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ORIGINAL ARTICLE

Knowledge and Perception of Malaysian Forest Fringe Population towards *Zika* Infection

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ABSTRAK

Organisasi Kesihatan Sedunia (WHO) telah mengisytiharkan jangkitan Zika sebagai Kecemasan Kesihatan Awam Antarabangsa pada tahun 2016. Kajian ini dijalankan bagi menilai pengetahuan dan persepsi risiko terhadap jangkitan Zika dalam kalangan populasi pinggiran hutan di Malaysia. Kajian keratan rentas melibatkan 433 responden dewasa yang telah melengkapkan soal selidik mengenai pengetahuan dan persepsi terhadap jangkitan Zika. Analisis dua hala pada kemampuan responden dan item diuji menggunakan 'Statistical Package for the Social Sciences' (SPSS) dan Rasch. Tahap pengetahuan dan persepsi diuji terhadap variabel sosiodemografik / sosioekonomi menggunakan Pearson's Chi Square dan kovariat dilaraskan pada tahap multivariat menggunakan regresi logistik binari. Kedua-dua domain pengetahuan dan persepsi disasarkan dengan baik. Berdasarkan hasil SPSS dan Rasch, lebih daripada separuh responden yang terlibat menunjukkan tahap pengetahuan dan persepsi risiko yang rendah [Skor pengetahuan: 50.8% (SPSS), 55.4% (Rasch); skor persepsi: (58.0% (SPSS), 58.2% (Rasch)]. Dengan kovariat yang telah dilaraskan, responden bukan bumiputera yang mempunyai tahap pendidikan tinggi, pendapatan isi rumah yang tinggi serta pergi ke hutan sejak kebelakangan lepas menunjukkan tahap pengetahuan yang baik. Perempuan dewasa yang telah menopaus dari Perak pula menunjukkan tahap persepsi risiko terhadap Zika yang

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baik. Walau bagaimanapun, secara keseluruhannya, majoriti populasi pinggiran hutan di Malaysia mempunyai pengetahuan dan persepsi risiko terhadap jangkitan Zika yang lemah. Instrumen soal selidik ini merupakan alat penilaian jangkitan Zika yang sesuai digunakan dalam kalangan populasi pinggiran hutan di Asia Tenggara.

Kata kunci: Flavivirus, jangkitan Zika, pengetahuan, persepsi risiko, populasi pinggiran hutan

ABSTRACT

The World Health Organization (WHO) has declared *Zika* infection as Public Health Emergency of International Concern in 2016. In this study, we aimed to assess the knowledge and risk perception towards *Zika* infection among the forest fringe population in Malaysia. A cross-sectional study of with 433 adult respondents in Malaysia completed the assisted-administered validated questionnaire on knowledge and perception to *Zika* infection. Bidirectional analysis on the person and item abilities were tested using Statistical Package for the Social Sciences (SPSS) and Rasch. The knowledge and perception levels were tested against significant sociodemographic or socioeconomic variables using Pearson's Chi Square; covariates were then adjusted at multivariate level using binary logistic regression. Both knowledge and perception domains were well-targeted. Complementing results from SPSS and Rasch showed poor knowledge and poor risk perception levels in slightly more than half of the respondents [knowledge score: 50.8% (SPSS), 55.4% (Rasch); perception score: (58.0% (SPSS), 58.2% (Rasch)]. With covariates adjusted, non-bumiputra (non-natives) of higher education level, higher household income and recent jungle visits showed good knowledge level. Adult, menopaused women from Perak state showed better risk perception level towards *Zika*. Majority of the forest fringe population in Malaysia have poor knowledge and risk perception towards the *Zika* infection. This questionnaire is a suitable tool to assess knowledge and perception towards Zika infection among the forest fringe populations in Southeast Asia.

Keywords: *Flavivirus*, forest fringe populations, knowledge, risk perception, *Zika* infection

INTRODUCTION

Zika virus (ZIKV) infection, a re-emerging infection that has been declared as Public Health Emergency of International Concern in year 2016 by World Health Organization (WHO), affected travel and trading, has recaptured the world's attention after almost a century (Musso et al. 2014; WHO 2016). Recent outbreaks associate microencephaly and

Guillain-Barre syndrome with *Zika* infection (Hughes et al. 2016). The *Flavivirus* is transmitted primarily by vector mosquitoes *Aedes* sp., and secondary routes, including sexual transmission, maternal to child transmission, blood transmission and possibly through various body fluids (Anderson 2017; Musso et al. 2015), including vaginal and seminal fluid, with longest incubation of 6 months reported in seminal fluid. Also, the virus seems to evolve fast; from 2004 to 2015, the spectrum of disease advanced from mostly asymptomatic (80% of the time), to haematospermia, microencephaly in new-born, and Guillain-Barre syndrome as acute inflammatory ascending paralysis (Brasil et al. 2016; Karwowski et al. 2016; Roze et al. 2016; Turmel et al. 2016; Uncini et al. 2017; Saba Villarroel et al. 2018).

Despite hosting the Asia lineage of ZIKV (Marchette et al. 1969; Pond 1963) which exploded massive outbreaks of *Zika* related microencephaly and Guillain-Barre syndrome in Latin America (year 2007-2016) (Musso et al. 2014), Malaysia only reported one suspected local *Zika* transmission in 2019 since the discovery of the P6-740 strain in 1954 (Smithburn 1954; Lim et al. 2017; Malay Mail 2019). There was no reported neurological complications or birth defect associated with *Zika* in the surveillance pathways of *Zika*, but under-reporting is possible due to the challenge of screening and diagnosis (Lim et al. 2017). Forest fringes represent the zone of sylvatic-urban cycle transition for *Zika* (Wolfe et al. 2001). It is worth investigating the forest fringe population's knowledge and perception towards the disease as ZIKV infected mosquito was discovered locally in 1954 (Smithburn 1954).

Knowledge and risk perception towards *Zika* infection would influence the prevention and control of the disease, not only in terms of vector breeding site destruction, but family planning and screening for blood donation (Villarroel 2018). Only scanty questionnaires were developed to assess the level of knowledge, attitude, and practice of the population towards the *Zika* infection for effective risk communication (Lim et al. 2017; Arief et al. 2017; Rosales et al. 2017); yet mostly focus on clinical populations rather than the public, resulting in systematic bias (Wong et al. 2017; Cheema et al. 2017; Whittemore et al. 2017). A validated questionnaire based on general question bank of World Health Organization (WHO 2016) has been developed for communities with ZIKV transmission or those at risk, to serve as the first proper screening tool for knowledge and risk perception towards *Zika* infection in Malaysia. This would aid in tailoring health education materials on the ZIKV that is suitable for local communities (Wong et al. 2020).

