set of medicines. The summary table of patient prices and availability, which you can access by clicking the **DATA/SUMMARY** button, contains data calculated across medicines from the medicine-specific MPRs in Column E, and per cent availability in Column J of the medicine-specific summaries. The summary measures calculated are:

- mean (average) per cent availability;
- standard deviation for mean per cent availability;
- median (mid-point) of the MPRs calculated for each medicine;
- 25th percentile MPR;
- 75th percentile MPR;
- minimum MPR; and
- maximum MPR.

You can produce and print the summary tables for patient prices by following the same steps outlined for the summary procurement price table in the previous section. Remember to enter a description of the outlets included in the analysis for each sector in Cell D116 before printing.

As with procurement data, in the top left-hand corner you can select between different groups or baskets of medicines to be analysed:

— All: all the medicines surveyed (global, regional and supplementary);

— Global: core global medicines only (i.e. the set of 14 core global medicines recommended for international comparisons);

— Regional: core regional medicines only (i.e. the set of 16 core regional medicines recommended for regional comparisons);

— Supplementary: the supplementary medicines selected at national level;

— Global + Regional: the 30 global and regional medicines; and

— EML: Medicines on the national Essential Medicines List only (as entered in Column H of the *International Medicine Reference Price Data* page).

For national analyses, it is most useful and accurate to analyse the full list of survey medicines. For international comparisons, the global and/or regional core list should be selected to increase the validity of the comparisons. You may also wish to limit your analysis to those medicines on the national Essential Medicines List, particularly in the public sector (procurement and patient prices).

Interpreting a patient price data summary table

Fig. 8.4 shows an example of a summary table for patient price data for 30 pharmacies in the private sector. The structure of the table summarizing patient price data is similar to the summary table for procurement price data described previously. The first table heading indicates the sector and the number of medicine outlets included in the summary, while the second heading indicates the group of medicines analysed (e.g. all, global) and the number of such medicines in the reference list. The set of reference prices used in the analysis is indicated at the bottom of the table.

As with the procurement price summary, the main body of the table has two sides. On the left of the table are two columns of data summarizing the findings for medicines that had the minimum number of prices (usually four) found in the outlets included in the analysis. The two columns are for the two product types surveyed (originator brand and lowest-priced generic equivalent). In comparing product types,

Fig. 8.4 Example of summary table containing patient price data

Field Data Consolidation:
Private Sector Patient Prices

Go To Home Page | Data/Summary

Describe outlets included in this summary:

- All
- Global
- Regional
- Supplementary
- Global + Regional
- EML

Private Sector Medicines Outlets (n=30 in survey)

Includes all medicines (n=50 on list)

	Analysis Includes All Meds.			Analysis Includes Only Medicines With Prices Found for Both Types in Pair	
	Brand		Lowest Price	Brand	Lowest Price
Overall Percent Availability of Medicines on List in Outlets Included in Analysis					
Mean availability	55.1%		57.7%		
Std dev availability	41.6%		37.3%		
Number of Listed Medicines For Which Prices Were Found in 4+ Outlets					
No. of meds. included	34		38	23	23
Summary of Medicine-specific Median Price Ratios (MPRs) For Meds. Found in 4+ Outlets					
Median MPR	12.73		2.33	11.00	3.85
25 %ile MPR	7.00		1.90	7.00	2.00
75 %ile MPR	21.00		9.25	16.50	16.05
Minimum MPR	2.70		0.93	2.70	1.75
Maximum MPR	37.12		36.00	24.00	36.00

Reference Price Data Used = MSH 2007

if the minimum number of prices was found for a low percentage of medicines, and especially if different medicines were found for each product type, it is more valid to use the data in the two columns on the right side of the table. On the right side, only medicines that match are included in comparisons between product types: that is, the analysis is limited to only those medicines for which both product types were found.

The first section of data in the table summarizes overall medicine availability in the medicine outlets included in the analysis. Two summary measures are reported:

- mean (average) per cent (%) availability; and
- standard deviation of mean per cent availability.

Standard deviation is used to measure the spread or dispersion around the mean. It is a measure of variation in a distribution.

These summary availability measures are calculated from the medicine-specific values labelled '% with med' in Column J in Fig. 8.3 (note that all medicines are included in the availability analysis regardless of how many times they were found). In the table in Fig. 8.4, of the 50 medicines for which prices were sought, the mean availability was 55.1% for originator brand products and 57.7% for lowest-priced generics. The standard deviation was similar for originator brands (41.6%) and for lowest-priced generics (37.3%), indicating a similarly high amount of variability in the aavailability of individual medicines for both product types.

