Original Article

Dengue Knowledge, Attitudes, and Practices among Primary Care Physicians in Singapore

Linda K Lee,[1] *MPH*, Tun Linn Thein,[1] *MBBS, MPH*, Changa Kurukularatne,[1,3] *MD*, Victor CH Gan,[1] *MBBS*,
David C Lye,[1,2,3] *MBBS, FRACP, FAMS*, Yee Sin Leo,[1,2,3] *MMed, FRCP, FAMS*

Abstract

Introduction: Dengue fever remains a significant public health concern in Singapore. Appropriate, timely diagnosis and risk stratification for severe disease are crucial in the optimal management of this illness. In the outpatient setting, the primary care physician plays a key role in dengue diagnosis, management, and triage. We present a descriptive analysis of the variations in dengue knowledge, attitudes, and practices among primary care physicians (PCPs) in Singapore. **Materials and Methods:** A survey of 25 multiple-choice questions was mailed to 2000 PCPs in Singapore. Responses were analysed by physician age group (21-40, 41-60, and >61) and practice setting (government subsidised polyclinic or private practice). **Results:** Of the 3 questions assessing dengue knowledge, 89.9% chose 2 or 3 of the preferred responses. Half of the respondents utilised dengue diagnostic tests at least 50% of the time, and 75% used serology when doing so. Older respondents and those from private practices used diagnostic tests more often than their counterparts, and both groups favoured non-serology tests. About 85% of surveyed PCPs monitored confirmed or suspected cases daily, and one-third referred patients to a hospital always or often. **Conclusions:** While no major gaps in knowledge about dengue were identified in PCPs in Singapore, there were significant variations in clinical practice by physician age group and practice setting. The results of this survey provide a useful opportunity to identify strengths and areas in need of improved awareness in primary care management of dengue.

Ann Acad Med Singapore 2011;40:533-8

Key words: Arbovirus, Guidelines, General practice, Ambulatory care

Introduction

Dengue fever is the most common mosquito-borne viral illness worldwide and has reached hyperendemic proportions in the urban tropics and subtropics over the last 2 decades.[1] With an estimated 2.5 billion people at risk and a global annual incidence of 50 million cases, dengue fever has been identified as an important public health issue.[2] Asia remains disproportionately affected by this disease, with 75% of the global disease burden borne by the populations within the Southeast Asia and Western Pacific regions.[2]

Singapore faced a major threat to childhood health in the form of dengue hemorrhagic fever (DHF) as it took its first steps as an independent republic.[3] On the merits of a highly successful vector control programme from 1966 to 1973, Singapore enjoyed a 15-year respite from dengue, only to see the incidence surge once again in the 1990s.[4] Two large epidemics followed in 2005 (14,209 reported cases)[5] and 2007 (8826 cases).[6] Several factors including decreased herd immunity, enhanced virus transmission outside the home, and clinically overt disease as a consequence of adult infection, have been cited as reasons for this resurgence.[4]

The World Health Organization (WHO) introduced practice guidelines for the diagnosis, treatment, prevention, and control of dengue in 1997,[7] with a more clinically applicable revision published in 2009.[2] Although dengue can present with a variety of symptoms and result in unpredictable disease progression, a case fatality of <1% is achievable with adherence to these new guidelines.[2] Early recognition of dengue is a crucial first step in this process, with a robust management strategy at the first point of care having the invaluable potential to reduce

[1]Communicable Disease Centre, Tan Tock Seng Hospital, Singapore
[2]Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore
[3]Department of Infectious Diseases, Tan Tock Seng Hospital, Singapore
Address for Correspondence: A/Prof Leo Yee Sin, Department of Infectious Diseases, Tan Tock Seng Hospital, Moulmein Road, Singapore 308433.
Email: yee_sin_leo@ttsh.com.sg

unnecessary hospitalisation and prevent death.[2] With the majority of dengue patients following a self-limiting clinical course and only a minority progressing to severe dengue with plasma leakage and hemorrhage, the primary care physician (PCP) is placed in a unique position to influence the course of illness, both for the individual patient and the community at large. Here we describe the differences in dengue management among PCPs in Singapore using the results of our knowledge, attitude and practice survey.

Materials and Methods

A multiple choice survey consisting of 25 questions to assess knowledge, attitudes, and practices about dengue management was designed by medical doctors at the Communicable Disease Centre, Tan Tock Seng Hospital, Singapore. From April to June 2011, surveys were mailed to 2000 PCPs in Singapore identified via the National Healthcare Group, SingHealth, and Singapore Medical Council networks. Incentives were not offered for returning the surveys. Of the 366 surveys received (18.3% response rate), 2 were excluded because of >50% missing data; 364 were used for analysis.

