International Journal of Public Health Asia Pacific

Open Access: e-Journal
ISSN: 2822-0587(Online)

Improving awareness on household flood preparedness and flood-related communicable diseases among students from high schools in Yangon Region, Myanmar

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ABSTRACT

Background: Rainfall-related, river-related, and coastal flooding are expected to be found at Yangon City in upcoming years with increasing climate change and sea level rise. Moreover, outbreaks prone infections can occur during and after flooding. Active participation of youth in flood hazard preparedness can promote overall personal, family, and community resilience.

Objectives: To improve students' awareness on household flood preparedness and flood-related communicable diseases.

Methods: Quasi-experimental study was conducted at two high schools from Kyeemyingdaing and Pazundaung townships. The health education package included health talks and poster displays for students from the intervention group. Data collection was done before and one month after health education. To assess and compare the awareness of students, the difference in difference (DID) was calculated and the effect of the intervention was analysed by multiple linear regression analysis using STATA.

Results: Awareness scores between the two groups were not different before the intervention. The awareness score difference between before and after intervention in the intervention group was significantly larger than that of the control group (DID) with mean different scores on flood preparedness, 1.13; flood-related infection, 2.23; and overall awareness, 3.36 respectively. The overall awareness among students from the intervention group was 3.4 scores higher than those from the controls (95% CI 2.4-4.3, $p<0.001$).

Conclusion: The awareness of household flood preparedness and flood-related communicable diseases was improved significantly among the students from the intervention groups with higher scores than that of the control groups. Therefore, this health education package can be applied in other schools from flood-prone areas to improve the awareness of students.

Keywords: Awareness, Communicable diseases, Flood, Myanmar, Students

1. Introduction

In Yangon, the coastal surges coinciding with high tides and high river levels during the monsoon season are the most dominant flood drivers. Because of sea level rise, rainfall-related, river-related, and coastal flooding is expected to be found in Yangon City in upcoming years [1]. The Yangon River flows from North to South by passing through the centre of Kyeemyingdaing township and Pann Hlaing River also flows into the Yangon River within this township [2]. In Pazundaung township, there is a 21cm alarming point of Yangon River and Pazundaung Creek pass through, which has an up-and-down flow of tidal water [3]. Therefore, people from these townships are threatened by the risk of flooding especially during monsoon season.

Floods can cause life-threatening injuries as well as lead to many impacts in terms of social, economic, and financial issues in the affected communities [4-6]. Contact with contaminated water, poor sanitation, overcrowding, increased vector breeding sites, animal displacements, and the presence of dust or molds are major risk factors for post-disaster disease transmission [7, 8]. To reduce flood-related hazards, flood preparedness plays an important role and household-level readiness is the essential component to respond effectively [9]. Meanwhile, the active engagement and the roles of youths are essential for disaster risk reduction and overall personal, family, and community resilience in the future [10].

Schools have become important areas to facilitate resilience and reduce disaster risk by providing education and preparedness programs [11, 12]. Through the training of school children, not only their knowledge of disaster risk can be improved, but also sharing information within their household can be enhanced [13, 14]. In Myanmar, flood information is not widely disseminated at schools. There are limited interventional studies concerning awareness of flood hazard and preparedness among school children. This study aimed to improve students' awareness of flood preparedness and flood-related communicable diseases.

2. Methods

2.1 Study Area

Kyeemyingdaing and Pazundaung township, Yangon Region

2.2 Study Design

School-based quasi-experimental study

2.3 Sample size and sampling

The calculated sample size was 232 by consideration of the design effect of 2, estimated 15% drop out rate and using mean knowledge scores among intervention and control groups (5.8±1.5 vs 4.5 ±1.7) for the type of flood-related communicable diseases from the study done in Malaysia [15]. Multistage sampling method was applied. Stage 1: To prevent the contamination effect of the intervention, the schools were selected purposely from two different townships as intervention and control sites. Stage 2: From the total of six high schools in the intervention area and four high schools in the control area, one school from each township was chosen. Stage 3: From each school, 116 students from grade 7 to 11 were assigned by convenient sampling using the registered students list.

