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PREDICTORS OF PRACTICES ON ZIKA VIRUS INFECTION AMONG WOMEN ATTENDING ANTENATAL CARE AT PUBLIC CLINICS IN JOHOR BAHRU DISTRICT 2017

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August 2017

Chairperson : Dr Salmiah Binti Md. Said
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Background: Zika Virus outbreak was announced as Public Health Emergency Of International Concern (PHEIC) in February, 2016 as sudden increasing of microcephaly cases and other neurological disorders in some areas affected by Zika Virus. Furthermore, other than transmitted via mosquito bites, some studies proven that Zika Virus infection can also be transmitted through sexual intercourse and blood-borne. In 2016, there was occurrence of two confirmed Zika Virus infection cases in Johor Bahru district, which one of them was a pregnant woman.

Objectives: To determine the predictors affecting preventive practices on Zika Virus infection among pregnant women attending antenatal check-up at public health facilities in Johor Bahru district in 2017.

Methods: The study was a cross sectional study, conducted in April 2017 on 724 pregnant women in Johor Bahru district, who were sampled by using probability proportional to size method. Data was collected by self-administrated questionnaire and had analysed using SPSS version 22.0.

Result: Majority of the respondents had high level of preventive practices and also on knowledge related to Zika Virus infection. The predictors for level of preventive practices on Zika Virus infection were Muslim, type of house (apartment, flat or condominium), and knowledge. Other variables, including health belief were found as not significant predictor in this study.

Conclusion: From this study, only 3 variables became the predictors for preventive practices and no significant association was found between level of preventive practices and health belief of the respondents. Our study recommends to increase health promotion to improve awareness and preventive practices technique on Zika Virus infection.

Keyword: Zika Virus infection, preventive practices, health belief model

Abstrak disertasi yang dikemukan kepada Senat Universiti Putra Malaysia Sebagai memenuhi keperluan untuk ijazah Sarjana Perubatan Kesihatan Awam

FAKTOR PERAMAL UNTUK AMALAN PENCEGAHAN TERHADAP JANGKITAN VIRUS ZIKA DIKALANGAN IBU HAMIL YANG MENGHADIRI KLINIK ANTENATAL DI FASILITI AWAM DI DAERAH JOHOR BAHRU 2017

Oleh

MOHD ANWAR SHAHRIR BIN AHMAD

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Pendahuluan : Wabak Virus Zika telah diumumkan sebagai *Public Health International* Concern (PHEIC) pada bulan Februari 2016 berikutan kenaikan mendadak kes "microcephaly" dan penyakit saraf yang lain di kawasan yang dijangkiti Virus Zika. Tambahan pula, selain berjangkit melalui gigitan nyamuk, beberapa kajian mengesahkan bahawa jangkitan Virus Zika juga boleh berjangkit melalui hubungan seks and melalui darah. Pada tahun 2016, dua orang disahkan menghidap jangkitan Virus Zika di daerah Johor Bahru, yang mana seorang daripadanya adalah perempuan hamil.

Objektif : Untuk menentukan faktor peramal ke atas amalan pencegahan terhadap jangkitan Virus Zika dikalangan ibu hamil yang menghadiri fasiliti kesihatan awam di daerah Johor Bahru pada tahun 2017.

Kaedah : Satu kajian keratan rentas telah dilaksanakan pada bulan April 2017 ke atas 724 ibu hamil di daerah Johor Bahru, yang telah dipilih melalui kaedah *probability proportional to size*. Maklumat dikumpul melalui borang kaji selidik yang diisi sendiri oleh responden dan dianalisa menggunakan SPSS versi 22.0.

Keputusan : Majoriti responden mempunyai taraf amalan pencegahan yang tinggi, dan juga pengetahuan berkenaan jangkitan Virus Zika yang tinggi. Faktor peramal ke atas amalan pencegahan terhadap jangkitan Virus Zika adalah beragama Islam, tinggal di apartmen, flat atau kondominium, dan pengetahuan. Faktor-faktor lain termasuklah kepercayaan terhadap kesihatan adalah tidak signifikan di dalam kajian ini.

Kesimpulan : Daripada kajian ini, hanya 3 faktor yang menjadi faktor peramal ke atas ke amalan pencegahan terhadap jangkitan Virus Zika dan tiada hubungan yang signifikan di antara amalan pencegahan dan kepercayaan terhadap kesihatan. Kajian kami mencadangkan supaya promosi kesihatan diperkukuhkan untuk meningkatkan kesedaran and teknik amalan pencegahan ke atas jangkitan Virus Zika.

