AWARENESS AND ADHERENCE TO THE MALAYSIAN CLINICAL PRACTICE GUIDELINES FOR MANAGEMENT OF DENGUE INFECTION IN ADULTS

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AWARENESS AND ADHERENCE TO THE MALAYSIAN CLINICAL PRACTICE GUIDELINES FOR MANAGEMENT OF DENGUE INFECTION IN ADULTS

ABSTRACT

Dengue fever (DF) is a major public health dilemma globally. Currently Malaysia is experiencing a surge of dengue cases and increase in dengue mortality. Early detection and risk stratification for severe disease are crucial in the optimal management of dengue. In addition, prompt management and appropriate fluid management are also known to reduce dengue mortality. Malaysia Dengue Clinical Practice Guidelines (CPG) has been developed to provide evidence-based guidance in the management of dengue infection, but healthcare providers' awareness and utilization as well as adherence to the Dengue CPG (revised 2nd edition) remain uncertain. Therefore, the aim of this study was to evaluate level of awareness and utilization of Dengue CPG among doctors in Malaysia and to evaluate the proportion of adherence to this Dengue CPG among the healthcare providers. This study was conducted in two phases. In phase one; a cross-sectional study was conducted among registered medical practitioners practicing at public or private Health Clinics and Hospitals in Malaysia. Doctors practicing only at hospital Medical and Emergency Departments were included, while private specialist clinics were excluded in this study. In phase two, a retrospective cohort study of dengue cases registered between 1 January 2014 to 1 June 2015 was conducted in public hospitals and health clinics in Selangor, Putrajaya and Kuala Lumpur. Adherence to the CPG recommendations were recorded by reviewing patient's case notes. A higher percentage of doctors from public facilities (99%) were aware of the CPG compared to those in private facilities (84%). The proportion of doctors utilising the CPG were also higher (98%) in public facilities compared to private facilities (86%). The high proportions of doctors using the CPG in both public (97%) and private (94%) hospitals

were also observed. However, only 69% of doctors in private clinics utilised the CPG compared to doctors in public clinics (98%). Overall proportion of adherence in clinical components of the recommendation were varies; (7.1 to 100.0% versus 7.7 to 73.8%) in history taking, (6.7 to 100.0% versus 12.3 to 60.0%) in physical examinations, (18.4 to 100.0% versus 23.1 to 83.2%) in assessment of warning signs, (0.6 to 100.0% versus 12.3 to 87.7%) in assessment of haemodynamic status, (60.0 to 100.0% versus 27.7 to 40.0%) in diagnosis, (46.6 to 80.0% versus 52.3 %) in case notifications, (73.2 to 100.0% versus 89.2 to 96.9 %) in performing specific laboratory investigations and (7.9 to 100.0 % versus 21.5%) in monitoring, for outpatient versus hospital settings respectively. Adherence trend were demonstrated to be higher in hospital settings compared to outpatient setting. Doctors in both public and private facilities were aware of the dengue CPG. However, most doctors in private clinic were less likely to utilise the CPG. Therefore, there is a need to increase the level of CPG utilisation especially in private clinics.

KESEDARAN DAN KEPATUHAN KEPADA GARIS PANDUAN AMALAN KLINIKAL MALAYSIA BAGI PENGURUSAN JANGKITAN DENGGI UNTUK DEWASA

ABSTRAK

Demam Denggi merupakan dilemma kesihatan utama di seluruh dunia. Pada masa ini, Malaysia sedang mengalami peningkatan kes denggi dan kematian akibat demam denggi. Pengesanan awal dan stratifikasi risiko untuk keadaan penyakit yang teruk adalah penting dalam pengurusan optimum denggi. Di samping itu, tindakan pengurusan segera dan pengurusan cecair yang sesuai juga dapat mengurangkan kematian denggi. Garis Panduan Pengurusan Denggi Klinikal (CPG) telah dibangunkan bagi menyediakan satu garis panduan berasaskan bukti-bukti penyelidikan dalam pengurusan jangkitan denggi. Walaubagaimanapun, tahap kesedaran, penggunaan dan pematuhan terhadap garis panduan CPG (edisi kedua yang disemak semula) dalam pengurusan pesakit oleh doktor masih lagi samar. Oleh yang demikian, matlamat kajian ini adalah untuk menilai tahap kesedaran dan pematuhan garis panduan CPG Denggi dalam kalangan doktor di Malaysia dan juga untuk menilai nisbah bilangan pematuhan terhadap CPG Denggi ini dalam kalangan pengamal perubatan. Kajian ini dijalankan dalam dua fasa. Dalam fasa pertama; satu kajian rentas telah dijalankan dalam kalangan pengamal perubatan berdaftar di klinik dan hospital kesihatan awam dan swasta di Malaysia. Hanya doktor yang berkhidmat di Jabatan Perubatan dan Kecemasan Hospital diambilkira, sementara klinik pakar swasta dikecualikan daripada kajian ini. Dalam fasa kedua, kajian retrospektif kohot terhadap kes denggi yang didaftarkan antara 1 Januari 2014 hingga 1 Jun 2015, telah dijalankan di hospital awam dan klinik kesihatan di Selangor, Putrajaya dan Kuala Lumpur. Pematuhan terhadap CPG telah direkodkan dengan meneliti fail pesakit. Peratusan kesedaran terhadap CPG lebih tinggi dicapai daripada doktor di fasiliti awam (99%) berbanding di fasiliti swasta (84%). Peratusan

doktor yang menggunakan CPG juga lebih tinggi (98%) di fasiliti awam berbanding di fasiliti swasta (86%). Peratusan doktor menggunakan CPG adalah tinggi di hospital awam (97%) mahupun di hospital swasta (94%).Walau bagaimanapun, hanya 69% doktor di klinik swasta menggunakan CPG berbanding dengan doktor di klinik awam (98%). Nisbah pematuhan komponen klinikal CPG secara keseluruhan adalah (7.1 hingga 100.0% berbanding 7.7 hingga 73.8%) dalam pengambilan sejarah penyakit, (6.7 hingga 100.0% berbanding 12.3 hingga 60.0%) dalam pemeriksaan fizikal, (18.4 hingga 100% berbanding 23.1 hingga 83.2%) bagi penilaian terhadap tanda-tanda amaran, (0.6 hingga 100.0% berbanding 12.3 hingga 87.7%) dalam penilaian status hemodinamik, (60.0 hingga 100.0% berbanding 27.7 hingga 40.0%) dalam diagnosis, (46.6 hingga 80.0% berbanding 52.3%) dalam notifikasi kes, (73.2 hingga 100.0% berbanding 89.2 hingga 96.9%) dalam siasatan makmal dan (7.9 hingga 100.0% berbanding 21.5%) dalam pemantauan, bagi pesakit luar berbanding pesakit dalaman. Nisbah pematuhan didapati lebih tinggi di hospital berbanding pesakit luar. Doktor di kedua-dua fasiliti awam dan swasta menyedari kewujudan CPG denggi. Walaubagaimanapun, kebanyakan doktor di klinik swasta kurang menggunakan CPG. Oleh sebab itu, terdapat keperluan untuk meningkatkan tahap penggunaan CPG terutama di klinik swasta.

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LIST OF ABBREVIATIONS

AHRQ	:	Agency for Healthcare Research and Quality
AHCPR	:	Agency for Health Care Policy and Research
CPG	:	Clinical practice guideline
CRF	:	Case Report Form
DHF	:	Dengue heamorraghic fever
DSS	:	Dengue shock fever
DF	:	Dengue fever
ED	:	Emergency department
HCT	:	Haematocrit
ICU	:	Intensive Care Unit
MOH	:	Ministry of Health
PTT	:	Partial Thromboplastin Time
PT	:	Prothrombin Time
SGOT	:	Serum Glutamic Oxaloacetic Transaminase
SGPT	:	Serum Glutamic Pyruvic Transaminase
WHO	:	World Health Organization

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

1.1.1 Dengue Epidemiology and Prevalence

Dengue fever (DF) is the world most common mosquito-borne infection illness and approximately 50–100 million cases are happening yearly and it is an endemic throughout the world (Saadiah, Sharifah, Robson, & Greaves, 2008). Generally, dengue virus (DENV) infection causes a various range of diseases characterised by dengue fever (DF) and dengue haemorrhagic fever (DHF) or dengue shock syndrome (DSS). There are four serotypes of DENV that typically caused the diseases and these serotypes are transmitted by the infected *Aedes* mosquito (Pérez-Castro, Castellanos, & Olano, 2016). Moreover, dengue possesses nonspecific clinical features as its symptoms are similar to other diseases, such as Japanese encephalitis, malaria, leptospirosis, and influenza.

More than 100 countries have been reported to be affected by dengue and it is spreading to the previously unaffected regions. Dengue epidemic in the Philippines and Thailand in the 1950s were the first recognised Dengue Haemorrhagic Fever. Prior to 1970, severe dengue epidemic was experienced by only nine countries, but now dengue virus is affecting a large portion of the total populace of 112 nations and dengue fever has become the second biggest arthropod-borne irresistible worldwide threat after malaria (Sankari, Hoti, Singh, & Shanmugavel, 2012). Furthermore, each year, half a million of patient with dengue haemorrhagic fever is hospitalised and a significant number of them are kids; about 2.5% of these patients died (Hadinegoro et al., 2015). Dengue fever causes a wide range of complication to the patient. Some of the complications may lead to severe dehydration and fluid leakage and that will cause circulatory fall (disappointment of the body to keep up sufficient blood supply to indispensable organs and proceed with ordinary substantial capacities) in the patient and

is conceivably lethal. In addition, severe dengue may cause brain damage due to bleeding and may lead to seizure and in a more severe condition, it may lead to dengue death (E. T. Ooi, Ganesananthan, Anil, Kwok, & Sinniah, 2008).

According to the Ministry of Health Malaysia, Malaysia reported its first case of DF in 1902 and the first case of DHF was reported in 1962. In 1973, Malaysia reported its first major outbreak of dengue haemorrhagic fever (DHF) and the country experienced a large epidemic with 3,005 notified cases with 35 deaths in 1982 (Tee et al., 2009). After more than three decades, the dengue cases were markedly increased. A total of 43,346 cases were observed in the year 2013, about a 14-fold increase compared to the cases in 1982. In 2017, a total of 70,447 cases, which is about one-fold higher than in 2013 (up until September 2017), were recorded. The incidence rate was consistently high during that period (Kementerian Kesihatan Malaysia, 2018). The repercussion of the increasing incidence warrants an urgent attention. Dengue fever, if not managed properly, may lead to dengue mortality and subsequently will increase the dengue mortality yearly rate. As of 2017, the number of reported dengue death was 159 cases (up until September) compared to 2013 in which the reported number of death was 92 cases (Kementerian Kesihatan Malaysia, 2018). The increase in the mortality rate due to dengue is distressing the Ministry of Health Malaysia and it calls for urgent measures to curb this issue.

1.1.2 Dengue Management and Clinical Practice Guideline

Dengue is the most vital arboviral disease infecting human that is emerging worldwide (Simmons & Farrar, 2009). As the infection is spreading to new territories, it is not just the dengue cases and deaths that are expanding but the touchy episodes of the ailment are occurring as well (Rezza, 2014). Without a particular treatment or rule, an appropriate administration of the cases is most crucial in dengue. Furthermore,

recognising dengue cases through potential warning signs may reduce the risk of dengue death. Primary finding, prompt management, and a proper fluid management are known to lessen dengue mortality (Kularatne, Weerakoon, Munasinghe, Ralapanawa, & Pathirage, 2015). Therefore, proper guidelines for managing dengue patient have been developed to assist and facilitate the clinician decision-making process in the management of dengue cases.

Clinical Practice Guidelines or CPGs have been created by proficient association for half of a century. CPGs are intended to guide the clinical practices, in light of the best accessible confirmation at the season of development (E. T. Ooi et al., 2008). The development has evolved from consensus-based to evidence-based. Reference was additionally made to different CPGs on dengue; for example, WHO initially distributed the dengue rules for conclusion, treatment, and control in 1986, which were assessed prior to being utilised as references (Halstead & Cohen, 2015).

In Malaysia, a gathering of multidisciplinary specialty from the Ministry of Health Malaysia (MOH) and the Ministry of Higher Education Malaysia is mindful to create CPGs for different ailment management. The CPG has been printed and disseminated to both the public and private health facilities. The softcopy adaptation of CPG is also downloadable from the portals of MOH and Academy of Medicine. In 2003, the main release of dengue CPG was distributed in Malaysia and in 2008 the second version of dengue CPG was disseminated. The most recent release of dengue CPG in Malaysia amid this investigation was the Clinical Practice Guidelines on Management of Dengue Infection in Adults (Revised second Edition) 2010, which is a revised edition of the earlier CPG (second Version) of 2008 (Mohd-Zaki, Brett, Ismail, & L'Azou, 2014). In the revised second edition, the main component being reviewed was the management of fluid. The revised second edition of dengue CPG is applicable to primary care doctors,

public health personnel, nurses, assistant medical officers, physicians, and critical care providers involved in treating adult patient with dengue fever, dengue haemorrhagic fever, or dengue shock syndrome, and other forms of severe dengue. In addition, it is suitable for both the outpatient and inpatient settings. The dengue CPG consists of eight parts, namely outpatient management, patient at emergency management, hospital referral and admission, intensive care management, disease monitoring, fluid management, bleeding management, and discharge criteria. The principal target of the CPG is to give a confirm-based direction in the administration of dengue contamination in adults' patients. In addition, the CPG provides directions of appropriate liquid administration (Ministry Of Health Malaysia MOH, 2010).

Clinical practice guidelines are viable only in the event that they are seen to be valuable and are actually utilised as part of the clinical decision. Therefore, it is imperative to ensure that clinicians are well-versed in the rules and they actually use and employ the guidelines in their clinical practice (Ferreira, 2017). Accordingly, it is vital to evaluate the awareness, utilisation, and adherence of dengue CPG among clinicians. The evaluation will provide data on whether the rules influence the clinicians' awareness and practice as well as the factors that contribute to non-compliance with the rules. Currently, the awareness, utilisation, and the adherence of the target users that include primary care doctors, public health personnel, physicians, and those involved in managing dengue cases, are indeterminate. Evidence shows that only a proportion of those who utilise the health system had actually accepted the recommended processes of medical care (McKinlay et al., 2007). Without assessing the awareness, utilisation, and the adherence of the CPG, the adequacy and nature of the rules remain unknown. Hence, the purpose of this investigation is to survey the awareness of dengue CPG among physicians in Malaysia and the usage of the CPG in their practice. Additionally,

it aims to study the proportion of adherence towards dengue CPG in the dengue patient management.

1.2 Statement of Problem

Dengue has been asserted as the most domineering mosquito-borne viral infection on the planet because of the noteworthy geographic spread of the infection and the resulting expensive weight of sickness it brings (Murray, Quam, & Wilder-Smith, 2013). Dengue infections cause various spectrum of illness, from asymptomatic, mild undifferentiated fever to classical dengue fever (DF), and dengue fever with haemorrhagic manifestations, or dengue haemorrhagic fever (DHF), and the dengue shock syndrome (DSS) (Murray et al., 2013). The classification of severe dengue has been complicated by the variation in clinical picture, for which the underlying pathophysiology may be different. Failure to detect dengue cases with potential weakening (warning signs) may cause high threat of dengue mortality. Several studies have indicated that primary detection of warning signs and proper fluids management will produce a good outcome (Pun, Shah, Gupta, Sherchand, & Pandey, 2012). Hence, CPGs have been established to offer references to the practice to improve patient care. In addition, CPGs provide huge evidence, data and expert opinion into a frame that is brief and effortlessly reasonable as well as prudent. They consolidated the most current evidence-based clinical data into a system that advances the best patient results. Guidelines are being designed to enhance the nature of medicinal services and reduce the utilisation of superfluous, insufficient, or unsafe mediations (Rosenfeld & Shiffman, 2009). There are many dengue CPGs published in many different countries, such as WHO dengue CPG, MOH Malaysia dengue CPG, Ministry of Health Singapore, the Philippines and many others. This CPGs are being produced to provide guidance on appropriate management and diagnosis of dengue cases in their respective countries. It is also to help in early and accurate health intervention in dengue cases. A proper

management and an early diagnosis of dengue can help in improving patient condition, avoiding severe complication, and eliminating the possibility of death.

Currently, the latest edition of dengue CPG in Malaysia is the Clinical Practice Guidelines on the Management of Dengue Infection in Adults (Revised second Edition). This guideline was published in 2010; however, the effectiveness of this guideline in dengue management is indefinite and the proportion of clinician that use this CPG in their daily dengue management is also unknown. Furthermore, the level of awareness of clinician towards the CPG is also undefined. For those reasons, this study aims to explore the awareness and adherence of the clinicians towards dengue CPG. Findings from this study will add evidence about the level of awareness and utilisation of CPG for dengue management among adults and the level of adherence to the guidelines that influenced the patient outcome.

1.3 Justification of the Study

Ministry of Health (MOH) Malaysia has been producing dengue CPG as a means to enhance the quality of patient care. Notable efforts were put in preparing the guideline, yet, there is no evidence indicating the implementation of dengue CPG among physician in Malaysia (Tee et al., 2009). Nevertheless, the number of dengue death still increasing throughout the years (Mohd-Zaki et al., 2014). Therefore, the need to study the awareness, utilisation, and proportion of adherence to dengue CPG among physicians in Malaysia is vital; the findings will provide information on the physicians' attitude towards dengue CPG and will elucidate whether the CPG is still appropriate in the current dengue situation in Malaysia, or does it need to be revised. Besides, the findings will shed light on the factors that affect the utilisation of dengue CPG and also help in the future improvement of the CPG. This leads to a proper patient care and management as well as reduce the complication of dengue patient and dengue death cases in

Malaysia. This study specifically focuses on the dengue CPG for adult patient due to the increasing dengue death rate among adult patient. Therefore, a study evaluating the dengue CPG among adult patient is indispensable.

1.4 Research Objective

1. To study the level of awareness of CPG for dengue management among doctors in Malaysia
2. To quantify the proportion of Malaysian doctors utilising the CPG
3. To identify what was the CPG used for in their practice
4. To identify factors that associated with CPG utilisation
5. To measure the proportion of patients managed according to the CPG of Dengue Infection in Adults
6. To study the association between the level of adherence to CPG and the outcome of patients

1.5 Public Health Significance

This study evaluates the clinicians' awareness and utilisation of the proper guidelines of dengue management system and the clinician adherence to the guidelines in managing dengue patient. Research on the dengue management system has increased steadily in the recent years (Chacko & Subramanian, 2008). Several reasons for the increase have been identified such as the number of patients diagnosed with dengue fever is increasing in most countries (Anders et al., 2011). Second, the early detection of the factors and risks of dengue infection improved the morbidity and mortality rate, thus, studies to evaluate the effectiveness of the management system is obligatory. Third, there has been no study conducted to evaluate the dengue CPG in Malaysia (Tee et al., 2009). Furthermore, this study could identify the barrier to implementing the dengue CPG among clinicians. Also, information gathered from this study were drawn

from clinicians with field experience in managing dengue patients. This would help immensely in getting valuable information regarding the applicability of the CPG, thus facilitating the improvement of the current dengue CPG by relevant stakeholders. Consequently, it would help to improve dengue patient management and care, which would indirectly improve the condition of the patient and reduce the complications and mortality rate in Malaysia (Kumarasamy, 2006).

