MedIC☺S

1 INTRODUCTION

The MedIC☺S file was developed to facilitate inventory control and order management for medical items in medical stores managed by humanitarian agencies as well as pharmacies in assisted health facilities.

Although the basic calculations for ordering are simple and can be done manually, they are time consuming and tedious. Moreover some calculations, such as demand analysis or calculation of remaining shelf life, would probably not be done as accurately if no tool was available.

This Excel spreadsheet application uses only simple functions and could be easily developed by anyone with average computer skills. However the value of this application lies in standardisation across an organisation. This allows staff which have used MedIC☺S in one place to be familiar with it in any other mission.

This spreadsheet application was developed by the author in the field. He has used it for several years and refined it over time. It is designed to be practical, "from the field for the field".

The main objective during developing and designing this application was to make it as simple and user-friendly as possible.

In order to make this manual as user-friendly as possible, the essential information on the file and its use is contained in less than 20 pages in chapters 5-8. Detailed information on each column of the worksheet as well as explanations of the formulas can be found in the appendices. These are meant as a reference which can be consulted if special questions arise.

2 GETTING STARTED

Welcome to MedIC☺S!

Before starting to study the file and the manual, the MedIC☺S file needs to be copied onto the computer hard disk and data from the national standard list (inventory list) needs to be inserted. This procedure is necessary only before using MedIC☺S the first time. This manual assumes that a version of WINDOWS is used as an operating system on the computer and a compression tool (such as WinZip) is available.

Before starting to use MedIC☺S the first time, the following steps must be followed:

- Switch on the computer.

- Open the Windows Explorer.

- Copy the file MedICOS.xls onto the hard disk.

- Open the MedICOS.xls file.

- Save the file under a name of your choice (and keep the original as a backup).

- Switch to the "CALCULATION" worksheet.

- Enter the name of your organisation, the location of the medical store and the current year in cell C1 as well as in the the header for printing.

- Enter (or copy) the item data of into the respective columns of the "CALCULATION" worksheet.

- Perform the same procedure for the "STOCK ON ORDER", the "DEMAMD" as well as the "STOCK" worksheet. Make sure that the order of all items in these worksheets correspond exactly. Every item must be entered into the same row all of these worksheets.

- Enter the aggregate monthly demand from the most recent six months into columns M through R of the "CALCULATION" worksheet.

- Save the file under its current name on the hard disk.

- Make a backup copy of the file.

- Close the file.

- Switch off the computer.

But please make a backup copy every time changes are made

Good Luck!

3 BASIC CONSIDERATIONS

Before explaining how to use MedIC☺S this short chapter will give an overview of the basic concept behind the MedIC☺S file.

Computer

Since MedIC☺S is a simple Excel spreadsheet, there is no need for any installation or modifying any setup. Most computer literate staff will be familiar with Excel and will therefore require little training.

Skills

The file is specifically designed for users who have only basic knowledge of Excel or other spreadsheet applications. Users who have never used a spreadsheet or Excel will be able to acquire the necessary skills quickly by individual training or by attending a computer course.

Simplicity

Whenever data is entered in any of the worksheets all calculations are instantly updated and there is no need to run any macros.

Since all data is contained in one file there is no need for transferring data between different files.

All data from the current year is contained in a single (the most recent) MedIC☺S file. Therefore there is no need to keep a monthly updates in a multitude of different files.

Since all data is contained in one file a backup can easily be made on one computer disk with a single copy command although the file might have to be compressed before.

All essential features for inventory control are contained in one worksheet, the "CALCULATION" worksheet while the other worksheets are intended mainly for further analysis and storing data.

Since, except for some totals at the top of the worksheet, all formulas in a column are identical they can be copied to cells above or below to amend errors or reverse accidental deletion.

Transparency

The file contains only basic mathematical formulas (plus, minus, multiplication, division, average, sum, if etc.) which can be understood with good knowledge of Excel or another spreadsheet application. Therefore the complete design is transparent and users can easily follow the logic of calculations.

No macros are used since it is not easy to follow their functions and accidental use might cause major problems. Some transfer of data between worksheets will have to be performed manually. This has the advantage that the user actually understands what is happening rather than initiating some automatic process without understanding its function.

Flexibility

Data can be entered any time in any worksheet and in any order. There is no need to follow a "protocol" in order to obtain correct calculations. Corrections can also be made any time.

The design of the file is kept simple and is adaptable to individual requirements. Items can be added at the bottom of the worksheets and columns with additional calculations can be added on the far right of the "CALCULATION" worksheet if the user wishes to do so.

Calculation of moving averages can be based on between one and six months of demand and changed any time.

The file can be used for inventory control of medical items in a medical store or warehouse as well as assisted health facilities such as hospitals and clinics.

MedIC☺S can in principle be used for any category of items requiring inventory control. It can also be useful for inventory control of nonmedical items used in health programmes such as spare parts, any kind of emergency stocks, stationary, food, fuel etc.

For printing data any combination of columns can be chosen by simply hiding the columns which should not be printed. Therefore the content and layout of prints can be adapted to individual needs.

4 REQUIRED SKILLS

The file was designed to require only basic spreadsheet skills. However it does require knowledge of basic features.

Before acquainting oneself with the MedIC☺S file users should make sure they have acquired all necessary skills listed below. Users who have never used any spreadsheet application or lack some of the listed skills should undergo some computer training before starting to use MedIC☺S.

Required skills for using the file

- Switching on the computer.
- Starting Excel from the desk top.
- Opening an existing file (in Excel or from the Windows Explorer).
- Freezing panes.
- Switching between worksheets within the file.
- Entering data into a specific cell.
- Deleting data from a specific cell.
- "Paste special", paste Values.
- Copying cell contents from one worksheet to another.
- Hiding columns.
- Printing worksheets.
- Saving the file (onto the hard disk as well as on a computer disk).
- Saving a file under a different name ("save as").
- "Zipping" (compressing) and "unzipping" (decompressing) files.
- Closing a file.
- Switching off the computer.
- Skills for removing errors
- Changing cell styles (font, lines, alignment, row height, column width).
- Changing number formats.
- Deleting rows and columns.
- Inserting rows and columns.
- Copying a formula from one cell to another.

If the user is lacking any of these skills s/he can consult Excel references or attend a computer course.

5 GENERAL REMARKS

The MedIC☺S file consists of eight worksheets in a single file. All important calculations are made in the "CALCULATION" worksheet. All other worksheets are added for further analysis, keeping records and storing data.

The "CALCULATION" worksheet will of course change every month. In case the user wants to keep the calculations of each individual month s/he must save the file under a different name every month and keep a backup.

The search function can be used for finding an item or a code in the file or a specific worksheet.

Throughout this manual a clear distinction is made between consumption and demand. Consumption is the quantity actually consumed (used) by all customers while demand is the quantity which was issued from stock. Obviously there may be great differences between monthly consumption and monthly demand. In principle this manual assumes that only demand data will be available. However if consumption data is available from customers (base stock control system), then forecasting will of course be more accurate if monthly consumption (rather than monthly demand) is entered into columns M through R of the "CALCULATION" worksheet.

Colours

The background of the first two rows in all worksheets (except the "INDICATORS" worksheet) is yellow. This is intended to facilitate orientation. These cells are also protected since except for entering some parameters they do not need to be changed after initial setup. In most cases it is useful to "freeze" the first two columns. This will allow to view the headers when scrolling down the worksheet.

In order to facilitate orientation and using the file some cells are colour coded. The basic rule is that data should be only entered or changed in cells where the text colour is blue, regardless of the background colour. Black text colour indicates that the cell contains formulas and therefore no data needs to be entered.

Cells with a grey background contain parameters which can be changed and are relevant for the whole worksheet or the entire application. For example the parameters in cell U1 and V1 which apply to all items in the "CALCULATION" worksheet.

In addition all cells where no data needs to be entered are protected to avoid accidental deletion or damage of formulas. When using a black and white printer blue and black cells will both be printed in black. However the different colours have no relevance after data is entered into cells and colour prints are therefore not needed. Note that if you want to add or delete rows in a spreadsheet the protection needs to be (temporarily) removed.

Cells in the upper rows of worksheets which contain formulas are marked by a blue background to prevent accidental change or deletion.

All cells where no data needs to be entered are protected. If the worksheet is protected it is not possible to alter these cells. However it is possible to select cells and copy their contents without any problem. The protection can be removed and restored anytime without a password. It is not applied to limit the flexibility of the file for the user but simply to prevent accidental deletion and damage to the file.

Conditional formatting is used in the "CALCULATION" worksheet. A red background alerts the user to a problem, such as expiry before use or too low order quantities. A green

background is used only in column Z ("Calc. order") indicating all the items which should be ordered.

<u>Units of measurement</u>

The unit of measure for all items should be "EA" (Each). This is vital since different batches of the same item might come in different packing sizes. The only exception might be items which are measured in meters (for example some types of tubing) or kilograms.

All weight calculations are made in kilograms (kg) and 1 tonne is equal to 1,000 kilograms. All volumes are calculated in litres (1 litre = 1 dm³) where 1 m³ is equal to 1,000 litres.

Any currency can be used for financial calculations. However it is vital to make sure that only one currency is used consistently.

The basic unit for time is the month. Monthly demand is used and stock levels, coverage time, review periods as well as replenishment lead times are also measured in months.

<u>Set-up and layout</u>

If any language other than English is used, the header of column G "ITEM DESCRIPTION IN ENGLISH" should be changed accordingly. Otherwise captions in the first and second row should not be changed.

The application has been designed under the assumption that a coding system similar to MsF is used. If more or less than four letters are used to denote the category of items, the formula in column C of the "CALCULATION" worksheet should be changed accordingly. If the items are not categorized concerning their storage and transport conditions (column "ST") as well as their inventory availability (column "IS") these columns should be hidden. If they are deleted this may adversely affect some functions in the application.

Before starting to use the file the first time the national standard list must be entered into the MedIC☺S file.

The first six columns (column C through H in the "CALCULATION" worksheet, A through F in the "STOCK ON ORDER" worksheet) etc. have the same format in several worksheets. Once the inventory list is established in the "CALCULATION" worksheet all item data can be copied to the respective columns of the other worksheets.

In any case any item entered in the "CALCULATION" worksheet must be copied to the other worksheets in exactly the same row.

300 lines are formatted in the "CALCULATION", "STOCK ON ORDER", "DEMAND" and "STOCK" worksheet and contain formulas. The "MONTHLY ORDER" worksheet has 150 formatted lines and the "EXPIRY DATES" worksheet 50 formatted lines.

However any number of lines can be added if more items are held in stock. Empty rows can be added between the first row containing an item description (below row 4) and above the last row containing an item description (above row 300). The formulas with a lookup function are formatted for 1,000 items in the "CALCULATION" worksheet. If more items are entered, these formulas will have to be changed.

All cells in an inserted row will be blank and therefore the formulas must be copied. from the cell above or below from the same column. This can be done by selecting the entire row and copying it to the empty rows. Since the formulas in all columns are identical (except for references to their row number), all formulas can be transferred vertically.

6 PREPARING A MONTHLY REPLENISHMENT ORDER

The following procedure is meant as a suggestion how to enter and process data for preparing a monthly order for medical items. However as stated above in principle there is no fixed order in which the data has to be entered. The user might follow these procedures until s/he is fully acquainted with the file and might adapt routines which are more convenient to her/him later.

The following procedure is proposed under the assumption that a complete physical stocktaking will be performed on the last day of the month and the stock on order as well as the backorders will be updated at the same time. Moreover that the monthly aggregate demand will be calculated from the first to the last day of the same month.

Therefore monthly demand, stock on hand, stock on order and the "corrected order" (!) will all be entered under the same month in all worksheets. For example for an order which is prepared on November 30th the demand will be calculated from the first to the last day of November, the stocktaking will be performed on the last day of November as will the updating of stock on order as well as backorders. All of this data will eventually be entered in columns labelled "NOV". The monthly order placed on December 1st will also appear in the "NOV" column.

6.1 Preparing the new file

Before entering any data a new file must be prepared. The file from the previous month (for example "ORDER015.XLS") is opened and saved under its new name (for example "ORDER089.XLS"). Saving the file under a new name allows the file from the previous month to be kept as a backup in case the new file is damaged for any reason. The file must be given an unambiguous name for example the number of the order. Using names of months is ambiguous as "November" could be the order made on the first or last day of the month.

The order reference number should be entered in cell C1 of the "CALCULATION" worksheet. It will appear in the other worksheets as well as on the monthly order printout. The proposed coding is two letters for the country, three letters for the location, two digits for the year and four digits for the order number. However any other system of number orders can be used.

The next step is to move the monthly aggregate demand columns to the left. The following explanations are given under the assumption that six months of aggregate demand are used as basis of calculation. The columns N to R are selected (highlighted) and copied to the columns M to Q. Only the data without the formats should be copied ("Paste special" - paste values). By this the data in column M will be replaced by data from column N and be erased. Then column R is highlighted and all data deleted to make space for entering the most recent data. After this the abbreviation for the next month is entered into the cell R2.

The next step is to remove data from the previous month which is no longer valid. All data from the column W ("STOCK ON HAND") and AA ("[Date] ORDER) is deleted. For the expiry dates the contents of column AI ("EXPIRY DATE") can be deleted. Alternatively only the expiry dates which have changed during the last month can be corrected. (If the storekeeper is given a printout of the expiry dates from the previous months s/he can just write the expiry date next to the printing if it has changed).

Now the new file is ready to be filled with the most recent data.

6.2 Collecting data

For preparing the monthly order the following data is required:

- Aggregate monthly demand from the past month (first to last day of the past month).

- Current stock on hand (according to a physical stocktaking).

- Expiry dates of the first expiring batch (according to FEFO).

- Updated list of stock on order.

- Updated list of backorders.

It seems advisable to perform the physical stocktaking on the last day of the month and update all other records at the same day. Alternatively the medical store can be closed for two days, suspending all movement of stock, and allowing two days for stocktaking, recording and updating records.

The stock on hand is immediately available from reviewing the stock cards.

The monthly demand is calculated by adding all stock issues (except damaged and expired items) from the past month recorded in the stock cards. It is important to exclude all items or quantities which were not distributed to customers but lost through expiry, damage or theft since inclusion would distort real demand. However any losses must be considered in the stock on hand since only the physical stock levels are relevant.

The column AK ("CHECK") which is empty when the new file is prepared, can be used for recording the corrected expiry dates. This information is available from reviewing the bin cards.

The updated stock on order data automatically appears on the "CALCULATION" worksheet whenever data is updated in the "STOCK ON ORDER" worksheet.

The updated backorders also automatically appear on the "CALCULATION" worksheet whenever data in the "BACKORDER" worksheet is updated.