In order to assess knowledge, the following 3 questions were asked: "Have you heard of 'warning signs' in dengue?," "Do you find monitoring haematocrit important in patients with suspected or confirmed dengue?," and "Do you agree with the following statement: 'It is not possible for a person older than 65 to have dengue infection.'" The responses of "yes," "no," or "uncertain" were collated and the number of preferred answers by each participant was determined.

These 3 questions specifically assess key concepts in the management of dengue, and are based on the WHO 2009 guidelines for dengue management (warning signs), signs of plasma leakage (hematocrit ≥20% above baseline), and

whether the elderly can become infected with dengue. The first question assesses familiarity with dengue warning signs, which help identify cases potentially progressing to severe dengue. The second question emphasises that, despite leukopenia and thrombocytopenia being among the better known haematologic manifestations of dengue, haematocrit serves as an important indicator of intravascular volume and is a useful assessment tool when serially monitored. The final question serves to highlight that dengue in the elderly, usually with atypical presentation, is a growing concern. While the 3 questions are not meant to explore the entire breadth of the PCP's dengue knowledge, they serve as a sufficiently representative marker of the PCP's awareness of current dengue diagnostic and management guidelines. The remaining questions were utilised to evaluate dengue clinical management as detailed in the results section.

The responses were stratified by age of participant (21-40, 41-60, or ≥61 years old) and practice setting (government subsidised polyclinic, private practice). Chi-square and Fisher's exact tests were used to determine statistical significance (Stata 12, Stata Corp., College Station, TX). All tests were conducted at the 5% level of significance.

Results

The demographic characteristics of the participating 364 PCPs were as follows: 223 (61.8%) were male; 111 (30.5%) were 21 to 40 years old, 185 (51.0%) were 41 to 60 years of age, and 67 (18.5%) were ≥61 years of age; polyclinic PCPs represented 31.2% of the respondents, and the remaining respondents were private PCPs.

Of the 3 questions on general dengue knowledge, 90% of PCPs chose 2 (35.0%) or 3 (55.0%) preferred responses. Among 21 to 40 year olds, 71.2% gave 3 preferred responses, compared with 47.6% of all other PCPs (*P* <0.001).

Table 1.1. Dengue diagnosis practices. Do you perform a dengue diagnostic test if you suspect dengue?

	Always (100% of the time)	Often (51%-99% of the time)	Sometimes (1%-50% of the time)	Never (0% of the time)	*P* value
	n (%)	n (%)	n (%)	n (%)	n (%)
Overall	107 (29.5)	69 (19.0)	105 (28.9)	82 (22.6)	NA
Age, years					
21-40	16 (14.4)	23 (20.7)	39 (35.2)	33 (29.7)	<0.001
41-60	70 (38.0)	30 (16.3)	49 (26.7)	35 (19.0)	0.004
≥61	21 (31.3)	16 (23.9)	16 (23.9)	14 (20.9)	0.60
Practice					
Private	93 (40.1)	46 (19.8)	53 (22.9)	40 (17.2)	<0.001
Polyclinic	7 (6.7)	17 (16.4)	41 (39.4)	39 (37.5)	NA

NA = not applicable

Table 1.2. Dengue diagnosis practices. If so, which of the following tests do you most frequently use?

	Dengue serology (IgM/IgG)	Dengue non-structural antigen 1 (NS1) assay	Dengue real-time polymerase chain reaction (PCR)	*P* value
	n (%)	n (%)	n (%)	n (%)
Overall	211 (75.6)	31 (11.1)	37 (13.3)	NA
Age, years				
21-40	70 (89.7)	5 (6.4)	3 (3.9)	0.001
41-60	101 (68.2)	18 (12.2)	29 (19.6)	0.003
≥61	39 (75.0)	8 (15.4)	5 (9.6)	0.45
Practice				
Private	128 (67.0)	29 (15.2)	34 (17.8)	<0.001
Polyclinic	62 (96.8)	1 (1.6)	1 (1.6)	NA

NA = not applicable

Ninety-seven percent of polyclinic respondents gave at least 2 preferred responses, in contrast to 86% of private practitioners (*P* <0.001).

Overall, about 50% of the survey respondents performed dengue diagnostic tests frequently (Table 1.1). Those in the 21 to 40 age group were less likely to utilise diagnostic tests when suspecting dengue (*P* <0.001), as were polyclinic respondents (*P* <0.001). Among polyclinic respondents, 96.8% used dengue serology (IgG/IgM) tests compared with those from private practices (67.0%; *P* <0.001; Table 1.2). Private PCPs utilised NS1 antigen and dengue virus polymerase chain reaction (PCR) tests more often than their polyclinic counterparts (33.0% versus 3.2%). Ninety-seven percent of all surveyed PCPs performed full blood counts 50% to 100% of the time when suspecting dengue, and older PCPs utilised full blood counts less frequently.

