



ANALYSIS AND USE OF HEALTH FACILITY DATA

# Exercise book

For malaria  
programme managers  
Learner's guide

WORKING DOCUMENT, SEPTEMBER 2018



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## Introduction

Transmission of malaria involves a complex interaction of five major epidemiological factors: parasite, vectors, human, environment and intervention. Consequently, the intensity of malaria is heterogeneous in space and time and its characteristics in one place may not be representative of that in a different, even nearby place, depending on the variability of the underlying determinants. Therefore, the data elements in a national surveillance of malaria should have spatial and temporal dimensions. Careful selection of the key data elements is necessary, however, so as not to overwhelm national surveillance systems. The selection of data elements should be determined by both the underlying malaria transmission and the use of this information for routine decision-making, monitor of interventions and disease trends and the adjustment of policies to respond to changing needs.

It is important to note that the data elements and indicators that are proposed for collection through the proposed DHIS2 modules for routine reporting should be used together with data from other sources such censuses, climate, household and health facility surveys during analysis for more accurate interpretation of results.

The exercises in this guide are aimed to help learners on the collation, processing, analysis and interpretation of DHIS2 data and triangulation with other data sources. At the end of the training, learners are expected to understand the details of DHIS2 malaria modules and the critical steps from data collection to interpretation for eventual use of the results by the programme.

Analysis, interpretation and use of surveillance data for malaria require attention to the following:

- Define the data elements for the burden reduction or elimination
- Generate key indicators using data elements
- Compile data by geographic unit (e.g. health facility, district, province, national), and temporal unit (e.g. month or week)
- Implement data cleaning and verification: check for completeness, outliers, missing data, etc.
- Develop an analysis plan with standard set of tables, graphs and maps for decision making levels (e.g. health facility, district, province and national)
- Interpret charts and tables
- Evaluate the results according to the context and triangulate with the other complementary data

An approach consisting of 10 steps is used to help learners through the process of data reporting, verification and validation, analysis and interpretation. For the following exercises, participants are expected to work in groups (preferably by country).

## Exercises

### STEP 1. DEFINE THE CORE DATA ELEMENTS FOR THE BURDEN REDUCTION OR ELIMINATION

Depending on your country situation, select the data elements and indicators that are relevant and useful for tracking progress on malaria disease trends. For this exercise, we will use the Excel data provided by facilitators.

**Exercise 1.1.** From the provided list of WHO malaria data elements provided by facilitators (Refer to list of WHO data elements: **MalariaDataElementsIndicators.xlsx**), identify the core data elements that are relevant for your country situation. (**Yes, No**).

**Exercise 1.2.** Which of the WHO malaria data elements are not collected and/or monitored by your program and should be added to your country list?

**Exercise 1.3.** If there are data elements monitored by your program but are not included on WHO’s core list, please provide a list.

Ensure that the data elements and indicators you have identified have been defined and included or configured within **DHIS2**.

### STEP 2. GENERATE KEY INDICATORS COMPUTED FROM THE DATA ELEMENTS

**Exercise 2.1.** From the provided list of WHO indicators (**list of indicators**), identify the core indicators that are relevant for your country situation. (**Yes, No**).

For indicators that involve population of a given area as denominator, ensure that you account for population growth pertinent to your country.

**Exercise 2.2 (for burden reduction settings).** For each core indicator below, define its purpose or use.

1. Annual parasite index (if annual)
2. Confirmed malaria cases (if monthly, confirmed cases per 1000 population)
3. Test positivity rate (separate for RDT and Microscopy)
4. Percentage of suspected cases tested
5. Annual blood examination rate
6. Reporting completeness
7. Non-malaria outpatient cases
8. Non-malaria inpatient cases
9. Non-malaria deaths
10. Proportion of outpatient malaria cases
11. Proportion of inpatient malaria cases
12. Proportion of malaria deaths

**Exercise 2.3.** For each indicator, define the data element(s) used as the numerator and denominator. Ensure that the indicators you have identified have been defined and included or configured within **DHIS2**.

If your country’s DHIS2 has additional indicators, ensure that they are defined with numerator and denominator?

**Exercise 2.4 (For elimination settings)**, the core indicators discussed in Exercise 2.2 are relevant to this setting in full or partially depending on the context. In very low transmission settings, burden of severe malaria and death are of less important. Therefore, the indicators such as non-malaria cases and proportion of malaria out of all cases (listed 7-12) may be ignored. The additional elimination-specific indicators are listed below:

1. Number of indigenous cases
2. Proportion of *P. falciparum* and *P. vivax*
3. Percentage of cases investigated
4. Percentage of foci investigated
5. Percentage of cases classified
6. Percentage of foci classified
7. Percentage of active foci with zero indigenous cases

For each indicator, define the data element(s) used as the numerator and denominator and their purposes.

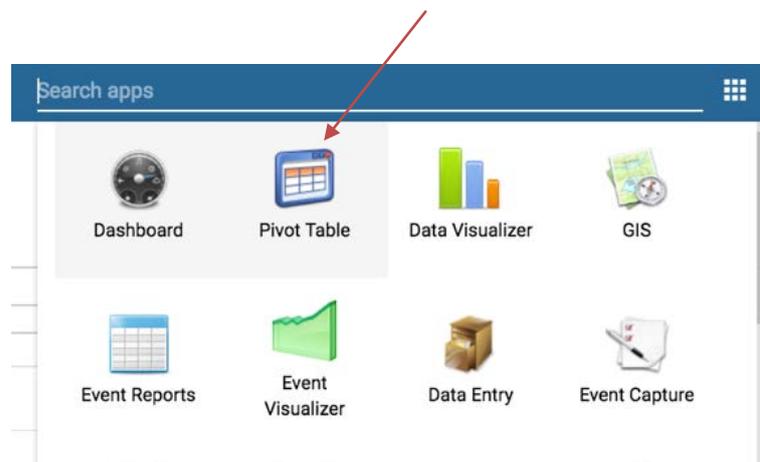
### STEP 3. COMPLETE DATA BY LEVEL (PROVINCE, DISTRICT OR EQUIVALENT, HEALTH FACILITY), BY MONTH OR WEEK

The following exercise will be used to demonstrate one method of extracting source data and importing data into DHIS2. This can be used to manage data outside of DHIS2 and re-importing updated or new additional data elements. It can also be a means for sharing data with other DHIS2 instances.