CHAPTER 2: LITERATURE REVIEW

2.1 Dengue Infection

Dengue fever is an arthropod-borne viral disease that is most significant throughout the globe. Moreover, over 100 countries around the world happened to have dengue cases and the health of more than 2,500 million individuals in the tropical and subtropical districts are being threatened by it (Lee et al., 2011). Dengue fever is caused by any one of four types of dengue viruses (DENV-1, DENV-2, DENV-3 and DENV-4) spread by mosquitoes that thrive in and near human lodgings. When a mosquito bites a person infected with a dengue virus, the virus enters the mosquito. When the infected mosquito then bites another person, the virus enters that person's bloodstream (Navarrete-Espinosa, Gomez-Dantes, Celis-Quintal, & Vazquez-Martinez, 2005). Also, people that have suffered from dengue fever previously can still be infected due to a number of different types of viruses. However, a secondary infection may lead to severer form of infection. This differs from the customary circumstances where the body that has been exposed to a certain virus would commonly produce antibodies that allow the body to combat the virus more easily for the second infection (E. E. Ooi, Goh, & Gubler, 2006).

Generally, the symptoms of dengue infection begin in four to six days after the infection and it lasts up to 10 days. The clinical course of dengue infection changes as the disease progresses, after the incubation period, the illness begins abruptly and will followed by three phases which are febrile, critical and recovery phase (Ministry Of Health Malaysia MOH, 2010).However, most of the dengue infections are asymptomatic, for instance, a dengue fever that will lead to a more significant complication, namely dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS) and this will probably lead to a severe morbidity and mortality (Setiati et al., 2007). There are diverse severities of dengue fever and the symptoms vary; commonly,

symptoms that appears up to one week after the Aedes mosquitos bites and then disappear is known as mild dengue fever. This type of dengue is usually non-fatal and causes mild complication to the patient. The other type of dengue symptom is dengue haemorrhagic fever (DHF), which stemmed from mild dengue fever; it gradually aggravated and may lead to death if not treated in time. DHF is characterized by sustained high fever for 2–7 days; bleeding diathesis such as positive tourniquet test, petechiae, epistaxis and hematemesis; thrombocytopenia with platelet counts ≤ 100 × 109/L and plasma leakage due to increased vascular permeability evidenced by hemoconcentration, pleural effusion and ascites (Ministry Of Health Malaysia MOH, 2010). Bleeding diathesis is caused by vasculopathy, thrombocytopenia, platelet dysfunction and coagulopathy. The severity of DHF varies from mild with minimal and transient change in vital signs, to severe, with threatened shock (e.g. blood pressure 100/90 mmHg) or profound shock. Intensive supportive care is the most important aspect of management. Early recognition of the disease and careful monitoring for circulatory disturbance are essential (Rosiek & Leksowski, 2016). Optimal fluid therapy to maintain the functions of the vital organs during the critical period and effective control of bleeding episodes will lead to favorable outcomes(Chatrath, Khetarpal, & Ahuja, 2015). Dengue shock syndrome may develop from mild dengue fever and this is the worst form of dengue that could also lead to death. Increased vascular permeability, together with myocardial dysfunction and dehydration, contribute to the development of shock, with resultant multi organ failure. The onset of shock in dengue can be dramatic, and its progression relentless. The pathogenesis of dengue shock syndrome is known that endothelial dysfunction induced by cytokines and chemical mediators occurs. Diagnosis is largely clinical and is supported by serology and identification of viral material in blood. No specific methods are available to predict outcome and progression (Rajapakse, 2011). Careful fluid management and supportive therapy is the mainstay of

management. Most people that got infected with dengue will recuperate within two weeks. Nevertheless, certain patients may suffer from fatigue and depression up to a month (Jayaratne et al., 2012).

Generally, for a patient with mild dengue fever, the treatment option would be prevention of dehydration. This is due to the high fever and vomiting, which would dehydrate the body, thus an increase in water intake would help to replace the fluid discharged. Second, for a patient with a more severe form of dengue, intravenous fluids supplement (IV drip) would be more appropriate. This is due to the patient inability to take fluid orally. For patients with a severe dehydration, blood transfusion would be recommended (Carrasco et al., 2011). The symptoms of dengue fever are similar to some of the other diseases and this causes difficulties in giving an accurate diagnosis. Thus, a standard diagnosis method is required for an early detection of a dengue infection. Although in primary prevention some progress had been made, it is still insufficient to overcome this deadly disease outbreak (Simmons & Farrar, 2009).

However, the adult syndrome might be significantly different with respect to epidemiology and clinical outcomes (Anders et al., 2011). According to World Health Organization (WHO), the classification of dengue disease might not be fully relevant to the adult infections. Even though dengue infection in adult does not threaten a patient life quite significantly, the symptom can be devastating. Therefore, a better understanding of the pathophysiology in adult patient is vital. Most of the past studies were to forecast the severity of the infection. Meanwhile, several of the studies proposed the standard parameters for diagnosing a patient, which include gender, age, presence of hepatomegaly, abdominal pain, lethargy, cold hands and feet, abnormal bleeding episodes, obesity or over-weight (in children), malnourishment, type two dengue infection, secondary infection, presence of ascites, plural effusion, leucopoenia,

thrombocytopenia , hemo-concentration, rising Serum Glutamic Oxaloacetic Transaminase (SGOT) and/or Serum Glutamic Pyruvic Transaminase (SGPT), prolonged Partial Thromboplastin Time (PTT) , prolonged Prothrombin Time (PT) , positive of the D-dimer test, and gallbladder wall thickening (measured by ultrasound). Many of these parameters are not used in general hospitals as a routine practice; also, these parameters evaluation would require days or even weeks to obtain the final results (Teixeira & Barreto, 2009).

Recently, many studies on the management of dengue and the clinical practice guideline for dengue patient have been conducted (Cates et al., 2001; Deen et al., 2006; Rezza, 2014; Sim et al., 2001). This is because dengue infection needs an early diagnosis and prompts management to prevent severe outcome of the disease. Furthermore, several studies show that clinician who follows the CPG management in managing dengue patient is known to reduce the dengue mortality cases (Dillmon et al., 2012). Based on their observation of a large multi-centre study conducted around the world, MOH Malaysia has revised their CPG guidelines and the latest and revised edition of Clinical Practice Guideline (CPG) management of dengue infection in adult was published in the year 2015 to offer an evidence-based guidance in the management of adult dengue patient. The CPG serves as a reference to the primary care doctor, public health personnel, clinician, and those involved in managing dengue cases (Ariff et al., 2017). Adherence to this CPG among the clinician is vital to ensure that dengue patients are diagnosed and managed appropriately so that morbidity and mortality of dengue cases can be reduced (Wolfe, Sharp, & Wang, 2004). The health care providers' awareness and adherence to the CPG are crucial to assure that dengue cases are managed accordingly. Therefore, a study to assess the health care providers' awareness and adherence to the CPG is highly needed in the local setting.

2.2 Clinical Practice Guideline

Clinical practice guidelines (CPGs) have been the fundamental components of medical practice. CPGs may be defined as statements that include hints meant to optimise patient care, which can be informed by using a systematic overview of the evidence and an evaluation of the benefits and harms of opportunity care options (Smith et al., 2015). CPG serves as an indispensable tool for the clinical decision-making, reduces the variation of practice, acts as an appropriate practice guidance, and measures the quality of care (Sim et al., 2001). Ultimately, the main goal of CPG is to improve the patient outcomes through evidence-based clinical practice. The CPG also provide a more rational basis for the health care provider to refer to. It also promotes an efficient use of resources and helps focus on continuous education (Fox, Patkar, Chronakis, & Begent, 2009). Over the past few years, the CPG is increasingly moving towards evidence-based health care, and this tendency is motivated by the concern of quality, consistency, and costs of the patient management. Despite the fact that the process of developing CPG is time and resource consuming, numerous CPGs have been developed and disseminated because of its rising importance (Greenhalgh, Howick, & Maskrey, 2014). Medical decisions have been based largely on skills and experience before the end of 20th century in which scientific teaching and practice were based on knowledge delivered with the aid of clinical chief and senior professional (Eddy, 2005). There have been no formal means of confirming a scientific and important approach in a scientific decision-making, although there was evidence in the clinical practice supporting the approach (Masic, Miokovic, & Muhamedagic, 2008).

Since the early 20th century, clinical practice guidelines (CPGs) have relished its existence in the health practice. The panel of expert or senior clinicians who had gained authority status in specific specialties were given the responsibility to develop the guidelines (Niland, Rouse, & Stahl, 2006). CPGs have been developed by professional

organisation for half of a century; it was known as “effectiveness initiative” and was announced in 1988 by William Roper who was the Health Care Financing Administrator at that time (Roper, 2008). The Agency for Healthcare Research and Quality (AHRQ) that was established as the Agency for Health Care Policy and Research (AHCPR) was given the authorisation in 1989 by the U.S Congress to continue the initiative of developing CPGs (Eddy, 2005). Throughout the 1980s and 1990s, the participation of specialty society in the development of clinical guidelines increased dramatically (Weisz et al., 2007). Currently, AHRQ created the National Guideline Clearinghouse as an agency responsible for all the CPGs developed (Smith et al., 2015).

At present, the National Guideline Clearinghouse has more than 2,700 listed guidelines (Smith et al., 2015). WHO first published the dengue guiding principle for diagnosis, treatment, and control in 1986, which gained popularity and had been recognised internationally as an authoritative reference. Typically, the dengue CPGs are meant to provide the physicians with a framework for diagnosing, assessing, and treating clinical conditions normally encountered in a practice. Moreover, they offer guidance in the management of dengue patients and help to improve reputation and diagnosis of dengue cases and offer proper care to the patients. In addition, the dengue CPGs also help in reaching early and correct notification of dengue cases for an immediate public health intervention (Weisz et al., 2007).

Assessing CPGs adherence in daily medical practice is important as it will be insignificant if the effort is more on developing the CPG rather than implementing it. For that reason many other studies have been done to assess the implementation of CPG by healthcare providers in managing patient. There are various methods done to assess the awareness and adherence toward CPG. As a systematic review done by Ebben et al.

(2013) shows that out of 35 study done on adherence toward clinical practice guideline and health protocol 26 are study done at hospital setting and 9 from prehospital setting. Out of the 35 study 25 were retrospective study and another 10 were prospective study. Moreover, in the systematic review also shows that out of 25 retrospective study 24 were done by reviewing the patient medical records and another 1 were done by reviewing the medical chart. Out of the 10 prospective study, 7 were done by using data collection chart prospectively where else another 3 were done by reviewing the medical records. 25 of the total study done were using checklist or case report form that contain guideline criteria in order to study the adherence towards the CPG. Furthermore, out of the 35 study done, 19 were monocenter study and another 16 were multicenter study. Most of the study done by assessing the patient manage in specific centre by specific health professional such as physician, paramedics and also nurses (Ebben, Vloet, de Groot, & van Achterberg, 2012).

2.3 CPG for dengue management in Malaysia

In Malaysia, a panel of expert from the Ministry of Health Malaysia is in charge of "producing" CPG for different management of disease. The group for guideline development comprises a family medicine specialist, an emergency medicine specialist, a general physician, infectious disease physicians, intensivists, haematologist, public health physicians, a virologist, and a nursing sister (Ministry Of Health Malaysia MOH, 2010). The CPG was then printed and disseminated to all public and private health facilities. The first edition of dengue CPG was published in 2003 whilst the second edition of the dengue CPG was published in 2008 by using the first edition as the basis for its development. Later, in 2010, the revised second edition of dengue CPG on the Management of Dengue Infection in Adults was published. This CPG is a revised version of the previous CPG on the Management of Dengue Infection in Adults (second Edition) 2008. The main difference between the revised second edition of dengue CPG

and the second edition is mainly on the fluid management of a dengue patient. The main objective of this CPG is to offer proof-based guidance in the management of dengue infection in adult patients. Moreover, it is also to improve the recognition and prognosis of dengue cases and to provide suitable care for the patients. Additionally, it assists in distinguishing severe dengue and carrying out a more focused, close monitoring, and prompt management of the patient. Other than that, the revised CPG also offers guidance on appropriate and timely fluid control.

2.3.1 Revised second edition of dengue CPG

The revised second edition of the dengue CPG is applicable to primary care doctors, public health personnel, nurses, assistant medical officers, physicians, and critical care providers involved in treating adult patient with dengue fever, dengue haemorrhagic fever, or dengue shock syndrome, and other forms of severe dengue. It is also appropriate for both outpatient and inpatient settings. The dengue CPG consists of eight parts, namely outpatient management, patient at emergency management, hospital referral and admission, intensive care management, disease monitoring, fluid management, bleeding management, and discharge criteria. The main component in each part is history, assess for warning sign, physical examination, assess for haemodynamic status, diagnosis, investigation, fluid management, and discharge criteria. These components are fundamental criteria that should be adhered to in an appropriate management of dengue patient in order to improve the condition of the patient. The aim of Clinical Practice Guidelines (CPG) Management of Dengue Infection in Adults (revised second edition) is to assist health care providers in making evidence-based decisions in the management of dengue infection in adults, by improving the identification and diagnosis of dengue cases and to provide appropriate care in order to reduce patient's morbidity and mortality (Ministry Of Health Malaysia MOH, 2010). The dengue CPG is the latest edition in Malaysia during the study period,

which summarised the best available evidence at the current time in order to provide a comprehensive set of recommendations to health care providers. The uptake of the guidelines by health care providers is essential to ensure these recommendations are practiced during patient care (Ferreira, 2017).

2.4 e- Dengue Registry

Malaysian national dengue registry known as e-dengue registry is a database that contain all the confirm dengue cases reported in all health facilities in Malaysia. All dengue cases diagnosed by clinical suspicion or serological conformation in Malaysia must be reported to the district health authorities using an online notification system which are e-Notice. Socio-demographic data, clinical features, full blood count and disease diagnosis data will be sent through e-Notice. A confirmed dengue case is one confirmed by laboratory criteria such as dengue virus isolation, a fourfold rise in antibody titres, virus antigen detection or virus genomic sequence detection. The data was then entered into the e-Dengue registry at the district health office (Liew et al., 2016).

CHAPTER 3: METHODOLOGY

There are two phases conducted in this study. In phase one, a cross-sectional study on the awareness and utilisation of CPG on dengue management among public and private hospital and clinic practitioners were conducted. In phase two, a retrospective study on the adherence to dengue CPG was conducted to measure the proportion of patients that have been managed according to the current CPG. This will reflect the clinicians' adherence to dengue CPG in managing their dengue patients. This study is registered with the National Medical Research Register (NMRRID: 20233) and approved by the University of Malaya Medical Centre Ethical Committee (MEC ID: 201412-902).

3.1 Awareness and Utilisation of Dengue CPG (Phase 1)

Clinical Practice Guideline (CPG) provides evidence-based guidance for the management of dengue infection in adult patients. Clinical practice guidelines will be effective only if they are perceived to be useful and are actually used in the clinical decision-making. Nevertheless, after producing the dengue CPG information, it is unknown whether clinicians are aware of the existence of the revised second edition of dengue CPG. Thus, it is imperative to discern whether clinicians who involve in handling dengue patients are aware of the dengue CPG. If they are aware of the CPG, do they utilise the guideline in their daily dengue patient management? Also, what are the factors contributing to non-utilisation of CPG and how do the CPGs assist in their daily practice? This information is crucial as they will help the stakeholders to learn the gaps between dengue CPGs and the clinicians' practice. For those reasons, it is important to evaluate the awareness, utilisation, and adherence to dengue CPG among the clinicians. Therefore, the aim of this study is to assess the awareness of dengue CPG among doctors in Malaysia and the utilisation of the CPG in their practice. Specifically,

this study evaluates the level of awareness and utilisation of CPG Management of Dengue Infection in Adults (revised second Edition) among doctors in Malaysia. The health care providers' awareness and utilisation of the dengue CPG are determined by using the validated self-administered questionnaires (CPG Awareness and Utilisation Feedback Form). The awareness in this study are defined as when the doctor admit that they know about the existence of the Malaysian CPG Management of Dengue Infection in adults and the utilisation are defined as when the doctor claimed that they have used the Dengue CPG. The information gathered in the questionnaire include whether they are aware of the revised second edition of the dengue CPG. If they are aware of it, they are further asked if they are utilising the guideline.

A cross-sectional study was conducted among registered doctors at health clinic and hospital (Medical and Emergency Department) of both the public and private health facilities in Malaysia to assess their awareness on the dengue CPG and to determine the proportion of them who utilise the CPG. A total of 860 validated self-administered questionnaires (CPG Awareness and Utilisation Feedback Form) were distributed between January 2014 and November 2014.

3.1.1 Sample size calculation

The sample size was estimated based on approximately 40,000 medical practitioners registered in Malaysia according to the Malaysian Health Fact 2013 by the Ministry of Health (MOH), with design effect of 1.5, awareness level of 50 %, significance level of 5% and the sample size calculated were 571. After taking into consideration of 40% non-response the desired sample size yielded were 860 medical doctors. Sample size is estimated using sample size calculation software Openepi.com.

3.1.2 Inclusion and Exclusion Criteria

Respondents for this study are registered medical practitioners practicing in health clinics and hospitals (medical and emergency department) both in public and private facilities in Malaysia. However, private specialist clinics such as obstetrics and gynaecology clinic, eye clinic, and skin specialist clinic were excluded from this study.

3.1.3 Sampling method

Proportionate multistage random sampling was conducted to ensure representativeness of the samples. The states were clustered into six regions (Central, North, South, East, Sabah, and Sarawak), while the health facilities were stratified according to hospitals and clinics. Estimated numbers of health facilities were based on Malaysian Health Facts 2013. Sampling units of medical doctors were randomly selected based on the desired sample size per department. A total of 550 clinics (public and private), 65 public hospitals (out of 140 for the whole country), and 25 private hospitals (out of 117 for the whole country) were identified and included in this study (Fig 1).

3.1.4 Questionnaire

The CPG Awareness and Utilisation Feedback Form were validated in a pilot study among public doctors in health clinics. The questionnaire comprises 18 questions for six sections: 1) personal details 2) awareness of CPG management of dengue infection in adults 3) training attended 4) utilisation of CPG 5) factor associated with utilisation, and 6) suggestion to improve utilisation of CPG (Appendix A).

3.1.5 Data Collection

The questionnaires were distributed and collected by a well-trained personnel; some were sent via email and fax. For those who did not return the questionnaire, they were reminded through emails, phone calls, fax, and finally a visit to their department or

clinic. Their status was coded as non-response following the unsuccessful attempt to get any feedback after three reminders.