2.4 Data Collection

Data collection was done from December 2022 to February 2023. Before the data collection, an advocacy meeting with the health staff from the Township Health Department; and teachers from selected high schools was held to explain the intervention procedures of the research. Survey questionnaires included the students' sociodemographic characteristics, understanding of the items required for household flood preparedness, and knowledge regarding flood-related communicable diseases. Pretesting was carried out among twenty students in a high school from Dagon township. For testing awareness questions, Cronbach alpha was calculated and the resulting value of 0.82 indicated a reasonable level of internal consistency and reliability. For data collection, pretested self-administered survey questionnaires were used to assess students' awareness of household flood preparedness and flood-related communicable diseases in both groups.

Intervention procedures

Health education package included health talks and poster displays for students from the intervention group. Health talks took about 45 minutes to give the messages included in poster followed by 10 minutes session to show the materials involved in the first aid kit. The posters covered items included in an emergency kit such as emergency warmth and shelter, food, water, tools, batteries, personal sanitation, battery-powered radio/or cell phone, first aid kit, and information of evacuation personnel, as well as information related to flood-related communicable diseases. Students from the control group

received routine classroom lessons according to the school curriculum. One month after health education intervention, end line data was collected to assess awareness on household flood preparedness and flood related communicable diseases in both groups.

2.5 Data Analysis

Data analysis was done by STATA 15.1 version (Single-user Stata perpetual license: 401506368524). There were 12 items assessing awareness on flood preparedness and 9 items about flood related communicable diseases. The response to "Yes" was scored "1" and response as "No" and "don't know" were given as score "0". The range of score was from "0" to "21" for overall awareness. Awareness of students was scored describing the summary statistics, and to determine the associations between categorical variables, Chi-squared test or Fisher's exact test was used. To assess and compare the awareness of students, paired t test, independent t test and difference in difference (DID) were calculated. Being a quasi-experimental design, a propensity score was generated for valid and counterfactual comparison groups because there was a significant difference in some background characteristics between the two groups. Firstly, the score was developed and then it was used as a covariate for adjusting baseline characteristics [16]. Then, the effect of intervention was shown by multiple linear regression analysis by different models, and a p-value less than 0.05 was considered statistically significant. The fitness of the models was determined by the values of Constant, R-squared, AIC, and Likelihood ratio Chi-square. Constant value allowed to evaluate the impact of an independent variable on a dependent variable while assuming no change in other independent variables. The R-squared value represented how much of the total variation in the dependent variable was explained by the independent variables and the larger the R-squared indicated the better the model fitness. Akaike Information Criterion (AIC) value showed the model adequacy and fitness of different models and the lower the value the more the model fits. Likelihood ratio Chi-square was used to compare the fitness of two nested models and assumed that model with lesser variables was better than the model with more variables.

2.6 Ethical Clearance

Ethical approval was received from the Research and Ethics Committee of University of Medicine (1), Yangon with the Human Research Ethics Certification

Number of "20/UM1, REC.2022" on 28.11.2022.

3. Results

The final analysis included 211 students with 9% drop out rate. Table 1 showed the background characteristics of the students from two different groups. In both groups, more than half of students were aged from 13 to 15 years and female to male ratio was approximate to one. More than 70% of students came from Grade 9 to 11 in both groups. Among the students, 93.5% from the intervention groups and 86.4% from the control group were currently living with parents. However, the proportion of students from the control groups living under the guardian of grandparents and other person was significantly higher than that from the intervention group. Regarding education of guardian, 35% in control group was found to be middle and below level while only 10.2% of guardian from intervention group was within these levels. In both groups, majority of student' guardians were working own jobs. Although there was similar background in receiving information about household flood preparedness in two groups, the history of exposure to disaster at least once in the lifetime was significantly higher in the control group (41.8%) than the intervention group (19.4%).

Table 1: Background characteristics of students (n=211)

Characteristics	Intervention group (n=108)		Control group (n=103)		p-value*
	n	%	n	%	
Age (year)					0.693
13 to 15	60	55.6	60	58.3	
16 to 17	48	44.4	43	41.8	
Sex					0.817
Male	51	47.2	47	45.6	
Female	57	52.8	56	54.4	
Level of education					0.323
Grade 7 and 8	25	23.2	30	29.1	
Grade 9 to 11	83	76.8	73	70.9	
Living with parents					0.085
Yes	101	93.5	89	86.4	
No	7	6.5	14	13.6	
Type of guardian					0.044
Father	50	46.3	51	49.5	
Mother	52	48.2	36	35.0	
Grand parents	2	1.8	9	8.7	
Uncle/Aunt/Others	4	3.7	7	6.8	
Education of guardian					<0.001†
Illiterate	0	0	4	3.9	
Primary	4	3.7	6	5.8	
Middle	7	6.5	26	25.2	