While an order can in principle be made at any time it is vital that the stock on order is updated the same day as the physical stocktaking. Otherwise items which were entered into stock already will not be cancelled from the stock on order yet, thus making correct calculations impossible. Likewise if items are cancelled from the stock on order list before they have been entered into stock and do not appear on the stock cards, correct calculations are impossible.

For collecting data from the medical store all columns except columns C through H, R, W, AI and AK should be hidden. A printout is given to the warehouse manager to enter the recent monthly aggregate demand, stock on hand as well as the correct expiry dates of the next expiring batch. Hiding columns where no data will be entered will prevent later accidental entry in the wrong column.

Before taking the next step the file should be saved as a precaution in case later errors are made which cannot be corrected.

6.3 Entering data

The monthly demand, stock on hand as well as the expiry dates (if changed) are copied from the printout which was filled in by the warehouse staff. After entering all data the figures should be checked again. After un-hiding all columns the file is saved again.

If an expire date is entered into column AI ("Expiry date") which is before the date of the order, then the background will appear pink as these items should have been destroyed and deducted from the stock on hand.

It is important that the columns for the monthly demand (columns M through R) for which no data is available (yet) must be kept blank and must not be filled with "0". Otherwise these zero-demands will be taken into consideration for the monthly average demand and decrease it falsely.

If average monthly demand should be based on less than six months, the columns toward the left should be left blank. In any case the most recent monthly demand should be entered into column R as this data is used for further calculations.

6.4 Updating the stock on order

If the stock on order and the backorders have not been continuously updated whenever changes occurred, it must be done before preparing an order.

Whenever items ordered for stock replenishment arrive and are entered into stock, the quantities should be manually recorded on the printout of the monthly order of the respective month. At the end of the month all monthly orders which have not be filled are reviewed. All items or quantities of items which have meanwhile arrived are removed from the respective column of the "STOCK ON ORDER" worksheet. Only items and their quantities which have not been delivered yet are entered or remain. When the order is completed and all items have arrived, the column will be empty and the whole column can be deleted. The total quantity of each item is calculated in column S ("Total"). The same data automatically appears in column X ("STOCK ON ORDER") in the "CALCULATION" worksheet.

If for any reason the "STOCK ON ORDER" worksheet is not being used to calculate the outstanding orders, the quantities of stock on order can be directly entered into the column X ("STOCK ON ORDER") of the "Calculation" worksheet manually. However in this case the formula will be destroyed.

6.5 Updating the backorders

The "BACKORDER" worksheet should be continuously updated whenever changes occur. Customers should regularly receive a printout of this worksheet.

However if the "BACKORDER" worksheet has not been continuously updated it must be done before preparing a monthly order. All items which have been ordered from customers but are not in stock are added to this record if necessary. Items which have meanwhile been shipped to customers are deleted. In case the requested quantities were only filled partially the quantities have to be corrected accordingly.

It is important to make sure that the correct item codes are used and that only one item code is used for every item. The formula used in the "CALCULATION" worksheet adds the quantities for every item code and displays the total in column Y ("BACKORDERS").

Any item and item code can be entered into the backorder record. However the total backordered quantity will only be displayed for the items which are entered in the "CALCULATION" worksheet. If items which are not commonly held in stock (for example equipment or spare parts) are backordered, they will not appear in the "CALCULATION" worksheet. However they should be entered into the "BACKORDER" worksheet to have a complete overview of all backordered items.

6.6 Non-routine changes

Before making the corrected order it may be necessary from time to time to make different changes. If the value of an item has changed it must be updated in column J ("VALUE PER UOM") of the "CALCULATION" worksheet.

In case the order is based on fixed reorder levels rather than average demand the reorder levels can be manually entered in column V ("REORDER LEVEL"). In this case, the background colour should be changed to grey to remind the user, that the formula has been deleted. Using fixed reorder levels may be useful for equipment, spare parts or emergency stocks (for example kits). Please note that in this case the formula will be deleted. In case calculation should later be based on average demand again the formula can be copied from any other cell in the same column.

In case the national standard list has changed the "CALCULATION" worksheet must be updated accordingly. It is important to make the same changes in the "STOCK ON ORDER", "DEMAND" as well as "STOCK" worksheet.

6.7 Determining safety stock level and reorder level

For calculating the order quantities a stock level as well as a reorder level must be determined.

The safety stock level is measured in multiples of average monthly demand. The number of months of average demand which should be kept in stock are entered into the cell U1 of the "CALCULATION" worksheet. The blue text colour indicates that this parameter may be changed as desired. While the desired safety stock levels may change for good reasons, in general it will not change every month and any change should be considered carefully.

The safety stock level itself is not used for the calculations. However this value is displayed for every item because it indicates the quantities which should be in stock at all times regardless of any stock on order.

The reorder level is also expressed as multiples of months of average demand. The desired value is entered in cell V1 of the "CALCULATION" worksheet. The blue text colour indicates that this parameter may be changed as desired.

Once the safety stock level has been determined the reorder level is calculated by adding the review period (in months) as well as the (maximum) replenishment lead time (in months). For example if 3 months of safety stock are to be held, an order is placed every month and the (maximum) replenishment lead time is expected to be 2 months, then the reorder level is calculated by multiplying average monthly demand with 6.

The reorder level must be carefully considered since it is the most important parameter for calculating order quantities.

It is important to keep in mind that the reorder level is fictitious. That means the physical stock levels will never reach the reorder level (unless there is no demand for several months). It is a theoretical parameter which is nevertheless indispensable for calculating reorder quantities. It is vital not to confuse the safety stock level with the reorder level.

6.8 "Corrected" order

After all data has been entered and updated MedIC☺S will propose calculated order quantities for every item in column Z ("CALC. ORDER").

These quantities are calculated by subtracting the stock on hand as well as the stock on order from the reorder level and adding the backorders.

All proposed quantities must be carefully reviewed and checked item by item. The final quantity which should be ordered is entered into column AA ("[Date] ORDER"). If an item does not need to be ordered the respective cell should remain blank and not be filled in with a zero since otherwise it will appear on the "MONTHLY ORDER" worksheet.

For each item the "CALC. ORDER" in column AA must be checked. Since the calculations are based on exact mathematical formulas the values will be odd numbers. Of course these figures must be rounded up or off. To facilitate decisions column AB ("PACKING") should be checked. The data in this column is the same as appears in column I. However it is displayed again next to the order column for convenience. The actual (corrected) order should be multiples of the quantities stated in column AB ("PACKING"). This will facilitate order picking at the supplying medical store.

The figures in column AA ("CALC. ORDER") should be seen as a suggestion. There are many considerations which must be taken into account when placing an order. Demand for an item might be expected to decrease due to the season, changes in assistance policy or replacing one item with another one. Likewise demand might increase due to an active front-line, increase of assistance to medical structures or an epidemic. Some items might have to be kept in stock even if there has been no demand for a long time for example emergency drugs.

The text colour of column AA ("[Date] ORDER") is blue which again indicates that data must be entered into this column and can be changed any time. For better overview in the printout of the monthly order data in this column is printed in bold.

Whenever the calculated order is less than 0.5, the "CALC. ORDER" column will remain blank since any value less than 0.5 would be rounded off and appear as "0". The assumption is made that whenever the calculated order is less than 0.5 units, no order will be placed]

Finally the date on which the order is being prepared is entered in cell AA1 of the "CALCULATION" worksheet. This date will appear on the printout for the monthly order and is used for the shelf life calculations.

6.9 Printing the monthly order

After all data has been entered and the order quantities are finalised, the "MONTHLY ORDER" worksheet is selected.

There is no need to enter any data in this worksheet whatsoever. All data from the "CALCULATION" worksheet is transferred automatically. Any changes should be made exclusively in the "CALCULATION" worksheet. If data is entered into column H ("[Date] ORDER") of the "MONTHLY ORDER" worksheet, the formula will be destroyed.

The total value of the order will appear in cell H3.

The worksheet is ranged from the top until the last row where data appears and is printed.

6.10 Overview of the ordering procedure

- Switch on the computer.
- Start Excel or open the Windows Explorer.
- Open the file used for the previous order.

- Save the file under the new name ("save as").

- Enter the order reference (number) in cell C3 of the "CALCULATION" worksheet.

- Range columns N through R from the second row until the bottom of the worksheet.

- Copy this data to columns M through Q.

- Delete all data from column R (to make space to enter the most recent monthly demand).

- Delete all data from column W ("STOCK ON HAND").

- Except for cell AD 1 delete all data from column AA ("[Date] ORDER").

- Delete the expiry dates from column AI (alternatively only the expiry dates which have changed can be updated).

- Update column J ("VALUE PER UOM") if prices have changed.

- Update columns K ("WEIGHT PER UOM") and L ("VOLUME PER UOM" if this data has changed.

- Hide all columns except columns C through H, R, W, AI and AK.

- Make a printout of the worksheet (in portrait).

- Record monthly demand, stock on hand as well as the expiry dates on the printed document by reviewing stock records.

- Enter the data into the respective columns of the "CALCULATION" worksheet. Keep the columns mentioned above hidden to prevent entry into the wrong column.

- Check all entered data for mistakes.

- Un-hide all columns which where hidden before.

- Check the parameters for the safety stock (cell U1) and reorder level (cell V1) and adjust them if necessary.

- In case the order should be based on fixed reorder levels rather than average monthly demand enter the respective reorder level in column Y ("REORDER LEVEL").

- Enter the current date (date on which the order is prepared) in cell AA1.

- Update the "STOCK ON ORDER" worksheet.

- Update the "BACKORDER" worksheet.

- Position column G to the far left of the worksheet and freeze column G.

- Check column Z ("CALC. ORDER") and enter the quantities that should be ordered in column AA (check that all figures are multiples of the "PACKING" in column AB).

- Check the figures in column AG ("Total Coverage") which should be near the reorder level selected in cell V1 and correct the order if necessary.

- Switch to the "MONTHLY ORDER" worksheet.

- Range the worksheet for printing from the third row until the last row in which data appears for printing.

- Print the worksheet.

- Return to the "CALCULATION" worksheet.

- Copy column R (most recent monthly demand) to the respective column of the first table of the "DEMAND" worksheet.

- Copy column AN ("VALUE DEMAND") to the respective column of the second table of the "DEMAND" worksheet. Make sure to "Paste special" - paste Values.

- Copy column AA ("[Date] ORDER") to the respective column of the third table of the "DEMAND" worksheet.

- Copy column U ("SAFETY STOCK") to the respective column of the first table of the "STOCK" worksheet. Make sure to "Paste special" - paste values.

- Copy column W ("STOCK ON HAND") to the respective column of the second table of the "STOCK" worksheet.

- Copy column AD ("COVERAGE TIME") to the respective column of the third table of the "STOCK" worksheet. Make sure to "Paste special" - paste values.

- Print any data from worksheets which are needed for updating hardcopy files.

- Save the file (on the hard disk).

- Make a backup copy.

- Exit Excel.

- Switch off the computer.

For "Pasting special - paste "Values"" select the cells you want to copy and give the copy command (or use CTRL+C). Then place the cursor in the first cell of range to which you want to copy. Choose "Paste Special" form the "Edit" menu. Select "Values" and click "OK".

If you have pasted the cell contents but forgotten to select "Paste special - paste "Values"" chose "Undo" and try again.

7 CALCULATIONS

Apart from the "calculated order" which has been explained above simultaneously with entering all data mentioned in chapter 6.3 MedIC☺S will update several calculations which are useful for management of medical stocks.

7.1 Coverage time

Column AD ("Coverage time") will show the number of months the stock on hand will last if the current average monthly demand does not change. This column is valuable since it will immediately indicate all items which have to be ordered urgently or which are over-stocked and therefore are in danger of expiring in the warehouse.

If no demand data is entered into columns M through R then the respective cell will remain blank. This is important since although the stock on hand will probably be zero it is not to be considered as a stockout.

But if total demand during the past one to six months was greater than zero and stock on hand is zero then "Stockout" will be displayed and the background will appear red.

Column AE ("On order Coverage") indicates the number of months of average monthly demand which have been ordered but not delivered yet. If the stock on hand is low one can check whether a large quantity of this item is already on order. If this is the case a request for shipping stock on order as a priority can be made rather than placing additional orders.

Column AF ("Order coverage") shows the number of months of average monthly demand the current order would last. If this number is larger than 1 than either demand has increased or the previous order was not large enough.

Column AG ("Total coverage") is the sum of the columns AD, AE and AF. It indicates how many months of stock would be in the medical warehouse if all stock on order was immediately delivered and average demand does not change.

7.2 Expiry dates

Column AJ ("SHELF LIFE") indicates the remaining shelf life (the number of months until the item will expire). This time span is calculated as the difference between the date of order (cell AA1) and the expiry date (column AI) of the respective item.

There are three features for managing expiry dates: calculations based on an absolute date, calculations based on a span of remaining shelf life and comparison of shelf life with usage.

The first option is to enter a date in cell AI3. Any item expiring before this date, will have its background changed to red in the respective row of column AI.

The second option is to enter a span of remaining shelf life (measured in months) into cell AJ3. Any item with a shelf life less than this parameter will appear with a red background.

These first two options have some significant shortcomings. Items with a short remaining shelf life (for example 2-3 months) may not necessarily cause a problem. For example if only 2 weeks of stock are left this item will easily be used before it expires. On the other hand an item with a remaining shelf life of say six months may appear to cause no problems. However when the remaining shelf life eventually drops below six months it may be discovered that the stock will last for two years and eventually some of it will expire before it can be used.

The third method avoids both problems by comparing the remaining shelf life with the coverage time.

The calculations are based on a "worst case scenario". Calculations are made assuming that all batches have the expiry date of the batch with the shortest shelf life.

If column AK ("CHECK") remains blank then even the worst case scenario will not cause any problems. Since the shelf life of batches must be at least as long as the shelf life of the batch with the shortest shelf life, there is no danger of expiry, whatever the expiry dates of other batches may be. For example if all batches have at least two years shelf life left and the stock will last for three to six months there is no need for more detailed analysis.

However if the shelf life (column AJ) is less than column AD ("Coverage time") then the caption "CHECK" will appear in the row of the respective item in column AK and the background will turn red. This means that if the whole stock had the same expiry date and average demand does not increase the stock will not be issued completely until the day of expiry.

All items which are concerned will automatically appear in the "EXPIRY DATES" worksheet. This worksheet is printed and given to the storekeeper. S/he will fill in the expiry dates as well as stock on hand for each batch.

After entering this data in the respective "QUAN." and "DATE" columns of the "EXPIRY DATES" worksheet, the quantities which will expire (provided that average monthly demand does not change) will appear in the respective "EXP." column. It is important to make sure that all batches are entered in ascending chronological order (the batch with the shortest shelf life first etc.). As a default, today's date appears in cell E1.

