Identifying requirements for targeted risk communication in prevention of dengue transmission in vulnerable areas, Mawlamyaing, Myanmar

Pe Thet Zaw[#], Khin Thet Wai, Tin Oo, Zaw Win, Hlaing Myat Thu, Moe Thida, Phyu Sin Aye & Tin Tin Wai

Department of Medical Research (Lower Myanmar), No. 5, Ziwaka Road, Dagon Township, 11191 Yangon Region, The Republic of the Union of Myanmar.

Abstract

This cross-sectional study focused on the largest periurban ward of Mawlamyaing Township in Myanmar to identify the requirements for targeted risk communication in the prevention of dengue transmission in vulnerable areas. During May 2011, 200 structured interviews of householders and six in-depth interviews of health personnel and ward administrators were conducted. Most of the respondents lived in wooden houses (145/200, 73%). Only 18% of the respondents had high school and higher education. Two thirds of the households had children under 15 years of age, and 8% reported hospitalization for dengue infection in the past one year. Only 30% (60/200) knew that dengue could occur all the year round. The majority acknowledged that dengue was preventable. However, their mean score for five specific preventive measures was 1.8 ± 0.8. The mean risk perception scores in chances of reinfection, and in severity, were 5.7 ± 2.2 and 6.0 ± 2.5 respectively. They stored rainwater mostly outdoors in cement tanks and in ceramic jars (52/102, 51%). They were unable to clean these containers within 7 days, and they did not change water regularly. Only 42% of cement tanks and 67% of ceramic jars had complete covering. Nearly 81% of the households had a few to abundant water-retainable discarded materials in their compounds. In-depth interviews revealed the need to strengthen advocacy for more community engagement in the removal of potential dengue vector breeding sites. In conclusion, extensive rainwater storage in key containers without adequate management and improper environmental management may lead to increased dengue vector breeding sites. The householders' low knowledge scores in preventive measures, and their low-risk perceptions towards reinfection may aggravate the situation. Greater emphasis should be on multisectoral collaboration and coordination to use advocacy as the best tool for risk communication in order to motivate community engagement. This will complement effective and sustained integrated vector management measures in vulnerable areas.

Keywords: Dengue transmission; Integrated vector management; Prevention; Risk perception; Water storage; Waste disposal; Risk communication; Vulnerable areas; Mawlamyaing; Myanmar.

[#]*E-mail: pethetzaw@gmail.com*

Introduction

In the South-East Asia and the Western Pacific regions of WHO, around 1.8 billion people are at risk for dengue.[1] In Myanmar, Mon State, Yangon Region, Ayeyarwaddy Region and Kayin State reported the maximum number of dengue cases in 2009 and 2010.[2] Dengue transmission is likely to occur under favourable climatic conditions, during population mobility and when there is inadequate water supply. Water scarcity leads to storage of water in various types of containers for domestic use and for drinking purpose. These containers may act as potential breeding sites for dengue vectors, especially when rainwater is stored.[3] Preventing or reducing dengue virus transmission depends entirely on the control of mosquito vectors, and control measures have been carried out in the most affected townships of Mon State. However, the participation of householders in the management of key containers as potential breeding sites of *Aedes aegypti* requires exploration. In addition, their practices of the disposal of discarded materials that can hold water increase the chance of the potential for dengue vector breeding. Apart from their knowledge and attitudes, their risk perceptions are important for taking precautionary actions in effective risk management of epidemic infectious diseases, including dengue, which does not have any specific treatment or vaccination.[4,5]

Risk communication is an interactive process of exchange of information and opinions among individuals, groups and institutions.[4] This issue is consistently understood as an effective strategy for infectious diseases prevention and control. Advocacy at various levels is an integral component of mobilizing the community and should be linked to the risk communication framework.[6] From this study, evidence-based requirements to improve knowledge and risk perceptions can be identified for effective risk communication, especially in times of an outbreak. This may lead to an enhancement in adoption and adaptation of locally-specific actions for adequate, timely and sustainable container management apart from chemical larviciding carried out by vector control services. Therefore, the objectives of this study were to find out the vulnerability of the study site to dengue infection, to outline the knowledge, attitudes and risk perceptions of householders of dengue infection, and to find out their water-storage patterns, container management practices specific to rain-filled water storage containers, and management of water-retainable discarded materials in a peri-urban ward of the district affected by dengue.

