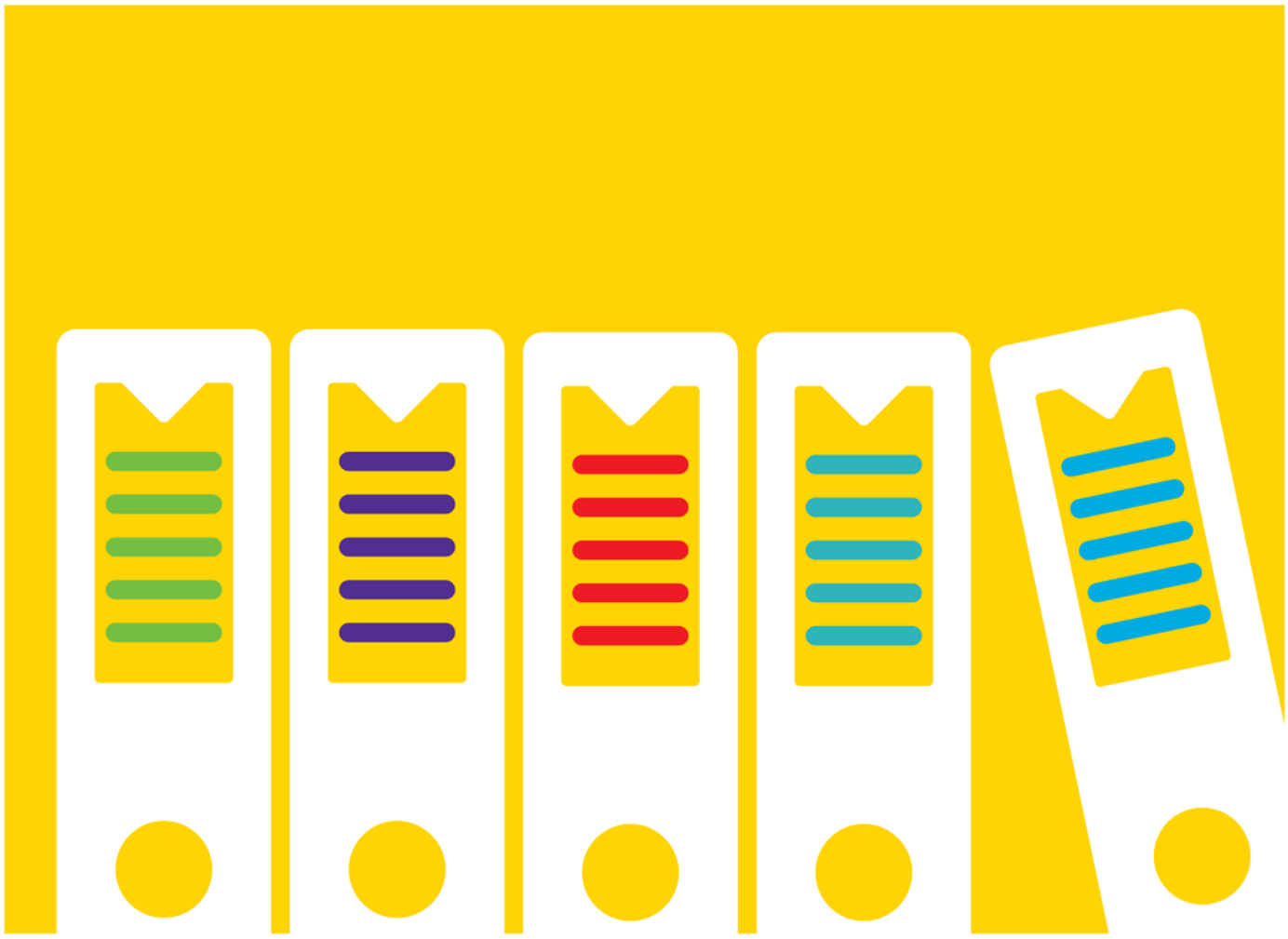

ANALYSIS AND USE OF HEALTH FACILITY DATA

Exercise book

For malaria programme managers

Tutor's guide

WORKING DOCUMENT, SEPTEMBER 2018

World Health Organization

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Acknowledgements

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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 leaners on the collation, processing, analysis and interpretation of DHIS2 data and triangulation with other data sources. At the end of the training, leaners 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).

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 2.2 and Exercise 2.3. For each core indicator below, define its purpose or use.

1. Annual parasite index (if annual) = Total tested (RDT/Mic)/total population of a given admin level

   Purpose: to estimate the incidence of malaria (as proxy) in a given year

2. Confirmed malaria cases (if monthly, confirmed cases per 1000 population) = Total confirmed cases in a given time (RDT/Mic)/total population of a given admin level and year

   Purpose: to estimate the incidence of malaria (as proxy) in a given month

3. Test positivity rate (separate for RDT and Microscopy) =
   a. Total RDT positives/Total RDT tests
   b. Total Positive slides/Total slides examined

   Purpose: to estimate the prevalence of malaria positivity (as proxy for transmission) in a given period

4. Percentage of suspected cases tested =Total tested (RDT+Mic)/Total suspected cases

   Purpose: to estimate the extent of malaria diagnosis (coverage) in a given period

5. Annual blood examination rate: Total examined/population

   Purpose: to interpret accurately if trends of confirmed malaria cases against a constant testing rate in a given period.

