ORIGINAL ARTICLE

A Preliminary Study of Before and After Activity-based Programme to Increase Dengue Awareness Among Kindergarten Children

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ABSTRACT

Introduction: Dengue is an endemic disease that affects community members of all ages, including young children. With proper exposure, children will be aware of their surroundings and can keep themselves protected. Thus, the current study design introduces an activity-based programme to suit children, with the aim of testing the effectiveness of this programme by analysing knowledge and practice scores of children before and after the programme. **Method:** A pilot study to determine the effectiveness of an activity-based programme was conducted among fifty KEMAS kindergarten children from June to July 2019. The one-day based programme consisting of theatre performance and games were conducted at the Universiti Sains Malaysia. Data from participants involved was collected a week before and a week after the activity-based programme using a validated questionnaire. Results from the data were statistically analysed using the Statistical Package of the Social Sciences (SPSS). Descriptive test was used to generate socio-demographic data while the Wilcoxon Sign-Rank test was used to compare knowledge and attitude scores before and after the programme. **Results:** A total of 46 participants have successfully attended the activity-based programme and completed pre and post questionnaires. There were significant differences in both knowledge and practice scores among participants following participation in the activity-based programme, where, $p < 0.001$. **Conclusion:** This preliminary study concludes that an activity-based programme on dengue has improved participants' knowledge and practice towards dengue, thus can be considered as a validated programme for early exposure of prevention knowledge and measures against dengue among kindergarten children.

Keywords: Dengue, Activity-based programme, Children, Knowledge, Practice

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INTRODUCTION

Dengue is a mosquito borne flavivirus that affects the immune system of humans, causing flu-like illness to adults, children and infants (1). Since dengue infection is spread across the globe, it has also become a burden to Malaysians for many decades now. In Malaysia, a total of 124,777 dengue cases and 174 deaths had been recorded in the year 2019, higher than 2018, proving that dengue is still vastly infectious among the public (2). No treatment had been effective in treating dengue till date and health authorities rely merely on treating symptoms when they occur in an infected person (3). Apart of treating symptoms, Malaysia had also been heavily dependent on preventive measures to prevent the transmission of dengue and eliminate breeding areas of *Aedes* mosquitoes (4). Several biological and chemical measures such as the introduction of Wolbachia and insecticides, had been introduced and implemented in Malaysia in the effort against dengue (5). Several programmes had also been carried out throughout the nation; however, the rate of dengue cases is still at hike.

Since dengue affects everyone from young children to adults, it is believed that every community member is responsible of being aware and are advised to take good care of their surroundings. As such, the involvement of all community levels plays an important role in interrupting Arboviruses as they infect all age groups of the community, helping to achieve a good level of community awareness (6). The change in the habits of an adult is possible if young started young, even in the case of dengue prevention. In America, children as young as five to 12 years had been involved in promoting awareness against dengue (7). Children can

also be ambassadors to promote awareness among adults (8). Previous studies have shown that interventional programmes in educational institutions such as schools can have a positive impact on the reduction rate of morbidity among schoolchildren as awareness of the viral diseases have been alerted among schoolchildren (9,10).

Due to the lack in actions taken by adults, children had been exceptionally vulnerable to dengue as no proper education regarding this disease is given to them, making them unaware and easily susceptible to the disease in uncontrolled environments. Children should be exposed to important information on dengue along with preventive practices in order to become well-informed individuals. Children who are aware are capable of identifying faulty environments and at a certain scale, help adults by protecting themselves from Aedes mosquito bites and breeding. Thus, this study aims to pilot testing the effectiveness of an activity-based programme by evaluating the knowledge and practice scores before and after an activity-based programme among children from the Kemajuan Masyarakat (KEMAS) kindergartens in Kota Bharu. Both knowledge and practice scores were then compared to identify any significant increase after the programme. This study will enable the researcher to test the effectiveness of communicating information on dengue through an activity-based approach with young children, hence, introducing a validated and standardised learning curriculum for young children on dengue.

MATERIALS AND METHODS

Study design

The study design used is a cross-sectional study to determine the effectiveness of an activity-based programme conducted among children aged five to six years old.

