IVCC
Building Partnerships
Creating Solutions
Saving Lives

Vector Control in the Indo-Pacific: Market Access Landscape

Country Report

Malaysia

INNOVATIVE VECTOR CONTROL CONSORTIUM

November 2019

Contents

List of Tables

List of Figures

Abbreviations

ASEAN	Association of Southeast Asian Nations
CFR	Case Fatality Rate
CIDB	Construction Industry Development Board
COMBI	Communication for Behavioural Impact
DOSH	Department of Occupational Safety and Health
DVSS	Dengue Virus Surveillance System
EPF	Employee Provident Fund
ETP	Economic Transformation Program
GDP	Gross Domestic Product
GTP	Government Transformation Program
IKRAM	Pertubuhan IKRAM Malaysia
iM4U	Malaysia for Youth
IRS	Indoor Residual Spray
ITNs	Insecticide-treated Nets
JEV	Japanese Encephalitis Virus
JE	Japanese Encephalitis
LLINs	Long Lasting Insecticidal Nets
MASCO	Malaysia Standard Classification of Occupations
MCMC	Malaysian Communications and Multimedia Commission
MoA	Ministry of Agriculture
MoH	Ministry of Health
MyEHIS	Malaysia Environmental Health Information System
NDSP	National Dengue Strategic Plan
NGO	Non-governmental Organization
NKRA	National Key Results Areas
NMCP	National Malaria Control Program
NPHL	National Public Health Laboratory
NTP	National Transformation Program
PPP	Public-People-Private
SOCSO	Social Security Organization
VBD	Vector-Borne Disease
VBDCP	Vector Borne Disease Control Program
WHO	World Health Organization

1. Executive Summary

Malaysia is a tropical country located in the Western Pacific region. It shares its land borders with Thailand, Brunei, and Indonesia. The Malaysian land is divided into two parts, namely Malaysian Borneo and Peninsular Malaysia, between which the South China Sea flows. Malaysia has a robust healthcare structure owing to funding from the government and healthier mechanism of healthcare financing. Major medical conditions resulting in death in Malaysia are diseases such as cardiovascular conditions and lung infections, matching the mortality causes of several developed nations.

Malaria is at pre-elimination stage in Malaysia

Over the past decade, Malaysia has achieved approximately 95% reduction in the number of malaria cases. Intensive control efforts undertaken by the Malaysian government have reduced the incidence of malaria parasites such as *Plasmodium vivax* and *P. falciparum* in the country; however, *P. knowlesi* accounts for a majority of indigenous cases that might be potentially fatal, and *P. malariae* is also responsible for a small number of infections. The increase in dengue incidence in Malaysia is a matter of concern due to the hyperendemicity of its serotypes. According to the 2009-2013 National Strategic Plan, the number of dengue cases was expected to reduce to half; however, this goal was not achieved.

The Malaysian government provides complete funding for vector control and prevention activities, there is minimal international funding in Malaysia

The Malaysian healthcare system delivers a comprehensive range of services through public and private providers. Malaria in Malaysia is at the elimination stage, but there is a rise in the incidence of dengue. The government of Malaysia provides 100% of the funding for vector prevention and control programmes. In 2017, the Malaysian government invested USD48.36 million for vector control and prevention activities. A total of USD6.75 million were invested in dengue control activities in 2018. The domestic funding for malaria is self-sufficient for the successful completion of programs, and hence the funding gap is not evident.. The donor market provides LLINs, fogging and awareness campaigns through digital as well as mass media for control and prevention of vector-borne diseases (VBDs).

The procurement channel in Malaysia is well structured, ensuring continuous and efficient supply of vector control products

Procurement channels for vector control products in Malaysia are government bodies, vendors, procurement bodies, and wholesalers, distributors such as NGOs, local bodies, community health centres, and retailers in urban and rural areas.

The geographic inaccessibility of Sabah and Sarawak states delays an early diagnosis and prevention of vector-borne diseases

Logistics and technical difficulties are the important challenges faced in Malaysia. Various other challenges include lack of healthcare professionals, improper waste management and recycling facilities, an increasing number of migrants in areas such as Selangor and Kuala Lumpur, ineffective activities such as fogging which targets only adult mosquitoes, high costs of fogging, behavioural patterns such as people being reluctant to allow fogging inside their houses. Geographic inaccessibility to at-risk populations in Sabah and Sarawak delays an early diagnosis of VBDs, and also the implementation of vector control activities. An increase in the number of monkey malaria cases and rise in the number of dengue cases will accelerate the growth of the vector control market in Malaysia.

National government funding reduces the gap between procurement bodies and end users for vector control products

The retail market in Malaysia is comprised of products such as insecticide coils, electric insecticide, sprays/ aerosol, insecticide bait and also LLINs. The retail market for vector control products in Malaysia was estimated to be ~USD170 million in 2018. The retail spending on vector control products in Malaysia is ~77% of the total vector control market spending i.e. USD167 million. The leading brands of the retail market are Ridsect, Shelltox/Shieldtox, Fumakilla, Mortein, and Baygon.

Digital campaigns by Sanofi and Bayer to increase dissemination of vector control activities

Rapid urbanization has increased the encroachment on natural habitats, which has led to greater co-habitation between mosquito vectors and humans. Initiatives such as environmental cleaning, the Communication for Behavioural Impact Project (COMBI), and integrated vector management have helped prevent and control the spread of VBDs in Malaysia. Along with this, the digital dengue prevention campaigns by key players such as Sanofi and Bayer are leading vector initiatives in Malaysia. VBD prevention campaigns through newspapers and social forums have helped increase awareness regarding vector control methods among the Malaysian population.

Increase in the number of monkey malaria cases and their prevention has encouraged the vector prevention and control program in Malaysia

With the increasing prevalence of dengue, the Malaysian government is focusing on dengue control and prevention activities. Government bodies and NGOs in Malaysia are spreading awareness through newspaper articles or pop-ups on a social media platform to inform the general public regarding the onset of malaria or dengue in a particular area. Since 2008, Malaysia has reported more than 15,000 cases of *P. knowlesi* infection and about 50 deaths. There were about 3,600 cases of *P. knowlesi* infection in 2017.

2. Introduction

Objectives of the Study:

- To study the vector control market, and market access landscape, by type of market, vector control implementing organizations, and consumers, including an understanding of regulatory pathways.
- To map and provide a better understanding of procurement channels for vector control products and their barriers.
- To perform a detailed market study for 6 countries in the Indo-Pacific region, namely, Indonesia, Myanmar, Cambodia, Vietnam, Malaysia, and Papua New Guinea (PNG).

2.1 Country Overview

Malaysia is a multi-cultural country, home to Malays, Chinese, Indians, Ibans, Kadazans, and other ethnic groups. The annual population growth rate of the country is expected to be 1.1%.

2.1.1 Geography

Malaysia is a tropical, equatorial country located in the Western Pacific region that has land borders with Thailand, Brunei, and Indonesia. The Malaysian land is divided into two parts, namely, Malaysian Borneo and Peninsular Malaysia, between which the South China Sea flows.

Malaysia is a federal state that has a monarchy system of governance. It is comprised of 13 large states and 3 different federal territories. Its area is about 330,803 square kilometres. Malaysia's ecology, geography, and climate enable the breeding and transmission of vector-borne diseases.

The country witnessed 71% reduction in reported malaria cases from 2000 to 2014; ~32% malaria cases occur in Peninsular Malaysia, and the majority of these are found in the central, south-eastern, and northern coastal regions.[1]

2.1.2 Demographics

The demographics of Malaysia are represented by multiple ethnic groups (such as Malays, Chinese, Indians, and others). The demographic composition of the country is as follows:

- Malay (or Muslim Malay) – 50.1%
- Chinese Malaysians – 22.6%
- Non-Malay Bumiputera and Other Indigenous Groups – 11.8%
- Indian Malaysians - 6.7%
- Other Groups – 8.8%.

The 2010 Population and Housing Census of Malaysia (Census 2010) was the fifth decennial census conducted in the country, since its formation in 1963. However, according to the Department of Statistics Malaysia, the country's population in 2018 was estimated to be 32.4 million as compared to 32.0 million in 2017, growing at an annual rate of 1.1%.

TABLE 1: POPULATION SIZE AND ANNUAL POPULATION GROWTH RATE, MALAYSIA, 2015–2018[2]

Year	Number ('000)	Annual Population Growth Rate (%)
2015	31,186.1	1.5
2016	31,633.5	1.4
2017	32,022.6	1.2
2018e	32,385.0	1.1

Note: e: estimated

The annual population growth rate in Malaysia is witnessing a decreasing trend over the years.

[1] WHO (CL: High)

[2] Department of Statistics Malaysia, 2018 (CL: High)

The table below represents the population density of Malaysian states and federal territories.

TABLE 2: DEMOGRAPHIC STATISTICS BY STATES AND FEDERAL TERRITORIES, MALAYSIA, (Q4) 2018[2]

State	Population	Live Births	Deaths
Perlis	254.7	1.1	0.5
Pulau Pinang	1,778.2	5.2	2.8
Perak	2,510.7	8.6	4.6
Selangor	6,518.5	25.6	6.7
W.P. Putrajaya	91.9	0.6	0.058
W.P. Kuala Lumpur	1,796.2	6.7	2.2
Kedah	2,173.7	9.3	3.6
Negeri Sembilan	1,138.2	4.7	1.8
Kelantan	1,870.7	9.5	2.8
Terengganu	1,241.6	7.0	1.8
Pahang	1,675.0	6.8	2.3
Melaka	926.8	3.7	1.3
Johor	3,764.8	15.5	5.2
W.P. Labuan	100.0	0.4	0.06
Sarawak	2,804.9	9.0	3.2
Sabah	3,921.0	13.5	2.4

The Selangor state in Malaysia has the highest population and the highest birth rate among other Malaysian states.

2.1.2.1 Health Indicators

Life expectancy at birth was 72.5 years for males and 77.4 years for females in Malaysia in 2018.

TABLE 3: KEY HEALTH INDICATORS[2]

Population (000)	31,624	2017
Under-5 population	2,665	2018
Rural (%)	25	2017
≥65 years (000)	2,088	2018

2.1.2.2 Employment

According to the Department of Statistics Malaysia (2017), there was an exponential increase in the number of service workers employed from 2005 to 2015, indicating the importance of this sector in the economy. In contrast, there is a decline in the number of persons employed in the agriculture-related occupations between 2010 and 2015.

[2] Department of Statistics Malaysia, 2018 (CL: High)

TABLE 4: EMPLOYED PERSONS BY OCCUPATION, MALAYSIA, 2005, 2010, AND 2015[3]

Occupation	Years		
	2005	2010	2015
Legislators, Senior Officials, and Managers	777.4	856.7	718.6
Professionals	555.1	737.4	1,462.0
Technicians and Associate Professionals	1,266.8	1,695.8	1,406.9
Clerical Workers	992.3	1,183.2	1,241.1
Service Workers and Shop and Market Sales Workers	1,483.7	1,959.6	3,188.9
Skilled Agricultural and Fishery Workers	1,268.6	1,382.0	940.3
Craft and Trade-related Workers	1,145.5	1,228.3	1,578.8
Plant and Machine-operators and Assemblers	1,427.5	1,502.8	1,585.2
Elementary Occupations	1,128.3	1,353.7	1,945.9

2.1.2.3 Living Conditions (Lifestyle)

Clean water, good hygiene practices, and other basic amenities are essential for social and economic development. Though Malaysia has abundant water resources, the country is experiencing increased demand for water over recent years for agricultural, industrial, and domestic purposes.[4]

In 2014, approximately 95.3% of the total population had access to safe water (97.1% in urban areas and 92.6% in rural areas); 95.2% of households had adequate excreta disposal facilities. However, in recent years, complex environmental issues, including air and water pollution, are increasingly driving the need to undertake health impact assessments and monitor the environment.

Pertaining to this, the Malaysia Environmental Health Information System (MyEHIS) is being developed. MyEHIS enables the creation of state environmental profiles to facilitate, mitigate, or predict actions before events occur.

Moreover, access to electricity (% of the population) in Malaysia was reported at 100% in 2014.[5]

2.1.2.4 Others (Internet Usage, Education, etc.)

The Internet Users Survey (IUS) was conducted by the Malaysian Communications and Multimedia Commission (MCMC) in 2017 with an aim to understand and measure user behaviour and uncover opportunities in the communications and multimedia industry.[6]

The survey draws attention to the following pointers:

- Smartphone was the most common device used to access Internet (89.4%). Internet access from other devices, such as tablets, laptops, and feature phones, witnessed a decline.
- Text communication (96.3%), information gathering from online sources (89.3%), and visiting social networking sites (89.3%) were the most common activities for internet users.
- Of those who visited social networking sites, 97.3% had Facebook, and 56.1% had Instagram accounts.
- Lack of confidence or skills and lack of interest were the main reasons for not using the Internet.