Characteristics	Intervention group (n=108)		Control group (n=103)		p-value*
	n	%	n	%	
High	34	31.5	53	51.5	
University and above	63	58.3	14	13.6	
Occupation of guardian					0.164
Dependent	23	21.3	22	21.4	
Government staff	25	23.2	12	11.7	
Non-government staff	11	10.2	13	12.6	
Own job	49	45.3	56	54.4	
History of exposure to disaster at least once in the lifetime	21	19.4	43	41.8	<0.001
Receiving information about household flood preparedness	46	42.6	34	33.0	0.152

*Chi-squared test; †Fisher's exact

Table 2 showed the awareness of household flood preparedness and flood-related communicable diseases before and after intervention. There were no significant differences between the two groups apart from awareness of tools such as flashlights, duct tape, and rope as necessary items for flood preparation to make households and homes safer from flood disaster (74.1 Vs 86.4, *p* 0.025) and hand washing as the importance for prevention of flood-related communicable diseases (13.9 Vs 27.2, *p* 0.017). After the intervention, apart from awareness on information of evacuation personnel as necessary items for flood preparation to make households and homes safer from flood disaster, all other awareness information were significantly more among the students from the intervention group than the control group.

Table 2: Awareness of students before and after intervention

Awareness	Before intervention					After intervention				
	Intervention group (n=108)		Control group (n=103)		p* value	Intervention group (n=108)		Control group (n=103)		p-value*
	n	%	n	%		n	%	n	%	
Any flood preparation makes households and homes safer from flood disaster	56	51.9	55	53.4	0.822	59	*54.6*	75	72.8	0.033
Necessary items for flood preparation to make households and homes safer from flood disaster										
Warmth and shelter	97	89.8	86	83.5	0.176	104	96.3	80	77.7	<0.001
Food – for ready to eat	104	96.3	97	94.2	0.468	106	98.2	95	92.2	0.034
Drinking water	105	97.2	100	97.1	0.953	106	98.2	95	92.2	0.034
Tools as flashlight, tape, rope	80	74.1	89	86.4	*0.025*	102	94.4	88	85.4	0.017
Batteries	83	76.9	77	74.8	0.722	101	93.5	77	74.8	<0.001
Battery-powered radio/cell phone	96	88.9	88	85.4	0.453	105	97.2	87	84.5	0.002
Personal sanitation such as toothbrush, paste, hand gel, soap	70	64.8	63	61.2	0.583	101	93.5	73	70.9	<0.001

Awareness	Before intervention					After intervention				
	Intervention group (n=108)		Control group (n=103)		p* value	Intervention group (n=108)		Control group (n=103)		p-value*
	n	%	n	%		n	%	n	%	
First aid kit – bandages, gauze, tape, alcohol pad, medicines, mask, glove	104	96.3	97	94.2	0.468	105	97.2	92	89.3	0.017
Personal identity card	90	83.3	84	81.6	0.734	102	94.4	86	83.5	0.007
Information of evacuation personnel	95	87.9	93	90.3	0.588	104	96.3	95	92.2	0.091
Receiving training for prevention of flood risk	93	86.1	87	84.5	0.736	103	95.4	80	77.7	<0.001
Being aware of flood related communicable diseases	73	67.6	75	72.8	0.407	99	91.7	77	74.8	0.001
Type of flood related communicable diseases										
Water borne	54	50	49	47.6	0.724	88	81.5	57	55.3	<0.001
Water wash	18	16.7	16	15.5	0.823	48	44.4	23	22.3	0.001
Vector borne	72	66.7	56	54.4	0.068	88	81.5	57	55.3	<0.001
Rodent borne	16	14.8	13	12.6	0.644	65	60.2	20	19.4	<0.001
Important things for prevention of flood related communicable diseases										
Hand washing	15	13.9	28	27.2	*0.017*	60	55.6	27	26.2	<0.001
Safe drinking water	67	62.0	50	48.5	0.049	89	82.4	60	58.3	<0.001
Personal hygiene	26	24.1	37	35.9	0.060	77	71.3	33	32.0	<0.001
Environmental sanitation	52	48.2	58	56.3	0.235	76	70.4	59	57.3	0.048

*Chi-squared test

Awareness on both household flood preparedness and flood-related communicable diseases were not different between intervention and control groups before the intervention (Table 3). After the intervention, awareness on household flood preparedness in the intervention group (11.2 ± 3.6) was significantly higher than the control group (9.6 ± 4.5), and the difference in difference of mean score between before and after intervention (DID) was 1.13. Regarding the flood related communicable diseases, there was also significant difference between intervention and control groups (5.5 ± 2.5 Vs 3.3 ± 2.2, p <0.001) where DID was 2.23.