6. Reporting completeness = Number of health facilities reported/Total number of health facilities expected to report (disaggregated for outpatient, inpatient and deaths)

Purpose: to ensure that all health facilities and admin levels have reported and avoid bias due to fluctuations in reporting

7. Non-malaria outpatient cases = All-cause outpatient – outpatient confirmed malaria cases

   Purpose: to ensure that the changes in trends of malaria are not due to other systemic factors that equally affect other diseases. Example insurance scheme increases service utilization and increase in all diseases.

8. Non-malaria inpatient cases = All-cause inpatients – malaria inpatients

   The same as in No 6.

9. Non-malaria deaths = All-cause deaths – malaria deaths

   The same as in No 6.

10. Proportion of outpatient malaria cases= Confirmed malaria cases/All-cause outpatients

    Purpose: to assess that the changes in trends of malaria over time are different compared to the other diseases. Significant reduction of proportion of malaria indicates reduction in true incidence either due to malaria interventions or other factors.

11. Proportion of inpatient malaria cases =Inpatient malaria cases/All-cause inpatients

    Purpose: The same as in No 9.

12. Proportion of malaria deaths = Malaria deaths/All-cause deaths

    Purpose: The same as in No 9.

Ensure that the indicators you have identified have been defined and included or configured within DHIS (see **Annex 2**).

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

Exercise 2.4. For elimination settings, in addition to the above core indicators discussed in Exercise 2, consider the following elimination specific indicators below:

1. Annual blood examination rate: The same as in Exercise 2.3.

   Purpose: In elimination, as cases reduce markedly, testing of suspected cases should continue at higher rate for some years to ensure that cases are not missed and the risk of re-introduction is minimal.

2. Number of indigenous cases: Number of cases attributed to local transmission

   Purpose: In elimination, as cases reduce markedly, we should disaggregate the cases by indigenous, introduced and imported cases. The aim is to reduce the number of indigenous cases to zero and also monitor the number of imported cases to ensure that the risk of re-introduction is minimal.

3. Proportion of P. falciparum= Number of P. falciparum/total positive cases x 100

   Purpose: Compare the trend of proportion of P.f and P.v over time. If a country has both species, often, it is easier to eliminate P.f first than P.v. Therefore, this graph helps monitor progress in eliminating the species of interest.

   The same for P. vivax.

4. Percentage of cases investigated= Number of cases investigated /total number of cases detected

   Purpose: Monitor progress on capacity to investigate all cases over time. Inability to investigate and respond to all cases will potentially lead to slow reduction of local transmission and hence slow progress in elimination. When a country starts elimination, this capacity doesn't exist and has to be built over time as the programme invests in training of the health staff and systems.

5. Percentage of foci investigated= Number of foci investigated /total number of foci detected

   Purpose: Monitor the capacity to investigate all foci over time. Inability to investigate and respond to all foci will potentially lead to slow progress in elimination. The same as above, this capacity is almost non-existent as country starts elimination.

6. Percentage of cases classified= Number of cases classified /total number of cases investigated

   Purpose: Monitor the capacity to classify all cases investigated over time. Inability to classify a case and respond is indicative of poor capacity in elimination.

7. Percentage of foci classified= Number of foci classified /total number of foci investigated

   Purpose: Monitor the capacity to classify foci investigated over time. Foci delineation and investigation are based on case surveillance and response. Foci provide a useful spatial unit to improve the efficiency of response

8. Percentage of active foci with zero indigenous cases= number of foci with indigenous cases/total foci with cases

   Purpose: Monitor the progress of subnational elimination over time and eventually clearance of all foci. Note that eventually, the number of years without zero indigenous cases inform certification of elimination.

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

Exercise 3.1. Enter data or copy and paste data into the DHIS structured data elements. If you have data in Excel or other sources, facilitators will demonstrate these steps with example on DHIS 2.

Guide participants to follow the steps illustrated in the learner's guide to do the following:

1. Export the data template from the DHIS2 (data structure) and save as CVS or Excel

2. Copy data from other sources and paste to the DHIS2 data structure.

3. Match the name of each data element in the source with DHIS2 structure.

4. Import the data to the DHIS2.

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

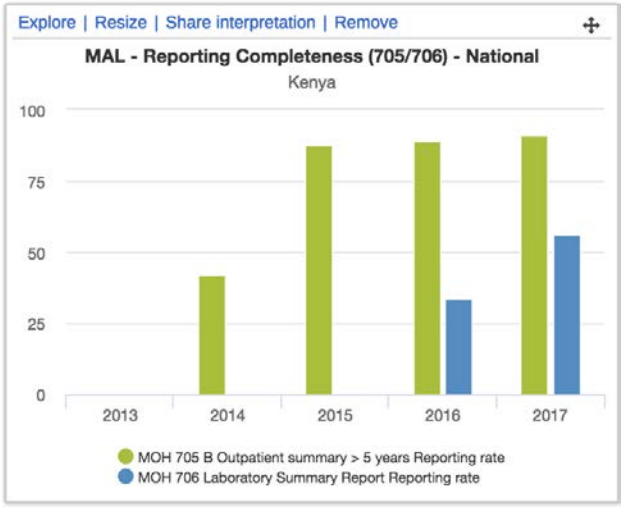
Exercise 4.1. Demonstrate on DHIS home page how the dashboard navigation works and click on "Malaria Surveillance Quality" in the row of dashboards.

