ORIGINAL ARTICLE

Understanding Dengue Mortality Factors and Nursing Roles: Insights from Two Malaysian Government Hospitals

Kim Lam Soh[1], Nor Lida Mohd Daud[2], Niazlin Mohd Taib[3], Kim Geok Soh[4], Salimah Japar[1], Ponpun Vorasiha[5]

[1] Department of Nursing, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.
[2] Nursing Unit, Hospital Sultan Idris Shah, 43400, Serdang, Selangor, Malaysia
[3] Department of Medical Microbiology and Parasitology, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.
[4] Department of Sport Studies, Faculty of Educational Studies / Sport Academy, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.
[5] Faculty of Nursing, Chalermkanchana University, Thailand.

ABSTRACT

Introduction: Dengue, a mosquito-borne viral infection, imposes significant socio-economic and disease burdens on tropical and subtropical regions worldwide. Data provided by Malaysia's Health Ministry indicate that the number of dengue cases in 2024 is exhibiting a steeper increase compared to the corresponding period last year. This study aims to identify factors contributing to dengue mortality in Malaysian government hospitals and assess nursing involvement in mortality prevention. **Method:** A retrospective study was conducted using a proforma. Electronic data and documented nursing care in the nursing report before the patient's death were extracted and analysed for all dengue mortality cases. **Results:** Thirty-seven dengue mortality cases were identified, 28 from Hospital 1 and 9 from Hospital 2, respectively. Most patients were admitted during the critical phase (day 4 or 5), with rates of 67.8% and 88.9% in Hospitals 1 and 2, respectively. Mean hospital stays were 3.39 days (SD±1.62) in Hospital 1 and 4.56 days (SD±1.88) in Hospital 2. Among cases with comorbidities (53.6%), diabetes mellitus was most common in Hospital 1. Common clinical signs included myalgia, arthralgia, severe vomiting, and fever (78.6%). Dehydration and headache were documented in approximately 75.0% of cases in Hospital 1 and 66.7% and 77.8%, respectively, in Hospital 2. Nursing interventions primarily focused on hyperthermia reduction, with dehydration management being less common. **Conclusion:** Major factors contributing to dengue-related deaths in both hospitals include illness stage at admission, dengue severity/classification, and delayed hospital admission. Future efforts should prioritise assessing patients' hydration status upon admission and continuous nursing assessment for early signs of dehydration.

Malaysian Journal of Medicine and Health Sciences (2025) 21(SUPP4):1-7. doi:10.47836/mjmhs.21.s4.1

Keywords: Dengue; Mortality factors; Nursing roles; Malaysian; Hospitals

Corresponding Author:
Kim Lam Soh, Professor
Email: sklam@upm.edu.my
Tel :+603 89472439

INTRODUCTION

The increasing incidence of dengue and dengue-related mortality worldwide and in Malaysia has significant implications for health services. Despite regular healthcare training on dengue management by respective medical teams, including nurses, the trend of dengue mortality cases remains alarmingly high, particularly affecting adults of reproductive age. The annual number of deaths from dengue disease increased from 45 in 2000 to 134 in 2010, although the case fatality rate remained constant at 0.2–0.3%, with 0.63% reported for the year 2000 (1). The case fatality rate for dengue hemorrhagic fever was relatively high in 2000 (10.9%) and then ranged between 2.5 and 6.9% from 2001 until 2011, with an apparent decline from 2006 until 2011 (1). Dengue cases continued to increase; in March 2015, the WHO reported 30,033 dengue cases, including 95 deaths in Malaysia, a 42% increase compared to the same reporting period in 2014 (n=8,922) (2). In 2018, dengue cases were still on the rise, with up to 75,612 cases and 135 deaths in Malaysia (3). The cumulative number of dengue cases reported up to week 6 of 2024 is 22,058 cases, representing an increase of 68.5% compared to 13,094 cases for the same period in 2023. Up to week 6 of 2024, ten dengue-related deaths were reported, compared to nine (9) deaths for the same period in 2023 (4). Thus, managing dengue patients is crucial in reducing the dengue mortality rate.

