

ORIGINAL ARTICLE

## A Rapid Rural Appraisal of a Remote Village in Lahad Datu, Sabah

Kwong Hui Wong<sup>1\*</sup>, Hui Wei Ho<sup>2</sup>

<sup>1</sup> Department of Internal Medicine,  
Queen Elizabeth Hospital,  
Kota Kinabalu, Sabah, Malaysia

<sup>2</sup> Health Clinic of Kemabong,  
Tenom, Sabah, Malaysia

\*Corresponding author's email:  
khwong\_5566@hotmail.com

Received: 1 April 2020

Accepted: 1 March 2021

**Keywords:** rural health, public health,  
social planning, Borneo

### ABSTRACT

Rapid rural appraisal (RRA) is a systematic but semi-structured study used to gain new insight into rural life in a quick manner. The current article describes the RRA conducted in a remote village in Lahad Datu, Sabah. The RRA aimed to address the background of the rural community and identify public health issues. Collection of secondary data, key informants' interview, field observation and a structured interview with the villagers selected via convenience sampling were applied to obtain necessary data. Findings from informal approaches were summarised. Descriptive analysis was carried out for data collected from structured interview. Water sanitation, sanitation facility, food safety, air pollution, zoonosis and non-communicable diseases were among the potential public health issues identified within the village. A total of 188 villagers participated in the structured interview. The median age was 28.0 (IQR 30.8). The percentage for manual workers were 21.3% while 13.8% were white collars. The illiteracy rate was 12.2% and the poverty rate at 48.9%. A total of 22.3% of respondents reported overcrowded households. The household environment and take-up rate of basic amenities were suboptimal. The highest self-reported chronic disease was hypertension, recording 13 cases. The foremost priority is to fill up the flaws in the public health needs of the villagers. Those challenges require participation from relevant authorities as well as individual empowerment.

### INTRODUCTION

Rapid rural appraisal (RRA) is a systematic but semi-structured study designed to gain new insight into rural life in a quick manner to

enable decision making and problem-solving. RRA, which was once popular in agricultural research has been applied widely in public health given its key characteristic – action-oriented (McCracken et al., 1998).

RRA is a different entity compared to a more time-consuming conventional study. Being recognised as “quick and dirty”, RRA is relevant for learning knowledge considering time and cost constraint. Perhaps, RRA plays a role as preliminary enquiry specifically for those outsiders to learn more contextual idea and to gain critical thoughts. To achieve the goals, there are a variety of techniques of data collection (Chamber, 1981), including key informants’ interview, focus group discussion, collection of pre-existing information, learning indigenous technical knowledge, field observation, etc. Nevertheless, every credit of RRA carries a potential pitfall (Gibbs, 1985). For instance, key informants can deliver useful idea on the one hand, but on the other, they can voice a biased opinion. The indiscriminate application of RRA makes no difference to anecdotes.

The current article describes the RRA conducted in a remote village in Lahad Datu, Sabah called Kampung Tambisan Darat (KTD) to fulfil the Health Promotion Programme, a compulsory module under the Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah. KTD was among the villages shortlisted for such an annual outreach project by the Local Health District Officer. The assignment intended to benefit the locals in terms of their physical health (Tha et al., 2014).

KTD is located on the east coast of Sabah, sandwiched between *Felda Sahabat* palm oil estate and the Sulu Sea. It was founded in the late 1800s and underwent German and British colonisation. The village was inhabited predominantly by the indigenous Suluk. Until 2000, the nearest town was Sandakan where the villagers had to travel by sea northbound. However, the rapid development of *Felda’s* palm oil project led to concurrent road development

and land travel was made possible to get to the Lahad Datu town. Since then, it is under the administration of Lahad Datu District Council with gazetted land up to 1,500 hectares and a population of more than 1,200 villagers up to the year 2010 (Karim, 2012).

The RRA aimed to address the background of the rural community and identify the public health issues. The major issue can then be intervened through health promotion.

