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## Acceptance and Adequacy of Water Supply Among Flood Victims at the Temporary Evacuation Centres in Kuala Krai, Kelantan, Malaysia

Koh Liew See, Nasir Nayan, Hanifah Mahat, Yazid Saleh,  
Mohmadisa Hashim

Department of Geography and Environment, Faculty of Human Sciences, Sultan Idris Education  
University Malaysia

### Abstract

This article discusses the analysis of water supply acceptance and adequacy among flood victims at the Kuala Krai Temporary Evacuation Centres (TECs) in Kelantan, Malaysia. This study applied a quantitative approach using questionnaire. A total of 300 flood victims were randomly selected. The aspects being measured were the types of water resource acceptance as well as the adequacy of water supply according to four main types of domestic activities at the TECs, namely drinking, cooking, bathing and washing. The analysis used was descriptive analysis, a cross-tabulation test to assess the relation of water supply adequacy to respondents' profile and the selected TECs. The findings showed that the bottled/mineral water acceptance by the flood victims was insufficient for drinking and cooking purposes, while the acceptance of rainwater as a water supply for bathing and washing was sufficient. The findings also show that the water supply was insufficient for drinking (84.96%), cooking (85.84%), bathing (61.06%) and washing (53.10%) for female compared to male. Similarly with the married respondents who claimed that water supply was inadequate for all types of domestic activities such as for drinking (74.29%), cooking (66.29%), bathing (53.71%) and washing (50.29%), compared to the unmarried and widowed. Based on TECs, more attention should be given to the water supply at SMK Laloh and SK Kuala Gris as the majority of respondents (>52.17%) stated that the water supply was insufficient for carrying out all domestic activities, compared to SMK Sultan Yahya Petra 2 and SMK Manek Urai Lama. Therefore, water supply management during flood disasters is urgently needed to deal with insufficient water supply issues by increasing the efficiency of water supply distribution so that the Kuala Krai flood victims can get sufficient water supplies at the TECs despite being hit by major floods.

**Keywords:** Acceptance, Adequacy, Water Supply, Flood

### Introduction

A clean water supply plays an important role as a major resource in human life to carry out domestic activities, especially for cooking, drinking and washing. Therefore, management plays an important