The next section of data in the table shows how many medicines of each product type obtained the minimum number of prices needed for price analysis. Of the 50 medicines in the survey, 34 originator brand products were found in at least four private sector outlets (of the 30 in the analysis), while 38 lowest-priced generically equivalent products were found this frequently. Because the basket of medicines for originator brands and lowest-priced generics differs, a matched pairs analysis is preferable when making direct comparisons between product types. As shown on the right side of the table, 23 medicines were found as both originator brands and lowest-priced generics in the minimum number of outlets required for price analysis.

The final section of the table summarizes the MPRs found in Column E of Fig. 8.3. In Fig. 8.4, the median of the MPR across the 34 originator brand products for which prices were found was 12.73. Lowest-priced generic equivalents were less expensive (median MPR = 2.33), but were still more than double international reference prices. The 25th and 75th MPR percentiles for both originator brands (7.00 and 21.00 respectively) and lowest-priced generics (1.90 and 9.25 respectively) show a high degree of variability in the MPRs of individual medicines; that is, medicines are not priced uniformly with respect to their international reference prices. Limiting analysis to medicines for which matching prices were found (on the right side of the table), originator brand products were about 2.9 times more expensive than lowest-priced generic equivalents (MPR_{OB}/MPR_{LPG} = 11.00/3.85 = 2.86).

Reporting summary results on patient prices

The data in this table can be used to explore whether patients are paying reasonable prices for medicines in this sector and how much they would save by purchasing generically-equivalent products as compared to originator brands. Because there

BOX 8.3

Medicines available for free or for a fixed fee

In the public sector, medicines are sometimes distributed free of charge, or for a fixed fee for either the medicine or the visit. In other cases, certain medicines are free or available for a fixed fee, while others are not. For example, this may occur if a certain medicine is paid for through donations or a special treatment programme. In these cases, data are collected on the availability of the medicine on the day of data collection, but not the price (See Chapter 6, pages 77–78).

If a medicine is available for free or for a fixed fee, an 'F' is entered into the appropriate cell in the data entry grid on the appropriate *Field Data Consolidation* page (See Chapter 7, page 92). This will allow this medicine to be included in the availability analysis even though there are no price data for it. An example is provided below:

	A	B	C	D	K	L	M	N	O	P	Q	R
1		Field Data Consolidation:										
2		Public Sector Patient Prices										
4		Go To Home Page	Data/Summary									
5		Ratio On/Off	Double Entry		Sort by:	ID	Region	Distance	Number			
6					Data for Individual Medicines Outlets (Enter Medicine Unit Prices in Local Currency)							
7	Medicines Outlet Study ID				1	2	3	4	5	6	7	8
8	Region				East	East	East	East	East	North	North	North
9	Distance From Population Centre				5	9	3	7	12	4	8	20
10	Include outlet in analysis (1=yes,0=no)?				1	1	1	1	1	1	1	1
11	Level of care				1	2	1	3	1	1	2	1
12	No.	Medicine Name	Medicine Type	Include in analysis?	1	2	3	4	5	6	7	8
13	1	Albendazole	Brand	1								
14	1	Albendazole	Lowest Price	1	0.01001		0.012012	0.009828		0.01274	0.0091	
15	2	Amitriptyline	Brand	1	0.01848		0.019712		0.02184	0.02352		0.01848
16	2	Amitriptyline	Lowest Price	1	0.011088	0.014112		0.016128		0.014112	0.01008	0.01176
17	3	Amoxicillin cap/tab	Brand	1								
18	3	Amoxicillin cap/tab	Lowest Price	1	F		F	F	F	F	F	
19	4	Amoxicillin suspension	Brand	1	0.009405	0.014364	0.053856	0.0171	0.011115	0.01197	0.00855	0.01197
20	4	Amoxicillin suspension	Lowest Price	1	0.007524		0.006207			0.009576		0.00456
21	5	Atenolol	Brand	1		0.023112					0.01605	
22	5	Atenolol	Lowest Price	1	0.02354	0.0178904	0.028248		0.030288	0.032642	0.034996	

Because generic amoxicillin is provided free of charge, the workbook will calculate per cent availability (56.7%), but not median price or MPR:

	A	B	C	D	E	F	G	H	I	J	El
1		Field Data Consolidation:									
2		Public Sector Patient Prices									
4		Go To Home Page	Data/Summary								
5		Ratio On/Off	Double Entry								
6											
7	Medicines Outlet Study ID				Summary Comparisons to Reference Prices and Percent Availability in Outlets						
8	Region										
9	Distance From Population Centre										
10	Include outlet in analysis (1=yes,0=no)?				(Blank if found in < 4 outlets)						
11	Level of care										
12	No.	Medicine Name	Medicine Type	Include in analysis?	Median Price Ratio	25%ile	75%ile	Min	Max	% with med.	Median Price
13	1	Albendazole	Brand	1						0.0%	
14	1	Albendazole	Lowest Price	1	1.15	1.06	1.32	0.90	2.10	66.7%	0.01
15	2	Amitriptyline	Brand	1	3.52	3.30	3.90	3.30	10.50	56.7%	0.02
16	2	Amitriptyline	Lowest Price	1	2.34	1.98	2.52	1.65	3.78	70.0%	0.01
17	3	Amoxicillin cap/tab	Brand	1						0.0%	
18	3	Amoxicillin cap/tab	Lowest Price	1						56.7%	
19	4	Amoxicillin suspension	Brand	1	2.52	1.95	4.50	1.50	9.45	70.0%	0.01
20	4	Amoxicillin suspension	Lowest Price	1	1.32	0.99	1.56	0.80	2.52	43.3%	0.01
21	5	Atenolol	Brand	1	2.13	1.65	2.31	1.50	5.25	40.0%	0.02
22	5	Atenolol	Lowest Price	1	2.64	2.41	3.16	1.67	4.37	63.3%	0.03