MATERIALS AND METHODS

A population based cross-sectional study recruited 433 adult respondents in forest fringe areas of Malaysia from September 2019 to March 2020. Respondents completed the assisted-administered, validated questionnaire

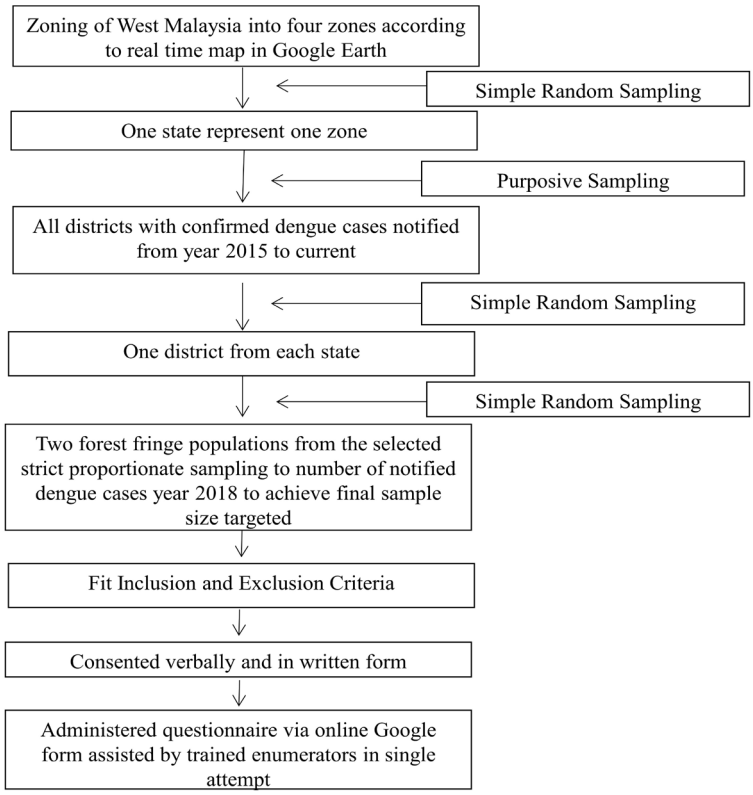

Figure 1: The sampling flow of data collection for respondents to administer questionnaire.

consisting of knowledge and perception domains on *Zika* infection via Google Form with the single attempt and compulsory modes set. The methodology of sampling in this study is shown in Figure 1.

Instrument

The English language validated questionnaire had 68 questions made up of 'knowledge' and 'perception' domains; 14 questions (63 items) tested on 'knowledge' towards *Zika* infection, and five items / questions tested on risk perception of ZIKV (Wong et al. 2020). The copyright number for the Bahasa Malaysia version is UKM. IKB.800-4/1/3215. Available answer options were 'Yes', 'No' or 'Don't know'. Correct answers were given 1 mark, while 'don't know' yielded 0 mark. Risk perception items were displayed as a 5-ratings Likert scale, consisting of 'Strongly agree', 'Agree', 'Neutral', 'Disagree' or 'Strongly disagree'. Three items (P1, P4, P5,) tested on positive perception and two items (P2, P3) tested on negative risk perception. For items tested on positive perception, "Strongly agree" carries a maximum score of 5, while "Strongly disagree" carries minimum score of 1. For items tested on negative perception, "Strongly disagree" carries a maximum score of 5, while "Strongly

Table 1: Sociodemographic characteristics of respondents

Variable		N	Percentage %
Age Group			
Adult (18-59)		399	92.1
Elderly (60 And Above)		34	7.9
Mean Age (Years)		37.4 ± 15.1 (Kurtosis -0.886, Skewness 0.406)	
Gender			
Male		145	33.5
Female		288	66.5
Ethnicity			
Malay		118	27.3
Chinese		124	28.6
Indian & Punjabi		17	3.9
Orang Asli & Orang Asal		174	40.1
Ethnicity Group			
Bumiputra	Malay	118	
	Orang Asli	172	
	Orang Asal	2	
Total		292	67.4
Non-Bumiputra	Chinese	124	
	Indian	16	
	Punjabi	1	
Total		141	32.6
Religion			
Muslim	Islam	134	30.9
Non-Muslim	Christianity	69	15.9
	Buddhism	90	20.8
	Hinduism	13	3.0
	Animism	57	13.2
	Others	70	16.2
Total		299	69.1
Educational Level			
Low		113	26.1
No Formal School		57	
Primary School		56	
High		320	73.9
Secondary School		169	
Tertiary Education		151	
Residence Area			
Forest fringe		433	100.0
City		0	0
Residence District			
Perak	Batang Padang-Sungkai	137	31.6
	Batang Padang-Tapah	96	22.2
Pahang	Bentong	200	46.2
Median Household Number: 4 Persons (25th Centile = 3, 75th Centile = 6) (Kurtosis 2.574, Skewness 1.076)			
Mean Household Women at Reproductive Age (15-49 Years): 1.3 ± 1.393 (Kurtosis 0.203, Skewness 0.977)			
Reproductive Age Group		320	73.9
Yes		113	26.1
No			

Variable		N	Percentage %
Number of Pregnant Women			
Non-pregnant		404	93.3
Pregnant		29	6.7
Median Household Monthly Income (RM): 1000 (25th Centile = 300, 75th Centile = 2900) (Kurtosis 7.954, Skewness 2.651)			
Household Income Group (Kurtosis 4.352, Skewness 2.232)			
B40 (RM3,000 and below)		357	82.4
M40 (RM6275 and below)		66	15.2
T20 (RM13148 and below)		10	2.3
Household Income Group (Kurtosis 4.352, Skewness 2.232)			
Low Income		357	82.4
High Income		76	17.5
Regular Jungle Visit (≥ 3x Per Week)			
Yes		133	30.7
No		300	69.3
Has Activity in Forest Fringe			
Yes		162	36.4
No		271	62.6
Activities in the Jungle			
Yes	Collect Forest Product	162	36.4
Work	Educational	58	
	Estate Work	5	
	Farming	54	
	Rubber Tapping	6	
	Wildlife Rescue	5	
	Land Use	12	
	Medical	3	
		3	
Total		146	
Leisure	Community work	5	
	Recreational	11	
Total		16	
No		271	62.6
Occupation Energy Level / Working Environment			
Low Energy Level / Indoor	Administrative	10	
	Businessman	29	
	Factory Worker	5	
	Housewife	96	
	IT-Based Works	7	
	Medical	8	
	Not Working	64	
	Student	74	
	Teacher	28	
	Tok Batin (Village Leader for aborigines)	1	
Total		322	74.4
High Energy Level / Outdoor	Contractor	12	
	Guard	2	
	Tractor Driver	1	
	Village Farmer	80	
	Logistic Worker	1	
	Wildlife Rescue Officer	15	
Total		111	25.6

agree" carries minimum score of 1. All negative perception items' scores were inverted for Rasch analysis.