3.1.6 Data Entry

The questionnaire was coded prior to data entry. All collected questionnaires were checked for completeness and internal consistency. Any inconsistency was re-checked and clarified by the researcher. Data then entered into a personal computer using the IBM SPSS Statistics for Windows, Version 22.0 (Corp, 2013). This was followed by cross-checking, cleaning, and transformation of data. Validating and data editing were carried out prior to data analyses. In order to process and analyse the data meaningfully, the raw data were sorted out in relation to the objectives of the study and variables selected. Data were entered in batches as soon as the collection of the questionnaire completed. The entry was re-checked immediately against the raw data to exclude typing error at the end of each session of data entry. Outliers and inconsistencies were re-checked against the raw data to rule out wrong entry. A password has been set up as an additional protection to secure the data. Moreover, data backed up were made to several other devices such as an external hard disc, Google drive, email, and saved into other laptop and computer.

3.1.7 Data Analysis

Data analysis were performed using IBM SPSS Statistics for Windows, Version 22.0 (Corp, 2013). Descriptive statistics were reported. Results were compared between weighted and unweight and since the results were comparable, therefore unweight results will be presented in this report. Population estimates were presented as prevalence rates.

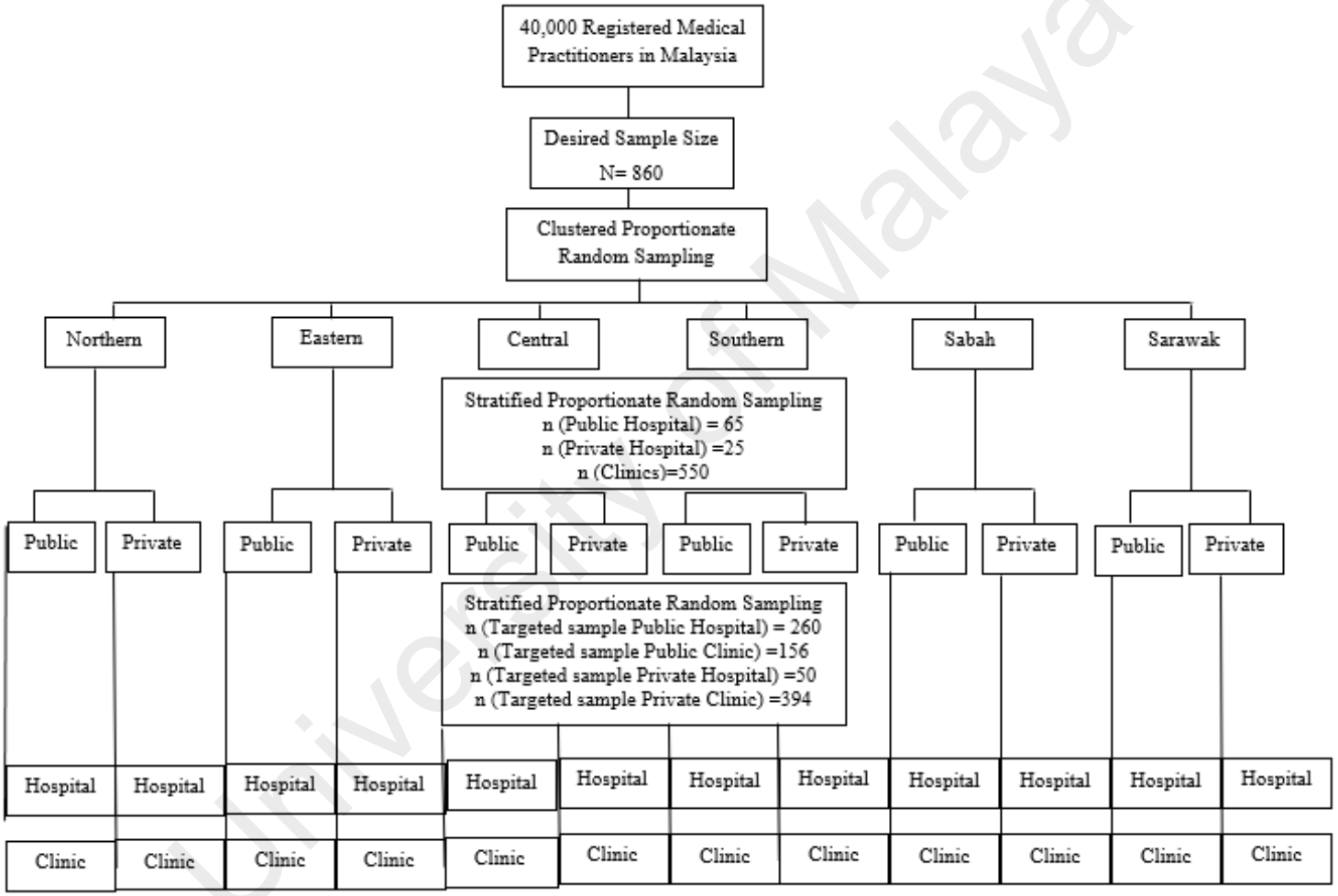


Figure 3.1 Flowchart of sampling method (Phase 1)

3.2 Adherence to Dengue CPG (Phase 2)

The proportion of adherence to the dengue CPG was measured by assessing the medical notes of a dengue patient where the dengue pro forma that contains all the dengue guidelines from the revised second dengue CPG were used as a checklist to see whether each step of management in managing adult dengue patient was undertaken. By using the documented data in the medical notes, the adherence to dengue CPG was determined. Adherence was defined as the presence of documentation in the medical record of the patient. Dengue management at the government outpatient clinics (health clinics), hospital Emergency Department (ED), medical department, and Intensive Care Unit (ICU) department were evaluated to determine the proportion of dengue patient managed according to the CPG and also the association between adherence to the CPG by these team in managing dengue patients and the outcome of the patients.

A retrospective cohort study was conducted on registered dengue cases from 1 January 2014 until 1 June 2015 extracted from the e-Dengue registry, Ministry of Health Malaysia.

3.2.1 Sample size calculation

Based on estimated dengue cases in population in 2014, (10,000), we estimated at least 50% of the doctors adhered to the CPG Dengue Management. Using the design effect of 1.0, the calculated sample size is 370. Estimated non available cases of 50%, the desired sample size are 555. Sample size is estimated using sample size calculation software Openepi.com.

3.2.2 Sampling method

A proportionate random sampling of registered dengue cases treated in public hospitals and health clinics in Selangor and Federal Territory (Kuala Lumpur & Putrajaya) provided by the Disease Control Division, Ministry of Health (MOH) was

carried out. Only patients aged 12-year-old and above were included in this study. The cases were divided into two setting which are outpatient setting (health clinic) and hospital setting which includes emergency department, medical department and ICU department. All medical records were reviewed. Patient case notes were assessed based on the MOH CPG Management of Dengue Infection in Adults (revised second edition) recommendations (Fig 2).

3.2.3 Inclusion and Exclusion Criteria

In this study, confirmed adult dengue cases (from e-dengue registry) managed at the public health facilities in Selangor and Federal Territory (Kuala Lumpur &Putrajaya) from 2014 until 1 June 2015 as reported to MOH were used as a sampling frame. Confirm dengue cases is the dengue cases that being notified by the health facilities once they diagnose patient with dengue and this database were extracted from e-dengue registry.

3.2.4 Data Collection

The case report form (CRF) for evaluating adherence level of CPG was developed and validated. The CRF was separated into six sections (Appendix B). In the first section, the baseline characteristics of patients were collected, which included age, gender, and type of health care facility. In the second until the fifth sections, data on first doctors' encounter for outpatient or health clinic, Emergency Department (ED) team, medical department team and Intensive Care Unit (ICU) team were recorded. For each of the section, data pertaining history taking, diagnosis, laboratory investigations, early management, and monitoring of dengue infection were collected. In the sixth section, data on individual patients' outcome in term of mortality or morbidity, a complication of hospital-acquired infection, thrombophlebitis, and whether patients' needed a follow-up treatment, and the management of dengue infection were recorded.

Data collectors were the junior doctors and health care workers who underwent training by family physician specialists, emergency physician, and internal medical physicians for CPG and details on how to acquire data from medical case notes. Data collectors training occurred in two phases—in May 2015 and September 2015. Data collection were conducted from June 2015 until March 2016.

3.2.5 Adherence to Clinical Practice Guideline

The latest edition of Dengue CPG in Malaysia used during the study period was 'Clinical Practice Guidelines on Management of Dengue Infection in Adults (Revised second Edition, 2010)', which is the revised version of Dengue CPG (second Edition, 2008). Based on this guideline, data collection was divided into four sections, namely the first encounter in outpatient clinic (health clinic), ED, medical, and ICU department. The patient medical records were assess using developed CRF to look for documentation of history taking, diagnosis, treatment, test conduct and other component that recommended by CPG in order to study the proportion of patient managed according to CPG. The presence of documentation in patient's clinical notes as recommended by CPG was defined as an adherence to CPG.

3.2.6 Data Entry

All collected CRF was checked for completeness and internal consistency. Any inconsistency was rechecked and clarified by the researcher. Data from the CRF then entered into a personal computer using the IBM SPSS Statistics for Windows Version 22.0 (Corp, 2013) and followed by a cross-checking, cleaning, and transforming of data. The validating and editing of data were carried out before data analyses were performed. The raw data were sorted out in order to process and analyse the data meaningfully, and also to achieve the study objectives. Data were entered in batches, according to the facilities or hospital, as soon as the collection of data using CRF was

completed in each hospital. The entered data then were re-checked against the raw data at the end of each session of data entry to exclude any typing error. Data were stored on a password-protected computer and data backup was scheduled on a weekly basis.

3.2.7 Data Analysis

All CRF were checked and verified by trained personnel. Verified data were stored in MS Access database. Quality control by a trainer was performed by taking 10% of data from the database and comparing them with the physical data to assure data consistency. Descriptive statistics related to each exposure variable were tabulated presenting the frequency and percentage. Statistical tests were conducted at 5% significance level and data analysis was performed using IBM SPSS Statistics for Windows, Version 22.0 (Corp, 2013). The association between categorical variables was measured using Chi-square statistics. The continuous variables were presented by mean, standard deviation, median, minimum and maximum values, and measured using appropriate statistical analysis depending on the type of distribution. Population estimates were presented as prevalence rates. The results were compared between weighted and unweighted analysis. Since the results were comparable, the unweighted result is presented here. Descriptive statistics were reported. Results were compared between weighted and unweighted and since the results were comparable, therefore the unweighted results are presented in this report.

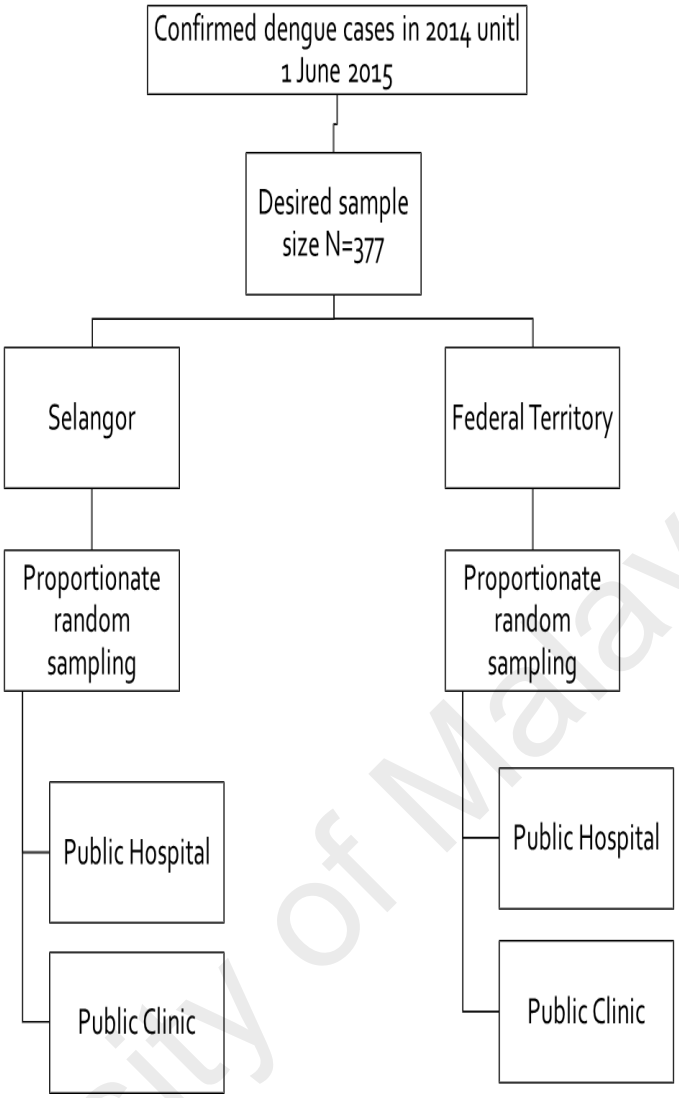


Figure 3.2 Sampling Method for Phase 2

CHAPTER 4: RESULT

4.1 Introduction

The presentation of result is divided into two parts: evaluation of awareness and utilisation of CPG for management of adult dengue infection among Malaysian doctors, and the adherence to CPG management of dengue infection in adults (Revised second edition).

4.2 Awareness and utilisation of dengue CPG (Phase 1)

4.2.1 Socio-Demographic

Out of 860 doctors invited to participate in the study, 634 (74%) doctors completed the questionnaire. Response rates were 84% for public hospitals, 82% for private hospitals, 70% for public clinics, and 64% for private clinics (Table 4.1).

Table 4.1 General Distribution of Respondents Comparing Public and Private Health Facility

Variables	Public		Private		Total
	Hospital	Clinic	Hospital	Clinic	
Target sample	260	156	50	394	860
Collected sample	219	128	35	252	634
Proportion of collected sample (%)	84	82	70	64	74

Most of the respondents of public facilities (95 or 27%) were from Central Region, 71 (21%) from Northern Region, 42 (12%) from Southern Region, 77 (22%) from Eastern Region, 37 (11%) from Sabah, and 25 (7%) from Sarawak. For the 287 respondents of private facilities, 150 (52%) were from Central Region, 53 (19%) from Northern Region, 37 (13%) from Southern Region, 36 (13%) from Eastern Region, 6 (2%) from Sabah and 5 (1%) from Sarawak (Figure 4.1).

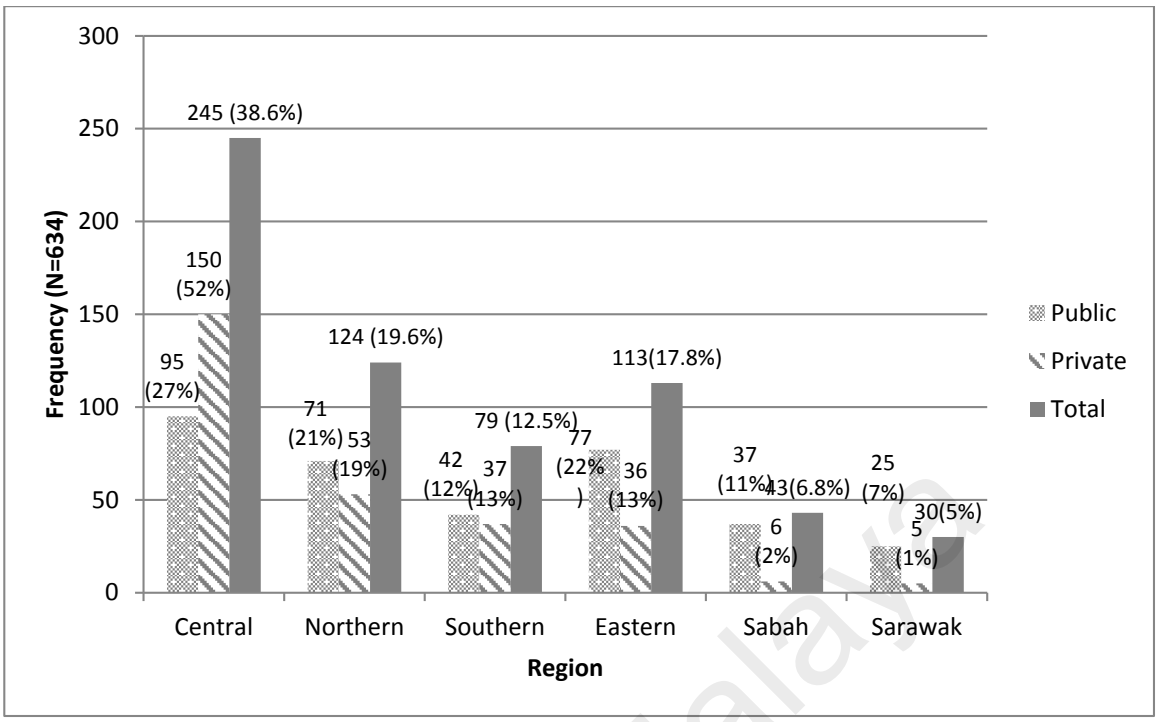


Figure 4.1 Distribution of Respondent by Region

Most (187 or 54%) of the respondents from public facilities were below 30 years old, whereas most (156 or 54%) of the respondents from private facilities were over 50 years old (Table 4.2). The majority (211 or 61%) of the respondents from public facilities were female, however, only 73 or 25% of the respondents from private facilities were female (Table 4.2). Out of 347 respondents from public hospitals, 34 (10%) were House Officer (HO), 246 (71%) were Medical Officer (MO), and another 62 (18%) were Specialist. The majority of the respondents from private facilities were also Medical Officer (237 or 82%), followed by Specialist (34 or 12%) and one House Officer (Table 2). The overall mean of length of service was 14 years, 6.4 years for public hospital and 24 years for private hospital. The overall maximum length of service was 51 years and a minimum of 1-year service (Table 4.2). Of the 634 respondents, 147 (23%) were from Medical Department with 112 and 35 from public and private hospital, respectively, 119 (19%) were from Emergency Department with 100 and 19 from public and private hospital, respectively, and another 357 (56%) were from public and private clinic—129 and 228, respectively (Table 4.2).

Table 4.2 Characteristics of respondents by type of health facilities

Characteristics	Overall	Public	Private	*P*-Value
Age group				<0.0001[b]
< 30 years	191 (30%)	187(54%)	4 (1%)	
31 - 40 years	149 (24%)	117(34%)	32 (12%)	
41 - 50 years	123 (19%)	37 (10%)	86 (30%)	
> 50 years	158 (25%)	2 (1%)	156 (54%)	
Unavailable	13 (2%)	4 (1%)	9 (3%)	
Sex				<0.0001[a]
Male	345 (54%)	132(38%)	213 (74%)	
Female	248 (45%)	211(61%)	73 (25%)	
Unavailable	5 (1%)	4 (1%)	1 (1%)	
Designation				<0.0001[b]
HO	35 (6%)	34 (10%)	1 (1%)	
MO	483 (76%)	246(71%)	237 (82%)	
Specialist	96 (15%)	62 (18%)	34 (12%)	
Unavailable	20 (3%)	5 (1%)	15 (5%)	
Length of service (years)				<0.0001[c]
Mean (sd)	13.98 (11.55)	6.40 (5.38)	23.85 (9.86)	
Median (IQR: 25th, 75th)	10 (4,22)	4 (3,9)	24 (16, 30)	
Range (min, max)	50 (1, 51)	29 (1, 30)	49 (2, 51)	
Department				<0.0001[a]
Medical Department	147 (23%)	112(32%)	35 (12%)	
Emergency Department	119 (19%)	100(29%)	19 (7%)	
Clinic (Public & Private)	357 (56%)	129(37%)	228 (79%)	
Unavailable	11 (2%)	6 (2%)	5 (2%)	

[a] *p* values were calculated using the Pearson Chi Square test
[b] *p* values were calculated using the Fisher's exact test
[c] *p* values were calculated using the Independent sample T test

4.2.2 Awareness of Dengue CPG

The majority (585 or 92%) of the respondents admitted that they were aware of the Dengue CPG. A higher proportion of respondents from public facilities (99%) admitted that they were aware of the CPG compared to those from private facilities (84%) (Table 4.3). Of the 345 respondents from public facilities who are aware of the Dengue CPG, 217 were from hospital and 128 were from clinic; whereas out of 240 respondents from

the private facilities, 35 were from hospital and 205 were from private clinic (Table 4.3). Among the respondents from public facilities, 33/34 (97%) of HO, 245/246 (99%) of MO, and all 62 Specialists admitted that they were aware of the CPG. Meanwhile, among the respondents from private facilities, one (100%) of HO, 198/237 (84%) of MO and 32/34 (94%) of Specialists admitted that they were aware of the CPG (Table 4.3).

