

Predictive Analysis of Malaysian Dengue Hemorrhagic Fever Data from 2010 - 2017 using BigML

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Introduction

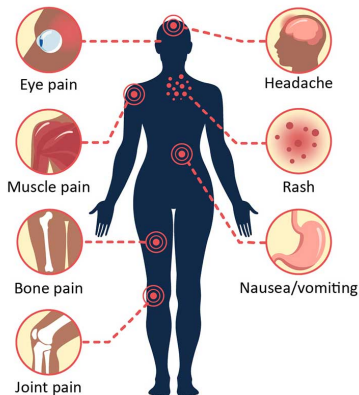
- Dengue Fever (DF)
- More than $\frac{1}{3}$ of population affected by dengue (World Health Organization, 2017)



Infected Aedes mosquitoes

Dengue Symptoms

- "Break-bone fever"
- Severe joint and muscle pain, rash, fever



Symptoms of Dengue Fever

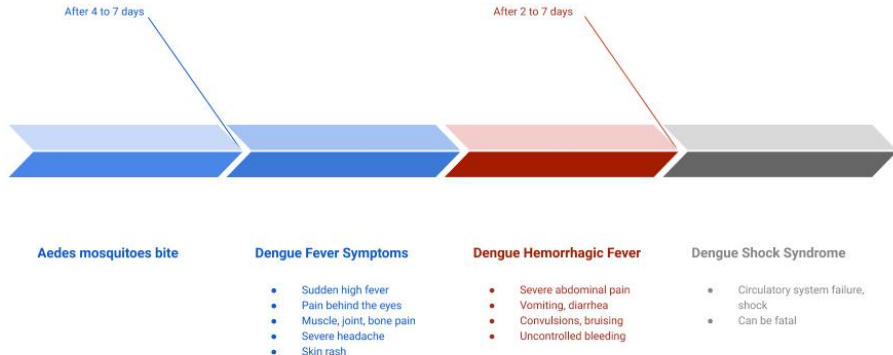
Dengue Fever in Malaysia

- 2013: 43,436 dengue cases
- 2014: 108,698 dengue cases
- 2015: 120,836 dengue cases item Reported by Malaysian Ministry of Health in 2017

Difference between DF and DHF

- Dengue Fever (DF) V.S. Dengue Hemorrhagic Fever (DHF)
 - ▶ There is a slight difference.
 - ▶ DF \rightarrow DHF

Evolution of DF to DHF



Dengue Fever to Dengue Hemorrhagic Fever

- Identify:
 - ① Infected areas/states
 - ② Age groups of dengue hemorrhagic fever
- Run time-series analysis:
 - ① Epidemic pattern
 - ② Future outbreaks

- ① Data Collection
- ② Data Pre-processing
- ③ Data Loading
- ④ Current data analysis
- ⑤ Run time-series analysis

- Malaysian Open Data Portal

The screenshot displays the Malaysian Open Data Portal interface. At the top, a breadcrumb trail reads: Home / Data Set Provider / Ministry of Health / Number of Dengue Disease Cases ...

On the left sidebar, there is a search bar with 'Carian Terperinci' and a 'LOOK FOR' button. Below it, the 'Data Set Provider' section features the Malaysian coat of arms and the text 'health Ministry'. Further down, an 'Openness' section shows a star rating of three stars. At the bottom of the sidebar are 'Social' and 'Google+' links.

The main content area has a search bar with 'Cari' and a 'LOOK FOR' button. Below this are tabs for 'Data Set' (selected) and 'Clusters'. The title of the dataset is 'Number of Annual Dengue Haemorrhagic Fever (DHF) Cases by State and Age'. The description states: 'This dataset shows the number of cases of Dengue Haemorrhagic Fever (DHF) cases annually by state and age in Malaysia. Data will be provided annually once the data is finalized.' It also shows 'Total Views: 0' and 'Status: Dataset is Published'.

Under the 'Data Sets and Sources' section, there is a link to the dataset with a download icon, the title 'Number of cases of Dengue Haemorrhagic Fever Disease ...', a description 'This dataset shows the number of cases of Dengue Haemorrhagic Fever (DHF) ...', and 'Downloads: 6'. An 'Explore' button is also present.