## **MATERIALS AND METHODS**

### **Study Location and Study Design**

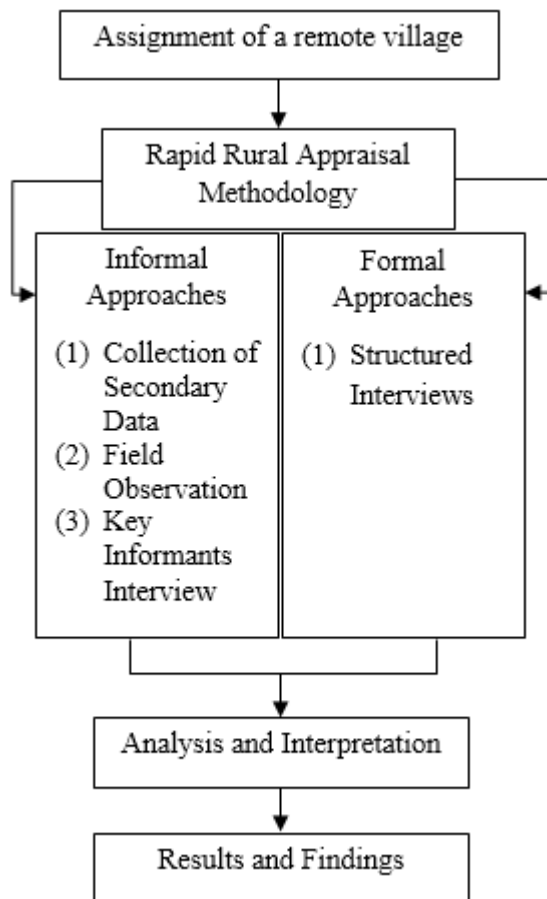
The RRA was conducted in Kampung Tambisan Darat which is one of the remote villages in Lahad Datu, Sabah. RRA was chosen as the study design due to the 5-day allowance for the field study. The period of study started on 27 August and ended on 31 August 2012. KTD is located deep into *Felda Sahabat*, an allotment scheme for the resettled poor rural native developed by the federal government in Malaysia. Permission for field study was granted from the District Health Office of Lahad Datu in cooperation with Universiti Malaysia Sabah.

Four techniques in compliance with the principle of RRA were applied: a collection of secondary data, key informants’ interview, field observation – the informal approaches and structured interview with the villagers – the formal approach. The RRA framework is summarised in Figure 1. A total of 188 villagers was involved in this RRA during the period of study.

### **Collection of Secondary Data**

Secondary data was collected from various sources to provide first-hand information before entering the field. Brief village profile and development was reviewed from an online

database. Health statistics were obtained from the local health office to ascertain the contemporary annual birth and death numbers. Performance in maternal and child health was extracted from local clinic record and annual report.



**Figure 1** Rapid rural appraisal framework

### Key Informants' Interview

Key informants were local figures who understand the village and villagers well in most aspects. Community leader, head of village managing committee and local healthcare provider were enlisted. Information gathered from the key informants included but not limited to socioeconomic background, infrastructures, village growth and development and public health issues. The contents of the interview were recorded for later reference.

### Field Observation

Field observation was to explore village dynamics and the villagers' interaction with their environment and resources. A social map was sketched to elaborate graphically the sociocultural and religious behaviours of the villagers. The map was also useful for the arrangement of a subsequent structured interview.

### Structured Interview with Villagers

A structured interview was carried out with the villagers using a standardised questionnaire. Opportunistic sampling was chosen to conform to this rural setting. The respondents included local villagers of all ages and those household visitors or outsiders were excluded. Socio-demographic data were collected including age, gender, ethnicity, marital status, religion, literacy, occupation, and monthly household income. Literacy was defined as an individual without formal education. Poverty was defined by using poverty line income per capita (Department of Statistics Malaysia, 2012) as the indicator due to variable household size.

The household environment and basic amenities were enquired about. Variables included the number of bedrooms and occupants, types of cookstove, refrigerator and television availability, latrine type and animal exposure defined by proximity with domestic livestock or pet. Household overcrowding was defined as more than 3 people in an inhabitable room. Self-reported chronic diseases were documented during a structured interview, in which the respondents were either on active follow-up or on medications. The self-diagnosed disease was excluded.