Research instrument

A validated knowledge and practice questionnaire with an internal consistency of 0.719 was used in this study (Subramaniam *et al.*, 2020). The questionnaire used was in Malay language with four major sections, with a total of 33 items. Section A consisted of basic sociodemographic items regarding the respondents. Section B consisted of 23 knowledge items grouped under five subdomains. Subdomain I, known to represent 'general information on *Aedes* mosquitoes' consisted of five items while subdomain II, known to represent 'stagnant water areas' consisted of eight items. Subdomain III, representing 'life cycle of *Aedes* mosquitoes' consisted of three items followed by subdomain IV, representing 'peak time of *Aedes* mosquito bites' consisted of two items. The final subdomain, subdomain V, which represents 'symptoms of dengue fever' consisted of five items. Section C consisted of 10 items grouped under one subdomain, known as 'prevention of Aedes mosquito bites and breeding'. Section D, the final section of the questionnaire consisted of three additional items as supportive information to the data collected.

Activity-based programme

The activity-based programme adapts an active learning procedure compared to the conventionally conducted passive learning methods such as talks and speeches to suit the learning abilities of young children. The activity-based programme included important information on basic knowledge for children on general information on *Aedes* mosquitoes, stagnant water areas for breeding, life cycle of *Aedes* mosquitoes, peak time of *Aedes* mosquito bites, symptoms of dengue fever and the prevention from *Aedes* mosquito bites and breeding activities. Items under these subdomains were developed according to the relevancy and suitability of these items to the young children. This activity – based programme consisted of two main activities, information delivery by engaging along with a theatre performance followed by reinforcement through games session as below:

Activity 1: Theatre

The objective of this activity was to deliver main information on dengue and Aedes mosquitoes to the children involved. Facilitators were recruited to act out important characters in the performance which were trained by the researcher to play their respective roles prior to the actual day of the programme. The theatre was conducted using native Malay language and had a duration of 25 minutes. The theatre performance had characters wear fancy costumes and use common words that are easily understandable by children. Characters communicated with children for a two-way response to increase concentration and for better attraction of participants towards the performance. Children were required to watch the performance and respond to characters and questions when needed.

Activity 2: Games

An educational game session consisting of two separate games was conducted after the theatre performance. The objective of this activity was to reinforce information delivered during the theatre performance as the games were made to be physically involve children. Children were divided into groups and were guided to play both the games by the researcher and programme facilitators. Game 1 required children to distinguish 2D print outs of Aedes mosquitoes as the targeted vector among other 2D print outs of insects from a container. Each child was encouraged to select the correct vector from the container and was rewarded upon the right selection. Game 2 required children to correctly fill the life cycle of the Aedes mosquito using 2D pictures provided. Each child was encouraged to correctly match the pictures to the specific stage of the life cycle and was rewarded upon the right selection.

Data collection

Recruitment

This study was done among children from KEMAS kindergartens in Kota Bharu. Systematic random sampling was used to select a total of 50 children based on inclusion criteria that included children within five to six years and voluntary participation and exclusion criteria that included children with learning disorders, unhealthy and sick. Children who fulfilled inclusion criteria were recruited at a total of five participating kindergartens with 10 children each. The ethical approval of the study was obtained from the Human Research Ethics Committee (JEPEM), Universiti Sains Malaysia (Reference number: USM/JEPeM/18070333).

Pre questionnaire distribution

Pre questionnaires were administered through a face to face interview by the researcher along with four other trained facilitators among selected participants in their respective kindergartens one week, prior to the programme. Written permission from parents and kindergarten authorities were obtained prior to data collection. During pre-questionnaire data collection, selected children were invited to join the programme.

Activity-based programme

A one one-day programme on the 14th of November 2019 in USM was conducted. The programme started at 8.30am and ended at 12pm. Children were accompanied by respective teachers from the kindergartens selected. The programme started with the theatre performance in order to introduce children to the targeted information on dengue. The programme was then continued with the games session to test the information learned. Children were given an hour of rest time in between both the activities. Children and teachers present were also rewarded with complimentary gift bags as a token of appreciation before leaving.

Post – questionnaire distribution

The same children were then visited again in their respective kindergartens for post questionnaire data collection after a duration of one week from the programme.