Quickly scroll through and review the malaria data quality dashboard. The dashboard includes several separate charts? Note the gear icon next to Search. We will practice using this function in one of the following exercises.

Review the completeness of data nationwide

Exercise 4.1.1: Use **Kenya data**: Generate a chart for reporting completeness by first admin (example by province or equivalent) and by data element (example: **outpatient malaria cases**)

1. Change the above chart to a trend of 5-years period



2. Describe the trend in reporting completeness over the last months.

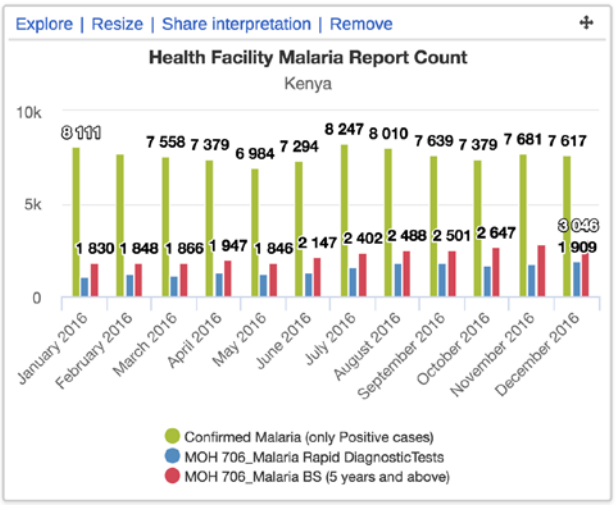
   This is summary report comprising reports of all diseases. It is hard to make any conclusions about reporting completeness for malaria from the graph. Outpatient summary reports have increasingly improved (>80%). But laboratory summary reports shows year-to-year variation but these trends may not be same for malaria.

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.

   Both summary reports were low in 2013.

4. Repeat activities 1-3 using **outpatient malaria cases by year and month**. The chart below shows count of health facilities by year and month. However, this chart does not show the denominator (the number of health facilities expected to report). For this, two tables are required: one with count of facilities with reported cases and the second with count of health

facilities expected to report. Then a percentage can be calculated.



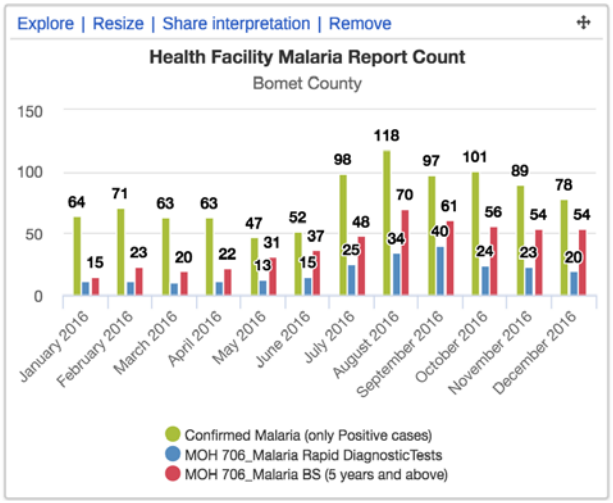
5. Describe your observation and conclusion of the two charts.

   The malaria cases reported are far more than the RDT or microscopy tests. RDTs are used less often than microscopy. The data suggests most malaria patients are not tested or most laboratory results are not recorded properly.

Review the completeness of sub-national data

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

1. Click on the gear icon (next to **Search**).
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**.



The above chart shows the count of health facilities that have reported for outpatient malaria cases and laboratory confirmation for RDT and microscopy. From this chart, it is clear that the reporting on RDT results is very low in Bomet County.

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 d*escribe your observation and conclusion.

Assess the consistency of malaria data

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 positive (confirmed and presumed); ii) total suspected cases should be more or equal to total tested, assuming a near 100% confirmation rate and adding the presumed cases; 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?

The purpose of assessing this indicator is to ensure that the overall changes in health utilization do not distort the interpretation of malaria trends.

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; and outliers and missing data tabs.

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:

Demonstrate to participants how to assess extreme values following the steps provided in learner's guide.

Discuss the outliers (low or high), on how to solve the problems in terms of whether it would be possible:

i. contact the country or health facility for correction and what to do when this impossible
ii. if outlier values could be edited in the DHIS (example: correct with moving average of two preceding values forward or backward (and note)
iii. If not who has permission to edit the data
iv. agree on strategies to reduce the number of suspicious values in the future

Data correction should be done at the lowest level where data entry occurs. However, outside the main database, at the level of data management or analysis, missing and extreme values can be corrected using moving averages of other rules.

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.