In addition to DHIS2, the original data source can be from various sources including other applications, and/or spreadsheets..

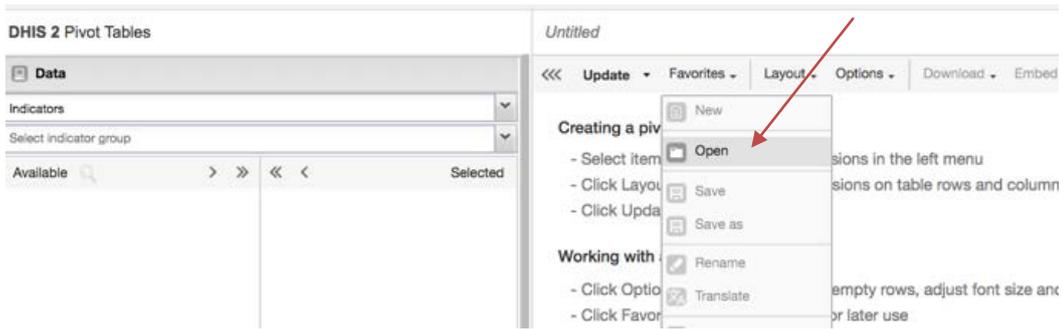
**Exercise 3.1.** Enter data or copy and paste data into the structured data template (**Data\_Template\_BR\_EL.xlsx**). If you have data in excel or other sources the following steps allow you to copy, save and import them into DHIS2.

- Go to App menu
- Select “Pivot Table” from the App menu

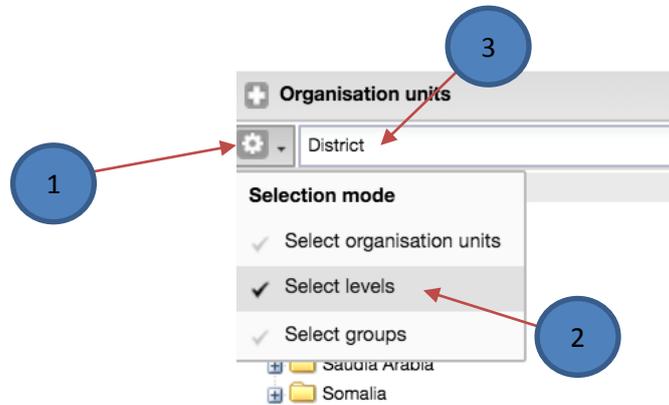


- Create or open a predefined table of data elements and/or indicators

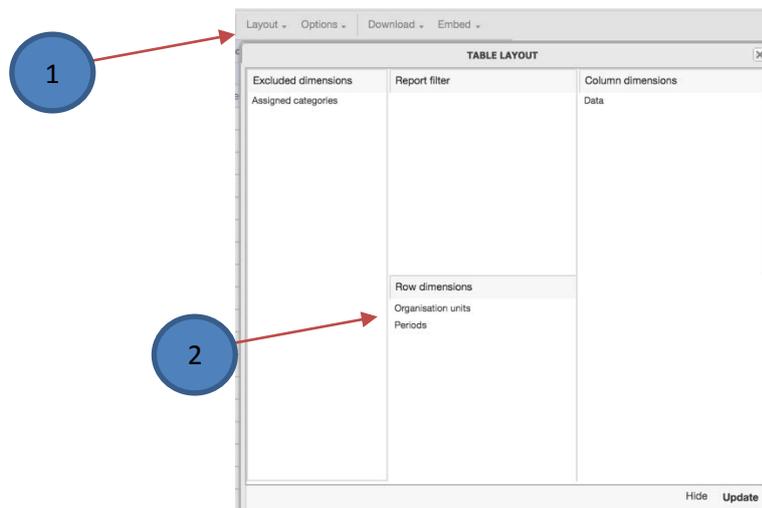
- To “Open” got to “Favorites” then “Open”



- Make sure the resulting table has the proper aggregated levels and periods selected “districts”, “year, month”.
- Select levels under “Organization units”, click on the gear icon to select the level. Multiple levels can be selected, but be sure to select only one level for this exercise.



- Use the “Layout” menu at the top to place the “Organization units” and Period as Rows Dimensions and the data as Columns dimensions.



- Resulting in a table similar to the one below

Organisation unit	Period / Data	Malaria cases tested with RDT	Confirmed malaria cases
Bajour	January 2016	724	65
	February 2016	611	67
	March 2016	660	94
	April 2016	771	171
	May 2016	1 153	381
	June 2016	1 477	531
	July 2016	1 694	600
	August 2016	1 901	812
	September 2016	1 528	582
	October 2016	1 307	657
	November 2016	1 134	500
	December 2016	945	166

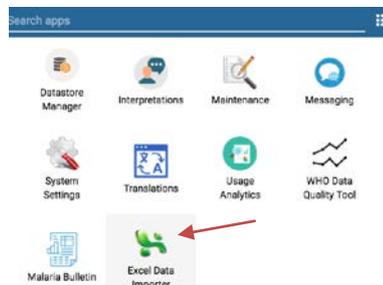
- Download the data via the “Download” menu, then select “csv” under table layout

Review the output in the downloaded csv named "data.csv" or “data (XX).csv”.