In column M ("QUAN.") the quantity of the first expiring batch and in the column N ("DATE") the expiry date of the first batch are entered. As data can be entered into all mentioned columns the text colour is blue. If the whole batch can be distributed before expiring "OK" will appear in column L, O, R, U, X, AA, AD, AG, AJ and AM ("EXP.)" respectively.

In case the whole batch cannot be distributed before expiring the number of items which will expire will appear in column L ("EXP.") etc. Again it must be stressed that these calculations are based on the current average demand (column H) which will eventually change. If demand increases the danger of expiring will decrease and if demand decreases the danger of expiring will increase. A total of 10 different batches with different expiry dates can be entered for every item.

Note also that the quantities appearing in the "EXP." column refer to expiry in the medical store or warehouse. If batches with short shelf but not expired on the day of issue are distributed they may still well expiry in the pharmacy of the assisted health facility because of their short shelf life.

The entered expiry date can of course not be before "Today's Date" (cell E1) since these items have already expired and must therefore be destroyed immediately.

The total value of all quantities which would expire (if demand does not change and if no measures are taken) will appear in column AN at the end of the table. This is meant as a tool to increase awareness of the usually large amounts of financial resources which are in danger of being wasted. The total value for all items which would expire, are shown in cell AN1.

This worksheet is then printed for detailed analysis. Batches which are in danger of expiry may be returned to another medical stock (provided that a sufficient shelf life remains) or distributed.

The calculation is made by multiplying the number of months between today (cell E1) and the entered expiry date with average demand. This is the quantity which will be used until the expiry date. If this quantity is smaller than the quantity of the respective batch the excess stock will not be used before expiring. For the second batch the calculation is performed likewise but it takes into consideration that the first batch must be distributed before items from the second batch can be used. It is also taken into consideration that if part of the first batch expires before it can be used, a larger number of the second batch can be used before the second batch expires. Likewise the calculations are performed for a maximum of ten batches of the same item.

Average demand is automatically transferred from column T ("AVG.") of the "CALCULATION" worksheet. This figure can be changed if a change in demand is anticipated. This way predictions can be made what quantities will expiry if demand increases or decreases. However if a figure is entered into this cell it will destroy the formula. In order to restore the link the formula can be copied from any other cell in the same column (column H) of the "EXPIRE DATES" worksheet.

The calculations are projections into the far future. Therefore if large stocks are kept with a shelf life of several years, a warning will be given already today that in future a problem will or could arise. This way of calculating expiry dates avoids suddenly being faced with the problem of having two years of stock expiring only in three months time.

7.3 Value, weight and volume calculations

Simultaneously while entering data for calculating an order, value, weight as well as volume of the stock on hand, stock on order, most recent monthly demand as well as the monthly order are calculated in columns AL to AW of the "CALCULATION" worksheet. The totals of these columns are shown in the cell in the third row of the respective column.

The value calculations are useful for determining the value of the monthly order and total stock value. Weight and volume are useful for monitoring productivity as well as planning.

7.4 Indicators

Some key performance indicators are calculated in the "INDICATORS" worksheet. Indicators of the current month will be displayed in column B and must be manually transferred to the respective month using "Paste special - paste Values" after completing the monthly order.

The indicators are divided into service received, stock management as well as service provided to customers.

Service received

- Number of line items on order.
- Total weight of stock on order.
- Average order completion rate.

Management of medical stocks

- Number of line items in stock.
- Items with stock on hand less than safety stock required.
- Value of stock on hand.

- Annual rate of turnover of stock on hand (in terms of value).

- Weight of stock on hand (kg).

- Volume of stock on hand (l).

- Value of goods in danger of expiry (CHF).

Customer service

- Value of monthly demand.

- Weight of monthly demand.

- Number of backordered lines.

- Average backorder time (days).

- Number of stockouts.

Below the table some of the indicators are presented as graphs with time as their x-axis

- Number of items of a specific coverage time.

- Number of line items on order by month.

- Coefficient of variation of demand from the past one to six months.

- Number of items and backorder time in weeks.

For the indicators concerning service received it is important to copy the data before making the monthly order. Otherwise all items ordered today will be taken into account and distort the statistics.

For all other indicators, the figures are transferred to the respective column C through N after all data is entered and the order is completed.

"Paste special - paste values" must be used for all of these transfers.

8 COPYING DATA TO OTHER WORKSHEETS

As mentioned earlier the "DEMAND" as well as the "STOCK" worksheet are not needed for calculating the monthly order. But if data such as monthly demand, stock on hand etc. are not transferred and stored in these worksheets the data will be lost next month when some older data is replaced by more recent data. Therefore it would be necessary to keep a copy of the file each month to preserve all the data.

To allow keeping all data from an entire year in one file two worksheets have been added into which some data which is of interest should be transferred after calculating the monthly replenishment orders.

8.1 "Demand" worksheet

In the first table the most recent monthly demand is added and copied into the respective column. For this the respective column in the "CALCULATION" worksheet is selected (ranged), the "DEMAND" worksheet is chosen and the data copied to the respective column. While the "CALCULATION" worksheet calculates average demand from the past one to six months, this worksheet calculates the totals and averages from the beginning of the year.

Column AN ("VALUE DEMAND") is copied from the "CALCULATION" worksheet into the respective column ("Paste special - paste values"). These figures can be used for monitoring the value of demand as well as for financial planning. The columns AH ("TOTAL") and AI ("AVG.") indicate the average and total value of demand for each item. The total for all items is again indicated in the last row.

The third table gives an overview of all corrected monthly orders. The column AA ("[Date] ORDER") from the "CALCULATION" worksheet is selected (ranged) and copied to the respective column. The order reference (number) is entered into the second row and the date of ordering in the third row.

8.2 "Stock" worksheet

The first table gives a monthly overview of the safety stock. This is meant for monitoring increases or decreases in safety stocks which indicate changes in demand or the inventory policy. Column U ("SAFETY STOCK") from the "CALCULATION" worksheet is copied to the respective column ("Paste special - paste values").

The second table gives an overview of the stock on hand at the end of the month. Large changes in stock levels can be easily detected. The recent stock on hand (column W) from the "CALCULATION" worksheet is copied to the respective column.

The third table gives an overview of coverage time. This is the number of months the stock will last if demand does not change and no goods are received. This is a useful tool to monitor the quality of stock management. Ideally all this figures should be near the desired safety stock. Very low figures indicate that items are under-stocked with the danger of stockouts. High figures indicate over-stocking with the danger of expiring in the medical warehouse. The column AD ("Coverage time") from the "CALCULATION" worksheet is copied ("Paste special - paste values") to the respective column.

9 PRINTING

Printouts are needed for preparing a record sheet for collecting data from the medical store, preparing the monthly order as well as for filing.

After the monthly order has been calculated it is recommended to print a copy of all worksheets.

By hiding columns the printout can be tailored to individual needs. In this way there is no need to create separate files for printing orders, demand data etc. All columns which need to be printed must be selected and previewed to define the printing range. For the "CALCULATION", "DEMAND" as well as "STOCK" worksheet printing in landscape is recommended.

As a default the following headers and footers will be printed:

Left header: [ORGANISATION] [LOCATION]

Centre header: MedIC☺S

Right header: [Current system date = date of printing]

Left footer: [File name]

Centre footer: [Page number]

Right footer: Health Care Logistics

It is important to have this information printed on every sheet especially for filing since printouts from different worksheets as well as different files look very similar.

Please replace [location] by the name of your medical store or its location.

As a default, the first two rows will be printed on each page of any worksheet (except the indicator worksheet) that is printed.

10 BACKUP

Throughout the procedure of entering data and printing, the file should be saved frequently. In case some major error occurs (for example power failure, mishandling etc.) the file can be closed without saving and reopened. This way a minimum of entered data and time will be lost.

After completing and printing the monthly order and before closing the file, MedIC☺S must be saved on the hard disk.

If many non-standard list items are added at the end of the standard list and a lot of data is entered (towards the end of the year) the file might require more than 1.4 MB. In this case the file must be compressed ("zipped") for example using WinZip.

A hardcopy of the printouts should be kept in case all data is lost for whatever reason. This will allow to at least re-enter the data to restore the file.

11 USING MedIC☺S FOR HEALTH CARE FACILITIES

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The file was originally designed for management of a medical stores or warehouse of humanitarian agencies. However the file can be used for calculating replenishment orders for regularly supplied health facilities such as first aid post, clinics or hospitals as well.

In this case less features might be necessary. For example when delivering from the medical warehouse there should be no stock on order and deliveries should be made within two days of ordering. And since only a few weeks stock of supplies will be kept there is no need for documenting expiry dates every month.

A simplified file (HeFacICOS.xls) is designed for this purpose.

The file is designed in the same way as the MedIC☺S file and all explanations and instructions given earlier apply.

Demand or consumption of the three most recent months is entered. A safety stock level as well as a reorder level can be chosen. After entering the stock on hand a calculated order is proposed. No backorders or stock on order is assumed.

12 ACRONYMS AND ABBREVIATIONS

APR	April
AUG	August
AVG.	Average
CALC.	Calculated
CAT	Category
DEC	December
EA	Each
EXP.	Expired
FEB	February
IS	In stock
JAN	January
JUN	June
JUL	July
MAR	March
MAY	May
NOV	November
NR	Number
OCT	October
ORD	Order
QUAN.	Quantity
SEP	September
ST	Storage / Transport
UOM	Unit of measurement

13 CHECKLIST FOR ORDERING

- Switch on the computer.
- Start Excel or open the Windows Explorer.
- Open the file used for the previous order.
- Save the file under the new name ("save as").
- Enter the order reference (number) in cell C3 of the "CALCULATION" worksheet.
- Range columns N through R from the second row until the bottom of the worksheet.
- Copy this data to columns M through Q.
- Delete all data from column R (to make space to enter the most recent monthly demand).
- Delete all data from column W ("STOCK ON HAND").
- Except for cell AD 1 delete all data from column AA ("[Date] ORDER").
- Delete the expiry dates from column AI (alternatively only the expiry dates which have changed can be updated).
- Update column J ("VALUE PER UOM") if prices have changed.
- Update columns K ("WEIGHT PER UOM") and L ("VOLUME PER UOM" if this data has changed.
- Hide all columns except columns C through H, R, W, AI and AK.
- Make a printout of the worksheet (in portrait).
- Record monthly demand, stock on hand as well as the expiry dates on the printed document by reviewing stock records.
- Enter the data into the respective columns of the "CALCULATION" worksheet. Keep the columns mentioned above hidden to prevent entry into the wrong column.
- Check all entered data for mistakes.
- Un-hide all columns which where hidden before.
- Check the parameters for the safety stock (cell U1) and reorder level (cell V1) and adjust them if necessary.
- In case the order should be based on fixed reorder levels rather than average monthly demand enter the respective reorder level in column Y ("REORDER LEVEL").
- Enter the current date (date on which the order is prepared) in cell AA1.
- Update the "STOCK ON ORDER" worksheet.
- Update the "BACKORDER" worksheet.
- Position column G to the far left of the worksheet and freeze column G.
- Check column Z ("CALC. ORDER") and enter the quantities that should be ordered in column AA (check that all figures are multiples of the "PACKING" in column AB).
- Switch to the "MONTHLY ORDER" worksheet.

- Range the worksheet for printing from the third row until the last row in which data appears for printing.

- Print the worksheet.

- Return to the "CALCULATION" worksheet.

- Copy column R (most recent monthly demand) to the respective column of the first table of the "DEMAND" worksheet.

- Copy column AN ("VALUE DEMAND") to the respective column of the second table of the "DEMAND" worksheet. Make sure to "Paste special - paste values".

- Copy column AA ("[Date] ORDER") to the respective column of the third table of the "DEMAND" worksheet.

- Copy column U ("SAFETY STOCK") to the respective column of the first table of the "STOCK" worksheet. Make sure to "Paste special - paste values".

- Copy column W ("STOCK ON HAND") to the respective column of the second table of the "STOCK" worksheet.

- Copy column AD ("COVERAGE TIME") to the respective column of the third table of the "STOCK" worksheet. Make sure to "Paste special - paste values".

- Print any data from worksheets which are needed for updating hardcopy files.

- Save the file (on the hard disk).

- Make a backup copy.

- Exit Excel.

- Switch off the computer.

14 DETAILED EXPLANATIONS

14.1 "CALCULATION" worksheet

The "CALCULATION" worksheet is the main tool of the whole application. Most of the data is entered into this worksheet and most calculations are made here.

This worksheet should be seen as q core which can be expanded downwards as well as towards the right. Any number of items (local purchase, spare parts, equipment etc.) can be added below the national standard list.

Likewise if any additional calculations are needed columns can be added to the right of the last column AW. Columns should not be added in between existing columns because some calculations rely on counting the column number. Adding columns in between will therefore disturb some features.

Only the columns C through AA are essential for calculating the order. The columns AB through AW contain additional data which is useful for inventory control and analysis of stocks.

The file was designed in a way that the essential data is placed to the left while additional columns are included to the right and can be "hidden" if they are not needed. The worksheet can therefore be customised to individual needs. However columns which are not needed should be hidden rather than deleted since some features may otherwise no longer work.

The first two rows contain the labels for the respective columns. The background is yellow to better distinguish them from the other rows. It is recommended to "Freeze titles" for these two rows. That way they will remain visible when scrolling down the worksheet.

Columns A, B and AC are hidden and are needed for some lookup functions for the monthly order as well as the shelf life calculations. They must not be deleted. In order to indicate that these columns should be hidden at all times, the background is pink. If pink columns suddenly appear this indicates that these columns have been unhidden accidentally. Simply select the columns and hide them.

Column C contains a formula which will display the category of the first item in this category in the inventory list. This sign will facilitate finding an item in a long list. This cell should not be deleted since it contains a formula.

Columns C through L contain the details of the national standard list. The order of these columns should not be changed as some features may no longer work.

All calculations are based on the most recent average demand. If demand changes considerably this will have implications for all calculations. Therefore certain parameters may change from month to month even if the stock on hand does not change.

The respective columns contain the following data:

COLUMN A - "ORDER"

This column is hidden and is needed as a link with the "MONTHLY ORDER" worksheet. A formula numbers the items which are included in the monthly order consecutively starting with 1. If the cell in column AA is empty nothing is displayed. If cell AA is not empty the number of entries are counted from the top of the column. The column or its contents must not be deleted.

COLUMN B - "EXPIRY"

Column B is also hidden and used for consecutively numbering all items for which "CHECK" appears in column AK. If the cell in column AK is empty nothing is displayed. If cell AK is not empty the number of entries are counted from the top of the entire column. The column or its contents must not be deleted.

COLUMN C - "CAT"

Column C ("CAT") contains a formula which extracts the first four letters from the item code in column F ("ITEM CODE") for the first item of the respective category.

If the inventory list is sorted by category this label will appear only in the row of the first item of the respective category. It is intended as a label which allows to locate items more quickly in a list.