Statistical analysis

Statistical Package of the Social Sciences (SPSS) version 25 was used to conduct statistical analysis. Socio-demographic data obtained from the questionnaire were analysed using the descriptive test. Wilcoxon Sign-Rank Test was used to compare knowledge and practice scores before and after the programme. Results were considered significant at $p < 0.001$.

RESULTS

Socio – demographic characteristics

The socio – demographic build-up of the respondents recruited was summarised as in Table I. A total of 46 respondents were fully involved pre and post this study, where 100% of them were from the Malay ethnicity and Islamic religion. Respondents recruited were within the range of five to six years old, where 63% of them were five years old while 37% of them were six years old. As for the gender category, 63% of the respondents were females and 37% of the respondents were males. Most fathers were self employed and more than half of them at 56.5% earned less than RM1,000. On the other hand, most mothers were unemployed and a large number of them, about 65.% of them earned less than RM 1,000. Respondents were seen to be almost equally residing in both town and interior areas where 47.8% of respondents were from town-based areas while the other 52.2% of them were from rural areas. This programme was the first to be participated by all respondents.

Table I : Distribution of respondents' socio demographic characteristics

Variables	Number (n)	Percentage (%)
Age		
5 years old	29	63
6 years old	17	37
Gender		
Male	17	37
Female	29	63
Race		
Malay	46	100
Chinese	0	0
Indian	0	0
Religion		
Islam	46	100
Buddha	0	0
Hindu	0	0
Fathers' Profession		
Government sector	11	23.9
Private sector	11	23.9
Self-employed	24	52.2
Unemployed	0	0
Mothers' Profession		
Government sector	15	32.6
Private sector	5	10.9
Self-employed	2	4.3
Unemployed	24	52.2
Fathers' Income		
< RM 1,000	26	56.5
RM 1,000 – RM 3,000	19	41.3
RM 3,000 – RM 5,000	1	2.2
RM 5,000	0	0
Mothers' Income		
< RM 1,000	30	65.2
RM 1,000 – RM 3,000	12	26.1
RM 3,000 – RM 5,000	3	6.5
RM 5,000	1	2.2
Type of residences		
Town areas	22	47.8
Interior areas	24	52.2

Knowledge

Data from total of 46 respondents out of the initial 50 respondents (92% response rate) was collected. The percentage of answers by respondents towards items for knowledge in five different sub-domains had been summarised as in Table II. All five items in the first sub-domain, namely, general information on Aedes mosquitoes have shown a similar outcome of percentage for the answer option "YES' at 97.83% after the programme. Items P1 (dengue), P2 (Aedes mosquitoes are the cause of dengue fever) & P3 (Aedes mosquitoes have black and white stripes on their body and legs) are seen to have similar answering patterns, where minimum response for the 'DON'T KNOW' answer option before the programme no longer existed after the programme. Respondents are observed to have the highest 'YES' option for items in this domain with no respondents opting for the answer 'DON'T KNOW' from the answer choices after the programme. For the second sub-domain, namely, stagnant water areas, a good increase in the 'YES' answer option can be seen for all the items under this domain with item P7 (toilet pump tank) recording the highest percentage of increase among the rest. Items P6 (flower pot base), P8 (water tank) and P10 (opened food and beverage containers) had no more 'DON'T KNOW' options after the programme compared to before the programme.

Table II : Comparison in the percentage of answers for knowledge domain by respondents before and after the activity-based programme