According to data provided by Malaysia's Health Ministry, the number of dengue cases in 2024 is exhibiting a steeper increase than last year. Dr. Muhammad Radzi Abu Hassan, the Ministry's Director-General of Health, reported that 18,247 cases were recorded during the initial five weeks of 2024, marking a 65.6 per cent rise from the 11,127 cases reported during the same period in 2023 (5).

Although dengue can cause mortality, limited data is available on nurses' role in preventing dengue mortality. Many studies have been conducted on nursing interventions in disease prevention, such as cardiovascular disease; however, inadequate studies have been found related to dengue prevention. A recent systematic review found a favourable effect of nurse-led clinics on mortality rate, major adverse cardiac events, and medication adherence among cardiovascular disease patients (6); this suggests the possibility that nursing contribution to dengue management is crucial, especially in preventing dengue mortality. Nurses are the frontline workers and spend the longest time with patients than other healthcare providers. Therefore, if they can detect any dengue complications earlier or before they occur, prompt actions can be taken to prevent dengue deaths.

Dengue is a complex disease in its manifestations, but its management is relatively simple, inexpensive, and very effective in saving lives. Correct and timely interventions are essential. Most deaths from dengue occur in patients with profound and prolonged shock resulting from plasma leakage and complicated by bleeding and fluid overload; therefore, informed care by nurses is significant (7).

This study will embark on specific nursing interventions for dengue management following the guidelines outlined by the World Health Organization (7) and the Malaysian Ministry of Health (8) Clinical Practice Guideline for dengue management. We aim for this protocol to guide nurses in caring for dengue patients and preventing dengue mortality in the near future. This study aimed to identify factors contributing to dengue mortality in Malaysian government hospitals and assess nursing involvement in mortality prevention.

MATERIALS AND METHODS

This study involved a retrospective analysis of dengue mortality cases from 2013 to 2015 in two Malaysian government hospitals. Data collection occurred within this timeframe and was conducted based on available funding to facilitate data gathering; a proforma was developed, drawing upon insights from existing literature on dengue mortality cases. This structured proforma was a tool for researchers to systematically collect essential data points, including patient demographics, comorbidities, clinical manifestations, laboratory findings, and documented nursing care/actions recorded in the nursing reports leading up to the patient's demise. Electronic records of dengue-related deaths were reviewed utilising this standardised proforma, allowing for a comprehensive analysis of the factors contributing to mortality within the studied period.

Data were collected from Hospital 1 in Serdang, Selangor, and Hospital 2 in Kuala Terengganu, the State of Terengganu. Hospital 1 is one of the government hospitals in the urban area of Klang Valley, serving approximately 570,000 people in Serdang, Putrajaya, Kajang, and Bangi. It is a referral centre with 682 beds, providing tertiary levels of care and equipped with modern facilities for both inpatients and outpatients. Hospital 2 is also one of the government hospitals in the urban area of Kuala Terengganu, serving the entire population of the State of Terengganu. It is a referral centre on the East Coast of Peninsular Malaysia, offering 1060 beds with tertiary levels of care and equipped with modern facilities and equipment. Both hospitals were selected due to the increasing incidence of dengue cases and associated mortality. Hospital 1 experienced a significant rise in dengue mortality rates, from 21.4% to 46.4% between 2013 and 2015. Likewise, Hospital 2 observed a dramatic increase in dengue mortality, from zero to 66.7%, with a total of 37 reported dengue-related deaths.

The electronic data were retrieved from the hospital's information system with the assistance of the medical record officer from each hospital. Keywords such as 'dengue' and code 18, representing dengue mortality, were used to retrieve the dengue mortality cases from January 2013 to December 2015. The retrieval process was conducted by two researchers, along with appointed enumerators with nursing backgrounds. A third researcher clarified any uncertainties regarding the information. If necessary, the data were recorded in written form. Subsequently, the enumerators retraced the data, and two researchers confirmed its completeness. The retrieved data included patient information such as demographic variables, comorbidities, clinical features, laboratory diagnosis, and documented nursing care/actions before the patient's death.