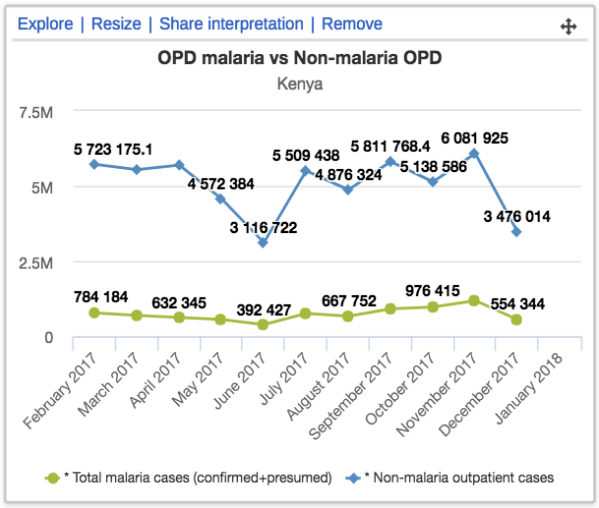
Exercise 4.5.1. Guide participants to apply same procedures as for the extreme values (except for the Mean+/- 2*Standard deviation) provided in the learner's guide.

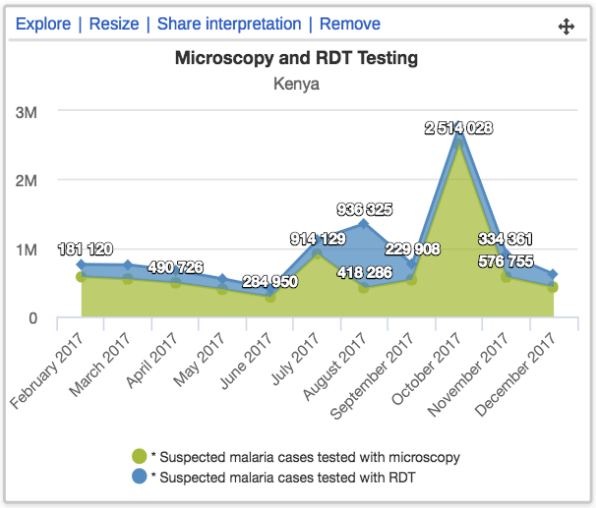
The missing values are indicated in yellow in the table (together with that of the extreme values in Exercise 4.4). Compare with the results of the participants, demonstrate on how to drill down to the lowest admin levels and discuss on what to do with such missing values.

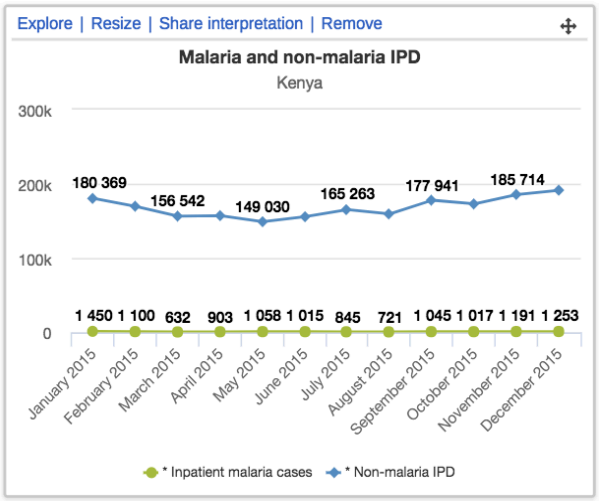
STEP 5. DEVELOP STANDARD GRAPHICS FOR NATIONAL AND INTERMEDIATE LEVELS

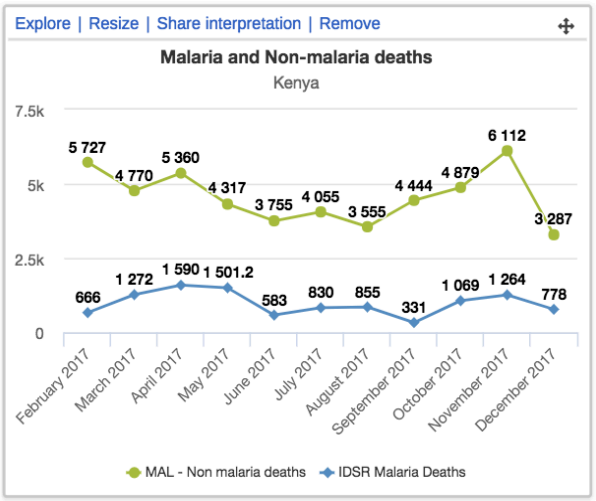
The best way for malaria programme to monitor progress and identify challenges is to select key data elements and indicators that are relevant to the information that they want to present and use standard graphs and maps for visualization and interpretation across all levels.