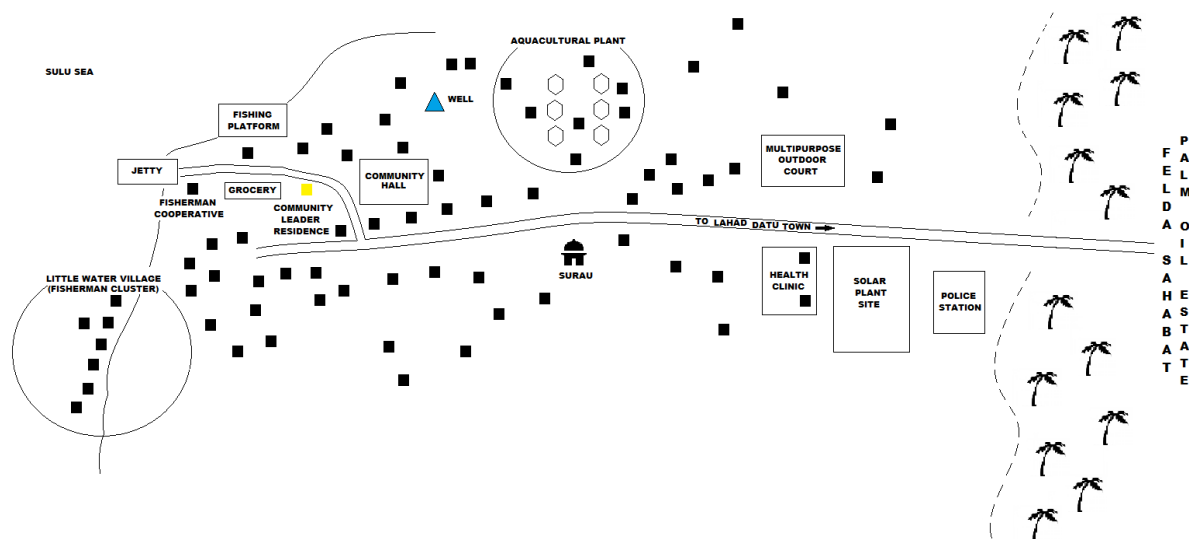
### Data Analysis

Data collected from informal approaches were summarised. Descriptive analysis was used for variables gathered from structured interview, by means of frequency and percentage, using the Statistical Package for the Social Science version 17 (SPSS Inc, Chicago, IL, USA).

## RESULTS

### Findings from Informal Approach (Collection of Secondary Data, Key Informant Interview and Field Observation)

A social map (Figure 2) was sketched. The houses were distributed rather haphazardly.



**Figure 2** Social map of Kampung Tambisan Darat

An open well was located near the residency area and water was delivered to respective houses via polyvinyl chloride pipe with a pumping system. Surau for public worship and religious assembly was established. Most fishermen stay on the water in a cluster, resembling a little water village. Small scale aquaculture was operated in the village compound for commercial purpose. Most houses were wooden made, well ventilated and built on stilts to avoid flooding. Drainage ditches took convergence at the sea. A fishing platform was provided for amateur fishing in which the catch was served for meal. Jetty was built for fishermen to offload their seafood harvest. Grocery existed in the region to retail manufactured or processed products rather than raw, fresh food items.

Local electricity was supplied via hybrid solar power provided by Sabah Electricity Company. The telecommunication network was poor which did not allow a distant connection. The villagers took water from

either underground or rainwater which was untreated. Cholera outbreak and diarrhoeal diseases were once prevalent in the 1990s but they were no longer endemic nowadays. Other basic infrastructures including school, health clinic, community hall and police station were set up. The only gravel road was provided which gave off-road dust or particulates by travelling vehicles, especially at dry day.

Garbage was routinely disposed of using open burning and litter by villagers. Livestock especially poultry, cattle and goats were free-roaming and droppings were deposited along the path. Rodents and cockroaches were common household pests. Snakes were occasionally seen but snake bite was infrequent.

Poultry, eggs and fish were the major protein source while rice was the main carbohydrate option. Some proportion of villagers was noticed producing homemade salted fish for preservation. The supply of

vegetables and fruits were restricted because the nearest food market would be a three-hour drive away. Some villagers grew self-sufficient crops like leafy vegetables, tomatoes, corns, brinjals. Natural gas was made available by a grocery shop. Demand for mineral water was high among the villagers. Smoking was prevalent at about 80% and especially among men and elderly women. Alcohol consumption was not observed.

The annual number of live births in 2011 was 66. No death was reported in the said year. In fact, the population has been shrinking due to the emigration of the young to urban for better employment opportunity. Local healthcare service was provided by a government health clinic with 2 in-house medical assistants and 2 community nurses. Maternal and child health were prioritised. However, outpatient services were available for endemic tropical infections like tuberculosis and screening for hypertension and diabetes mellitus were offered. The immunisation programme was well established with high coverage of more than 95%. The nearest district hospital is about 150 kilometres away. Most women got married at an earlier age but teen pregnancy was rare in the community. The

family size was on average 6 – 7 per household. Clinic attendance for family planning has been seen increasing in trend, with the achievement of a 38.2% rise in 2011.