Data analysis

This study's reference population comprised patients registered as mortality cases due to dengue fever in both hospitals from 2013 to 2015. A total of 37 mortality cases were identified and included in this study. Data analysis was conducted using Statistical Package for Social Science (SPSS) version 24. Descriptive statistics were employed to organise and summarise the characteristics of the study population and the dengue incidences in both hospitals. Specifically, descriptive statistics such as percentages, frequencies, means, and standard deviations were utilised for data analysis.

Ethical considerations

Approval was secured from the Western Pacific Region Ethics Committee and the Malaysian Ministry of Health Medical Research Ethics Committee. All 37 cases of dengue-related mortality from 2013 to 2015 were reviewed in both hospitals. Hospital 1 recorded 3,057 cases in 2013, 12,295 cases in 2014, and 5,792 cases in 2015. Hospital 2 reported 667 cases in 2013, 1,611 cases in 2014, and 1,394 cases in June 2015.

RESULTS

Both hospitals collected 37 cases of dengue mortality, with 28 and 9 cases from Hospital 1 and 2, respectively. Between 2013 and 2015, mortality cases increased from 21.4 per cent to 46.4 per cent in Hospital 1. In Hospital 2, mortality cases surged from zero to 66.7 per cent during the same period (Table I).

Table I: Number of mortality cases in two hospitals

		Hospital 1 (n=28)		Hospital 2 (n=9)		Total (n=37)	
		n	%	n	%	n	%
Year	2013	6	21.4	0	0	6	16.2
	2014	9	32.2	3	33.3	12	32.4
	2015	13	46.4	6	66.7	19	51.4
	Total	28	10	9	100	37	100
Age of patients	≤ 40	13	46.4	3	33.3	16	43.3
	41 - 64	13	46.4	2	22.2	15	40.5
	≥65	2	7.2	4	44.5	6	16.2
Age of patient with co morbidities	≤ 40	4	26.7	1	33.3	5	27.8
	41 - 64	9	60.0	1	33.3	10	55.5
	≥65	2	13.3	1	33.3	3	16.7
Mortality of dengue cases by ethnicity	Malay	13	46.4	9	100	22	59.5
	Chinese	2	7.2	Nil		2	5.4
	Indian	6	21.4	Nil		6	16.2
	Others	7	25	Nil		7	18.9
	Total	28	100	9	100	37	100
Risk factors of dengue cases related to staying areas	Staying in endemic areas	22	78.6	7	77.8	29	78.4
	Travel to endemic areas	1	3.6	2	22.2	3	8.1
	Construction worker	1	3.6	Nil		1	2.7
	Unknown	4	14.2	Nil		4	10.8
Type of admission of dengue mortality cases	Emergency	20	71.4	2	22.2	22	59.5
	Referral	8	28.6	7	77.8	15	40.5
Place of admission of dengue mortality cases	Ward	14	50	6	66.7	20	54.0
	ICU	14	50	3	33.3	17	46.0

CONTINUE

Table I: Number of mortality cases in two hospitals (CONT.)

		Hospital 1 (n=28)		Hospital 2 (n=9)		Total (n=37)	
Stage of illness on admission to the hospitals	Febrile (1-3)	8	28.6	1	11.1	9	24.3
	Critical (4-5)	19	67.8	8	88.9	27	73.0
	Recovery (6-10)	1	3.6	Nil		1	2.7
Dengue classification during admission	Myalgia	23	82.1	8	88.9		
	Arthralgia	23	82.1	7	77.8		
	Persistent severe vomiting & Fever	22	78.6	5	55.6		
	Headache	21	75	7	77.8		
	Dehydration	21	75	6	66.7		
	Restlessness / lethargy	15	53.6	5	55.6		
Clinical presentation on admission	Dengue without warning signs	1	3.6	1	11.1	2	5.4
	Dengue with warning signs	12	42.9	7	77.8	19	51.4
	Severe dengue	15	53.6	1	11.1	16	43.2
Co morbidity of dengue cases in both hospitals	Yes	15	53.6	3	33.3	18	48.6
	No	13	46.4	6	66.7	19	51.4
Types of Co-morbidity	Diabetes	12		3			
	Hypertension	7		3			
	Sick cell anemia	1		0			
	IHD +Dyslipidemia	1		1			
Clinical presentation on admission	Myalgia	23	82.1	8	88.9		
	Arthralgia	23	82.1	7	77.8		
	Persistent Severe vomiting & Fever	22	78.6	5	55.6		
	Headache	21	75	7	77.8		
	Dehydration	21	75	6	66.7		
	Restlessness/lethargy	15	53.6	5	55.6		
				Mean (SD)			Mean (SD)
Patients length of stay in both hospitals	1-2	10	35.7	3.39 (1.62)	1	11.1	4.56 (1.88)
	3-4	12	42.9		4	44.5	
	5-6	4	14.3		3	33.3	
	7-10	2	7.1		1	11.1	