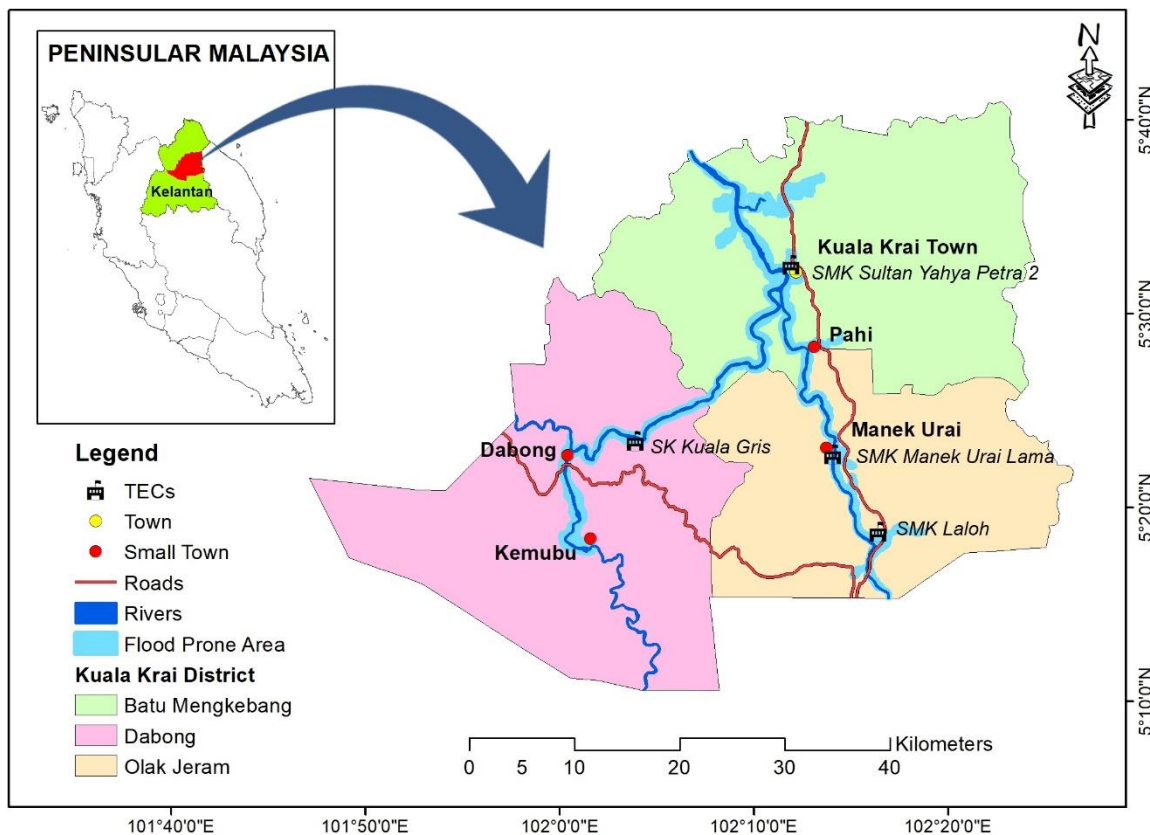
role to ensure the quality of clean water supplies and sufficient for user consumption. However, ensuring the adequacy of clean water supplies during floods is difficult if there is no systematic management to ensure that clean water supplies are continuously distributed during flood disasters. This is due to the rising of flood water levels which causes damage to the water supply facilities and water treatment plant equipment (Sharad et al., 2007; Abbas & Routray, 2014; Linscott, 2007; Shimi et al., 2010; Mahmood, 2004) resulting in water supply being shut off. Such condition will result in flood victims not having sufficient clean water supplies during floods, which prompts the flood victims to use water with unknown hygienic status. Indirectly, many water-borne infectious diseases occur during floods such as malaria, cholera, eye diseases and skin diseases (Few et al., 2004; Abbas & Routray, 2014).

The monsoon floods have gained full attention in Malaysia, especially in the east coast of Peninsular Malaysia such as Kuala Krai, Kelantan. Among the areas under Kuala Krai District that are often exposed to floods are Kuala Krai town, Pahi, Manek Urai, Lela Jasa and Dabong as these areas are low areas situated along Sungai Kelantan. The main factor that causes the area to flood is the monsoon season heavy rain resulting in the overflow of Sungai Kelantan, Sungai Lebir and Sungai Galas (Department of Town and Country Planning, 2011). During floods, the water supply aspect is the issue that needs to be addressed by the authorities, especially those responsible for flood disaster management in Kuala Krai. It is important to ensure that the flood victims evacuated at the TECs are provided with clean and sufficient water supplies. However, the flood victims are often faced with the problem of insufficient water supply during floods. Due to the lack of clean water during flood, the flood victims have to resort to using water with unknown quality status such as flood water for domestic activities (Shimi et al., 2010).

This situation is evident when the Kuala Krai District was hit by a major flood in 2014 known as "Bah Kuning" (yellow flood) (Wan et al., 2015; Kamarul et al., 2015). The flood had caused the flood victims who were transferred to the temporary evacuation centres (TECs) to be disconnected from the authorities to the extent that it disrupted the supply of basic needs for the flood victims due to the increase in river water levels, including clean water supply. The highest levels of river water recorded that year for Sungai Galas in Dabong was 46.47 meters (dangerous level: 38 meters), Sungai Lebir in Tualang was 42.17 meters (dangerous level: 35 meters) and Sungai Kelantan was 34.17 meters (dangerous level: 25 meters) (eBanjir Negeri Kelantan, 2015). These difficulties had caused the flood victims to face insufficient water supply at the TECs and exposed them to water-borne diseases if they were to use contaminated water such as flood water for domestic activities. The major flood event in 2014 was reported to have 458 cases of leptospirosis occurring in Kelantan (Ministry of Health Malaysia, 2015). Because of that, the aspect of water adequacy plays an important role in ensuring that the flood victims can carry out their usual domestic activities at the TECs. Therefore, this article will discuss the acceptance and adequacy of water supply as well as the relation of water supply adequacy based on the profiles of the respondents and the TECs.