### Findings from Formal Approach (Structured Interview)

#### Sociodemographic Background

A total of 188 respondents participated in the interview. The median age was 28.0 with the 1st quartile and 3rd quartile being 15.3 and 46.0 respectively (IQR 30.8). There was a near-equal gender distribution and more than two-third aged 40 and below. The majority were Suluk (60.1%) followed by Bajau (14.4%) and Bugis (3.7%). Other minorities include Cocos, Jawa, Kadayan, Idahan, and Dusun. All were Muslim. The majority of the respondents was either married (48.4%) or single (48.9%) and the rest was widowed. More than half (53.7%) were students and housewives; 13.8% were white collars. The remaining respondents were manual workers, consisted of 12.8% odd-job men, 4.8% fishermen, 1.6% farmers and 2.1% palm oil workers; 11.2% of respondents were unemployed, retired or dependant. The illiteracy rate was 12.2% among the respondents. Poverty was rated at 48.9% (Table 1).

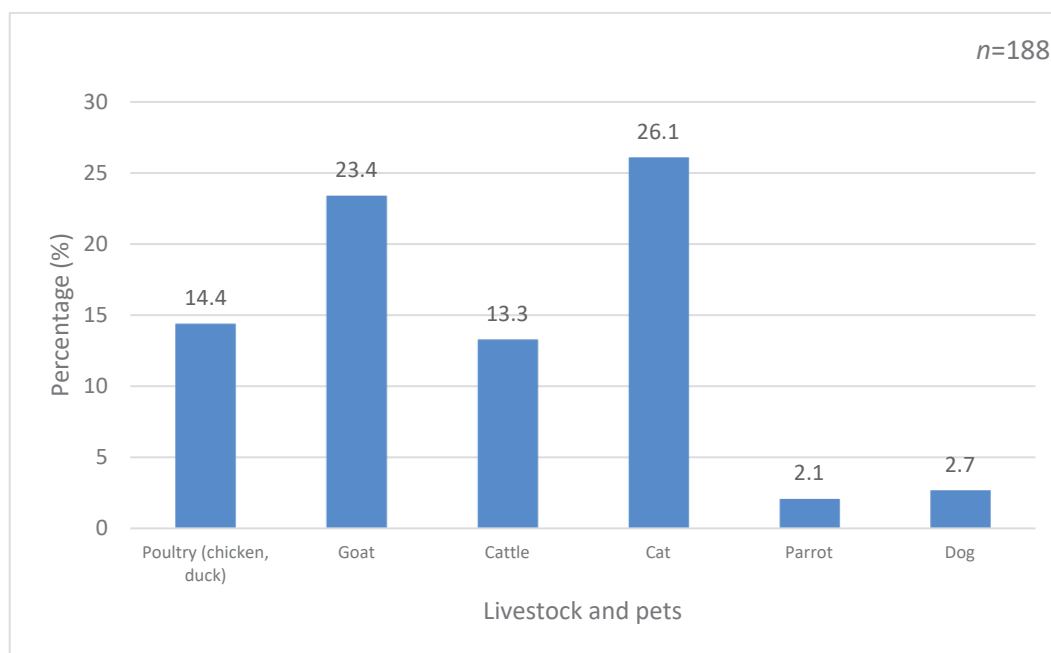
**Table 1** Distributions of sociodemographic characteristics of the respondents (n = 188)

Variable	n (188)	%
<b>Gender</b>		
Male	95	50.5
Female	93	49.5
<b>Age</b>		
< 19	61	32.4
19 – 40	72	38.3
41 – 64	46	24.5
> 64	9	4.8
<b>Ethnic</b>		
Suluk	113	60.1
Bajau	27	14.4
Bugis	7	3.7
Others (Cocos, Jawa, Idahan, Kadayan, Dusun, etc.)	41	21.8
<b>Religion</b>		
Islam	188	100
<b>Marital status</b>		
Married	91	48.4
Single	92	48.9
Widow/ widower	5	2.7

<b>Occupation</b>		
Student	54	28.7
Housewife	47	25.0
Clerical	26	13.8
Odd-job men	24	12.8
Farmer	3	1.6
Palm oil worker	4	2.1
Fisherman	9	4.8
Retired/ unemployed/ dependant	21	11.2
<b>Literacy</b>		
Literate	151	80.3
Illiterate	23	12.2
<b>Monthly income (per capita)</b>		
≤ RM240	92	48.9
> RM240	96	51.1

### Household Environment and Basic Amenities

Household overcrowding occurred in 22.3% of households, where 4.8% burned solid fuel for cooking indoor while the rest used natural gas, 68.1% reported refrigerator use and 88.8% owned a television. Hanging latrines were found in 27.1% of households, while others practised improved system: a flush latrine with a septic tank, 26.6% and a pit latrine with slab, 46.3%. Cats (26.1%) were the most reared pets, followed by dogs, 2.7% and parrots, 2.1% (Figure 3). Among the domestic livestock, goat took up 23.4% and 13.3% were cattle. Poultry (chickens and ducks) stood at 14.4% (Table 2).