COLUMN D - "ST"

This column ("ST") contains special information concerning storage and/or transport of medical items. Useful information is for example:

DG Dangerous goods. These items need a special and therefore expensive packing for shipping.

C1 Strictly controlled substances.

C2 Specific rules might exist for import of these substances. Please check local regulations.

CC Cold chain item requires cold transport and storage.

Any appropriate classification may be entered into this column.

COLUMN E - "IS"

This column ("IS") denotes items which are permanently kept in stock at a higher level and therefore are available with a shorter lead time. All other items will have to be purchased or ordered from higher level with the respective delays.

COLUMN F - "ITEM CODE"

This column contains the standard coding used in the humanitarian agency. For example the MsF coding may be used where the first character indicates the group, the following three characters the family and the remaining characters the specific item. Any other item coding may be used instead.

COLUMN G - "ITEM DESCRIPTION IN ENGLISH"

This columns contains the item description according to the standard item catalogue used within the humanitarian agency. It specifies every item as well as its dosage form and strength. For medical supplies and equipment further information (disposable, sterile etc.) may be added.

Any items which are permanently kept in stock (equipment, spare parts, instruments etc.) can be added below the national standard list. All added items should have a detailed item description (size, weight, colour etc.).

All items from the national standard list should be sorted first by their category and alphabetically within their respective category. This will allow to quickly locate any item in the inventory list.

COLUMN H - "UOM"

This column contains the. As far as possible "EA" (Each) should be used. However for selected items other UOMs such as meter, litre or kilogram may be appropriate.

COLUMN I - "PACKING"

This column contains the standard packing quantities. It should not be confused with the unit of measure. Order quantities should be multiples of the packing quantity to facilitate procurement.

COLUMN J - "VALUE PER UOM"

This column contains the value of one unit of each item in the selected currency. It is the basis for the calculations in columns AL, AM, AN and AO. Whatever currency is used it must be used consistently throughout the application. This data is is updated only if the value changes. This cell is formatted to 4 decimals as the value of a single tablet for example may be very small.

COLUMN K - "WEIGHT PER UOM"

This column contains the weight (in kilograms) of one unit of each item (including an aliquot part of the packaging). It is the basis for calculation of the columns AP, AQ, AR and AS. These data is updated only if the value changes.

In order to be able to enter the weight of very light items (like one tablet, one surgical blade etc.) the cell is formatted to 4 decimals (corresponding to a minimum weight of 100 mg). If the weight is less it will appear as 0. However when multiplied with a reasonable quantity the total weight will be accurate.

COLUMN L - "VOLUME PER UOM"

This column contains the volume (in litres) of one unit of each item from the standard list and is formatted to 4 decimals. It is the basis for calculation of the columns AT, AU, AV and AW.

COLUMN M through R - "MONTHLY DEMAND"

In these six columns the aggregate monthly demand is entered. The second row contains the abbreviation of the month ("JAN", "FEB" etc.). The aggregate demand is the total of all stock issue excluding claims (damage, theft, expiry etc.).

According to the users needs demand of only one month or up to six months can be entered. It is important that if data is entered for only three months the remaining three columns must remain blank. The formula is designed for the file to recognise into how many columns data has been entered and to calculate the average only according to the number of columns in to which data was entered. Therefore if three months of demand are entered the file will automatically divide the sum by three. If all empty columns are filled with "0" the file will assume that the demand of this month was actually zero and include these figures in its calculations which will lead to a false low average.

If less than six months of demand are entered (for example when starting a program or if demand is changing rapidly) the data should be entered as far right as possible. Therefore the columns to the left will be blank. This is important since calculations with the most recent demand will be made with data from column R only.

The blue text colour indicates that data should or can be entered into these columns.

COLUMN S - "TOTAL"

This column contains the sum of the columns M through R and is the sum of the demand of the months for which data was entered (one to six months).

If all cells from column M through R are blank, than "no data" is printed in column S.

Since the text colour is black no data should be entered into this column.

COLUMN T - "AVG."

This column calculates the average monthly demand. If columns M through R are blank, "no data" is displayed.

The sum in column S ("TOTAL") is divided by the number of months for which data is entered. The application will automatically differentiate between blank cells and cells into which "0" was entered. The average is only taken if the cells are not blank. If data is entered into four columns and two columns are blank (in case the calculation should be based on the most recent four months) the average will be calculated by dividing the total (column S) by four.

The number format is set to zero decimals. Therefore the figures contained in this column are equal to the actual average plus or minus 0.5, since only the rounded up or rounded off figures are shown. Since all items are calculated in units of one item (one tablet, vial, catheter etc.) and never in quantities of packing it should never be necessary to view decimal places. However all further calculations are based on the accurate value with all decimals.

Since the text colour is black no data should be entered into this column.

COLUMN U - "SAFETY STOCK"

This column calculates the safety stock which should be available at all times in the medical store or warehouse. It is calculated by multiplying the average monthly demand with the number of months which is chosen by the user.

The number of months of average demand is entered into the cell U1. The average monthly demand is multiplied by this parameter in every row. The parameter of the cell U1 has one decimal. This allows to adjust safety stock levels to weeks (for example 2.5 months is equal to 10 weeks).

The text colour of the cell U1 is blue which means that data should be entered into this cell. They grey background indicates that this parameter affects the calculations in column U ("Safety stock") for all items. If the figure in this cell is altered all the data in this column will immediately be updated.

Since (except for the cell U1) the text colour is black no data should be entered into this column.

COLUMN V - "REORDER LEVEL"

This column calculates the reorder level. The reorder level is calculated by multiplying the parameter in cell V1 with the average monthly demand. Calculation of the reorder level represents a forecast based on moving averages from the past months. Concerning the number format the same remarks as given for column U apply.

This parameter must consider the safety stock, review period as well as replenishment lead time. Any number of months can be entered into the cell V2. Hereby this number is the sum of number of months of safety stock, plus replenishment lead time (in months) plus review period (in months). However for practical reasons this figure must be equal or larger than the figure entered into the cell U1 since the replenishment lead time cannot be negative.

For example if 3 months of safety stock is kept, an order is placed once a month and replenishment lead time is 2 months, the reorder level is calculated by multiplying average monthly demand by 6. The stock kept to cover the review period as well as the replenishment lead time is called the working stock. The reorder level can therefore be seen as the sum of the safety stock plus working stock.

Under some circumstances it might be necessary to base the reorder level on fixed numbers rather than average demand. In this case any number can be entered into the respective cell of column V (which will deliberately erase the formula) and will serve as a basis for calculating the "CALC. ORDER". For example if an item is no longer provided to medical facilities "0" can be entered into the respective cell. This will destroy the formula which calculates the reorder level from average demand and prevent it from being reordered although demand will still be recorded for some months. In case this item has to be ordered again the formula can simply be copied from the cell above or below. Another reason for entering a fixed number might be that an item needs to be kept in stock although there is no demand (for example emergency kits).

If the formula is replaced by a fixed number the background colour should be changed to grey. This will indicate that the formula has been deleted and reorder levels are based on fixed numbers.

Since (except for the cell V2) the text colour is black no data should be entered into this column.

COLUMN W - "STOCK ON HAND"

The total quantity of stock on hand for every item is entered into this column following a physical stocktaking at the end of the month.

The total number of items with stock on hand (i.e. where the figure entered into this column was greater than 0) at the time of the physical stocktaking is displayed in cell W3. This figure can be used as an indicator for analysis of the medical stocks.

The blue text colour indicates that data should be entered into these columns and can be changed any time.

COLUMN X - "STOCK ON ORDER"

The column is linked to the "STOCK ON ORDER" worksheet. Every cell displays the sum of the quantities which have been ordered but have not arrived yet. It is identical with the content of column S "TOTAL" from the "STOCK ON ORDER" worksheet". It is vital that the inventory lists ("ITEM DESCRIPTION IN ENGLISH) match exactly. If an item is removed or added in only one worksheet, all data will shift and stock on order from the wrong item will appear in column X leading to false calculations.

The number in column X ("STOCK ON ORDER") of the "CALCULATION" worksheet is automatically updated whenever the "STOCK ON ORDER" worksheet changes.

Alternatively the stock on order can be calculated from records manually and entered into the respective cell. The formula and consequently the link to the "STOCK ON ORDER" worksheet will be destroyed. However it can be restored by copying the formula from a cell below.

Since the text colour is black no data should be entered into this column.

COLUMN Y - "BACKORDERS"

This column displays the total quantities of an item which are ordered from customers but have not been delivered because of a stockout.

This column is linked to the "BACKORDER" worksheet. The formula sums up the quantities in column D ("QUANTITY") of the "BACKORDER" worksheet for every item. The calculations are made by adding the quantities in column D ("QUANTITY") for the respective item code in column F ("ITEM CODE") of the calculation worksheet. It is therefore essential that whenever backorders are entered, the same code as in the "CALCULATION" worksheet is used. The item description entered into column B ("ITEM DESCRIPTION IN ENGLISH") of the "BACKORDER"

worksheet has no effect on the calculations whatsoever. The assumption was made, that errors in the item codes are less likely to occur than in the longer item descriptions. To avoid miscalculations, the item codes should be copied from the respective row of the "CALCULATION" worksheet to the respective cell of the "BACKORDER" worksheet.

Considering backorders in the order quantity is vital. Otherwise backorders will be filled from the safety stock which can quickly and repeatedly lead to stockouts.

Since the text colour is black no data should be entered into this column.

COLUMN Z - "CALC. ORDER"

This column proposes an order quantity for every item. This quantity is calculated by subtracting the stock on hand as well as stock on order from the reorder level and adding the backorders.

QO = Dm x (SS + LT + PP) - SH - SO

QO = quantity to order

Dm = average monthly demand

SS = safety stock (expressed in months of average demand)

LT = replenishment lead time

PP = review period

SH = stock on hand

SO = stock on order ("pending")

If the calculated number is positive (that means if this item has to be ordered) the cell background will turn light green. If the number is negative (which means that the stock on hand plus stock on order plus backorder is more than the stock on hand already) then the cell will remain blank. Therefore it is immediately obvious which items have to be ordered and which not.

The calculated order can be negative even if a stockout has occurred if large quantities of stock are on order. Likewise the calculated order may be positive even if the stock on hand is far larger than the safety stock if there are large backorders.

The figures in this column are calculated exactly and not rounded up or off (except for the decimals) since they are derived from mathematical formulas. They will therefore require some adjustment to comply with packing quantities.

Since the text colour is black no data should be entered into this column.

COLUMN AA - "[Date] ORDER"

This column contains the quantities which the user decides to actually order, based on the calculated order in column Z ("CALC. ORDER").

The date on which the order is made is entered into the cell AA1. This date will later appear on the printout but is also the basis of calculation for the expiry dates. The format of this date is DD.MM.YY (day/month/year). Only two digits should be entered for the year.

After entering the order date the calculated quantity (column Z) for every item is checked. The user needs to consider whether the calculated order quantity is appropriate or needs to be adapted to expected changes in demand.

Since there are many considerations which determine the amount the user wants to order the actual order quantity will have to be entered manually. For example if an item has been cancelled from the inventory list but there has been demand until recently the "CALC. ORDER" will contain a figure. Nevertheless the user will actually enter a "0" order.

It also might be the case that reduction in the demand is expected for example if assistance to a health facility is being terminated in the near future. In this case the corrected order will be reduced according to these considerations.

Conversely a sharp increase in demand might be expected due to an active front line or increase of assistance. Then the respective number for the corrected order must be increased.

Some items might be kept in stock even if there is zero demand for a long time for example emergency kits, emergency drugs or spare parts.

The calculated order quantities need to be rounded up or off according to the packing quantities displayed in column AB ("PACKING").

To improve the overview it is advisable to leave cells blank when no order for the respective item is placed rather than entering "0". All items where "0" is entered in column AA will (unnecessarily) appear in column H ("[Date] order") of the "MONTHLY ORDER" worksheet.

The blue text colour indicates that data should or can be entered into these columns and changed any time. Since this column is the aim of the whole application and will be printed on the monthly order the values are bold.

COLUMN AB - "PACKING"

This column is meant to facilitate work of the supplying medical store. Some tablets are packed in 100, 500 or 1,000 and other medical products may come in any kind of odd numbers.

When the corrected order is entered all quantities should be a multiple of the quantities printed in column AB "PACKING".

However these quantities can change and an item might even be delivered in different packing quantities in the same shipment or at different times. However it will in general facilitate the work of the supplying medical store as original packing does not have to be (and should not) be opened during order picking.

COLUMN AC - "Stock shortage"

This column is hidden, is needed for calculating the indicator "Items with stock on hand less than safety stock" and should not be deleted. For technical reasons this indicator cannot be calculated directly from AD ("Coverage time"). To indicate that this column should remain hidden the background is pink.

COLUMN AD - "Coverage time"

This column divides the stock on hand by the average monthly demand. The coverage time is the number of months stock can be issued until a stockout occurs, provided that monthly demand does not change and no stock is received.

If average demand increases during the next month the coverage time will decrease even if the stock on hand has not change. Likewise if average demand decreases during the next month the coverage time will increase even if the stock on hand has not changed.

The idea behind this column is that absolute numbers (like stock on hand) have less meaning than the coverage time which can be directly related to the desired safety stock and allows to quickly identify shortages and overages.

This column is very valuable for checking the stock and determining which items must be ordered urgently or where stock on order has to be requested for urgent shipment. If there has been demand of an item at least once during the months which are used for calculating the average demand and the coverage time is less than half a month then "0" will appear. If there never has been demand during the past months then the cell will remain blank. This is to distinguish between zero stock of items which are needed (and therefore must be ordered urgently) and items which do not need to be ordered because there was no demand.

The figures in this column are integers. Although the figures are calculated exactly only the rounded figures are shown for simplicity and better overview.

This column is also valuable to detect items which are over-stocked, because too much was ordered or because demand has dropped. For these items there is a great danger that they will expire in the medical store or warehouse. Therefore all items with more than 12 to 18 months of stock must be exactly checked for their expiry date.

If there is no problem with delivery and the stock is managed perfectly all figures in this column should be very close to the safety stock parameter chosen in cell U1 ("SAFETY STOCK").

The data from this column is the basis for the coverage time graph in the "INDICATORS" worksheet which will be explained below.

Since the text colour is black no data should be entered into this column.

The third row of this column contains a formula which calculates the number of stockouts.

COLUMN AE - "On order Coverage"

This column divides the total stock on order by the average monthly demand. This is useful to calculate whether this item has to be ordered or not. If the stock on hand for a specific item is low but the "On order Coverage" is high an inquiry should be made about the stock on order rather than placing an additional order. This column will also give a quick overview of all items with large quantities of stock on order and priority delivery might need to be requested.

If the sum of column AD ("Coverage time") and AE ("On order coverage") is less than the reorder level selected in cell V1 ("REORDER LEVEL"), then this item must be ordered.