are no easy "rules of thumb" for determining a 'reasonable' price, you should be cautious in your conclusions about price levels. However, medians of the MPRs much greater than 2.00 for lowest-priced generically equivalent products would generally be cause for concern, since this is twice the price of these medicines if procured from international suppliers. The standard report template (Chapter 12) provides guidance on reporting patient prices; this template can be adapted and/or expanded as appropriate.

If the median of the MPRs seems high, you should investigate the reasons. Some possible reasons for high patient prices are similar to those for high procurement prices:

- originator brand patent protection;
- lack of generic competition; and
- suppliers of generic medicines pricing popular products only slightly below the originator brand version.

Additional reasons might include:

- high manufacturer profit margins;
- high government taxes and duties on medicines;
- inefficient supply system; and
- high wholesale or retail mark-ups.

Your survey will give you data to start such an assessment.

In your report, you should try to describe the overall product availability situation, and the levels and variability of the MPRs that you found for each product type. To the extent that originator brand and lowest-price generic products have enough common medicines to be compared, you should also compare MPRs across product types. If some or all medicines are provided for free or for a fixed fee in certain sectors, this should be described in your report.

8.4 CROSS-SECTOR ANALYSIS: PRICE AND AVAILABILITY COMPARISONS

After looking at each individual sector, the next stage in the analysis is to compare results across sectors, drawing contrasts between procurement data and whichever sectors of patient data were included in the survey. It will be informative to analyse both relative price levels (both procurement and patient prices) and product availability (in medicine outlets).

As for within-sector analyses, there are two different types of cross-sector analysis:

- comparisons of the results for individual medicines; and
- comparison of the sector summary results.

There are two separate pages in the workbook that automatically prepare summary tables for these two types of analysis.

If you have collected procurement data from multiple sectors, be aware of which data set is included in the analysis (data columns set to '1') at the time that you are conducting cross-sector comparisons.

8.4.1 Cross-sector comparison of data for individual medicines

Begin the cross-sectoral analysis by using the **SUMMARY: PRODUCT COMPARISON** button on the *Home* page to go to the *Medicine Availability and Price Summary* page. This page is divided into two sections. The left side contains results on medicine availability for each surveyed medicine (Fig. 8.5), while the right side contains medicine-specific MPRs (Fig. 8.6). The data in this table are identical to the information in Columns J and E, respectively, of the individual *Field Data Consolidation* pages when the data view is displayed and ratios are turned 'on'. They are collected here for easy comparison. Both sections will automatically print in order when you use the Excel print functions described at the beginning of the chapter.

Interpreting medicine availability and price summaries

In Fig. 8.5, medicine availability results are displayed for the three sectors for which patient prices were collected (public, private, NGOs); the price results in Fig. 8.6 also contain MPRs for the procurement sector.

Fig. 8.5 Example of the summary page comparing medicine-specific availability across sectors

	A	B	C	D	E	F	G	H	I	J	K
1		Medicines Availability									
2		And Price Summary									
3											
4		Go To Home Page									
5											
6				Medicines Availability in Outlets							
7											
8				Brand				Lowest Price			
9		Medicine Name	Medicine list	Public (n=30)	Private (n=30)	NGOs (n=22)	Other2 (n=)	Public (n=30)	Private (n=30)	NGOs (n=22)	Other2 (n=)
10		Albendazole	Regional	0.0%	83.3%	45.5%		66.7%	60.0%	54.5%	
11		Amitriptyline	Global	56.7%	83.3%	72.7%		70.0%	76.7%	63.6%	
12		Amoxicillin cap/tab	Global	0.0%	73.3%	36.4%		56.7%	66.7%	72.7%	
13		Amoxicillin suspension	Regional	70.0%	90.0%	100.0%		43.3%	33.3%	45.5%	
14		Atenolol	Global	40.0%	80.0%	54.5%		63.3%	70.0%	90.9%	
15		Atorvastatin	Regional	73.3%	20.0%	100.0%		0.0%	0.0%	0.0%	
16		Beclometasone inhaler	Regional	23.3%	0.0%	36.4%		23.3%	46.7%	45.5%	
17		Captopril	Global	0.0%	0.0%	0.0%		0.0%	0.0%	0.0%	
18		Carbamazepine	Regional	43.3%	0.0%	0.0%		60.0%	100.0%	100.0%	
19		Ceftriaxone injection	Global	70.0%	100.0%	81.8%		0.0%	0.0%	0.0%	
20		Chloramphenicol eye drops	Regional	46.7%	100.0%	54.5%		70.0%	0.0%	45.5%	