Materials and methods

Study design

A cross-sectional and community-based descriptive study was conducted in May 2011.

Study area and study population

The study area was the largest peri-urban ward of Mawlamyaing Township in Mon State. It covered an area of 1049 acres with 3498 households and a population of 25 755 in 2010. The average annual rainfall was 190 inches (482.6 cm).[2] The study population included householders and their water-storage containers in and around the households.

Sample size determination and sampling procedure

The sample size of 200 households met the assumptions of correct container management practices in peri-urban areas, being 15% at 95% confidence level, and 5% precision. The study site was purposively selected due to the presence of the reported high number of dengue cases compared to others during past three years.[7] The streets were selected at random followed by visiting all households in each street till the required sample size was reached. In each selected household, one adult respondent, either head of the household or the assigned person, was recruited to participate in the structured interview. For in-depth interviews, two health personnel from the State Vector Borne Diseases Control (VBDC) team, two midwives responsible for dengue vector control in the study site and two ward authorities were recruited.

Data collection methods

Six trained interviewers used pretested and modified structured questionnaire for eligible householders. They used the observation sheet to note down the water-storage containers and their characteristics and the presence of water-retainable discarded materials in the household compounds. Water-storage containers mainly focused upon were metal and plastic drums, cement drums, ceramic jars and cement tanks. These large and medium-sized containers were specifically chosen because these were likely to be the most productive containers (key containers) for larvae and pupae of *Aedes aegypti* already proved in other studies from Yangon Region and Kayin State.[8,9] In-depth interviews of personnel from VBDC, basic health staff and ward administrators were conducted using the pretested guideline to underscore their ideas towards prevention of dengue transmission in risk areas and opportunities and challenges.

Data processing and analysis

The SPSS version 19.0 software was used for data entry and analyzed after thorough form checks, range and consistency checks. Frequency distributions and cross tabulations of variables of interest were carried out. The questionnaire covered 37 knowledge items: general knowledge (4 items), mode of transmission (5 items), symptoms (8 items), dengue vectors (8 items), prevention (6 items) and container management (6 items). The knowledge score

was computed by assigning 1 for correct response. Risk perceptions related to dengue in the questionnaire included perceived susceptibility, perceived severity, perceived response efficacy and self-efficacy with reference to the "Health Belief Model".[10] The questionnaire also covered 10 items for risk perceptions and 2 attitudinal statements. These items were measured by the visual analog scale (0–10). Mean scores and standard deviations were computed. The reliability coefficient was computed for knowledge scores and the value of ≥0.7 was considered as reliable. Qualitative data from in-depth interviews were triangulated with quantitative findings as appropriate for meaningful interpretations.

Ethical considerations

Privacy and confidentiality issues were observed during the interviews following verbal informed consent for every form of data collection.

Findings

Vulnerability to dengue transmission

The study site was the community vulnerable for dengue transmission in which 75% (150/200) of the households had children less than 15 years of age. Some 70% (140/200) of respondents were either heads of the household or their spouses. Only 18% of respondents had attained an educational level of high school and above. A vast majority of the people were living in wooden houses (145/200, 73%). Of the 200 households surveyed, 8% reported hospitalization for dengue infection in the past one year.

Knowledge of dengue infection, dengue vectors and prevention

Over half of the respondents did not know that adults could also contract dengue infection. Only 30% (60/200) knew that dengue could occur all the year round. This finding indicated the likelihood of less attention being given to water-storage containers to prevent dengue vector breeding, especially in the dry season. Symptoms of dengue shock were not widely known (<30%). Moreover, 83.5% (167/200) of respondents thought that there was medication available to cure dengue. The majority of them knew that dengue infection was transmitted via mosquitoes (186/200, 93%). However, only a few knew that dengue could be transmitted and spread due to unclean environment (Table 1).