---

3 Employment Structure in Malaysia (2018) (CL: High)

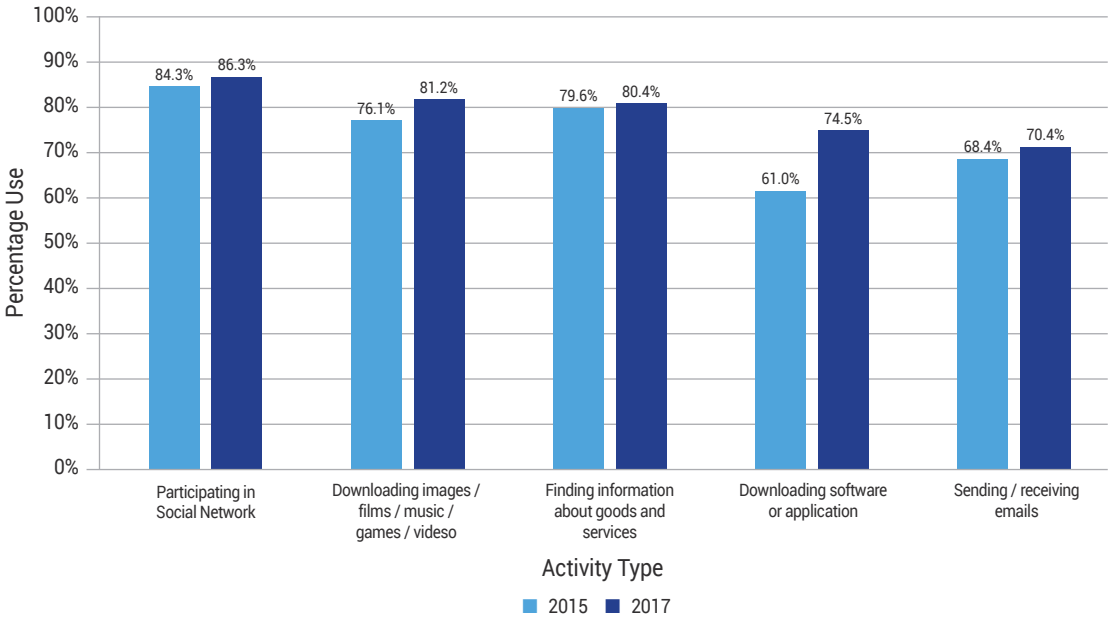
4 IRIS (CL: Medium)

5 World Bank (CL: High)

6 Nielsen 2018 (CL: Medium)

According to the Department of Statistics Malaysia, the percentage of individuals aged 15 years and above using Internet was 80.1% in 2017 as compared to 71.1% in 2015. Similarly, the percentage of individuals using computers increased by 1.1% points, from 68.7% in 2015, to 69.8% in 2017. Meanwhile, 97.7% of individuals were using mobile phones in 2017 compared to 97.5% in 2015.

FIGURE 1: PERCENTAGE OF MAIN ACTIVITIES OF INTERNET USE[7]



Participating in social networks is the most common activity observed among the Malaysian population in 2015 as well as 2017.

Education:

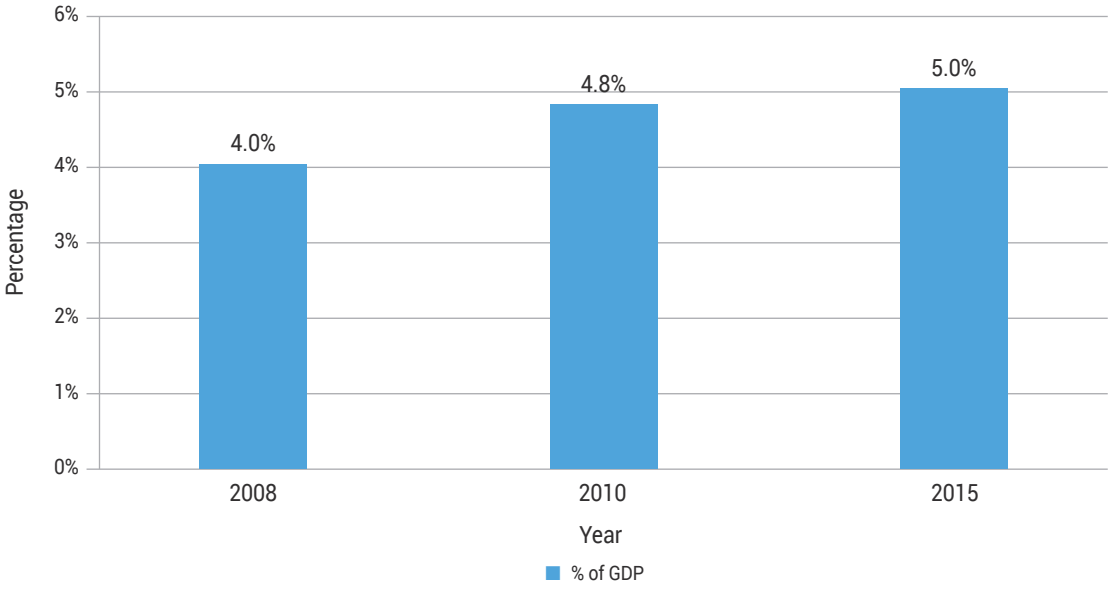
The Malaysian government declared assuring education quality as one of its key national priorities, or National Key Results Areas (NKRAs). In line with this, in 2009, the Prime Minister implemented the National Transformation Program (NTP) that reflected developmental objectives and vision with the motto "People First, Performance Now."

NTP was divided into two parts: The Government Transformation Program (GTP) (public service delivery) and the Economic Transformation Program (ETP) (industrial policy). Under GTP, there are eight NKRAs, including reducing crime, fighting corruption, and improving quality education. The ETP is an initiative by the Malaysian government to turn Malaysia into a high-income economy by 2020. It is managed by the Performance Management and Delivery Unit (PEMANDU), an agency under the Prime Minister Department of Malaysia.

Pertaining to this initiative, the enrolment at the primary level was approximately 94% by 2011. Moreover, public spending on education is around 5% of the GDP, and the education budget is consistently the largest component of the total federal government budget, rising from 14% of the total spending in 2008 to 20% in 2015.

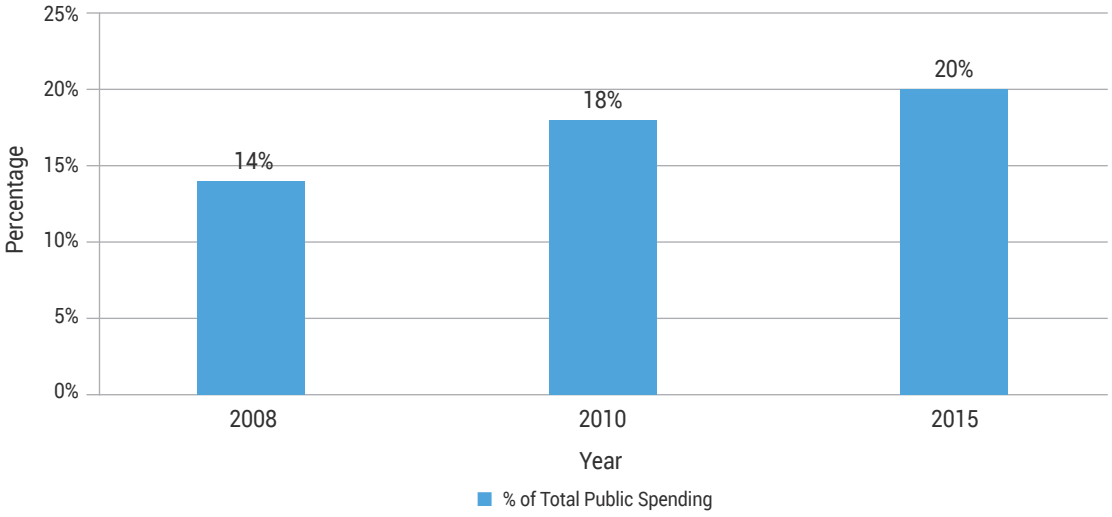
[7] Department of Statistics Malaysia (2018) (CL: High)

FIGURE 2: PUBLIC SPENDING ON EDUCATION AS A SHARE OF GDP[8]



Malaysia focuses on improving the quality of education through the NTP and increasing its educational spending through the GDP.

FIGURE 3: PUBLIC SPENDING ON EDUCATION AS A SHARE OF TOTAL PUBLIC SPENDING[8]



The education budget is consistently the largest component of the total federal government budget, rising from 14% of the total spending in 2008 to 20% in 2015.

[7] Malaysia Economic Data (CL: High)

2.1.3 Economic Situation

According to The World Bank, Malaysia is categorized under the upper-middle-income economies in the world for 2019. In the fourth quarter of 2018, Malaysia's economy recorded a growth of 4.7%. All the sectors recorded positive growth that included service, manufacturing, construction, mining, and quarrying, except agriculture.

TABLE 5: GDP BY ECONOMIC ACTIVITY[9]

Economic Activity	Share	Growth Rate (Q4 2018)
Service	56.0%	6.9%
Manufacturing	22.8%	4.7%
Construction	4.2%	2.6%
Mining and Quarrying	7.9%	0.5%
Agriculture	7.9%	-0.4%
Other	1.2%	0.5%

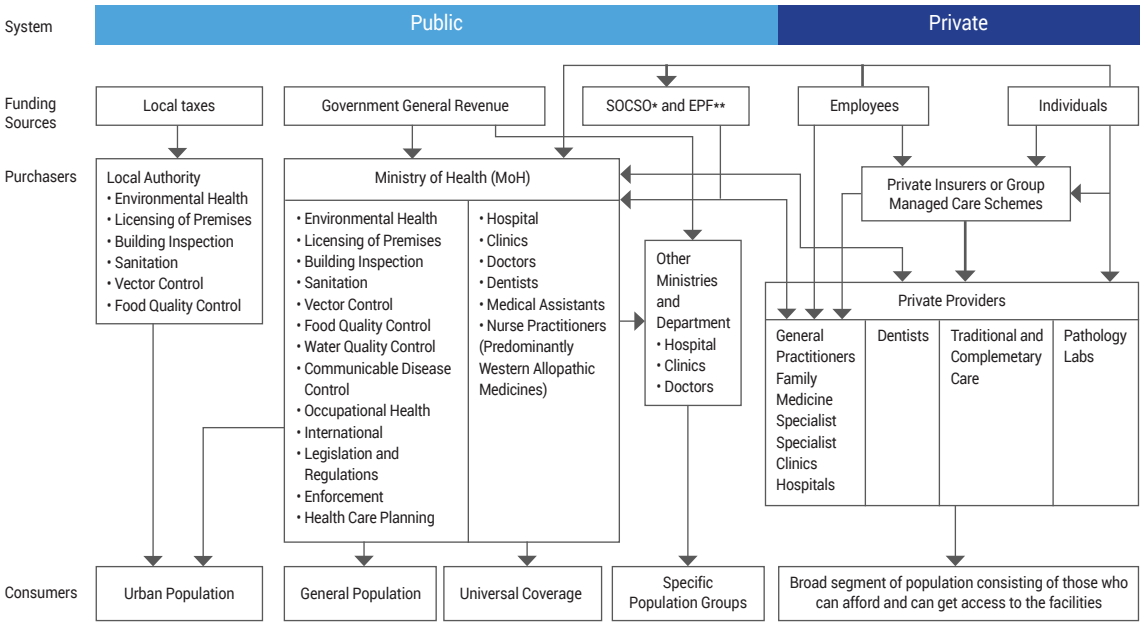
2.1.4 Health Status

2.1.4.1 Healthcare Structure

According to the World Bank Atlas method, Malaysia is categorized under the upper-middle-income economies in the world for 2019. This allows the country to manage its population health and health system, especially in primary care.[10]

The Malaysian health system delivers a comprehensive range of services through public and private providers. The public sector supplies 76.7% of inpatient services, with an average stay of 6.2 days compared to five days in the private sector. The urban population uses significantly more private inpatient services than the rural population (28.8% compared to 6.3%).[9]

FIGURE 4: SCHEMATIC REPRESENTATION OF THE MALAYSIAN HEALTH SYSTEM[11]



Note: *SOCSO – Social Security Organization, **EPF – Employee Provident Fund

[9] Department of Statistics Malaysia (2018) (CL: High)

[10] WPRO 2017 (CL: Medium)

[11] The World Bank Data (CL: Medium)

2.1.4.2 Healthcare Spending

Malaysia has a strong healthcare structure with a government-sponsored, universal-coverage healthcare system. Healthcare indicators are higher than regional averages. Public esteem and satisfaction with healthcare provisions are relatively positive.