Most mortality cases occurred among patients under 64 years old, with comorbidity rates of 86.7 per cent in Hospital 1 and 22.2 per cent in Hospital 2. Table 1 illustrates the distribution of dengue cases among different ethnic groups, revealing that the majority were of Malay ethnicity (46.4% in Hospital 1 and 100% in Hospital 2), with only 7.2% of mortality cases being of Chinese ethnicity.

Approximately 80 per cent of the dengue mortality victims were reported to have stayed in endemic areas or had previous travel history to such areas. However, in 14.2 per cent of mortality cases, exposure to risk related to staying areas was not recorded. Over 70 per cent of cases were admitted as emergency cases in Hospital 1, while 77.8 per cent were admitted as referral cases in Hospital 2. In Hospital 1, 50 per cent of dengue mortality cases were directly admitted to the intensive care unit, compared to 66.7 per cent in Hospital 2, which were admitted to the general ward.

Most dengue mortality cases were admitted during the critical phase in both hospitals, at 67.8 per cent and 88.9 per cent, respectively. In Hospital 1, most patients were admitted with dengue warning signs and severe dengue; in Hospital 2, 77.8 per cent were admitted with dengue warning signs. Approximately 46 per cent of patients in Hospital 1 and 66.7 per cent in Hospital 2 had no reported comorbidity.

The most common clinical presentations on admission were myalgia, arthralgia, headache, dehydration, persistent severe vomiting, and fever. The length of stay in both hospitals was at most five (5) days. Nurses in Hospital 1 documented minimal signs of bleeding, and none in Hospital 2 (Table II). Most nurses documented signs of gastrointestinal disturbance and musculoskeletal problems, especially joint pain. Additionally, signs of shock, such as hypotension and rapid and weak pulse, were also documented in dengue mortality cases.

Based on the nurses' documentation, most interventions by nurses in both hospitals were targeted at reducing hyperthermia, at 64.3 and 33.3 per cent, respectively (Table III). Less than 50 per cent of nurses' interventions in both hospitals were aimed at preventing fluid volume deficit and the risk of hypovolemic shock, and none of the nurses in Hospital 2 documented interventions related to controlling the risk of hypovolemic shock.

Table II: Nurse documentations: Dengue signs

		Hospital 1 (n=28)				Hospital 2 (n=9)			
		Yes		No		Yes		No	
		n	%	n	%	n	%	n	%
Dengue signs	Gum bleeding	4	14.3	24	85.7	0	0	9	100
	Epistaxis	Nil	Nil	28	100	0		9	
	Hematuria	1	3.6	27	96.4	0		9	
Signs of GIT disturbances	Nausea	23	82.1	5	17.9	6	66.7	3	33.3
	Vomiting	22	78.6	6	21.4	5	55.7	4	44.4
	No appetite	22	78.6	6	21.4	6	66.7	3	33.3
	Diarrhea	13	46.4	15	53.6	5	55.7	4	44.4
	Heart burn	4	14.3	24	85.7	0	0	9	100
Musculo-skeletal problems	Joint Pain	23	82.1	5	17.9	8	88.9	1	11.1
	Sore muscle	1	3.6	27	96.4	0	0	9	100
Signs of shock	Hypotension	12	42.9	16	57.1	6	66.7	3	33.3
	Rapid and weak pulse	12	42.9	16	57.1	4	44,4	5	55.6
	Cold and Moist skin	5	17.9	23	82.1	1	11.1	8	88.9
	Cyanosis	5	17.9	23	82.1	1	11.1	8	88.9
	Restlessness	2	7.1	26	92.9	1	11.1	8	88.9
	Conscious-ness	2	7.1	26	92.9	2	22.2	7	77.8