Dengue Hemorrhagic Fever data from 2010 - 2017
(Source: <http://www.data.gov.my/>)

Data Pre-processing

- Use tool for data cleaning and formatting

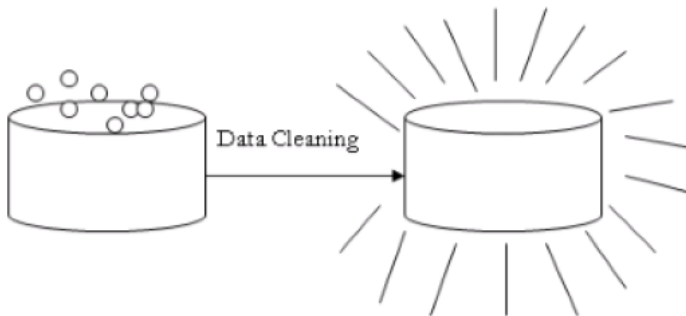


Illustration on Data Cleaning process

Data Pre-processing (cont.)

- Translate the variables names into English
- Transform to the right data format!

BILANGAN KES PENYAKIT DENGUE HAEMORRHAGIC FEVER TAHUNAN MENGIKUT NEGERI DAN KUMPULAN UMUR, TAHUN 2010																
KUMPULAN UMUR	JOHOR	KEDAH	KELANTAN	MELAKA	NEGERI SEMBILAN	PAHANG	PERAK	PERLIS	PULAU PINANG	SABAH	SARAWAK	SELANGOR	TERENGGANU	WP KUALA LUMPUR	WP LABUAN	MALAYSIA
0-4	10	0	4	1	0	0	0	0	3	1	5	32	2	5	0	63
5-9	16	0	11	2	2	4	4	0	1	3	12	63	4	21	0	143
10-14	63	0	25	29	9	12	8	0	5	2	10	182	9	37	0	391
15-19	67	0	55	38	15	16	4	0	1	2	12	243	14	38	0	505
20-24	102	0	32	52	18	10	2	0	0	0	22	348	13	44	0	643
25-29	115	0	31	41	18	13	2	0	3	2	21	330	14	48	0	638
30-34	78	0	20	28	14	13	4	0	2	2	12	246	5	33	0	457
35-39	63	0	23	28	13	10	1	0	4	1	17	166	6	20	0	352
40-44	35	1	14	27	9	7	2	0	1	3	20	132	5	15	0	271
45-49	29	1	22	18	13	12	0	0	1	1	8	83	3	6	0	197
50-54	18	0	21	15	9	11	1	0	0	0	11	61	3	11	0	161
55-59	12	1	6	16	6	4	3	0	0	0	4	34	4	10	0	100
60-64	12	0	5	5	2	2	0	0	0	0	3	16	0	5	0	50
65-69	7	0	8	3	0	1	0	0	0	0	3	10	0	2	0	34
70-74	3	0	0	4	0	0	1	0	0	0	0	7	0	2	0	17
>75	0	0	2	1	0	1	0	0	0	0	2	2	1	0	0	9
Grand Total	630	3	279	308	128	116	32	0	21	17	162	1955	83	297	0	4031

Dengue Hemorrhagic Fever Dataset in 2010

Data Pre-processing (cont.)

- Include cases from 13 states, remove cases from 2 federal territories
- Avoid duplicated cases (since 2 federal territories are part of the 13 states)

KUMPULAN UMUR	JOHOR	KEDAH	KELANTAN	MELAKA	NEGERI SEMBILAN	PAHANG	PERAK	PERLIS	PULAU PINANG	SABAH	SARAWAK	SELANGOR	TERENGGANU	WP KUALA LUMPUR	WP LABUAN	MALAYSIA
0-4	10	0	4	1	0	0	0	0	3	1	5	32	2	5	0	63
5-9	16	0	11	2	2	4	4	0	1	3	12	63	4	21	0	143
10-14	63	0	25	29	9	12	8	0	5	2	10	182	9	17	0	391
15-19	67	0	55	38	15	16	4	0	1	2	12	243	14	8	0	505
20-24	102	0	32	52	18	10	2	0	0	0	22	348	13	4	0	643
25-29	115	0	31	41	18	13	2	0	3	2	21	330	14	4	0	638
30-34	78	0	20	28	14	13	4	0	2	2	12	246	5	3	0	457
35-39	63	0	23	28	13	10	1	0	4	1	17	166	6	2	0	352
40-44	35	1	14	27	9	7	2	0	1	3	20	132	5	5	0	271
45-49	29	1	22	18	13	12	0	0	1	1	8	83	3	6	0	197
50-54	18	0	21	15	9	11	1	0	0	0	11	61	3	11	0	161
55-59	12	1	6	16	6	4	3	0	0	0	4	34	4	10	0	100
60-64	12	0	5	5	2	2	0	0	0	0	3	16	0	5	0	50
65-69	7	0	8	3	0	1	0	0	0	0	3	10	0	2	0	34
70-74	3	0	0	4	0	0	1	0	0	0	0	7	0	2	0	17
>75	0	0	2	1	0	1	0	0	0	0	2	2	1	0	0	9
Grand Total	630	3	279	308	128	116	32	0	21	17	162	1955	83	297	0	4031