Table 4.3 Dengue CPG Awareness Distribution of the Respondent Comparing Public and Private Facility

Variable	**Overall**	**Public**		**Private**	
		Hospital	**Clinic**	**Hospital**	**Clinic**
Aware	585/634(92%)	217/219(99%)	128/128(100%)	35/35(100%)	205/252(81%)
Not Aware	46/634(7%)	1/219(0.5%)	0	0	45/252(18%)
Missing	3(1%)	1(0.5%)		2(1%)	
***P*-Value**		0.0001[a]		0.0001[a]	
Personnel		**Public**		**Private**	
		Aware	**Not Aware**	**Aware**	**Not Aware**
HO		33/34(97%)	1/34(3%)	1/1(100%)	-
MO		245/246(99%)	0	198/237(84%)	37/237(16%)
Specialist		62/62(100%)	0	32/34(94%)	2/34(6%)
Missing		-	-	-	6/15(40%)
***P*-Value**		0.100[a]		0.307[a]	

[a] *p* value were calculated using the Pearson Chi Square test

A total of 548 (94%) of the aware respondent answered that primary care doctors is the target user, 425 (74%) answered the public health personnel are the target user, 343 (59%) paramedic and 455 (78%) physician. There were also some incorrect answers of which 70 (12%) answered pharmacist and 29 (5%) answered dietician as the target user of the Dengue CPG (Table 4.4). The other Dengue CPG awareness verification parts indicate that around 308 were using the revised second edition of Dengue CPG, 122 were using second edition, 37 were using the revised first and 49 were using the first edition of the Dengue CPG. Another 60 respondents claimed that they were using the third edition of the Dengue CPG (Table 4.4).

Table 4.4 Verification of Awareness of Dengue CPG among Aware Respondent

	Overall	Public	Private
Target users of the Dengue CPG?			
Primary care doctors	548/585(94%)	324/345(94%)	224/240(93%)
Public health personnel	425/585(74%)	268/345(78%)	157/240(65%)
Paramedics	343/585(59%)	240/345(70%)	103/240(43%)
Physicians	455/585(78%)	294/345(85%)	161/240(67%)
Pharmacists	70/585(12%)	50/345(15%)	20/240(8%)
Dieticians	29/585(5%)	19/345(6%)	10/240(4%)
Which edition of CPG do you use?			
First	49/585(8%)	14/345 (4%)	35/240 (15%)
Revised First	37/585(6%)	21/345 (6%)	16/240 (7%)
Second	122/585(21%)	60/345 (17%)	62/240 (26%)
Revised Second	308/585(53%)	203/345 (59%)	105/240 (44%)
Third	60/585(10%)	48/345 (14%)	12/240 (5%)

*Note: Sum of the percentage will not be 100% as the respondent may answer more than once.

4.2.3 Utilisation of the Dengue CPG

Of the 585 respondents who were aware of the Dengue CPG, 544 (93%) claimed that they utilised the Dengue CPG (Table 4.5). Of the 345 respondents from public facilities that were aware, 338 (98%) claimed they utilised the Dengue CPG. In private facilities, among those who were aware of the CPG, 86% (206/240) of them claimed to utilise the CPG (Table 4.5). Details of the characteristic of the respondents who are aware and utilise the Dengue CPG are shown in Table 5. Most (30 or 83%) of the respondents who were not utilising the Dengue CPG were private doctors in clinics.

Table 4.5 Characteristic of Dengue CPG Utilisation among Aware Respondent

Characteristics	Overall	Public	Private	*P*-Value
Health facilities				0.000[a]
Hospital	246 / 252 (98%)	213/217 (98%)	33/35 (94%)	
Clinic	298/333 (89%)	125/128 (98%)	173/205 (84%)	
***P*-Value**		0.000[a]		
Personnel				0.112[a]
HO	33/34 (97%)	32/33 (97%)	1/1 (100%)	
MO	408/443 (92%)	241/245 (98%)	167/198 (84%)	
Specialist	91/94 (97%)	61/62 (98%)	30/32 (94%)	

[a] *p* value were calculated using the Pearson Chi Square test

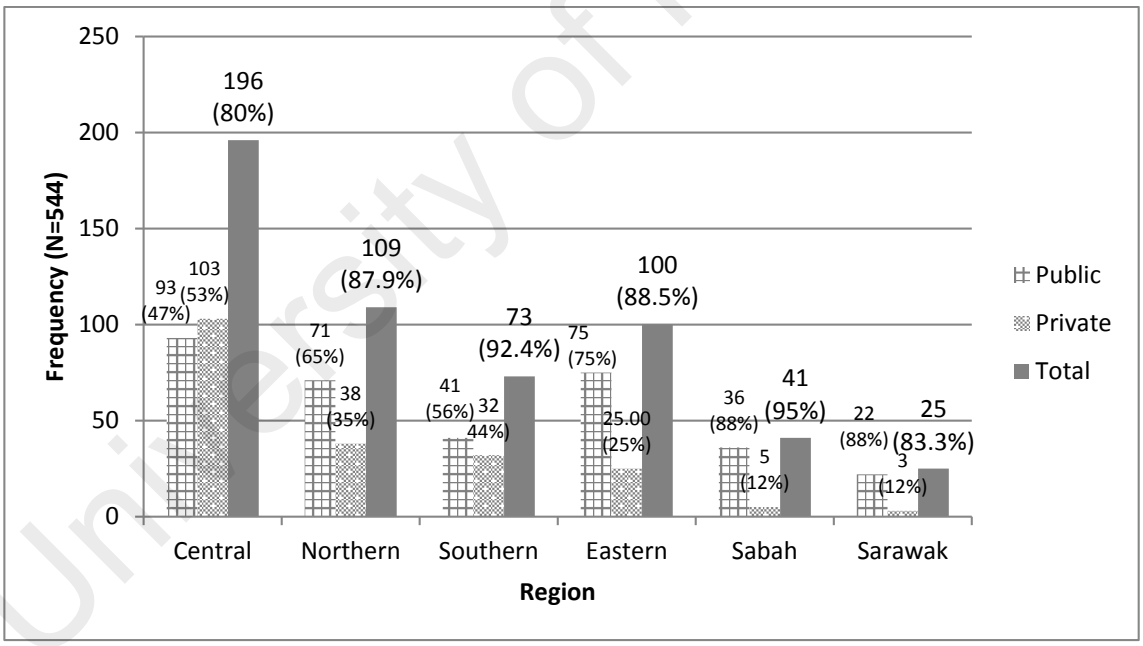


Figure 4.2 Distribution of Respondent Utilising Dengue CPG by State

Figure 4.2 shows the distribution of respondents who utilise the CPG by health facilities according to region. The highest utilisation was in Sabah (95%), followed by 92.4% from the Southern region, 88.5% from the Eastern region, 87.9% from the

Northern region and 83.3% from Sarawak. The lowest percentages of utilisation were from the Central region, which is 80%.

4.2.4 Reason of Using Dengue CPG

Most of the respondents who are utilising the Dengue CPG indicated that their reasons for using the CPG were to assist in the clinical practice decision-making, to increase their understanding in dengue management, and as a reference material. Additionally, some of them stated that their reasons for utilising the CPG were for teaching purposes, research purposes, and policy development (Table 4.6).

Table 4.6 Reason of Using Dengue CPG

Reason of Using	Overall	Public	Private
• Assist in decision making in clinical practice	461/544(85%)	289/338(86%)	172/206(84%)
• As a reference material	441/544(81%)	287/338(85%)	154/206(75%)
• For teaching purposes	195/544(36%)	177/338(52%)	18/206 (9%)
• For research purposes	30/544 (6%)	30/338(9%)	0
• Increase understanding in the management of the disease	385/544(71%)	250/338(74%)	135/206(66%)
• Assist in developing related operational policy/financial decision	90/544(17%)	75/338 (22%)	15/206 (7%)
• Others	5/544 (1%)	1/338 (1%)	4/206 (2%)

*Note: Sum of the percentage will not be 100% as the respondent may answer more than once

4.2.5 Reason of non-Utilisation of Dengue CPG

Most of the respondent who did not utilise the Dengue CPG stated their reason for not utilising it are lack of resources, lack of time, and they already know how to manage dengue patients. In addition, some stated that the reason was that the guidelines were not accessible and too complicated (Table 4.7).

Table 4.7 Reason for Not Utilising Dengue CPG

Reasons	Overall (N=41)	Public (N=7)	Private (N=34)
Lack of time (too busy)	6 (14.6%)	1 (14.3%)	5 (14.7%)
Lack of resources	13 (31.7%)	1 (14.3%)	12 (35.3%)
Guidelines are too complicated	2 (4.9%)	0	2 (5.9%)
Guidelines not accessible	4 (9.7%)	1 (14.3%)	3 (8.8%)
Do not agree with the recommendations in the guidelines	1 (2.4%)	0	1 (2.9%)
Already know how to manage patients with dengue infection	6 (14.6%)	1 (14.3%)	5 (14.7%)

*Note: Sum of the percentage will not be 100% as the respondent may answer more than once.

4.2.6 Factor associated with CPG utilisation

The results of univariate analysis in Table 4.8, showed that the utilization of CPG was found to be significantly associated with age, sex, health sector and type of facilities ($p<0.05$). Participant with the age of more than 51 years old were 0.06 less likely to utilize CPG (95% CI: 0.02, 0.20). In this study, we found that female participation were three times more likely to use CPG compared to male (95% CI: 1.41, 7.05). The odds of private sector to utilize CPG were 0.08 (95% CI: 0.03, 0.22). Last but not least, we found that clinic were 0.08 less likely to utilize CPG compared to hospital (95% CI: 0.08, 0.51). After adjusted with other variables (age, sex, designation, healthcare sector, type of facilities and region) none of the variables were found significant with CPG utilization.

Table 4.8 Factor associated with CPG utilisation

Factor	Utilisation to CPG				
	Frequency	Univariate odd ratio (95% Confidence Interval)	P-value	Multivariate odd ratio (95% Confidence Interval)	P-value
Age group					
< 30 years	186/189(98.4%)	1.00		1.00	
31-40 years	142/143(99.3%)	2.29(0.24, 22.3)	0.48	2.33 (0.20, 26.7)	0.50
41-50 years	108/112(96.4%)	0.44(0.10,1.98)	0.28	0.60 (0.06, 6.46)	0.67
> 51 years	100/128(78.1%)	0.06(0.02, 0.20)	<0.01*	0.10 (0.01, 1.12)	0.06
Sex					
Male	284/312(91%)	1.00		1.00	
Female	256/264(97%)	3.16 (1.41, 7.05)	<0.01*	1.31 (0.53, 3.26)	0.56
Designation					
HO	33/34(97%)	1.00		1.00	
MO	408/443(92%)	0.38 (0.05, 2.83)	0.34	1.35 (0.14, 13.3)	0.80
Specialist	91/94(97%)	1.38 (0.12, 15.7)	0.80	5.38 (0.37, 78.0)	0.22
Health sector					
Public	338/342(98.8%)	1.00		1.00	
Private	206/238(86.6%)	0.08 (0.03, 0.22)	<0.01*	0.50 (0.05, 4.72)	0.54
Type of facilities					
Hospital	246/252(98%)	1.00		1.00	
Clinic	298/333(89%)	0.20 (0.08, 0.51)	<0.01*	1.00 (0.29, 3.44)	1.00
Region					
Central	196/214(91.6%)	1.00		1.00	
Northern	109/116(94%)	1.43 (0.58, 3.53)	0.44	1.26 (0.47, 3.37)	0.65
Southern	73/75(97.3%)	3.35 (0.76, 14.8)	0.11	3.17 (0.68, 14.9)	0.14
Eastern	100/108(92.6%)	1.15 (0.48, 2.73)	0.76	0.70 (0.26, 1.85)	0.47
Sabah	41/42(97.6%)	3.77 (0.50, 29.0)	0.20	1.37 (0.15, 12.3)	0.78
Sarawak	25/25(100%)	0.00		0.00	

*significant value where $p < 0.05$

4.2.7 Preferred Form of Dengue CPG for Daily Practice

Respondents were asked via the questionnaire of their preferred form of dengue CPG for daily practice; 375 (59%) stated quick reference (pocket version) were preferred, followed by 135 (21%) who preferred flowchart, and 106 (17%) preferred the full CPG version (Table 4.9).

Table 4.9 Preferred Form of Dengue CPG for Daily Practice

Preferred form	Overall	Public	Private
Full CPG	106 (17%)	53 (15%)	53 (19%)
Quick reference (QR)[pocket version]	375 (59%)	197 (57%)	178 (62%)
Algorithm/flowchart	135 (21%)	88 (25%)	47 (16%)
Others (Please specify)	6 (1%)	1 (1%)	5 (2%)
Missing	12 (2%)	8 (2%)	4 (1%)

*Note: Sum of the percentage will not be 100% as the respondent may answer more than once

4.2.8 Best Mode of Accessing Dengue CPG

The questionnaire reveals that mobile application was voted by 293 (46%) of respondents as the most preferred mode of accessing CPG, followed by downloading the CPG from MOH website (259 or 41%) (Table 4.10).

Table 4.10 Best Mode in Accessing Dengue CPG

Best mode	Overall	Public	Private
Via mobile application	293 (46%)	190 (55%)	103 (36%)
Download from MOH/Malaysian Academy of Medicine website	259 (41%)	124 (36%)	135 (47%)
Others (Please specify)	65 (10%)	22 (6%)	43 (15%)
Unavailable	17 (3%)	11 (3%)	6 (2%)

*Note: Sum of the percentage will not be 100% as the respondent may answer more than once

4.2.9 Training on Dengue CPG

Among those who were aware of the Dengue CPG, only 40% (233/585) had ever attended training on CPG. Nonetheless, the majority of respondents (530 or 84%) stated that they would use the Dengue CPG if a training is provided (Table 4.11).

Table 4.11 Training on Dengue CPG and Usage

Would use the CPG if a training is provided	Overall	Public	Private
Yes	530 (84%)	306 (88%)	224 (78%)
No	52 (8%)	13 (4%)	39 (14%)
Missing	52 (8%)	28 (8%)	24 (8%)
Ever attended training (among those aware)			
Yes	233/585 (40%)	199/345(58%)	34/240(14%)
No	350/585 (60%)	145/345(42%)	205/240(85%)
Ever attended training (among all respondent)			
Yes	233/634 (37%)	199/347(57%)	34/287 (12%)
No	350/634 (55%)	145/347(42%)	205/287 (71%)

4.2.10 Suggestions to Improve Awareness and Utilisation of Dengue CPG

The questionnaire asked suggestions to increase dengue CPG awareness; 327 (52%) suggested to link dengue CPG to continuous Professional Development (CPD), followed by 303 (48%) who suggested to conduct dengue CPG launching to increase the awareness of dengue CPG, and 253 (40%) suggested to organised dengue CPG campaign (Table 4.12).

Table 4.12 Suggestions to Increase Dengue CPG Awareness

Activities can be done to increase awareness on this CPG	Overall	Public	Private
• Launching of CPG	303(48%)	191(55%)	112 (39%)
• Roadshow	209(33%)	116(33%)	93 (32%)
• Linking to CPD (Continuous Professional Development)	327(52%)	192(55%)	135 (47%)
• Publicise in mass media	204(32%)	114(33%)	90 (31%)
• CPG campaign e.g. CPG week	253(40%)	183(53%)	70 (24%)
• Others (please specify)	42 (7%)	17(5%)	25 (9%)

*Note: Sum of the percentage will not be 100% as the respondent may answer more than once

The majority of the respondents suggested to conduct a continuous medical education session about the dengue CPG (540, 85%), 213 (34%) suggested encouragement from head of a department, and 210 (33%) suggested that in order to increase utilisation of dengue CPG, undergraduates should be given a training about CPG (Table 4.13).

Table 4.13 Suggestions to Improve Dengue CPG Utilisation

Means	Overall	Public	Private
• Conduct Continues Medical Education session	540 (85%)	317 (91%)	223(78%)
• Encouragement from head of department	213 (34%)	175 (50%)	38 (13%)
• Encouragement from peers	185 (29%)	139 (40%)	46 (16%)
• Audit implementation	119 (19%)	96 (28%)	23 (8%)
• Official directive	122 (19%)	70 (20%)	52 (18%)
• Undergraduate training	210 (33%)	147 (42%)	63 (22%)
• Linking budget	34 (5%)	26 (8%)	8 (3%)

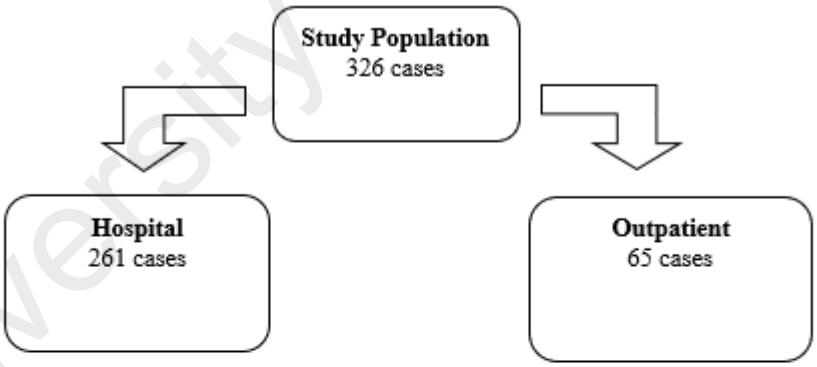
*Note: Sum of the percentage will not be 100% as the respondent may answer more than once

4.3 Adherence to dengue CPG (Phase 2)

4.3.1 Characteristic of Patients

Of the 377 cases eligible for this study, only 326 cases were included. Fifty-one cases were excluded due to age less than 12 years old, cases that were not from 1 January 2014 until 1 June 2015, and missing record. Of the 326 cases included, a total of 261 cases (80%), were from hospital and 65 (20%) were from outpatient setting.