Malaysia's top causes of death are cardiovascular conditions and lung infections, matching the mortality causes of several developed nations. Most common causes of death are high numbers of road traffic accidents, and HIV-related deaths.

Listed below are a few characteristics of the Malaysian healthcare system:

- Malaysia provides an extensive basic healthcare provisions package in a comparatively low-costing universal healthcare system, financed through national taxes and general revenues. Since this universal healthcare has been present for several generations, it is difficult to convince healthcare users to contribute co-payments. Furthermore, though healthcare is widely universal (in the public sector), there are challenges related to overcrowding and staffing.
- Healthcare financing has a progressive collection and distribution mechanism; wealthier households pay more for healthcare as compared to poorer households.
- Favourable protection for households against financial risks related to poor health is firmly embedded. This is made possible as over 70% of public hospitals benefit from public sector subsidies.
- It entails a comprehensive system to extend healthcare accessibility to even the most remote areas: zero charges for public primary healthcare in rural areas, and around 200 mobile clinics built and 500 mobile dental services offered in remote areas.
- Lack of regulation and the velocity at which the private sector grew alongside the public sector have left the current public-private provider systems parallel and disruptive to one another, rather than complementary.

In 2016, Malaysia's healthcare expenditure was 4.3% of the total GDP. In comparison, Singapore spends 5.6% of its GDP on healthcare, whereas Thailand spends 6.9% and Indonesia spends 2.9% of their GDP on healthcare services.

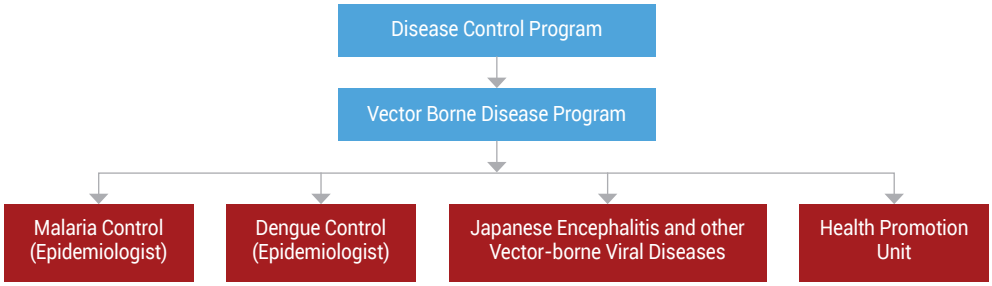
3. Vector Control Market Overview

TABLE 6: DIFFERENT VECTOR CONTROL TOOLS USED BY DIFFERENT END USERS

Vector Control Tools	End Users
LLINs	• Households Residents • Forest Workers • Migrants • Women and Children
Fogging	• Government Agencies • Private Pest Control Operators
Indoor Residual Spray (IRS)	• Hospitals • Academic Institutions • Corporate & Government Offices • Factories • Households

3.1 Vector Control Overview[12]

Malaysia has a universal healthcare system that provides free healthcare facilities and promotes health tourism. The Malaria Control Program was a vertical program that functioned independently, and later, it was integrated into the Vector Borne Disease Control Program (VBDCP). The national level VBDCP is divided according to the type of vector-borne diseases.



- **LLINS:** The WHO is committed to engaging its employees to distribute LLINs, increase the frequency of residual spraying in housing and other accommodations, as well as provide information on malaria prevention techniques and possible treatment methods.

TABLE 7: COMMODITIES DISTRIBUTION AND COVERAGE, 2014–2016 – MALAYSIA[13]

Year	No. of LLINs sold or delivered	No. of People Protected by IRS
2014	622,673	615,384
2015	285,946	489,030
2016	284,031	513,076
2017	278,104	539,029

The table above provides the total number of LLINs that have been distributed each year in Malaysia as part of the vector control and prevention activity.

- **Indoor Residual Spraying (IRS):** House-spraying is traditionally carried out in Malaysia by a specialized spray programme. Simple and cheap alternative methods for IRS are available in the market
- **Fogging:** Fogging was mainly conducted by trained health practitioners after several cases of malaria were reported. In Malaysia, insecticides applied in fogging consist of numerous formulation and active ingredients, such as malathion, fenitrothion, fenthion, cyphenothrin, pirimiphos-methyl, temephos, and others.

3.1.1 Vector Borne Diseases (VBD) Trends[14,15]

In 2015, Malaysia had a population of 31 million and life expectancy at birth of 72.5 years for males and 77.4 years for females. The Malaysian health system delivers a comprehensive range of services through public and private sectors. The public sector provides 76.7% of inpatient services. The urban population uses more private inpatient services as compared to the rural population.

There has been a dramatic improvement in the healthcare status of Malaysia since 1980. Presently, the country follows the epidemiological shift of middle and upper-income countries and also a shift from communicable diseases to non-communicable diseases. According to the Ministry of Health, there is a steady increase in communicable diseases such as diabetes, hypertension, and obesity, and therefore the outlook towards controlling these diseases has been renewed since 2010. The most significant diseases since 2010 were dengue fever, HIV, malaria, tuberculosis, hand and mouth disease, and food poisoning. After the inclusion of malaria under the infectious diseases category, notification of all infectious diseases was made mandatory to the public and private sectors under the Prevention and Control of Infectious Disease Act of 1988.

In relation to malaria, Malaysia is classified as being in the pre-elimination phase, moving towards elimination by 2020.

---

13 World Malaria Report (2018) (CL: High)

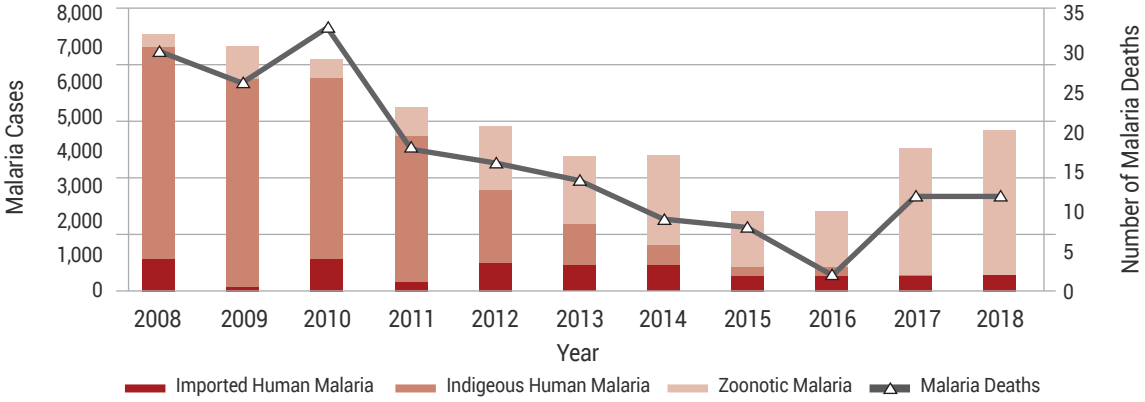
14 UCSF (CL: High)

15 IRIS (CL: Medium)

3.1.2 Burden of Disease

Malaria[16]

FIGURE 5: BURDEN OF DISEASES – MALARIA[16]



In 2017, there were 4,114 malaria cases (dominated by *P. knowlesi* 88% cases) reported in Malaysia; an increase of 79% as compared to 2016, and an increase in the incidence rate of 12.7 per 100,000 populations. The highest number of malaria cases were reported in Sabah (~49%), followed by Sarawak (35%). A total of 415 imported malaria cases were reported, and among them, with the highest numbers in Sarawak (52.2%), Selangor (19.5%), and Johor (8.2%). In the same year, 12 malaria deaths were reported compared to 2 deaths in 2016.

In 2017, there were 500 human malaria cases. Among them, only 85 (17%) cases were of indigenous human malaria, registered in Perak, Kelantan, and Sabah. There is a reduction of 70% cases compared to 2016. The incidence of indigenous human malaria reduced to 0.3 per 100,000 populations in 2017. There were 3,614 cases of zoonotic malaria reported in 2017; an increase of 125.9% as compared to 2016. Of these, 54.4% were reported in Sabah, 33.9% cases in Sarawak, and the remaining 11.7% cases reported from states in Peninsular Malaysia, except for Perlis and Kuala Lumpur.

The case fatality rate of malaria increased from 0.08% in 2016 to 0.29% in 2017. There were 11 death cases of malaria involving *P. knowlesi* infection and one death case involving *P. falciparum* infection. Malaria deaths were reported from Sabah (4 cases), Sarawak (3 cases), Selangor (2 cases), and 1 case each from Pahang, Perak, and Kedah. Of the 85 indigenous human malaria reported in 2017, 50 (58.8%) cases occurred in previously active foci, 3 (3.5%) cases in residual non-active foci, and 32 (37.6%) cases in cleared foci. This results in the current total of 33 active foci, 28 residual non-active foci, and 42,272 cleared foci.

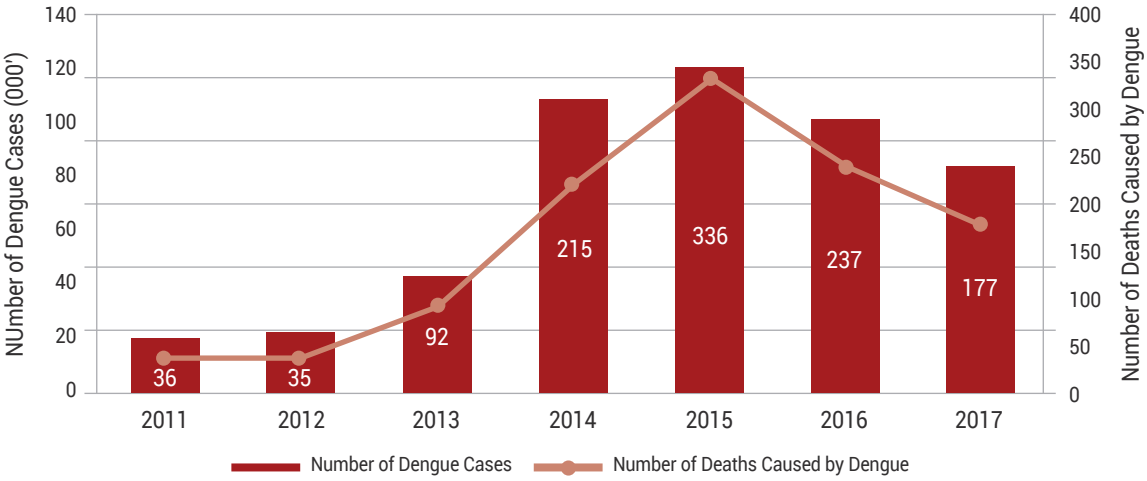
[16] HUA L Y. et al., (2018) (CL: Medium)

Monkey Malaria (*P. knowlesi* and *P. cynomolgi*)

Since 2008, Malaysia has reported more than 15,000 cases of *P. knowlesi* infection, which resulted in ~50 deaths. Infections in 2017 alone hit 3,600. In 2017, another species of monkey malaria parasite, *P. cynomolgi*, was found in five Malaysians. Monkey malaria is excluded from the WHO campaign as the agency regards it as an animal disease that has not been shown to transmit among humans. Deforestation brings monkeys and humans close enough to share the disease.

Dengue[17]

FIGURE 6: BURDEN OF DISEASES – DENGUE[17]



In 2017 Malaysia recorded 83,849 dengue cases, with 177 deaths; there was a 17.2% decline in dengue cases and 25.3% in deaths in 2017, as compared to 2016. The incidence was 258 cases per 100,000 populations, while the Case Fatality Rate (CFR) was 0.21%, a slight reduction compared to the previous year (0.23%). Malaysia is hyperendemic, with the presence of all four serotypes of dengue virus spread across the population.