Statistical Analysis

Knowledge and perception scoring were analysed using a unique dual-instruments approach with IBM Statistical Product and Service Solutions Statistics (SPSS) (Armonk, NY, USA) and Rasch Model analysis (Winsteps) (Winsteps, Oregon, USA) to provide bidirectional analysis of person's ability and item's ability (Rosnah et al. 2015). This approach ensures respondents' ability in answering the question items were on well-targeted question item, removing bias of possible language barrier and culture comprehensibility (Azrilah 2010). The validation made has a proven model of fitness and suitability of 5-rating Likert scale in the measurement of risk perception by (Wong et al. 2020). Normality of data distribution was checked with kurtosis and skewness, confirmed by formal Kormogorov-Smirnov test; continuous variables were reported in mean $\pm$ 2 SD for normally distributed data, and median (25^{th}, 75^{th} centile) for non-normally distributed data. Frequency and percentage were used for categorical variables. Both knowledge and perception levels were categorized into 'good' and 'poor' levels based on mean score in both SPSS and Rasch (Wright map). Scores above mean level (normality satisfied) (in SPSS and in "summary statistic of person" in Rasch), or above median (if normality not satisfied in SPSS) were considered as of "good" knowledge and "good" perception. For Rasch analysis, question items within Mean $\pm$ 1 SD of the 'person map of item' (left side of Wright map) were well-targeted items, beyond which were difficult, while items below -1 SD of were too easy to test the ability of the respondents. Person measure correlation with $r<0.32$ was considered respondents with erratic performance, in which they could answer very difficult item correctly but getting easy item wrong. Bivariate analysis for discrete proportions were tested using Pearson Chi Square for dichotomous outcomes, reported as X^2 (df), with confidence interval of 95%, p-value of <0.05 as significant, with the power of study set as 80%. Results were analysed in consideration of possible biases.

RESULT

After meticulous data cleaning, a total of 433 respondents completed the questionnaire. The sociodemographic characteristics of the respondents areb shown in Table 1.

Knowledge on *Zika* Infection

All respondents answered all the questions with the highest score achieved being 59/63 (0.5% of respondents) while 1.8% respondents scored 0 (lowest) for the knowledge domain. Median score for knowledge domain was 43/63 (25^{th} centile = 35, 75^{th} centile = 49) by SPSS, while mean $\pm$ 2 SD score of 39.6 $\pm$ 11.8/63 from Rasch complimented the result. Both analyses showed that less than half of

Table 2: Comparison of knowledge and perception scores using SPSS and Rasch

i. Knowledge Score				
Category	**SPSS**		**Rasch (person measures)**	
Poor Knowledge (0-43)	220	50.8%	240	55.4%
Good Knowledge (44-63)	213	49.2%	193	44.6%
Mean or median score	Median (25th, 75th Centiles) 43 / 63 (25th Centile = 35, 75th Centile = 49) Kurtosis 1.936, Skewness -1.395		Mean ± 2SD 39.6 + 11.8 / 63	
Mean Person's measure (Logit)	-		0.78 + 1.09	
Max Person's measure (Logit)	-		2.92	
Min Person's measure (Logit)	-		- 6.02	
ii. Perception Score				
Category	**SPSS**		**Rasch**	
Poor perception (0-18)	252	58.2%	251	58.0%
Good Perception (19-25)	181	41.8%	182	42.0%
Mean ± 2SD Score (total converted score)	18.04 ± 3.1/25 Kurtosis -0.195, Skewness 0.092		17.8 ± 2.8/25	
Mean Person's measure (Logit)	-		0.45 + 0.59	
Max Person's measure (Logit)	-		2.78	
Min Person's measure (Logit)	-		0.95	

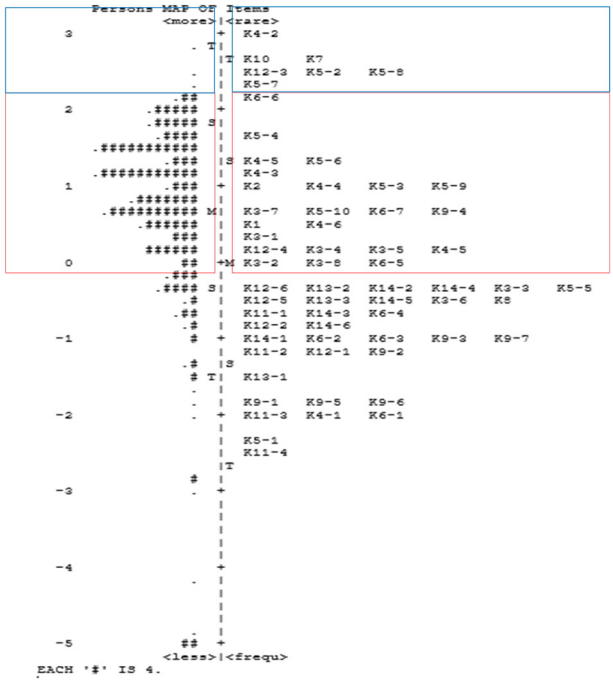

Figure 2: The Wright map of item fitness to persons' ability for knowledge level of Zika disease.

the respondents had good knowledge on *Zika* infection, as showed in Table 2.

Rasch analysis was used to access the person's ability on knowledge level towards *Zika* infection among forest fringe population in Malaysia. Person's ability measured a Log 2.92 to Log -6.02. The score reflects a poor knowledge level on *Zika* infection rather than random answers, as they tended to get more correct answers accidently (Azrilah 2010; Rosnah et al. 2015). From the Wright map in Figure 2, 44.4% items were well-targeted, 12.7% of the items in knowledge domain were able to test the most able respondents. There were 6.5% respondents who were able to answer the hardest knowledge items (above 1 SD). The "knowledge" items were easy to endorse and well-fitted to test the respondents at Malaysia forest fringe.