Table III: Nurse interventions: Hyperthermia related to dengue infection

	Hospital 1 (n=28)		Hospital 2 (n=9)	
	Fre-quency	Per-centage	Fre-quency	Per-centage
Hyperthermia related to dengue infection Give Tepid Sponging Encourage patient drink 1500 - 2000ml/day Instruct patient to wear thin cloth-ing and absorb sweats Observation Intake/Output & vital signs as indicated Collaborative: Iv fluid and drug delivery according to the program	18	64.3	3	33.3
Fluid Volume deficit related to in-travascular fluid into the extravas-cular migration Monitor vital signs every 3 hourly as indicated Observation of capillary refill Observation of intake output Encourage patient drink 1500-2000ml/day Collaboration: intravenous fluid	12	42.9	2	22.2
Risk of hypovolemic shock related to excessive bleeding, intravas-cular fluid into the extravascular migration Monitor patient's general condition Observation of vital signs every 3 hourly Explain to patient and family signs of bleeding and immediate report if bleeding occurs Collaboration: Intravenous fluid Collaboration: Hb, PCV, Platelet	13	46.4	0	0

Table IV: Time of death during shift

Time of Death (Shift)	Number of mortality cases					
	Hospital 1 (n=28)		Hospital 2 (n=9)		Total (n=37)	
	Fre-quency	Per-centage	Fre-quency	Per-centage	Fre-quency	Per-centage
Morning (0700 - 1400)	7	25	6	66.7	13	35.0
Afternoon (1400 – 2100)	8	28.6	2	22.2	10	27.0
Night (2100 – 0700)	13	46.4	1	11.1	14	38.0

Most patient deaths in Hospital 1 occurred during the night shift, accounting for 46.4 per cent, while conversely, 66.7 per cent of patients in Hospital 2 passed away during the morning shift (Table IV).

DISCUSSIONS

Throughout the study period, there was a notable rise in the dengue mortality rates observed in both hospitals, escalating from 21.4 per cent to 46.4 per cent in Hospital 1 between 2013 and 2015. Similarly, in Hospital 2, the incidence of dengue mortality surged from zero to 66.7 per cent, with a total of 37 reported cases of dengue-related deaths. The escalating trend in dengue mortality over the past decade may be attributed to several ongoing factors that have yet to be identified and addressed (9). This study aimed to determine the factors contributing to dengue mortality in Malaysian government hospitals and assess nursing involvement in dengue mortality prevention.

This study found that dehydration was the main contributing factor to dengue mortality in these two hospitals. Most patients were admitted during the febrile and critical stages, accounting for 96.4 per cent and 100 per cent, respectively, in Hospital 1 and Hospital 2. According to the WHO stages of dengue illness, patients can develop dehydration, shock, or bleeding during these two stages (febrile and critical), which can exacerbate organ impairment (10). However, nursing documentation and actions regarding these complications need to be included. Among the three stages of dengue, patients in the critical phase had the highest mortality rates, at 67.8 per cent and 88.9 per cent in Hospital 1 and Hospital 2, respectively.

We also found that approximately 75 per cent of patients in both hospitals presented with clinical symptoms such as myalgia, arthralgia, persistent vomiting, fever, and headache upon admission. A retrospective observational study conducted from 2014 to 2017 on the clinical manifestations of dengue about dengue serotype and genotype in Malaysia also revealed that cases infected with DENV 2 commonly presented with persistent vomiting, epigastric pain, plasma leakage, and shock (11). Additionally, the authors reported a high prevalence of myalgia and arthralgia among DENV 3 infections.