Dengue Hemorrhagic Fever 2010 Dataset

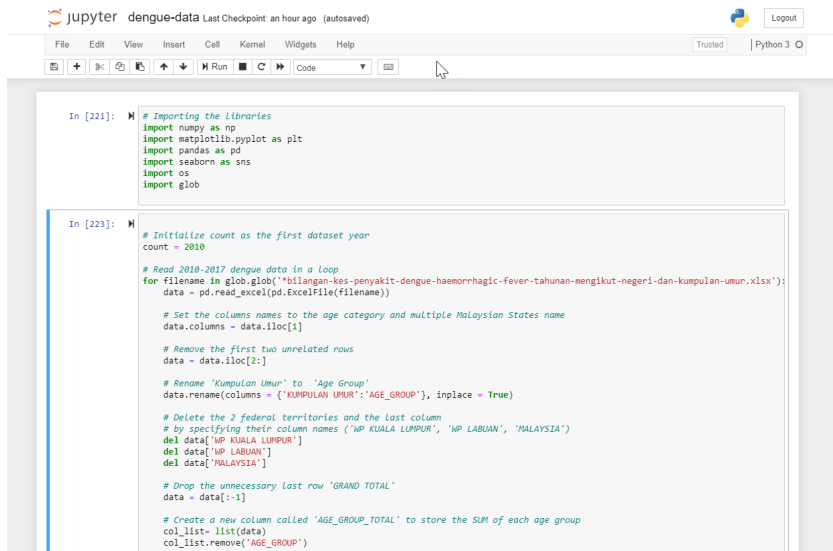
Data Pre-processing (cont.)

- Remove the last column and last row
- Rename 'KUMPULAN UMUR' to 'AGE_GROUP'

KUMPULAN UMUR	JOHOR	KEDAH	KELANTAN	MELAKA	NEGERI SEMBILAN	PAHANG	PERAK	PERLIS	PULAU PINANG	SABAH	SARAWAK	SELANGOR	TERENGGANU	WP KUALA LUMPUR	WP LAEUN	MADAT
0-4	10	0	4	1	0	0	0	0	3	1	5	32	2	5	0	63
5-9	16	0	11	2	2	4	4	0	1	3	12	63	4	21	0	43
10-14	63	0	25	29	9	12	8	0	5	2	10	182	9	27	0	391
15-19	67	0	55	38	15	16	4	0	1	2	12	243	14	8	0	505
20-24	102	0	32	52	18	10	2	0	0	0	22	348	13	4	0	643
25-29	115	0	31	41	18	13	2	0	3	2	21	330	14	4	0	638
30-34	78	0	20	28	14	13	4	0	2	2	12	246	5	3	0	457
35-39	63	0	23	28	13	10	1	0	4	1	17	166	6	2	0	452
40-44	35	1	14	27	9	7	2	0	1	3	20	132	5	3	0	471
45-49	29	1	22	18	13	12	0	0	1	1	8	83	3	6	0	497
50-54	18	0	21	15	9	11	1	0	0	0	11	61	3	11	0	461
55-59	12	1	6	16	6	4	3	0	0	0	4	34	4	10	0	400
60-64	12	0	5	5	2	2	0	0	0	0	3	16	0	5	0	400
65-69	7	0	8	3	0	1	0	0	0	0	3	10	0	2	0	400
70-74	3	0	0	4	0	0	1	0	0	0	0	7	0	2	0	400
>75	0	0	2	1	0	1	0	0	0	0	2	2	1	0	0	9