Table 3: Comparison of awareness score between two groups

Awareness score	Intervention group (n=108) Mean ± SD		Control group (n=103) Mean ± SD	p-value†
Household flood preparedness				
Before intervention	10.9 ± 0.2		10.8 ± 0.2	0.784
After intervention	11.2 ± 3.6		9.6 ± 4.5	**0.003**
DID		1.13		**0.005**
Flood related communicable diseases				
Before intervention	2.9 ± 1.9		2.9 ± 2.2	0.952
After intervention	5.5 ± 2.5		3.3 ± 2.2	**<0.001**

Awareness score	Intervention group (n=108) Mean ± SD	Control group (n=103) Mean ± SD	p-value†
DID	2.23		**<0.001**

† Independent sample t-test

In the comparison of the overall awareness score between intervention and control groups (Table 4), although there was no difference before the intervention, overall awareness in the intervention group was significantly higher than the control group after the intervention (17.5 ± 3.5 Vs 14.1 ± 4.2, *p* <0.001). Moreover, the score in the intervention group after the intervention became significantly higher than before the intervention (17.5 ± 3.5 Vs 13.9 ± 2.9, p <0.001). The mean score between before and after the intervention was found to be higher significantly in the intervention group than the control group (3.7 ± 3.8 Vs 0.3 ± 3.9, *p* <0.001). Therefore, the difference in difference mean score between the two groups was 3.36.

Table 4: Comparison of overall awareness score between two groups (n = 211)

Awareness score	Intervention group (n=108) Mean ± SD	Control group (n=103) Mean ± SD	p value
Before intervention	13.9 ± 2.9	13.8 ± 3.6	0.868†
After intervention	17.5 ± 3.5	14.1 ± 4.2	**<0.001**†
Mean difference between before and after intervention	3.7 ± 3.8	0.3 ± 3.9	**<0.001**¶
p value	**<0.001***	0.394*	
DID	3.36		**<0.001**

* Paired t test; † Independent sample t test, ¶ DID: difference in mean difference

Table (5) showed the results of linear regression analysis of overall awareness score on household flood preparedness and flood-related communicable diseases between two groups by three models: Model 1 (Crude model); Model 2 (Adjusted for awareness score before intervention); and Model 3 (Adjusted using propensity score). Different models revealed that students in the intervention group were more likely to have higher in overall awareness score regarding household flood preparedness and flood related communicable diseases. The constant value of models 2 and 3 were not so different and R-squared value was same between them. However, out of the three models, Model 2 had the lowest AIC value and model 2 nested in model 3 which met the assumption of the model with lesser variables was better than the model with more variables ($p = 0.308$). Therefore, model 2 was chosen as a best-fitted model where the

overall awareness among students from the intervention group was 3.4 scores higher than those from the controls (95%CI: 2.4-4.3, p <0.001).

Table 5: Multiple linear regression analysis to compare overall awareness score on household flood preparedness and flood related communicable diseases between two groups

Predictor variables	Overall awareness score on household flood preparedness and flood related communicable diseases		
	Model 1	Model 2*	Model 3†
	Coefficient(crude) [95%CI]	Coefficient (Adj) [95%CI]	Coefficient (Adj) [95%CI]
Control group	1	1	1
Intervention group	3.4 [2.4,4.5] [a]	3.4 [2.4,4.3] [a]	3.2 [2.1,4.4] [a]
Awareness score before intervention		0.5 [0.4,0.6] [a]	0.5 [0.4,0.7] [a]
Model Summary			
Constant	14.1 [a]	7.2 [a]	7.4 [a]
Adj R^2	0.16	0.31	0.31
AIC value	1172.5	1133.0	1136.0
LR Chi-square for testing: Model2 nested in Model3		**4.8, p = 0.308**	