Figure 4.3 shows 513 encounters depicted from the 326 cases. A total of 65 encounters were from outpatient settings while 448 encounters were from hospital settings. Within the hospital encounters, 228 encounters were from ED, 215 encounters were from Medical department and 5 encounters were from ICU department. Among the 65 outpatient clinics encounters, 13 cases needed to be referred to the hospital, 28 cases were discharged with follow-up, and 24 cases were discharged with no follow-up.



Hospital encounters	448
Total ED encounters	228
Total medical encounter	215
Total ICU encounter	5

OPD encounters	65
Discharge with follow-up	28
Discharge without follow-up	24
Refer hospital	13

Figure 4.3 Dengue Assessment Encounters

A total of 196 cases (60.1%) were male and 130 cases (39.9%) were female. The median age of patients was 26 years old. Only 2.8% (9 cases) aged more than 65 years old. There were 14 cases (4.3%) with a previous history of dengue and five cases (1.2 %) were pregnant patients. The average length of hospital stay was two days. However, the maximum length of hospital stay was up to 40 days. Underlying co-morbidities were found in 25 cases (7.7%); 5.2% (17) diabetes mellitus, 1.5% (5) hypertension, 0.3% (1) ischemic heart disease, and 0.6% (2) morbid obesity. About 53.7% of cases had health clinic as first place of consultation and 46.3% had ED as the first place of consultation for dengue infection (Table 4.14).

Table 4.14 Demography and Baseline Information

Patients characteristics	**N=326 n (%)**
Gender	
• Male	196 (60.1)
• Female	130 (39.9)
Age Group	
• ≤20	87 (26.7)
• 21-30	124 (38)
• 31-40	54 (16.6)
• 41-50	30 (9.2)
• >50	27 (8.3)
Elderly (>65 years old)	5 (1.5)
Previous Dengue History	14 (4.3)
Pregnancy	4 (1.2)
Co morbidities	25 (7.7)
• DM	17 (5.2)
• HPT	5 (1.5)
• IHD	1 (0.3)
• Morbid Obesity	2 (0.6)
Place of First Consultation	
• Primary care	175 (53.7)
• Emergency department	151 (46.3)
Age, years Median (n=322) (min, max)	26 (13,77)
Length of hospitalisation (n=220), days Median (min, max)	2 (0,40)

4.3.2 Proportion of Adherence to Dengue CPG

According to the CPG, notification to the Ministry of Health should be done within 24 hours of diagnosis. Notification were documented in four domains; (80.0%) ICU encounters, 165 (76.7%) medical encounters, 34 (52.3%) and 152 (46.6%), respectively, for outpatient clinic and emergency department encounters (Table 4.15).

Table 4.15 Disease Notification

Clinical Documentation	Outpatient clinic (N=65) n (%)	Emergency department (N=228) n (%)	Medical department (N=215) n (%)	ICU department (N=5) n (%)	P-value
Notification within 24 hours from diagnosis	34 (52.3)	152 (46.6)	165 (76.7)	4 (80)	< 0.01*

*significant value where $p < 0.05$

In term of blood investigations; Full Blood count (FBC), Haematocrit (HCT) and Dengue Serology in dengue patient are also recommended in each encounter for dengue cases. In outpatient clinic settings, 63 (96.9%) of encounters documented FBC results and only 58 (89.2%) of encounters documented patient's HCT level (Table 4.16).

Table 4.16 Documented Investigation (Outpatient)

Documented investigation	Outpatient clinic N=65 n(%)	P-value
Full blood count (FBC)	63 (96.9)	<0.09
Haematocrit (HCT)	58 (89.2)	

For inpatient settings, both FBC and HCT were documented; 5 (100.0%) encounters by ICU department, 213 (99.1%) by medical department, and 220 (96.5%) encounters at the emergency department setting. Dengue confirmation test was documented in five

(100.0%) encounters by ICU department, 187 (87.0%) encounters by medical department, and 167 (73.2%) by the emergency department (Table 4.17).

Table 4.17 Documented Investigation (Inpatient)

Clinical Documentation	Emergency department N=228, n (%)	Medical department N=215, n (%)	ICU department N=5,n (%)	P-value
FBC & HCT	220/228(96.5)	213/215(99.1)	5/5(100)	< 0.02*
Febrile	160/220 (72.7)	120/213 (56.3)	1/5 (20)	
Critical	55/220 (25)	89/213 (41.8)	4/5 (80)	
Recovery	5/220 (2.3)	4/213 (1.9)	0	
Dengue Serology	167/228(73.2)	187/215(87)	5/5(100)	<0.01*
Febrile	121/167 (72.5)	107/187 (57.2)	1/5 (20)	
Critical	42/167 (25.1)	79/187(42.2)	4/5 (80)	
Recovery	4/167 (2.4)	1/187(0.5)	0	

*significant value where $p < 0.05$

A total of 265 (81.3%) of cases had either Dengue antibody Ig G, IgM, or NS1Ag being performed. There were 243 (91.7%) cases reported as either one of the confirmation test positive (Table 4.18).

Table 4.18 Documented Diagnostic Test

Dengue Tests:	Total cases	P-value
Dengue Antigen Antibody test performed (IgG, IgM, NS1Ag)	**n (%)**	
Any Test Done	265/326 (81.3)	< 0.01*
Any Positive Test	243/265(91.7)	

*significant value where $p < 0.05$

Documentation of history for dengue case is required in CPG. Eight clinical variables are recommended in the CPG; (1) date of onset of fever/illness, (2) Oral intake, (3) Diarrhoea (4) Bleeding (5) Change in Mental state/seizures/dizziness, (6) Urine frequency, (7) Urine volume, and (8) Time of last voiding. In the history taking section, the highest documentation was 'Bleeding', 100% documentation by the ICU team followed by 89.8% in medical team. The lowest percentage of documentation was information on 'Time of last voiding' 7.7% in outpatient department, and 10.9% in ED setting. 'Date of onset of fever/illness' was documented, which ranged from 20% to 73.8% across 4 areas. 'Oral intake history' was noted to be documented in 40.0% to 62.3%, while 'Change in mental state/seizures/dizziness' had a range of 26.8% to 40% documentation. 'Urine volume' was documented in the range of 10.1% to 60% (Table 4.19).

Table 4.19 Documented History

Clinical variables	**Outpatient clinic (N=65), n (%)**	**Emergency department (N=228), n (%)**	**Medical department (N=215), n (%)**	**ICU department (N=5),n (%)**	**P-value**
Date of onset of fever/illness	48 (73.8)	115 (50.4)	158 (73.5)	1 (20)	< 0.01*
Oral intake	37 (56.9)	142 (62.3)	131 (60.9)	2 (40)	< 0.68
Diarrhoea	39 (60.0)	169 (74.1)	181 (84.2)	3 (60)	< 0.01*
Bleeding	31 (47.7)	196 (85.9)	193 (89.8)	5 (100)	< 0.01*
Change in mental state/seizure/dizziness	18 (27.7)	61 (26.8)	73 (34.0)	2 (40)	< 0.37
Urine frequency	8 (12.3)	53 (23.2)	46 (21.4)	2 (40)	< 0.20
Urine volume	15 (23.1)	23 (10.1)	52 (24.2)	3 (60)	< 0.01*
Time of last voiding	5 (7.7)	25 (10.9)	52 (24.2)	3 (60)	<0.01*

*significant value where $p < 0.05$

CPG requires assessment of warning signs, which includes 'abdominal pain' or 'abdominal tenderness', 'persistent vomiting', 'clinical fluid accumulation', 'mucosal

bleed', 'restlessness or lethargy', 'tender enlarged liver' and laboratory trend of increase in HCT and decrease in platelet. Documentation of warning signs was below 70.0% in outpatient setting, where abdominal pain and persistent vomiting were documented in 69.2%. Adherence to documentation of these warning signs was better in ED and medical department with more than 95.0% adherence. Abdominal pain or tenderness and HCT were documented 100% in ICU, followed by clinical fluid accumulation 96.1% in ED. On the contrary, the tender enlarged liver was poorly documented, which was less than 40.0% in outpatient and ED settings. Clinical fluid accumulation was poorly documented in outpatient with 50.8% adherence compared to 96.1% and 94.4%, respectively in ED and medical team. Restlessness or lethargy was only documented between 20.0% and 38.5% in all setting. The mucosal bleed was documented in less than 50% in outpatient setting but more than 70% in ED and medical department (Table 4.20).

Table 4.20 Documented Assessment for Warning Signs

Clinical variables	Outpatient clinic (N=65),n (%)	Emergency department (N=228),n (%)	Medical department (N=215), n (%)	ICU department (N=5), n (%)	P-value
Assessment for warning signs					
• Abdominal pain or tenderness	45 (69.2)	217 (95.2)	206 (95.8)	5 (100)	<0.01*
• Persistent vomiting	45 (69.2)	217 (95.2)	204 (94.9)	4 (80)	<0.01*
• Clinical fluid accumulation (pleural effusion, ascites)	33 (50.8)	219 (96.1)	203 (94.4)	4 (80)	<0.01*
• Mucosal bleed	32 (49.2)	166 (72.8)	170 (79.1)	3 (60)	<0.01*
• Restlessness or lethargy	25 (38.5)	60 (26.3)	75 (34.9)	1 (20)	<0.12
• Tender enlarged liver	15 (23.1)	86 (37.7)	126 (58.6)	3 (60)	<0.01*
• Laboratory: Increase in HCT concurrent with rapid decrease in	54 (83.1)	197 (86.4)	173 (80.5)	5 (100)	<0.42

platelet

*significant value where $p < 0.05$

Two components recommended in CPG are physical examination and assessment of haemodynamic status. It is mandatory to assess mental state, hydration status, to look for tachypnoea, acidotic breathing and pleural effusion, bleeding manifestations, hepatomegaly, and ascites in physical examination. Assessment of haemodynamic status includes skin colour, cold/warm extremities, capillary filling time, pulse rate, pulse volume, blood pressure, and pulse pressure. For the physical examination section, assessment of mental state, Glasgow Coma Scale score, assessment of hydration status, pleural effusion, and abdominal tenderness was the highest documented, which were 100% in ICU team and more than 80.0% from other departments. Mental state examination was done in more than 92.0% of cases in ED and in hospital setting, while it was documented in 52.3% in outpatient clinic. There was more than 50.0% adherence for examination of abdominal tenderness, however, the adherence to examination of hepatomegaly and ascites were much lower across all departments. Blood pressure and pulse rate were consistently documented in more than 85.0% of all encounters. In the assessment of haemodynamic status, the entire variable was 100.0% documented in ICU except for skin colour that only 40.0% documented. Among medical team, blood pressure (98.6%), pulse rate (98.1%), capillary filling time (96.7%), and pulse volume (91.6%) were documented. These were among the highest documented and adhered. The lowest adherence in this section was pulse pressure (0.9%) in ED (Table 4.21).

Table 4.21 Documented Assessment for Physical Examination

Clinical variables	Outpatient clinic (N=65),n (%)	Emergency department (N=228),n (%)	Medical department (N=215), n (%)	ICU department (N=5), n (%)	P-value
Physical examination					
• Assess mental state and Glasgow Coma Scale (GCS) score	34 (52.3)	211 (92.5)	205 (95.3)	5 (100)	<0.01*
• Assess hydration status	39 (60.0)	187 (82.0)	174 (80.9)	5 (100)	<0.01*
• Look out for tachypnoea/ acidotic breathing	36 (55.4)	183 (80.3)	168 (78.1)	3 (60)	<0.01*
• Look out for pleural effusion	38 (58.5)	220 (96.5)	202 (94.0)	5 (100)	<0.01*
• Examine for bleeding manifestation	35 (53.8)	73 (32.0)	85 (39.5)	2 (40)	<0.02*
• Check for abdominal tenderness	34 (52.3)	214 (93.9)	209 (97.2)	5 (100)	<0.01*
• Check for hepatomegaly	8 (12.3)	54 (23.7)	109 (50.7)	1 (20)	<0.01*
• Check for ascites	15 (23.1)	22 (9.7)	35 (16.3)	1 (20)	<0.04*

*significant value where $p < 0.05$

Malaysia's Dengue CPG recommended that clinician should be able to determine diagnosis, disease staging, and severity assessment based on evaluation of history, physical examination and FBC with HCT. Our study shows that in the outpatient clinic, 27.7% had documented complete dengue diagnosis (with or without warning signs), and 40.0% documented phase of dengue illness. Medical and emergency department documented the highest adherence in terms of recording phase of illness and complete dengue diagnosis. ICU was noted to have 100.0% adherence to document complete dengue diagnosis with two third of patients in febrile phase. The majority of patients in outpatient (55.6%), emergency (71.9%), and medical department (82.0%) had

documentation of dengue with warning signs. All patients in ICU had complete dengue diagnosis documented (Table 4.22).

Table 4.22 Documented Assessment for Hemodynamic Status

Clinical variables	Outpatient clinic (N=65),n (%)	Emergency department (N=228),n (%)	Medical department (N=215), n (%)	ICU department (N=5),n (%)	P-value
Haemodynamic status					
• Skin colour	22 (32.3)	122 (53.5)	82 (38.1)	2 (40)	<0.01*
• Cold/ warm extremities	21 (32.3)	172 (75.4)	192 (89.3)	5 (100)	<0.01*
• Capillary filling time (normal <2 seconds)	28 (43.1)	205 (89.9)	208 (96.7)	5 (100)	<0.01*
• Pulse rate	56 (86.2)	198 (86.8)	211 (98.1)	5 (100)	<0.01*
• Pulse volume	11 (16.9)	190 (83.3)	197 (91.6)	5 (100)	<0.01*
• Blood pressure	57 (87.7)	200 (87.7)	212 (98.6)	5 (100)	<0.01*
• Pulse pressure	8 (12.3)	2 (0.9)	8 (3.7)	5(100)	<0.01*
Phase of illness	26(40.0)	199(87.3)	204(94.9)	3(60)	<0.01*
• Febrile	18 (45.0)	137 (68.8)	100 (46.5)	2 (66.7)	
• Deferversence/ Critical	6 (23.1)	58 (29.1)	101 (49.5)	1 (33.3)	
• Recovery	2 (7.7)	4 (2.0)	3 (1.5)	0	
Dengue diagnosis	18(27.7)	206(90.4)	205(95.3)	5(100)	<0.01*
• Dengue without warning sign	8 (44.4)	57 (27.7)	35 (17.1)	0	
• Dengue with warning sign	10 (55.6)	148 (71.9)	168 (82.0)	1 (20)	
• Severe plasma leakage	0 (0)	1 (0.5)	2 (0.1)	3 (60)	
• Severe	0 (0)	0	0	3 (60)	

bleeding				
• Severe organ impairment	0 (0)	0	0	2 (40)

*significant value where $p < 0.05$

It is recommended in the CPG that patients who do not need hospital admission, need to be followed up daily or more frequent with a Home Care Advice Leaflet until the patient becomes febrile for 24 to 48 hours without antipyretic. In the case where admission is indicated, patients need to be optimised pre-transfer from the clinic. Pre-transfer information needs to be communicated to the receiving team. Our study showed that all dengue patients of outpatient had a median of two days clinic review (one-eight days) with 21.5% documented were given a home care advice leaflet for dengue patients. Out of the 13 outpatients that needed hospital referral, 61.5% of patients had management optimised prior to the transfer but only 30.8% was informed to ED/medical pre-transfer (Table 4.23).

Table 4.23 Documented Plan of Management

Clinical documentation	**Days / n(%)**	
Number of daily review, median (min-max), N=65	2 (1-8) days	
	Yes	**No**
Home Care Advice Leaflet for Dengue Patients given, N=65	14 (21.5%)	51 (78.5%)
Prerequisites for transfer		
• Patient was *optimised pre-transfer, N=13	8 (61.5%)	5 (38.5%)
• ED/Medical was informed pre-transfer, N=13	4 (30.8%)	9 (69.2%)
• Adequate information includes fluid chart, monitoring chart and investigation result given, N=13	6 (46.2%)	7 (53.8%)

Parameters and frequency of monitoring according to different phases of dengue illness are stated in the CPG. The parameters include 'pink/cyanosis', 'extremities (cold/warm)', 'capillary refill time', 'pulse volume', 'pulse rate', 'blood pressure', 'respiratory rate', 'oxygen saturation', 'warning sign assessment' and 'urine output'. ICU team adhered to 100% documentation of all monitoring parameters. The medical team documented more than 85% of parameters except 43.3% in 'pink/cyanosis'. Documentation of parameters of monitoring was somewhat varied in emergency setting. More than 80% were documented in 'capillary refill time', 'pulse volume', 'pulse rate', 'blood pressure', and 'warning sign assessment'. More than 50.0% documentations were observed in 'pink/cyanosis', extremities 'cold/warm', 'respiratory rate 'and 'oxygen saturation'. Poor documentation was noted in 'urine output', 39.9% and 'pulse pressure', 7.1%, respectively (Table 4.24).