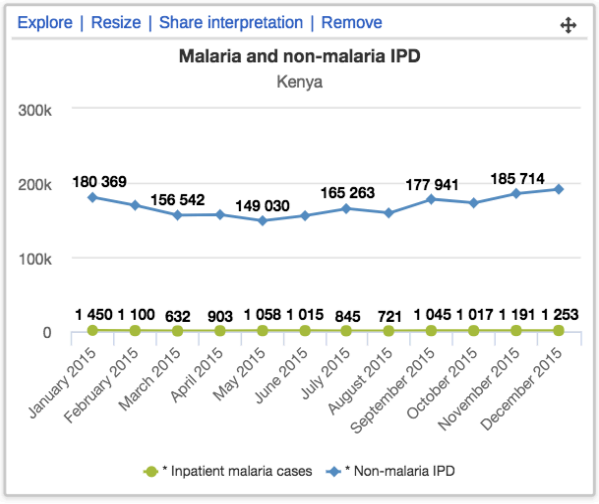
Exercise 5.1: In burden reduction setting of Kenya, the following are possible interpretations of the standard charts.

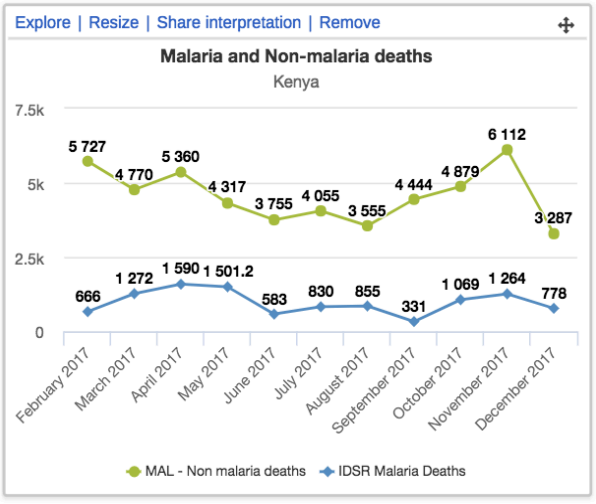

Explore | Resize | Share interpretation | Remove
OPD malaria vs Non-malaria OPD
Kenya
7.5M
5M
2.5M
0
5 723 175.1
4 572 384
3 116 722
5 509 438
4 876 324
5 811 768.4
5 138 586
6 081 925
3 476 014
784 184
632 345
392 427
667 752
976 415
554 344
February 2017
March 2017
April 2017
May 2017
June 2017
July 2017
August 2017
September 2017
October 2017
November 2017
December 2017
January 2018
* Total malaria cases (confirmed+presumed)
* Non-malaria outpatient cases