### **Study Area**

This study was conducted in Kuala Krai District, Kelantan, Malaysia, focusing on four selected TECs, namely SMK Sultan Yahya Petra 2, SMK Manek Urai Lama, SMK Laloh and SK Kuala Gris (Figure 1). This is because the four TECs were the TECs affected during the flood and had the highest number of flood victims.



**Figure 1. Location of Selected TECs**

### Research Methodology

The research approach applied was quantitative. This study used a questionnaire to measure water supply acceptance and adequacy among the flood victims at the selected TECs. Respondents live in selected TECs approximately a week more. The questionnaire consisted of three sections, namely respondents' background (Section A), types of water resource acceptance (Section B) and water supply adequacy based on four main domestic activities at TECs which are drinking, cooking, bathing and washing (Section C). Content validity was carried out on the items constructed with the help of the experts in statistics and hydrology to see the extent to which the measurements made represent the content needed to be measured (Chua, 2014). Besides, the reliability of the research instrument was also measured to assess the stability or accuracy of the instrument constructed.

The results of the pilot study on 30 respondents showed that the Cronbach's alpha reliability coefficients calculated using SPSS (Statistical Package for Social Science) were 0.831 with four items in Section B and 0.907 with four items in Section C. These values explain that the reliability of the research instrument is high and satisfactory. Determination of the sample size was based on Krejcie and Morgan (1970) which involved 300 people from 1,020 families of flood victims who were transferred to four selected TECs. Table 1 shows the division of samples for four selected TECs. The sampling method used was simple random sampling. The analysis methods used in this study were descriptive analysis and cross-tabulation test. The cross-tabulation test was used in this study to identify water supply adequacy according to respondents' profiles such as the respondents' gender

and marital status. This is due to reason that the two aspects play an important role in examining the adequacy of water supply for domestic activities of the flood victims transferred. Besides, this test was also applied in examining the adequacy of water supply at four selected TECs. It would also be able to find out more about the types of water supply that need to be distributed to the flood victims at the TECs.

**Table 1. Sample Sizes for Four Selected TECs**

TECs	Population	Sample Size
SMK Sultan Yahya Petra 2	288	85
SMK Manek Urai Lama	450	132
SMK Laloh	79	23
SK Kuala Gris	203	60
Total	1,020	300

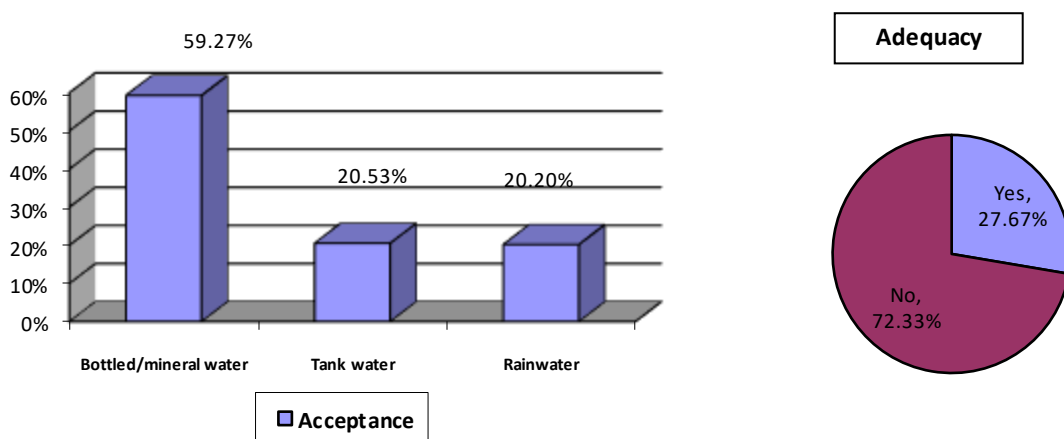
**Findings and Discussion**

**Profile of Respondents**

The majority of the respondents were male (62.30%) and the rest were female (37.70%). The survey results showed that most respondents were married (58.35%), followed by single status (31.35%) and widowed status (10.30%).