Kata kunci : Jangkitan Virus Zika, amalan pencegahan, *health belief model*

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I certify that a Thesis Examination Committee has met on 1st August 2017 to conduct the final examination of Mohd Anwar Shahrir bin Ahmad on his thesis entitled "Predictors of Practices on Zika Virus Infection among Women attending Antenatal Care at Public Clinics in Johor Bahru 2017" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Master of Public Health.

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This is to confirm that:

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- supervision responsibilities as stated in the Universiti Putra Malaysia (Graduate Studies) Rules 2003 (Revision 2012-2013) are adhered to.

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LIST OF ABBREVIATIONS

CDC	Centers of Disease Control and Prevention, US
CNS	Central Nervous System
ELISA	Enzyme-linked Immunoassay
EPA	Environmental Protection Agency
HBM	Health Belief Model
Ig	Immunoglobulin
IMM	Integrated Mosquito Management
IVC	Integrated Vector Control
KKIA	Maternal and Child Health Clinic
MOH	Ministry of Health, Malaysia
PHEIC	Public Health Emergency of International Concern
PPS	Probability Proportional to Size
PRNT	Plague Reduction Neutralization Test
RNA	Ribonucleic acid
RT-PCR	Reverse Transcription- Polymerase Chain Reaction
SPSS	Statistical Packages for the Social Sciences
WHO	World Health Organization
ZIKV	Zika Virus

CHAPTER 1

INTRODUCTION

1.1 Background

The Zika Virus outbreak has captivated the attention of the global audience and information has spread rapidly and wildly through the internet and other media channels. This infection mainly transmitted via mosquito-borne (World Health Organization [WHO], 2016a), but also can be transmitted sexually (Musso et al., 2015b) and vertically from pregnant women to her fetus (Besnard, Lastere, Teissier, Cao-Lormeau, & , Musso, 2013) which can cause certain birth defects such as microcephaly (WHO, 2016a).

Since this virus first discovered in 1947 until 2007, only 14 human Zika Virus cases were documented (Filipe, Martins & Rocha, 1973). Then after 2007, Zika Virus re-emerged as a public health concern as an outbreak occurred in Yap Island, Micronesia in 2007 involving 49 confirmed cases of Zika Virus infections with presenting symptoms such as rashes, arthralgia and conjunctivitis (Duffy et al., 2009). Then an independent outbreak occurred in French Polynesia in 2013 involving more than 8000 suspected cases and unusual rise in neurological syndromes is reported including 8 cases of microcephaly and 42 cases of Gullain-Barre syndrome (Roth et al., 2014). Subsequently multiple outbreak occurred in 2014 in New Caledonia (1400 confirmed cases) and Cook Islands (50 confirmed cases) (Roth et al., 2014), and in 2015, outbreak occurred in Solomon Islands (302 cases), then spread into South America regions, including Brazil in 2015 (European Centre for Disease Prevention and Control, 2015).

For Malaysia, this Zika Virus was already found on mosquito in 1969 but no reported human case (Smithburn, 1954). Then after recent outbreak worldwide in 2016, Malaysia reported their first Zika Virus infection case in September, subsequently followed by another 7 cases (Ministry of Health of Malaysia (MOH), 2016).

The use of health belief model as a framework that attempt to predict and explain health behaviour towards preventive practices on disease. This model suggests that a person's belief in a personal threat of an illness or disease together with a person's believe in the effectiveness of the recommended health behaviour or action will predict likelihood the person will adopt the behaviour (Green & Murphy, 2014).

For the time being, there is still no vaccine or medicine for Zika Virus infection (WHO, 2016a). Thus, disease preventive practices is the main intervention for Zika Virus infection prevention and control. In view of the main transmission of Zika Virus infection is identical with dengue fever, which is transmitted by Aedes mosquito, the type of preventive practices toward Zika Virus share the same characteristics. Examples for preventive practices on this vector-borne infection are application of insect repellent, mosquito control at home, mosquito control during outbreak, integrated mosquito control and mosquito surveillance (Centers of Disease Control and Prevention of US [CDC],

2016). Other prevention methods toward other mechanism of transmission are preventing sexual transmission, preventing Zika Virus infection in pregnancy and preventing unintended pregnancy during Zika Virus outbreak (CDC, 2016).