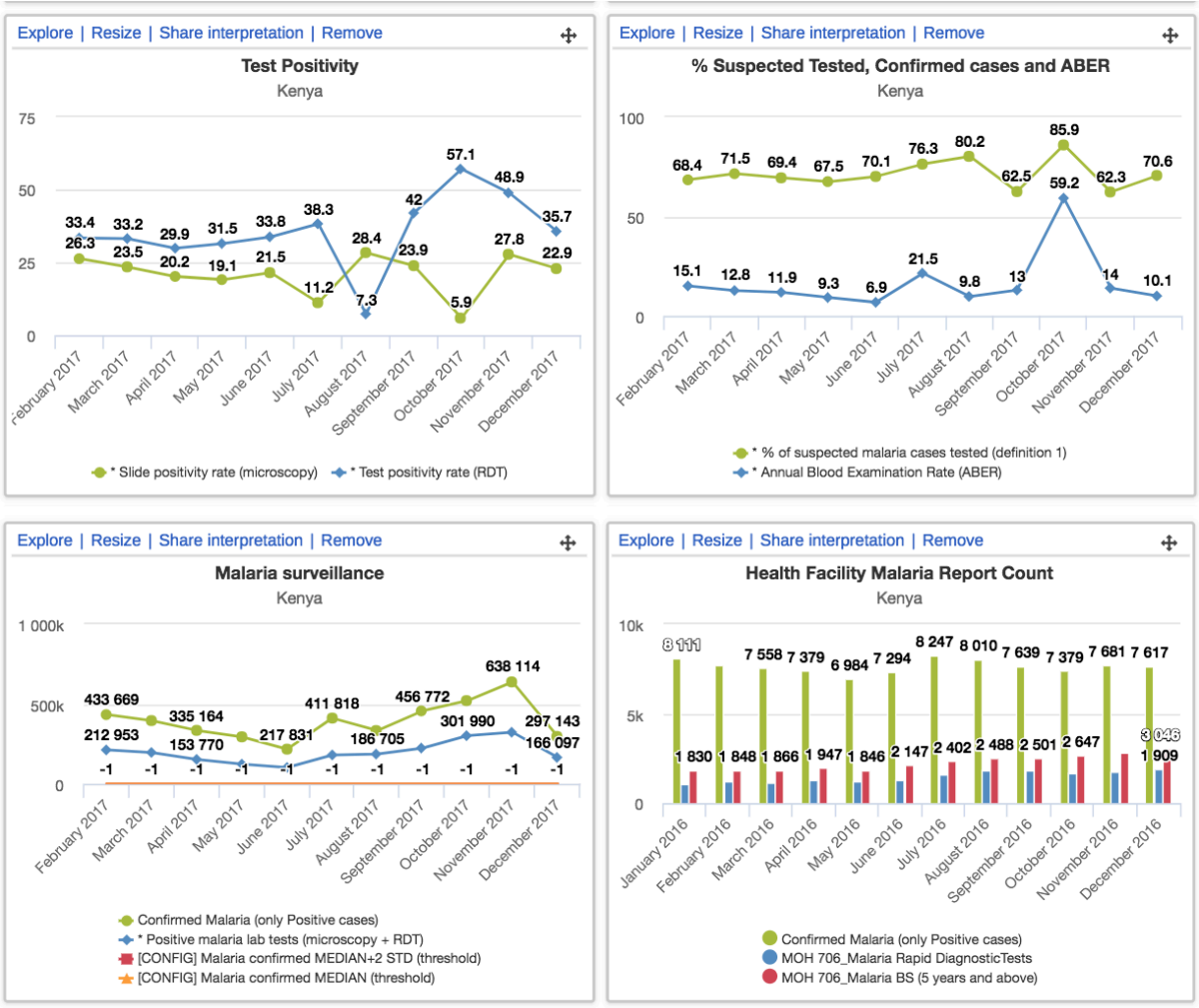

Explore | Resize | Share interpretation | Remove
Microscopy and RDT Testing
Kenya
3M
2M
1M
0
161 120
490 726
284 950
914 129
936 325
418 286
229 908
2 514 028
334 361
576 755
February 2017
March 2017
April 2017
May 2017
June 2017
July 2017
August 2017
September 2017
October 2017
November 2017
December 2017
* Suspected malaria cases tested with microscopy
* Suspected malaria cases tested with RDT


Explore | Resize | Share interpretation | Remove
Malaria and non-malaria IPD
Kenya
300k
200k
100k
0
180 369
156 542
149 030
165 263
177 941
185 714
1 450
1 100
632
903
1 058
1 015
845
721
1 045
1 017
1 191
1 253
January 2015
February 2015
March 2015
April 2015
May 2015
June 2015
July 2015
August 2015
September 2015
October 2015
November 2015
December 2015
* Inpatient malaria cases
* Non-malaria IPD


Explore | Resize | Share interpretation | Remove
Malaria and Non-malaria deaths
Kenya
7.5k
5k
2.5k
0
5 727
4 770
5 360
4 317
3 755
4 055
3 555
4 444
4 879
6 112
3 287
666
1 272
1 590
1 501.2
583
830
855
331
1 069
1 264
778
February 2017
March 2017
April 2017
May 2017
June 2017
July 2017
August 2017
September 2017
October 2017
November 2017
December 2017
MAL - Non malaria deaths
IDSR Malaria Deaths


Explore | Resize | Share interpretation | Remove
Malaria and non-malaria IPD
Kenya
300k
200k
100k
0
180 369
156 542
149 030
165 263
177 941
185 714
1 450
1 100
632
903
1 058
1 015
845
721
1 045
1 017
1 191
1 253
January 2015
February 2015
March 2015
April 2015
May 2015
June 2015
July 2015
August 2015
September 2015
October 2015
November 2015
December 2015
* Inpatient malaria cases
* Non-malaria IPD


Explore | Resize | Share interpretation | Remove
Malaria and Non-malaria deaths
Kenya
7.5k
5k
2.5k
0
5 727
4 770
5 360
4 317
3 755
4 055
3 555
4 444
4 879
6 112
3 287
666
1 272
1 590
1 501.2
583
830
855
331
1 069
1 264
778
February 2017
March 2017
April 2017
May 2017
June 2017
July 2017
August 2017
September 2017
October 2017
November 2017
December 2017
MAL - Non malaria deaths
IDSR Malaria Deaths



1. Outpatient confirmed cases vs non-malaria outpatient cases (double y-axis)

   While there are some fluctuations, non-malaria outpatients trends are general stable. Malaria outpatient cases start high but clearly there is data quality issue over time.

2. Number of cases tested with microscopy and RDT (Areal graph)

   The dominant diagnostic method is microscopy while use RDT is increasing over time.

3. Inpatient malaria vs non-malaria inpatient cases

   Inpatient malaria cases in 2016 (about 1000 per month), given the past trends, seemed realistic while 2017 are too low, again probably due to reporting.

4. Malaria deaths vs non-malaria deaths

   Apart from seasonal variation, malaria deaths seem constant over time.

5. Proportion of outpatient malaria cases, inpatient malaria cases and malaria deaths

   Proportion of outpatient malaria is very variable over time, while proportion of inpatients is constant. Proportion of death has declined but is not clear if this is due to reporting.

6. Test positivity rate for RDT and Microscopy

   TPR with microscopy is lower than RDT except August 2017, which is probably due to poor data quality.

7. Confirmed cases vs Annual blood examination rate (ABER)

ABER is consistently around 10-15%, percentage of suspected cases has shown slight increase over time reaching to >70%.

8. Reporting completeness by malaria indicator (outpatient cases, inpatient cases and malaria deaths)

   Please note that, there is difficulty to identify health facility count expected to report from the DHIS2. When extracted the total list into Excel, the total list of health facilities in the DHIS2 was 8,647.

   Based on this denominator, the reporting completeness based on health facility counts if >84% for outpatient confirmed cases taking the denominator 8247 total count expected to report.