**Note:** XX corresponds to a number, 1-n

**Load exported figures in to Excel template**

- Open template file “Data\_Template\_BR\_EL.xlsx”
- Copy one or two data elements from “data.csv” over to the corresponding columns in the template file.
- Upload the template file back to the database using the “Excel Data Importer” app
- Select “Excel Data Importer” app from the App menu



- Select Orgunit Scheme (code or UID) then Select “Upload”



- Search for the Excel file on your computer, then click open

7. Wait for file to load



8. Examine log file when complete; verify that all elements have been loaded without errors.

## STEP 4. CLEAN THE DATA: CHECK FOR COMPLETENESS, CONSISTENCY OF DATA, OUTLIERS AND MISSING DATA

For this exercise we will use the Kenya database.

URL: <https://datause.dhis2.org/dhis>

As a start, familiarize yourself with the dashboard navigation as shown below.

- Dashboard items are arranged in alphabetical order.
- Use the left and right arrows (1) to shift the items. More items will appear from the right.
- Click on the right arrow (1) until you find the relevant section (tab) appears.
- In this example, the tab (2) that deals with data quality is “**Malaria Surveillance Quality**”, then click on it. In this section you will find charts of reporting completeness,



**Exercise 4.1.** Go to the DHIS2 home page and click on tab “**Malaria Surveillance Quality**” in the row of dashboards.

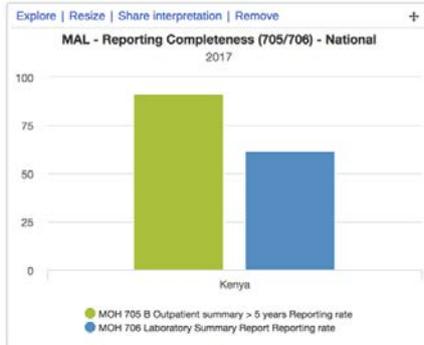
How many charts does the dashboard have?

**Note:** the gear icon next to the Search button (3). We will practice using this function in one of the following exercises.

## Review the completeness of data at national level

**Exercise 4.1.1:** Use **Kenya data**: Generate a chart for reporting completeness for the **Outpatient Summary Form** (for all diseases) and the **Laboratory Summary Form** at national level. [see Screenshot]

a. Summary report (in DHIS2)



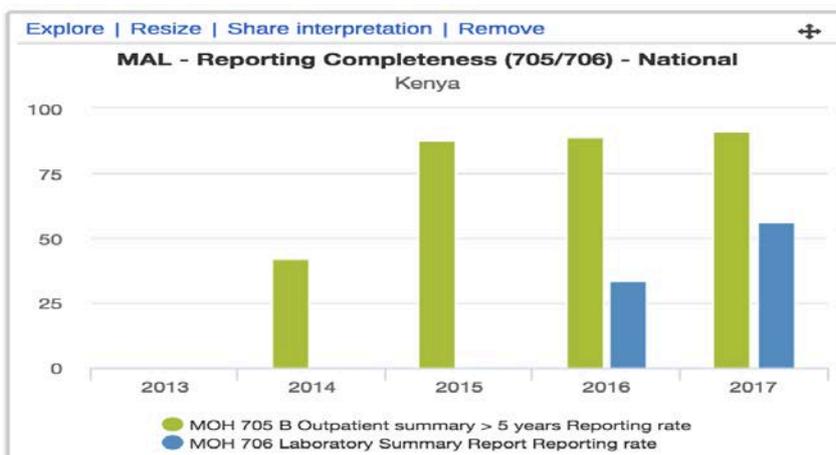
1. Change the above chart to a trend of 5-years
2. Describe the trend in reporting completeness over the 5 years.
3. Identify the year and month with lowest reporting completeness. Do further checks to identify the admin level that led to the lowest reporting completeness.
4. Repeat the activities 1-3 using **Outpatient malaria cases by year and month and first admin level**.

This DHIS2 module does not provide reporting completeness by a given data element. Therefore, please use count of health facilities that have reported on outpatient malaria cases by year.

5. Describe your observation and conclusion of the two charts (**compare with Tutor’s results**)

## Review the completeness of sub-national data

Repeat the same exercise above for each subnational level down to county level or equivalent. In the given example, the lowest admin will be county.



1. Click on the gear icon (next to the **Search** button).
2. Click on the “+” sign next to “Kenya”. A drop down list of counties will appear.
3. Click on “**Bomet county**” so that the color of the font changes to orange.
4. Click on **Update**.

**Exercise 4.2.1:** Review the two charts [see Screenshot]. Describe the trend in reporting completeness over the last 5+ years, identify the county with lowest reporting completeness and describe your observation and conclusion.

## Assess the consistency of malaria data

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### Exercise 4.3.1. Consistency of data elements

Apart from outbreaks or epidemics, the expected seasonality in the number of malaria cases should be consistent year-to-year and month-to-month. Consistency can be assessed between **data elements and by type and location**. Three indicators of consistency are given as example: i) total positive cases should be less or equal to total confirmed plus presumed; ii) total suspected cases should be more or equal to total tested, assuming a near 100% confirmation rate and presumed cases if not 100% confirmation rate; iii) total outpatient malaria cases should be higher than total admitted malaria cases; iv) ratio of all-cause outpatient cases to total population.

In this example, we will practice with consistency of suspected cases and tested cases.

1. Generate table with the three comparisons and identify any inconsistency.
2. For each data element, drill down on inconsistent values till you discover the source of the inaccurate value.
3. Calculate ratio of all-cause outpatient cases (excluding immunization and ANC) to total population, presented as per 10,000 population. What is the purpose of assessing this indicator?