For the availability summaries, first look for availability issues for individual medicines to highlight in your report. For example, in Fig. 8.5, no captopril was found in any outlets, and the overall availability of beclometasone inhaler was quite low. These examples may point to policy or supply system issues that can be addressed to improve availability.

Next, examine the MPR data for issues to highlight (Fig. 8.6). In your report, you may want to give examples of medicines that have particularly high (e.g. originator brand atorvastatin) or low (e.g. lowest-priced generic co-trimoxazole suspension) MPRs in all sectors. Alternatively, you can highlight examples of medicines that have a particularly high originator brand premium (e.g. amoxicillin suspension in the private sector). Again, these examples may lead to insights into how the medicine supply system is working.

Fig. 8.6 Example of the summary page comparing medicine-specific median price ratios (MPRs) across sectors

	A	B	C	L	M	N	O	P	Q	R	S	T	U
1		Medicines Availability											
2		And Price Summary											
3													
4		Go To Home Page											
5													
6				Medicines Median Price Ratios (MPRs) in Procurements and Outlets									
7				(Reference Price Data Used = MSH 2006)									
8				Brand					Lowest Price				
9		Medicine Name	Medicine list	Procurement (n=4)	Public (n=30)	Private (n=30)	NGOs (n=22)	Other2 (n=)	Procurem ent (n=4)	Public (n=30)	Private (n=30)	NGOs (n=22)	Other2 (n=)
10		Albendazole	Regional	3.20		6.00	8.00		0.58	1.15	3.85	2.16	
11		Amitriptyline	Global	4.76	3.52	15.00	11.00		2.40	2.34	9.00	5.00	
12		Amoxicillin cap/tab	Global	1.60		2.70	2.80		0.80		1.90	1.70	
13		Amoxicillin suspension	Regional	2.30	2.52	10.00	9.00		0.99	1.32	2.55	2.10	
14		Atenolol	Global	1.95	2.13	24.00	16.00		0.75	2.64	22.84	5.50	
15		Atorvastatin	Regional	11.61	15.15	7.00	12.00						
16		Beclometasone inhaler	Regional		2.16		2.24		0.70	1.07	9.25	9.50	
17		Captopril	Global	4.10					0.95				
18		Carbamazepine	Regional		1.95				0.70	0.79	2.00	1.50	
19		Ceftriaxone injection	Global	5.62	1.70	21.00	14.00						
20		Chloramphenicol eye drops	Regional										
21		Ciprofloxacin	Global	1.80	2.11		1.80		0.80	0.81	9.25	6.90	
22		Co-trimoxazole suspension	Global	1.80	10.19	2.80	2.80		0.70	0.84	1.75	1.15	

8.4.2 Comparison of summary data for each sector

To compare summary data for medicine availability and price across sectors, click the **SUMMARY: SECTOR COMPARISON** button on the *Home* page. This will bring you to the *Sector Availability and Price Summary* page. Note that you can use the buttons in the left-hand corner to switch between analyses that report on all medicines, global medicines only and EML medicines only, etc.

There are two sections on the *Sector Availability and Price Summary* page. The top section (Fig. 8.7) contains the following information for each sector:

- mean (average) % availability of medicines;
- numbers of products with the minimum number of prices found; and
- median of the MPRs for medicines with the minimum number of prices found.

These data are identical to the data in the summary tables on the individual *Field Data Consolidation* pages. They are collected here for easy comparison. However, since data from different sectors will almost always be based on different baskets of available medicines, they may not be truly comparable.

The bottom section of the *Sector Availability and Price Summary* page (Fig. 8.8) contains matched pairs analysis between different pairs of sectors. In each comparison, only medicines found in both sectors are included in the analysis (i.e. based on the same basket of medicines). This enables valid price comparisons between sectors by controlling for differences in the availability of individual medicines.

Each table shown in Fig. 8.8 reports the median of the MPRs for the group of matching medicines found in two sectors. To the right of each table is the number of matching medicines found in both sectors, and the percentage difference between the median MPR in the right column of the table to the median MPR in the left column. Note that there are sufficient tables to allow comparisons between procurement, public sector, private sector and two 'other' sectors. However, if one or more of these sectors was not surveyed then some of the tables will be blank.