Since the text colour is black no data should be entered into this column.

COLUMN AF - "Order coverage"

Similar to columns AD ("Coverage time") and AE ("On order coverage") this column divides the corrected order (column AA) by average monthly demand. It shows for how many months the ordered stock would last provided that demand does not change.

This feature is intended as a double check for the order in column AA. In a perfect steady state inventory control system, this figure is always 1. If it is lower, then demand might have decreased or too much stock was ordered previously. If the figure is larger than 1, then demand has increased or a mistake was made when entering the calculated order in column AA.

Since the text colour is black no data should be entered into this column.

COLUMN AG - "Total Coverage"

This column calculates the sum of the previous three columns AD ("Coverage time"), AE ("On order Coverage") and AF ("Order coverage").

In a perfect stead state inventory control system, this figure should be equal to the parameter for the reorder level chosen in cell V1. If the figure is lower, than the recent

corrected order (column AA) is too small and should be corrected unless there is a special reason for not ordering. If the figure is larger than the reorder level, then the recent corrected order (column AA) is too large and should be reduced or there are backorders to be considered.

It is worthwhile to check this column after completing the order to double check and find gross errors in the corrected order. Especially when 10,000 are ordered instead of 1,000 (or vice versa) these kinds of mistakes will quickly be detected.

Since the text colour is black no data should be entered into this column.

COLUMN AH - "Coefficient of variation"

This column is meant to give some information on the consistency and regularity of demand. The standard deviation of monthly demand (columns M through R) is divided by the average monthly demand (column T) and expressed in percent. A coefficient of variation of "0" means that demand was equal every month. The higher the coefficient of variation the more irregular demand is. The coefficient of variation can by definition not exceed the square root of the number of the observations used for calculating the standard deviation. For example if six months of demand are used the maximum coefficient of variation can be Å6 or 245%.

This information is helpful for determining order quantities (corrected orders). If demand is very regular then calculation of the order and keeping sufficient safety stocks is easy. But the higher demand fluctuations (and therefore the coefficient of variation) are the more difficult predicting future demand becomes.

Therefore for items with regular demand (low coefficient of variation) safety stocks can be kept lower while additional safety stocks are needed for items with a high coefficient of variation.

A parameter can be entered into cell AH3. Any coefficient of variation greater than this parameter will appear with a red background.

COLUMN AI - "EXPIRY DATE"

The expire date of the batch with the shortest shelf should be entered into the respective cell of this column.

This expiry date will be used to make a pre-selection of items based on the "worst case scenario" that all batches have the same expiry date as the batch with the shortest shelf life.

This is a compromise to reduce the complexity of the "CALCULATION" worksheet. It would of course be possible to enter all individual quantities with their respective expiry dates. However this would require much (unnecessary) work and make the worksheet more complex. Moreover experience shows that in a well managed stock less than 10% of items will require more detailed shelf life calculations.

The format of the date is DD.MM.YY (day/month/year). If no day of expiry is stated the last day of the respective month should be entered.

A date can be entered into cell AI3. Any expiry date prior to this date will appear with a red background. This can be used to determine all items with an expiry date before a chosen date.

The blue text colour indicates that data should or can be entered into these columns and changed any time.

COLUMN AJ - "SHELF LIFE"

The figure in this column indicates in how many months the item will expire. The date in column AA1 (the date of ordering) is simply subtracted from the entered expiry date ´(column

AI) of the respective item. This again under the assumption that all batches of an item expire on the same date.

If no stock is entered or issued then the "SHELF LIFE" will decrease by the value of 1 every month. The "SHELF LIFE" therefore does not depend on stock issues and average demand.

A parameter can be entered into cell AJ3. Any item with a shorter shelf life than this parameter will appear with a red background. This can be used to determine all items with a shelf life shorter than a chosen shelf life.

Since the text colour is black no data should be entered into this column.

COLUMN AK - "CHECK"

If no expiry date is entered in column AI ("EXPIRY DATE") or the stock on hand (column W) is zero this cell remains blank.

The cell in this column will also remain blank if the coverage time (column AD) is less than the shelf life (column AJ) expressed in months. This means that if average demand does not change the stock will be depleted before the date of expiry and the whole stock will be used (distributed) before it expires. The assumption is made that until the date of expiry no stock with shorter shelf life will be entered into the stock.

If the coverage time (column AD) is greater than the remaining shelf life (column AJ) expressed in months then the caption "CHECK" will automatically appear in the respective cell. As mentioned above if the whole stock of this item has the same expiry date and demand does not increase then some of the stock will expire in the medical store or warehouse before it is issued.

All items for which "CHECK" appears will automatically be transferred to the "EXPIRY DATES" worksheet for more detailed calculations.

It must be stressed that even if "CHECK" does not appear there is still a danger of items expiring in the medical warehouse if demand decreases. f demand increases there will of course be less danger of items expiring in the medical warehouse.

It is important to note that these calculations only consider the danger of expiry in the medical warehouse until items are issued. However even if an item has not expired when it is distributed possibly only a few days of shelf life remain. Depending on the size of the safety stock in the assisted health facility this may lead to expiry of items in this health facility.

Since the text colour is black no data should be entered into this column.

COLUMNS AL, AM, AN and AO - "VALUE"

In these columns the value of the stock on hand, stock on order, monthly demand (most recent month) as well as the corrected order is calculated for each item. These calculations are based on indicative (average) values as the actual prices may be different for different batches.

The total value is indicated in the third row of the respective column. This is useful for knowing the value of the order, insurance of stocks and to know the value of stock issued during the past month.

Since the text colour is black no data should be entered into this column.

COLUMNS AP, AQ, AR and AS - "WEIGHT"

These columns will automatically calculate the total weight (in kilograms) of the stock on hand, stock on order, monthly demand (most recent month) as well as the corrected order for every item. The total weight of all items is indicated in the third row of the respective column.

The weight of the stock on hand is useful for monitoring stock levels. The total weight of stock on order might be useful for a medical warehouse which can be only supplied by air to know immediately how many rotations will be necessary for stock replenishment.

Since the text colour is black no data should be entered into this column.

COLUMNS AT, AU, AV and AW - "VOLUME"

In these columns the volume (in litres, 1 litre = 1 dm3) of the stock on hand, stock on order, monthly demand (most recent month) as well as the corrected order is calculated for each item. The total volume is indicated in the third row of the respective column.

These volumes are useful for monitoring stocks and determining necessary storage capacities as well as for estimating necessary transport capacities for stock replenishment.

Since the text colour is black no data should be entered into this column.

14.2 "STOCK ON ORDER" worksheet

COLUMN A through F

Columns A through F contain the inventory list (national standard list).. The contents of these columns is identical with the columns C through H of the "CALCULATION" worksheet.

The row number of each item must correspond exactly to the row number in the "CALCULATION" worksheet.

COLUMN G through R

These columns contain a record of all quantities of items which were ordered in the previous months but not delivered yet.

The order reference (number) of the respective monthly order (or additional orders) is entered in the second row and the date of ordering in the third row to unambiguously identify the orders.

After the monthly order is completed and the file is saved under a new name, column AA ("[Date] ORDER") is copied into the next empty column of the "STOCK ON ORDER" worksheet. When the order is placed all items are on order.

Before making the next monthly order all monthly orders which have not been completely filled yet must be checked. All items which were ordered and have arrived must be deducted from the respective cell of the item. If the whole ordered quantity has arrived the cell contents should be deleted (rather than entering a "0"). If partial shipments are received the quantities which have already arrived are deducted. Only the stock on order should remain.

When all items of an order have arrived the column can be deleted or the stock on order from the other columns can moved to the left which will over-write the empty column.

The sum of all stock on order from all outstanding orders is calculated in column S ("TOTAL"). This figure is automatically transferred to column X ("STOCK ON ORDER") of the "CALCULATION" worksheet and is automatically updated whenever quantities in the "STOCK ON ORDER" worksheet are changed.

At the end of the table the total number of ordered line items is entered into the cell with the grey background manually.

In the row below the number of outstanding line items is calculated for each order automatically.

Finally in the row below the order completion rate for each order is calculated. When the order is filled, the order completion rate is 100%.

14.3 "BACKORDER " worksheet

Unlike the other worksheets, the "BACKORDER" this worksheet contains only only essential item data, namely item code, item description, UOM and backordered quantity rather than the entire inventory list.

This worksheet records all items which were ordered from customers but have not been delivered yet. This could be because of a stockout at the medical store or because non-stock items were ordered.

This worksheet serves two important purposes. First it keeps a record of all backordered items, regardless whether they are stock or non-stock items. This ensures that eventually all orders are completely filled.

Secondly, the backordered stock items (items contained in the inventory list) are important for calculating monthly replenishment orders correctly.

For every order received from a customer, a record is established if the order was not completely filled from stock immediately.

Example of a backorder record for an individual customer. [update with Excel]

For each order the header (grey background) contains the customer (column B), the order reference (number) (column C and D) as well as the date of the order (column E).

Below the header any number of items can be listed. Columns A through D contain the item code (column A), item description in English (column B), unit of measure (column C) as well as the backordered (outstanding) quantity. The items can be entered in any order but preferably alphabetically within categories. However the formula in the "CALCULATION" worksheet will search the entire worksheet and calculate the total corresponding to each item code regardless of the order of items. Note that if partial deliveries were made already, only the backordered items should be entered into column D ("QUANTITY").

The date on which the respective item was ordered from the supplying medical store is entered into column E ("ORDERED"). The item might be on order already, be ordered immediately or be included in the next monthly order. Before preparing an order to the supplying medical store, column E must be checked to find all items which have not been ordered yet.

When the last item has been delivered, the record for the respective customer can be deleted.

In column G ("BO TIME") the number of days since the customer placed the order are counted. This value increases by one every day until the line is delivered to the customer. Note that an item code must be entered into column A ("ITEM CODE") for every item otherwise the calculations will not work.

14.4 "MONTHLY ORDER " worksheet

This worksheet converts the "corrected order" from column AA ("[Date]Order") of the "CALCULATION" worksheet into a user-friendly format by eliminating all line items from the inventory list which are not ordered this month. This worksheet can be printed and attached to a order instead of copy/pasting all information or even writing an order by hand.

All data in the worksheet (including the headers) is automatically transferred from the "CALCULATION" worksheet. Because there is no need to enter any data the whole worksheet is protected.

COLUMN A - "NR"

This column numbers the line items of the monthly order. This is useful for counting the number ordered line items as well as for further reference. Nothing should be entered into this cell since it contains a formula.

COLUMN B through G

Columns B through G contain the data corresponding to the inventory list in the same order as in the "CALCULATION" worksheet. The contents of these columns is identical to the columns C through H of the "CALCULATION" worksheet.

COLUMN H - "ORDER"

This column contains the quantities entered into the "corrected order" column (column AA) of the "CALCULATION" worksheet.

The total value of the order is printed in cell H3.

COLUMN I - "RECEIVED"

This column is empty but printed to allow the follow-up of monthly orders.

A physical copy of the monthly order is kept in the files. Whenever an item arrives the date as well as the packing list number is written into this column manually with a pen. If an item is delivered in several partial shipments, each of these partial shipments needs to be recorded.

At the end of the month this record is used to update the "STOCK ON ORDER" worksheet.

14.5 "EXPIRY DATES " worksheet

This worksheet is used for detailed shelf life calculations. The current date is automatically displayed in cell E1.

After entering all data in the "CALCULATION" all items which need further analysis of their remaining shelf life will automatically appear in the "EXPIRY DATE" worksheet. A printout is given to the warehouse manager for entering the expiry dates of all batches of the concerned items. It is important to enter all batches in chronological order of their expiry dates, that means the batch which will expiry first is entered on the left. Otherwise all calculations will be wrong.

COLUMN A - "Row count"

This column is hidden and contains a formula for numbering the rows. It is needed for the lookup function and must not be deleted. The background colour is pink to indicate that this column should remain hidden.

COLUMN B through G

Columns B through G contain the specifications of the respective items according to the inventory list in the "CALCULATION" worksheet. The contents of these columns is identical to the columns C through K of the "CALCULATION" worksheet.

The data of all items for which "CHECK" appears in column AK ("CHECK") of the "CALCULATION" worksheet automatically appears in these columns.

COLUMN H - "AVG."

The average monthly demand from column T ("AVG.") of the "CALCULATION" worksheet appears in this column. This average demand is the basis for all further calculations.

COLUMN I - "STOCK ON HAND"

The stock on hand from column W ("STOCK ON HAND") of the "CALCULATION" worksheet appears in this column. The sum of all batches should be equal to this quantity.

COLUMN J - "QUAN."

The quantity of the first batch (according to a physical stocktaking) is entered.

The text colour is blue indicating that data should be entered into this cell.

COLUMN N - "DATE"

The expiry date of the batch with the shortest remaining shelf life is entered.

The blue text colour indicates that data should be entered into this cell.

COLUMN O - "EXP."

The formula in this cell calculates the quantity of the respective batch which would expiry if the average monthly demand does not change in future and no stock is received at the medical store (if more stock with the same expiry date arrive, the quantities which may expiry will increase).

If the entire batch will be used before it expires, "OK" is displayed. Otherwise only the quantity which will (or would) expire appears.

Every formula takes the quantities which will be used of all batches into consideration. Therefore if part of a batch with an earlier expiry date will expiry before use, more of the batch with the next expiry date will be used etc.

If after checking the stock the warehouse manager concludes that the respective item cannot be consumed before it expires it can be distributed, donated or returned to the supplying medical store, possibly for transfer to another programme.

COLUMN M through AM

These columns are identical with columns J through L and allow to enter up to 10 batches of the same item.

COLUMN AN - "VALUE EXP."

These columns calculates the value of the quantities which would expiry, provided that no measures are taken. The total value of all items which will (would) expire appears in cell AN3.

14.6 "INDICATORS " worksheet

This worksheet contains a table as well as some graphs with key performance indicators.

The first two columns are protected to avoid accidental deletion or damage.

The indicators based on the current worksheet and the most recent data (stock on hand, backorders) etc. are calculated in column B.

The indicators for "Service received" should be copy/pasted into the respective column of the month before entering other data. Otherwise the current monthly order will be considered in the stock on order and distort service measurements.

All other indicators are calculated after all data is entered and an order has been prepared.

Only indicators which can be calculated from data already entered in MedIC☺S are considered.

"SERVICE RECEIVED" TABLE

The number of line items on order is a crude indicator for the replenishment lead time. If the replenishment lead time is always less than one month, this value should be zero.

The total weight of stock on order allows to estimate future workload for receiving goods as well as planning for storage space.

The average order completion rate gives a good indication of the overall replenishment lead time. If the replenishment lead time is less than one month, this average will be 100%.

"STOCK MANAGEMENT" TABLE

The number of line items in stock gives an indication of the complexity of stock management. It also allows to monitor changes and make sure that the number of items in stock (which tends to increase over time) does not get out of hand.