For the hardest endorse knowledge item that was item K10: 'Is there treatment to cure *Zika*?', with the correct answer being 'No', only 15.5% answered correctly, while 60.3% respondents answered 'Yes'. Respondents possibly assumed that symptomatic treatment as a curative treatment. Respondents may have answered this based on their previous perception towards Dengue fever, which presents similarly to a *Zika* infection, with the former being much more familiar to the local population. However, respondents did not understand the pathophysiology of the virus infection. There was a discrepancy of understanding between the knowledge level of researchers and the public. The easiest endorsed item was K11-4, answer "Yes" to 'Seek medical advice', for symptomatic treatments for Zika. Almost all (91.9%) of the respondents would seek medical advice if they contracted the *Zika* infection. This is a proxy to show that majority of the respondents had good health seeking behaviour and established trust towards local healthcare facilities/services.

Perception of Risk

The perception domain of questionnaire consisted of five items to test respondents' risk perception towards the vulnerability, transmission, complication, prevention, and health seeking behaviour on *Zika* infection. Items in 'perception' domain were all presented in a five level Likert scale, where participants answered 'Strongly agree', 'Agree', 'Not sure', 'Disagree' or 'Strongly disagree'. Perception item P1, P4, P5 tested on perception towards a positive health seeking behaviour, where 'Strongly agree' was given a score of 5 and 'Strongly disagree' was given a score of 1; item P2, P3 tested on perception towards negative health seeking behaviour with 'Strongly disagree' given a score of 5 and vice versa. The score of negative perception items were inverted for the Rasch analysis. The five level Likert scale has a logits of 2.72 ($1.4<s<5.0$), indicating good separation between the rating options.

Rasch analysis showed good model of fitness for both item and person's measure for risk perception towards *Zika* infection, indicating suitability of perception items towards assessment

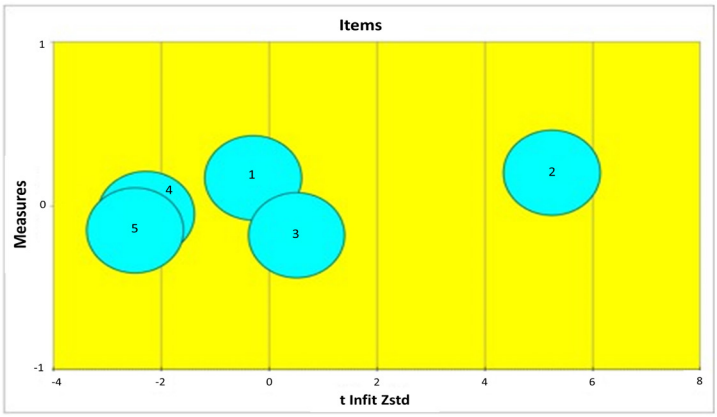

Figure 3: The bubble chart for items of risk perception in Rasch

of targeted population. Overall, 2/3 of the questioned items were well targeted. The bubble chart in the Rasch analysis showed perception for item P1 and P3 were well-fitted to test the respondents' ability (Figure 3). Item P1 was 'I am at a risk group of getting *Zika* infection', with 'Strongly agree' given a score of 5. Item P3 was 'I feel safe from *Zika* infection when I enter forest fringe even if I do not use mosquito net/repellent/using mosquito coil/wearing protective clothing', with 'Strongly disagree' given a score of 5.

There were 3.5% respondents who achieved a perfect score, while 0.2% had the lowest score of 8/25. Mean score for risk perception was 18.04 ± 3.1/25 by both SPSS and Rasch. Less than half of the respondents had good risk perception (41.8% by SPSS and 42% by Rasch), result that are summarised in Table 2. Overall, this set of questions were too easy to endorse (Wright map), with 9.3% respondents having risk perception above +1 SD and 8.3% below -1 SD.

Both knowledge and perception scores were subjected to bivariate analysis against sociodemographic/ socioeconomical status with Pearson's Chi Square using SPSS, as summarised in Table 3.

Respondents from the state of Perak generally had a significantly higher level of knowledge and risk perception towards *Zika* infection. Sociodemographic/socioeconomical status which influenced knowledge level significantly included state of residence (X^2 = 7.95 (1), p <0.005, OR = 0.579, 95% CI (0.395, 0.848)); ethnicity (X^2 = 10.292 (1), p<0.001, OR = 1.945, 95% CI (1.292, 2.927); education level (X^2 = 7.590 (1), p = 0.006, OR =1.845, 95% CI (1.19, 2.861); household income group (X^2 = 15.568 (1), p<0.0001, OR = 0.352, 95% CI (0.207, 0.600) and being in the reproductive age group (15-49 years) (X^2 = 4.403 (1), p = 0.036, OR = 1.590, 95% CI (1.029, 2.455). The forest fringe population in Perak had 42% lower odd of poor knowledge, with bumiputra (natives) having almost two times better knowledge levels than non-bumiputras. Those with higher education levels had 84.5% better odd performance in knowledge level.

Table 3: Knowledge and risk perception on Zika infection among different sociodemographic / socioeconomical status using Pearson's Chi Square for bivariate analysis