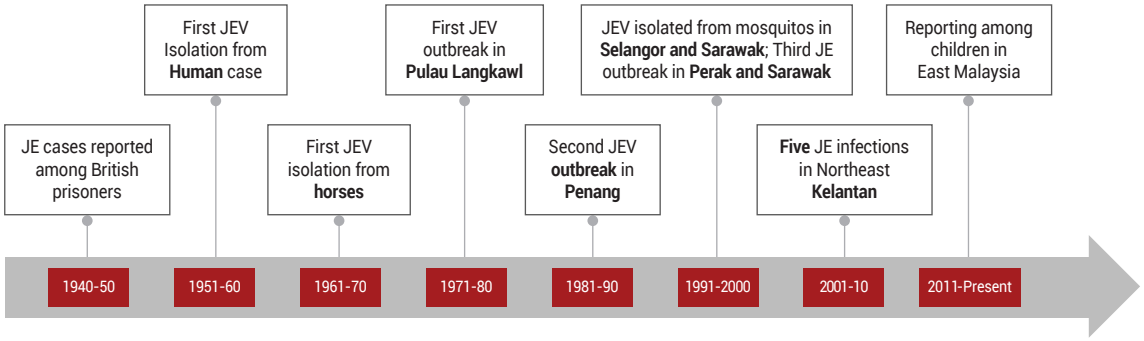
Burden of Diseases – Japanese Encephalitis (JE)[18]

In 2017, there were 23 reported JE cases in Malaysia, a decline of 53% as compared to 2016. The Sarawak region reported the highest number of JE cases (43.5%), followed by Kedah (13%) and Terengganu (13%); one death was recorded in 2017 at Terengganu. The national incidence rate decreased from 0.16 per 100,000 populations in 2016 to 0.07 per 100,000 populations in 2017.

[17] ASEAN (CL: High)

[18] Kumar K et al., (2018) (CL: Medium)

FIGURE 7: MALAYSIA: JAPANESE ENCEPHALITIS VIRUS TIMELINE INFECTION[19]

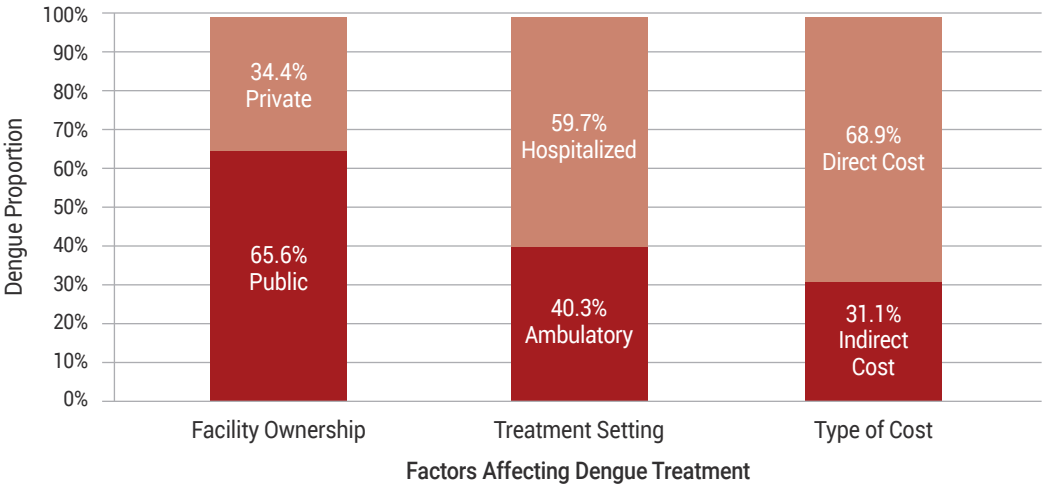


3.1.3 Economic Burden of VBD

Dengue[20]

The increasing incidence of dengue is directly correlated with the increasing healthcare burden. The annual dengue economic and disease burden is estimated to be USD103.4 million per year, which is approximately USD3.7 per capita. Inclusion of dengue prevention and control activities and dengue surveillance will increase the economic burden of the disease in Malaysia.

FIGURE 8: PROPORTION OF DENGUE ACCORDING TO FACILITY OWNERSHIP, TREATMENT SETTING, AND TYPE OF COST[20]



Malaria[21]

According to a study conducted in Malawi (Malar J., 2017), the total household cost for malaria was ~USD17.48 per patient, the direct cost was ~USD7.59, and the indirect cost was ~USD9.90. Facility management type, household distance from the healthcare facility, patient age, household wealth, and duration of hospital stay were all significant factors contributing to the overall cost.

[19] Ministry of Health Malaysia AR2017 (CL: High)

[20] Burden of Dengue in Malaysia (CL: Medium)

[21] Malar J et al.,(2017) (CL: Medium)

3.1.4 Measures/Initiatives for Vector Control

Malaria Prevention and Control in Malaysia

Malaysia's malaria program is one of the oldest in the world. Anti-malaria campaigns were initially carried out in the politically and economically important coastal cities of Peninsular Malaysia (also known as Malaya). Overall, malaria transmission in Malaysia is largely confined to Sabah and Sarawak, two states located on the island of Borneo, where a significant proportion of the population is at risk of acquiring the disease.

The country implemented a national strategic plan for the elimination of malaria covering the 2011-2020 period, with the aim to strengthen surveillance, intensify vector control, and ensure early detection and treatment. The major aim of the strategic plan is to ensure prompt diagnosis of malaria cases in remote and hard-to-reach regions, where access to healthcare services is limited. The country also aims to control the prevalence of malaria among temporary foreign workers, as it becomes difficult to track and screen such malaria cases.

Strategies used in Malaysia for malaria vector control are:

- A selective and effective use of chemical insecticides
- Encouragement of personal protective measure use
- Promotion of the use of environmental measures
- Promotion of community participation in vector control

The WHO is committed to engaging its employees to distribute LLINs, increase the frequency of residual spraying in housing and other accommodations, and provide information on malaria prevention and treatment. Awareness is created among the Malaysian population regarding several other vector control activities, such as distribution of clothing and repellent and mosquito coils, with the distribution of leaflets and billboards.

TABLE 8: COMMODITIES DISTRIBUTION AND COVERAGE, 2014–2016 – MALAYSIA[22]

Year	Population at Risk	No. of LLINs Sold or Delivered	No. of People Protected by IRS	IRS Coverage (%)
2014	1,209,120	622,673	615,384	51
2015	1,228,926	285,946	489,030	40
2016	1,247,490	284,031	513,076	41
2017	1,264,970	278,104	539,029	43

*Note: IRS coverage has been calculated by the no. of people protected by IRS with respect to the population at risk.

[22] World Malaria Report (2018) (CL: High)

Dengue Prevention and Control in Malaysia[23,24]

Environmental Management and Cleanliness

A cleanliness campaign was jointly organized by the MoH, Ministry of Housing and Local Government, and the Department of National Unity and Integration in August 2017.

Communication for Behavioural Impact (COMBI) Project

Focusing on environmental cleanliness is the way forward, as a long-term solution to overcome the dengue burden in Malaysia. Community participation and social mobilization in dengue prevention and control will be strengthened through the implementation of the COMBI project, especially in hotspot areas. In 2017, there were 3,082 COMBI projects involving 63,000 volunteers. Additionally, MoH also celebrates ASEAN Dengue Day annually as to promote dengue awareness and prevention, and to gain community participation.

Universities, NGOs, private sectors, and local authorities such as the Construction Industry Development Board (CIDB) and the Department of Occupational Safety and Health (DOSH), work in coordination with the COMBI project to control and prevent dengue. The Ministry of Communication in Malaysia is spreading awareness regarding dengue control and prevention methods through various mass media, such as television, radio channels, electronic billboards, and social media.

In 2014, National Dengue Task Force was established by the Malaysian MoH to overcome issues regarding dengue, which included prevention and control activities such as solid waste management, environmental cleanliness, and improvement of architectural designs.

Integrated Management

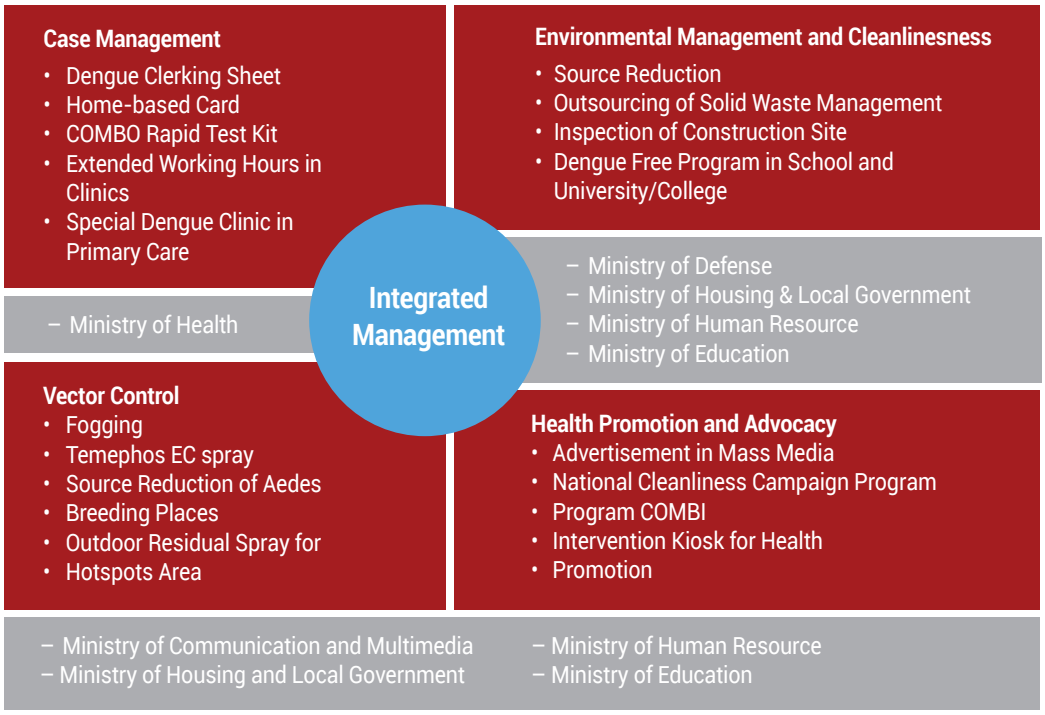
A task force consists of seven ministries, including the MoH, Ministry of Housing and Local Government, Ministry of Human Resource, Ministry of Education, Ministry of Internal Affairs, Ministry of Defense, and Ministry of Works. It serves as an integrated management system that conducts weekly meetings chaired by the Director-General of Health.

Through this task force, dengue prevention activities, such as source reduction, have been included in the educational curriculum. Additionally, Guidelines for Dengue Prevention, Education, and Management in School, Guidelines for *Aedes* Free Building Structures, and Guidelines for Dengue Prevention in Construction Sites were developed with the help of this task force.

[23] CDC (CL: High)

[24] ASEAN (CL: High)

FIGURE 9: INTEGRATED VECTOR MANAGEMENT[22]



The Dengue Virus Surveillance System (DVSS) is an important strategy in the National Dengue Strategic Plan (NDSP) since its inception in 2009; it is coordinated and monitored by the National Public Health Laboratory (NPHL).

Strategy for Dengue Prevention and Control in Malaysia were Focused on Five Elements:

- Vector control, based on the principles of integrated vector management
- Active disease surveillance based on a comprehensive health information system
- Emergency preparedness
- Capacity building and training
- Vector control research

House Inspection:

- House and premise inspection were carried out mainly for surveillance of *Aedes* potential breeding sites, and to inspect the owner's premises for a regular clean-up to reduce mosquito breeding sites.
- The Destruction of Disease-Bearing Insect Act 1975 enforces the owner of the premise to undertake preventive measures when *Aedes* larvae are found.

Insecticidal Treatment:

- **Larvicides:** This treatment comprises the use of temephos (Abate) that is added to the drinking water as a treatment measure, due to its low toxicity to humans. This larvicide also helps control the breeding of mosquitoes in ponds, marshes, swamps, and neighbouring grounds.
- **Fogging:** Fogging was mainly conducted by trained health practitioners after cases of dengue were reported. In Malaysia, insecticides are mainly applied in fogging; these insecticides comprise numerous formulation and active ingredients, such as malathion, fenitrothion, fenthion, cyphenothrin, pirimiphos-methyl, temephos, and others.

Public Health Education:

- Health awareness has been promoted by the Malaysian government to gain support and cooperation from key players in the vector control market.
- The educational sector is involved in promoting vector control and prevention techniques through various media channels, such as television, radio, press, and posters and leaflets.