### Exercise 4.3.2. Year-to-year and month-to-month variations.

1. Generate a chart showing year-to-year **national trends** of outpatient confirmed malaria cases.
2. Generate a chart by year and month **national trends** of outpatient confirmed malaria cases. Explain if the trends are consistent. What months show high seasonality?
3. Generate a chart by year and month with **county level trends** of outpatient confirmed malaria
4. Identify the counties with inconsistent trends and explain the possible source of data inconsistency.

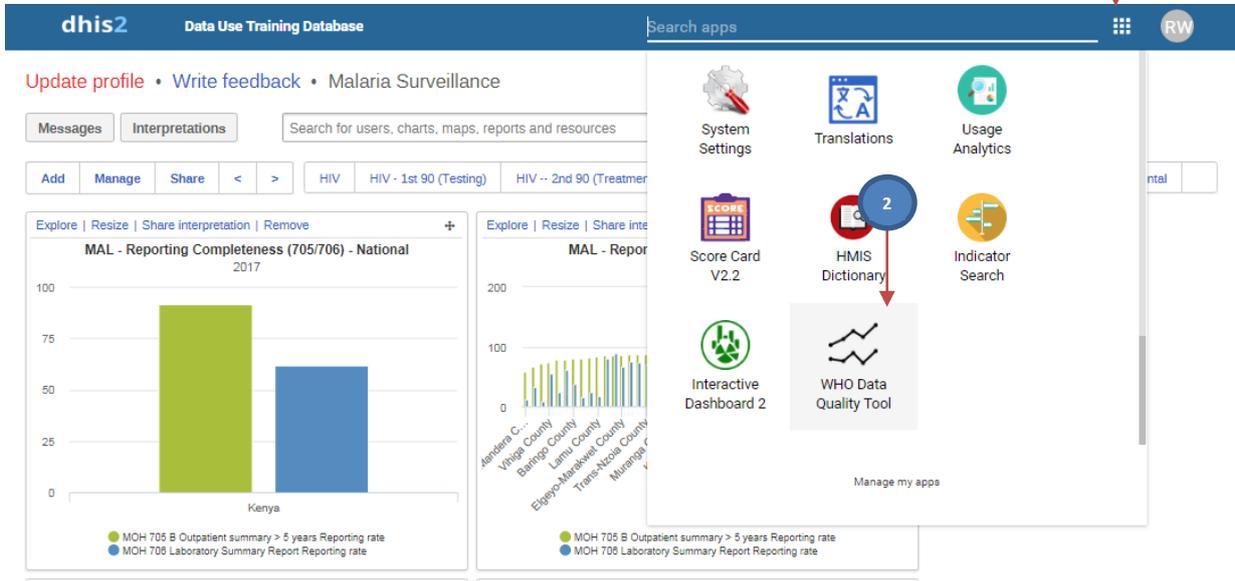
Alternatively we can use **WHO Data Quality Tool**. In this tab, you will find completeness, consistency over time, consistency between data elements; outliers and missing data tabs.

Follow the steps below.

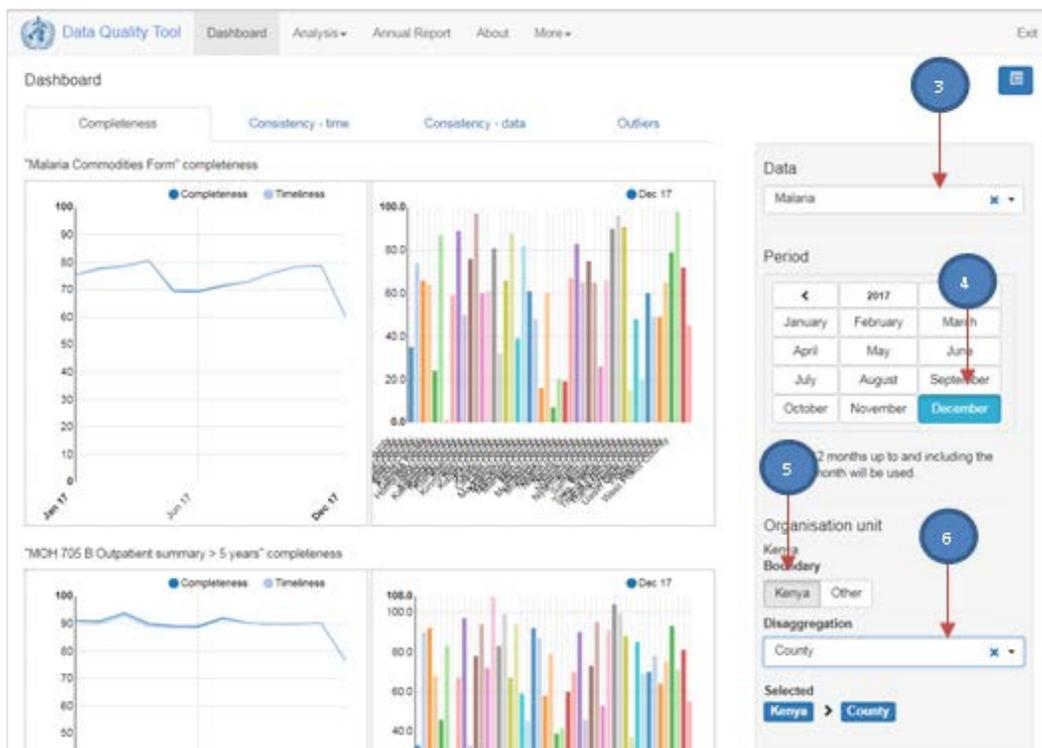
Use DQ Tool to review reporting completeness

Go to the home page then click on the search apps icon ( 1, )

Click on the “WHO Data Quality Tool”(2). Then, you will see the screen below.