Persistent vomiting leads to extensive loss of body fluids, which, if not replaced, can result in severe dehydration. We discovered that at least 75 per cent of hospital patients complained of headaches. According to Woon et al. (12), symptoms of dehydration, such as headaches, serve as indicators of the patient's hydration status and can potentially lead to dengue shock syndrome.

Other factors contributing to dengue mortality were dengue classification and delays in hospital admission. Higher dengue mortality was observed in patients with warning signs and severe dengue cases compared to those without warning signs. During the febrile and critical stages, patients require hospital treatment, and necessitating intensified patient monitoring and frequent fluid regime adjustments by nurses.

This study's findings revealed that 77.8 per cent of patients preferred to visit clinics before seeking immediate admission through the emergency department in Hospitants experienced severe dehydration due to delays in hospital admission. Another study also found that delayed hospitalisation can rapidly deteriorate in severe dengue cases and may increase the risk of dengue mortality (13).

The mortality rates among patients under the age of 40 with comorbidities in Hospital 1 and Hospital 2 were 26.6 per cent and 33.3 per cent, respectively; this finding suggests that even though these patients belong to a younger age group, they still face the risk of dengue-related death, which their comorbidities may exacerbate, this aligns with a study conducted in Singapore, which reported that female Chinese aged 30 to 49 years with diabetes or diabetes with hypertension were at a greater risk of developing dengue haemorrhagic fever during the year 2007 and 2008 when dengue serotype 2 was predominant (14).

A systematic literature review has indicated that comorbidities, particularly cardiovascular disease, stroke, diabetes, respiratory disease, renal disease, and old age, may contribute to severe dengue (15). Furthermore, a study has demonstrated that higher dengue mortality rates were observed among patients with comorbidities, such as diabetes mellitus (16). Another study reported that worsening comorbidities could be the underlying cause of dengue-related deaths rather than the direct impact of dengue infection (3). However, in this study, we found that almost half (53.6%) of the dengue mortality patients had no comorbidities in Hospital 1, while two-thirds (66.7%) of the patients in Hospital 2 had no comorbidities. This suggests that patients without comorbidities also face an equal probability of mortality when admitted to hospitals.

We observed that out of the 37 cases of dengue mortality, six patients were aged 65 or older, and three patients had no comorbidities; this suggests that advanced age alone may contribute to mortality. This finding aligns with Toledo et al. (15), who found that age may also contribute to severe dengue. In their study, Liew et al. (17) reported that increasing age was associated with mortality.

From the perspective of ethnicity, the findings of this study reflected the proportions of the country's population, with mainly Malays followed by Chinese, Indians, and other ethnicities, including immigrants.

In this study, patients of Chinese ethnicity exhibited a lower mortality rate compared to Indians and Malays. Other contributing factors that may have influenced the mortality rate, such as cultural beliefs and socioeconomic status, should be explored in future research. Ethnicity was considered a determinant influenced by cultural and socioeconomic conditions (18). High endemic areas were associated with a higher mortality rate in both hospitals. Approaches must be strengthened among communities living in endemic areas, with continuous and sustainable preventive measures to prevent dengue.

This study found an equal percentage of dengue deaths in the ordinary ward and the ICU in Hospital 1. In contrast, in Hospital 2, higher mortalities were recorded in the ordinary ward. This finding suggests that regardless of the place of admission, nurses play an essential role in ensuring optimum nursing care to patients. Dengue management must provide care to all dengue patients, regardless of whether they are treated in the ward or the Intensive Care Unit. Furthermore, this study identified dehydration as the main contributing factor to dengue mortality in both hospitals. Therefore, based on this study, nursing care should prioritise the patient's hydration status during the critical illness stage.

The findings also revealed that nurses need to be more responsible and improve documentation on all fluid intake and output throughout all stages of dengue (up to 10 days). Based on the results, the length of stay in both hospitals was, at most, ten days. Additionally, patients' fluid status should be closely monitored and recorded, including adjustments to fluid rates.