		Knowledge			Perception		
Factors	**(n=433) Prevalence (%)**	**X^2 (df)**	**p**	**OR (95% CI)**	**X^2 (df)**	**p**	**OR (95% CI)**
Age group							
Adult (18-59 years)	399 (92.1%)	1.772 (1)	0.183	0.616 (0.300, 1.264)	3.565 (1)	0.059	0.475 (0.216, 1.044)
Elderly (60 years and above)	34 (7.9%)						
Gender							
Male	145 (33.5%)	1.335 (1)	0.248	1.266 (0.848, 1.888)	0.111 (1)	0.739	0.933 (0.622, 1.400)
Female	288 (66.5%)						
Ethnicity							
Bumiputra	292 (67.4%)	10.292 (1)	0.001	1.945 (1.292, 2.927)	24.776 (1)	<0.0001	0.330 (0.211, 0.516)
Non-Bumiputra	141 (32.6%)						
Religion							
Muslim	134 (30.9%)	0.159 (1)	0.69	0.92 (0.612,1.384)	1.592 (1)	0.207	1.303 (0.864, 1.965)
Non-muslim	299 (69.1%)						
Education level							
Low level	320 (73.9%)	7.590 (1)	0.006	1.845 (1.19, 2.861)	0.698 (1)	0.404	0.832 (0.540, 1.282)
High level	113 (26.1%)						
Household Income group							
Low Income	357 (82.4%)	15.568 (1)	<0.0001	0.352 (0.207, 0.600)	0.932 (1)	0.334	1.286 (0.771, 2.143)
High Income	76 (17.5%)						
Location of Workplace							
Forest Fringe	289 (66.7%)	1.110 (1)	0.292	0.806 (0.540, 1.204)	8.617 (1)	0.003	1.868 (1.228, 2.841)
City	144 (33.3%)						
Occupation Energy level / Working Environment							
Low / indoor	322 (73.9%)	0.018 (1)	0.894	0.971 (0.631, 1.495)	2.877 (1)	0.090	1.455 (0.942, 2.245)
High / outdoor	111 (26.1%)						
Regular jungle visit							
Yes	133 (30.7%)	0.108 (1)	0.743	1.071 (0.712, 1.611)	3.945 (1)	0.047	1.516 (1.004, 2.289)
No	300 (69.3%)						
Has activity at forest fringe area							
Yes	271 (62.6%)	0.733 (1)	0.392	1.185 (0.803, 1.750)	1.600 (1)	0.206	1.289 (0.870, 1.910)
No	162 (36.4%)						
Recent jungle visit (<14 days)							
Yes	121 (27.9%)	2.566 (1)	0.109	1.411 (0.925, 2.151)	7.273 (1)	0.007	1.786 (1.169, 2.128)
No	312 (72.1%)						

		Knowledge			Perception		
Factors	**(n=433) Prevalence (%)**	**X^2 (df)**	**p**	**OR (95% CI)**	**X^2 (df)**	**p**	**OR (95% CI)**
State							
Perak	231 (53.3%)	7.95 (1)	0.005	0.579 (0.395, 0.848)	33.057 (1)	<0.0001	3.207 (2.142, 4.803)
Pahang	202 (46.7%)						
Reproductive Age Group (15-49 years)							
Yes	320 (73.9%)	4.403 (1)	0.036	1.590 (1.029, 2.455)	6.812 (1)	0.009	0.564 (0.366, 0.869)
No	113 (26.1%)						
Pregnant							
Yes	29 (6.7%)	0.237 (1)	0.626	0.829 (0.389, 1.767)	2.582 (1)	0.108	0.509 (0.220, 1.176)
No	404 (93.3%)						

Respondents from a higher household income group has 30% lower odd of poor knowledge level, while those who were in their reproductive age had 59% higher odd of good knowledge level.

Sociodemographic/socioeconomic status which influenced risk perception significantly include state of residence (X^2 = 33.057 (1), p<0.0001, OR = 3.207, 95% CI (2.142, 4.803); ethnicity (X^2 = 24.776 (1), p<0.0001, OR = 0.330, 95% CI (0.211, 0.516); location of workplace (X^2 = 8.617 (1), p= 0.003, OR = 0.330, 95% CI (0.211, 0.516); regular and recent jungle visit (X^2 = 3.945 (1), p = 0.047, OR = 1.516, 95% CI (1.004, 2.289); (X^2 = 7.273 (1), p = 0.007, OR = 1.786, 95% CI (1.169, 2.128); Reproductive Age Group (15-49 years) (X^2 = 6.812 (1), p = 0.009, OR = 0.564, 95% CI (0.366, 0.869). Forest fringe population from Perak had 3.2 times higher odd of good knowledge level than those in Pahang; working in the forest fringe had 67% lower odd of poor knowledge level while respondents who enter jungle regularly and those who had recent jungle visit has 1.5 times and 1.78 times higher odd of risk perception level, respectively. Women in the reproductive age group had 44% lower odd of poor risk perception level. The bivariate analysis of all covariates against the knowledge level of respondents is summarised in Table 3.

Association of Risks Factors with Knowledge and Risk Perception Level of Respondents from Forest Fringe Population in Malaysia

All significant factors were subjected to multivariate analysis using Multiple Logistic Regression in SPSS identify confounders and effect modifiers. Table 4 summarises the factors significant for knowledge and perception levels with covariates adjusted.

Non-bumiputra, high education level, high income group, and recent jungle visit had better knowledge level than their counterparts. Bumiputra (Malay, *Orang Asli* (aborigine) and *Orang Asal* (natives of Sabah/Sarawak)

Table 4: Factors associated with knowledge and risk perception level for Zika infection among forest fringe population in Malaysia (Multiple Logistic Regression Analysis - SPSS)

Variable	Adjusted OR	(95% CI OR)	p value[a]
Knowledge Level			
Ethnicity (Bumiputra)	0.602	0.377; 0.961	0.033
High Education Level	1.818	1.123; 2.943	0.015
High Household Income Group	2.116	1.181; 3.792	0.012
Recent Jungle Visit (<14 Days)	2.076	1.288; 3.344	0.003
Hosmer-Lemeshow Test = 0.276 (p>0.05)			
Prediction Power 50.8%			
No Influential Outlier			
No Multicollinearity: All S.E. < 0.5 (0.001-5.0)			
All Interaction Terms Checked, Not Significant			
Risk Perception Level			
Adult Age Group (18-59)	2.854	1.213; 6.716	0.016
Perak State	3.054	2.028; 4.598	<0.0001
Reproductive Age Group (15-49 years)	0.537	0.334; 0.864	0.010
Hosmer-Lemeshow test = 0.929 (p>0.05)			
Prediction Power 65.6%			
No Influential Outlier			
Collinearity: Max VIF 2.386 (<10)			
All Interaction Terms Checked, Not Significant			

[a]Likelihood Ratio (LR) test, adj OR = Adjusted Odd Ratio

had 60% lower odd of good knowledge (95% CI 0.377; 0.961); high education level has 1.8 times higher (95% CI 1.123; 2.943) knowledge level than their counterparts. High household income group (M40 & T20)(Kirat 2020) and recent jungle visit (<14 days) both had 2.1 times higher odd of good knowledge level than those below the poverty line (95% CI 1.181; 3.792) and without recent jungle visit (<14 days) (95%CI 1.288; 3.344).