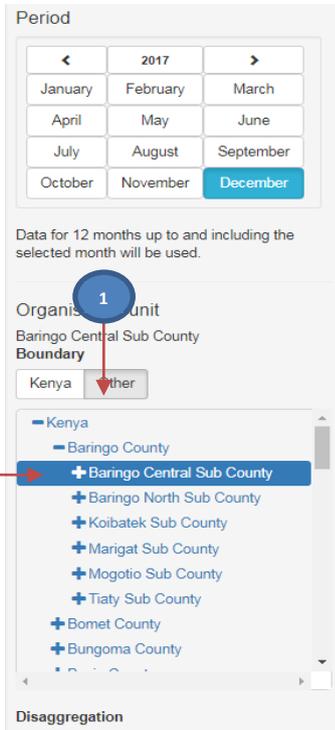


1. Under “**Data**” (3) select “Malaria” from the list
2. You can choose the time period here. Click “**December and 2017**” (4) if not already selected
3. Select boundary “**Kenya**” (5)
4. Select Disaggregation “**County**” (6)
5. Wait for dashboard to update



The above chart shows reporting completeness for Summary forms of malaria commodity, outpatient and malaria lab. But this is not adequate as we do not know the malaria specific reporting completeness.

To generate the same charts for subnational, select Baringo County using the following steps.



Drill down using the menu to the right to see what is happening in the **Baringo** region

1. Click on the “Other” button under the Organization unit section
2. Use the **boundary** filter to filter the graph on the **Baringo** county
3. Click on the “+” next to “**Baringo County**”
4. Select a low reporting sub-county
5. Then filter down further to the low reporting health facilities

## Assess for presence of extreme values (outliers)

Presence of extremely **low** or **high** numbers in a given admin level for a given month or week is indication of data quality problem. In general, malaria data should be within the expected ranges allowing for seasonal patterns or fluctuations. Drastic changes in number of malaria cases are possible when effective interventions are applied or when there is breakdown in malaria control effort or other reasons that lead to an epidemic. However, these effects are unlikely to occur over a short period such as a week. In the case of epidemics, high number of cases above the usual thresholds may be observed for some weeks. Very high number in a single week may rather reflect presence of data error. Over medium to long term, it is possible to better describe the association between interventions and disease trends.

**Exercise 4.4.1.** For a systematic review, any value that is higher than the Mean +/- 2\* Standard Deviation should be reviewed for its quality. In the given example (Kenya data), use outpatient confirmed malaria cases:

1. Click on the **WHO Data Quality Tool** dashboard
2. Click on “**Outlier**” and generate a table by year and month with Mean+/-2\* Stand Dev for by county.
3. Wait for several seconds for the table to update.
4. By default, the extreme values (both high and low) are highlighted pink.
5. The table brings many malaria indicators by county and spans many pages.
6. Compare the extreme values with the values of adjustment years and months

## 7. Record the extreme values for further investigation before further analysis

Unit	Data	Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Missing	Outlier	Total
Vihiga County	Antenatal client IPT 1st dose	883.0	1023.0	1111.0	926.0	978.0	687.0	1387.0	1120.0	1183.0	1149.0	1230.0	179.0	0	883	883
Baringo County	MCH T06_Malaria Rapid Diagnostic Tests Number Positive	280.0	539.0	206.0	139.0	135.0	30.0	9.0	26.0	16.0	41.0	34.0	2.0	0	850	850
Makueni County	Suspected Malaria	1913.0	2342.0	1697.0	1360.0	1070.0	1011.0	1611.0	1590.0	1653.0	1272.0	1678.0	1388.0	0	865	865
Hyandarua County	Suspected Malaria	47.0	26.0	29.0	182.0	36.0	28.0	13.0	23.0	64.0	361.0	420.0	133.0	0	849	849
Taita Taveta County	Antenatal client IPT 2nd dose	697.0	670.0	682.0	657.0	636.0	81.0	644.0	979.0	817.0	600.0	568.0	109.0	0	848	848
Lamu County	* Suspected malaria cases tested with RDT	76.0	120.0	121.0	116.0	251.0	176.0	0.0	0.0	0.0	5.0	320.0	953.0	0	845	845
Vihiga County	Antenatal client IPT 2nd dose	969.0	956.0	1121.0	964.0	883.0	650.0	966.0	1051.0	1160.0	1007.0	1096.0	132.0	0	842	842
Nairobi County	* Malaria cases positive with microscopy	200.0	264.0	375.0	216.0	389.0	286.0	418.0	209.0	220.0	389.0	1126.0	263.0	0	831	831
Samburu County	* Suspected malaria cases tested with RDT	0.0	30.0	0.0	240.0	27.0	0.0	0.0	42.0	0.0	217.0	146.0	443.0	0	818	818
Narok County	* Suspected malaria cases tested with RDT	965.0	232.0	1041.0	477.0	420.0	480.0	592.0	468.0	421.0	339.0	1368.0	793.0	0	801	801
Homa Bay County	Antenatal client IPT 2nd dose	2090.0	2195.0	1874.0	1683.0	1767.0	1375.0	1665.0	2178.0	2105.0	1942.0	1983.0	1120.0	0	771	771
Mandera County	Suspected Malaria	1144.0	1074.0	1520.0	759.0	633.0	896.0	613.0	702.0	556.0	266.0	957.0	504.0	0	765	765
Kilifi County	MCH T06_Malaria Rapid Diagnostic Tests Number Positive	668.0	512.0	530.0	714.0	472.0	525.0	722.0	734.0	457.0	927.0	1364.0	455.0	0	748	748
Bomet County	Confirmed Malaria (only Positive cases)	399.0	670.0	550.0	1131.0	286.0	321.0	425.0	256.0	341.0	487.0	303.0	245.0	0	741	741
Embu County	Confirmed Malaria (only Positive cases)	1140.0	829.0	583.0	560.0	320.0	278.0	416.0	285.0	337.0	332.0	309.0	202.0	0	737	737