The items on hand with a stock level less than the safety stock are an indicator for the quality of management of the inventory control system. Ideally this number should be zero.

The value of stock on hand is useful for monitoring and ensuring that the stock value (and therefore the risk) are in a reasonable relationship to the provided service.

The annual rate of turnover corresponds to the number of "stock turns". The higher the rate of turnover the shorter items are kept in stock. A low rate of turnover carries the risk of expiry in the warehouse and also indicates holding unnecessary high stocks. Annual turnover is calculated by dividing the total value of annual stock issues by the total current stock value.

The weight and volume of stock on hand gives an indication of the physical size of the stock.

The value of goods in danger of expiry is a good indicator for management of stock rotation. Ideally this value should be zero.

"CUSTOMER SERVICE" TABLE

The value and weight of monthly demand give an indication of the workload at the medical store.

The number of backordered lines is a good indicator of the quality of inventory control and customer service. Every line is counted. Therefore if several customers have the same item backordered, it is counted as a backordered line for every customer. All backorders are considered whether for stock or non-stock items.

The number of backordered line items counts all items which are backordered to at least one customer. The number of backordered line items from the inventory list corresponds to the number of stockouts.

The average backorder time gives a good indication of how long customers have already been waiting. This indicator should be used in conjunction with the number of backorders.

A stockout is considered whenever an item from the inventory list is backordered. Backorders for items which are not general stock (permanently kept in stock) are not counted as a stockout. Moreover items which are usually kept in stock but are currently out of stock are not considered as a stockout if no customer has ordered this item. Although all items which should be in stock but are currently out of stock are relevant for monitoring the quality of inventory control, for the customer they are of no interest unless they are needed.

"COVERAGE TIME" GRAPH

This graph is a graphic representation of column AD ("Coverage time") of the "CALCULATION" worksheet.

It allows to immediately visualise the number of stockouts as well as the number of items which are under-stocked or over-stocked.

Ideally a high peak will appear near the desired safety stock level (entered in cell U1 of the "CALCULATION" worksheet).

The flatter the curve is, the poorer the inventory control.

"LINE ITEMS ON ORDER" GRAPH

This graph gives an overview of the number of line items on order as well as the length of time they have been on order. It allows to determine the maximum replenishment lead time.

"COEFFICIENT OF VARIATION" GRAPH

The coefficient of variation and is a measure for the "erraticness" of demand. It actually gives an indication of the quality of inventory control of customers and the regularity of their orders.

The smoother demand, the easier inventory control is to manage. If demand is constant forecasts could be made with hundred percent accuracy.

This graphs shows the number of items within a range of "erraticness" in percent. Ideally the graph will display a sharp peak on the far left. If the peak is shifted to the right, demand is very irregular and measures to smooth demand should be taken.

"BACKORDER TIMES" GRAPH

The number of backordered lines or line items in the third table do not give any indication of how long customers are waiting. The average backorder time does not give any indication of the longest backorder time.

This graph shows the maximum backorder time and the number of lines backorder for one, two, three etc. weeks. The graph displays backorder times of up to 6 months.

14.7 "DEMAND " worksheet

This worksheet is intended as archives for various data. It ensures, that the most recent MedIC☺S file contains all data from the beginning of the year. The overview also allows analysis of various data.

When the monthly order has been prepared, data from the respective columns of the "CALCULATION" worksheet are copied into this worksheet.

COLUMN A through F

Columns A through F contain the inventory list. The contents of these columns is identical to the columns C through H of the "CALCULATION" worksheet.

COLUMN G through R - "OVERVIEW OF MONTHLY DEMAND"

The monthly demand of the most recent month is copied from column R of the "CALCULATION" worksheet into the respective column. The column header in row two denotes the month.

This table allows to analyse and monitor monthly demand and detect increases and decreases in demand.

COLUMN S - "TOTAL"

The sum of monthly demand since the beginning of the year is calculated.

This column contains a formula and therefore no data should be entered.

COLUMN T - "AVG."

The average monthly demand since the beginning of the year is calculated.

This average is calculated by dividing the total demand since the beginning of the year by the number of months for which data is entered.

This column contains a formula and therefore no data should be entered.

COLUMN U

This column is kept empty on purpose to separate the tables.

COLUMN V through AG - "VALUE OF STOCK ISSUES"

The value of the most recent demand is copied from column AN of the "CALCULATION" worksheet. For copying this data it is vital to "Paste special - paste values".

The total value of stock issued during every month is displayed in the third row of the respective column. It is useful for monitoring the value of issued stock.

COLUMN AH - "TOTAL"

The total value of the distributed quantities for each item since the beginning of the year is calculated.

This column contains a formula and therefore no data should be entered.

COLUMN AI - "AVG."

The average value of monthly demand for each item since the beginning of the year is calculated.

This column contains a formula and therefore no data should be entered.

COLUMN AJ

This column is kept empty on purpose to separate the tables.

COLUMN AK through AV - "MONTHLY ORDERS"

The corrected monthly orders are recorded.

This table is useful as a reference and allows to monitor the regularity of orders.

COLUMN AW - "AVG."

The average monthly order quantities are displayed for each item.

This average is calculated by dividing the sum of all monthly orders for each item since the beginning of the year by the number of monthly orders (which corresponds to the number of columns for which data is entered in the first table). Even if cells in one row are blank the total ordered quantity is divided by the number of monthly orders rather than the number of times this line item was ordered.

This column contains a formula and therefore no data should be entered.

14.8 "STOCK " worksheet

Like the "DEMAND WORKSHEET" this worksheet contains archives of various data. It ensures, that the most recent MedIC☺S file contains all data since the beginning of the year. The overview also allows analysis of various data.

After the monthly order has been prepared, data from the respective columns of the "CALCULATION" worksheet are copied into this worksheet.

COLUMN A through F

Columns A through F contain the inventory list. The contents of these columns is identical to the columns C through H of the "CALCULATION" worksheet.

COLUMN G through R - "OVERVIEW OF SAFETY STOCK"

The safety stock calculated in column U ("SAFETY STOCK") of the "CALCULATION" worksheet is copied into this table. It is important to "Paste special - paste values".

The column header in row two denotes the month.

This table is allows to analyse changes in the calculated (!) safety stock levels.

COLUMN S - "AVG."

The average safety stock since the beginning of the year is calculated.

This column contains a formula and therefore no data should be entered.

COLUMN T

This column is kept empty on purpose to separate the tables.

COLUMN U through AF - "OVERVIEW OF STOCK ON HAND"

Data from column W ("STOCK ON HAND") from the "CALCULATION" worksheet is copied into this table.

This table allows to analyse fluctuations in actual stock levels.

COLUMN AG - "AVG."

The average stock on hand is calculated by dividing the total since the beginning of the year by the number of months for which data is entered.

This column contains a formula and therefore no data should be entered.

COLUMN AH

This column is kept empty on purpose to separate the tables.

COLUMN AI through AT - "OVERVIEW OF COVERAGE TIME"

Data from column AD ("Coverage time") is copied into this table. For copying this data it is vital to "Paste special - paste values".

The stock on hand is expressed in multiples of average monthly demand rather than absolute figures.

COLUMN AU - "AVG."

The average stock on hand (expressed in multiples of monthly demand) is displayed.

This average is calculated by dividing the sum of the coverage times since the beginning of the year by the number of months for which data has been entered.

This column contains a formula and therefore no data should be entered.

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15 EXPLANATION OF FORMULAS

15.1 "CALCULATION" worksheet

It must be stressed that in order to enter data and make orders it is not at all necessary to understand the underlying formulas or even know about them. However for the sake of completeness, transparency as well as for interested users the formulas of each column are explained below. These explanations may also be helpful in case a user would like to add some features.

Throughout the following explanations the formula as in the first row of the respective column where calculations are made will be printed. All formulas in cells of the same column are identical except for the row number. Where different formulas are used in a column (mainly for calculating indicators in the top rows), this will be stated separately.

COLUMN A

=IF(AA4="","",COUNT($AA$4..$AA4))

The formula checks whether the respective cell in column AA is empty. If the cell in column AA is empty the cell remains blank. If the cell in column AA contains an entry, the number of entries in column AA starting from row 4 is calculated.

The formula in the second row (=MAX(A4:A300)) calculates the largest number in the column below which determines the total number of line items included in the monthly order.

The formula is used for the lookup function in the "MONTHLY ORDER" worksheet.

COLUMN B

=IF(AK4="CHECK",COUNTIF($AK$4:$AK4,"=CHECK"),"")

The formula checks whether the caption "CHECK" appears in column AK. If not, then the cell remains blank. If "CHECK" appears, then the number of cells in which the caption "CHECK" appears is counted starting from row 4.

The formula in the second row (=MAX(B4:B300)) calculates the largest number in the column below which determines the total number of line items which require further analysis in the "EXPIRY DATES" worksheet.

This formula is used for the lookup function in the "EXPIRY DATES" worksheet.

COLUMN C

=IF(F4="","",IF(F3="",LEFT(F4,4),IF(LEFT(F3,4)=LEFT(F4,4),"",LEFT(F4,4))))

The formula returns the first four letters of the item code (column F) if the category of the item in the row above is different from the category of the item in the respective row. The category is defined as the first four characters of the item code. If more or less characters denote the category, the number (currently 4) can be changed accordingly.

Therefore a label is displayed in this column whenever a new category starts. This function works only if all items are sorted by category and alphabetically within the category.

COLUMN S

=IF(COUNT(M4:R4)=0,"no data ",SUM(M4:R4))

If columns M through R are blank, "no data" is displayed. If data is entered in at least one of these columns the total demand of the past months is calculated.

The total is calculated by adding the monthly demand from columns M through R.

COLUMN T

=IF(COUNT(M4:R4)=0,"no data ",AVERAGE(M4:R4))

If columns M through R are blank, "no data" is displayed. If data is entered in at least one of these columns the average is calculated.

The average is calculated by dividing the total by the number of columns for which data is entered. If cells are left blank the formula will consider only non-blank cells for calculation of the average.

COLUMN U

=IF(COUNT(M4:R4)=0,"no data ",T4*$U$1)

If columns M through R are blank, "no data" is displayed. The average demand from column T is multiplied by the parameter entered in cell U1.

COLUMN V

=IF(COUNT(M4:R4)=0,"no data ",T4*$V$1)

The average demand from column T is multiplied by the parameter entered in cell V1.

COLUMN W

=COUNTIF(W$4:W$1000,">0")

This formula is contained only in the third row of the column. It counts the number of all cells which contain numbers greater than zero. This corresponds to the number of line items for which stock is available. This parameter is used in the "INDICATORS" worksheet.

COLUMN X

='STOCK ON ORDER'!$S4

The cell content from column S of the "STOCK ON ORDER" worksheet is copied. There is no lookup function therefore the contents of the cell with the same row number is transferred.

COLUMN Y

=SUMIF(BACKORDER!$A$4:$A$1000,F4,BACKORDER!$D$4:$D$1000)

This formula looks up all items with the item code from column F in the "BACKORDER" worksheet and adds the contents of column D ("QUANTITY").

This allows items to be entered in any order and several times in the "BACKORDER" worksheet. Wherever the item code is entered, the corresponding quantities are added up to give the total number of backorders for this individual item.

The formula in the third row (=COUNTIF(Y$4:Y$1000,">0")) calculates the number of backordered line items and is used in the "INDICATORS" worksheet.

COLUMN Z

=IF(COUNT(M4:R4)=0,"",IF(V4-W4-X4+Y4<0.5,"",V4-W4-X4+Y4))

If no data is entered into columns M through R then the cell remains blank. The assumption is made that if there has been no demand during the past six months there is no need to calculate a replenishment order. The number format of the "CALC. ORDER" is set to zero decimals. Therefore any calculated order less than 0.5 will appear as "0". Therefore the formula calculates whether the calculated order is less than 0.5. If this is the case the cell

remains empty. The assumption is made that it is not worthwhile to order such small quantities especially since the unit of measure for almost all items will be each.

If there has been demand at least once during the past six months and the calculated order is larger than 0.5, then the "calculated" order is calculated by subtracting the stock on hand (column W) as well as stock on order (column X) from the reorder level (column V) and adding the backorders (column Y),

The conditional formatting is set to change the background to green whenever the cell value is between 0 and 100000000000. The upper limit is a technicality. If the condition is simply set to change the background whenever the cell value is larger than 0, it will also change if the cell remains blank.

COLUMN AA

=COUNTIF(AA$4:AA$1000,">0")

This formula is contained only in the third row of the column. It counts the number of all cells which contain numbers greater than zero. This corresponds to the number of line items which are being ordered and which will appear in the "MONTHLY ORDER" worksheet.

COLUMN AB

+I4

The packing quantities are copied from column I to eliminate the need for moving back and forth when determining the corrected order quantities.

COLUMN AC

=AD4-$U$1

This column was added to overcome the problems of counting values in a column which also contains text such as "Stockout" etc. This column should remain hidden.

The safety stock level (cell U1) is subtracted from the coverage time. Any value less than zero indicates that the stock on hand is less than the desired safety stock.

The number of line items with a value less than zero (coverage time is less than desired safety stock) are counted in the third row of the column (=COUNTIF(AC$4:AC$1000,"<0")). This parameter is used in the "INDICATORS" worksheet.

COLUMN AD

=IF(COUNT(M4:R4)=0,"",IF(W4=0,"Stockout",W4/T4))

The formula first checks whether columns M through R contain any entries. If all cells are blank the cell in column AD remains blank. In this case there is no average demand and the calculation of the coverage time becomes meaningless. This check is included to avoid error messages.

If there is at least one entry in columns M through R and stock on hand (column W) is equal to zero than the caption "Stockout" appears.

If the stock on hand is greater than zero, than the coverage time is calculated by dividing stock on hand (column W) by the average monthly demand (column T).

Only the third row of the column contains a formula (=COUNTIF(AD$4:AD$1000,"=Stockout")) which counts the number of stockouts. This parameter is used in the "INDICATORS" worksheet.

The conditional formatting changes the background of the cell to red in all cells in which "Stockout" appears.

COLUMN AE

=IF(X4=0,"",X4/T4)

If stock on order (column X) is zero, than the cell remain blank. Otherwise the "on order coverage" will be calculated by dividing the order quantity by average monthly demand.

COLUMN AF

=IF(COUNT(M4:R4)=0,"",IF(AA4="","",AA4/T4))

If columns M through R are blank, the cell remains blank as well. The assumption is made that if there has been no demand during the past six months there is no need to place an order. This check is included to avoid error messages.

If cell AA ("[Date]ORDER") is empty than the cell remains blank. If no order is placed calculating the order coverage is meaningless.

Otherwise the order (column AA) is divided by average monthly demand (column T).