Fig. 8.7 Example of the summary page comparing overall medicine availability and price ratios (median MPR) across sectors

Sector Availability and Price Summary

Go To Home Page

Describe summary:

All
EML
Global
Supplementary
Regional
Global + Regional

Summary Availability and Median MPR by Product Type
Includes all medicines (n=50 on list)

	Procurement (n=4 orders)	Public Sector (n=27 outlets)	Private Sector (n=30 outlets)	NGOs Sector (n=22 outlets)	Other2 Sector (n= outlets)
Mean Percent Availability					
Brand	NA	32.8%	55.1%	54.7%	
Lowest Price	NA	63.6%	57.7%	68.5%	
No. of Products With Minimum No. of Prices Obtained					
# Prices Required	*1*	*4*	*4*	*4*	*4*
Brand	22	27	34	41	0
Lowest Price	43	46	38	45	0
Median MPR for Medicines With Minimum No. of Prices					
Brand	2.64	2.16	12.73	10.00	
Lowest Price	0.80	0.90	2.33	1.50	

Reference Price Data Used = MSH 2007

Fig. 8.8 Example of summary page comparing medians of median price ratios (MPRs) across sectors using matched pairs analysis

Sector Availability and Price Summary

Go To Home Page

Describe summary: comparison of government procurement prices, and public, private and NGO patient prices

Comparisons of Median MPRs for Medicines With Prices in Both Sectors
Includes all medicines (n=50 on list)

	Procurement (n=4 orders)	Public Sector (n=30 outlets)	# of Meds. in Both Sectors	% difference Public to Procurement
Brand	2.68	3.30	9	23.3%
Lowest Price	0.80	0.86	40	7.5%

	Procurement (n=4 orders)	Private Sector (n=30 outlets)	# of Meds. in Both Sectors	% difference Private to Procurement
Brand	3.13	10.50	16	235.8%
Lowest Price	0.80	2.55	35	218.8%

	Procurement (n=4 orders)	NGOs Sector (n=22 outlets)	# of Meds. in Both Sectors	% difference NGOs to Procurement
Brand	2.68	8.00	19	199.0%
Lowest Price	0.80	1.50	41	87.5%

	Public Sector (n=30 outlets)	Private Sector (n=30 outlets)	# of Meds. in Both Sectors	% difference Private to Public
Brand	2.53	12.73	20	402.5%
Lowest Price	0.84	2.55	37	203.6%

	Public Sector (n=30 outlets)	NGOs Sector (n=22 outlets)	# of Meds. in Both Sectors	% difference NGOs to Public
Brand	2.16	10.00	24	363.0%
Lowest Price	0.90	1.50	43	66.7%

	Private Sector (n=30 outlets)	NGOs Sector (n=22 outlets)	# of Meds. in Both Sectors	% difference NGOs to Private
Brand	14.45	11.00	33	-23.9%
Lowest Price	2.33	1.60	38	-31.2%

Interpreting cross-sector comparisons of medicine availability and price summary data

Begin your analysis by focusing on the top section of the *Sector Availability and Price Summary* page, which summarizes medicine availability and price by originator brand and lowest-priced generic equivalent. In the example in Fig. 8.7, lowest-priced generic equivalents are more widely available than originator brands in all sectors. The lower availability of originator brands is not necessarily a cause for concern provided that generic equivalents are available.

Price comparisons across sectors must be based on comparable baskets of medicines in each sector. If prices were found for nearly all of the medicines within each sector, the summary data at the top of the page would be fairly comparable across sectors. However, if prices for all medicines were not found, and especially if different medicines were found in each sector, data will not be comparable.

Fig. 8.7 shows that the number of medicines found varied by sector. For example, only 27 originator brands were found in at least four outlets in the public sector, while 34 and 41 originator brands had the minimum number of prices in the private and NGO sector outlets, respectively. Because of variability in medicines between sectors, inter-sector price comparisons should be based on the matched pairs analyses in Fig. 8.8 and not on the MPRs shown in Fig. 8.7.

The results of the matched pairs analysis are presented in the bottom section of the page (Fig. 8.8), in which summaries are based on the same basket of medicines.

While the workbook provides sector comparisons for each of the sectors included in the survey, some comparisons may not be particularly useful or relevant. Where patients pay for medicines in the public sector, the difference between procurement prices and patient prices represents the total medicine mark-up in the public sector distribution chain, provided no local purchasing is taking place. In the upper left table of Fig. 8.8, it can be seen that government facilities charge a 23.3% mark-up on originator brand medicines and a 7.5% mark-up for generic medicines.

It is also useful to compare patient prices in the public, private and other sectors to see which sectors have large price differentials. In the example in Fig. 8.8, the prices in private sector outlets are 203.6% higher than public sector prices for lowest-priced generics and 402.5% higher than public sector prices for originator brands. The charges to patients in NGO facilities are lower than the prices charged in the private sector (23.9% lower for originator brands and 31.2% lower for lowest-priced generics). However, originator brands and lowest-priced generics in the NGO sector cost 363.0% and 66.7% more, respectively, than in the public sector.