With regards to daily monitoring of suspected or confirmed dengue patients, 84.0% of PCPs monitored patients daily 50% to 100% of the time (Table 2.1). Similarly, 84.8% performed daily full blood counts 50% to 100% of the time. PCPs in the ≥61 age group utilised full blood counts less frequently than their counterparts (*P* = 0.003; Table 2.2).

The majority (60.5%) of surveyed PCPs reviewed dengue patients 3 to 4 times during follow-up; 18.4% reviewed patients 5 to 6 times, 17.8% reviewed patients 1 to 2 times, and 3.3% reviewed patients more than 6 times. Most PCPs (43.0%) provided 5 to 7 days of medical leave, and few (3.9%) provided 2 days' medical leave.

Thirty-one percent of PCPs referred dengue patients to a hospital 51% to 100% of the time (Table 3.1). Older PCPs tended to refer more patients to the hospital, as did private PCPs. A platelet cutoff of <80,000/mm^3 was identified by most PCPs (52.2%) as the threshold for hospital referral; this was most prominent in the youngest age group (*P* = 0.01; Table 3.2). About 2% of those in the 21 to 40 age group did not use thrombocytopenia as an indicator for

Table 2.1. Daily monitoring of suspected or confirmed dengue cases. Do you monitor confirmed or suspected dengue cases daily?

	50%-100% of the time	0%-49% of the time	*P* value
	n (%)	n (%)	
Overall	304 (84.0)	58 (16.0)	NA
Age, years			
21-40	96 (86.5)	15 (13.5)	0.38
41-60	154 (83.7)	30 (16.3)	0.90
≥61	53 (80.3)	13 (19.7)	0.37
Practice			
Private	192 (83.1)	39 (16.9)	0.88
Polyclinic	88 (83.8)	17 (16.2)	NA

NA = not applicable

Table 2.2. Daily monitoring of suspected or confirmed dengue cases. Do you perform full blood counts to monitor patients with suspected or confirmed dengue on a daily basis?

	50%-100% of the time	0%-49% of the time	*P* value
	n (%)	n (%)	
Overall	307 (84.8)	55 (15.2)	NA
Age, years			
21-40	100 (90.1)	11 (9.9)	0.06
41-60	157 (85.8)	26 (14.2)	0.58
≥61	49 (73.1)	18 (26.9)	0.003
Practice			
Private	193 (83.9)	37 (16.1)	0.26
Polyclinic	93 (88.6)	12 (11.4)	NA

NA = not applicable

Table 3.1. Dengue hospital referral practices. What is the rough proportion of dengue patients that you refer to the hospital?

	51%-100%	0%-50%	*P* value
	n (%)	n (%)	
Overall	114 (31.4)	249 (68.6)	NA
Age, years			
21-40	17 (15.3)	94 (84.7)	<0.001
41-60	68 (36.8)	117 (63.2)	0.03
≥61	29 (43.9)	37 (56.1)	0.02
Practice			
Private	90 (39.0)	141 (61.0)	<0.001
Polyclinic	14 (13.3)	91 (86.7)	NA

NA = not applicable

Table 3.2. Dengue hospital referral practices. For which platelet cutoff would you normally refer patients for hospital management?

	<100,000/mm³	<80,000/mm³	<50,000/mm³	Platelet count is not an indicator	*P* value
	n (%)	n (%)	n (%)	n (%)	
Overall	88 (24.2)	190 (52.2)	83 (22.8)	3 (0.8)	NA
Age, years					
21-40	18 (16.2)	69 (62.2)	22 (19.8)	2 (1.8)	0.01
41-60	51 (27.6)	92 (49.7)	42 (22.7)	0	0.16
≥61	19 (28.4)	28 (41.7)	19 (28.4)	1 (1.5)	0.20
Practice					
Private	73 (31.4)	109 (47.0)	48 (20.7)	2 (0.9)	<0.001
Polyclinic	8 (7.6)	70 (66.7)	27 (25.7)	0	NA

NA = not applicable

hospital referral.

Seventy-seven percent of participants assessed for normalisation of laboratory tests upon recovery from dengue illness 51% to 100% of the time. In the oldest age group, 13.6% never did so, compared with 6.1% of their counterparts (P <0.001). Among polyclinic PCPs, 55.2% always assessed for laboratory normalisation, in contrast to 39.2% of private PCPs (P = 0.01).

Conclusions

The results of our survey demonstrate that dengue knowledge, attitudes, and practices varied among physicians depending on age and practice setting. One limitation of our study is that we received a relatively small number of responses (18.3%). In addition, only multiple-choice questions were asked to avoid a lengthy questionnaire, which could discourage response. Thus the reasons behind the responses were not explored comprehensively (i.e., we did not ask why PCPs do not perform dengue diagnostic tests if they responded "sometimes" or "never").