No	Item	Before programme (n=46)			After programme (n=46)		
		Yes (%)	No (%)	Don't know (%)	Yes (%)	No (%)	Don't know (%)
	Knowledge						
	General information on Aedes mosquitoes						
P1	Dengue	80.4	17.3	2.1	97.8	2.1	-
P2	Aedes mosquitoes are the cause of dengue fever	82.6	10.8	6.5	97.8	2.1	-
P3	Aedes mosquitoes have black and white stripes on their body and legs	78.2	21.7	4.3	97.8	2.1	-
P4	Aedes mosquitoes breed in stagnant water	84.7	15.2	-	97.8	2.1	-
P5	Dengue fever can be transmitted to humans through the bite of female Aedes mosquito that has the virus	71.7	28.2	-	97.8	2.1	-
	Stagnant water areas						
P6	Flower pot base	63.0	21.7	15.2	82.6	13.0	-
P7	Toilet pump tank	52.1	36.9	10.8	82.6	13.0	4.4
P8	Water tank	47.8	37.1	13.0	82.6	17.4	-
P9	Pail of water in the toilet	56.5	30.4	13.0	76.1	21.7	2.2
P10	Opened food and beverage containers	43.4	36.9	19.5	76.1	23.9	-
P11	Unused tyres	50.0	50.0	-	76.1	23.9	-
P12	Unclosed trash bins	73.9	26.0	-	84.8	15.2	-
P13	Clogged drains	73.9	13.0	13.0	78.3	15.2	6.5
	Life cycle of Aedes mosquitoes						
P14	Aedes mosquito eggs hatch into larvae before they become adult Aedes mosquitoes	36.9	47.8	15.2	82.6	17.4	-
P15	Aedes mosquito larvae can only live in water	36.9	43.4	19.5	97.8	2.2	-
P16	The life cycle of Aedes mosquitoes from eggs to adult takes seven days	19.5	63.0	17.3	73.9	23.9	2.2
	Peak time of Aedes mosquito bites						
P17	Aedes mosquitoes bite the most in the early mornings	52.1	47.8	-	54.4	45.7	-
P18	Aedes mosquitoes bite the most in late evenings	54.3	45.6	-	78.3	21.7	-
	Symptoms of dengue fever						
P19	Death causing if severe	76.1	23.9	-	95.7	4.4	-
P20	High fever	78.3	21.7	-	89.1	10.9	-
P21	Rashes	56.5	36.9	-	82.6	17.4	-
P22	Body and joint aches	58.7	41.3	-	82.6	17.4	-
P23	Vomiting	50.0	50.0	-	87.0	13.0	-

For the third sub-domain, namely, life cycle of Aedes mosquitoes, a tremendous increase towards the correct answer can be seen compared to all the other sub-domains, with item P15 (Aedes mosquito larvae can only live in water) recording the highest percentage of increase. The answer option 'DON'T KNOW' by

respondents have effectively reduced to almost none. Items in the fourth sub-domain, namely peak time of *Aedes* mosquito bites had shown a good increase, especially item P18 (*Aedes* mosquitoes bite the most in late evenings) while item P17 (*Aedes* mosquitoes bite the most in the early mornings) showed a poor increase. Lastly, items in the final sub-domain, namely, symptoms of dengue fever, had shown a steady increase with item P23 (vomiting) recording the highest percentage of increase among other items. Respondents did not opt for the answer 'DON'T KNOW' before and after the programme for all items under this sub-domain.

Practice

The answers by respondents towards items for the domain, practice is as recorded in Table III. In general, all the items displayed an increase in the practices of the respondents after the activity-based programme. Item P29 (removing water from containers that hold water) showed the highest increase with an elevated number of respondents practicing to remove water from containers before disposing them after the programme. Item P33 (throwing food and beverage containers into trash can) is seen to be leading by having the greatest number of respondents practicing the particular habit before and after the programme. Item P33 (throwing food and beverage containers into trash can) and item P25 (wearing covered clothes when going out) is further seen to be the most successful practice for the respondents after the programme no respondents not practicing wearing covered clothes before heading out of their house. However, item P25 (wearing covered clothes when going out) is also seen to have the smallest percentage of increase for the option 'ALWAYS' although it is recorded to be the third highest practiced habits after item P33 (throwing food and beverage containers into trash can) and P30 (closing trash bins after disposing rubbish). Item P24 (using mosquito net when sleeping) is observed to be the item where most respondents never practiced before and after the activity-based programme.