1.2 Problem Statement

Zika Virus infection was discovered in 1947, with sporadic outbreak trend until 2007. Since then, there were Zika outbreak throughout several continents especially in 2014 to 2016 in South America (Chang, Ortiz, Ansari, & Gershwin, 2016). Several big events, such as Olympic Games 2016 in Rio, Brazil, held in 2016 in which can contribute to wide spreading of the Zika Virus Infection (WHO, 2016a).

In 2016, a retrospective study was conducted to identify association of microcephaly cases involving pregnant mother and Zika Virus infection in French Polynesia following an outbreak in that region. This study provides a weak statistical support for the suspected association between infection with Zika Virus and microcephaly as the risk is only 1% when mothers are infected with Zika Virus during the first trimester of pregnancy. When compared with other viral infections which cause birth defect, this risk is considered low, however it is still an important community health problem (Cauchemez et al., 2016).

In Malaysia, by end of September 2016, there were eight confirmed Zika Virus infection cases, including one pregnant woman in Johor Bahru (Ministry of Health, Malaysia, 2016). Johor Bahru district is located adjacent to Singapore, which reported 458 confirmed cases of Zika Virus infection in 2016 (Ministry of Health [MOH] Singapore, 2016).

To date, no study related to Zika Virus infection has been conducted in Malaysia but factors being studied before on preventive practice on dengue fever could be used as proxy. Therefore, it is important to conduct a study concerning Zika Virus infection prevention especially in Johor Bahru district because the potential for Zika outbreak in Johor Bahru due to the incidence of dengue cases in this district is the among the highest in Malaysia (Sector of Vector-Borne Disease, Disease Control Division, MOH (2015) - unpublished) and prevalence of Zika Virus cases in neighbour country, Singapore (MOH Singapore, 2016). Nevertheless, approximately 4 million of people enter to Malaysia from Singapore via international entry in Johor Bahru per month (Johor Bahru District Health Office (2017) - unpublished).

Due to the absence of vaccine or a cure, the only effective measure available to prevent and control Zika Virus infection is by preventing transmission of the disease, especially by the Aedes mosquito. Control measure require support, cooperation and participation by individual and community (Chang et al., 2016).

1.3 Significant of Study

In view of currently no previous study on Zika Virus infection, this study will become a baseline for further study on this infection in Malaysia. It is very essential for public health professionals and physicians in Malaysia to have in-depth knowledge about Zika virus. This study will contribute a valuable information regarding preventive practices on Zika Virus infection especially for Johor Bahru district. The finding from this study could be used to improve preventive practices, knowledge, and health belief among pregnant women in Malaysia especially in Johor Bahru district.

1.4 Research Question

The research question of this study was:

What was the predictors of practices on Zika Virus Infection using health belief model among pregnant women attending antenatal check-up at public health facilities in Johor Bahru district in 2017?

1.5 Objectives

1.5.1 General objective

The general objective was to determine the predictors affecting preventive practices on Zika Virus infection among pregnant women attending antenatal check-up at public health facilities in Johor Bahru district in 2017.

1.5.2 Specific Objectives

The specific objectives of this study were

i to describe the socio-demographic characteristic (age, ethnicity, level of education, occupation, average monthly household income), environmental factors, health belief and knowledge related to Zika Virus infection of pregnant women attending antenatal check-up at public health facilities in Johor Bahru district.

ii to describe the preventive practices on Zika Virus infection of pregnant women attending antenatal check-up at public health facilities in Johor Bahru district.

iii to identify the association between preventive practices on Zika Virus infection and

a) socio-demographic characteristics

b) environmental factors

c) health belief factors (perceived severity, perceived susceptibility, perceived barrier, perceived benefit and self-efficacy)

d) knowledge related to Zika Virus infection

iv to identify predictors of preventive practices on Zika Virus infection

1.6 Hypotheses

Alternative Hypotheses

$H_{a\,1}$ There is significant association of preventive practices on Zika Virus infection with the socio-demographic characteristics

$Ha_{\,2}$ There is significant association of preventive practices on Zika Virus infection with environmental factors

$Ha_{\,3}$ There is significant association of preventive practices on Zika Virus infection with health belief factors

$Ha_{\,4}$ There is significant association of preventive practices on Zika Virus infection with knowledge related to Zika Virus infection

REFERENCES

Al-Dubai, S. A. R., Ganasegeran, K., Rahman, A. M., Alshagga, M. A., & Saif-Ali, R. (2013). Factors affecting dengue fever knowledge, attitudes and practices among selected urban, semi-urban and rural communities in Malaysia. *Southeast Asian Journal of Tropical Medical Public Health, 44*(1)*,* 37-49.