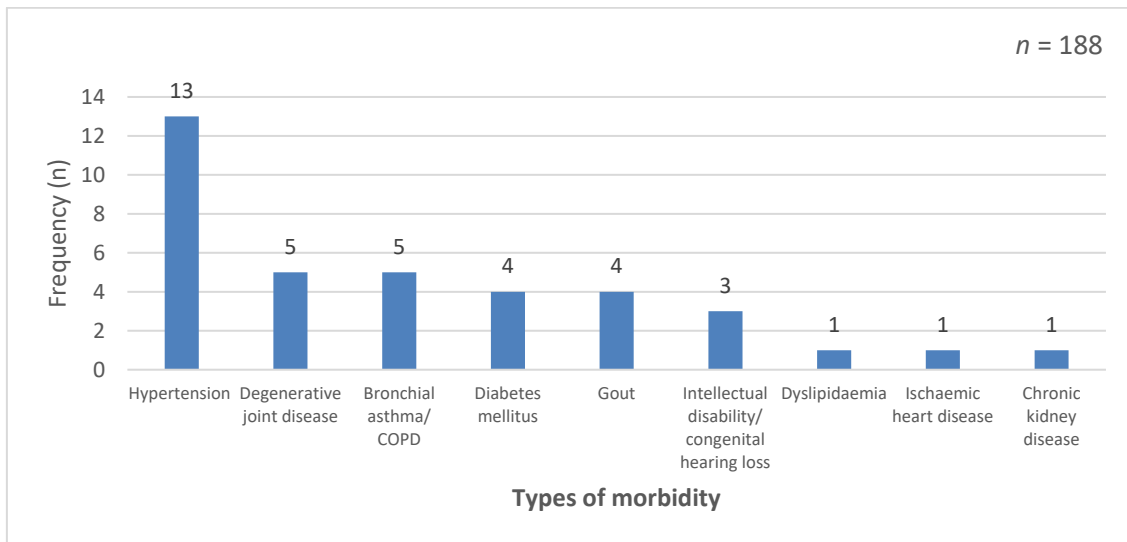
**Figure 3** Percentage distribution of livestock and pets

**Table 2** Distributions of household environment variables and basic amenities (*n* = 188)

Variables	<i>n</i> (188)	%
Household overcrowding		
Yes	42	22.3
No	146	77.7
Cook stove		
Natural gas	179	95.2
Solid fuel (wood, charcoal)	9	4.8
Refrigerator		
Present	128	68.1
Absent	60	31.9
Television		
present	167	88.8
absent	21	11.2
Latrine		
Flush latrine with septic tank	50	26.6
Pit latrine with slab	87	46.3
Hanging latrine	51	27.1

**Prevalence of Non-communicable Diseases (NCD)**

The majority of NCD reported were cardiovascular and metabolic diseases. Thirteen individuals reported hypertension, five each for degenerative joint disease and chronic respiratory diseases (bronchial asthma or COPD), 4 each for diabetes mellitus and gout followed by 3 for congenital illnesses. Dyslipidaemia, ischaemia heart disease and chronic kidney disease were reported by one individual each (Figure 4).



**Figure 4** Frequency distribution of non-communicable diseases

## DISCUSSION

The current study describes the RRA conducted in a remote village of Lahad Datu called Kampung Tambisan Darat. KTD is a multi-ethnic village with a very basic infrastructural set-up, resembling most remote villages within the Sabah (Chua et al., 2013; Wong et al., 2017). KTD is relatively small in size and the population is young based on the demographic pyramid and positive growth rate. Setting up a local health clinic in the vicinity was an effort by the Malaysian government to uphold the principle of universal healthcare but the facility ought to be upgraded according to the local needs. Contemporary low socio-economic standing indicated by the triad of education, income and occupation linked the villagers to poor health outcome (Amiri et al., 2014; Mohd Ghazali et al., 2015). Furthermore, few public health concerns in KTD are worth to be highlighted.