Dengue Hemorrhagic Fever 2010 Dataset

Data Formatting (cont.)



```
In [221]: # Importing the Libraries
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
import seaborn as sns
import os
import glob

In [223]: # Initialize count as the first dataset year
count = 2010

# Read 2010-2017 dengue data in a loop
for filename in glob.glob('*bilangan-Kes-penyakit-dengue-haemorrhagic-fever-tahunan-mengikut-negeri-dan-kumpulan-umur.xlsx'):
    data = pd.read_excel(pd.ExcelFile(filename))

    # Set the columns names to the age category and multiple Malaysian States name
    data.columns = data.iloc[1]

    # Remove the first two unrelated rows
    data = data.iloc[2:]

    # Rename 'Kumpulan Umur' to 'Age Group'
    data.rename(columns = {'KUMPULAN UMUR':'AGE_GROUP'}, inplace = True)

    # Delete the 2 federal territories and the last column
    # by specifying their column names ('WP KUALA LUMPUR', 'WP LABUAN', 'MALAYSIA')
    del data['WP KUALA LUMPUR']
    del data['WP LABUAN']
    del data['MALAYSIA']

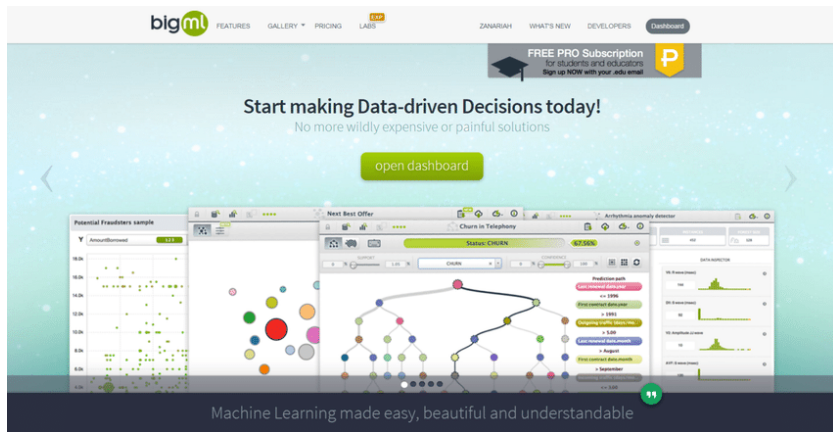
    # Drop the unnecessary last row 'GRAND TOTAL'
    data = data[:-1]

    # Create a new column called 'AGE_GROUP_TOTAL' to store the SUM of each age group
    col_list= list(data)
    col_list.remove('AGE_GROUP')
```

Python script to create formatted datasets to be read into BigML

Data Loading

- Online machine learning service
- Easy to use



BigML: A machine learning platform

Data Loading (cont.)

ml PRODUCT GETTING STARTED PRICING SUPPORT FOONGMINWONG Dashboard

FOONGMINWONG - My Dashboard Malaysian Dengue Hemorrhagic Fever 2010-2...

Sources Datasets Supervised Unsupervised Predictions Tasks WhizzML

Sources

Type	Name				
	dengue2014.xlsx 15 fields (1 categorical, 14 numeric)	1h 56min	737 bytes	1	
	dengue2015.xlsx 15 fields (1 categorical, 14 numeric)	1h 56min	733 bytes	1	
	dengue2017.xlsx 15 fields (1 categorical, 14 numeric)	2h 6min	724 bytes	1	
	dengue2016.xlsx 15 fields (1 categorical, 14 numeric)	2h 6min	727 bytes	1	
	dengue2013.xlsx 15 fields (1 categorical, 14 numeric)	2h 6min	733 bytes	1	
	dengue2011.xlsx 15 fields (1 categorical, 14 numeric)	2h 6min	747 bytes	1	
	dengue2012.xlsx 15 fields (1 categorical, 14 numeric)	2h 6min	725 bytes	1	
	dengue2010.xlsx 15 fields (1 categorical, 14 numeric)	2h 9min	808 bytes	2	

Show 10 sources 1 to 8 of 8 sources

Loading 2010-2017 datasets into BigML

Data Merging



bigml.com/dashboard/dataset/5dcdd0aff80b1640d7004a90/table



MERGE DATASETS CONFIGURATION

Current dataset:
dengue2010

Merge the current dataset with:

dengue2011

dengue2012

dengue2013

dengue2014

dengue2015

dengue2016

dengue2017

+ Add dataset

Dataset name:
dengue2010-2017

Sample rate: 100%

Sample rate: 100%

Sample rate: 100%

Sample rate: 100%

Sample rate: 100%

Sample rate: 100%

Sample rate: 100%

Sample rate: 100%

Seed

Seed

Seed

Seed

Seed

Seed

Seed

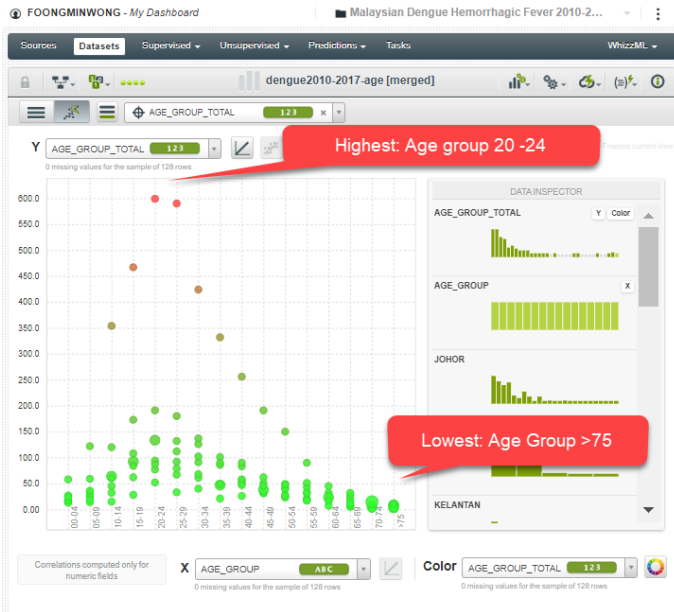
Seed

Reset

Merge datasets

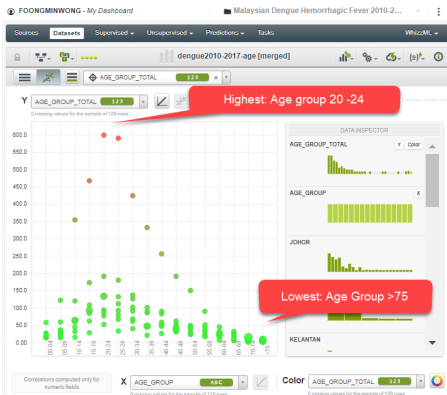
Merging 2010 - 2017 individual datasets

Data Overview - Age Groups

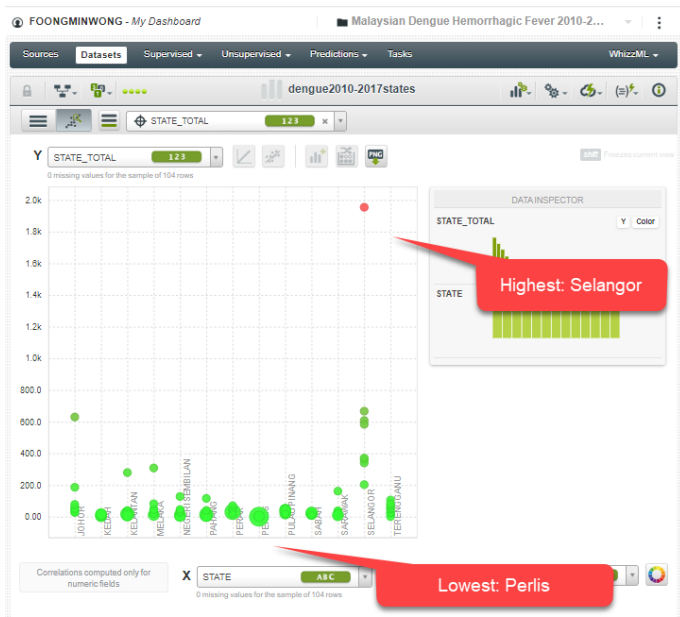


Data Overview - Age Groups (cont.)

- In South-East Asia, severe DHF cases are predominant among paediatric patients aged between 2 and 15 years (R. Bhatia, A.P. Dash, T. Sunyoto, 2013)
- In Malaysia, majority of the affected community are the age group of 13–35 years old (Sam et al, 2013)

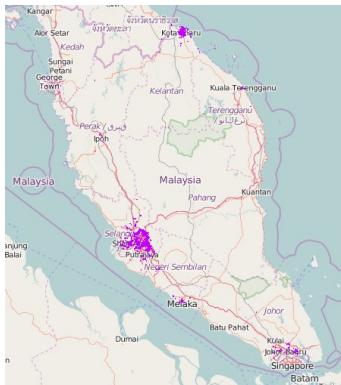


Data Overview - 13 states



Why Selangor has the highest number of DHF cases?

- Selangor - Highest number of dengue fever cases



Hotspot for Dengue in Malaysia based on Website IDengue for community (Government Portal, 2016)

Why Selangor has the highest number of DHF cases? (cont.)