Besnard, M., Lastere, S., Teissier, A., Cao-Lormeau V.M., & Musso, D. (2013). Evidence of perinatal transmission of Zika virus, French Polynesia, December 2013 and February 2014. *EuroSurveillence, 19*(13), 1-5.

Begonia, C. T. & Lendoro, J. L. (2013). Dengue knowledge and preventive practices among rural residents in Samar province, Philippines. *American Journal of Public Health Research, 1*(2)*,* 47-52.

Bierrenbach, A. L. (2008). Steps in applying probability proportional to size. WHO Training workshops on TB prevalance surveys, Geneva. Retrieved from www.who.int/tb/advisory_bodies/.../psws_probability_prop_size_bierrenbach.pdf.

Brasil, P., Pereira, J. P. J., Gabaglia, R., C., Damasceno, L., Wakimoto, M., Ribeiro Nogueira, R. M., … Nielsen-Saines, K. (2016). Zika Virus infection in pregnant women in Rio de Janeiro - Preliminary Report. *The New England Journal of Medicine, 375*(24), 2321-2334. doi:10.1056/NEJMoa1602412

Cauchemez, S., Besnard, M., Bompard, P., Dub, T., Guillemette-Artur, P., Eyrolle-Guignot, D., … Mallet, H. P. (2016). Association between Zika Virus and microcephaly in French Polynesia, 2013-2015: A retrospective study. *The Lancet*, *387*(10033), 2125–2132. doi:10.1016/S0140-6736(16)00651-6

Chang, C., Ortiz, K., Ansari, A., & Gershwin, M. E. (2016). The Zika outbreak of the 21st century. *Journal of Autoimmunity*, *68*, 1–13. doi:10.1016/j.jaut.2016.02.006

Chandren, J. R.,Wong, L. P., & AbuBakar, S. (2015). Practices of dengue fever prevention and the associated factors among the Orang Asli in Peninsular Malaysia. *PLoS Negleted Tropical Diseases*, *9*(8): e0003954. doi:10.1371/journal.pntd.0003954

Centers of Disease Control and Prevention (CDC) of United State (2012). Mosquito Life-Cycle. Retrieved from https://www.cdc.gov/dengue/entomologyecology/m_life cycle.html on April 4, 2017.

Centers of Disease Control and Prevention (CDC) of United State (2016). Key message - Zika Virus Disease. Retrieved from https://www.cdc.gov/zika/pdfs/zika-key-messages.pdf on April 4, 2017.

Department of Statistics Malaysia (2010). *Population and Housing Census of Malaysia 2010.* Putrajaya: Department of Statistics Malaysia, pp. 11-12. Retrieved from https://web.archive.org/web/20131114184213/http://www.statistics.gov.my/portal/download_Population/files/population/04Jadual_PBT_negeri/PBT_Johor.pdf.

Dick, G. W. A., Kitchen, S. F., & Haddow, A. J. (1952). Zika Virus (I) - Isolations and serological specificity. *Transaction of the Royal Society of Tropical Medicine and Hygiene, 46*(5), 509–520. doi:10.1016/0035-9203(52)90042-4

Duffy, M. R., Chen, T. H., Hancock, W. T., Powers, A. M., Kool, J. L., Lanciotti, R. S., … Hayes, E. B. (2009). Zika Virus outbreak on Yap Island, Federated States of Micronesia. *The New England Journal of Medicine, 360,* 2536-2543. *doi:10.1056/NEJMoa0805715*, 2536–2543

European Centre for Disease Prevention and Control. (2015). *Zika virus infection outbreak, Brazil and the Pasific region*. Stockholm: Rapid Risk Assessment, pp. 4-5. Retrieved from http://ecdc.europa.eu/sites/portal/files/media/en/ publications/Publications/rapid-risk-assessment-Zika%20virus-south-america-Brazil-2015.pdf on December 12, 2016.