TABLE 9: VECTOR CONTROL AND PREVENTION CAMPAIGNS

Name of the Campaign	Time Period	Target Disease	Coverage	Organization	Organization
Strive for a Dengue-free Malaysia	2014	Dengue	National	No	The campaign educated Malaysians on control measures for prevention of dengue
Wide Campaign Against Dengue Fever in Malaysia	2015	Dengue	National	No	It encouraged upon preventive measures for dengue
Mosquito Control Learning Lab	2015	Dengue/Malaria	National	Yes	1500 local school children have completed Mosquito Learning Lab this has increased the awareness regarding prevention of dengue
360° Vector Control	2015	Dengue/Malaria	National	Yes	The program provided training and continuous education to enhance the preventive outcomes for malaria and dengue

Dengue Prevention Campaign

- **Strive for a Dengue-free Malaysia**[25]
  - Sanofi Malaysia launched the #MerdekaTanpaDenggi campaign to raise awareness and reduce the number of dengue cases in July 2014.
  - This campaign is part of the initiative by the Health Ministry and provides a platform for all Malaysians to pledge for a future that is free from dengue.
  - The campaign invites Malaysians to educate themselves on ways to prevent dengue from spreading.

- **Wide Campaign Against Dengue Fever in Malaysia**[26]
  - In 2015, Malaysia launched a massive campaign against the transmission of diseases by mosquito *Aedes aegypti*, vector of the dengue fever virus.
  - Initially, the campaign was exercised in all states and federal territories, except Malaka and Johor, which were covered later.
  - Tasks include garbage collection, inspection of works construction, removal of abandoned vehicles, and ecological use of larvicides to prevent mosquito growth.
  - Awareness campaigns were organized to help individuals realize the importance of dengue prevention measures.

[25] Sanofi Malaysia (2014) (CL: Medium)

[26] Wide Dengue Fever Campaign (2015)

- **Malaysia Adopts New Tactic in the Fight against Dengue as Cases Soar to Record High**
  - Malaysia's MoH initiated outdoor spraying of a deltamethrin-based insecticide to kill *Aedes* mosquitoes and control the increased number of dengue fever cases.

FIGURE 10: DENGUE AWARENESS IN NEWSPAPER AND SOCIAL MEDIA[27]


45 daripada 46 biak nyamuk aedes

■ Kementerian Kesihatan lancar Ops Gempur Tapak Binaan


PM pandang serius ancaman aedes

TABLE 10: SUMMARY OF DENGUE PREVENTION PROGRAM[28]

Ministry / Agency	Activities
Ministry of Health	• As lead ministry and coordinator • Dengue case management • Vector control and prevention • Surveillance • Enforcement of Destruction of Disease Bearing Insects Act 1975 • COMBI
Ministry of Urban Wellbeing, Housing, and Local Government	• Rubbish collection • Vector control and prevention of areas under the jurisdiction • Anti-litter programs • Enforcement and cleaning up of vacant lands • COMBI & Local Agenda 21
Ministry of Works	• To ensure construction sites and building structures are Aedes free
Ministry of Communications and Multimedia	• Provide periodical media slots on radio & TV • Increase community awareness on dengue prevention and campaigns
Ministry of Education	• To include a cleanliness program in the educational curriculum • To ensure that school premises are free from Aedes breeding
Ministry of Home Affairs	• Assist in dengue prevention programs by mobilizing uniform bodies
Ministry of Human Resources (DOSH)	• Enforce activities at construction sites
State Governments	• Ensure prevention and control activities are done at the state level

[27] CDC

[28] FutureBridge Analysis

Japanese Encephalitis Prevention and Control in Malaysia

- Japanese encephalitis cases were reduced after the introduction of JEV vaccination among children. This has helped develop robust surveillance with a good immunization program.
- The vaccination program, along with improved vector control and isolation of pig farms from paddy cultivation areas, led to a decline in JE cases.
- Although JEV infection is not a critical issue in peninsular Malaysia, the circulation of the JEV among bats, birds, and other animals might lead to a reoccurrence of human JE cases every year.

Vector Control Program by Bayer[29]

- Over the past 15 years, Malaysia has witnessed a dramatic reduction in human-to-human transmission of malaria. On the other hand, the country was inundated with an unprecedented number of dengue cases in 2015.
    - **2001:** Of 12,780 malaria cases in 2001, 8,808 were of indigenous human malaria transmission. The remaining cases were from zoonotic transmission.
    - **2015:** Fourteen years later, malaria cases decreased to 2,510, a decline of 242 from the total number of human-to-human transmission cases. A noted increase in zoonotic transmission in recent years has been attributed to urbanization and deforestation. The same year, dengue cases topped 120,000 with 322 deaths.
    - **2020:** By 2020, the Malaysian MoH has pledged to achieve a malaria-free status (human-to-human transmission). Making this pledge a reality will require a concerted effort from both the public and private sectors.
    - There is an urgent need to reduce these increasing numbers of dengue cases and deaths, and take a step back to realign current approaches and vector management strategies.

- Bayer has come up with two major initiatives for dengue and malaria control:
    - **Mosquito Control Learning Lab:** In 2015 at Singapore, over 1,500 local school children have completed Mosquito Learning Lab - an online learning tool to help bring the message closer to everyone in the community, from school children to families, with the aim of sustaining a high level of awareness and vigilance.
    - **360° Vector Control:** This program is leveraged by Bayer's expertise and innovation capacity to eliminate vector-borne diseases. It is aimed at encouraging product developments and partnerships. Training and continuous education enhance the outcome.

Mosquito Control Learning Lab

360° Vector Control

[29] Bayer (CL: High)

[30] Dengue Prevention and Control in Malaysia, 2015

National Dengue Strategic Plan (2015 – 2020)[30]

The objective of National Dengue Strategic Plan is to strengthen the preparedness and response capacity in order to detect cases and outbreaks for immediate action.

The programme has developed 7 strategies:

- Dengue Surveillance
- National Cleanliness Policy and Integrated Vector Management (IVM)
- Management of Dengue Cases
- Social Mobilization and Communication for Dengue
- Dengue Outbreak Response
- Dengue Research
- Reduction of Dengue Burden in The Klang Valley

Dengue Surveillance

Dengue surveillance is a digital program where in there is continuous update regarding outbreak of dengue cases, and preventive measures. The following are the major components of dengue surveillance:

- eNotification
- eDengue System
- Dengue Outbreak Management System (SPWD)
- iDengue System
- Laboratory Surveillance (coordinated by The National Public Health Laboratory)

eDengue and iDengue

National Cleanliness Policy and Integrated Vector Management

- National Cleanliness Policy emphasized on 5 core issues:
  - Establishing the National Cleanliness Policy
  - Establishing and adopt a National Cleanliness Index
  - Expanding the implementation of solid waste management and public cleansing as provided under the Solid Waste Management and Public Cleansing Act 2007 (Act 672)
  - Banning or limiting the use of plastic
  - Declaring of the National Cleanliness Week every year

- Integrated Vector Management
  - Space spraying using temephos EC or Bti in hotspot areas
  - Residual spraying as a complementary measure
  - Effective waste collection system by local authorities
  - Reliable water supply system to reduce the need for additional water storage
  - Cleanliness activities (Gotong Royong)
  - Advice on personal protection during the peak of mosquito bites
  - Enforcement activities in the construction sites with other agencies such as local authorities, CIDB and DOSH

Management of Dengue Cases

The ministry of Malaysia has designed guidelines are dengue management – Clinical Practice Guideline (CPG) on Management of Dengue Infection in Adults as below

- Early detection of dengue cases
- Standard and effective dengue management
- Public awareness on symptoms and signs of dengue and seek early treatment
- Awareness of medical practitioners to detect dengue cases

Social Mobilization and Communication for Dengue

This encourages community involvement in dengue prevention and control programs such as the COMBI project, along with participation of universities, NGOs and the private sector. Social mobilization has enhanced the use of mass media platforms such as television, radio, electronic billboards, newspaper and social media such as Facebook, WhatsApp and personal blogs.

45 daripada 46 biak nyamuk aedes

Kementerian Kesihatan lancar Ops Gempur Tapak Binaan

Dengue Outbreak Response

There are outbreak operation rooms at the district and national levels with Dengue Task Force Committees. The members on the board work on an epidemic response plan, early detection of epidemic and risk communication.

3.1.5 Challenges[31]

The National Strategic Plan for Dengue 2009-2013 was on track until 2012, when the number of cases was almost half compared to 2009. However, since 2013 dengue cases have increased, and presently the plan shows no signs of reaching its target.

- **Fogging and House Inspection:**
  - Dengue control techniques such as fogging are not very effective in Malaysia, as homeowners do not allow fogging distributors into their homes. As a result, when fogging is carried out, mosquitos find refuge inside houses.
  - Fogging remains ineffective as it targets only adult mosquitoes; thus, to improve the efficiency of fogging, it is important to collaborate with private companies. However, private companies result in high fogging costs, and may also dilute chemicals which can have dangerous consequences as mosquitoes may develop a resistance to fogging (due to the weakness of chemicals).

[31] Health Governance and Dengue in Southeast Asia (NTS Report, 2015) (CL: High)

- **Communication for Behavioural Impact (COMBI):**
    - The instruction and awareness campaigns implemented by local authorities for COMBI were not able to communicate their messages effectively, which highlighted the high turnover of volunteer staff and lack of innovative ways to engage the public.

- **Lack of Healthcare Professionals:**
    - According to statistics from the MoH Malaysia (2014), as of 31 December 2013, there were a total of 46,916 medical doctors in Malaysia. Of these 28,949, were associated with MoH, 6,270 are not associated with MoH, and 11,697 are private practitioners. This translates to a 1:633 ratio of doctors to people.
    - Additionally, there are a total of 89,167 nurses. Of these, 56,503 are associated MoH, 26,653 are private nurses, and 6,011 are non-MoH, which means that the ratio of nurses to population is 1:333

- **Waste Management and Recycling:**
    - In Kuala Lumpur, contractors with weak credentials do not collect rubbish frequently, and also the drains were left clogged.
    - In Penang, the amount of solid waste at landfill sites exceeded the limit, rubbish bins were too small for household waste, and there were unnecessary delays in responding to complaints.
- **Increase in the Number of Migrants:**
    - In Selangor and Kuala Lumpur, an increase in the number of migrants has led to further overcrowding of urban spaces. As a result of urbanization, there has been an erosion of natural habitats and more co-habitation between mosquitoes and humans, highlighting the dominance of non-sustainable land use strategies.

- **Logistical and Technical Challenges:**
    - Geographic inaccessibility to risk populations in Sabah and Sarawak challenges malaria control efforts, particularly for vector control activities. It delays an early diagnosis of any kind of infection such as dengue, malaria, and JE. Additionally, continual transfer of trained staff within the MoH (typically among VBDCP and other environmental health units) can be particularly challenging for the retention of knowledge in the Malaria Control Program, and the quality of interventions.

4. Market Analysis

4.1 Procurement Channels

Procurement channels for vector control products in Malaysia are government bodies, vendors, procurement bodies, and wholesalers, distributors such as NGOs, local bodies, community health centres, and others.[32]

4.1.1 Overview of Procurement Channels

In Malaysia, there is only national funding for vector control and prevention activities. The procurement of LLINs in Malaysia follows the processes, of tender, biding and national procurement. The government bodies procure LLINs from global manufacturing firms which are further disbursed to vendors through the tender process. Vendors quoting the lowest price for WHO pre-qualified vector control products usually get the distributorship. These vendors further distribute the LLINs to NGOs/local bodies/community health centres to achieve a maximum reach of products. Wholesalers and retailers are involved in the supply chain of retail products.

[32] FutureBridge Analysis

FIGURE 11: OVERVIEW OF PROCUREMENT CHANNELS FOR VECTOR CONTROL PRODUCTS IN RETAIL MARKET

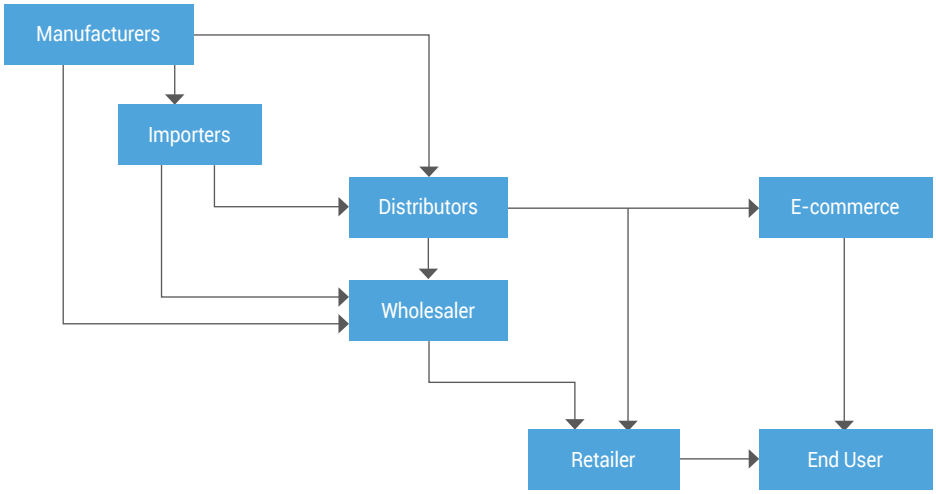


Figure 11 explains the procurement of retail vector products and its further supply to end users. In case of foreign manufacturers, the products are imported by an intermediate agency such as NGOs or government procurement organizations. These products are bought by the distributors and then from the distributor by the wholesaler. The wholesaler is area-specific, from where the goods are further transported to the retailer in that particular area. The end-users buy this product from the retailers.