This study showed that most cases were admitted during the critical phase, where dehydration is the main problem. However, nursing interventions revealed that nurses in both hospitals had overlooked the patients' hydration status. Therefore, nurses should understand and stay updated on the current dengue stages and classifications to provide appropriate patient care and maintain hydration status according to these stages and classifications.

Current practice includes empowering patients to monitor their fluid intake and output. However, these practices must be strictly supervised by nurses to ensure the adequacy of hydration status, especially for very ill patients; this is evidenced by most patients who died within the critical stage in both hospitals, indicating their severe illness.

The results in Table II display what was documented by the nurses during their assessments and actions in this study. Most patients exhibited gastrointestinal disturbances, which could hinder the success of planned oral fluid intake interventions. Patients should be allowed to consume their preferred beverages, such as coconut or papaya leaf juices, which local patients believe to aid in the treatment of dengue and meet their fluid requirements (10). Fluids should be administered in small, frequent amounts during each shift to ensure adequate fluid intake for all dengue patients. This task is time-consuming and requires considerable effort from nurses to ensure that patients receive sufficient fluid intake. If gastrointestinal disturbances persist, the issues must be promptly addressed, and alternative methods of fluid replacement, such as intravenous infusion, should be considered.

The burden of caring for dengue patients is overwhelming (19). Therefore, updating nurses' knowledge regarding dengue warning signs would assist them in differentiating between dengue patients to prevent the deterioration of their condition. From the results of nurses' documentation, it was found that most interventions by nurses in both hospitals were targeted at reducing hyperthermia, at 64.3 and 33.3 per cent, respectively; however, less than 50 per cent of documented interventions aimed at preventing fluid volume deficit and the risk of hypovolemic shock. None of the nurses in Hospital 2 documented the prevention of the risk of hypovolemic shock.

Nurses should also know about dengue's clinical stages to advocate for patients effectively. Improvement and continuous nursing assessment upon patient admission are crucial to detect early signs of dehydration; this includes being attentive to patient complaints, such as headaches. Patient complaints must be taken seriously, especially by nurses as frontline healthcare providers, to prevent rapid deterioration in severe dengue and reduce the risk of dengue mortality (13). Assessment of hydration status should also be tailored based on the patient's health status.

This study is subject to certain limitations, primarily due to its retrospective nature. It involves reviewing patients' mortality data documented between 2013 and 2015. Consequently, the data collected rely solely on the medical records furnished by the respective hospitals.

CONCLUSIONS

The main factor contributing to dengue deaths in both hospitals is dehydration. Another factor contributing to dengue mortality is the severity of dengue when patients are admitted, including the stage of illness, dengue classification, delay in hospital admission, and patient comorbidity. The majority of patients were admitted during the critical phase; therefore, they already had severe dehydration. Nursing documentation indicated that most nurse interventions were focused on reducing hyperthermia rather than addressing dehydration.

There is a crucial need to focus on monitoring and taking immediate action to ensure the adequacy of fluid intake among all dengue patients at all times,

including during night shifts. Symptoms of dehydration, such as headaches, must be monitored as they indicate the patient's hydration status and can lead to dengue shock syndrome. Therefore, nursing education should prioritize updates on dengue management.

ACKNOWLEDGEMENTS

This project was funded by the World Health Organisation Western Pacific Region (WPR) and Special Programme for Research and Training in Tropical Diseases (TDR) under the Joint TDR/WPR Small Grants Scheme for implementation research in infectious disease of poverty. We would also like to extend our thanks to the dedicated staff members of both hospitals for their invaluable assistance in retrieving the electronic data essential for this research.