Several factors may explain the variability in prices paid by patients in different sectors:

- The three sectors have different purchasing and distribution efficiency.
- The public and NGO sectors may use medicine sales as a cost-recovery mechanism to finance operating expenses.
- Prices and mark-ups are unregulated and highly variable.

These issues are examined further in the price composition analyses (Chapter 9). Future studies can focus on hypotheses generated about the reasons for similarities and differences in prices.

Reporting cross-sector comparisons of medicine availability and price summary data

The way in which you report intersector comparisons will vary considerably from survey to survey, depending on the nature of the differences between sectors in your setting and the actual results of the comparisons. The standard report template (Chapter 12) provides guidance on reporting medicine availability and price summaries that can be adapted or expanded as appropriate.

Begin by comparing medicine availability. You might expect that availability for originator brand items would be better in the private sector while generics might be more widely available in the public sector. However, your situation may be different. If it is, check your data and investigate the reasons for these differences.

For pricing analyses, you have the opportunity to compare median patient prices in each sector to:

- international reference prices, either from MSH or another set;
- public procurement prices; and
- patient prices in other sectors.

Results may differ across sectors for originator brands and generics. Depending on the findings, your report could go into great detail on these comparisons, including references to individual products that reveal interesting facts about the way in which pricing operates in your setting.

In your report's text you do not need to quote all the comparison price ratios or percentages, but you may wish to highlight important or particularly interesting ones, while referring readers to tables with individual medicine or sector summary results for more detailed examination of differences.

8.5 SUBGROUP ANALYSIS

The national analyses using the complete sample of field data are the pricing survey's primary focus. However, you may also wish to assess or compare prices in different subgroups within a sector, such as:

- prices in outlets from different regions;
- prices in urban vs rural areas;
- prices in public facilities for a specific level of care (e.g. primary, secondary or tertiary);
- public procurements by the central ministry of health versus regional procurement agencies; and
- prices for specific groups of medicines, such as medicines from the same therapeutic class.

If you have collected procurement data from multiple sectors, data from each sector must be analysed separately. This can be done by following the procedures for subgroup analysis described below.

To allow for analysis by subgroups of medicines and facilities, the *Field Data Consolidation* pages permit you to select individual columns (i.e. facilities) and rows (i.e. medicines) of data for the analysis. That is, you can include or exclude data from specific medicine outlets by turning on/off the column where the data are contained, and include or exclude data for specific medicines by turning on/off the corresponding row.

By default, analyses in the workbook include all the columns and rows of data you enter. To make it easier to exclude certain columns, the *Field Data Consolidation* pages allow you to sort procurements or outlets (left to right) by variables you entered as identifying information. For the *Medicine Procurement Prices* page, these identifying variables are:

- Procurement ID number (Row 7)
- Procurement agency (Row 8)
- Procurement date (Row 9)
- Number (Row 12)

For the other *Field Data Consolidation* pages, the variables are:

- Medicine outlet study ID number (Row 7)
- Region (Row 8)
- Distance from the nearest population centre (Row 9)
- Level of care (Row 11)
- Number (Row 12).

Pressing the Number button returns to the original sort order.

8.5.1 Selecting subgroups

Row 10: Include outlet in analysis (1 = yes, 0 = no) allows you to include/exclude data from individual medicine outlets in the analysis. Changing the '1's in Row 10 to '0's will exclude the columns from calculations (excluded columns are shaded grey). To include columns again, either change the '0's back to '1's, or press the **INCLUDE ALL OUTLETS** button.

For example, Fig. 8.9 shows prices from public sector outlets that have been sorted by region; in this example, all outlets except those in the North region have been excluded. Alternatively, if you were interested in the effect of distance, you could sort by distance and exclude all columns above or below a target distance (e.g. include all outlets further than 10 km from a population centre). Fig. 8.10 shows procurement data from two different sectors that have been entered into the same *Field Data Consolidation: Medicine Procurement Prices* page. Because each sector must be analysed separately, procurement data from the NGO sector has been excluded while data from the public sector are analysed.

Column D: Include in analysis also allows you to include/exclude data from individual medicine products. For example, you may wish to conduct a subanalysis of a specific therapeutic category. Changing the '1's in Row 10 to '0's will exclude medicine products from calculations (excluded rows are shaded grey).

If a medicine is under patent and no generics are registered, the lowest-priced generic row for this particular medicine should always be 'turned off' (i.e. excluded from all analyses since it was not surveyed). Similarly, for an older medicine where the originator brand cannot be identified, the originator row should always be 'turned off'. Otherwise, your analysis will include medicine products that were not surveyed, which will skew the results.