Approximately 61% (113/200) could name the mosquitoes causing dengue in local term, and 58.6% (109/200) correctly stated that dengue was caused by daytime biting of mosquitoes. Only 21.5% (40/186) cited clean water as dengue vector breeding sites which required attention. A vast majority (184/186, 92%) knew that dengue was preventable. Nearly 90% (165/184) of respondents knew it was necessary to prevent from being bitten

Table 1: Knowledge of dengue infection, dengue vectors and prevention

Characteristic*	No.	%
Knowledge of dengue shock	**(n = 200)**	
• Sudden decrease in fever and got cold extremities	39	19.5
• Frequent vomiting	59	26.5
• Blood streaks in the vomitus	55	27.5
Medication that can cure dengue	167	83.5
Transmission of dengue infection		
• Via mosquitoes	186	93.0
• Via unclean environment	14	7.0
Knowledge of dengue vector		
• Can name dengue-causing mosquitoes	113	60.8
• Daytime biting of dengue-causing mosquitoes	109	58.6
Where the dengue causing mosquitoes lay their eggs	**(n = 186)**	
• Clean water	40	21.5
Knowledge of prevention		
• Dengue is preventable	184	92.0
Methods of prevention	**(n = 184)**	
• Prevent from being bitten by mosquitoes during daytime	165	89.7
• Prevent water-storage containers as breeding sites	80	43.5
• Keeping the household utensils neat and tidy	54	29.3
• Proper disposal of water-retaining discarded materials	35	19.0

*Columns do not add up to 100 percent due to single item, yes responses only

by mosquitoes during daytime. Conversely, knowledge of preventive measures against vector breeding was not high. Nearly 44% (80/184) knew about protecting water storage containers as breeding sites, and only 19% (35/184) knew how to carry out proper disposal of water-retainable discarded materials in the neighborhood. A majority attained the maximum score of '5' in the knowledge sub-score of 5 items related to dengue transmission (170/200, 85%). However, their mean knowledge sub-score on dengue vector breeding sites was not high, and their mean knowledge sub-score on five specific preventive measures focused on

container management was only 2.2 ± 0.69. The mean knowledge score of 20.5 ± 2.3 for all knowledge items was low in the study households. The overall reliability coefficient for 37 knowledge items was 0.8, which indicated that the responses were reliable.

The respondents mentioned the channels that they had received messages from on dengue as follows: health personnel (114/200, 57%) and audio-visual materials (61/200, 30.5%). They mostly preferred health personnel as risk communicators (189/200, 94.5%). The findings indicated the confidence and trust of the householders towards health personnel as risk communicators in conveying comprehensive dengue-related information. Among those who knew how to prevent breeding of mosquitoes in water storage containers, 65% (52/80) said that they should discard the water at least once a week. Only 35% (28/80) knew that proper covering of the water containers was necessary to prevent dengue vector breeding. Nearly 78% could cite the requirement to discard the water stored for more than 7 days. The least-known practices were the application of ABATE (Temephos) for larviciding and the requirement of thorough cleaning/scrubbing of the inside of the containers (<15%). Nearly 81% of households had few to abundant water-retainable discarded materials in their compounds, according to observations. Nearly 30% of respondents preferred special garbage bags to store the water-retainable discarded materials before systematic disposal, followed by turning them upside down and burial (Table 2).

Attitudes and risk perceptions

Around 75% (150/200) of the respondents acknowledged that all household members were responsible for the reduction of dengue vector breeding sites. The respondents' attitudes towards the seriousness of dengue attained high scores (Table 3) such as *"Dengue is life-threatening"* (8.84 ± 1.53), and *"Consequences of dengue as a serious concern"* (9.64 ± 6.62). The respondents scored high for perceived efficacy towards "*Ability to carry out effective vector control at home*" (7.25 ± 2.13). In the area of prevention of dengue, they scored high for *"Perceived effectiveness to prevent dengue by controlling vector breeding sites"* (7.61 ± 2.02), and *"Perceived effectiveness to prevent dengue at places where children gather during daytime"* (7.75 ± 2.19). However, they gave low scores especially for *"Own chance of being infected by dengue*" (4.19 ± 2.35), *"Possibility of reinfection"* (5.39 ± 2.52), and *"Possibility of severity when reinfected"* (6.08 ± 2.52) (Table 3).