Faye, O., Freire, C. C., Iamarino, A., Faye, O., de Oliveira, J. V., Diallo, M., … Sall, A. A. (2014). Molecular evolution of Zika virus during its emergence in the 20(th) century. *PLoS Neglected Tropical Diseases, 8*(1), e2636. doi: 10.1371/journal.pntd.0002636

Farizah, H., Ong, C. H., Suhaimi, A., Tsung T. W., Anis Ahmad, M. A., & Sundaraj, C. (2003). A knowledge, attitude and practices (KAP) study on dengue among selected rural communities in the Kuala Kangsar district. *Asia-Pasific Journal of Public Health, 15,* 37-43.

Filipe, A. R., Martins, C. M. V., & Rocha, H. (1973). Laboratory infection with Zika virus after vaccination against yellow fever. *Archiv für die gesamte Virusforschung, 43*(4), 315-319. doi:10.1007/BF01556147

Glanz, K., Lewis, E. M., & Rimer, B. K. (1997). (Eds.) *Health behavior and health education: Theory, research, and practice.* San Fracisco: Jossey-Bass Publishers.

Grard, G., Caron, M., Mombo, I. M., Nkoghe, D., Mboui Ondo, S., Jiolle, D., …, Leroy, E. M. (2014). Zika Virus in Gabon (Central Africa) 2007: A new threat from Aedes albopictus?. *PLoS Neglected Tropical Diseases*, 8(2), 1–6. doi:10.1371/journal.pntd.0002681

Green, E. C. & Murphy, E. (2014). Health Belief Model. *The Wiler Blackwell Encyclopedia of Health, Illness, Behaviour, and Society.* John Wiley & Sons, Ltd, pp. 766-769. doi: 10.1002/9781118410868.wbehibs410/pdf

Gunasekara, T. D. C. P., Velathanthiri, V. G. N. S., Weerasekara, M. M., Fernando, S. S. N., Peelawattage, M., Guruge, D., & Fernando, S. (2012). Knowledge, attitudes and practices regarding dengue fever in a suburban community in Sri Lanka. *Galle Medical Journal, 17*(1), 10-17.

Hamel, R., Liegeois, F., Wichit, S., Pompon, J., Diop, F., Talignani, L., … Misse, D. (2016). Zika virus: Epidemiology, clinical features and host-virus interactions. *Microbes and Infection*, *18*(7–8), 441–449. doi:10.1016/j.micinf.2016.03.009

Hayes, E. B. (2009). Zika virus outside Africa. *Emerging Infectious Disease*, *15*, 1347–1350. doi:10.3201/eid1509.090442

Hills, S. L., Russell, K., Hennessey, M., Williams, C., Oster, A. M., Fischer, M., & Mead, P. (2016). Transmission of Zika Virus through sexual contact with travelers to areas of ongoing transmission - Continental United States, 2016. *Morbidity and Mortality Weekly Report*, *65*(8), 215–216. doi:10.15585/mmwr.mm6508e2

Hosmer Jr, D. W., & Lemeshow, S. (2000) *Applied logistic regression.* New York, US: John Wiley & Sons.

Itrat, A., Khan, A., Javaid, S., Kamal, M., Khan, H., Javed, S., … Jehan, I. (2008). Knowledge, awareness and practices regarding dengue fever among the adult population of dengue hit cosmopolitan. *PLoS One, 3*(7), e2620. doi: 10.1371/journal.pone.0002620

Ioos, S., Mallet, H. P., Leparc Goffart, I., Gauthier, V., Cardoso, T., & Herida, M. (2014). Current Zika virus epidemiology and recent epidemics. *Medecine et Maladies Infectieuses*, *44*(7), 302–307. doi:10.1016/j.medmal.2014.04.008

Janz, N. K., Champion, V. L., & Strecher, V. J. (2002). The Health Belief Model. In K.Glanz, B.K. Rimer, & F.M. Lewis (Eds.), *Health behavior and health education: Theory, research, and practice 3rd ed.,* pp. 45-66.

Knipe, D. M. & Howley, P. M. (2007). *Fields Virology* (5th ed.). San Francisco: Lippincott Williams & Wilkins. pp. 1156-1199.

Kindhauser, M. K., Allen, T., Frank, V., Santhanaa, R. S. & Dyea, C. (2016). Zika: The origin and spread of a mosquito-borne virus. *Bulletin World Health Organization, 94*, 675–686. doi:10.2471/BLT.16.171082

Marchette, N. J., Garcia, R., & Rudnick, A., (1969). Isolation of Zika virus from *Aedes aegypti* mosquitoes in Malaysia. *American Journal Tropical Medicine and Hygiene, 18*(3)*,* 411–415.