Water sanitation has been a great challenge in the remote villages in Sabah (Zin et al., 2015). Untreated water was unsafe for the villagers because the contamination risk especially by *Vibrio cholerae* or *Escherichia coli* was high. Improper human waste management in KTD with the unimproved sanitation facility further aggravated the problem. In 2012, 4 outbreaks of cholera were reported in Lahad Datu (Sabah Department of Health, 2012) but none were notified from KTD. It is believed that preventive measures like boiling water before use, good hand hygiene and purchase of mineral water are practised by the villagers. Contaminated food was more likely the source of cholera outbreak in Sabah (Jikal et al., 2019).

Food safety remains a potential issue in KTD. The provision of electricity encouraged the use of refrigerator to maintain food freshness but the take-up rate was suboptimal. On the other hand, seafood catch inshore might get contaminated by human coliforms due to direct discharge of sewage into the sea from the little water village. Common faecal

coliforms contamination from human sewage (Iwamoto et al., 2010) include *Salmonella*, *Shigella*, *Norovirus* and *Hepatitis A virus*, which can cause acute diarrhoea with or without complications. Food poisoning or acute diarrhoeal cases appeared rare in KTD (Health Department of Sabah, 2012), possibly because raw, uncooked food consumption was not a local eating culture. This was reflected in the cholera outbreak in northern Sabah by Sea Gypsy who practise eating raw seafood (Jikal et al., 2019).

Outdoor air pollution was generated by open burning and road dust in KTD. The utilisation of solid fuel for cooking in certain households and second-hand smoke led to indoor air pollution. Interestingly, sea breeze might impact negatively the air quality in the coastal region (Papanastasiou et al., 2009). For those with airway hypersensitivity, especially children will be susceptible to these air pollutants. Air pollution by burning activity should not be overlooked in the rural area to cause respiratory symptoms despite lower traffic emissions (Zainal Abidin et al., 2014). Household crowding in KTD provided a hotbed for respiratory infections like tuberculosis. Having said that, only 294 or 6.7% of tuberculosis cases in Sabah (Health Department of Sabah, 2012) was reported in Lahad Datu [population density (Department of Statistics Malaysia, 2010): 30.8 per squared kilometre], after Kota Kinabalu (1294.1 per squared kilometre), Sandakan (175.4 per squared kilometre), Tawau (65.1 per squared kilometre), Semporna (117.0 per squared kilometre) and Keningau (48.8 per squared kilometre). Apparently, high tuberculosis cases seem to attribute to crowding and population density.

Zoonosis is another prospective problem. Among the zoonotic infections, leptospirosis and *Plasmodium knowlesi* malaria are endemic in Sabah. In 2012, Lahad Datu alone registered the second largest proportion of malaria cases (10.4%) after Tawau and only



3.4% for leptospirosis cases, the lowest on the east coast of Sabah (Health Department of Sabah, 2012). Palm oil field, fragmented forest and low lying terrain (Kimberly et al., 2019) were just the right pre-requisites described in KTD. The incidence rate of malaria was estimated at 106.5 per 100,000 population (Department of Statistics Malaysia, 2010) which translated into 1.3 cases in KTD. The bright side was that most local health facility provides trained personnel to smear and exam for malaria parasite. Therefore, the infection could be diagnosed earlier and notified for public health intervention. Lack of partition between domestic livestock and villagers in addition to improper management of animal wastes gave an opportunity for cross-contamination via animal excreta (Delahoy et al., 2018). Excreta of household rodents and dogs, in particular, could expose villagers in KTD to leptospirosis.

NCDs especially cardiovascular disease was seen widespread in a rural setting. In 2011, Sabah registered 29.1% hypertension burden in the state and 37.4% of them were rural population (Institute of Public Health, 2011). In KTD, hypertension recorded the highest counts among the NCDs, being equivalent to 10.2% of adults aged more than 19. Looking to villages inland, hypertension reported at 13.2% in the nearby township of Kinabatangan (Chua et al., 2013) and 24.3% in the north, Kudat (Wong et al., 2017). Comparatively lower prevalence of hypertension in KTD might be explained by opportunist high consumption of fish in KTD as demonstrated by a population-based study in rural coastal Ecuadorian village (Brutto et al., 2016). Despite practising salting as a food preservation method still, the provision of electricity had slowly transformed the villagers to the use of refrigerator. The power supply can make revolutionary changes in terms of health outcome when Begossi et al. (2013) found a difference in the prevalence of hypertension in two fishing communities in Southeast Brazil.