[a] p <0.001, *Model adjusted for awareness score before intervention.
†Model using propensity score adjusting awareness score before intervention and background characteristics

4. Discussion

Health education was an important tool to improve health-oriented attitudes of people [17]. For disaster risk reduction, health education for vulnerable people in the community including children is vital and operational [18, 19]. By educational training, knowledge and competency for disaster preparedness of the targeted community can be increased [20, 21]. The current interventional study provided health education consisting of health talks and displaying posters to improve students' awareness of household flood preparedness and flood-related communicable diseases. There was evidence that individual knowledge about the environment and experiences were related to disaster preparedness [22, 23]. In this study, there was more history of exposure to disaster during a lifetime in the control group than in the intervention group. Therefore, their previous exposure to flooding might lead to higher awareness of flood preparation to be safe from the disaster, than the students from the intervention group. Although the previous exposure to disaster could be an explanatory factor on the result of the intervention, the effect of health education intervention could be proved by the regression model with propensity score adjustment that showed the

awareness level after the intervention was higher among the intervention group.

For disaster management, the role of an evacuation plan and close contact with the evacuation personnel are essential requirements [24]. In the current study, awareness of the need for information on evacuation personnel for preparation of flood risk reduction was not significantly different between the two groups. This finding pointed out that students from both groups had limited information about evacuation and were not very familiar with local evacuation personnel. Although students from the control group were more aware of tools such as flashlights, tapes, and ropes for preparation of flood risk reduction before the intervention, the awareness score on these requirements became significantly higher among the intervention group than the controls after the intervention. This finding highlighted that not only giving information but also showing visual aids such as posters and the materials involved in first aid kits for flood preparedness during health education sessions were effective in improving the awareness of students. Similarly, the pre-test and post-test interventions by showing picture cards to school-age children in Indonesia revealed that post-intervention knowledge of fire disaster response was significantly increased [25].

Other awareness scores on household flood preparedness increased significantly after the intervention, among the students from the intervention groups. Moreover, the awareness of household flood preparedness among students from the intervention group was significantly higher than the control group. The findings were consistent with the cluster randomized trial to increase flood disaster preparedness in Malaysia where the knowledge of the community from the intervention group was effectively improved by providing an education program composed of health talks and displaying posters [26]. Another quasi-experimental study in Turkey also pointed out the positive effect of disaster education using discussion, visual materials, and interactive teaching on improving school children's awareness of preparedness [27].

Regarding flood-related communicable diseases, the awareness of students from the intervention group was distinctly higher than the control after the intervention and this finding was consistent with non-randomized community trials in Malaysia [15]. Because of the urgency to prevent infection during the COVID-19 pandemic, the adherence to hand

hygiene practices within the community has improved globally [28-30]. Therefore, higher awareness of hand washing for the prevention of communicable diseases was indistinctly found within the control group before the intervention. Alternatively, this awareness being significantly higher in the control group pointed out the successful effect of the health education intervention to improve the children's awareness level to prevent flood-related infection.

After the intervention, the overall combined awareness score of household flood preparedness and flood-related communicable diseases among the students from the intervention group was significantly higher than that of students from the control group. Based on these findings, health education interventions that included health talks added with relevant demonstrations and displaying posters for some periods were effective in improving the awareness level of students from high schools.

Because of the nature of interventional design, the generalizability of the findings was limited. The study was conducted during the reopening time of Basic High Schools shortly after the COVID-19 pandemic, the number of students who reattended schools was not enough to use systemic random sampling using the sampling frame and therefore the convenient sampling had to be applied to meet the calculated sample size. There were some different background characteristics between the two groups, but it was adjusted by developing a propensity score for regression analysis.

5. Conclusion

The school-based health education package on household flood preparedness and flood-related communicable diseases was a successful intervention to improve the awareness of students from high schools. Moreover, the use of visual aids like posters and the materials involved in first aid kits for disaster preparedness during health education was an effective way to improve the awareness of school children. Therefore, the health education package used in this study can apply to students from high schools located in other flood-prone areas to reduce flood-related risk by improving their awareness of household flood preparedness and flood-related communicable diseases.

Acknowledgment

We would like to deeply acknowledge the Ministry of Health and Department of Medical Research for giving the grant. Special thanks go to the respective authorities for permission of data collection; and

students from selected high schools for participating in this research.

Conflict of interest

Non conflict of Interest.

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