Mia, M. S., Begum, R. A., Er, A. C., Abidin, R. D., & Pereira, J. J. (2013). Trends of dengue infections in Malaysia, 2000-2010. *Asian Pasific Journal of Tropical Medicine*, *6*(6), 462-466. doi: 10.1016/S1995-7645(13)60075-9

Ministry of Health (MOH) Malaysia. (2016). Situasi terkini jangkitan Zika di Malaysia. *From the Desk of the Director-General of Health Malaysia.* Retrieved from https://kpkesihatan.com/2016/12/18/kenyataan-akhbar-kpk-18-disember-2016-situasi-terkini-zika-di-malaysia-kes-zika-ke-8/ on April 2, 2017.

Ministry of Health (MOH) Singapore. (2016). 458 cases of Zika infection reported in 2016. *The Online Citizen,* posted on 2017-01-23 by Neyla Zannia. Retrieved from https://www.theonlinecitizen.com/2017/01/23/458-cases-of-zika-infection-reported-in-2016/ on April 2, 2017.

Musso, D., Roche, C., Nhan, T., Robin, E., Teissier, A., & Cao-Lormeau, V.M. (2015a) Detection of Zika virus in saliva. *Journal of Clinical Virology, 68,* 53-55. doi: 10.1016/j.jcv.2015.04.021

Musso, D., Roche, C., Robin, E., Nhan, T., Teissier, A., & Cao-Lormeau, V.M. (2015b). Potential sexual transmission of Zika Virus. *Emerging Infectious Diseases Journal, 21*(2), 359-361. doi: 10.3201/eid2102.141363

Musso, D., Nhan, T., Robin, E., Roche, C., Bierlaire, D., Zisou, K., … Broult, J. (2014). Potential for Zika virus transmission through blood transfusion demonstrated during an outbreak in French Polynesia, November 2013 to February 2014. *Eurosurveillance*, *19*(14), 1-3. doi:10.2807/1560-7917.ES2014.19.14.20761

National Birth Defects Prevention Network. (2013). Birth defects surveillance: Epidemiology, health services research, public health, and prevention. *Congenital Malformations Surveillance Report, 97*(10), 617-618. Retrieved from https://www.nbdpn.org/annual_reports.php.

Nahida, A. & Surasak, T. (2008) Knowledge, attitude and practice of dengue fever prevention among the people in male, Maldives. *Journal of Health Research, 22*(supp)*,* 33-37.

Nazri, C. D., Abu Hassan, A., & Rodziah, I. (2013). Habitat characterization of aedes sp. breeding in urban hotspot area. *Procedia - Social and Behavioral Sciences*, *85*, 100–109. doi: 10.1016/j.sbspro.2013.08.342

Oehler, E., Watrin, L., Larre, P., Leparc-Goffart, I., Lastere, S., & Valour, F. (2014). Zika virus infection complicated by Guillain Barré syndrome—case report, French Polynesia. *EuroSurveillence, 19*, 20720. Retrieved from http://www.eurosurveillance.org/images/dynamic/EE/V19N09/art20720.pdf

Olson, J. G., Ksiazek, T. G., Gubler, D. J., Lubis, S. I., Simanjuntak, G., & Lee, V. H. (1983). A survey for arboviral antibodies in sera of humans and animals in Lombok, Republic of Indonesia. *Annals of Tropical Medical Parasitology, 77*, 131–137.

Olson, S,.Gangnon, R., Silveira, G., & Patz, J. (2010). Deforestation and malaria in Mancio Lima count. *Brazil Emerging Infectious Diseases, 16*(7),1108-1115. *doi: 10.3201/eid1607.091785*

Oster, A. M., Russell, K., Stryker, J. E., Friedman, A., Kachur, R. E., Peterson, E. E., … Brooks, J. T. (2016). Update: interim guidance for prevention of sexual transmission of Zika virus. *Morbidity Mortality Weekly Report, 65*(12), 323–325.

Palanivel, C., Nishant, G., Ravi, P.U., Komal, P., Tejas, M.S., & Kapil, Y. (2012). High level of awareness but poor practices regarding dengue fever control: A cross-sectional study from North India. *North American Journal of Medical Sciences*, *4*(6), 278-283.