Adult, menopaused women, from Perak had better risk perception level for *Zika* infection, as shown in Table 4. Adult (18-59 years) had 2.86 times higher odd of good risk perception, (95% CI 1.213; 6.716); women of reproductive age group had 53.7% lower odd of good risk perception (95% CI 0.334; 0.864) and respondents from Perak has 3 times higher odd of good risk perception than respondents from Pahang (95% CI 0.334; 0.864).

DISCUSSION

Almost 2/3 (68.25%) of the question items used to test the knowledge level of respondents in forest fringe population of Malaysia was well-targeted and easy to endorse. The hardest item to answer was item K10: 'Is there treatment to cure *Zika*?' (No). Respondents possibly

assumed admission to hospital is considered as a form of treatment, and assuming a discharge from hospital is equivalent of being cured. This assumption is without understanding the pathophysiology of immune response towards the viral infection (Klimpel 1996). Most of the study population mistook asymptomatic spectrum of *Zika* infection or gave low emphasis of disease in the country as 'cure'.

The result indicated geographical factor, social status (such as education, earning level), and prior experience with jungle related activities affects the knowledge level of respondents towards a subject, similar to a study conducted in Brunei (Chaw et al. 2018). Respondents from higher household income had better knowledge towards *Zika* infection. They could be potential advocates to provide health education to their at-risk neighbours to prevent a *Zika* infection. A similar approach was proposed by Desjardins et al. (2020). Health education materials should be more accessible to the lower odd groups to raise knowledge level and reduce inequity, hence narrowing the gap for universal health coverage (Lyratzopoulos et al. 2012).

However, risk perception towards the *Zika* disease is affected differently as compared to how knowledge was affected. Risk perception is largely affected by prior experiences, which forms a behaviour (Ohman 2017). Most respondents had good perception towards prevention of *Zika* (item P3, P5) and health-seeking (item P4), but majority did not perceive that they were vulnerable to *Zika* infection (item P1) and risk of complications (item P2). Adult, women beyond reproductive age group from Perak were having better risk perception than their counterparts, at 2-3 times higher odd. Risk perception denotes prior personal experiences or comprehension towards a subject (Carpenter 2010; Mohd Shahrol et al. 2021). In the case of *Zika* infection, respondents' risk perception level was most likely influenced by their prior experience towards the more common hyperdemic Dengue infection in Malaysia (Ministry of Health Malaysia 2017). The risk perception level was not related to socioeconomy status or prior experience of forest-related activity. The poor risk perception towards vulnerability was most likely due to poor emphasis on the diseases because of underreporting of cases (National Public Health Laboratory MOH 2016; Woon et al. 2019). This could possibly be affected by the input and pathway of surveillance system for *Zika* in Malaysia, which focuses on international ports (MOH 2019). The poor risk perception level reported in the present study was similar to Southeast Asian (Heang et al. 2012; Leung et al. 2015; Moi et al. 2017) and the Middle Eastern countries (Cheema et al. 2017); however lesser than respondents from Latin American regions (Carabali et al. 2018), possibly due to a higher incident of *Zika* infection and related microencephaly cases that has sparked more widespread awareness (Korhonen et al. 2016; Krauer et al. 2017; Zammarchi et al. 2015; Zanluca et al. 2015).

With poor knowledge and risk perception levels towards *Zika*,

Malaysia is in a precarious state to curb this re-emerging disease. Autochtonous transmission of *Zika* may have long been affecting Malaysia, but many cases could have been mistaken as dengue fever due to the similarity in presentation (Musso et al. 2015; Pond 1963; Duong & Dussart 2017). The low prevalence of *Zika* in Malaysia could be due to false assurance given by the current surveillance system and a low funding interest for *Zika*-related research in the Southeast Asian region (WHO 2017). There are likely more cases in this region than currently reported, such as in Thailand (Ruchusatsawat et al. 2019). The recent report of a local ZIKV transmission case in the Malaysian Navy proves that autochthonous transmission of *Zika* does exist (Malay Mail 2019). The Asian lineage of *Zika* which mutated to American lineage was responsible for the Public Health Emergency of International Concern in year 2016 (Hu et al. 2019). The missing link of the Asian lineage ZIKV mutation in Southeast Asia may provide answer to how other *flavivirus* family members, particularly Dengue virus, mutated (Musso et al. 2015). Recent evidence has shown that the dengue virus is sexually transmissible (ECDC 2019). The economic power of most developing countries is inadequate to cope with the health expenditure of *Zika* complications, particularly microencephaly and Guillain-Barre syndrome, as compared to Latin America and European continents (Jaydip et al. 2014; Kuadkitkan et al. 2020). Therefore, preventive public health effort should be strengthened, particularly in raising the knowledge and risk perception levels of the residence towards *Zika* infection in order to prevent uncontrolled outbreaks which may further exhaust the Gross National Income of the country (World Bank 2020).

CONCLUSION

In conclusion, majority of the forest fringe population in Malaysia have poor knowledge and poor risk perception towards *Zika* infection. The questionnaire was well-targeted and easy to endorse. Non-bumiputra of higher education level, higher income status and recent jungle visits were found to have better knowledge. Adult, menopaused women from the state of Perak had better risk perception. This tool would provide insight for the Ministry of Health Malaysia to develop *Zika* related health education material to the forest fringe populations in Southeast Asia.

REFERENCES

Anderson, J.L. 2017. *Zika* virus: a review and clinical updates. *Infect Dis Clin Pract* **25**(6): 289-93.

Arief, M., Hassali, M.A., Saleem, F., Khan, M.U., Bhagavathulha, A.S., Jamshed, S.Q. 2017. A cross-sectional survey on the knowledge and attitudes towards *Zika* virus and its prevention among residents of Selangor, Malaysia. *J Pharm Pract Community Med* **3**(2): 81-9.

Azrilah, A.A. 2010. *Rasch model fundamentals: scale construct and measurement structure. Malaysia*. Kuala Lumpur: Perpustakaan Negara Malaysia.

Brasil, P., Sequeira, P.C., Freitas, A., Zogbi, H.E., Calvet, G.A., de Souza, R.V., Siqueira, A.M., de Mendonca, M.C., Nogueira, R.M., de Filippis, A.M., Solomon, T. 2016. Guillain-Barre syndrome associated with *Zika* virus infection. *Lancet* **387**(10026): 1482.