Table 4.24 Documented Patient Monitoring

Clinical Documentation	Emergency department (N=228) n (%)	Medical department (N=215) n (%)	ICU department (N=5) n (%)	P-value
Pink/cyanosis	119/228(52.2)	93/215(43.3)	5/5(100)	<0.06
Febrile	84/119 (70.6)	53/93(56.9)	1/5(20.0)	
Critical	34/119 (28.6)	38/93(40.9)	4/5(80.0)	
Recovery	1/119 (0.8)	2/93(2.2)	0	
Extremities (cold/warm)	169/228(74)	186/215(86.5)	5/5(100)	<0.01*
Febrile	126/169(74.6)	107/186(57.5)	1/5(20.0)	
Critical	41/169 (24.3)	75/186(40.3)	4/5(80.0)	
Recovery	2/169 (1.2)	4/186(2.2)	0	
Capillary refill time	195/228(85.5)	195/215(90.7)	5/5(100)	<0.22
Febrile	145/195(74.4)	111/195(56.9)	1/5(20.0)	
Critical	46/195(23.6)	80/195(41.0)	4/5(80.0)	
Recovery	4/195(2.1)	4/195(2.1)	0	
Pulse volume	189/228(82.9)	187/215(87.0)	5/5(100)	<0.47
Febrile	138/189(73.0)	106/187(56.7)	1/5(20.0)	
Critical	47/189(24.9)	77/187(41.2)	4/5(80.0)	
Recovery	4/189(2.1)	4/187(2.1)	0	
Pulse rate	191/228(83.8)	211/215(98.1)	5/5(100)	<0.01*
Febrile	140/191(73.3)	119/211(56.4)	1/5(20.0)	
Critical	48/191(25.1)	89/211(42.2)	4/5(80.0)	
Recovery	3/191(1.6)	3/211(1.4)	0	

Blood pressure	191/228(83.8)	212/215(98.6)	5/5(100)	<0.01*
Febrile	140/191(73.3)	120/212(56.6)	1/5(20.0)	
Critical	48/191(25.1)	88/212(41.5)	4/5(80.0)	
Recovery	3/191(1.6)	4/212(1.9)	0	
Pulse pressure	18/228(7.9)	39/215(18.1)	5/5(100)	<0.01*
Febrile	11/18(61.1)	22/39(56.4)	1/5(20.0)	
Critical	6/18(33.3)	16/39(41.0)	2/5(40.0)	
Recovery	1/18(5.6)	1/39(2.6)	0	
Respiratory rate	162/228(71.1)	188/215(87.4)	5/5(100)	<0.01*
Febrile	122/162(75.3)	110/188(58.5)	1/5(20.0)	
Critical	39/162(24.1)	76/188(40.4)	4/5(80.0)	
Recovery	1/162(0.6)	2/188(1.1)	0	
SpO2	168/228(73.7)	185/215(86.0)	5/5(100)	<0.01*
Febrile	122/168(72.6)	107/185(57.8)	1/5(20.0)	
Critical	44/168(26.2)	75/185(40.5)	4/5(80.0)	
Recovery	2/168(1.2)	3/185(1.6)	0	
Warning sign assessment	185/228(81.1)	197/215(91.6)	5/5(100)	<0.01*
Febrile	133/185(71.9)	113/197(57.4)	1/5(20.0)	
Critical	48/185(25.9)	80/197(40.6)	4/5(80.0)	
Recovery	4/185(2.2)	4/197(2.0)	0	
Urine output	91/228(39.9)	197/215(91.6)	5/5(100)	<0.01*
Febrile	59/91(64.8)	114/197(57.9)	1/5(20.0)	
Critical	31/91(34.1)	80/197(40.6)	4/5(80.0)	
Recovery	1/91(1.1)	3/197(1.5)	0	

*significant value where $p < 0.05$

The overall proportion of adherence for the eight components of CPG—history, physical examination, assessment for warning sign, hemodynamic status, diagnosis, notification, investigation, and monitoring—varied across all settings. In health clinics, high documentation was seen in 'investigation' with proportion range between 89.2% and 96.9%. A wide range of proportion of adherence was seen in the assessment of hemodynamic status, 12.3% to 87.7% and assessment for warning sign, 23.1% to 83.3%. In history and physical examination component, proportion of adherence was lower with a range of 7.7% to 73.8% and 12.3% to 60.0%, respectively. The lowest adherence in health clinics was seen in 'diagnosis' (27.7% to 40.0%), dengue notification (52.3%) and monitoring/home based card (21.5%). In a hospital setting, the highest proportion of adherence was seen in the component of dengue diagnosis with 60.0% to 100.0%, and dengue investigations with 73.2% to 100.0%. A wider range of

proportion of adherence was seen in dengue history (7.1% to 100%), physical examination (6.7% to 100.0%), assessment of warning signs (18.4% to 100%), assessment of haemodynamic status (0.6% to 100.0%) and in monitoring of dengue (7.9% to 100.0%). Notification of dengue was not up to 100%, with the range of proportion of adherence was only 46.6% to 80% (Table 4.25).

Table 4.25 Overall Proportion of Documentation (Adherence)

Components	Proportion of Adherence (%)	
	Health clinic	Hospital
History	7.7-73.8	7.1-100.0
Physical Examination	12.3-60.0	6.7-100.0
Assessment for warning Signs	23.1-83.1	18.4-100.0
Assess hemodynamic status	12.3-87.7	0.6-100.0
Diagnosis	27.7-40.0	60-100.0
Notification	52.3	46.6-80.0
Investigation	89.2-96.9	73.2-100.0
Monitoring/Home Based Card	21.5	7.9-100.0

No death was reported in our study population. In health clinics, 20.0% (13) were referred to hospitals. 43.1% (28) of dengue patients needed a follow-up and 36.9% (24) do not need a follow-up. In hospital settings, five cases (1.9%) were admitted to ICU with one patient needing non-invasive and another needing invasive ventilation. About 67.2% (175) were discharged from hospital and needed a follow-up and 31.6% (83) were discharged without a follow-up. Complications that occurred during hospitalisation were thrombophlebitis four cases (< 2%), hospital-acquired pneumonia

and other types of complications (unspecified) were one case (<1%), respectively. Mean length of hospitalisation was 3.4 days (Table 4.26).

Table 4.26 Overall Outcome

Section	Outcome	n (%)
Outpatient (n=65)	• Follow up	28(43.1)
	• No follow up	24(36.9)
	• Refer to hospital	13(20.0)
	• Death	0
Hospital (n=261)	• Discharge with follow up	175(67.2)
	• Discharge without follow up	83(31.6)
	• ICU admission	5(0.7)
	• Non-Invasive ventilation	1(0.4)
	• Invasive ventilation	1(0.4)
	• Thrombophlebitis	4(1.6)
	• Fluid overload	0
	• Hospital Acquired Pneumonia	1(0.4)
	• Other complications	1(0.4)
	• Death	0
	Length of hospital stay (mean)	3.4 days

4.3.3 Proportion of adherence and outcome of the patient

Table 4.27 showed the proportion of adherence and patient outcome at emergency department. There are five different patient outcome being measured which were discharge without follow up, discharge with follow up, medical referral, ICU referral and also dengue death. We performed a chi-square/fishers' exact test between patient

outcome and CPG component only four patient outcome that were significantly associated with some CPG component as shown in table 4.27. For ICU referral, we found that most of the cases that documented on diarrhea and abdominal pain were not referred to ICU ($p<0.05$). Moving on, for medical referral, we found that cases that do not documented on urine volume (n=205, 89.9%) and dengue without warning sign (n=171, 75%); and cases that documented on Assess mental State (n=211, 92.5%), Assess Hydration Status (n=187, 82%) and dengue with warning sign (n=148, 65%), were mostly referred to medical department ($p <0.05$). For the next patients outcome which is discharge without follow up, we found that cases that documented on assess hydration status (n=187, 82%) and cold warm extremities (n=172, 75%) were mostly discharge without the need of following up. Last but not least, for discharge with follow up, it is reported that cases that documented on assess hydration status were mostly discharge with follow ($p <0.05$).

Table 4.27 proportion of adherence and patient outcome (ED)

CPG component		Patient outcome		
Emergency Department	**Total (N=228)**	**ICU Referral (N=228)**		**P-value**
		Yes	**No**	
Diarrhea	Yes (n=169) (74.1%)	1 (0.6 %)	168 (99.4%)	<0.05[b]
	No (n=59) (25.9%	3 (5%)	56 (95%)	
Abdominal Pain	Yes (n=217) (95.2%)	2 (1%)	215 (99%)	<0.01[b]
	No (n=11) (4.8%)	2 (18%)	9 (82%)	
	Total (N=228)	**Medical Referral (N=228)**		
		Yes	**No**	
Urine volume	Yes (n=23) (10.1%)	22 (95%)	1 (5%)	<0.02[b]
	No (n=205) (89.9%)	151 (73%)	54 (27%)	
Assess mental State	Yes (n=211) (92.5%)	164 (77%)	47 (23%)	<0.04[b]
	No (n=17) (7.5%)	9 (53%)	8 (47%)	
Assess Hydration Status	Yes (n=187) (82%)	149 (80%)	38 (20%)	<0.01[a]
	No (n=41) (18%)	24 (58.5%)	17 (41.5%)	
Dengue Without warning sign	Yes (n=57) (25%)	25 (44%)	32 (56%)	<0.01[a]
	No (n=171) (75%)	148 (86.5%)	23 (13.5%)	
Dengue with warning sign	Yes (n=148) (65%)	135 (91%)	13 (9%)	<0.01[a]
	No (n=80) (35%)	38 (47.5%)	42 (52.5%)	
	Total (N=228)	**Discharge without follow up (N=228)**		
		Yes	**No**	
Assess Hydration Status	Yes (n=187) (82%)	8 (4.3%)	179 (95.7%)	<0.02[b]
	No (n=41) (18%)	6 (14.6%)	35 (85.4%)	
Cold warm extremities	Yes (n=172) (75%)	7 (4.1%)	165 (95.9%)	<0.05[b]
	No (n=56) (25%)	7 (12.5%)	49 (87.5%)	
	Total (N=228)	**Discharge with follow up (N=228)**		
		Yes	**No**	
Assess hydration status	Yes (n=187) (82%)	16 (8.6%)	171 (91.4%)	<0.01[b]
	No (n=41) (18%)	10 (24.4%)	31 (75.6%)	

[a] *p* values were calculated using the Pearson Chi Square test
[b] *p* values were calculated using the Fisher's exact test

Table 4.28 showed the proportion of adherence and patient outcome at Medical department. There are five different patient outcome being measured which were discharge without follow up, discharge with follow up, medical referral, ICU referral and also dengue death. We performed a chi-square/fishers' exact test between patient outcome and CPG component only two patient outcome that were significantly associated with some CPG component as shown in table 4.28. For discharge with follow up, we found that most of the cases that documented on check ascites (n=135, 16.3%) were discharge with follow up ($p < 0.05$) whereas for cases not documented on bleeding (n=22, 10.3%) most of them were discharge with follow up ($p < 0.05$). For discharge without follow up it is summarised that cases that not documented on date of fever onset (n=56, 26%), diarrhea (n=33, 15%) and bleeding (n=22, 10%) were mostly not discharge without follow up ($p < 0.05$).

Table 4.28 Proportion of adherence and patient outcome (Medical department)

CPG component		**Patient outcome**		
Medical Department	**Total (N=215)**	**Discharge with follow up (N=215)**		**P-value**
		Yes	**No**	
Bleeding	Yes (n=193) (89.7%)	121 (62.7%)	72 (37.3%)	P=0.03[b]
	No (n=22) (10.3%)	19 (86.4%)	3 (13.6%)	
Check Ascites	Yes (n=35) (16.3%)	29 (82.9%)	6 (17.1%)	P=0.02[b]
	No (n=180) (83.7%)	111 (61.7%)	69 (38.3%)	
	Total (N=215)	**Discharge without follow up (N=215)**		
		Yes	**No**	
Date of fever onset	Yes (n=158) (74%)	44 (27.8%)	114 (72.2%)	P= 0.03[a]
	No (n=56) (26%)	8 (14%)	48 (84.2%)	
Diarrhea	Yes (n=181) (85%)	48 (26.5%)	133 (73.5%)	P=0.02[b]
	No (n=33) (15%)	4 (11.8%)	29 (85.3%)	
Bleeding	Yes (n=192) (90%)	52 (26.9%)	140 (72.5%)	P=0.02[b]
	No (n=22) (10%)	0	22 (100%)	

[a] *p* values were calculated using the Pearson Chi Square test
[b] *p* values were calculated using the Fisher's exact test

4.3.4 Significant association between proportion of adherence and outcome of the patient

The results of univariate analysis in Table 4.29 showed that cases that do not documented on abdominal pain were 24 times more likely to referred to ICU compared to cases documented (95% CI: 0.92, 88.3). The odds of cases that were referred to medical department were 0.13 (95% CI: 0.02, 0.97), 0.32 (95% CI: 0.12, 0.89), 0.36 (95% CI: 0.18, 0.74), 8.23 (95% CI: 4.16, 16.3) and 0.09 (95% CI: 0.04, 0.18) for urine volume, assess mental state, assess hydration, dengue without warning sign and dengue with warning sign respectively. In this table, it is reported that cases that were not documented on assess hydration status (95% CI: 1.25, 11.7) and cold warm extremities (95% CI: 1.13, 10.1) were three times more likely to be discharge without follow up compared to cases that were documented. Last but not least, we found that cases that were not documented on assess hydration status were three times (95% CI: 1.43, 8.29) more likely to be discharge with follow up.

For multivariate analysis for ICU referral, after adjusted with documentation of diarrhoea and abdominal pain, we found that cases that were not documented on abdominal pain were eighteen times more likely to be referred to ICU (95% CI: 2.11, 155.6). For medical referral, after adjusted with other variables (urine volume, assess mental state, assess hydration status, dengue without warning sign and dengue with warning sign) it is suggested that cases that documented on dengue with warning sign were 0.14 less likely to be referred to medical department (95% CI: 0.05, 0.40). last but not least, we found that cases that not documented on assess hydration status (95% CI:

1.01, 10.1) were three times more likely to be discharge without follow up after we adjusted with other variable (cold warm extremities).

Table 4.29: significant association between proportion of adherence and outcome of the patient (ED)

Emergency department Factor	Patient Outcome			
	ICU referral			
	Crude Odd Ratio (95% Confidence Interval)	P-value	Adjusted Odd Ratio (95% Confidence Interval)	P-value
• Diarrhea Yes No	1.00 9 (0.92,88.3)	<0.06	1.00 6.95 (0.66, 73.3)	<0.11
• Abdominal Pain Yes No	1.00 24 (3, 189)	<0.01	1.00 18.1 (2.11, 155.6)	<0.01
	Medical referral			
	Crude Odd Ratio (95% Confidence Interval)	P-value	Adjusted Odd Ratio (95% Confidence Interval)	P-value
• Urine volume Yes No	1.00 0.13 (0.02, 0.97)	<0.05	1.00 0.2 (0.02,1.66)	<0.14
• Assess mental state Yes No	1.00 0.32 (0.12, 0.89)	<0.03	1.00 0.63 (0.19, 1.99)	<0.43
• Assess hydration status Yes No	<0.01 1.00 0.36 (0.18, 0.74)		1.00 0.70 (0.31, 1.62)	<0.41
• Dengue without warning sign Yes No	1.00 8.23 (4.16, 16.3)	<0.01	1.00 1.61 (0.59,4.39)	<0.35
• Dengue with warning sign Yes No	1.00 0.09 (0.04, 0.18)	<0.01	1.00 0.14 (0.05, 0.40)	<0.01
	Discharge without follow up			
	Crude Odd Ratio (95% Confidence Interval)	P-value	Adjusted Odd Ratio (95% Confidence Interval)	P-value
• Assess hydration status Yes No	<0.02 1.00 3.8 (1.25, 11.7)		<0.05 1.00 3.2 (1.01, 10.1)	
• Cold warm extremities Yes No	<0.03 1.00 3.4 (1.13, 10.1)		<0.07 1.00 2.8 (0.92, 8.67)	
	Discharge with follow up			

	Crude Odd Ratio (95% Confidence Interval)	P-value	Adjusted Odd Ratio (95% Confidence Interval)	P-value
• Assess hydration status Yes No	 1.00 3.4 (1.43, 8.29)	<0.01	 1.00 3.4 (1.43, 8.29)	<0.01

Table 4.30 showed the result for the significant association between proportion of adherence and outcome of the patient (ED). In univarite analysis, it showed that cases that do not documented on bleeding (95% CI: 1.08, 13.2) were three times more likely to be discharge with follow up and cases that do not documented on check ascites (95% CI: 0.13,0.84) were 0.33 less likely to be discharge with follow up. Moreover, it is reported that cases that not documented on date of fever onset and diarrhea were both 0.43 (95% CI: 0.19, 0.99) and 0.38 (95% CI: 0.13, 1.14) less likely to be discharge without follow up.

For multivariate analysis, after adjusted with bleeding and check ascites, it showed that cases that not documented on bleeding were four (95% CI: 1.29, 16.0) times more likely to be discharge with follow up, while cases that not documented on check ascites were 0.29 (95% CI: 0.11, 0.73) less likely to be discharge with follow up.

Table 4.30: Significant association between proportion of adherence and outcome of the patient (ED)

Factor Medical department	Patient Outcome			
	Discharge with follow up			
	Crude Odd Ratio (95% Confidence Interval)	P-value	Adjusted Odd Ratio (95% Confidence Interval)	P-value
• Bleeding Yes No	1.00 3.77 (1.08,13.2)	<0.04	1.00 4.54 (1.29, 16.0)	<0.02
• Check Ascites Yes No	1.00 0.33 (0.13,0.84)	<0.02	1.00 0.29 (0.11, 0.73)	<0.01
	Discharge without follow up			
	Crude Odd Ratio (95% Confidence Interval)	P-value	Adjusted Odd Ratio (95% Confidence Interval)	P-value
• Date of fever onset Yes No	1.00 0.43 (0.19, 0.99)	<0.05	1.00 0.46 (0.20,1.07)	<0.07
• Diarrhea Yes No	1.00 0.38 (0.13, 1.14)	<0.09	1.00 0.43 (0.14, 1.32)	<0.14
• Bleeding Yes No	1.00 0.00		1.00 0.00	

CHAPTER 5: DISCUSSION

5.1 Introduction

The discussion chapter is divided into two parts; phase one of the study, which is the evaluation of awareness and utilisation of CPG for the management of adult dengue infection among Malaysian doctors, and phase two of the study, which is the adherence to CPG management of dengue infection in adults (Revised second edition).

5.2 Phase 1: Awareness and Utilisation Study

5.2.1 Socio-demographic

To my knowledge, this is the first study in Malaysia that investigates the awareness and utilisation of Dengue CPG among clinicians in both the public and private facilities. An aggregate of 634 doctors reacted to this study, with 345 of them were men and 248 were women. This is comparable to a study conducted by Susan et al. (Polanco-Briceno, Glass, & Plunkett, 2016); the number of male respondents was 63% compared to female, 37%. Similar to a study done by Cuspidi et al. (Cuspidi et al., 2003); where the percentage of the male respondent is 75% compare to 25% of female respondent. A study performed by Theodorou et al. (Theodorou et al., 2012) reported that 66.2% of the participants were male compared to 33.8% female participants. The highest response rates were achieved from public facilities. This may be due to most of the dengue cases were referred to public facilities and this has increased the interest of the doctor in public facilities to respond to the study (Ladner et al., 2017). In another study, 89% of the respondents were from the public facilities (Hadely, Power, & O'Halloran, 2014). Most of the respondents in this study were from the central region, which are 245 (38.6%) participants. This is because the number of health facilities in the central region is higher compared to the other region in Malaysia (Thomas, Beh, & Nordin, 2011). In a study done by Susan et al, (Polanco-Briceno et al., 2016), most of the participants were from urban and suburban areas, 49% and 48% respectively. Another study shows that

40.8% of the respondent were from health care facilities of the urban area (Jenkins, 2016; Wolfe et al., 2004).

The majority of the respondent from private facilities aged more than 51 years old compare to respondent from public facilities, which were younger. This may be due to junior doctors need to work at the government facilities once they completed their training. In addition, private hospitals are popular among much senior or specific specialists with considerably a higher compensation (Hameed & Nor, 2014). This is similar to a study done by Ping et al. (P. Y. Lee et al., 2015) in which the majority of the participants were from age 24 to 35 years old. The highest respondent from both facilities was Medical Officer (MO) with 246 (71%) were from public facilities and 237 (82%) were from private facilities. The number of MO is higher compared to other personnel. This is because most of the junior doctor would be located in public facilities after they graduated and underwent a special training before they get their professional title (Fang, Luo, & Fang, 2015). Furthermore, most of the senior or specialist doctor would be concentrating on their subspecialties, thus their response rate is lower (P. Y. Lee et al., 2015). Similar to a study conducted by Jenkins (Jenkins, 2016), most of the respondents years in clinical practice in the study were less than six years, which means that most of the respondents were junior doctors. Of the 634 respondents, 357 (56%) were from public and private clinic—129 and 228, respectively. The public and private clinic have a lower number of patients compared to hospital facilities, thus the doctor has time to respond to the study compared to hospital facilities.

5.2.2 Awareness of CPG

This study indicates that most of the doctors were aware of the revised second edition of Dengue CPG. However, the awareness among doctors in public facilities was higher compared to doctors in private facilities. There are several reasons for this result.