Progress in KTD was observed 8 years beyond the RRA. Domestic connectivity and network coverage have become available which is capable of transforming the local community in terms of health benefits. From the perspective of public health, the delivery of services like health promotion or public health messages is no longer hindered by the geographical challenge. Perhaps, positive perception within the rural community of Sarawak toward the dissemination of health information through the online platform could be encouraging (Nor et al., 2013). Upgrade of the existing health facility is undergoing stepwise in KTD to tailor for the local needs from time to time. A new health clinic building was set up in KTD to serve the local more efficiently. With the introduction of telemedicine in Sabah, any clinical referral can be made without clients being asked to travel out to distant district or tertiary hospitals (Lee, 2020).

## **CONCLUSION**

Rural development is a manifestation of Millennium Development Goals and the closing disparity is the ultimate goal. The foremost priority is to fill up the flaws in the public health needs particularly clean water supply and sanitation facility which is lacking, not forgetting healthcare quality and strategy against non-communicable diseases. Those challenges require participation from relevant authorities as well as individual empowerment.

## **CONFLICT OF INTEREST**

The authors declare that they have no competing interests in publishing this article.

## ACKNOWLEDGEMENTS

The authors would like to take this opportunity to thank the Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah for the sponsorship and ethical clearance for this study. Special thanks also go to all lecturers involved in Health Promotion Programme for their guidance.

## REFERENCES

- Amiri, M., Majid, H. A., Hairi, F., Thangiah, N., & Bulgiba, A. (2014). Prevalence and determinants of cardiovascular disease risk factors among the residents of urban community housing projects in Malaysia. *BMC Public Health*, 14 (3), S3. <https://doi.org/10.1186/1471-2458-14-S3-S3>
- Begossi, B. O., Cavichiolo, M. P., & Gurgel, C. B. F. M. (2013). Blood pressure and hypertension among coastal fishermen in South-east Brazil. *Journal of Community Medicine and Health Education*, 4, 261. <https://doi.org/10.4172/2161-0711.1000261>
- Brutto, O. H. D., Mera, R. M., Gillman, J., Castillo, P. R., Zambrano, M., & Ha, J. E. (2016). Dietary oily fish intake and blood pressure levels: A population-based study. *Journal of Clinical Hypertension (Greenwich)*, 18, 337 – 341. <https://doi.org/10.1111/jch.12684>
- Chambers, R. (1981). Rapid rural appraisal: Rationale and repertoire. *Public Administration and Development*, 1, 95 – 106. <https://doi.org/10.1002/pad.4230010202>
- Chua, P. Y. S., Lee, S. L., Tow, Z. J., Mantok, R., Mohamad Nor, M. K. H., Dorairaja, L., Javier, J., Rusly, N. F., Mohamad Hanafi, N., & Zin, T. (2013). Rapid rural appraisal of a rural village in Sabah. *International Journal of Public Health Research*, 3 (1), 223 – 231.
- Communicable Disease Control Unit. (2012). *Epidemiology Bulletin - Epid week 52* (23 December 2012 – 29 December 2012). Sabah Department of Health, Ministry of Health. [http://www.jknsabah.gov.my/v2/muatturun/lainlain/epidjkns/Buletin%20Minggu%20Epid%2052%20\(2012\).pdf](http://www.jknsabah.gov.my/v2/muatturun/lainlain/epidjkns/Buletin%20Minggu%20Epid%2052%20(2012).pdf)
- Delahoy, M. J., Wodnik, B., McAliley, L., Penakalapati, G., Swarthout, J., Freeman, M. C., & Levy, K. (2018). Pathogens transmitted in animal feces in low- and middle-income countries. *International Journal of Hygiene and Environmental Health*, 221 (4), 661 – 676. <https://doi.org/10.1016/j.ijheh.2018.03.005>
- Department of Statistic Malaysia. (2010). *Population and Housing Census of Malaysia 2010: Preliminary Count Report*. <https://www.mycensus.gov.my/index.php/census-product/publication/census-2010/679-preliminary-count-report-2010>
- Department of Statistics Malaysia. (2012). *Household Income and Basic Amenities Survey (HIS/BA) Report*. <https://catalog.ihsn.org/index.php/catalog/5431/download/65755>
- Gibbs, C. J. N. (1987). Rapid rural appraisal: An overview of concepts and application. *Proceedings of the 1985 International Conference on Rapid Rural Appraisal Khon Kaen*. Khon Kaen University, Thailand, pp. 193 – 206.
- Institute for Public Health. (2011). *National Health and Morbidity Survey 2011, Vol. II: Non-Communicable Diseases*. Ministry of Health Malaysia. <http://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2011-Volumell.pdf>
- Iwamoto, M., Ayers, T., Mahon, B. E., & Swerdlow, D. L. (2010). Epidemiology of seafood-associated infections in the United States. *Clinical Microbiology Reviews*, 23(2), 399–411. <https://dx.doi.org/10.1128%2FCMR.00059-09>
- Jikal, M., Riduan, T., Aarifin, R., Jeffree, M. S., & Ahmed, K. (2019). Cholera outbreak by Sea Gypsies in Sabah, Malaysia: A challenge in North Borneo. *International Journal of Infectious Diseases*, 83, 83 – 85. <https://doi.org/10.1016/j.ijid.2019.04.008>
- Karim, A. A. B. (August 30, 2012). An oral history with Amir Bangsa bin Abd. Karim/ Interviewer: Jamil bin Muhamad Sharif. Origin and profile of Kampung Tambisan by President of Village Development and Security Committee, Kampung Tambisan Darat, Lahad Datu, Sabah.
- Kimberly, M. F., Brock, P. M., Abidin, T. R., Grignard, L., Herman, L. S., & Chua, T. H. (2019). Environmental risk factors and exposure to the zoonotic malaria parasite Plasmodium knowlesi across northern Sabah, Malaysia: A population-based cross-sectional survey. *Lancet Planet Health*, 3, e179-86. [https://doi.org/10.1016/S2542-5196\(19\)30045-2](https://doi.org/10.1016/S2542-5196(19)30045-2)
- Lee, S. (2020, May 21). Hospital Universiti Malaysia Sabah launches state's first telemedicine service. *The Star*. <https://www.thestar.com.my/news/nation/2020/05/21/hospital-university-malaysia-sabah-launches-state039s-first-telemedicine-service>
- McCracken, J. A., Pretty, J. N., & Conway, G. R. (1988). *An introduction to rapid rural appraisal for agricultural development*. International Institute for Environment and Development.