Table III : Comparison in the percentage of answers for practice domain by respondents before and after the activity-based programme

No	Item	Before programme (n=46)			After programme (n=46)		
		Always (%)	Sometimes (%)	Never (%)	Always (%)	Sometimes (%)	Never (%)
	Practice						
	Prevention from Aedes mosquito bites and breeding						
P24	Using mosquito net when sleeping	26.1	8.7	65.2	37.0	13.0	50.0
P25	Wearing covered clothes when going out	58.7	28.3	13.0	67.4	32.6	-
P26	Using mosquito sprays	36.1	45.7	17.4	52.2	43.5	4.35
P27	Using mosquito repellent before leaving the house	26.1	6.5	67.4	41.3	21.7	36.96
P28	Using electrical mosquito coil	19.6	58.7	21.7	30.4	60.9	8.70
P29	Removing water from containers that hold water	15.2	47.8	37.0	54.4	30.4	15.22
P30	Closing trash bins after disposing rubbish	56.5	28.3	15.2	73.9	21.7	4.35
P31	Changing water in flower pots	30.4	21.7	47.8	39.1	32.6	28.26
P32	Washing the base of flower pots	39.1	19.6	41.3	45.7	26.1	28.29
P33	Throwing food and beverage containers into trash can	74.0	21.7	4.4	84.8	15.2	-

Table IV: Comparison of knowledge and practice scores for before and after the activity-based programme

	Variable	Median (IQR)		Z statistics	*p* - value
		Pre	Post		
Knowledge					
	Subdomain 1: General information on Aedes mosquitoes	4.00 (2.00)	5.00 (0)	-4.156	$p = 0.001$*
	Subdomain II: Stagnant water areas	4.00 (3.00)	7.00 (3.00)	-5.553	$p = 0.001$*
	Subdomain III: Life cycle of Aedes mosquitoes	3.00 (1.00)	1.00 (1.00)	-5.367	$p = 0.001$*
	Subdomain IV: Peak time of Aedes mosquito bites	1.00 (2.00)	1.00 (1.00)	-1.952	$p = 0.051$*
	Subdomain V: Symptoms of dengue fever	4.00 (2.00)	5.00 (1.00)	-4.606	$p = 0.001$*
	Total score for knowledge	14.00 (7.00)	20.00 (2.50)	-5.917	$p = 0.001$*
Practice					
	Prevention from Aedes mosquito bites and breeding	4.00 (2.25)	5.00 (2.00)	-5.417	$p = 0.000$*

Wilcoxon Paired Sign-Rank test
*Significant at $p < 0.001$

Knowledge and practice scores on dengue before and after activity-based programme

Table IV shows significant differences before and after the activity-based programme for knowledge and practice scores. The total knowledge score with a median score of 20.0(IQR2.5) after the programme is observed to be much higher, showing a significant increase compared to the median score of 14.0(IQR7.0) before the programme. All sub-domains under knowledge displayed a significant increase of scores except for sub-domain IV that showed an insignificant increase with a median score of 1.00(IQR 1.00) after the programme when compared to the median score of 1.00(IQR 2.00) before the programme. For total practice score, the median score of 5.0(IQR 2.0) after the programme is observed to be slightly higher, exhibiting a significant increase compared to a median score of 4.0(IQR 2.25) before the programme, where, $p < 0.001$.

DISCUSSION

Five major areas were highlighted through sub-domains in this study, where the first sub-domain, representing items on 'general information on Aedes mosquitoes' showed satisfying knowledge scores even before the programme. For the second sub-domain, items on 'stagnant water areas' showed that respondents were not very aware about areas of Aedes mosquito breeding and had caused a mixed level of increase in answering 'YES', while opting for the answer choice 'NO' had also been successfully reduced except for item P13 (clogged drain) that recorded an increase for answer option 'NO' after the activity-based programme. However, the outcome of knowledge on stagnant water areas among adults showed a fairly good level of increase, seen to be similar with another study (12). The initial level of knowledge among participants in this study can be assumed that knowledge from parents is not passed to children at home, stressing the need of education of dengue in school platforms. Information on this item needs to be further highlighted in the process of activity-based programme. This programme completely reduced the respondents from opting for the answer choice 'DON'T KNOW' for items P6 (flower pot base), P8 (water tank) and P10 (pail of water in the toilet), as respondents were observed to be familiar with these areas as potential stagnant water areas within their household.