COLUMN AG

=IF(COUNT(M4:R4)=0,"",SUM(AD4:AF4))

If columns M through R are blank, the cell remains blank as well. Otherwise the sum of columns AD ("Coverage time"), AE ("On order coverage") and AF ("Order coverage") is calculated.

If the value in the respective cell is less than the reorder level (cell V1) the background colour will change to red. This indicates that the order is too small and should be reviewed.

COLUMN AH

=IF(COUNT(M4:R4)=0,"",STDEV(M4:R4)/T4*100)

If columns M through R are blank, the cell remains blank as well as in this case no standard deviation can be calculated. Otherwise the coefficient of variation is calculated by dividing the standard deviation of the monthly demand (columns M through R) by the average monthly demand (column T). This value is multiplied by 100 to convert it into percent.

Any parameter can be entered into cell AH3. The conditional formatting of the cells in this column will change to red whenever the value is larger than the parameter in cell AH3. This allows to identify items with a large coefficient of variation which require special attention when considering the quantity to order.

COLUMN AI

The third cell allows to enter any date. Whenever a date entered into any cell below is before this date, the background will change to red.

This conditional formatting allows to quickly identify any items with a near expiry date.

COLUMN AJ

=IF(AI4="","",(AI4-$AA$1)/30)

If no expiry date is entered into the cell in column AI then the cell remains empty. Otherwise the remaining shelf life (in months) is calculated by subtracting the expiry date (column AI) from the date of ordering (cell AA1) and dividing it by 30 days to convert it into months.

Any parameter can be entered into the cell AJ3. If the remaining shelf life of any item is less than this parameter, the background will change to red. This allows to quickly identify all items with a remaining shelf life of less than a specified number of months.

COLUMN AK

=IF(AI5="","",IF(W5=0, "",IF(AD5>AJ5,"CHECK","")))

If no expiry date is entered into column AI then the cell remains blank as expiry date calculations would be meaningless. If the stock on hand (column W) is zero then the cell also remains blank. In this case the expiry date must have been entered by accident as expiry date calculations are meaningless without any stock on hand.

Otherwise the remaining shelf life (column AJ) is compared with the coverage time (column AD). If the coverage time (column AD) is greater than the remaining shelf life in months (column AJ), then the caption "CHECK" appears in bold letters. The background will automatically change to red through conditional formatting. Otherwise the cell remains blank.

All item data for which "CHECK" appears in this column is transferred to the "EXPIRY DATE" worksheet.

COLUMN AL

+W4*J4

The value of the stock on hand of every item is calculated by multiplying the stock on hand (column W) with the value per unit (column J).

Total value of stock on hand = stock on hand (in UOM) x value per UOM.

The total stock value is calculated in cell AL3 by adding the stock value of all items.

COLUMN AM

+X4*J4

The value of the stock on order of every item is calculated by multiplying the stock on order (column W) with the value per unit (column J).

Total value of stock on hand = stock on hand (in UOM) x value per UOM.

The total value of the stock on order is calculated in cell AM3 by adding the value of stock on order of all items.

COLUMN AN

+R4*J4

The value of the most recent monthly demand of every item is calculated by multiplying the most recent monthly demand (column R) with the value per unit (column J).

Total value of recent monthly demand = recent monthly demand (in UOM) x value per UOM.

The total value of the most recent monthly demand is calculated in cell AN3 by adding the value of the most recent monthly demand of all items.

COLUMN AO

+AA4*J4

The value of the corrected monthly order of every item is calculated by multiplying the "corrected" order quantities (column AA) with the value per unit (column J).

Value of monthly order = order quantity (UOM) x value per UOM.

The total value of the corrected order is calculated in cell AO3 by adding the order values of all items.

COLUMN AP

+W4*K4

The weight (in kg) of the stock on hand of every item is calculated by multiplying the stock on hand (column W) with the weight per unit (column K).

Total weigh of stock on hand = stock on hand (in UOM) x weight per UOM.

The total weight of the stock on hand is calculated in cell AP3 by adding the weight of the stock on hand of all items.

COLUMN AQ

+X4*K4

The weight (in kg) of the stock on order of every item is calculated by multiplying the stock on order (column X) with the weight per unit (column K).

Total weight of stock on hand = stock on hand (in UOM) x weight per UOM.

The total weight of the stock on order is calculated in cell AQ3 by adding the weight of the stock on order of all items.

COLUMN AR

+R4*K4

The weight (in kg) of the most recent monthly demand of every item is calculated by multiplying the most recent monthly demand (column R) with the weight per unit (column K).

Total weight of recent monthly demand = recent monthly demand (in UOM) x weight per UOM.

The total weight of the demand is calculated in cell AR3 by adding the weight of the most recent monthly demand of all items.

COLUMN AS

+AA4*K4

The weight (in kg) of the corrected monthly order of every item is calculated by multiplying the corrected order quantities (column AA) with the weight per unit (column K).

Weight of monthly order = order quantity (UOM) x weight per UOM.

The total weight of the corrected monthly order is calculated in cell AS3 by adding the weight of the corrected monthly order of all items.

COLUMN AT

+W4*L4

The volume (in l) of the stock on hand of every item is calculated by multiplying the stock on hand (column W) with the volume (in l) per unit (column L).

Total volume of stock on hand = stock on hand (in UOM) x volume per UOM.

The total volume of the stock on hand is calculated in cell AT3 by adding the volume of the stock on hand of all items.

COLUMN AU

+X4*L4

The volume (in l) of the stock on order of every item is calculated by multiplying the stock on hand (column X) with the volume (in l) per unit (column L).

Total volume of stock on order = stock on hand (in UOM) x volume per UOM.

The total volume of the stock on order is calculated in cell AU3 by adding the volume of the stock on order of all items.

COLUMN AV

+R4*L4

The volume (in l) of the most recent monthly demand of every item is calculated by multiplying the most recent monthly demand (column R) with the volume (in l) per unit (column L).

Total volume of recent monthly demand = recent monthly demand (in UOM) x volume per UOM.

The total volume of the demand is calculated in cell AV3 by adding the volume of the most recent monthly demand of all items.

COLUMN AW

+AA4*L4

The volume (in l) of the corrected monthly order of every item is calculated by multiplying the order quantities (column AA) with the volume (in l) per unit (column L).

Volume of monthly order = order quantity (UOM) x volume per UOM.

The total volume of the corrected monthly order is calculated in cell AW3 by adding the volume of the corrected monthly order of all items.

15.2 "STOCK ON ORDER" worksheet

COLUMN A

=IF(D5="","",IF(D4="",LEFT(D5,4),IF(LEFT(D4,4)=LEFT(D5,4),"",LEFT(D5,4))))

The formula returns the first four letters of the item code (column D) if the category of the item in the row above is different from the category of the item in the respective row. The category is defined as the first four characters of the item code. If more or less characters denote the category, the number (currently 4) can be changed accordingly.

Therefore a label is displayed in this column whenever a new category starts. This function works only if all items are sorted by category and alphabetically within the category.

COLUMN J through U

=COUNT(G$4:G300)

All cells except the last are empty for copying data from the "CALCULATION" worksheet.

Only the last two rows in each column contains a formula.

The formula in row 302 counts the number of line items for which the cell in the respective column is not blank. That is the number of outstanding line items for every monthly order.

After the number of ordered line items has been entered into row 301, the formula in row 303 (=IF(G301="","",100-G302/G301*100)) calculates the order completion rate. If no number

is entered into the cell of column G, the cell remains blank. Otherwise the order completion rate is calculated by dividing the number of outstanding items (row 302) by the number of ordered items (row 301). This value is multiplied by 100 to convert it into percent and subtracted from 100 to calculate the completion rate (cell 302 calculates the number of missing items not the number of completed items).

COLUMN S

=SUM(G5:R5)

The total stock on order for each item is calculated by adding the stock on order from all monthly orders from column G through R.

=SUM(G301:R301)

The total number of outstanding line items from all monthly orders are added.

15.3 "BACKORDER" worksheet

COLUMN A

=COUNTA($A$4:$A$465)

Only cell A2 contains a formula. It calculates the total number of backordered lines. This parameter is used in the "INDICATORS" worksheet. Note that if the same item code is entered several times it will be counted each time. On the contrary the cell Y3 of the "CALCULATION" worksheet counts only the number of backorder lines, regardless whether any line item is backordered only once or several times.

COLUMN F

=IF(COUNTA(A5:E5)=0,"",IF(A5="",E5,F4))

Column F is hidden and contains a formula.

The formula first checks whether any data is entered in columns A through E of the same row. If all these cells are blank then the cell remains blank. Then the formula checks whether the cell A5 is blank. This should only be the case in the first row of each backorder table with the header with a grey background. If this is the case then the date of the order from column E of the same row is copied. Otherwise the contents of the cell from the next row above is copied. This formula ensures that the date of the order in the respective cell of column E is copied to all rows belonging to the same backorder table for a particular order.

This date is needed for calculating the backorder time in the next column.

COLUMN G

=IF(A6="","",TODAY()-F6)

If cell A6 is blank then the cell remains blank. Otherwise the formula calculates the backorder time (in days) for each item by calculating the difference between the today's date and the date the order was placed (column E). This number will be updated whenever the current date changes.

The average backorder time of all backordered items is calculated in cell G1 (=SUM($G$4:$G$465)/COUNT($G$4:$G$465)). It is calculated by adding the backorder time for every individual line item in column G and dividing it by the number of lines which are backordered.

15.4 "MONTHLY ORDER" worksheet

All formulas in this worksheet are a link to data or calculations in the "CALCULATION" worksheet.

The formulas ensure that only items from the "corrected order" are displayed and cells otherwise remain blank.

Note that all columns in this worksheet are offset from the "CALCULATION" worksheet by one column because the later has two hidden columns.

COLUMN A

=ROWS(A$4:A4)

The row number is counted and displayed starting with 1 in row 4. This formula will automatically renumber all rows when rows are deleted or added.

COLUMN B

=IF(E4="","",IF(E3="",LEFT(E4,4),IF(LEFT(E3,4)=LEFT(E4,4),"",LEFT(E4,4))))

The formula returns the first four letters of the item code (column E) if the category of the item in the row above is different from the category of the item in the respective row. The category is defined as the first four characters of the item code. If more or less characters denote the category, the number (currently 4) can be changed accordingly.

Therefore a label is displayed in this column whenever a new category starts. This function works only if all items are sorted by category and alphabetically within the category.

COLUMN C

=IF($A4>CALCULATION!$A$2,"",IF(VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,4)="","",VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,4)))

If the number of ordered line items (calculated in cell A2 of the "CALCULATION" worksheet) is less than the row number then the cell remains blank. Otherwise the content of column D ("ST") is copied from the respective row of the "CALCULATION" worksheet.

COLUMN D

=IF($A4>CALCULATION!$A$2,"",IF(VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,5)="","",VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,5)))

If the number of ordered line items (calculated in cell A2 of the "CALCULATION" worksheet) is less than the row number then the cell remains blank. Otherwise the content of column E ("IS") is copied from the respective row of the "CALCULATION" worksheet.

COLUMN E

=IF($A4>CALCULATION!$A$2,"",VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,6))

If the number of ordered line items (calculated in cell A2 of the "CALCULATION" worksheet) is less than the row number then the cell remains blank. Otherwise the content of column F ("ITEM CODE") is copied from the respective row of the "CALCULATION" worksheet.

COLUMN F

=IF($A4>CALCULATION!$A$2,"",VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,7))

If the number of ordered line items (calculated in cell A2 of the "CALCULATION" worksheet) is less than the row number then the cell remains blank. Otherwise the content of column G

("ITEM DESCRIPTION IN ENGLISH") is copied from the respective row of the "CALCULATION" worksheet.

COLUMN G

=IF($A4>CALCULATION!$A$2,"",VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,8))

If the number of ordered line items (calculated in cell A2 of the "CALCULATION" worksheet) is less than the row number then the cell remains blank. Otherwise the content of column H ("UOM") is copied from the respective row of the "CALCULATION" worksheet.

COLUMN H

=IF($A4>CALCULATION!$A$2,"",VLOOKUP($A4,CALCULATION!$A$4:$AG$1200,27))

If the number of ordered line items (calculated in cell A2 of the "CALCULATION" worksheet) is less than the row number then the cell remains blank. Otherwise the content of column AA ("[Date] ORDER") is copied from the respective row of the "CALCULATION" worksheet.

Only the cell H1 contains the formula +$CALCULATION:$AD1, to copy the date of the order from cell AA1 of the "CALCULATION" worksheet to the "MONTHLY ORDER" worksheet.

Only cell H3 contains the formula =CALCULATION!$AO3 to copy the value of the monthly order from cell AO3 of the "CALCULATION" worksheet to the "MONTHLY ORDER" worksheet.

15.5 "EXPIRY DATES " worksheet

COLUMN A

=ROWS(A$4:A4)

The row number is counted and displayed starting with 1 in row 4. This formula will automatically renumber all rows when rows are deleted or added.

COLUMN B

=IF(E4="","",IF(E3="",LEFT(E4,4),IF(LEFT(E3,4)=LEFT(E4,4),"",LEFT(E4,4))))

The formula returns the first four letters of the item code (column E) if the category of the item in the row above is different from the category of the item in the respective row. The category is defined as the first four characters of the item code. If more or less characters denote the category, the number (currently 4) can be changed accordingly.

Therefore a label is displayed in this column whenever a new category starts. This function works only if all items are sorted by category and alphabetically within the category.

COLUMN C

=IF($A4>CALCULATION!$B$2,"",IF(VLOOKUP($A4,CALCULATION!$B$4:$AG$66,3)="","",(VLOOKUP($A4,CALCULATION!$B$4:$AG$66,3))))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column D ("ST") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN D

=IF($A4>CALCULATION!$B$2,"",IF(VLOOKUP($A4,CALCULATION!$B$4:$AG$66,4)="","",(VLOOKUP($A4,CALCULATION!$B$4:$AG$66,4))))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column E ("IS") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN E

=IF($A4>CALCULATION!$B$2,"",VLOOKUP($A4,CALCULATION!$B$4:$AG$66,5))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column F ("ITEM CODE") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN F

=IF($A4>CALCULATION!$B$2,"",VLOOKUP($A4,CALCULATION!$B$4:$AG$66,6))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column G ("ITEM DESCRIPTION IN ENGLISH") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN G

=IF($A4>CALCULATION!$B$2,"",VLOOKUP($A4,CALCULATION!$B$4:$AG$66,7))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column K ("UOM") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN H

=IF($A4>CALCULATION!$B$2,"",VLOOKUP($A4,CALCULATION!$B$4:$AG$66,19))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column T ("AVG.") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN I

=IF($A4>CALCULATION!$B$2,"",VLOOKUP($A4,CALCULATION!$B$4:$AG$66,22))

If the number of items in column AK ("CHECK") of the "CALCULATION" worksheet (registered in cell B2 of the "CALCULATION" worksheet) is less than the row number (column A) then the cell remains blank. Otherwise the content of column W ("STOCK ON HAND") is copied to the "EXPIRY DATE" worksheet from the same row in the "CALCULATION" worksheet.