Carpenter, C.J. 2010. A meta-analysis of the effectiveness of health belief model variables

in predicting behavior. *Health Commun* **25**(8): 661-9.

Carabali, M., Austin, N., King, N.B., Kaufman, J.S. 2018. The *Zika* epidemic and abortion in Latin America: a scoping review. *Glob Health Res Policy* **3**(1): 15.

Chaw, L.L., Tuah, N.A., Wong, J.Y., Naing, L. 2018. Knowledge, attitudes and practice survey on *Zika* virus infection among pregnant women in Brunei Darussalam. *Asian Pac J Trop Med* **11**(11): 638-44.

Cheema, S., Maisonneuve, P., Weber, I., Fernandez-Luque, L., Abraham, A., Alrouh, H., Sheikh, J., Lowenfels, A.B., Mamtani, R. 2017. Knowledge and perceptions about *Zika* virus in a Middle East country. *BMC Infect Dis* **17**(1): 524.

Desjardins, M.R., Casas, I., Victoria, A.M., Carbonell, D., Davalos, D.M., Delmelle, E.M. 2020. Knowledge, attitudes, and practices regarding Dengue, Chikungunya, and *Zika* in Cali, Colombia. *Health Place* **63**(20): 1-11.

Duong, V., Dussart, P.B.P. 2017. *Zika* virus in Asia. *Int J Infect Dis* 54: 121-8.

European Centre for Disease Prevention and Control (ECDC). 2019. Sexual transmission of Dengue in Spain - rapid risk assessment. *European Centre for Disease Prevention and Control*. Stockholm: European Centre for Disease Prevention and Control.

Heang, V., Yasuda, C.Y., Sovann, L., Haddow, A.D., Travassos da Rosa, A.P., Tesh, R.B., Kasper, M.R. 2012. *Zika* virus infection, Cambodia, 2010. *Emerg Infect Dis* **18**(2): 349-51.

Hu, T., Li, J., Michael, J.C., Sebastia´N, D. & Shi, W.F. 2019. The Asian lineage of *Zika* virus: transmission and evolution in Asia and the Americas. *Virol Sin* 34(1): 1-8.

Hughes, B.W., Addanki, K.C., Sriskanda, A.N., Mclean, E. Bagasra, O. 2016. Infectivity of immature neurons to zika virus: a link to congenital zika syndrome. *EBioMedicine* **10**: 65-70.

Jaydip, R.C., Suvarna, A., Rukmini, M., Demudu, B.B., Rao, M.V., Hemanth, C., Dhanalaxmi, V., Reddy, J.M., Rao, S.M., Balaraju, B., Srinivasarao Bandaru, V.C.S. 2014. Clinical outcome of Guillain-Barré syndrome with various treatment methods and cost effectiveness: a study from tertiary care center in South India: Yashoda GBS Registry. *Neurology Asia* **19**(3): 263-70.

Karwowski, M.P., Nelson, J.M., Staples, J.E., Fischer, M., Fleming-Dutra, K.E., Villanueva, J., Powers, A.M., Mead, P., Honein M.A., Moore, C.A., Rasmussen, S.A. 2016. *Zika* virus disease: a CDC update for pediatric health care providers. *Pediatrics* **137**(5): e20160621.

Kirat, K. 2020. B40, M40 & T20: What Do They Even Mean??? TRP Jan: 8. https://www.therakyatpost.com/2020/01/08/b40-m40-t20-what-do-they-even-mean/ [1 Mar 2020].

Klimpel, G. 1996. Immune Defenses. In *Medical Microbiology*. Edited by Baron, S. Galveston (TX): University of Texas Medical Branch at Galveston.

Korhonen, E.M., Huhtamo, E., Smura, T., Kallio-Kokko, H., Raassina, M., Vapalahti, O. 2016. *Zika* virus infection in a traveller returning from the Maldives, June 2015. *Euro Surveill* **21**(2): 30107.

Krauer, F., Riesen, M., Reveiz, L., Oladapo, O.T., Martínez-Vega, R., Porgo, T.V., Haefliger, A., Broutet, N.J., Low, N. 2017. *Zika* virus infection as a cause of congenital brain abnormalities and Guillain–Barré Syndrome: systematic review. *PLoS Med* **14**(1): e1002203

Kuadkitkan, A., Wikan, N., Sornjai, W., Smith, D.R. 2020. *Zika* virus and microcephaly in Southeast Asia: a cause for concern?*J Infect Public Health* **13**(1): 11-5.

Leung, G.H., Baird, R.W., Druce, J., Anstey, N.M. 2015. *Zika* virus infection in Australia following a monkey bite in Indonesia. *Southeast Asian J Trop Med Public Health* **46**(3): 460-4.

Lim, S.K., Lim, J.K., Yoon, I.K. 2017. An Update on *Zika* irus in Asia. *Infect Chemother* **49**(2): 91-100.

Lyratzopoulos, G., Elliott, M., Barbier, J.M., Henderson, A., Staetsky, L., Paddison, C., Campbell, J., Roland, M. 2012. Understanding ethnic and other socio-demographic differences in patient experience of primary care: evidence from the English general practice patient survey. *BMJ Qual Saf* **21**(1): 21-9.

Malay Mail. 2019. Health D-G: Perak *Zika* Patient's Death Possibly Due to Local Virus Infection. https://www.malaymail.com/news/malaysia/2019/10/18/health-d-g-perak-*Zika*-patients-death-possibly-due-to-local-virus-infection/1801617 [1 November 2020].

Marchette, N.J., Garcia, R., Rudnick, A. 1969. Isolation of *Zika* virus from Aedes *Aegypti* mosquitoes in Malaysia. *Am J Trop Med Hyg* **18**(3): 411-5.

Ministry of Health (MOH). 2017. Dengue fever, Chikungunya and *Zika* situation report week 42/2017.

Ministry of Health (MOH). 2019. Updated *Zika* Alert. Administrative Order for Surveillance and Management of *Zika* Virus Infection 2019 2:1-32. Malaysia: Ministry of Health.

Mohd Shahrol A.W., Sharifah Fazlinda S.N., Chin Mun W., Norain A., Noor Dalila I.Z.A., Siti Rasidah A.G., Lavanyah S., Sharifah Ain Shameera S.R., Abdullah Aliff A.W., Safirah Jaan J., Faiz D. 2021. Visitors' perception of the effectiveness of Leptospirosis health hazard warning signage in recreational parks, Hulu Langat District, Malaysia. *ASM Sc J* **14**: 1-12.