The third sub-domain, representing items on 'life cycle of Aedes mosquitoes' showed a highest level of increase after the programme among the other sub-domains as respondents, being children, did not have enough knowledge on the items tested before the programme. This is considered a common phenomenon as even adults were unaware about the information on these aspects (13). The same trend of increase was also seen in studies focussing on such areas of information among school children (14). Respondents opting for answer choices 'NO' and 'DON'T KNOW' showed a tremendous reduction as well. Item P17 (Aedes mosquitoes bite the most in the early mornings) in the fourth sub-domain representing 'peak time of Aedes mosquito bites' showed a relatively small change, whereas item P18 (Aedes mosquitoes bite the most in late evenings) showed a good increase in respondents answering 'YES' after the programme. Both these items can be focussed more as they are important to be known to children.

The last sub-domain representing items on 'symptoms of dengue fever' showed a good increase in scores following the programme especially item P23 (vomiting). Respondents were aware of the symptoms in a general way but lacked specificity on symptoms related to dengue as symptoms were perceived to be common ones, just like any other disease. A study among adults showed the similar outcome as this study (12), however, a study in among school children observed that children were well aware of the symptoms of dengue (14), enhancing that through education, children can be equipped with the right knowledge that is generally not taught by adults in most cases.

The domain practice also did show an increase in 'YES' options after the programme; however, it is less likely to have a great increase in their percentages. Item P29 (removing water from containers that hold water) showed an impressive increase while the outcome on item P24 (using mosquito net when sleeping) indicated that nearly half of the respondents never practiced using mosquito nets at home. This might probably due to household habits that no longer use mosquito nets or find them inconvenient for usage. The increase in activities such as removing water from containers, throwing rubbish into the dustbin, wearing covered clothes and closing trash bins after disposing rubbish showed a good habitual increase and perception among respondents. School students, generally, were observed to be less exposed to practices in preventing Aedes mosquitoes breeding and bites, as most of them were known to be least children-friendly or effective to be carried out by children whereas practices that can enable children to complete them independently needs more exposure (15). A study revealed that school children exhibited poorer preventive practices and only focussed on covering stagnant water jars (14) while adults were seen to be largely involved in such practices especially in protecting from Aedes mosquito bites through the use of various different mosquito nets and electrical coils (12). The positive change in this study may have been caused by the convenient changing of habit at an individual level which does not require adults to help in the process. This change can be slowly adapted to be a part of their lives if continuously done from young.

Additionally, sources of participants' correct answers in the knowledge domain prior to the programme were

investigated. A number of 38 out of 40 respondents were concluded to have been exposed to items in the domains through a number of sources. A majority of respondents (19.6%), although young had knowledge on the basic information on Aedes mosquitoes as they were all infected by dengue at a relatively young age. About 17.4% of them admitted to have known information through teachers. Another 15.2% of respondents were known to have seen advertisements on television/radio or have seen other family members suffer from dengue. Other minor sources were identified to be information from family members (8.7%), the internet (4.3%) and through peer sharing (2.2%). The activity-based programme caused a further elevated increase in the knowledge scores in the first sub-domain after the programme, with no respondents opting for the answer choice "DON'T KNOW". A survey on the source of information in another study also showed that information was mostly and preferably transferred through mass media such as the television (15, 16, 17). However, another study showed that the internet through social media is preferred by university students (18), probably due to the evolvement of internet usage nowadays. Unlike adults and elder children who mostly obtained their information from media mass and newspapers, younger children were seen to be more dependent on their teachers as a source of information.

The significance of both the knowledge and practice scores before and after the activity-based programme was analysed using the non-parametric test for two dependent samples, known as the Wilcoxon Paired Sign-Rank test as score data was not normally distributed in this study. The test on the normality of distribution was run using the Kolmogorov-Smirnov test, showing that the outcome of normality was not significant with the value of $p > 0.05$ in all sub-domains of knowledge and practice. This statistical test used is similar other studies as well (19,20). This might be due to the presence of outliers in the scores recorded or if scores fall into a same range in either one dependent sample group, causing the data to become skewed (21). Hence, the non-parametric test was chosen as the data did not meet its main assumptions, which are the non-normality of data distribution and the presence of definite outliers. In this study, all data was described using the median and interquartile range (IQR) values. Median values are chosen as reference values as they are not really affected by outliers and has the tendency of producing more accurate results, having a similar response presentation to other studies that use median and IQR as well (19, 22).