COLUMN L

=IF(J4="","",IF((J4-(K4-$E$1)/30*H4)<0,"0",J4-(K4-$E$1)/30*H4))

If no quantity is entered in cell J4 the cell remains blank. If average monthly demand (column H) multiplied with the number of months between today (cell E1) and the expiry date (column K) is greater than the quantity of the batch (column J), then "0" is printed. Otherwise the quantity which can be used until the expiry date is subtracted from the quantity of the batch and displayed. The value in column L ("EXP.") is the quantity which cannot be used before the expiry date and will therefore expiry in the medical store before use.

The quantity of an item which can be used until the expiry date is always calculated by calculating the difference between the expiry date and today (in days), dividing it by 30 (to convert it to months) and multiplying it with average demand. Consequently there may be a slight difference to the calculations made with the actual numbers of days in the month. However the differences are not significant.

Number of expiring items = batch quantity - ((expiry date - today's date) / 30 x (average monthly demand)).

The conditional formatting is set to change the background colour whenever the value in column L is greater than zero. The upper limit of 1E+30 is a technicality to prevent empty cells (which contain a formula) to change the background colour. It is assumed that the expired quantities of any item are less than this number.

COLUMN O

=IF(M4="","",IF((J4-L4)+M4-(N4-$E$1)/30*H4<0,"0",(J4-L4)+M4-(N4-$E$1)/30*H4))

The calculations follow the same principle as for column L. However the 2nd batch as well as the quantity from the first batch which will be used (before expiring) are both considered.

Quantity of expiring items (2nd batch) = stock (2nd batch) - (stock first batch - quantity of expiring items from the first batch) - (number of months until day of expiry of the second batch) x (average monthly demand).

COLUMN R

=IF(P4="","",IF((J4-L4)+(M4-O4)+P4-(Q4-$E$1)/30*H4<0,"0",(J4-L4)+(M4-O4)+P4-(Q4-$E$1)/30*H4))

The calculations follow the same principle as for column O. However the quantity of the 3rd batch as well as the quantity from all previous batches which will be used (before expiring) are all considered.

Quantity of expiring items (3rd batch) = stock (3rd batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 3rd batch) x (average monthly demand).

COLUMN U

=IF(S4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+S4-(T4-$E$1)/30*H4<0,"0",(J4-L4)+(M4-O4)+(P4-R4)+S4-(T4-$E$1)/30*H4))

The calculations follow the same principle as for column R. However the quantity of the 4th batch as well as the quantity from all previous batches which will be used (before expiring) are both considered.

Quantity of expiring items (4th batch) = stock (4th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 4th batch) x (average monthly demand).

COLUMN X

=IF(V4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+V4-(W4-$E$1)/30*H4<0,"0",(J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+V4-(W4-$E$1)/30*H4))

The calculations follow the same principle as for column U. However the quantity of the 5th batch as well as the quantity from all previous batches which will be used (before expiring) are both considered.

Quantity of expiring items (5th batch) = stock (5th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 5th batch) x (average monthly demand).

COLUMN AA

=IF(Y4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+Y4-(Z4-$E$1)/30*H4<0,   "0",(J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+Y4-(Z4-$E$1)/30*H4))

The calculations follow the same principle as for column X. However the quantity of the 6th batch as well as the quantity from all previous batches which will be used (before expiring) are all considered.

Quantity of expiring items (6th batch) = stock (6th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 6th batch) x (average monthly demand).

COLUMN AD

=IF(AB4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+AB4-(AC4-$E$1)/30*H4<0,"0",(J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+AB4-(AC4-$E$1)/30*H4))

The calculation follow the same principle as for column AA. However the quantity of the 7th batch as well as the quantity from all previous batches which will be used (before expiring) are all considered.

Quantity of expiring items (7th batch) = stock (7th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 7th batch) x (average monthly demand).

COLUMN AG

=IF(AE4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+(AB4-AD4)+AE4-(AF4-$E$1)/30*H4<0,"0",(J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+(AB4-AD4)+AE4-(AF4-$E$1)/30*H4))

The calculations follow the same principle as for column O. However the quantity of the 8th batch as well as the quantity from all previous batches which will be used (before expiring) are all considered.

Quantity of expiring items (8th batch) = stock (8th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 8th batch) x (average monthly demand).

COLUMN AJ

=IF(AH4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+(AB4-AD4)+(AE4-AG4)+AH4-(AI4-$E$1)/30*H4<0,"0",(J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+(AB4-AD4)+(AE4-AG4)+AH4-(AI4-$E$1)/30*H4))

The calculations follow the same principle as for column AG. However the quantity of the 9th batch as well as the quantity from all previous batches which will be used (before expiring) are all considered.

Quantity of expiring items (9th batch) = stock (9th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 9th batch) x (average demand).

COLUMN AM

=IF(AK4="","",IF((J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+(AB4-AD4)+(AE4-AG4)+(AH4-AJ4)+AK4-(AL4-$E$1)/30*H4<0,"OK",(J4-L4)+(M4-O4)+(P4-R4)+(S4-U4)+(V4-X4)+(Y4-AA4)+(AB4-AD4)+(AE4-AG4)+(AH4-AJ4)+AK4-(AL4-$E$1)/30*H4))

The calculations follow the same principle as for column AJ. However the quantity of the 10th batch as well as the quantity from all previous batches which will be used (before expiring) are all considered.

Quantity of expiring items (10th batch) = stock (10th batch) - (stock from all previous batches) - (quantity of expiring items from all previous batches) - (number of months until day of expiry of 10th batch) x (average monthly demand).

COLUMN AN

=VLOOKUP($A4,CALCULATION!$B$4:$AG$66,9)*SUM(L4,O4,R4,U4,X4,AA4,AD4,AG4,AJ4,AM4)

The value of all expiring batches (if no measures to prevent expiry are taken) is calculated by adding the expiring quantities from each batch and multiplying this sum with the value per UOM. This value per UOM is looked up in column J ("VALUE PER UOM") of the "CALCULATION" worksheet.

The total value of all expiring lines is calculated in cell AN3 (=SUM(AN$4:AN$1000).

15.6 "INDICATORS " worksheet

TABLE "SERVICE RECEIVED"

COLUMN B - "Current month"

='STOCK ON ORDER'!$S$301

The total number of line items on order is copied from the bottom of the end of column S ("TOTAL") of the "STOCK ON ORDER" worksheet.

=CALCULATION!$AQ$3

The total weight of stock on order is copied from the third row of column AQ ("WEIGHT ON ORDER") of the "CALCULATION" worksheet.

='STOCK ON ORDER'!$S$303

The average order completion rate is copied from last row of column S ("TOTAL") of the "STOCK ON ORDER" worksheet.

TABLE "STOCK MANAGEMENT"

COLUMN B - "Current month"

=CALCULATION!$W$3

The total number of line items in stock is copied from the third row of column W ("STOCK ON HAND") of the "CALCULATION" worksheet.

=CALCULATION!$AC$3

The number of line items with stock on hand of less than the safety stock specified in cell U1 ("SAFETY STOCK") of the "CALCULATION" worksheet is copied from the third row of the hidden column AB ("Stock shortages") of the "CALCULATION" worksheet.

=CALCULATION!$AL$3

The value of stock on hand is copied from the third row of column AL ("VALUE ON HAND) of the "CALCULATION" worksheet.

=CALCULATION!$AN$3*12/CALCULATION!$AL$3

The annual rate of turnover is calculated by dividing the annual turnover (value of distributed goods) by the value of the stock on hand (column AL of the "CALCULATION" worksheet). The annual turnover is estimated by multiplying the value of the most recent monthly demand (column AN) by 12.

=CALCULATION!$AP$3

The total weight of stock on hand is copied from the third row of column AP ("WEIGHT ON HAND") of the "CALCULATION" worksheet.

=CALCULATION!$AT$3

The total volume of stock on hand is copied from the third row of column AT ("VOLUME ON HAND") of the "CALCULATION" worksheet.

='EXPIRY DATES'!$AN3

The total value of goods which would expiry is copied from the third row of column AN ("VALUE EXP.") of the "EXPIRY DATES" worksheet.

TABLE "CUSTOMER SERVICE"

COLUMN B - "Current month"

=CALCULATION!$AN$3

The total value of monthly demand is copied from the third row of column AN ("VALUE DEMAND") of the "CALCULATION" worksheet.

=CALCULATION!$AR$3

The weight of the most recent monthly demand is copied from the third row of column AR ("WEIGHT DEMAND") of the "CALCULATION" worksheet.

=BACKORDER!$A$2

The total number of backordered line items is copied from cell A2 of the "BACKORDERS" worksheet.

=BACKORDER!$G$1

The average backorder time is copied from cell G1 of the "BACKORDER" worksheet.

=CALCULATION!$AD$3

The number of stockouts calculated in cell AD 3 of the "CALCULATION" worksheet is copied.

GRAPH "COVERAGE TIME"

The tables and formulas used to produce the respective graphs are hidden behind the graphs.

COLUMN B

=COUNTIF(CALCULATION!AD$4:AD$1000,"=Stockout")

This formula counts the number of cells in column AD ("Coverage time") in which "Stockout" appears.

=COUNTIF(CALCULATION!AD$4:AD$1000,"<1")

This formula counts the number of cells in column AD ("Coverage time") in which the coverage time is less than 1 month.

=COUNTIF(CALCULATION!AD$4:AD$1000,"<2")-
COUNTIF(CALCULATION!AD$4:AD$1000,"<1")

This formula counts the number of cells in column AD ("Coverage time") in which the stock on hand is less than 2 month. The number of line items with a coverage time of less than 1 is subtracted from the number of line items with a coverage time of less than 2 to calculate the number of lines with a coverage time between 1 and 2.

Except for =COUNTIF(CALCULATION!AD$4:AD$1000,">=24"), the last formula, all the following formulas in this table are built accordingly.

The contents of the table is displayed in the graph in front of the table as simple bar chart.

GRAPH "LINE ITEMS ON ORDER"

COLUMN E

='STOCK ON ORDER'!$G$2

The name or number of the first monthly order in the "STOCK ON ORDER" worksheet is copied.

The rows below copy the respective name or number from the second, third etc. monthly order (columns H through R).

COLUMN B

='STOCK ON ORDER'!$G301

The total number of line items on order in the last row of the "STOCK ON ORDER" worksheet is copied.

The rows below copy the respective number of open line items from the second, third etc. monthly order (columns H through R).

The contents of the table is displayed in the graph in front of the table as simple bar chart.

GRAPH "COEFFICIENT OF VARIATION"

COLUMN B

=COUNTIF(CALCULATION!AH$4:AH$1000,"<10")

This formula counts the number of cells in column AH ("Coefficient of variation") with a coefficient of variation less than 10%.

=COUNTIF(CALCULATION!AH$4:AH$1000,"<20")-
COUNTIF(CALCULATION!AH$4:AH$1000,"<10")

This formula counts the number of cells in column AH ("Coefficient of variation") in which the deviation is between 10% and 20%. The number of cells with a coefficient of variation below 10% is subtracted from the number of cells with a coefficient of variation below 20% to give the number of cells with a coefficient of variation between 10% and 20%.

All formulas below are built accordingly.

The contents of the table is displayed in the graph in front of the table as simple bar chart.

GRAPH "BACKORDER TIME (WEEKS)"

COLUMN F

=COUNTIF(BACKORDER!G$4:G$1000,"<7")

The formula calculates the number of cells in column G ("BO TIME DAYS") of the "BACKORDER" worksheet which contain a value less than 7 days (1 week).

=COUNTIF(BACKORDER!G$4:G$1000,"<14")-COUNTIF(BACKORDER!G$4:G$1000,"<7")

This formula counts the number of cells in column G ("BO TIME DAYS") in which the backorder time is between 14 days (2 weeks) and 7 days (1 week). The number of cells with a backorder time of less than 7 days is subtracted from the number of cells with a backorder time of less than 14 days to give the number of cells with a backorder time between 2 weeks and 1 week.

Except for =COUNTIF(BACKORDER!G$4:G$1000,">168"), the last formula, all the following formulas in this table are built accordingly.

15.7 "DEMAND" worksheet

COLUMN A

The formula returns the first four letters of the item code (column D) if the category of the item in the row above is different from the category of the item in the respective row. The category is defined as the first four characters of the item code. If more or less characters denote the category, the number (currently 4) can be changed accordingly.

Therefore a label is displayed in this column whenever a new category starts. This function works only if all items are sorted by category and alphabetically within the category.

COLUMN S

=SUM(G4:R4)

Total monthly demand for every item from the beginning of the year is calculated by adding the monthly demand.

COLUMN T

=AVERAGE(G4:R4)

The formula calculates average monthly demand since the beginning of the year. Only non-blank cells are considered.

COLUMN V

=SUM(V$4:V$1000)

The total value of all line items issued during the respective month is calculating by adding the value of stock issues for every line item during the same month.

The formulas in column W through AG are calculated likewise.

COLUMN AH

=SUM(V4:AG4)

The total value of each line item issued since the beginning of the year is calculating by adding the value of stock issued each month. The total value of all stock issued since the beginning of the year is calculated in cell AH3 (=SUM(AH$4:AH$1000)).

COLUMN AW

=SUM(AK4:AV4)

The formula calculates the total quantity of each line item ordered since the beginning of the year.

COLUMN AX

=SUM(AK4:AV4)/COUNT(G4:R4)

The average quantities ordered every month are calculated by dividing the total quantity ordered since the beginning of the year by the number of monthly orders.

All items which were not ordered during any month remain blank. Therefore the number of orders is counted by counting the number of columns for which data is entered in the first table (column G through R).

15.8 "STOCK" worksheet

COLUMN A

=IF(D4="","",IF(D3="",LEFT(D4,4),IF(LEFT(D3,4)=LEFT(D4,4),"",LEFT(D4,4))))

The formula returns the first four letters of the item code (column D) if the category of the item in the row above is different from the category of the item in the respective row. The category is defined as the first four characters of the item code. If more or less characters denote the category, the number (currently 4) can be changed accordingly.

Therefore a label is displayed in this column whenever a new category starts. This function works only if all items are sorted by category and alphabetically within the category.

COLUMN S

=AVERAGE(G4:R4)

The formula calculates the average safety stock. Only non-blank cells are considered in the calculation.

COLUMN AG

=AVERAGE(U4:AF4)

The formula calculates the average stock on hand (at the end of the month). Only non-blank cells are included in the calculation.

COLUMN AU

=AVERAGE(AI4:AT4)

The formula calculates the average coverage time. Only non-blank cells are included in the calculation.