Fig. 8.9 Selecting subgroups of outlets for analysis: analysis by region

	A	B	C	D	K	L	M	N	O	P	Q	R
1		Field Data Consolidation:										
2		Public Sector Patient Prices										
4		Go To Home Page	Data/Summary									
5		Ratio On/Off	Double Entry		Sort by:	ID	Region	Distance	Number			
6					Data for Individual Medicines Outlets (Enter Medicine Unit Prices in Local Currency)							
7	Medicines Outlet Study ID				1	2	3	4	5	6	7	8
8	Region				North	North	North	North	North	East	East	West
9	Distance From Population Centre				5	9	3	7	12	4	8	20
10	Include outlet in analysis (1=yes,0=no)?				1	1	1	1	1	0	0	0
11	Level of care				1	2	1	3	1	1	2	1
12	No.	Medicine Name	Medicine Type	Include in analysis?	1	2	3	4	5	6	7	8
13	1	Albendazole	Brand	1								
14	1	Albendazole	Lowest Price	1	0.01001		0.012012	0.009828		0.01274	0.0091	
15	2	Amitriptyline	Brand	1	0.01848		0.019712		0.02184	0.02352		0.01848
16	2	Amitriptyline	Lowest Price	1	0.011088	0.014112		0.016128		0.014112	0.01008	0.01176
17	3	Amoxicillin cap/tab	Brand	1								
18	3	Amoxicillin cap/tab	Lowest Price	1	F		F	F	F	F	F	
19	4	Amoxicillin suspension	Brand	1	0.009405	0.014364	0.053856	0.0171	0.011115	0.01197	0.00855	0.01197
20	4	Amoxicillin suspension	Lowest Price	1	0.007524		0.006207			0.009576		0.00456
21	5	Atenolol	Brand	1		0.023112					0.01605	
22	5	Atenolol	Lowest Price	1	0.02354	0.0178904	0.028248		0.030288	0.032642	0.034996	

Fig. 8.10 Analysis of procurement data by sector

	A	B	C	D	K	L	M	N	O	P	Q	R
1		Field Data Consolidation:										
2		Medicine Procurement Prices										
4		Go To Home Page	Data/Summary									
5		Ratios On/Off	Double Entry		Sort by:	ID	Agency	Date	Number			
6					Data for Procurement Orders (Enter Medicine Unit Prices in Local Currency)							
7	Procurement ID				A	B						
8	Procurement Agency				MOH	NGO						
9	Date (Mon-YY as in Jan-02)				Feb-07	Mar-07						
10	Include order in analysis (1=yes, 0=no)?				1	0	0	0	0	0	0	0
11												
12	No.	Medicine Name	Medicine Type	Include in analysis?	1	2	3	4	5	6	7	8
13	1	Albendazole	Brand	1	0.0291	0.0314						
14	1	Albendazole	Lowest Price	1	0.0061	0.0034						
15	2	Amitriptyline	Brand	1	0.0218	0.0315						
16	2	Amitriptyline	Lowest Price	1	0.0151	0.0118						
17	3	Amoxicillin cap/tab	Brand	1	0.0420							
18	3	Amoxicillin cap/tab	Lowest Price	1	0.0084							
19	4	Amoxicillin suspension	Brand	1	0.0086	0.0120						
20	4	Amoxicillin suspension	Lowest Price	1	0.0068	0.0046						
21	5	Atenolol	Brand	1	0.0161	0.0193						
22	5	Atenolol	Lowest Price	1	0.0086	0.0118						

8.5.2 Comparing subgroups

Go to the *Field Data Consolidation* page for the sector for which you would like to conduct subgroup analysis. The data entry grid should be visible ('data' view with ratios turned 'off').

To compare subgroups of medicine outlets, use Row 10 to include ('1') the medicine outlets corresponding to the subgroup you wish to analyse and to exclude ('0') all other data. To compare subgroups of medicines, use Column D to include ('1') the medicines corresponding to the subgroup you wish to analyse and to exclude ('0') all other data. Go to the summary view by clicking on the **DATA/SUMMARY** button. You are provided with a space to describe the sample of data included in the analysis; **be sure to complete this description before printing**. After printing out the summary table you can go back to the data entry grid and change the subgroup of medicine outlets/medicines included in the analysis. By printing a (clearly labelled!) summary table for each subgroup, you can then compare different subgroups as you write your report.

When analysing subgroups, you should take account of the sample size of each group. In some cases the sample size will be so small that the results are no longer representative. For example, in analysing medicine availability in the public sector according to level of care, you may only have a small number of tertiary hospitals. In this case you should report results as absolute numbers (e.g. medicine X was found in two out of three outlets) rather than as a percentage value (e.g. availability of medicine X was 66.7%).

CAUTION

Always make sure you re-include medicine outlets and medicine products before proceeding with the general survey analysis. The number of medicine outlets and medicines included in the analysis can be checked on the *Field Data Consolidation: Summary* pages.