First, most of the respondents from public facilities were from the younger age group compared to those in private facilities. Therefore they received training from much recent resources and most updated information.

Second, respondents from public facilities have a shorter year of services. Junior medical doctors still have knowledge about the latest available guideline as they just graduated comparing to the senior doctor (B, P, MM, & DJ, 2015), and also junior doctors were more likely to look for guidance compared to those with much longer year of services who are already comfortable in managing their patients based on experience. Finally, public facilities normally will be conducting training for their personnel upon receiving a new guiding principle to ensure notification and implementation of the new guideline. Furthermore, in public facilities most of the respondents were junior doctors and primary care doctors, thus the awareness is higher compared to private facilities. Another study shows that primary care doctors were the main user of CPG, while for the junior doctor, it was perceived as a relevant guideline for their daily clinical practice (P. Y. Lee et al., 2015). In private facilities, the highest percentage of not aware is the Medical Officer, 37 (16%). This percentage may be due to the lack of training for junior doctors at private facilities. Furthermore, at the private facilities, senior doctors are preferred to be sent for training compared to junior doctors because the latter needs to focus on providing service (Maisonneuve, Lambert, & Goldacre, 2014). A study conducted among the UK medical graduates on their first year of medical practice shows that the junior doctors were not given enough training and practice as a high volume of administrative work were given to them (Maisonneuve et al., 2014). Moreover, junior doctors usually would be trained by the senior doctor, which at times, the guideline and practice may be differed and out-dated from the new guideline (P. Y. Lee et al., 2015). Another study shows that awareness of CPG was 90% and this is

comparable to our study (Hadely et al., 2014; Mickan, Burls, & Glasziou, 2011; Theodorou et al., 2012).

The verification of the respondents' awareness of this study was done through questions in the questionnaire, which asks the target user of the dengue CPG and the edition of dengue CPG they used. Most of the doctors answered the target user of the CPG correctly. Although, there were some who named the pharmacist and dietician as the target user, however, the number is trivial. This shows that most of the respondents recognise the target user of the dengue CPG. More than 50% of the respondents answered that they used the revised second edition of dengue CPG and 21% answered using the second edition. These numbers show that more than half of the doctors were aware and using the revised second edition.

5.2.3 Utilisation of CPG

Most of the respondents that were aware of the dengue CPG claim that they were utilising dengue CPG in their dengue management. Utilisations of dengue CPG were seen high among doctors in Malaysia, especially in the public facilities. This may be because CPGs have become widely accepted and used in the current practice (Wolfe et al., 2004). According to a study by Kruger et al. (Kruger, O'Halloran, & Rosenthal, 2015), nearly all primary care provider are utilising the CPG and this is comparable to this study. In another study, the findings show that the self-reported utilisation of the CPG among doctors was 92.5% (Theodorou et al., 2012). Nevertheless, the utilisation of dengue CPG was found to be low among doctors practicing in the private clinics, especially among medical officers. Furthermore, most doctors in the private clinic thought that the CPG is unsuitable to their daily practice as they are not managing a lot of dengue patient (P. Y. Lee et al., 2015). Some physician also perceived that CPG is only to be used by primary care doctor even though it was stated in the CPG that it

provides guidance to all health care providers on the newest concepts in patient management (P. Y. Lee et al., 2015). The local CPG is also not perceived as up-to-date and reliable as the international guidelines (P. Y. Lee et al., 2015). Furthermore, most of the clinicians in private clinics are senior doctors and they are less likely to implement the CPG compared to junior doctors (Hadely et al., 2014). In addition, some clinicians prefer and feel more confidence with their own established field guideline compared to other guidelines as it suite their working environment and daily practice (Mickan et al., 2011). A study conducted by Kathleen et al. (Hadely et al., 2014) reveals that 88.6% of medical practitioner utilise the clinical practice guideline for stroke management. Likewise, another study shows that almost all participants were aware of the stroke CPGs (Hadely et al., 2014). These findings suggest that doctors may not utilise CPG despite their awareness of the guideline and the utilisation is probably lower given that it was from self-report.

5.2.4 Reason for Using CPG

There are various reasons for using the dengue CPG. The reasons were mainly due to its assistance in the decision-making of clinical practice and as a reference material. The finding shows that CPG is relevant in providing additional information that helps a doctor to effectively manage patient and minimise the associated risk (Jenkins, 2016; van der Wees et al., 2013; Wolfe et al., 2004). Similarly, Hanney et al. (Hanney, Masaracchio, Liu, & Kolber, 2016) suggested that CPGs are mainly for helping the doctor in making a decision in medical practice. In another study performed by Hadely et al. (Hadely et al., 2014), their finding shows that the use of CPGs is mainly to implement the best available data for clinical practice (88%), 86.6% stated that the use of CPG is to improve patient outcome, and 83.3% stated that the CPG is used to assist in decision-making. Moreover, CPG provides a standard and reliable framework for clinicians to follow to ensure that the patient will receive up-to-date and the best

practice (Hadely et al., 2014; van der Wees et al., 2013). Another reason for using the dengue CPG was to increase the personnel understanding of the disease management. The key finding of the study performed by Hadely et al. (Hadely et al., 2014) shows that CPGs were used to help change the level of understanding towards the clinical practice. Meanwhile, a study conducted by Philip et al. (van der Wees et al., 2013) reported that more than 90% of the respondents stated that CPG provides information beyond their professional views.

Respondents who did not utilise the dengue CPG stated that the main reason for them not utilising the CPG was due to lack of resources. This is comparable to the study performed by Hadely et al. (Hadely et al., 2014) in which they reported that the work environment and limited resources are vital factors that reduce the utilisation of CPG. Other studies show that the most common limitation to CPG utilisation was the difficulty to access the guideline (Theodorou et al., 2012; Wolfe et al., 2004). Additionally, another reason for not utilising the CPG was lack of time. In a study performed by Santamaria et al. (Santamaria et al., 2009), they reported that lack of time to follow the guideline was one of the barriers to implementing the CPG. Similar to a study conducted by Van der wees et al. (van der Wees et al., 2013) that described 40% of the respondent stated that they could not adopt CPG due to time constrains. Some of the clinicians may consider that following the CPG in managing their patient is time-consuming, thus, this could a challenge for facilities with a high volume of patient, especially in public facilities (Heneghan, Perera, Mant, & Glasziou, 2007; P. Y. Lee et al., 2015). In a study by Hadely et al. (Hadely et al., 2014), 92.3% suggested that insufficient time acts as a barrier to implementing the CPG and some doctors may disagree with the recommendation, thus they did not follow the CPG. Disagreement with the guideline could be due to personal opinion, low-quality evidence, transferability/applicability of evidence, or consideration of patient values and

preferences (Heneghan et al., 2007). Recommendations provided by the guideline may be impractical in some clinical settings for instant some health clinic does not have enough laboratory kits to run certain test so they might not able to perform certain diagnosis test in order to screen the patient (Hadely et al., 2014). Several studies suggested that the CPG implementation strategies could be improved by identifying the local barrier and solving it (Hadely et al., 2014; Santamaria et al., 2009). Furthermore, although the factor influence the utilisation varies across different facilities, there are certain main factors that could be studied on to improve the utilisation which is the CPGs, the clinician, patient characteristics, the work environment and also the implementation strategy (Hadely et al., 2014).

5.2.5 Factor associate with CPG utilisation

There are few factors associated with utilization of dengue CPG. In our study, we found that healthcare professionals that were younger were incline towards utilization of the dengue CPG. Our findings is parallel to Francke, Smit, de Veer, and Mistiaen (2008) where they found that young professionals would be more inclined to use guidelines than older. Francke et al. (2008) suggested that younger professionals have less experienced, therefore, they need to refer to the guidelines when managing patients compared to those older professionals as they have more experienced. This notion is also supported by Simpson, Marrie, and Majumdar (2005). Our study found that most of female professionals were more likely to utilize CPG and this is supported by Tsugawa et al. (2017) where the study suggested that female physician maybe likely to adhere to clinical guidelines, provide preventive care more often, use more patient-centered communication, perform better as well or better on standardized examinations and provide more psychosocial counseling to their patients than do their male peers.

There are scarce information on the characteristic of professionals towards CPG utilization, however, according to Almazrou Mazrou (2013), knowledge, attitude and behavior are the main factors that contribute towards the adherence of physicians to the guidelines. For knowledge, it is suggested that the professionals lack of familiarity, has volume overload, time needed to stay informed and guidelines accessibility are the factors that affecting the adherence (Cabana et al., 1999). Moreover, for attitude, he explained that lack of agreement and confidence with specific guidelines, explains that most individual doctors may not agree with guidelines issued by their own peers, leading them to choose a different course of treatment, however, many doctors have been seen that a specific guideline may be too rigid to apply. Last but not least, for behavior, it is found that patient-related characteristics may include the fact that some patients perceive no need for guideline recommendations or resistance towards the guidelines recommendations as a factor negatively affecting the adoption of clinical guidelines (Francke et al., 2008).

5.2.6 Preferred Form and Best Mode of Accessing CPG

Most of the respondent of this study proposed that the preferred form of the Dengue CPG is the quick references (pocket version). This finding may be because a quick reference (pocket version) is easier to refer and carry by clinicians, thus, it is available to the clinicians whenever they need it. Some studies suggested that CPG in a simpler format with a summary of the main components is preferable and will help to increase its utilisation by clinicians (P. Y. Lee et al., 2015; Santamaria et al., 2009; Wolfe et al., 2004). Other studies reveal that easy accessibility of the CPGs improves the utilisation rate (Hadely et al., 2014; Wolfe et al., 2004). A study performed by Sola et al. (Sola et al., 2014) with Spanish clinicians found that a brief and simpler format of CPG were preferred.

Participant in our study suggested that the best mode of accessing the dengue CPG is through a mobile application. This may be due to the increased usage of smartphone and an easy access to the internet. Aside from a mobile application, according to our participants, downloading the CPG from MOH official website is one of the best modes to access the dengue CPG as it is a trusted and reliable source. On the other hand, according to Pushpa et al. (Narayanaswami & Gronseth, 2015), the best method to disseminate CPG is through traditional dissemination (print, email and internet), which has been proven to increase the awareness of the clinician. Furthermore, in the same study, Pushpa et al. (Narayanaswami & Gronseth, 2015) explained that the traditional dissemination of CPG is more effective compared to the social media due to several reasons. One of the reasons is that when CPG is disseminated through social media, it is perceived as old news since traditional dissemination has their own target audience. Similarly, another study stated that an announcement of the guideline through the monthly newsletter would be more effective compared to a letter to the health care facilities (Mickan et al., 2011).

More than half of the respondents from this study never attended a dengue CPG training before, despite the high awareness percentage of the respondents. This shows that the availability of dengue CPG is well-known among the respondents. Most of the respondents suggested that they will use the CPG if training were provided. This is because a CPG training was proven to improve the utilisation of CPG (Hadely et al., 2014). Moreover, providing a proper CPG training will render a clearer picture of the CPG and this would facilitate the guideline utilisation (Fischler, Riahi, Stuckey, & Klassen, 2016). Therefore, a CPG should be simple, up-to-date, and reliable for all stakeholders with a good policy support.

5.2.7 Suggestions to Improve the Awareness and Utilisation of CPG

Hadely et al. (Hadely et al., 2014) suggested that a frequent reminder of the CPG was moderately effective in improving the awareness and utilisation of CPG. In addition, the same study by Hadely et al. (Hadely et al., 2014) mentioned that continuous medical education was the best way to increase the implementation of CPG. Likewise, the respondents of this study suggested that linking to the CPD would increase the awareness of dengue CPG. Additionally, a CPG and CPG campaign initiatives were suggested in order to improve the awareness among health care providers. This is comparable to a study conducted by Suman et al. (Suman, Dikkers, Schaafsma, van Tulder, & Anema, 2016) in which a continuous clinical reminder was found to be effective in improving CPG awareness. Furthermore, the media campaign and medical workshops were also shown to increase CPG awareness among the clinicians (Bussieres, Laurencelle, & Peterson, 2010).

Most of the respondents suggested that by conducting a continuous medical education (CME) may improve the utilisation of dengue CPG. Another study conducted by Medves et al. (Medves et al., 2009) proposes two most common strategies that were reported would improve the CPG implementation, namely the educational material and educational meeting. Likewise, an unceasing reminder about the guideline in clinical practice was proven to be effective in increasing the CPG utilisation (Grimshaw et al., 2004). Erhardt et al. (Erhardt, Komajda, Hobbs, & Soler-Soler, 2008) found that most of the European cardiologist learned about CPG from congresses and medical journal and these were perceived as strategies to improve the utilisation of CPG. In another study, poor training on the use of the guideline was reported to be the main reason of not utilising CPG (Santamaria et al., 2009). Facilities with a low level of CPG utilisation should be targeted during the educational training, focusing on the benefit of the CPG implementation in clinical practice.

Some of the respondents of this study suggested that encouragement from the head of a department would improve the CPG utilisation. As a person with authority, the head of a department would be the right person to encourage their staff and to make sure that clinician at their facilities adheres to the proper guideline in managing the patient. A study performed by Hadely et al. (Hadely et al., 2014) reveals a similar finding that shows the highest implementing facilitator was the support from organisations and colleagues. Likewise, a study by Pathman et al (Pérez-Castro et al., 2016) found that some physicians utilise the CPG despite disagreeing with it and this was due to fear of malpractice, peer pressure, and organisation policies. Several studies show that lack of motivation and encouragement from the department may lead to lack of utilisation of CPG (Matiz; Santamaria et al., 2009). Furthermore, CPG was proven to be successfully used in an organisation with strong support and a quality work environment as it is a good strategy to improve the implementation of CPG with unmet cost (Sheldon et al., 2004). Adapting the guideline into the local practice, which complements the work environment was also found to improve the utilisation of CPG (Fervers et al., 2006). On the other hand, undergraduate training was suggested by the respondents to improve the utilisation of CPG. The latest and up-to-date guideline should be incorporated into the learning syllabus of the undergraduate training. As mentioned in one of the studies, primary care doctors and junior doctors were the main users of the CPG, thus, it is important to make sure that the medical graduates were aware and understand the CPG (P. Y. Lee et al., 2015).

5.3 Phase 2: CPG Adherence Study

5.3.1 Characteristics of Patients

During the study period, the latest edition of Dengue CPG in Malaysia was the Clinical Practice Guidelines on Management of Dengue Infection in Adults (Revised Second Edition, 2010). This CPG is the revised version of the previous CPG (second Edition, 2008). The main objective of this CPG is to provide evidence-based guidance in the management of dengue infection in adult patients, to improve recognition and diagnosis of dengue cases and to provide appropriate care to the patients. However, adherence to clinical practice has not been studied. Adherence to CPG will reduce the variation in practice in the management of dengue, thus, appropriate management and quality patient care can be delivered.

This is the first study in Malaysia that explores the adherence of health care providers to Malaysia's Dengue CPG. The results of the study indicate that most of the dengue cases were managed at hospital setting as compared to the outpatient setting. This may be because most of the confirmed dengue cases would be referred to the hospital instead of the outpatient clinic as only confirmed dengue cases were used in this study. Furthermore, the results reported that most of the hospital cases were from emergency department encounter. As emergency department acts as the frontline in a hospital setting, thus most cases would be encountered at this venue. A study by Alessandra et al. (Vieira Machado, 2014) reported more than 90% of the cases were hospitalised in the medical ward. This is similar to the result from this study of which almost half of the cases were encountered in the medical ward setting. However, the study performed by Janessa et al. (Graves, Fulton-Kehoe, Jarvik, & Franklin, 2014) shows that primary care was the highest visited during the first encounter. This may be due to the different policy of health care practice in different countries. In addition, male preponderance in our study was similar to that reported in other dengue studies (M.

Afzal, 2014; Saqib, Rafique, Bashir, & Salam, 2014). Similarly, a study by Janessa et al. (Graves et al., 2014) reported male patients were more than 70% compared to female patients. The young male adults were affected mainly because they were involved in outdoor activities more than the female, which rendered them to be exposed to *Aedes* mosquitoes (Institute of Medicine Committee on Clinical Practice, 1992). Nevertheless, several studies reported that female patients were hospitalised more compared to male patients (Grant, Buse, & Meigs, 2005; Oude Wesselink, Lingsma, Robben, & Mackenbach, 2015). The Majority of cases were from the young age group. Chew MH et al. (2012) reported a highly endemic dengue in Malaysia and the age group between 20 and 29 were vulnerable to dengue infection (Chew MH, 2012). This finding is also similar to another locally reported study by Abdul Hamid et al. (Hameed & Nor, 2014) and also non-locally reported studies from India, Pakistan, and Saudi Arabia (Ayyub et al., 2006; Gargi Ghosh, 2013; A. Mohd-Zaki, J. Brett, E. Ismail, & M. L'Azou, 2014; Saqib et al., 2014). Alessandra et al. (Vieira Machado, 2014) reported that most of the hospitalised dengue patients were from age group between 15 and 60. Our study captured a small percentage (1.5%) of elderly with dengue infection. We defined elderly as those aged 65 and above. Two local studies showed that less than 6% of dengue patients were from the elderly population (aged 60 years and above) (Azami, Salleh, Neoh, Zakaria, & Jamal, 2011; Chew MH, 2012). A study by Emily et al. reported 4.4% of elderly aged 60 years and above with dengue infection (Rowe et al., 2014). This is probably because this age group engaged in less activity outside the house. However, diagnosing dengue in this group is challenging as the presentation can be atypical.

It is important to assess co-morbidities and pregnancy status in managing dengue as these populations are more vulnerable to complications. In our study, only a small percentage of participants had a co-existing illness that includes diabetes mellitus, hypertension, and ischemic heart disease and our finding were similar to a study by

Emily et al. (Rowe et al., 2014). This could be because dengue infection is more common in the younger age group with lower prevalence non-communicable disease. In other studies, the comorbidities of the patient reported were small compared to patient with comorbidities (Oude Wesselink et al., 2015; Vieira Machado, 2014). Length of hospitalisation (LOS) for dengue can be varied depending on the phase of dengue during admission, co-existing illness and the severity of dengue. Khalil et al. reported that the mean for LOS was 3.46 ±3.45 days whereas Emily et al. reported the median of LOS of 4 days (Khalil, Tan, Khalil, Awan, & Rangasami, 2014; Rowe et al., 2014).