**Exercise 4.4.2.** Alternatively, there is another adhoc entry point for assessing extreme values.

- Go to the home page then click on the search apps icon (🔍)
- Click on the “WHO Data Quality Tool”.
- Click on “Analysis” then “Outliers and Missing Data”.
- Under Data, find and click on the down arrow to the right of “Data element group”. From the drop down menu that appears, find and select “04 - Malaria”. This group includes all of the data elements on the form that is submitted each month by each facility.
- Click in the box below that reads “Select data element” then select the following data elements from the drop down menu that appears: Confirmed Malaria (only positive cases)
- Click on and open the Period menu, then click on Custom. Under “From”, select January of last year. Under “To”, select January of this year.
- Click on and open the “Orgunit” menu. Leave Boundary set on “Kenya”, unless you want to limit your review to a subset of national data. To view a subset of national data, click on “Other” and a drop down menu will appear that allows you to select the organizational units for which you want to review the data. Under Disaggregation, find and click on the down arrow to view the drop down menu and select “County”. With Boundary set to “Kenya”, click on the Analyze button and wait for the table of nationwide results to appear.

Unit	Data	Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Missing	Outlier	Total
Turkana County	Confirmed Malaria (only Positive cases)	33038.0	30416.0	25758.0	8972.0	6148.0	5725.0	8205.0	7993.0	7724.0	4640.0	5761.0	4993.0	0	60158	60158
Bomet County	Confirmed Malaria (only Positive cases)	399.0	670.0	550.0	1131.0	286.0	321.0	425.0	256.0	341.0	487.0	303.0	245.0	0	741	741
Embu County	Confirmed Malaria (only Positive cases)	1140.0	829.0	583.0	560.0	320.0	278.0	416.0	285.0	337.0	332.0	309.0	202.0	0	737	737
Makueni County	Confirmed Malaria (only Positive cases)	222.0	108.0	110.0	121.0	82.0	117.0	189.0	120.0	193.0	107.0	122.0	92.0	0	98	98

The output table brings all counties with outliers on the selected indicator i.e. confirmed malaria

- Click on the menu icon at the end of this row (right-hand side) and select “Drill down” from the drop down menu. [see Screenshot] to investigate the source of the outliers as shown below.

Unit	Data	Weight												Missing	Outlier	Total
		Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17			
Turkana County	Confirmed Malaria (only Positive cases)	33038.0	30416.0	25758.0	8972.0	6148.0	5725.0	8205.0	7993.0	7724.0	4640.0	5781.0	4993.0	0	69158	69158
Bomet County	Confirmed Malaria (only Positive cases)	399.0	670.0	550.0	1131.0	298.0	321.0	425.0	256.0	341.0	487.0	303.0	245.0	0	741	741
Embu County	Confirmed Malaria (only Positive cases)	1140.0	829.0	583.0	580.0	320.0	278.0	416.0	265.0	337.0	332.0	309.0	202.0			
Makueni County	Confirmed Malaria (only Positive cases)	222.0	108.0	110.0	121.0	82.0	117.0	189.0	120.0	193.0	107.0	122.0	82.0			

Hierarchy				Weight												Missing	Outlier	Total
County	Sub-County	Unit	Data	Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17			
Bomet East Sub County	Longisa Ward	Kapkimotwa Dispensary	Confirmed Malaria (only Positive cases)			3.0	8.0		5.0							45	0	45
Bomet East Sub County	Longisa Ward	Bomet county Beyond Zero mobile clinic	Confirmed Malaria (only Positive cases)	1.0			822.0							1.0		9	0	9

You could note that the extreme value for Bomet county in April 2017 (1131) was attributed to two health facilities with patchy data completeness. **Bomet County Beyond Zero Mobile Clinic** alone had 882 cases in in April 2017.

9. If you confirm that the values are indeed outliers (low or high), two possible actions:
  - i. contact the county or health facility for correction. What would you do if this is not possible and staff at sub-national level failed to respond to your request?
  - ii. should the outlier value be edited in the DHIS2 and who has permission to edit the data in the DHIS2?;
  - iii. what steps will be taken to reduce the number of suspicious values in the future
  - iv. should you need to correct the extreme values, see example with moving average of two preceding values forward or backward (and note), or leave them blank?
10. Repeat these above steps for all counties or admin levels

## Assessing missing values

Zero values in malaria are true values. Therefore missing values should be left as blank or with a specific value selected to represent missing data. Ensure that your country follows strictly the policy of non-zero as missing value.

Also, ensure that the system is configured to store zero for data elements that require to be specified as zero or above. On paper, many countries customarily report only when event happens. For example a malaria death is recorded only when it happens as is often left blank when there is no death. This is not ideal and could lead to misinterpretation of data as it would be difficult to differentiate between non-event and missing values.

**Exercise 4.5.1.** Please refer to Exercise 4.4.2 number 8 which refers to the table for **Bomet County** that contains both extreme values and empty cells. These cells are missing values, i.e. the two health facilities did not enter values for those months highlighted in light yellow.

Hierarchy																Weight		
County	Sub-County	Unit	Data	Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	Jul 17	Aug 17	Sep 17	Oct 17	Nov 17	Dec 17	Missing	Outlier	Total
Bomet East Sub County	Longisa Ward	Kapkimolwa Dispensary	Confirmed Malaria (only Positive cases)		3.0	8.0		5.0								45	0	45
Bomet East Sub County	Longisa Ward	Bomet county Beyond Zero mobile clinic	Confirmed Malaria (only Positive cases)	1.0			822.0							1.0		9	0	9

## STEP 5. DEVELOP STANDARD GRAPHICS FOR NATIONAL AND INTERMEDIATE LEVELS

The best way for malaria programme to monitor progress and identify challenges is to select key data elements and indicators that are relevant to the information that they want to present and use standard graphs and maps for visualization and interpretation across all levels.