8.6 ANALYSIS OF TREATMENT AFFORDABILITY

The affordability analysis expresses the survey results in a different way. Instead of comparing medicine prices with an index price, the cost of a course of therapy for important conditions can be compared with the daily wage of the lowest-paid unskilled government worker. This analysis is very valuable as an advocacy tool since it expresses prices in relation to an individual's ability to pay rather than to international prices. It is much easier to explain to policy-makers that the cost of a month's treatment for a specific condition with Medicine X would require 10.5 days' wages with originator brand products and 6.3 days' wages with a low-cost generic alternative. To the extent that standard treatments are similar across countries, expressing results in this way also allows international comparisons of price levels that are not affected as much by differences in economic structures and exchange rates.

Click on the **TREATMENT AFFORDABILITY** button on the *Home* page to go to the *Standard Treatment Affordability* page. The process for defining and entering data on days' wages and on the standard treatments for individual conditions is described in Chapter 7 (pages 95–97). After you have completed this process, the workbook will automatically calculate the affordability measures in each sector and for each product type for which you have sufficient price data in the *Field Data Consolidation* pages. An example of affordability analysis for treatment of an ulcer is provided in Fig. 8.11.

Fig. 8.11 Example of standard treatment and affordability for treating an ulcer with one month's supply of omeprazole 20mg daily

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		Standard Treatment											
2		Affordability											
3													
4		Go To Home Page											
5													
6			Daily wage of lowest paid government worker (in local currency):							15			
7													
8		Ulcer						Public Sector		Private Sector		NGOs	
9		Select Medicine Name	Medicine Strength	Dosage Form	Treatment Duration (in Days)	Total # of Units per Treatment	Product Type	Median Treatment Price	Days' Wages	Median Treatment Price	Days' Wages	Median Treatment Price	Days' Wages
10		Omeprazole	20 mg	cap/tab	30	30	Brand	60.03	4.0	63.78	4.3	57.34	3.8
11							Lowest Price	32.85	2.2	59.11	3.9	52.56	3.5

To analyse the data, compare the median treatment price and number of days' wages required across sectors and for different product types. Although it is difficult to assess true affordability, treatments costing one day's wage or less (for a full course of treatment for an acute condition or a 30-day supply of medicine for chronic diseases) are generally considered affordable. In the example, median treatment costs for omeprazole treatment in public sector health facilities, private pharmacies and NGO facilities are very similar, with the exception of lowest-priced generics in the public sector. In all other cases, purchasing a month of therapy with originator brand or lowest-priced generic omeprazole would require 3.5 to 4.3 days' wages. In contrast, purchasing the lowest-priced generic omeprazole from the public sector is about half as expensive, costing 2.2 days' wages. Several conclusions can be drawn:

- Treating an ulcer with omeprazole may be unaffordable for many patients in all sectors.
- Even the lowest-priced generic omeprazole in the public sector is still unaffordable for many low-income patients, at just over 2 days' wages.
- In the public sector, patients would need to spend nearly twice as much to purchase originator brand omeprazole than the lowest-priced generic.

When analysing standard treatment data, be sure to examine the range of variation in medicine prices within each of the sectors in the summary ratio section of the *Field Data Consolidation* pages (see Fig. 8.3). Treatments for which the median prices are similar in two sectors may actually vary widely across outlets within the sectors.

Remember that for standard treatments that require more than one medicine, it will be necessary to enter each medicine separately and then add together the data on Median Treatment Price and Days' Wages for both medicines to get correct summary information for the treatment as a whole.

Treatment affordability should always be examined in conjunction with availability data. A treatment may appear affordable in a given sector, but if the availability of the medicine in that sector is low, patients will not benefit from this low cost. Instead, they will be forced to obtain medicines from a different sector where treatments may be much less affordable. When analysing affordability, always check the availability of medicines used in different courses of treatment. Where a treatment appears affordable in a given sector but availability in that sector is low, this should be noted in the survey report.

The section on affordability in your report should highlight the findings for key conditions of public health importance in your setting. Some conditions may be affordable

for low-paid workers to treat, while others may be completely out of their range. Try to describe the situation for both acute and chronic illnesses. For chronic illnesses, you should express the treatment in monthly amounts, which you would calculate by multiplying the daily dose by 30. Be sure to use the amount for a month's treatment for chronic conditions in the Total # of Units per Treatment field.

In some countries, many people may earn much less than the lowest government wage. Therefore, treatments that appear relatively affordable may still be out of reach for much of the population. This can be illustrated in the survey report by noting the proportion of the population living on less than 1 US dollar per day (international poverty line) and 2 US dollars per day.[1]

[1] World Bank Development Indicators, (http://devdata.worldbank.org/wdi2006/contents/Section2.htm, accessed 25 February 2008).