In case of local manufacturers, the products are procured directly by the distributor and the subsequent chain remains the same. Many distributors sell their products to end-users directly through e-commerce. This reduces the cost of the product, as it bypasses the intermediate supply chain.

4.1.2 Stakeholders

In Malaysia, the National Malaria Control Program (NMCP) is responsible for developing innovative approaches for malaria control through partnerships with private companies, at local-level as well as district- and state-level projects. The NMCP receives 100% of its funding from the Malaysian government.

The NMCP undertakes all program activities such as financing, implementation of the program, strategy development, guidelines for malaria, and also provides inputs for vector control prevention to all states. Furthermore, NMCP also monitors and analyses data based on trends across the country. The NMCP has foci-oriented vector control with IRS and ITNs, along with routine surveillance as key strategies to meet the elimination target.[33]

4.1.3 Procurement Channels – Gap Analysis

The gap in the procurement channel is due to issues with logistics, finance, and human resources.

- In the case of logistics, challenges associated with the procurement of goods include: adverse climatic conditions affecting the quality of goods and other factors (such as untimely delivery); low quality of approachable roads, or places inaccessible through roadways; and individuals carrying their products.
- Financial gaps could cause a delay in the approval process of funds, an untimely and partial disbursal of funds, and an improper utilization of funds.
- Human resource gaps include unskilled healthcare workers, inaccessible healthcare workers, and lack of data because of the difficulties of tracking migrant populations.

[33] Eliminating Malaria (2015) (CL: High)

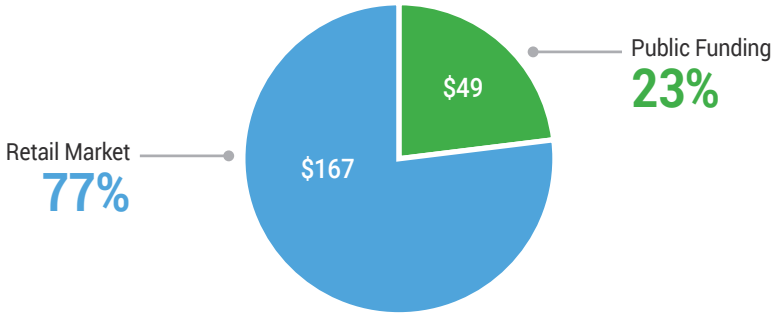
4.2 Sponsors & Payers

In Malaysia, the National Malaria Control Program (NMCP) receives 100% funding from the Malaysian government.

4.3 Vector Control Related Spending

In Malaysia, malaria is at an elimination stage. The government of Malaysia aims to eliminate malaria from the Sabah and Sarawak regions by 2020. On the other hand, there is a rise in the number of dengue cases. Funds allocated for vector control programs in Malaysia are mainly for creating awareness regarding the disease or its occurrence, through billboards, distribution of ITNs, IRS spraying, and digital surveillance.

FIGURE 12: SHARE OF VECTOR CONTROL MARKET SPENDING ($MILLION), 2017-18



4.3.1 Funding

In Malaysia, vector prevention and control programs are funded by the Malaysian government. International funding is not available in Malaysia.

4.3.1.1 National Funding

TABLE 11: NATIONAL FUNDING FOR MALARIA[34]

Year	Malaysian Government (NMCP) (USD)
2015	64.88 Million
2016	39.70 Million
2017	48.36 Million

The Malaysian government provides funds for malaria prevention and control activities. In 2017, the Malaysian government invested USD48.36 million for malaria control and prevention activities. Procurement and distribution of LLINs, awareness campaigns, education, environment cleanliness, IRS and other activities are carried out with the funds thus invested.

[34] World Malaria Report (2018) (CL: High)

FIGURE 13: NATIONAL FUNDING FOR MALARIA IN MALAYSIA FROM 2007-2017[35]

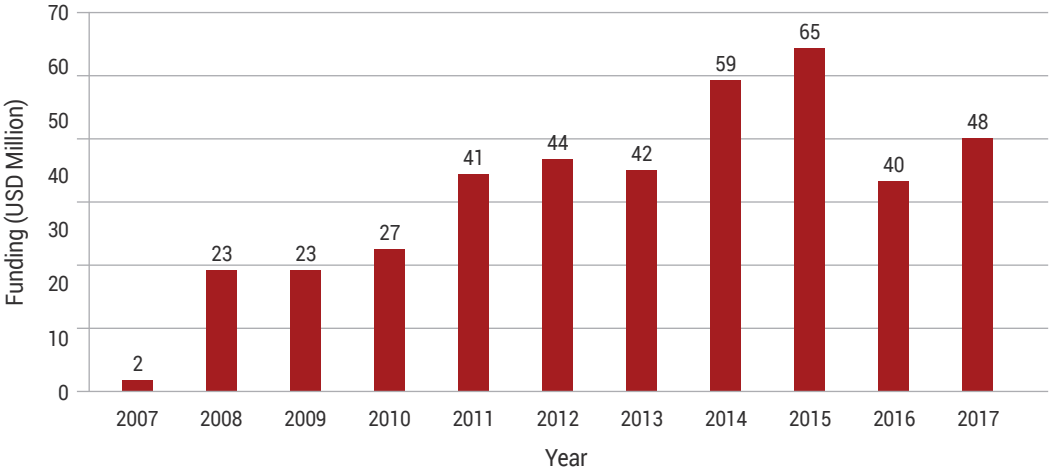
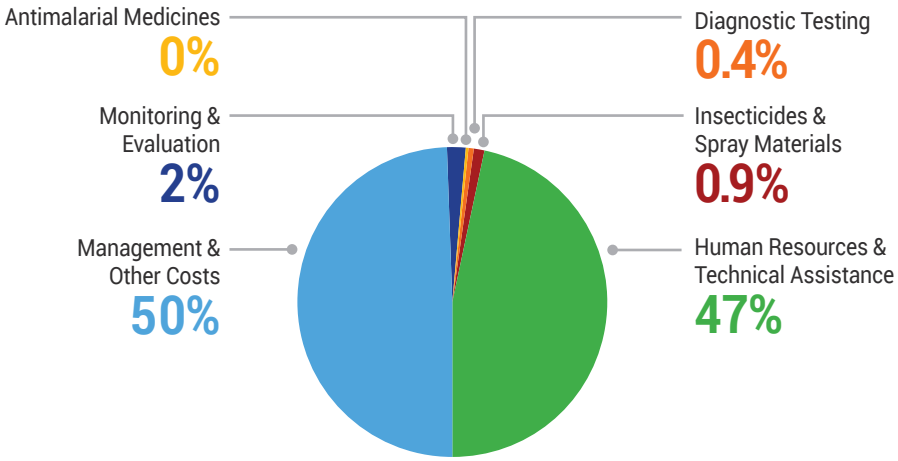


FIGURE 14: GOVERNMENT EXPENDITURE BY INTERVENTION IN 2017[32]



National Funding for Dengue[36]

In 2018, the Ministry of Health allocated USD6.75 million (1.04%) of its national budget for dengue treatment and prevention in Malaysia; the average spending on dengue prevention and control measures per year is USD15.8 million. The Malaysian healthcare system scores well as a percentage of GDP expenditure (5%), percentage of out-of-pocket health expenses (below 40%), and a public health system that is financed through taxes.

The funds allocated are further distributed for various activities. It is estimated that ~26% of the funds are allocated for inspection of premises, ~8% for entomological surveillance, ~33% is spent on fogging, ~19% is allocated for larviciding, and ~ 14% of funds are used for spreading awareness and educating the population regarding vector control and prevention activities.[36]

[35] WHO (CL: High)

[36] Health Governance and Dengue in Southeast Asia (NTS Report, 2015) (CL: Medium)

The below table provides explicit data regarding cost incurred for dengue control

TABLE 12: CHARACTERISTICS AND DENGUE VECTOR CONTROL COSTS AT DISTRICT, STATE, AND FEDERAL LEVELS[37]

Study Site	Population	Reported Dengue Cases	Total Dengue Vector Control Cost (USD million)	Dengue Vector Control Cost per Reported Cases (USD)	Dengue Vector Control Costs Per Capita Population (USD)
Districts					
Gombak	0.7	3,107	2.85	915.94	4.26
Petaling	1.8	5,147	2.75	534.34	1.56
Hulu Langat	1.1	4,852	1.53	314.48	1.34
Klang	0.8	1,752	1.42	810.96	1.69
Melaka Tengah	0.5	1,048	1.39	1,325.64	2.87
Batu Pahat	0.4	175	0.75	4,289.24	1.87
Kuala Langat	0.2	524	0.43	814.61	1.94
Sik	0.1	71	0.19	2,730.34	2.92
States					
Selangor	5.3	16,367	0.29	17.97	0.06
Malacca	1.9	1,485	0.22	149.49	0.28
Kedah	0.8	782	0.34	436.66	0.18
Federal	27.5	46,171	1.72	37.21	0.06

4.3.1.2 International Funding

International funding is very nominal in Malaysia. There is no reported funding from global donors.

4.3.2 Funding Gap

Domestic funding is self-sufficient. Gap in fund requirements is not evident.

4.4 Market Description and Analysis

Retail market[38]

The retail market in Malaysia for vector control products comprises insecticide coils, insecticide sprays or aerosols, household insect repellents, electric insecticides, moth proofers, and others. Presently, insecticide sprays/aerosols are widely used in Malaysia as they seem to be the most efficient way to eliminate mosquitoes. Insecticide coils are also used on a large scale due to their low cost.

The vector control retail market was estimated to be ~USD170 million in 2018. The sale of aerosols/sprays was approximately 16 million in 2018, and the value generated was estimated to be USD90-100 million. The market share for electric insecticides is anticipated to increase in the near future due to the harmful effects of insecticide coils and insecticide aerosols/sprays on children and pregnant women.

[37] Packierisamy, P. R et al., (2015) (CL: Medium)

[38] FutureBridge Analysis

Leading companies in the retail market for vector control products in Malaysia are SC Johnson & Son (M) Sdn Bhd (SC Johnson & Son Inc.), Reckitt Benckiser (M) Sdn Bhd (Reckitt Benckiser Group Plc.), Fumakilla Malaysia Bhd (Fumakilla Ltd.), Tohtonku Sdn Bhd, Amway (M) Sdn Bhd (Amwsy Corp), and others. Leading brands in the retail market are Ridsect, Fumakilla, Shieldtox, Baygon, Mortein, and others.

Donor Market[27]

The government has allotted funds for vector prevention and control programs in Malaysia; there is no international funding in Malaysia. In 2017, the National Malaria Control Program received USD48 million from the Malaysian government. In 2018, the MoH allocated USD6.75 million (1.04%) of its national budget for the prevention of dengue and malaria. A major portion of these funds is disbursed for human resources, technical assistance, and management of government activities.

TABLE 13: VOLUME AND SALES OF VECTOR CONTROL PRODUCTS IN MALAYSIA[27]

Product Class	Malaysia						
	Volumes 2016 (Mn)	Volumes 2017 (Mn)	Volumes 2018 (Mn)	Average Unit Price (USD)	Value 2016 (USD Mn)	Value 2017 (USD Min)	Value 2018 (USD Min)
Insecticide Coils	50	58	67	0.6	25-30	35-40	40-50
LLINs	0.28	0.28	NA	2.25	0.63	0.63	NA
Electric Insecticides	7	8	10	2.5	15-20	20-25	25-30
Sprays/Aerosols	13	15	16	6	80-90	80-90	90-100
Insecticide Bait	NA	NA	NA	NA	0.1-0.3	0.1-0.3	0.1-0.3
Other Home Insecticides	NA	NA	NA	NA	6-8	6-8	6-8
Leading Brands	Ridsect, Shelltox/Shieldtox, Fumakilla, Mortein, Baygon						
Leading Companies	SC Johnson & Son Inc., Reckitt Benckiser Group Plc (RB), Fumakilla Ltd.						