- Selangor state recorded the highest number of dengue cases in Malaysia.
- Selangor is a state with a high population density in Malaysia compared to other states (Ghani et al, 2019)
 - ▶ Household cleanliness
 - ▶ Behavior of its citizens

Comparison of Knowledge, Attitude, and Practice among Communities Living in Hotspot and Non-Hotspot Areas of Dengue (Ghani et al, 2019)

- Communities living in non-hotspot areas of dengue had better knowledge and attitude about dengue
- People are not clear about dengue treatment and people's behavior not keeping household clean



Filthy water in household area

Comparison of Knowledge, Attitude, and Practice among Communities Living in Hotspot and Non-Hotspot Areas of Dengue (cont.)

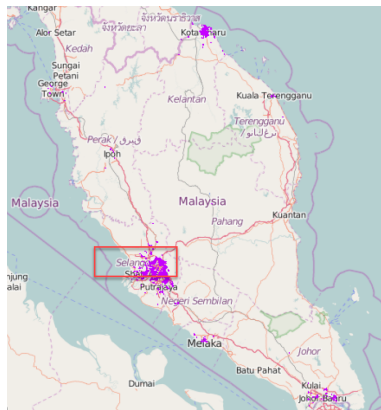
- Low education, socioeconomic status and knowledge on dengue prevention
- Educational campaigns for those with lower income and education, Government prevention



Spraying insecticide smoke to prevent the spread of dengue fever

Conclusion

- Used BigML to run data analysis to describe Dengue Hemorrhagic Fever Pattern over the past 8 years (2010-2017)
 - ▶ Age group (20-24)(Highest), 25-29 (Second Highest), >75 (Lowest)
 - ▶ Selangor (Highest), Johor (Second highest), Perlis (Lowest)



Future Improvements

- Use BigML/other software to forecast dengue hemorrhagic outbreaks using time series analysis
- Run predictive analysis on Dengue Death Cases Data

References



Datasets of Number of Annual Dengue Hemorrhagic Fever (DHF) Cases by State and Age 2010 - 2017.



BigML.com: A comprehensive Machine Learning platform for all predictive use cases. <https://bigml.com/>. 2019.



Data Formatting Python Script
<https://github.com/foongminwong/dengue-analysis/blob/master/dengue-data.ipynb>. 2019.



R. Bhatia, A.P. Dash, T. Sunyoto Changing epidemiology of dengue in South-East Asia WHO South-East Asia J Public Health, 2 (1) (2013), pp. 23-27



S.S. Sam, S.F. Omar, B.T. Teoh, J. Abd-Jamil, S. AbuBakar Review of dengue hemorrhagic fever fatal cases seen among adults: a retrospective study PLoS Negl Trop Dis, 7 (5) (2013), p. e2194

References (cont.)



Jesse Alaniz. Most common types of mosquitoes in north america. "www.thebugmaster.com/ most-common-types-of-mosquitoes/", 2019.



N.A. Muhammad Azami, S.A. Salleh, H.M. Neoh, S.Z. Syed Zakaria, R. Jamal Dengue epidemic in Malaysia: not a predominantly urban disease anymore BMC Res Notes, 4 (2011), p. 216



Nurul Akmar Ghani ,Shamarina Shohaimi,Alvin Kah-Wei Hee,Hui-Yee Chee ,Oguntade Emmanuel and Lamidi Sarumoh Alaba Ajibola Comparison of Knowledge, Attitude, and Practice among Communities Living in Hotspot and Non-Hotspot Areas of Dengue in Selangor, Malaysia Trop. Med. Infect. Dis. (2019), p. 37



World Health Organization. World health organization. dengue and severe dengue.

"http://www.who.int/mediacentre/factsheets/fs117/en/", 2017.

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U.S. Department of Health, Human Services Centers for Disease Control, title = "Prevention", and Dengue Hemorrhagic Fever. "https://www.cdc.gov/dengue/resources/denguedhf-information-for-health-care-practitioners_2009.pdf", 2009.



Malaysia Ministry of Health (MMOH). Hotspot locality list. idengue portal. "http://idengue.remotesensing.gov.my/idengue/page2.php?kandungan=c", 2017.



Rajesh Bhatia, Aditya P Dash, Temmy Sunyoto, et al. Changing epidemiology of dengue in south-east asia. WHO South-East Asia Journal of Public Health, 2(1):23, 2013.

Thank You!

Questions?