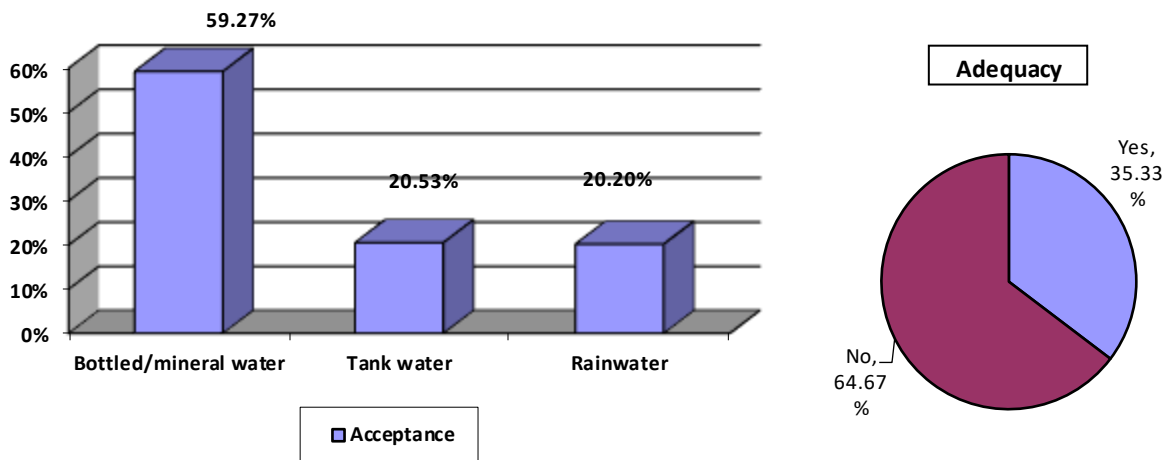
**Acceptance and Adequacy of Water Supply at the TECs**

Water supply use at TECs varies for every domestic activity such as drinking, cooking, bathing and washing. This section will discuss the types of water supply acceptance and adequacy at TECs. Figure 2 shows the types of water supply acceptance and adequacy for drinking purpose. The highest type of water supply acceptance for drinking was from bottled/mineral water at 59.27% , followed by tank water (20.53%) and rainwater (20.20%). However, most respondents stated that the water supplies for drinking were insufficient with a percentage value of 72.33%. This situation shows that the majority of the flood victims consumed bottled/mineral water for drinking, but it was insufficient to cater for the flood victims at the TECs during flood disaster.



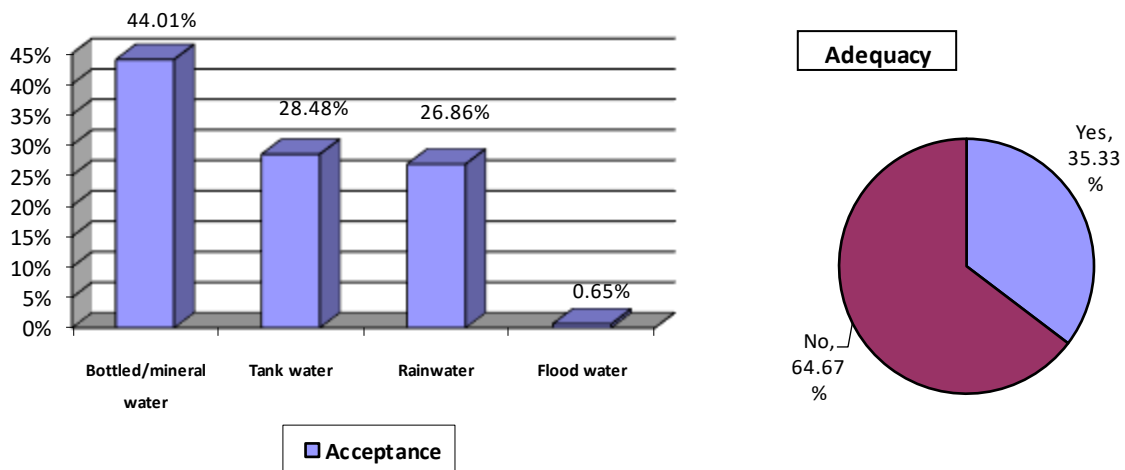
**Figure 2. The Types of Water Supply Acceptance and Adequacy for Drinking Purpose**