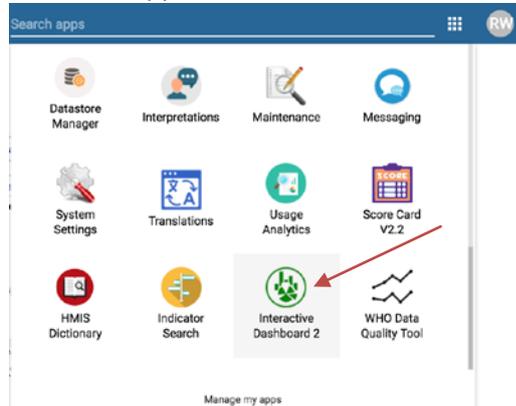
**Exercise 5.1:** If you are in burden reduction setting, identify the core data elements and indicators for malaria to be displayed in standard graphs displayed.

Review and interpret these trends of the following standard graphs.

1. Outpatient confirmed cases vs non-malaria outpatient cases (double y-axis)
2. Number of cases tested with microscopy and RDT (Areal graph)
3. Inpatient malaria vs non-malaria inpatient cases
4. Malaria deaths vs non-malaria deaths
5. Proportion of outpatient malaria cases, inpatient malaria cases and malaria deaths
6. Test positivity rate for RDT and Microscopy
7. Confirmed cases vs Annual blood examination rate (ABER)
8. Reporting completeness by malaria indicator (outpatient cases, inpatient cases and malaria deaths)

Now that you have familiarized with the standard graphs, you can reproduce them in the Interactive Dashboard 2 app shown below.

Go to the App menu, then click on the Interactive Dashboard 2 app





The three buttons in the charts enable you:

1. Expands chart to fit the browser
2. Filter for data, period and organization selection
3. Change chart type

Interpret the graphs and compare your results and ensure if you find similar charts as provided in the tutor’s guide.

**Exercise 5.2:** If you are in elimination setting, in addition to those relevant to burden reduction, identify the core data elements and indicators for malaria to be displayed in standard graphs. Generate standard graphs for the following.

1. Outpatient confirmed cases vs non-malaria outpatient cases (double y-axis)
2. Number of cases tested with microscopy and RDT (Areal graph)
3. Inpatient malaria vs non-malaria inpatient cases (optional, ignore it if you negligible malaria inpatients)
4. Malaria deaths vs non-malaria deaths (ignore it if you negligible malaria inpatients)
5. Test positivity rate for RDT and Microscopy
6. Confirmed malaria cases vs Annual blood examination rate (ABER)
 

In addition to the above (similar to that of the burden reduction setting), the following four are useful indicators for elimination.
7. Percentage of *P. falciparum* and *P. vivax*
8. Proportion of cases and proportion of foci investigated (double y-axis)
9. Proportion of cases and proportion of foci classified (double y-axis)
10. Indigenous cases vs Proportion of foci with zero-indigenous cases (double axis)
11. Reporting completeness by malaria indicator (outpatient cases, inpatient cases and malaria deaths)

Interpret the graphs and compare your results and ensure if you find similar charts as provided in the Tutor’s guide.

## STEP 6: STRATIFY BY ADMIN LEVEL (NATIONAL, SUB-NATIONAL) USING SELECTED INDICATORS

Stratification is a vital analytic step for malaria to determine epidemiological differences (spatial, vector, ecology, resistance, etc) and socioeconomic aspects such conflict, population movement, human behavior, poverty, access to health services, etc.

The purpose of stratification is to employ different interventions in different geographical places or populations. Example: IRS vs LLIN or LSM, mobile clinic in mobile population, etc.

It allows managers decide which intervention should be applied in which population.

The common malaria parameters used for stratifications include API, TPR, parasite rate and aggregate case count of cases and deaths. For this purpose, we will use API and TPR (RDT).

Two stratification steps are applied: macro-stratification (broader national view) and micro-stratification (subnational view) both of which could be depicted using table or map.

**Exercise 6.1.** Macro-stratification - please use annual parasite index (API) and use threshold of <10/1000 (Low), 10-50/1000 (Moderate) and >50/1000 (High) to develop three strata at national level. Click on Map

1. Show the three strata in tabular form and show how many counties fall within each stratum
2. Show the three strata in a map and indicate the strata with colored legend and thresholds.
3. Use Test Positivity Rate (TPR) with RDT and use threshold of <5% (Low), 5-20% (Moderate) and >20% (High) to develop three strata at national level. Show this in the map. Compare the two maps (API map and RDT map) and interpret.
4. Map coverage of LLIN in the three strata, using Number of (LLINs\*1.8)/population for each stratum.
5. Compare the two maps (API map and TPR map) with the LLIN coverage and interpret. Does the high stratum receive high LLIN coverage? If not what should the programme do? Please provide suggestion for programme readjustment if there is misalignment of LLIN coverage with the intensity of malaria by stratum.

**Exercise 6.2.** Micro-stratification - within a given stratum, **select Nyamira** and use annual parasite index (API) and a threshold of <5/1000 (Low), 5-20/1000 (Moderate) and >20/1000 (High) to develop three strata at national level.

1. Show the three strata in tabular form and show how many districts fall within each stratum
2. Similar to Exercise 6.1, show the three strata in a map, similar to that of macro-stratification, produce map of TPR and LLIN coverage maps and show if the high stratum has the highest LLIN coverage.
3. Please provide suggestion what readjustments should the malaria programme make if there is misalignment of LLIN coverage with the intensity of malaria by stratum.