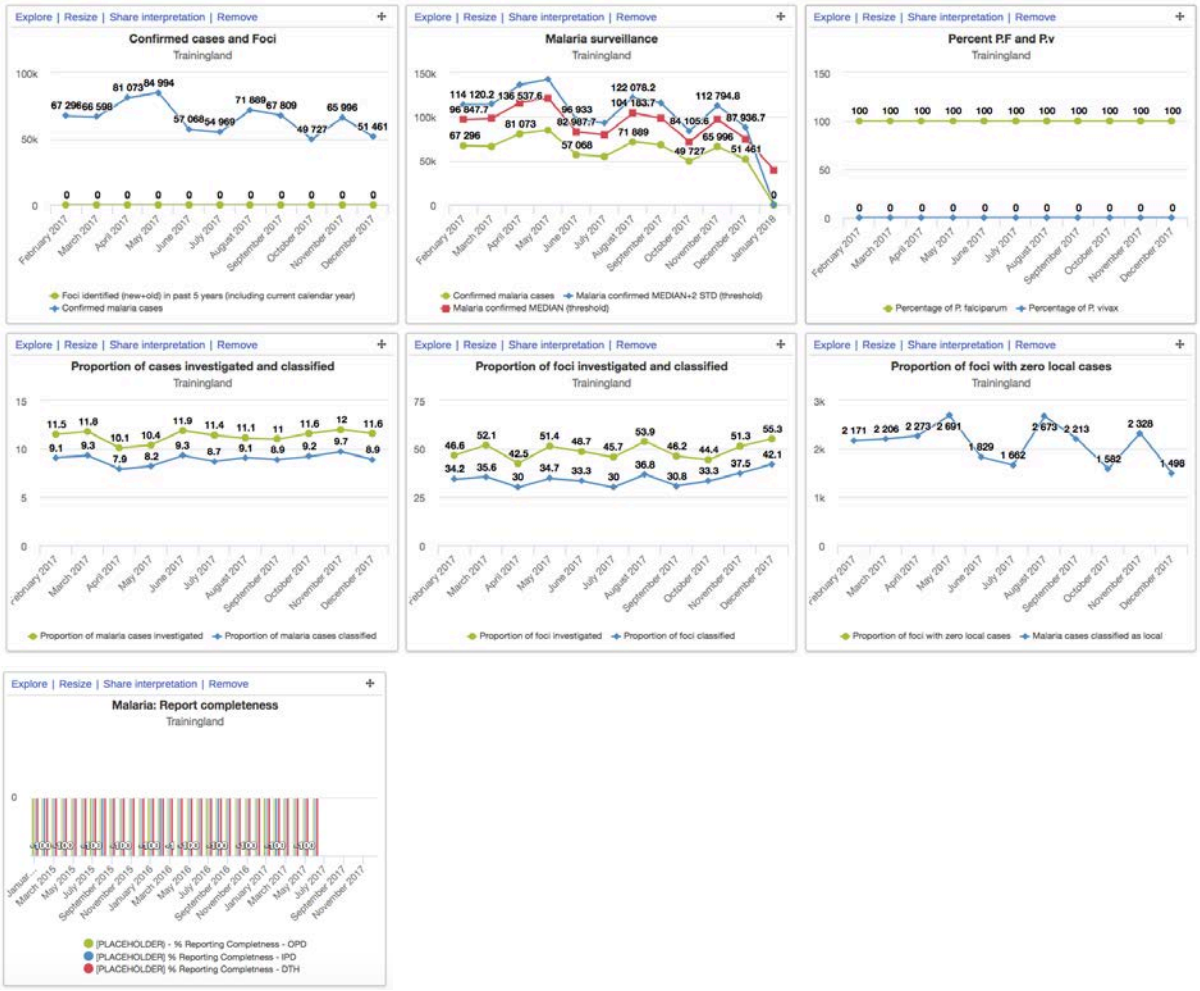
Exercise 5.2: If you are in elimination setting, in addition to the those relevant to burden reduction, identify the core data elements and indicators for malaria to be displayed in standard graphs. Generate standard graphs for the following.

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 below.



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, 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.

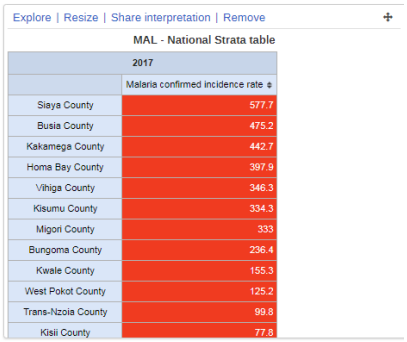
It allows managers decide on which intervention should be applied in which population.

The common parameters used for stratifications include API, TPR and aggregate case count

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.

Answers for 6.1 (1-4).