Besides that, Figure 3 shows the types of water supply acceptance and adequacy for cooking purpose. Bottled/mineral water recorded the highest value for cooking use of 44.01%, followed by tank water (28.48%), rainwater (26.86%) and flood water (0.65%). 64.67% of the respondents stated that the water supplies for cooking purposes were insufficient. This situation explains that the use of bottled/mineral water for cooking was insufficient to accommodate the cooking activities among the flood victims at the TECs during flood disaster.



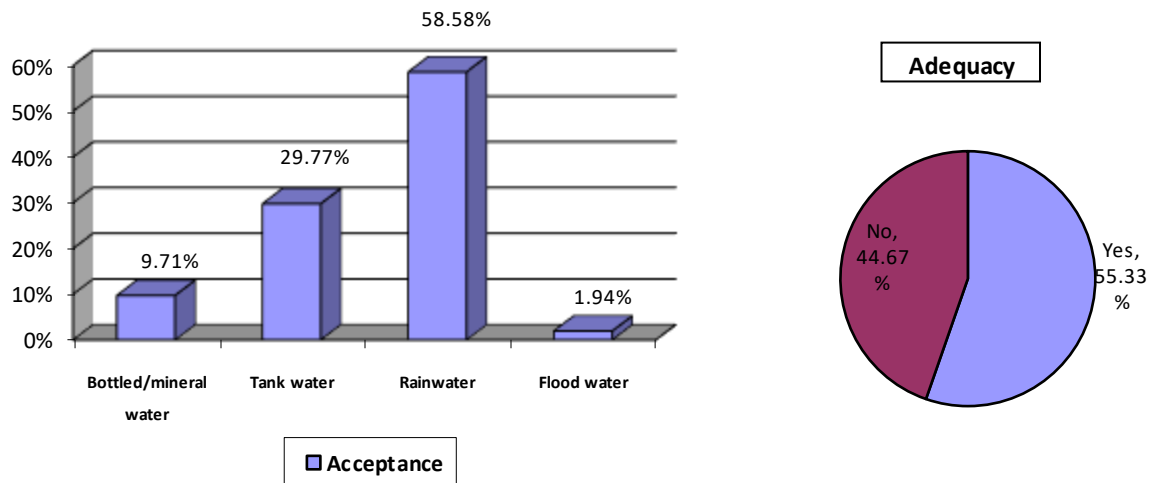
**Figure 3. The Types of Water Supply Acceptance and Adequacy for Cooking Purpose**

Figure 4 shows the types of water supply acceptance and adequacy for bathing purpose. The findings showed that most respondents used rainwater for bathing with a percentage value of 46.06%, followed by tank water (37.85%), bottled/mineral water (14.83%) and flood water (1.26%). In terms of adequacy, 51.00% of the respondents stated that the water supplies for bathing purposes were sufficient. This situation explains that most flood victims relied on rainwater for bathing and it was sufficient.



**Figure 4. The Types of Water Supply Acceptance and Adequacy for Bathing Purpose**

Meanwhile, Figure 5 shows the types of water supply acceptance and adequacy for bathing purpose. The results also show that most of the respondents used rainwater for washing which was 58.58%, followed by tank water (29.77%), bottled/mineral water (9.71%) and flood water (1.94%). The majority of the respondents stated that the water supplies for washing were sufficient with a percentage value of 55.33%. This situation explains that most of the flood victims used rainwater for washing activities which was sufficient.