Commentary:

- Market for some retail products surpasses by far the public budget, e.g., mosquito coils in Malaysia
- A portion of this retail market can be leveraged for disease control

[39] FutureBridge Analysis

FIGURE 15: MARKET SIZE OF VECTOR CONTROL PRODUCTS[39]

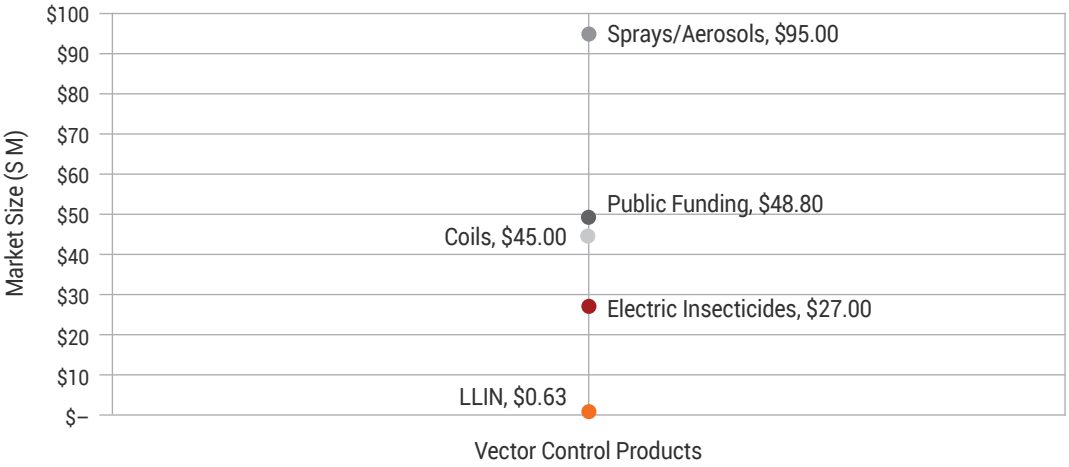


TABLE 14: MALARIA BURDEN FUNDING, RETAIL MARKET[36]

Parameter	Value	Malaysia
Population at Risk 2017 (Million)	1.26	○
Incidence of Malaria (Cases/1000) (2017)	0.003	○
LLINs (Million) (2017)	1.7	○
Public Funding ($Million) (2017-18)	48.8	◒
Public Fund ($)/Person at Risk	38.7	●
Retail Market ($Million) (2018)	167	●
Est. Funding for LLINs (% of Public Fund)	8%	○

Note: High ● Medium ◒ Low ○

FIGURE 16: KEY RETAIL BRANDS AND PRODUCTS

Manufacturer	Electric Insecticides	Coils	Aerosols
SC Johnson & Son Inc	Ridsect 	Ridsect 	Ridsect 
Fumakilla Ltd	Vape 	Fumakilla 	Fumakilla 
Reckitt Benckiser Group Plc (RB)	Shieldtox 	Shieldtox 	Shieldtox 
Amway Corp			Target 

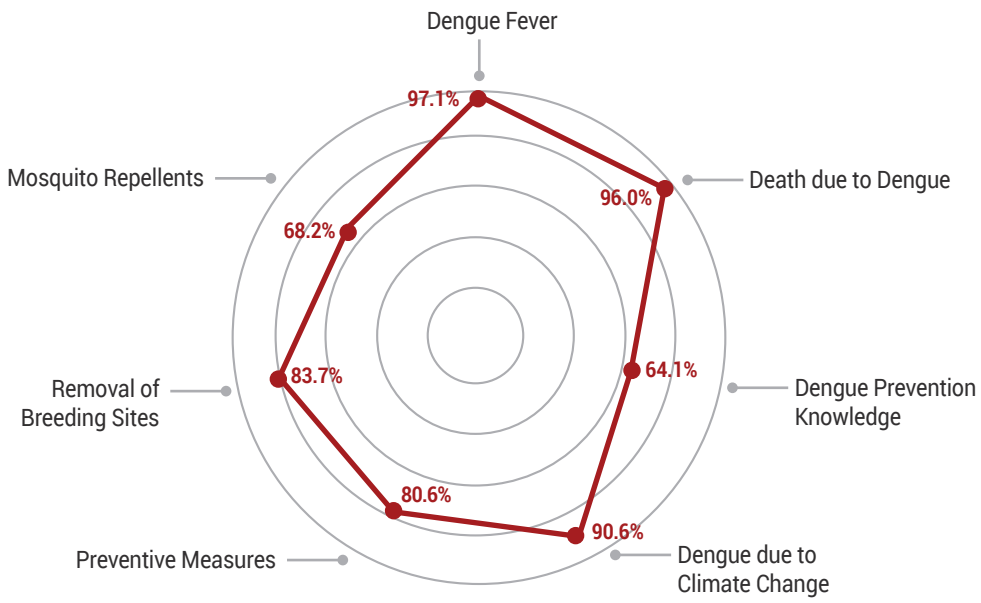
[40] Zaki et al., 2019. PLoS ONE

4.4.1 Level and Need for Awareness

Level of dengue awareness in Malaysia[40]

In 2010, Malar J. published a study that explored the perception and attitude of Malaysians towards dengue and its prevention. The sample size included 847 individuals (above 18 years of age) from Petaling District in Malaysia. The study was conducted between May 2017 and July 2017 in which 1,000 dual language questionnaires were distributed among English and Malay speaking individuals. Among 1,000, only 847 (84.7%) surveys were completely filled. 64.7% respondents were females, with most of the respondents being students (52.7%); the rest were private sector workers (19.7%), civil servants (13.9%), self-employed (9.6%), unemployed (3.3%), and others (0.8%). 80.8% of respondents never had dengue, and 78.1% knew individuals infected by dengue.

FIGURE 17: LEVEL OF DENGUE AWARENESS AMONG THE MALAYSIAN POPULATION[29]



Level of malaria awareness in Malaysia[41]

According to the WHO Malaria Report 2015, Malaysia is in the pre-elimination phase of malaria, with approximately of 1.3 million people living in areas where malaria transmission is active. However, increasing incidence of zoonotic malaria in Malaysia has created awareness among the population. In a study conducted among 100 forest – aboriginal and 123 rural households, the level of awareness regarding transmission was higher in the rural population, i.e., 86.2% in comparison to that of 76% with forest – aboriginal.

- **Digital Platform**

  Increasing awareness regarding prevention and control of malaria and dengue with the use of digital technology, such as Bayer's Mosquito Control Learning Lab and 360° Vector Control, has contributed to the growth of the vector control products market in Malaysia. In 2015, over 1,500 school children in Singapore completed the Mosquito Learning Lab - an online learning tool to help bring the message closer to everyone in the community, from school children to families, to sustain a high level of awareness and vigilance.

[41] Malar J. et al., 2010 (CL: Medium)

5. Regulatory Pathways

Insecticides that are used for the control of VBDs such as Malaria, Dengue, Lymphatic Filariasis, and Chikungunya, are regulated and registered in the country prior to their use. This is known as regulatory process. Insecticides are regulated and registered by the Pesticides Board under the Ministry of Agriculture (MoA), Malaysia; the regulatory authority is responsible for the scrutiny and approval of pesticides belonging to Chemical, Microbial and Biochemical classes.

The registration process in the country requires efficacy reports on the effectiveness of the product for its intended use. Though local trials are preferred, the country's regulatory authority also accepts trials that have been conducted in countries with similar climatic/pest conditions, following internationally accepted protocols. The regulatory authorities also accept justification and waiver requests for data that are not required for some pesticidal products.

Registration of chemical pesticides in Malaysia is primarily categorized as (i) Commodity pesticides and (ii) Proprietary Pesticides. Commodity pesticides are those in use in the country for more than 15 years, and all the other pesticides fall under proprietary pesticides. There are some data waivers for commodity pesticides.

The cost of registration is around USD10,000 for in-country trials but reports from other countries could waive off this cost and time. however, the timelines for regulatory approvals would be 10 - 12 months from the time of submission of dossier for registration. Newer and innovative product registration without established specifications would take time for registration and the timelines would be longer.

Registrations are granted for a period of 5 years and the certificate can be renewed for another 5 years before the validity of registration expires. There is no provisional registration available in the country. An Experimental Use Permit (EUP) is granted for one (1) year and this is to facilitate the import of a limited quantity of unregistered pesticides for research purposes, or for testing in the country leading to product registration for commercial use.

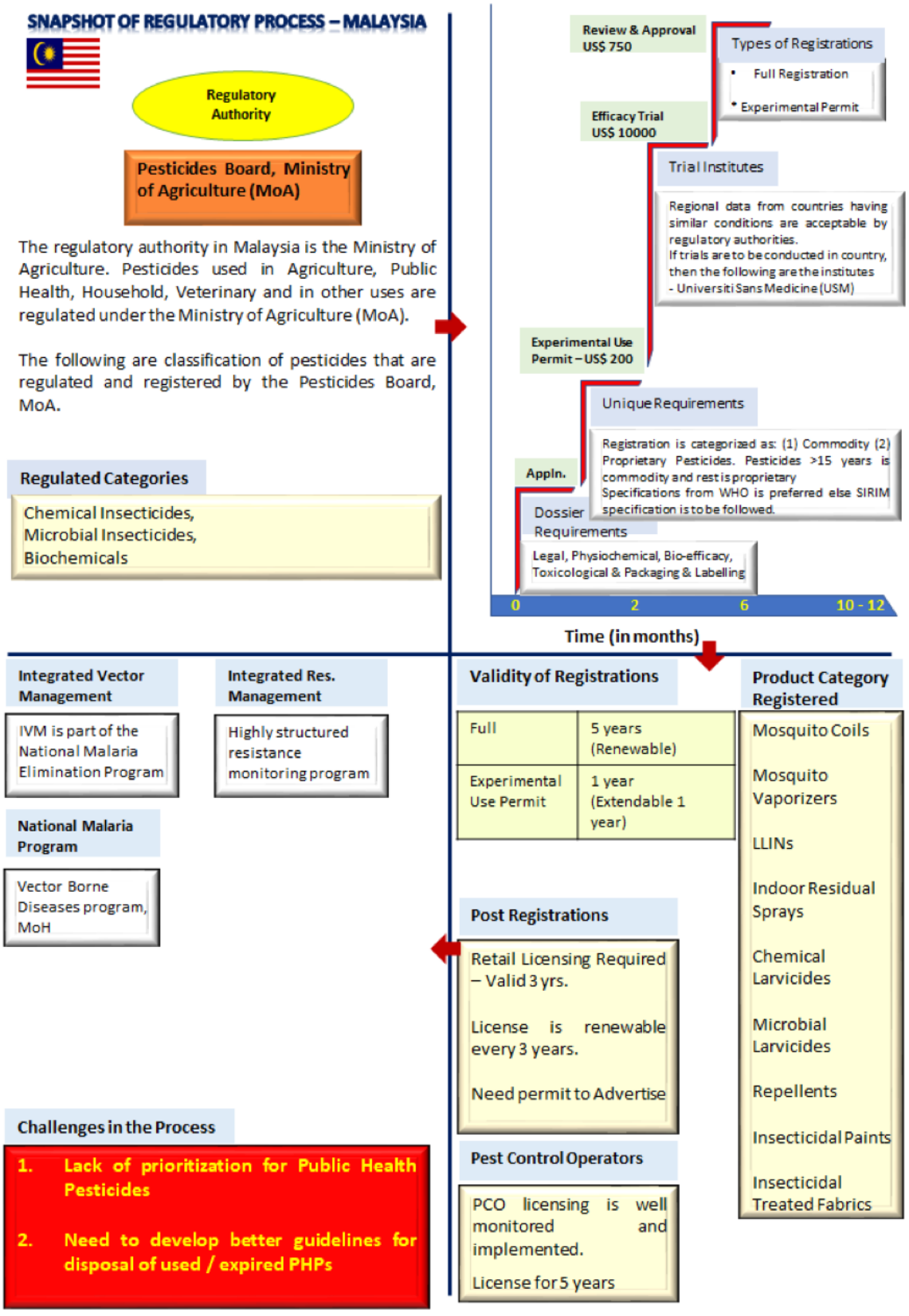
The products that are registered for commercial use are mosquito coils, emanators, LLINs, insecticides for indoor residual spraying, chemical larvicides, microbial larvicides, spatial repellents and personal repellents.

Post registration requirements include obtaining a retail license to permit the sale of the registered pesticides in retail outlets. A retail license is granted for a period of 3 years, and is also renewable. A permit is also need to do advertisement in the country for products required in household pesticides.