## STEP 7: DEVELOP A TABLE WITH % CHANGE IN TRENDS BY INDICATOR AND BY LEVELS USING REFERENCE OR COMPARISON PERIODS

Surveillance data is useful to assess progress and monitor challenges so that malaria programme makes adjustments and tailor interventions in relation to the intensity of malaria burden in a given geographical area and population. Such approach informs resource optimization. Malaria programme can monitor progress in change of trend of a given indicator in recent years by comparing with a given reference period. Depending on the purpose, reference period may be 5 years, 3 years or one year ago.

The percent change is calculated as  $(\text{value of recent year (year of interest)}/\text{value of reference period} - 1) \times 100$ .

Negative percentage show decrease in the value of the indicator compared to the reference period and vice versa.

**Because of the difficulty to perform such analysis in the DHIS2 module's default reporting system, an Excel of a given country will be provided at the training session to compute the % changes for requested indicators below.**

**Exercise 7.1.** Use Annual parasite index (API), and TPR as key indicators and generate a table of percent change for 2017 compared to reference period 2012 at national level.

**Exercise 7.2.** Use Annual parasite index (API), and TPR as key indicators and generate a table of percent change for 2017 compared to reference period 2016 at national level.

**Exercise 7.3.** Use Annual parasite index (API), and TPR as key indicators and generate a table of percent change for 2017 compared to reference period 2012 for each county.

**Exercise 7.3.** Use Annual parasite index (API), and TPR as key indicators and generate a table of percent change for 2017 compared to reference period 2016 for each county.

Compare your results with the tables (answers) provided by the facilitators.

## STEP 8: ANALYSIS FOR EPIDEMIC DETECTION USING THRESHOLDS

Countries that are prone to epidemics or countries that are in transition from burden reduction to elimination should have an epidemic preparedness plan. One way of detecting epidemics early is using thresholds of retrospective surveillance data. The threshold you build is peculiar to each geographical unit as it dynamically established using the number of malaria cases observed in that place over time. Preferably, weekly data are needed to monitor and respond to epidemics in time. Monthly data may mask the initial and ending week of epidemics, and hence late response.

**Because of the difficulty to perform such analysis in the current DHIS2 module's default reporting system, an Excel of a given country will be provided at the training session to compute the % changes for requested indicators below.**

**Exercise 8.1.** Use confirmed malaria cases and TPR as key indicators and generate a table of epidemic thresholds using third quartile (75% percentile). To monitor presence of epidemics in 2017, compare it with the weekly data 2012-2016 (5-years threshold). If the country is experiencing sharp decrease in

malaria cases in recent years as a result of intensive malaria intervention, use the threshold of last 3 years instead of 5 years. Computation of third quartile threshold for 5 years involves arranging of the same weekly data of the 5 years (example: to generate third quartile of week 20, rank the values of week 20 in 2012, 2013, 2014, 2015 and 2016) in ascending or descending order and take the 4<sup>th</sup> value. The Computer does this automatically.

**Exercise 8.2.** Use confirmed malaria cases and TPR as key indicators and generate a chart of epidemic thresholds using C-sum. Computation of an average or base year by calculating the expected number of cases using the average for that week (and the previous and following week) during the past 5 years. For example, the C-sum for week 20 will be average values of week19, 20 and 21 for 2012, 2013, 2014, 2015 and 2016.

**Exercise 8.3.** Which of the two methods is more sensitive to pick even slight increase. Which of the methods would you apply to burden reduction and elimination settings?

**Exercise 8.4.** Which of the weeks or months is considered as acceptable seasonal peak with no need of declaring epidemics?

**Exercise 8.5.** What are the steps you would follow to declare epidemics at district level that would trigger local response?

## STEP 9: INTERPRET CHARTS AND TABLES

This section brings together all the results of the analyses above to make some concrete interpretations and conclusions that will lead to either augmentation or adjustments of the programme in its current efforts.

Association of percent change and coverage of interventions will lead to calibration of intervention plans. If there is reduction in incidence, the programme will attempt to potentially attribute which interventions have had the most impact.

**Exercise 9.1:** Using the core indicators, and exercises in step 6, 7 and 8 to describe the epidemiological situation of the country. Summarize the geographical areas most affected by malaria.

**Exercise 9.2:** Using the core indicators, and exercises in step 6, 7 and 8, deduce if there is good coverage of interventions (example LLIN) in all strata suitable to the prevailing epidemiological situation.

**Exercise 9.3:** Using the core indicators, and exercises in step 6, 7 and 8, deduce if there is good progress in reduction of malaria morbidity and mortality including aversion of epidemics over time. If not, explain the situation in relation to deployment of interventions (example LLIN).

**Exercise 9.4:** Put proposal forward for the programme to follow to improve impact based on your analyses.

## STEP 10: EVALUATE THE RESULTS ACCORDING TO THE CONTEXT AND TRIANGULATE WITH THE OTHER EVIDENCES

The findings of surveillance data could be misleading if some of the confounders are adequately addressed during the analysis.

These include:

- decreased or increased reporting by the health services (reporting completeness);
- diminished or improved provision of services ( physical structures, health workforce, health commodities);
- imposition or removal of barriers (example: fees);
- climatic factors such rainfall and humidity that have direct effect on malaria transmission;
- population movement, social or political crises, etc.

Therefore triangulation of the findings with other sources of data is vital to arrive at well informed set of conclusions and recommendations. These other data sources include:

1. intervention coverage data from household surveys including DHS and MIS;
2. parasite prevalence data from household surveys including DHS and MIS;
3. climatic data on rainfall and humidity corresponding for the same period by week or month;
4. data on malaria relevant funding from government and other sources
5. results from research studies.



World Health Organization  
20, Avenue Appia  
1211 Geneva 27  
Switzerland