- Mohd Ghazali, S., Seman, Z., Kee, C. C., Lim, K. H., Manickam, M., Lim, K. K., Yusoff, A. F., Mustafa, F. I., & Mustafa, A. N. (2015). Sociodemographic factors associated with multiple cardiovascular risk factors among Malaysian adults. *BMC Public Health*, 15, 68. <https://doi.org/10.1186/s12889-015-1432-z>
- Nor, R. M., Chapun, T. E. & Wah, C. R. J. (2013). Malaysian rural community as consumer of health information and their use of ICT. *Jurnal Komunikasi: Malaysian Journal of Communication*, 29(1). <https://ejournal.ukm.my/mjc/article/view/15035/4659>
- Papanastasiou, D. K., & Melas, D. (2009). Climatology and impact on air quality of sea breeze in an urban coastal environment. *International Journal of Climatology*, 29, 305 – 315. <https://doi.org/10.1002/joc.1707>
- Tha, N. O., Win, S. S., Myint, T., Thwin, O., Fun, S. H., & Mudin, D. K. D. (2014). Annual health promotion programmes in remote rural Sabah. *International Journal of Integrated Care*, 14 (9), None. <http://doi.org/10.5334/ijic.1964>
- Wong, K. H., Hanisah, M. S., Nur Fadzlina, A. S., Padmanathan, K., Mohd Amiruddin, M. K., Yukin, G., Farah, N. Z. M. S., Nor Nadia, M. R., Liyana, S. J., Noor Shahira, M. F., Ahmad Afiq, A. A., Lim, S. M. K., Nik Nazminuruddin, N. R., Hamil, R., John, S., & Naing, D. K. S. (2017). The risk factors and associated co-morbidities of obesity among adults in Northern Borneo. *Borneo Journal of Medical Sciences*, 11 (1), 56 – 67. <https://doi.org/10.51200/bjms.v11i1.640>
- Zainal Abidin, E., Semple, S., Rasdi, I., Syed Ismail, S. N., & Ayres, J. G. (2014). The relationship between air pollution and asthma in Malaysian schoolchildren. *Air Quality, Atmosphere & Health*, 7, 421 – 432. <https://doi.org/10.1007/s11869-014-0252-0>
- Zin, T., Aung, T. S., Saupin, S. Myint, T., Naing, D. K. S., Aung, M. S., & Shamsul, B. S. (2015). Influencing factors for cholera and diarrhoea: Water sanitation and hygiene in impoverished rural villages of Beluran District, Sabah, Malaysia. *Malaysian Journal of Public Health Medicine*, 15, 30 – 40.