**Figure 5. The Types of Water Supply Acceptance and Adequacy for Washing Purpose**

Overall, the results of the analysis indicated that the bottled/mineral water acceptance by the flood victims at the TECs was insufficient for drinking and cooking purposes. The findings of this study showed that more water supply assistance are needed, especially bottled/mineral water from the responsible parties to help the flood victims to use clean and safe water for drinking and cooking. This is because the use of contaminated water during floods can affect the health of the flood victims and increase the risk of the spreading of water borne diseases (Bariweni et al., 2012; Shimi et al., 2010). However, the acceptance of rainwater as a water supply for bathing and washing at the TECs was sufficient. This is because rainwater is a water resource that is easy to be obtained during monsoon season.

**Cross-tabulation test of water supply adequacy among flood victims**

The results of cross-tabulation test in Table 2 show that most male respondents stated that water supplies were insufficient for drinking (64.71%) and cooking (51.87%) purposes, but there were enough water supplies for bathing (58.29%) and washing (60.43%). While the female respondents stated that water supplies were insufficient for all purposes including for drinking (84.96%), cooking (85.84%), bathing (61.06%) and washing (53.10%). This situation explains that the bottled/mineral water aid for drinking and cooking was insufficient for male and female. As for the use of rainwater for bathing and washing, it was sufficient for male but not enough for female.

**Table 2. Cross-Tabulation Test Between Gender and Water Supply Adequacy**

Water supply adequacy		Gender				Total	
		Male		Female			
		N	%	N	%	N	%
Drinking	Yes	66	35.29	17	15.04	83	27.67
	No	121	64.71	96	84.96	214	71.33
Cooking	Yes	90	48.13	16	14.16	106	35.33
	No	97	51.87	97	85.84	194	64.67
Bathing	Yes	109	58.29	44	38.94	153	51.00
	No	78	41.71	69	61.06	147	49.00
Washing	Yes	113	60.43	53	46.90	166	55.33
	No	74	39.57	60	53.10	134	44.67

Note. N = frequency, % = percentage

According to the results of cross-tabulation test in Table 3 show that the respondents with single status stated that water supplies were insufficient for drinking (70.21%) and cooking (61.70%), but enough for bathing (57.45%) and washing (64.89%) purposes. As for the respondents who were married, they stated that water supplies were insufficient for all purposes including drinking (74.29%), cooking (66.29%), bathing (53.71%) and washing (50.29%). As for the widowed respondents, they stated that water supplies were insufficient for drinking (67.74%) and cooking (64.52%), but enough for bathing (58.06%) and washing (58.06%). This situation clearly shows that the respondents who had families required plenty of water supplies to accommodate the needs of family members at the TECs where bottled/ mineral water supplies were inadequate for drinking and cooking, and the use of rainwater was also inadequate for bathing and washing.

**Table 3. Cross-Tabulation Test between Marital Status and Water Supply Adequacy**

Water supply adequacy		Marital status						Total	
		Single		Married		Widowed			
		N	%	N	%	N	%	N	%
Drinking	Yes	28	29.79	45	25.71	10	32.26	83	27.67
	No	66	70.21	130	74.29	21	67.74	214	71.33
Cooking	Yes	36	38.30	59	33.71	11	35.48	106	35.33
	No	58	61.70	116	66.29	20	64.52	194	64.67
Bathing	Yes	54	57.45	81	46.29	18	58.06	153	51.00
	No	40	42.55	94	53.71	13	41.94	147	49.00
Washing	Yes	61	64.89	87	49.71	18	58.06	166	55.33
	No	33	35.11	88	50.29	13	41.94	134	44.67

Note. N = frequency, % = percentage

Besides that, the results of cross-tabulation test in Table 4 show that most respondents who were transferred to the TECs at SMK Sultan Yahya Petra 2 mentioned that water supplies were not enough for drinking (85.88%) and cooking (68.26%), but enough for bathing (51.76%) and washing (84.71%). Similarly, the respondents who were transferred to the TECs at SMK Manek Urai Lama



stated that water supplies were insufficient for drinking (55.30%) and cooking (52.27%), but enough for bathing (67.42%) and washing (65.15%). In addition, the respondents who were transferred to SMK Laloh and SK Kuala Gris claimed that the water supplies were not enough for all purposes. These findings explain that the water supplies at SMK Laloh and SK Kuala Gris were inadequate for all domestic activities at the TECs during floods, especially the water supply aid. While at the TECs of SMK Sultan Yahya Petra 2 and SMK Manek Urai Lama, the inadequacy was only for drinking and cooking purposes.