Water storage patterns and container management practices

Nearly 96% of the study households stored water for domestic use and drinking purpose in 459 containers, an average of 2.4 ± 1.2 containers per household (range 1 to 8). They were filled by river water, either piped in or carried manually from the small reservoir in the ward (314/459, 68.4%), rain water (126/459, 27.5%), and water from tubewells (19/459, 4.1%). Of these, we elaborated on the storage of rainwater, which mostly favoured dengue vector

Table 2: Knowledge of management of water storage containers, presence of water-retainable discarded materials in premises during the survey and preferences

Characteristic*	No.	%
Container management to prevent from becoming the breeding site	**(n = 80)**	
• Discarding water at least once a week	52	65.0
• Proper covering of the water container	28	35.0
• Discarding water stored for more than 7 days	62	77.5
• Application of chemical larvicide (ABATE)	10	12.5
• Thorough cleaning of inner part of the container	2	2.5
• Placing larvae-eating fish	24	30.0
Water-retainable discarded materials (Observations)	**(n = 200)**	
• Abundant	29	14.5
• Few	132	66.0
• Absent	39	19.5
Preferred methods of disposal for water-retaining discarded containers	**(n = 35)**	
• Special garbage bag	10	28.6
• Turning upside down	9	25.7
• Burial	9	25.7
• Burning and throwing out into the river	4	11.4
• Discarded at the public dumping site	3	8.6

*Columns do not add up to 100 percent due to single item, yes responses only

breeding. Among the 126 rain-filled containers, metal and plastic drums were common (39/126, 30.9%) and 102/126 (81%) of containers were kept outdoors (Table 4). The householders stored rainwater outdoors in 51% (52/102) of the cement tanks and ceramic jars. Only 42% (14/33) of the cement tanks and 67% (22/33) of the ceramic jars had complete covering. The rain-filled large cement tanks were mainly located outside (29/33, 87.9%). The householders reported that they changed water only in 26% (24/33) of these tanks within seven days. Moreover, 75.8% (25/33) of the inner surfaces of the cement tanks were not scrubbed when changing the water. Therefore, the likelihood of these tanks becoming

Table 3: Attitudes and risk perceptions related to dengue

Attitudes and risk perceptions	Mean ± SD	Range
Attitudes		
Dengue infection is life-threatening	8.84 ± 1.526	1-10
Consequences of dengue as a serious concern	9.64 ± 6.619	1-10
Risk perceptions		
Own chance of being infected by dengue	4.19 ± 2.354	1-10
Possibility of dengue infections in other children if there is one infected child at home	5.39 ± 2.524	1-10
Possibility of dengue infection at home if in the vicinity of 10 houses that had dengue	5.20 ± 2.159	1-10
Possibility of reinfection	5.66 ± 2.225	1-10
Possibility of severity when reinfected	6.08 ± 2.520	1-10
Perceived effectiveness to prevent dengue by controlling vector breeding sites	7.61 ± 2.020	1-10
Ability to carry out effective vector control at home	7.25 ± 2.128	2-10
Perceived effectiveness to prevent dengue at places where children gather during daytime	7.75 ± 2.199	1-10
Perceived willingness to participate regularly in ward cleanup activities	6.42 ± 2.671	1-10

key breeding sites for *A. aegypti* increased (Table 4). The findings supported application of specific mechanical, chemical and biological control measures to prevent dengue vector breeding in key containers.

On the other hand, challenges faced by the ward administrative authorities and basic health staff while mobilizing dengue vector control efforts were described in the following words:

> *"Whenever we asked householders to discard the water if we found larvae and pupae in it, they were reluctant to do so. They had to buy water out of their own pockets". (Ward authority)*

> *"People are very poor. They can't spare sufficient time for cleaning the water containers, as they try hard to make their ends meet". (Midwife)*

"It's more convenient for us to put ABATE in the water containers rather than persuading householders for effective container management". (VBDC personnel)

Discussion

In this study, 8% of the surveyed households with reported hospitalization reflected the severity of the dengue infection. Others might have had sub-clinical infection which was uneventful, hence increasing the risk of having a more serious infection later.[3] This study focused on behavioural determinants and potential dengue vector breeding sites that may increase the risk of transmission in the locality, accentuated by inadequate water supply and water storage practices. After the commencement of the river water distribution project which included the construction of a small reservoir to collect water from Attaran river, the problem of water scarcity in the study site has been overcome, since 2009. The regional administrative authorities and municipal services provided technical and financial assistance, with partial cash contributions made by the householders. However, people continued to store the rainwater which was preferred over the river water due to its cleanliness. Thus, dengue transmission continued in the locality due to the presence of potential breeding sites.