5.3.2 Adherence to CPG

The results of this study show that there is a wide range of adherence to dengue CPG depending on the type of facility and sections of the CPG. In a hospital setting, the highest proportion of adherence was seen in the ICU team, followed by the medical team. This is probably due to severe dengue patient being monitored very closely in the ICU. In medical wards, dengue cases are managed in the dedicated dengue wards by trained dedicated staff. This is comparable to a study by William et al. (Hanney et al., 2016) who reported that the range of adherence to non-adherence were 60% to 78%. High adherence to CPG was also reported by Theodorou et al. (Theodorou et al., 2012) in which more than 80% of the patients received treatment according to the CPG. The lowest proportion of adherence in a hospital setting was seen in the emergency department. This may possibly be due to the high workload of patients and a short stay in the area prior to assessment or transfer to the medical ward (Santamaria et al., 2009). Ebben et al. (Ebben et al., 2013) reveal the percentages of adherence to the CPG in a pre-hospital setting that vary from 7.8% to 90%. In the health clinics, an overall lower proportion of adherence was observed compared to the hospital setting. This may possibly be due to similar reasons observed in the emergency department setting and the cases may probably be from the early phase of dengue illness. Furthermore, it is often

due to poor evidence-based pre-hospital guideline and to justified deviations as guidelines have to be tailored to unique patients (Fox et al., 2009). In ED and health clinic, in the initial presentation, a patient may exhibit undifferentiated fever with symptoms suggestive of URTI or with high total white blood count that dengue fever was probably not suspected. Often the dengue diagnosis was made following daily follow up in which the dengue features became clearer (WHO Department of Control Neglected Tropical Diseases, Epidemic and Pandemic Alert and Response, & Diseases, 2009). Furthermore, the overall lower adherence in health clinic setting may be due to the work environment; the health care provider in this setting is not working in an interdisciplinary team, thus adherence is low (Hadely et al., 2014). Another study shows that different health care occupation may give a different effect on the adherence to CPG (Hadely et al., 2014). Furthermore, CPG was perceived to be inaccessible to a certain group of health care provider and this limits the adherence level (P. Y. Lee et al., 2015).

5.3.2.1 Disease notification and investigation

This current study reported that highest adherence to the disease notification was in ICU encounter followed by the medical encounter. This result may be because patients referred to ICU and medical were deemed high risk. Countries with a high prevalence of suspected dengue cases and confirmed dengue cases should be notified so that necessary action could be initiated by the stakeholders (Ministry Of Health Malaysia MOH, 2010). Additionally, for Malaysia, dengue is placed under mandatory national notification in which all suspected dengue fever or dengue haemorrhage fever cases should be notified (Ministry Of Health Malaysia MOH, 2010). Lower adherence to disease notification was also observed in ED; this may be because the cases were notified after being admitted to medical or ICU. A study conducted in Malaysia shows that in 2007 dengue cases notified by the public hospital was 98.4% compared to only 1.6% notified by

health clinics. (A. Mohd-Zaki et al., 2014). More than 80% adherence were observed in blood investigation FBC and dengue serology testing in a health clinic. This may be because dengue virus could be detected from blood investigation after the onset of illness and at the early stage of the infection (Ferreira, 2017). An increase in haematocrit (HCT) is a marker for plasma leakage and also helps the clinician to distinguish between DF and DHF (Polanco-Briceno et al., 2016; Roper, 2008; Rosenfeld & Shiffman, 2009). Furthermore, platelet count could be beneficial in identifying the phase of dengue disease as the count will decrease rapidly during the disease progress to the late febrile phase (Shah, Islam, & Das, 2006). A study by Maria G T (Teixeira & Barreto, 2009) shows that dengue virus can be detected by using reverse transcription polymerase chain reaction from the blood of the febrile dengue patient. Similarly, the dengue serology testing was proven to confirm the dengue infection (Ferreira, 2017; Teixeira & Barreto, 2009). A study performed by Adikari et al. (Stenström) suggested that an investigation of dengue antigen such as the NS1 antigen, which is associated with disease pathogenesis, is vital in detecting severe dengue. Also, Tomashek et al. (Tomashek, 2012) reported that among the 11 dengue death cases, eight were DENV RT-PCR positive and three were anti-DENV IgM positive. A study reported that dengue IgM was only detected before five days after the onset of illness, thus in an early stage, it is important to run serology test on a dengue patient (Tomashek, 2012). Therefore, adherence is high in outpatient and primary care setting as these is the early stage of diagnosis.

5.3.2.2 History taking

History taking component in this study shows that 'Bleeding' was highly documented, mainly in the hospital setting. According to Siripen K (Kalayanarooj, 2011), the major criteria in dengue infection patient were high fever and bleeding. In history taking, the information of bleeding is indispensable because it tells the severity

and phase of the disease, as one of the criteria for severe dengue is severe bleeding (Ferreira, 2017; Pun et al., 2012). In addition, due to the transient and reversible imbalance of inflammatory mediators, cytokines and chemokine's during severe dengue may lead to dysfunction of vascular endothelial cells, thus causing plasma leakage, shock, and bleeding (Ferreira, 2017). Also, platelet dysfunction, vasculopathy, and coagulopathy may cause severe bleeding and lead to dengue death (Chacko & Subramanian, 2008). The overall proportion of adherence in dengue history taking recommended by CPG demonstrated a lower adherence (about 20% or less) in urinary frequency, volume, time of last voiding, and change in mental state. However, a study suggested that information of the urine output is vital and helps to indicate the rate of plasma leakage (P. Y. Lee et al., 2015). The low adherence may be due to high volume of patients and time consuming as low adherence was observed only in outpatient clinic and ED. This is different compared to medical and ICU of which the volume of patients is lesser and the doctor was more focused on the patient because it was already a confirmed case and the doctor is not required to screen the patient again (Palmieri & Stern, 2009).

5.3.2.3 Assessment for warning signs

Assessment of warning sign is essential to be recognised by clinician so that anticipatory guidance can be given to minimise delay and an appropriate care can be initiated in a timely manner as failure to recognise it will increase the risk of disease severity (Tomashek, 2012). The current study reported that adherence to the documentation of these warning signs was high, especially in hospital setting except for restlessness or lethargy. This may be because the clinician only looks at the minimum presence of warning sign as the presence of five or more signs should be diagnosed as severe dengue (Jayaratne et al., 2012). The findings of a study by Jayaratne et al. (Jayaratne et al., 2012) reported that less than 1% of patients with severe dengue

experienced lethargy or restlessness. Nevertheless, the assessment of restlessness or lethargy is important as it is one of the criteria to diagnose severe dengue (Ferreira, 2017). Documentation of warning signs was also low in outpatient setting compared to the hospital setting. This may be due to poor documentation in the outpatient setting. Abdominal pain and persistent vomiting were highly documented throughout all encounters. This finding is because information of abdominal pain is indispensable in categorising the severity of the dengue cases (Jayaratne et al., 2012). Tomashek et al. (Tomashek, 2012) reported that more than 50% of severe dengue patient had persistent vomiting and abdominal pain. Tomashek et al. (Tomashek, 2012) also stated that several cases developed these warning sign during their hospital stay. Moreover, abdominal pain was reported to be a prognostic factor as it could be caused by hepatomegaly or gastrointestinal bleeding (Roper, 2008). Meanwhile, Lovera et al. (Lovera et al., 2016) reported that abdominal pain is caused by tissue hypoxia when the blood supply to the visceral organ is reduced. Therefore, adherence to the documentation of abdominal pain and persistent vomiting is high, especially in hospital settings.

5.3.2.4 Assessment of physical examination

Physical examination is an important component to be performed as it helps to confirm dengue cases, the phase of the disease, and also assists the clinician in making a decision to admit a patient (Halsey et al., 2013; Setiati et al., 2007a). Findings from this study indicate a high adherence to documentation in physical examination, especially in the hospital setting. However, there are three criteria that scored the lowest adherence in the documentation, namely bleeding manifestation, check for hepatomegaly, and check for ascites. This may be due to insufficient laboratory facilities and the high diagnosis cost become a barrier to its implementing (Hanney et al., 2016). Appropriate examination room is required to ensure privacy and a proper examination can be carried

out. Therefore, to improve adherence in this area, having an appropriate setting is crucial. However, the high number of patients in the outpatient setting may probably hinder the doctors from performing proper abdominal examinations, which is due to consultation time constraint. Another factor for low adherence is the possibility of an examination conducted but was not documented. A study shows that ascites that was not used as a sign of plasma leakage has a definite limitation in the precise diagnosis of ascites (Setiati et al., 2007b). Nonetheless, hepatomegaly and ascites were reported as important signs of the severity of dengue where they are associated with increased risk for DHF (Cuspidi et al., 2003; Navarrete-Espinosa et al., 2005). Also, reported by Navarrete et al. (Navarrete-Espinosa et al., 2005), hepatomegaly and ascites were mainly documented in the fatal group of dengue cases. Therefore, further investigation must be done to see whether the clinician did not follow the guideline, or they did not document even though they had performed the physical examination.

5.3.2.5 Assessment of haemodynamic status

Navarrete et al. (Navarrete-Espinosa et al., 2005) reported that a high number of a weak capillary and plasma leakage were found in dengue death cases. Also, other studies show that vital sign of dengue patient is indispensable in differentiating the dengue severity grade (Pham, Nguyen, Vu, Nguyen, & Malvy, 2007; Tomashek, 2012). Thus, the information of haemodynamic status is a useful guide in diagnosing and treating dengue patient. This study reported that the adherence in documentation was high throughout all encounter except for skin colour and pulse pressure. However, the pulse pressure status was documented consistently in ICU encounter. Tomashek et al. (Tomashek, 2012) mentioned that the vital sign measurement became less frequent after the patient was admitted to the hospital. Also, reported in the same study by Tomashek et al. (Tomashek, 2012), of the eight dengue death cases only three cases had no vital sign recorded. Even though the number of documented pulse pressure status is low, the

number of pulse rate, pulse volume, and blood pressure status were highly documented. This shows that vital sign screening was done but not documented. Thus, health care provider awareness in documenting every clinical practice should be improved.

5.3.2.6 Plan of management

Our study identified lower adherence of about 20% in giving a home based card to outpatient for the management of dengue fever. This figure may be underestimated due to poor documentation. Furthermore, high adherence was recorded in all sections of patients' monitoring, except urine output, specifically in the outpatient setting. This result indicates that more compliance needs to be emphasised to health care workers in this area. Utilisation and compliance in using current gazetted dengue monitoring chart in inpatient setting could contribute to good adherence in patient's monitoring section. The outpatient dengue clerking sheet and the home-based card should be fully utilised to improve documentation and adherence.

5.3.3 Overall proportion of Documentation (adherence)

In summary, the adherence to the documentation of Dengue CPG varies from different encounters. As mentioned by Taba et al. (Taba et al., 2012), different settings may have different barriers in implementing the CPG, therefore, to improve the adherence to CPG, first of all, stakeholders must consider the existing barrier. A study by Green LA et al. (Green, Wyszewianski, Lowery, Kowalski, & Krein, 2007) suggested that an improvement of the guideline adherence could be achieved by implementing strategies to overcome the barrier. Furthermore, the degree of adherence to CPG by health care providers is believed to be influenced by individual experience, professional autonomy, and attitude, as mentioned in other studies (Berben, Meijs, van Grunsven, Schoonhoven, & van Achterberg, 2012; Ebben, Vloet, de Groot, & van Achterberg, 2012). Thus, further research to evaluate these factors is needed.

5.3.4 Overall Outcome of CPG Adherence

Studies reported that adherence to CPG in managing patient had improved the patient outcomes, especially on the mortality rate, patient hospital stay, and patient adverse events (Ebben et al., 2013; Kirves et al., 2007). However, the number of data is not significant due to limited studies conducted to evaluate the effect of utilising the CPG towards the outcome of a patient (Ebben et al., 2013). Thus, the overall patients' outcome is considered good as there is no dengue death reported and also the length of hospital stay is not long. This shows that the significant outcome of the patient due to the overall adherence was high. Furthermore, the number of ICU admission, namely patients with other complication, is trivial; this may be related to the high adherence in the hospital setting. As reported by William et al. (Hanney et al., 2016), the mean number of patients visit for patient managed according to the CPG were lower compared to patient managed not according to the CPG. These findings show that adherence to CPG affects the patients' outcome. Similarly, other studies suggested that there is an association between guideline adherence and outcome of the patients (Hoeks et al., 2010; Kolfschoten et al., 2012). Nevertheless, there are several studies reported that there is no significant relationship between guidelines adherence and patient improvement (Jayaratne et al., 2012; Oude Wesselink et al., 2015). However, studies that show no association between guideline adherence and patient outcome were using incomplete evidence-based guideline. Thus, lack of evidence to a single element in the guideline may have an effect on the guideline adherence and patient improvement. To sum up, the outcome of the patient can be improved by adhering to the proper evidence-based guideline.

5.3.5 Association between proportion of adherence and patient outcome

In our study, we found that there are significant association between adherence (documentation) of CPG and the outcome of the patient depending on the type of facility (department) and component of CPG. As in emergency department encounter there are significant association between abdominal pain and ICU referral, where cases that were not documented on abdominal pain more likely to be referred to ICU comparing to cases who does documented. This finding is differ from study done by Reintam Blaser, Starkopf, and Malbrain (2015), where the study shows that abdominal pain act as the primary factor for patient to be referred to ICU. Similarly to study done by Tsai et al. (2016), show that most of the patient with abdominal pain visit ED will subsequently referred to ICU. The different of these finding to ours maybe due to poor documentation in the ED department encounter, the patient maybe with abdominal pain but it is not documented in the medical notes, this reflected to our findings. Another significant association were between dengue with warning signs and medical referral, where our findings shows that dengue patient with warning sign are more likely to be referred to medical department. These is comparable to other study, where dengue patient that present with warning sign would be admitted or refer to medical department for further treatment and care (Lum, Ng, & Khoo, 2014). Another significant association are between assess hydration status and discharge with follow up, where our result found that cases with no documentation of assess hydration status more likely to be discharge with follow up compare to cases with documentation of assess hydration status. Hydration status is one of the most important component to be assess for dengue patient as the key symptom of dengue disease are dehydration, therefore to classified severity of the dengue patient it is important to assess the hydration status. Thus, patient with no documentation of assess of hydration status usually discharge with follow up and not admitted (Sicuro Correa et al., 2016).

In medical department encounter there are significant association between bleeding and check ascites to discharge with follow up. As for bleeding, our finding show that cases with documentation of bleeding are less likely to be discharge with follow up. This may be due to bleeding is one of the criteria to determine the severity of the dengue patient, so if the patient present with bleeding they should not be discharge as it is severe dengue (Pongpan, Wisitwong, Tawichasri, Patumanond, & Namwongprom, 2013). For other component which are check ascites, our finding shows that cases with documentation of check ascites are more likely to be discharge with follow up, different from study done by Volk, Tocco, Bazick, Rakoski, and Lok (2012) show that the rate of re admission were high for patient with ascites, thus patient present with ascites should be admitted.

The overall finding of our study shows some significant association between adherences to CPG component with outcome of the patient, however, it is not easy to conclude as our results varies. Our results seems parallel to a study done by Muayqil, Rowe, and Ahmed (2007) where he suggested that patient received the recommended order and sequence treatment from physicians were most likely to have similar outcome with those who did not received the recommended order and sequence treatment. However, he reported that patients who were managed within the recommended time frames has better outcome from those who did not. This notion is also supported by Shepherd (1994) , stated that in the pediatric groups, the implementation of therapeutic protocols and adherence to time frames improves the quality of emergency care and patient outcome in up to 94% cases.

5.4 Strength and Limitation of the Study

5.4.1 Phase 1 study

The first strength of this study was it is the first study conducted in Malaysia that evaluates the awareness of doctors towards the dengue CPG. Secondly, the sample representatives were from both the public and private facilities throughout the country with a good response rate. Thirdly, the sampling method used which is proportionate random sampling help minimized bias. Moreover, we received full cooperation from the MOH in order to get their staff participate and help in data collection. In order to minimise the incomplete data reminder were given to the respondent. Other than that, as this were cross sectional study it is less costly and could be done in shorter time. . However, there are some limitations in this study, as the level of awareness and utilisation were measured through self-reporting method. Also, there were certain obstacle in verifying incomplete data from private facilities as the cooperation were low from them.

5.4.2 Phase 2 study

Phase 2 study were also the first study conducted in Malaysia to see the proportion of dengue patient manage according to the dengue CPG. The second strength of phase 2 study were it provide a useful data that reflect the degree of guideline implementation in real clinical practice as we were looking through the medical records. The third strength of phase 2 study were the cases are randomize from the e-dengue registry and this limit the selection bias. Other than that, the enumerator were well trained for data collection and reviewing the medical records and the training were conducted in few times. Moreover, as this were retrospective cohort study it required less time to complete. Also retrospective study are better for study that analyzing multiple outcome. However, there are some limitations in this study, there is limitation in assessing the adherence due to poor documentation, thus adherence could be

underestimated, which could be reflected by the overall good patient outcome. As it is retrospective study there is frequent absence of data on potential confounding factors.

CHAPTER 6: CONCLUSION

In conclusion, we achieved a substantial awareness and utilisation level among doctors in Malaysia. However, the utilisation of CPG among doctors in private clinic is still poor. Further research is needed to identify strategies to improve the utilisation of the guideline, especially among doctors in private clinic. Additionally, our study shows that adherence of health care providers to the Dengue CPG varies widely based on the documentation. The overall statement about adherence is impossible with a mixture of high and low adherence in certain parts of CPG. However, good clinical outcomes were observed with the current proportion of adherence.

Therefore, further investigation should focus on the factor and barrier in the implementation of these CPGs in the daily patient management. In addition, several recommendations are suggested. First, awareness on the importance of complete record documentation needs to be emphasised among health care providers in all health care setting, because the lower proportion of adherence may possibly be due to poor documentation of medical record by health care workers. Second, a standard dengue clerking and monitoring sheet should be utilised more to facilitate guidelines adherence in all setting. A further quality study such as prospective evaluation and clinical audit may be conducted in the future to ascertain the true proportion of adherence among health care providers in this country.

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LIST OF PUBLICATIONS AND PAPERS PRESENTED

The following works have been accomplished during this candidature:

Published manuscript:

1. Mohd Izhar Ariff, Abqariyah Yahya , Rafdzah Zaki, Roza Sarimin, Izzuna Mudla Mohamed Ghazali, Balvinder Singh Gill, Zailiza Suli, Mohd. Aminuddin Mohd. Yusof, Nafisah Ahmad Lutfi, Sin Lian Thye, Fatanah Ismail, Maimunah Mahmud, Rugayah Bakri. Evaluation of awareness & utilisation of clinical practice guideline for management of adult dengue infection among Malaysian doctors (Published: May 31, 2017) https://doi.org/10.1371/journal.pone.0178137
2. Marzilawati Abd.Rahman , Rafdzah Ahmad Zaki , Roza Sarimin , Mohd Izhar Ariff , Zailiza Suli , Maimunah Mahmud , Ker Hong Bee , Cecilia Anthonysamy , Azahirafairud Abdul Rahim , Balvinder Singh Gill , Shanti Rudra Deva , Ana Fizalinda Abdullah Sani , Erni Zurina Romli , Izzuna Mudla Mohamed Ghazali , Mohd. Aminuddin Mohd. Yusof , Nafisah Ahmad Lutfi , Shahril Effendi Shuib , Noormah Mohd Darus , Rugayah Bakri , 'Abqariyah Yahya. Adherence to Clinical Practice Guidelines (CPG) management of dengue infection in adults (revised second edition) (Published: November 2, 2017) https://doi.org/10.1371/journal.pone.0184559

Conference presentations (Oral Presentation)

1. Attended the 47th Asia Pacific Academic Consortium of Public Health, Bandung Indonesia (21-23 October 2015) for oral presentation. Presented conference paper "Factors Associated with Utilization of Dengue Clinical Practice Guideline in Management of Adult Patients among Malaysian Doctors".