**Table 4. Cross-Tabulation Test between TECs and Water Supply Adequacy**

Water supply adequacy		TECs								Total	
		SMK Sultan Yahya Petra 2		SMK Manek Urai Lama		SMK Laloh		SK Kuala Gris			
		N	%	N	%	N	%	N	%	N	%
Drinking	Yes	12	14.12	59	44.70	8	34.78	4	6.67	83	27.67
	No	73	85.88	73	55.30	15	65.22	56	93.33	214	71.33
Cooking	Yes	27	31.76	63	47.73	9	39.13	7	11.67	106	35.33
	No	58	68.26	69	52.27	14	60.87	53	88.33	194	64.67
Bathing	Yes	44	51.76	89	67.42	11	47.83	9	15.00	153	51.00
	No	41	48.24	43	32.58	12	52.17	51	85.00	147	49.00
Washing	Yes	72	84.71	86	65.15	1	4.35	7	11.67	166	55.33
	No	13	15.29	46	34.85	22	95.65	53	88.33	134	44.67

Note. N = frequency, % = percentage

From the results of the cross-tabulation tests, it can be concluded that water supplies were insufficient for female compared to male, for all domestic activities. According to Makoni et al. (2004), different genders do have different assessments with regard to water use. The findings also indicate that water supplies were insufficient for carrying out domestic activities at the TECs during floods for the married couples. This is because household size is one of the factors that affect water demand positively (Hoffmann et al., 2006; Schleich & Hillenbrand, 2009; Arbués et al., 2010). The married respondents required more clean water supplies to cater for their family members than the single and widowed respondents. In terms of TECs, it is clear that there were not enough water supplies at the TECs, especially with regard to the bottled/mineral water aid. This difficulty occurred at the TECs of SMK Laloh and SK Kuala Gris where the water supplies were not enough for drinking, cooking, bathing and washing, while the water supplies were not enough for drinking and cooking at the TECs of SMK Sultan Yahya Petra 2 and SMK Manek Urai Lama.

Therefore, a flood disaster management that prioritises on the management of water supply during floods, plays an important role in ensuring flood victims at TECs receive a continuous clean water supply assistance. Management of water supply during floods can be implemented with helps from various parties working together to improve the efficiency in the distribution of clean water supplies to TECs which often experience shortage in water supplies such as SMK Laloh and SK Kuala Gris. The existence of an effective disaster management can help mitigate its impact (Eden & Matthews, 1997; Ibrahim, 2007). In addition, the step to enhance access to alternative water resources such as rainwater to be used during floods is also one of the approaches that can be

practiced by the authorities to ensure that victims receive sufficient water at TECs. Rainwater resources can be collected through rainwater harvesting method. Rainfall harvesting is an alternative step in providing water during an emergency (CEHI, 2009). According to Wulandari and Sirait (2008), rainwater is an alternative source of clean water supply in Jakarta, Indonesia during floods to reduce the impact on the population, especially in terms of health. Nashima et al. (2013) emphasis that rainwater is a very cheap and uncontaminated source. Hence, taking no effective measures can lead to a deterioration in health and affect the domestic activities of flood victims at TECs in the future.

### Conclusion

Water supply is an important resource for the Kuala Krai flood victims to carry out domestic activities at the TECs such as drinking and cooking. Thus, the authorities need to improve the efficiency of flood disaster management in the aspect of water supply assistance so that the water distribution activities to the TECs can be implemented systematically and continuously. Furthermore, the search efforts for alternative water resources such as rainwater through rainwater harvesting systems also can be implemented to increase access to water at the TECs. An efficient management of flood disaster and alternative water will be able to cater for the water supply needs of the flood victims at the TECs in Kuala Krai and subsequently able to address water supply problems during floods.

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### Corresponding Author

Koh Liew See

Department of Geography and Environment, Faculty of Human Sciences, Sultan Idris Education University, 35900 Tanjong Malim, Perak, Malaysia

Email: kohliewsee89@gmail.com

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