REFERENCES

1. Mohd-Zaki AH, Brett J, Ismail E, L'Azou M. Epidemiology of dengue disease in Malaysia (2000-2012): A systematic literature review. PLoS Neglected Tropical Diseases. 2014;8(11):e3159-e67. Available from internet address.
2. World Health Organisation. Dengue Situation Update 461: World Health Organisation; 2015. Available from: http://www.wpro.who.int/emerging_diseases/dengue_biweekly_20150324.pdf. Available from internet address.
3. World Health Organisation. Dengue Situation Update Number 558: Update on the Dengue situation in the Western Pacific Region. Western Pacific Region; 2018. Available from internet address.
4. World Health Organization. Dengue Situation Update 691. 15 February 2024. Available from: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://iris.who.int/bitstream/handle/10665/375485/Dengue-20240215.pdf?sequence=25&isAllowed=y. Available from internet address.
5. New Straits Times. Dengue cases in Malaysia up by 65%. New Straits Times. 2024. Available from internet address.
6. Al-Mallah MH, Farah I, Al-Madani W, Bdeir B, Al Habib S, Bigelow ML, et al. The impact of nurse-led clinics on the mortality and morbidity of patients with cardiovascular diseases: A systematic review and meta-analysis. Journal of Cardiovascular Nursing. 2016; 31(1):p 89-95. doi:10.1097/JCN.0000000000000224.
7. World Health Organisation. Handbook for clinical management of dengue 2012. Available from internet address.
8. Malaysia Ministry of Health. Management of dengue infection in adults. 2010. Available from internet address.
9. Liew SM, Khoo EM, Ho BK, Lee YK, Omar M, Ayadurai V, et al. Dengue in Malaysia: Factors Associated with Dengue Mortality from a National Registry. PLoS One. 2016;11(6):e0157631. doi:10.1371/journal.pone.0157631.
10. Hairi F, Ong C-H, Suhaimi A, Tsung T-W, bin Anis Ahmad MA, Sundaraj C, et al. A knowledge, attitude and practices (KAP) study on dengue among selected rural communities in the Kuala Kangsar district. Asia-Pacific Journal of Public Health. 2003;15(1):37-43. Available from internet address.
11. Suppiah J, Ching S-M, Amin-Nordin S, Mat-Nor L-A, Ahmad-Najimudin N-A, Low GK-K, et al. Clinical manifestations of dengue in relation to dengue serotype and genotype in Malaysia: A retrospective observational study. PLoS Neglected Tropical Diseases. 2018;12(9):e0006817-e36. doi:org/10.1371/journal.pntd.0006817.
12. Woon YL, Hor CP, Hussin N, Zakaria A, Goh PP, Cheah WK. A Two-Year Review on Epidemiology and Clinical Characteristics of Dengue Deaths in Malaysia, 2013-2014. PLoS neglected tropical diseases. 2016;10(5):e0004575-e90. doi:10.1371/journal.pntd.0004575.
13. Kittigul L, Suankeow K, Sujirarat D, Yoksan S. Dengue hemorrhagic fever: knowledge, attitude and practice in Ang Thong Province, Thailand. 2003. Available from internet address.
14. Pang J, Salim A, Lee VJ, Hibberd ML, Chia KS, Leo YS, et al. Diabetes with hypertension as risk factors for adult dengue hemorrhagic fever in a predominantly dengue serotype 2 epidemic: a case control study. PLoS Negl Trop Dis. 2012;6(5):e1641-e8. doi:10.1371/journal.pntd.0001641.
15. Sharp SJ, Poulaliou M, Thompson SG, White IR, Wood AM. A review of published analyses of case-cohort studies and recommendations for future reporting. PloS One. 2014;9(6):e101176-e81. doi:10.1371/journal.pone.0101176.
16. Agency MRS. iDengue untuk komuniti 2016. Available from: http://idengue.remotesensing.gov.my/idengue/index.php. Available from internet address.
17. Liew SM, Khoo EM, Ho BK, Lee YK, Omar M, Ayadurai V, et al. Dengue in Malaysia: factors associated with dengue mortality from a National Registry. PloS One. 2016; 11(6):e0157631- e44. doi:10.1371/journal.pone.0157631.
.18. Wong LP, Shakir SMM, Atefi N, AbuBakar S. Factors affecting dengue prevention practices: Nationwide survey of the Malaysian public. PLoS One. 2015; 10(4):e0122890. doi:10.1371/ journal.pone.0122890.
19. Herriman R. Dengue fever cases in Thailand near 15,000 for 2016. Available from internet address.