A majority (92%) of the respondents acknowledged that dengue infection was preventable. Yet, their mean knowledge score on five specific preventive measures was only 1.84 ± 0.77. However, the householders expressed a positive attitude toward accepting the life-threatening nature of dengue and the seriousness of its consequences. On the other hand, their misconceptions about contracting dengue may lead to an increase in more severe forms of dengue infection. Moreover, heavy rainfall in the area multiplied the favourable conditions for vector breeding in and around premises.[3] Low level of knowledge among householders related to dengue vectors and infection highlighted the need for more comprehensive risk communication through innovative approaches. Their positive attitudes may act as a trigger when arranging for community advocacy to strengthen risk communication, targeting householders in vulnerable areas.

Risk perception is an individual's perception of the magnitude of the risk.[5] In this study, the score for perceived efficacy in controlling dengue vector breeding sites was high but was not consistent with adequate container management practices, especially regular changing of the water. Though several KAP studies on dengue in Asia and Latin America have disproved this linkage,[11-14] in this study the householders' knowledge and risk perceptions towards dengue infection are of great importance, offering the potential for improved container management and reduction in pupal and larval productivity, which is supported by recently completed multi-country study on eco-bio-social research for dengue vectors.[15]

The knowledge-to-action gap was found especially in the regular changing of water within seven days. Around 65% of the respondents knew this specific requirement and 44% put it into actual practice. The programme personnel and ward administrators noticed that the

householders were reluctant to change water regularly due to economic reasons. Besides, poor knowledge (2.5%) about the need for cleaning the inner part of the water storage containers may have a link with the low percentage (22.4%) of householders scrubbing the interior of rain-filled cement tanks (Table 4). The presence of larvae and pupae of *Aedes* mosquitoes required inspection, together with the KAP study. But owing to financial and operational constraints, this activity could not be included in the present study.

Rainwater storage in both indoor and outdoor containers increased the chances of becoming potential vector-breeding sites. Large cement tanks were found to be the most productive type of water-holding containers, which is already documented in VietNam.[11] Therefore, rain-filled large cement tanks in this study, which were without appropriate container management, were subjected to biological control or regular chemical control.[16] In southern VietNam of the Mekong Delta, in response to water infrastructure projects, the storage of rainwater was based upon their perceptions of cost, quality and security of supply.[17] Likewise, apart from the piped water available from the Attaran river water distribution project, rainwater is still being used. Using both rainwater and river water without adequate household water treatment and safe storage facilities might result in the double burden of diarrhoea and dengue. This issue calls for putting in place integrated services as outlined in integrated vector management principles.[18]

In addition, unsatisfactory disposal of water-retaining discarded materials may lead to more dengue vector breeding. Thus, we also need to put emphasis on improvement in household waste disposal and ward waste collection system apart from improved water storage practices. In this context, efforts to prevent dengue transmission by enlisting householders' involvement require intensification. For example, fully empowered, environmental friendly, ward-based multistakeholder partner groups and trained volunteers successfully carried out inspection and removal of dengue vector breeding sites together with environmental management in periurban households of Yangon Region.[16] Such actions may encourage less reliance on chemical control, which is costly and likely to face householders' resistance.[1]

Conclusion and recommendations

Despite the river water distribution project, the storage of rainwater being preferred for its cleanliness may become potential dengue vector breeding source, particularly when stored in outdoor containers under the shade. There was an exposure to IEC messages, but the corresponding knowledge level of householders did not increase much. Their misconceptions about the risk of dengue infection still existed. However, householders in the study site accepted dengue infection as a matter of serious concern. They needed motivation which can be enhanced through an improved understanding of the risk of dengue infection and active engagement in the management of water storage containers as well as water-retainable discarded materials. Barriers in the way of prevention and control of dengue vector breeding and the overriding concerns of the community should be addressed through advocacy

at various levels. Greater emphasis should be placed on multisectoral collaboration and coordination in the use of advocacy as a communication tool for community engagement. This will complement effective and sustained integrated vector management efforts in vulnerable areas.

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