Pan American Health Organization (PAHO) / World Health Organization (WHO). (2016). *Epidemiological Update*: Neurological syndrome, congenital anomalies and Zika virus infection. 17 January, Washington, DC: PAHO / WHO. Retrieved from http://www.paho.org/hq/index.php?option=com_docman&task=doc_view &Itemid=270&gid=32878&lang=en on January 17, 2016.

Pan American Health Organization (PAHO), (2016). Algorithm for detecting Zika virus. *Zika virus (ZIKV) Surveillance in the Americas: Laboratory detection and analysis.* Washington, DC: PAHO. Retrieved from https://www.cdc.gov /zika/pdfs/zap_webinar_lab_06062016.pdf on April 4, 2017.

Petersen, E., Wilson, M. E., Touch, S., McCloskey, B., Mwaba, P., Bates, M., … Zumla, A. (2016). Rapid spread of Zika Virus in the Americas - Implications for public health preparedness for mass gatherings at the 2016 Brazil Olympic Games. *International Journal of Infectious Diseases*, *44*(5), 11–15. doi:10.1016/j.ijid.2016.02.001

Roberto, T. C., Jorge, M. G., & Pierre, B. Z., (2012). Community participation in the prevention and control of dengue: the patio limpio strategy in Mexico. *Paediatrics and International Child Health, 32*, 10-13. doi: 10.1179/2046904712Z.00000000047

Rosenstock, I. M., Strecher, V. J., & Becker, M. H. (1988). Social learning theory and the Health Belief model. *Health Education & Behavior*, *15*(2), 175-183. doi: 10.1177/109019818801500203

Roth, A., Mercier, A., Lepers, C., Hoy, D., Duituturaga, S., Benyon, E., ... Souares, Y. (2014). Concurrent outbreaks of dengue, chikungunya and Zika virus infections – an unprecedented epidemic wave of mosquito-borne viruses in the Pacific 2012–2014. *Euro Surveillance,* 19, 41. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=20929.

Sirohi, D., Chen, Z., Sun, L., Klose, T., Pierson, T. C., Rossmann, M. G., & Kuhn, R. J. (2016). The 3.8 Å resolution cryo-EM structure of Zika virus. *New York Science*, *352*(6284), 467–470. doi.org:10.1126/science.aaf5316

Stokes, L. (2014). Sample size calculation for a hypothesis test. AMA guide to statistics and methods. *The Journal of American Medical Association, 312*(2), 180-181. doi:10.1001/jama.2014.8295

Smithburn, K. C. (1954). Neutralizing antibodies against arthropod-borne viruses in the sera of long-time residents of Malaya and Borneo. *American Journal of Hygiene*, *59*, 157–163.

Waggoner, J. J., & Pinsky, B. A. (2016). Zika virus: Diagnostics for an emerging pandemic threat. *Journal of Clinical Microbiology*, *54(4)*, 860–867. doi:10.1128/JCM.00279-16

Wong, L. P., Shakir, S. M. M., Atefi, N., & Abubakar, S. (2015). Factors affecting dengue prevention practices: Nationwide Survey of the Malaysian Public. *PLoS ONE, 10*(4), e0122890. doi: https://doi.org/10.1371/journal.pone.0122890

World Health Organization (WHO) (2014). Steps in applying probability proportional to size (PPS) and calculating basic probability weights. Retrived from http://www.who.int/tb/advisory_bodies/impact_measurement_taskf.orce/meetings/prevalence_survey/psws_probability_prop_size_bierrenbach.pdf.

World Health Organization, (2016a). Zika virus disease. Retrieved from http://www.who.int/csr/disease/zika/en/ on October 20, 2016.

World Health Organization, (2016b). Laboratory testing for Zika virus infection - World Health Organization. Retrieved from apps.who.int/iris/bitstream/10665/204671/1/WHO_ZIKV_LAB_16.1_eng.pdf. Retrieved on February 2, 2017.

Zanluca, C., De Melo, V. C. A., Mosimann, A. L. P., Dos Santos, G. I. V., dos Santos, C. N. D., & Luz, K. (2015). First report of autochthonous transmission of Zika virus in Brazil. *Memorias Do Instituto Oswaldo, 110*(4), 569-572. doi:10.1590/0074-02760150192

Wehre, T., Maagard, A., Tappe, D., Cadar, D., & Schmidt-Chanasit, J. (2013). Zika virus infection after travel to Tahiti. *Emerging Infectious Diseases journal*, *20*, 1412–1414. doi:10.3201/ eid2008.140302