Moi, M.L., Nguyen, T.T.T., Nguyen, C.T., Vu, T.B.H., Tun, M.M.N., Pham, T.D., Pham, N.T., Tran, T., Morita, K., Le, T.Q.M., Dang, D.A., Hasebe, F. 2017. *Zika* virus infection and microcephaly in Vietnam. *Lancet Inf Dis* **17**(8): 805-6.

Musso, D., Nilles, E.J., Cao-Lormeau, V.M. 2014. Rapid spread of emerging *Zika* virus in the Pacific Area. *Clin Microbiol Infect* **20**(10): 595-6.

Musso, D., Roche, C., Robin, E, Nhan, T., Teissier, A., Cao-Lormeau, V-M. 2015. Potential sexual transmission of *Zika* virus. *Emerg Infect Dis* **21**(2): 359-61.

National Public Health Laboratory MOH. 2016. Update on *Zika* cases. Bulletin Insert.

Ohman, S. 2017. Previous experiences and risk perception: the role of transference. *J Educ Soc Behav Sci* **23**(1): 1-10.

Pond, W.L. 1963. Arthropod-borne virus antibodies in sera from residents of South-East Asia. *Trans R Soc Trop Med Hyg* **57**: 364-71.

Rosales, A., Yepes-Mayorga, A., Arias, A., Franz, F., Thomas, J., Huddle, J., Soto, R., Haynes, M., Prado, M., & Cherian, D. 2017. A cross-sectional survey on Zikv in Honduras: implications for gngovernance and risk communication approaches. *Int J Health Gov* **22**(2): 83-92.

Rosnah, I., Mohd Zali, M.N., Noor Hassim, I., Azmi, M.T. 2015. A tale of two construct validation analysis: Rasch model and exploratory factor analysis approach for three-factor eating questionnaire (Tfeq-R21) among Malaysian male workers. *Med J Malaysia* **70**(3): 169-76.

Roze, B., Najioullah, F., Signate, A., Apetse, K., Brouste, Y., Gourgoudou, S., Fagour, L., Abel, S., Hochedez, P., Cesaire, R., Cabié, A., Neuro-*Zika* Working Group of Martinique. 2016. *Zika* virus detection in cerebrospinal fluid from two patients with encephalopathy, Martinique. *Euro Surveill* **21**(16): 30205.

Ruchusatsawat, K., Wongjaroen, P., Posanacharoen, A., Rodriguez-Barraquer, I., Sangkitporn, S., Cummings, D.A.T., Salje, H. 2019. Long-term circulation of *Zika* virus in Thailand: an observational study. *Lancet Infec Dis* **19**(4): 439-46.

Saba Villarroel, P.M., Nurtop, E., Pastorino, B., Roca, Y., Drexler, J.F., Gallian, P., Jaenisch, T., Leparc-Goffart, I., Priet, S., Ninove, L., de Lamballerie, X. 2018. *Zika* virus epidemiology in Bolivia: a seroprevalence study in volunteer blood donors. *PLoS Negl Trop Dis* **12**(3): 0006239.

Smithburn, K.C. 1954. Neutralizing antibodies against arthropod-borne viruses in the sera of long-time residents of Malaya and Borneo. *Am J Hyg* **59**(2): 157-63.

Turmel, J.M., Abgueguen, P., Hubert, B., Vandamme, Y.M., Maquart, M., Le Guillou-Guillemette, H., Leparc-Goffart, I. 2016. Late sexual transmission of *Zika* virus related to probable long persistence in the semen. *Lancet* **387**(10037): 2501.

Uncini, A., Shahrizaila, N., Kuwabara, S. 2017. *Zika* virus infection and Guillain-Barre syndrome: a review focused on clinical and electrophysiological subtypes. *J Neurol Neurosurg Psychiatry* **88**(3): 266-71.

Whittemore, K., Tate, A., Illescas, A., Saffa, A., Collins, A., Varma, J.K., Vora, N.M. 2017. *Zika* virus knowledge among pregnant women who were in areas with active transmission. *Emerg Infect Dis* **23**(1): 164-6.

Wolfe, N.D., Kilbourn, A.M., Karesh, W.B., Rahman, H.A., Bosi, E.J., Cropp, B.C., Andau, M., Spielman, A., Gubler, D.J. 2001. Sylvatic transmission of Arboviruses among Bornean orangutans. *Am J Trop Med Hyg* **64**(5-6): 310-6.

Wong, C.M., Rozita, H., Mohd Rohaizat, H., Sazaly, A.B. 2020. A tale of dual-approaches construct validation & reliability testing for *Zika* infection awareness / knowledge questionnaire. *J Health Res* (in press).

Wong, L.P., Alias, H., Aghamohammadi, N., Sam, I.C., Abu Bakar, S. 2017. Differences in perceived severity of *Zika* virus infection and Dengue fever and its influence on mosquito control practices in Malaysia. *J Community Health* **42**(5): 854-64.

Woon, Y.L., Lim, M.F., Tg Abd Rashid, T.R., Thayan, R., Chidambaram, S.K., Syed Abdul Rahim, S.S., Mudin, R.N., Sivasampu, S. 2019. *Zika* virus infection in Malaysia: an epidemiological, clinical and virological analysis. *BMC Infect Dis* **19**(1): 152.

World Bank. Gni Per Capita, Ppp (Current International $)-Malaysia. https://data.worldbank.org/indicator/NY.GNP.PCAP.PP.CD?locations=MY. [9 October 2020].

World Health Organization. 2016. *Knowledge, attitudes and practice surveys: Zika virus disease and potential complications: resource pack*. Geneva: WHO Press; 2-29.

World Health Organization. 2017. Sexual transmission of *zika* virus: current status, challenges and research priorities: summary of discussions. WHO/RHR/17.23 pp.8-9. Geneva: World Health Organization.

Zammarchi, L., Tappe, D., Fortuna, C., Remoli, M.E., Günther, S., Venturi, G., Bartoloni, A., Schmidt-Chanasit, J. 2015. *Zika* virus infection in a traveller returning to Europe from Brazil. *Euro Surveill* **20**(23): 21153.

Zanluca, C., Melo, V.C., Mosimann, A.L., Santos, G.I., Santos, C.N., Luz, K. 2015. First report of autochthonous transmission of *Zika* virus in Brazil. *Mem Inst Oswaldo Cruz* **110**(4): 569-72.

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