Some of the challenges of the registration process in the country are as follows:

1. Lack of prioritization of public health pesticides registration
2. Lack of proper disposal of pesticides

FIGURE 18: SNAPSHOT OF REGULATORY PROCESS



6. Market Dynamics

6.1 Market Trends

Currently, the vector control market in Malaysia is more focused on the elimination of dengue due to the increasing prevalence of cases:

The prevalence of malaria in Malaysia is at a pre-elimination stage. The government of Malaysia aims for the complete eradication of malaria by 2020. On the other hand, there is a rise in the incidence of dengue cases. In 2017, 83,849 dengue cases were detected, which resulted in 177 deaths.

Use of digital platforms to spread awareness as well as monitor the success of diseases:

Programs such as 360° Vector Control and the Mosquito Control Learning Lab are two major digital initiatives implemented by Bayer to spread awareness regarding prevention and control of dengue in Malaysia. In addition to knowledge transfer, these initiatives also help monitor and ensure surveillance for dengue.

Increasing awareness among the Malaysian population with the help of campaigns through newspapers and social platforms:

To inform the general public regarding the onset of malaria or dengue in a particular area, government bodies and NGOs in Malaysia are spreading awareness through newspaper articles or pop-ups on social media platforms. This has helped the residents of that area to ensure preventive measures for dengue or malaria.

Electric insecticides to witness decreased demand, affecting the growth of the retail vector control products market:

Electric insecticides in both mat and liquid forms provide round-the-clock protection, thereby reducing the probability of mosquito bites. However, it has been observed that parents are seeking substitutes that are safer for children and pregnant women.

6.2 Market Drivers

An increase in the number of monkey malaria cases and their prevention has encouraged the vector prevention and control program in Malaysia:

Since 2008, Malaysia has reported more than 15,000 cases of *P. knowlesi* infection and about 50 deaths. There were about 3,600 cases of *P. knowlesi* infection in 2017. In the same year, another species of monkey malaria parasite, P. cynomolgi, was found in five Malaysians.

The rising number of dengue cases in Malaysia has driven the market for vector control products, such as aerosols/sprays:

Due to the high numbers of dengue cases and deaths over the past decade, the MoH continued to warn Malaysians to take proactive measures: destroy mosquito breeding grounds, use spray/aerosol insecticides to eliminate adult mosquitoes, and to use repellents, especially during outbreaks. Despite concerns regarding the harmful content of spray/aerosol insecticides, their demand continues to grow, as they are the fastest and the most efficient way to eliminate mosquitoes.

Potential drivers for change:

- **Disease Pattern:**
  Malaysia has achieved approximately a 95% reduction in the number of malaria cases over a decade. However, monkey malaria (*P. knowlesi*) has accounted for a majority of the indigenous cases. The increase in the incidence of dengue cases, with the presence of all four serotypes of the virus spread across the population, is a major concern for Malaysians.
- **Impact of Disease:**
  The highest number of malaria cases was reported in Sabah (~49%), followed by Sarawak (35%). A total of 415 imported malaria cases were reported, with the highest numbers registered in Sarawak (52.2%), Selangor (19.5%), and Johor (8.2%). In 2017, there were 12 malaria deaths, compared to 2 deaths in 2016. Since 2008, Malaysia has reported more than 15,000 cases and ~50 deaths due to *P. knowlesi* infection (monkey malaria). There were 83,849 cases and 177 deaths due to dengue in 2017.
- **Technology:**
  Digital vector control programs have helped spread awareness regarding the prevention and control of VBDs, such as the Mosquito Control Learning Lab and 360° Vector Control by Bayer, with a strong monitoring and surveillance team and other marketing platforms including social sites and television news.
- **Social Focus:**
  Dengue control techniques such as fogging are not very effective in Malaysia as homeowners do not allow fogging distributors into their premises. As a result, when fogging is carried out, mosquitos find refuge inside homes. Moreover, the size and colour of LLINs that are distributed are a matter of concern for many individuals, and this has resulted in decreased use of LLINs.
- **Economic Dynamics:**
  Funds for the prevention and control of all VBDs are provided by the Malaysian government. There is no international funding in Malaysia. The Malaysian government spends approximately 5% of its GDP on healthcare.

6.3 Success Stories

Bayer has formulated two major initiatives for dengue and malaria control:

- **Mosquito Control Learning Lab:** In 2015, over 1,500 local school children in Singapore completed the Mosquito Learning Lab - an online learning tool to help bring the message closer to everyone in the community, from school children to families, to sustain a high level of awareness and vigilance.
- **360° Vector Control:** This program is leveraged by Bayer's expertise and innovation capacity to develop innovative vector control products through product development, training, and partnerships.

These two initiatives have worked on a larger scale to prevent and control malaria and dengue in Malaysia. Along with these campaigns, there are other activities conducted by the NMCP such as fogging, IRS, house inspections, insecticidal treatment, and distribution of both ITN and LLINs.

[42] Health Governance and Dengue in Southeast Asia (NTS Report, 2015) (CL: High)

7. Market Access Analysis

Vector control programs involve partnerships among various NGOs, government bodies, and social media platforms. Following are the initial recommendations for better market access:

- Advocate the use of 'mosquito-unfriendly' building design to prevent the breeding of disease vectors
- Innovate ways of incentivizing doctors and medical professionals to work in rural areas
- Stimulate improvements in the communication methods used by house inspectors through the provision of training
- Promote the publication of literature on dengue awareness in different languages at various platforms, such as hoardings, newspapers, and social media to increase their reach to migrant workers

Market Access Analysis[42]

Partnership: Organizations should look for any of the following partnership programs described below to gain access to the Malaysian vector control market.

- **Public-People-Private (or PPP):**
  NGOs partner with private sector companies, such as BASF, Shieldtox, Tiger Balm, and Revive Isotonic, which sponsor events with mosquito repellents, ointments, and hydrating drinks, to raise dengue awareness at subsidized rates or free-of-charge in exchange for positive publicity and product placement.

- **PPP partnerships in different forms:**
  Malaysia for Youth (iM4U) contacted the Ustad to raise awareness in the community about the link between hygiene and dengue during Friday prayers. The Pertubuhan IKRAM Malaysia (IKRAM), a non-profit organization in Malaysia, which runs kindergartens and pre-schools in coordination with Malaysia for Youth (iM4U), conducts interactive learning programs to educate young children regarding health, hygiene, sanitation, and cleanliness.

- **Inter-Ministerial Collaborations:**
  Consultation meetings with officials from public health authorities, urban planning agencies, and other relevant stakeholders to strengthen information sharing on methods of dengue prevention and associated challenges.

- **Improve public sector communication with young people:**
  iM4U uses info graphics on their Facebook page to share the top ten symptoms of dengue, and provide daily reminders about times when mosquitoes are the most active. iM4U partners with mainstream media, such as the Astro Awani channel and cable television. It has its own radio station that broadcasts public service announcements in the Klang Valley, one of the biggest hotspots for dengue.

Products:

As Malaysia is at the malaria pre-elimination stage, large-scale distribution of LLINs will accelerate the speed of elimination. In addition, the increasing prevalence of dengue in this country has driven the demand for home insecticides or insecticidal sprays/aerosols, to eliminate mosquito breeding sites. Hence, to enter the Malaysian vector control market, organizations should focus on the wide distribution of household insecticides/repellents. Additionally, the retail market accounts for more than 75% of the vector control market spending, as depicted in figure 18.

Awareness Campaign:

In Malaysia, awareness campaigns are focused on the prevention and control of dengue. These campaigns include newspaper articles regarding the onset of the disease, hoardings on the road, house inspection, larvicides, and education on prevention and control of VBDs.

Target VBD:

Control and elimination of dengue is the topmost priority in Malaysia. Due to the increasing incidence of dengue in Malaysia, the government is focusing primarily on the elimination of dengue in the coming years, which has driven the demand for vector control products.

8. First Conclusion

LLINs, IRS, and fogging are vector control products/activities that can effectively control the spread of various vector-borne diseases, such as malaria and dengue.

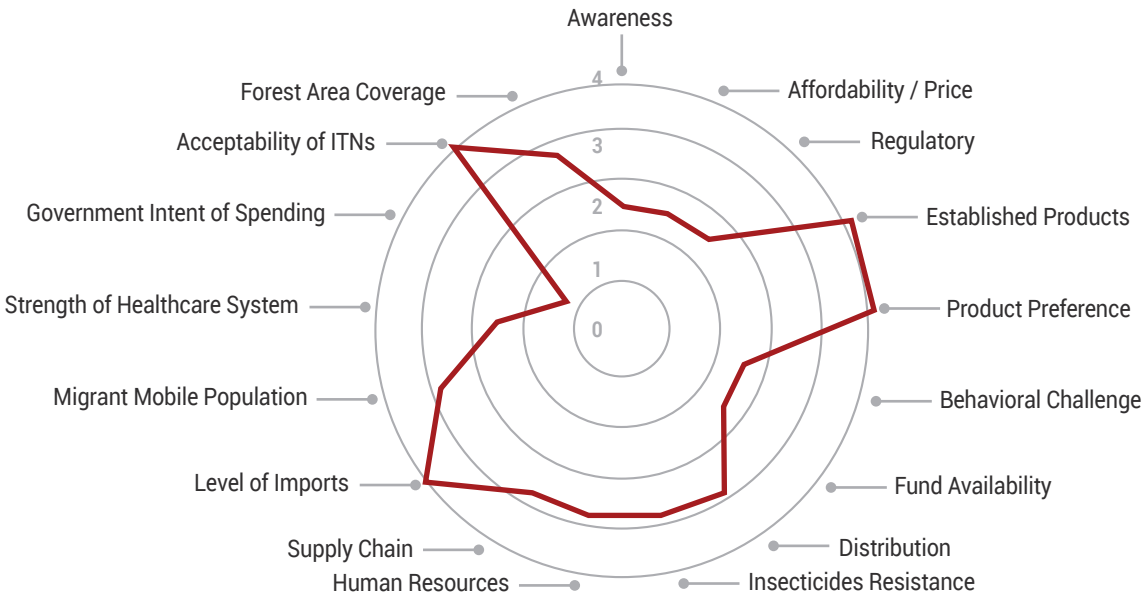
In addition to introducing these products, awareness and education campaigns conducted through different media platforms (hoardings and digital apps) have helped educate the people of Malaysia regarding the precautionary measures to control VBDs.

How to enter the market?

As vector control activities in Malaysia are managed by domestic funding, organizations should consider partnering with government bodies. The market for retail products is ~4X the annual investment for donor-driven products. Hence, any new organization willing to enter the Malaysian vector control and prevention market can focus on the retail market, with product categories such as insecticide sprays/aerosols, or electric insecticides. Furthermore, new organizations should emphasize on investing in awareness programs, to educate the population and create digital platforms encouraging citizens to build a clean environment.

Low acceptability of ITNs and a strong preference for existing products are the some of the most significant challenges impacting the entry of new products in Malaysia.

FIGURE 19: CHALLENGES FOR NEW PRODUCTS IN MALAYSIA



9. References

The list of participants in the primary interview research process is listed below.

1. Independent Consultant and IVM Adviser – World Health Organization
2. Country Director – Leading Insecticide Manufacturer
3. Region Head – Global Donor
4. Director Access & Policy – Regional Body
5. Vector Control Specialist – MNC Insecticide Manufacturer
6. Associate Manager-Marketing and Commercialization - Leading MNC Re

10. Appendix

1. Confidence Level for Sources Used in Secondary Research

The following criteria have been used for defining confidence level of secondary sources used in this report:

High:

- Reports published by major funding bodies such as The Global Fund, PMI, WHO, etc.
- Literature published in scientific journals
- Publications from government bodies (MoH)
- Company websites, press releases, and annual reports

Medium:

- News articles, blogs, published interviews, etc.
- Conference presentations
- Awareness websites
- University websites

2. Malaria Burden Funding, Retail Market – Rating Criteria

Key Parameters	High	Medium	Low
Population at Risk 2017 (% of total population)	>75	25-75	<25
Incidence of Malaria (Cases/1,000) (2017)	>50	5-50	<5
LLINs (Million) (2017)	>10	5-10	<5
Public Funding (USD Million) (2017-18)	>50	30-50	<30
Public Fund ($)/Person at Risk	>10	2-10	<2
Retail Market (USD Million) (2018)	>100	50-100	<50
Est. Funding for LLINs (% of Public Fund)	>25%	10-25	<10

3. Malaria Burden Funding, Retail Market – Data

Parameters	Malaysia
Population at Risk 2017	1.26
Incidence of Malaria (2017)	0.003
LLINs (2017)	1.7
Public Funding (2017-18)	48.8
Public Fund ($)/person at risk	$38.7
Retail Market (2018)	167
Retail Spending ($)/person at risk	132.5
Est. funding for LLINs (% of Public Fund)	8%