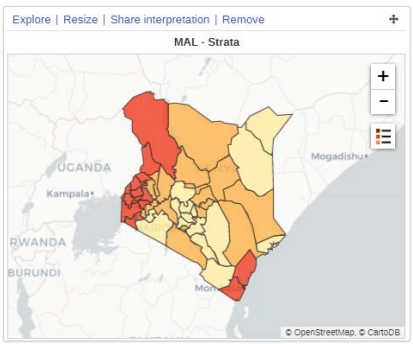

Explore | Resize | Share interpretation | Remove

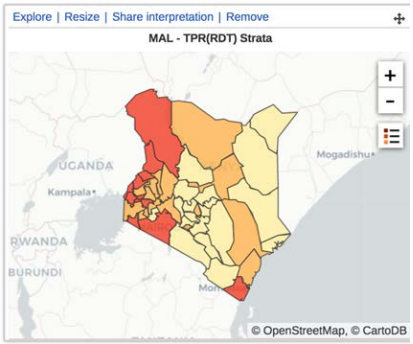
MAL - National Strata table

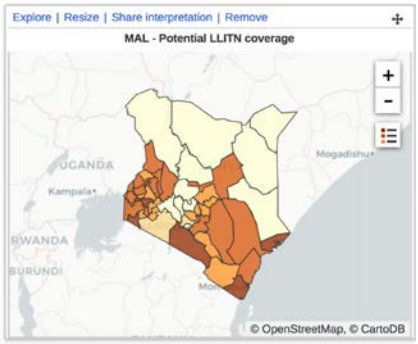
	2017
	Malaria confirmed incidence rate
Siaya County	577.7
Busia County	475.2
Kakamega County	442.7
Homa Bay County	397.9
Vihiga County	346.3
Kisumu County	334.3
Migori County	333
Bungoma County	236.4
Kwale County	155.3
West Pokot County	125.2
Trans-Nzoia County	99.8
Kisii County	77.8

A table of three strata is generated coloured and ranked from high to low in each stratus. The table on the screen is actually much longer and could not be pasted here due to the long list of the sub-counties.

From the first map using API and TPR, it is clear that the three strata using the thresholds have geographical proximity: High in the Western and southern; moderate in the middle north; and low in the east north and middle.



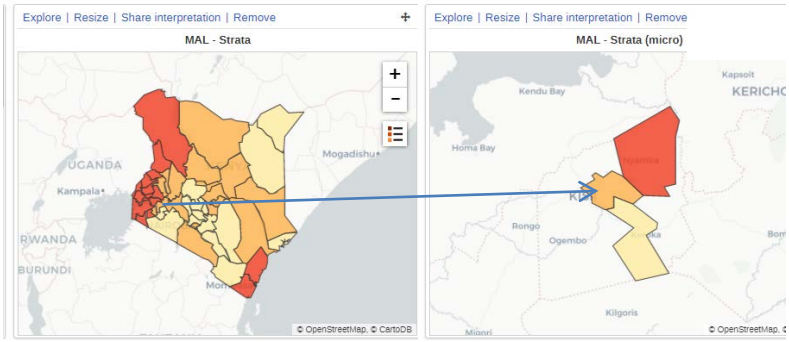




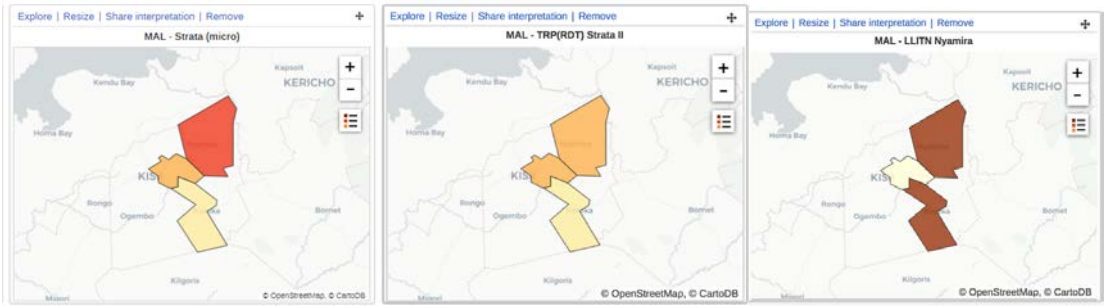
Coverage with LLIN appears to be lower in the northern western despite high incidence and TPR.

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

Answers for Exercise 6.2 (1-3). The first map is based on API to locate in which strata Nyamiara falls.



From the macro-stratification, it is clear that the Nyamira County falls within moderate strata but in further micro-stratification by sub-county, malaria is diverse: one with high, one moderate and one low. This allows the county to tailor interventions by subcounty.



The middle sub-county seems receiving lower LLIN coverage in spite of higher incidence and TPR.

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 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.

Use the Excel data provided to facilitators and participants. Use Excel to guide the participants to compute the questions below. Produce the table by subnational level and give clear instructions to the participants.

The percent change is calculated as (value of recent year (year of interest)/value of reference period -1) x 100.

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

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 the results of participants with your outputs.

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.

Provide the Excel data of country A by week and request participants to generate the following analysis and demonstrate the methods in Excel. Compare results of participants with your outputs.

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 4th 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?

When district observes two- week trend exceeds threshold, it should undertakes rapid assessment, confirm malaria as the main cause of increased cases and respond according to national epidemic preparedness and response plan.

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, 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, deduct 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, deduct 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 ways forward the programme has to follow based on your analysis.

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. **Provide some external data and slides to show the importance of these factors.**

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.

Show triangulation of the finding of surveillance data with other sources of data as vital exercise to make deductions:

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