Knowledge scores after the activity-based programme had been seen to show a significant increase among kindergarten children who participated, proving that activity-based initiative ignites the promotion of new knowledge in children. The positive outcome of this study had been seen to be similar to previous studies using educational programmes as an intervention among adults (12, 18, 23). Studies closer to this study that included school children also revealed the same outcome (14, 15, 24). This can be due to the right approach taken to deliver information to target participants. School based education in Puerto and Thailand have also proved its effectiveness in the prevention and control on the dengue disease (9, 10). The main benefit of an activity-based approach specifies in the involvement and implementation of learning, by well-trained individuals, improving functional development and practice among children (25). Since this programme is mainly focussed on getting children to learn information taught in a fun and effective way, this activity-based programme had boosted the interest and longer lasting memory of the information taught (26).The results obtained could also mean that the knowledge spread through this activity-based programme emphasises the right areas of knowledge in which children lack. When discrminated according to sub-domains, score of items in every sub-domain showed a small, significant increase in the median recorded showing that improvement is seen in aspects of 'general information on Aedes mosquitoes', 'stagnant water areas', 'life cycle of Aedes mosquitoes' and 'symptoms of dengue fever'. Only sub-domain IV, referring to the aspect of 'peak time of Aedes mosquito bites' showed that there was no increase in the median score, producing an insignificant difference. Therefore, this information delivery on this aspect of the programme has to be improved and further focussed for a better outcome in future.

For practice, a significant increase in also observed in the practice scores of children after the programme. However, practice scores seem to have a lower increase compared to knowledge scores. A study conducted among university students revealed a similar outcome as well (18). As much as it may have been possible among older students, a steady practice can only be achieved through a high frequency of exposure towards the prevention of Aedes mosquito bites and breeding among younger children. Usually, habit formation occur when an action is consciously motivated and takes time (27). Through this activity-based programme, it is proved that children are able to adapt new practices or habits easily at a younger age. Experiments have shown fundamental cognitive functions become more active with a higher information or action copying rate at ages 4 to 6 years old (28). Although children are not actively involved, proper education on practices can act as the motivation needed. Thus, these activity-based programmes that centralises active learning proves to leave a positive impact on young children when they are planned and conducted in a way that is easily received by children.

The proven effectiveness of this pilot study further helps in validating the activity-based programme to be carried out on studies that involve larger sample sizes of kindergarten children. The outcome of this pilot

work is also considered successful as overall feedbacks collected from five teachers accompanying the students after the programme were seen to be positive. Remarks such as the programme being engaging, entertaining, knowledge inducing and important to the health of every children were obtained. The presence of a small lag in time between each activity was the only negatively shaded remark reported by one teacher. Verbal feedback from a number of ten participating children also showed that they were accepting of the knowledge taught and considered the programme a fun and enjoyable one. Every of the feedback was analysed and the negative remark will be improved before implementing this validated activity-based programme in a larger scale by the researcher.

As for the limitation, the programme carried out in this phase is only based on one time measurement of knowledge and practice after the programme, thus it does not measure the lasting ability of the information delivered for a longer period of time. Several follow ups upon a certain time duration and constant exposure as a form of reinforcement can be introduced to further enhance the knowledge and practices grasped for a longer period of time and overcome the limitation. Nevertheless, the strength and objective of this research had been proved successful based in its piloting level, in which the programme is able to stand as an effective way of educating children towards the prevention of dengue. The novelty of this study also stands as a strength, as a new programme targeting young children. Many more studies using this programme may boost the effectiveness of programmes further introduced for kindergarten children. On a whole, this validated activity-based programme is worthwhile to instill and elevate knowledge and practices against *Aedes* mosquito bites and breeding activities, proving that effort taken at a younger age is seen to be more successful.

CONCLUSION

The activity-based programme developed and conducted against dengue was found to be significantly helpful in increasing the knowledge and practice scores among kindergarten children. This validated programme will enable researchers to take initiatives to include young children in programmes designed to curb dengue. By considering the positive outcome from this research, the development of this effective programme can be as an enhancement to formal education ways to create a far more protected generation of adults against dengue in future.

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