We have not identified any major skew in our respondent sampling; 31% of our respondents were from polyclinics (MOH estimates 20% of primary healthcare is provided by polyclinics),[8] and the ages of our respondents are consistent with a recent survey of PCPs with a higher response rate (70%) than ours, in which the mean ages of private and polyclinic physicians were 46 years and 35 years, respectively.[9] In our study, the majority of private GPs (66.8%) were in the 41 to 60 age group, and the majority of polyclinic GPs (78.1%) were in the 21 to 40 age group. However, without demographic details for the entire population of PCPs in Singapore, it is difficult to make more conclusive statements regarding our sample representation.

PCPs in Singapore were able to give at least 2 out of 3 preferred answers in more than 90% of cases. While we have not identified any major gaps in knowledge regarding dengue in this survey, a more detailed survey will be required to map out the full spectrum of dengue knowledge among PCPs.

Most physicians who responded to the survey were noted

to perform full blood counts frequently. This reflects good clinical practice; leukopenia ($<6.0 \times 10^3$ cells/mm³) and lymphopenia ($<0.58 \times 10^3$ cells/mm³) have previously been identified as useful predictors of dengue during the early phase of the illness.[10] The responses showing that physicians monitor patients with proven or suspected dengue regularly represent good clinical practice in concordance with WHO recommendations. Nonetheless, opportunities exist for further risk stratification to identify those patients requiring more frequent and diligent follow-up, based on criteria such as platelet counts $<100 \times 103$/mm³ within the first 3 days of illness,[10] warning signs, as well as published guidelines for outpatient management of dengue.[2]

In suspected cases, dengue diagnostic tests were ordered always or often by less than half of the surveyed physicians. There is much room for improvement in this area with early diagnosis being a crucial first step. Polyclinics utilise laboratory services provided by government restructured hospitals (with more dengue serology ordered), while private practitioners employ research facilities (with more dengue PCR and NS1 ordered) provided by the Environmental Health Institute, Singapore.[11] The availability and affordability of serologic testing make the lack of resources an unlikely explanation for these figures but may represent limited understanding in the value of early diagnosis of dengue.

Most participants performed dengue serology as the diagnostic test of choice rather than the PCR or NS1 antigen test.[12] There are several issues with dengue serology tests; they may be falsely negative during the febrile early phase of illness, which is characterised by dengue viremia or antigenemia (hence dengue PCR/NS1).[13,14] In addition, dengue serology has been shown to have low specificity.[13, 14] Because patients typically present to PCPs during the acute phase of illness, underutilising PCR and NS1 testing may hinder early diagnosis. The latter tests are readily available to polyclinics via hospital laboratory services but may be less accessible or affordable in the private setting. Thus tools such as the full blood count, clinical predictors of dengue,[10] and serial follow-up of suspected cases become even more important. Increasing physician awareness of the appropriate timing of dengue diagnostic tests is a potential area for improvement based on our survey.

Patients with proven or suspected dengue were referred for hospital admission by 31.4% of surveyed PCPs 51% to 100% of the time. This may represent an overutilisation of resources, unnecessary healthcare costs, and risks of nosocomial complications, given that dengue hemorrhagic fever (DHF) among adults with dengue in Singapore ranges from 4% to 6%,[15, 16] and, more strikingly, the dengue case fatality of <1% in Singapore.[17] Practical and safe outpatient care protocols have successfully been implemented in Singapore and elsewhere during epidemics.[18, 19] Early case identification,[10] risk stratification, and monitoring[20] are needed to fine-tune our management approach in dengue. The issue of site of care becomes even more important during dengue epidemics, where hospital inpatient capacity and infrastructure become heavily taxed by the burden of dengue. During the 2005 dengue outbreak in Singapore, 8% of all available acute hospital beds were occupied by dengue patients.[10]

Among the survey participants, only 0.8% appropriately did not view low platelet count as an indicator for hospital referral. The lack of correlation between the presence and degree of thrombocytopenia in dengue and risk of bleeding or severe illness has been well-documented,[21, 22] as has been the lack of benefit of prophylactic platelet transfusion in dengue.[23,24] The notion that thrombocytopenia necessitates hospital admission is another area with potential for improving dengue patient management.

PCPs in Singapore demonstrated adequate general knowledge on select dengue topics. Practices regarding frequent clinical monitoring were consistent with local and international guidelines. However, the utility of early diagnostic tests should be recognised, and the propensity to hospitalise patients could be improved. The newest guidelines issued by the Ministry of Health in August 2011 advocate use of the newer antigen tests and delineate proper inpatient and outpatient management.[25]

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