Knowledge, attitudes and practice survey on Zika virus infection among pregnant women in Brunei Darussalam

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ARTICLE INFO

Objective: To assess the knowledge, attitudes, and practices (KAP) on Zika virus infection among pregnant women in Brunei Darussalam by a cross-sectional survey. Methods: Between February and June 2017, we recruited 234 pregnant women from all government healthcare centres at Brunei-Muara district, using a modified systematic sampling approach. A pre-tested and self-administered questionnaire was used and data analysis was conducted using descriptive statistics and multiple logistic regression analyses. Results: The study participants were mainly Malay (87.2%) and their mean age was 28.0 years. The median knowledge score was 13, out of a possible score of 28. Most participants (92.7%) knew that Zika virus was transmitted by mosquito bites whereas some (34.6%) knew that sexual transmission was also possible. Media (radio, television or newspapers) was the preferred source of updated information on Zika virus, followed by healthcare workers (44.0%), government announcements (43.2%), and social media (38.0%). Pregnant women who were 25 years old or older [Adj. OR=3.62 (95% CI: 1.57, 9.51)], not Malays [Adj. OR=3.32 (95% CI: 1.35, 8.55)], and had an average monthly household income of more than BND $3 000 [Adj. OR=4.06 (95% CI: 1.81, 19.44)] were more likely to score higher for knowledge on Zika virus. The median prevention practice score was 23, out of a possible score of 36. Most participants reported wearing covering clothes (98.3%) and kept their living surroundings clean (99.6%). Most participants (88.0%) agreed that Zika virus infection among pregnant women attending government maternal and child healthcare centres in Brunei Darussalam, in particular that Zika virus can be sexually transmitted. Such information could be well disseminated at the healthcare centre level. Health literacy studies should be conducted to understand the facilitators and barriers of KAP on Zika virus infection among pregnant women.

Conclusion: We found a lack of knowledge on Zika virus infection among pregnant women attending government maternal and child healthcare centres in Brunei Darussalam, in particular that Zika virus can be sexually transmitted. This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

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How to cite this article: Chaw LL, Tuah NAA, Wong JYY, Naing L. Knowledge, attitudes and practice survey on Zika virus infection among pregnant women in Brunei Darussalam. Asian Pac J Trop Med 2018; 11(11): 638-644.
expansion of the virus epidemic from 33 countries in early February 2016[4] to 84 countries as of March 2018[5].

It is already established that Zika virus causes microcephaly and other serious brain abnormalities in new-borns[6]. Zika-associated birth defects were identified in 6% of infants among pregnant women with completed pregnancies and laboratory evidence of Zika infection[7]. As of March 2017, the World Health Organization (WHO) has recorded 2 656 congenital syndromes associated with Zika virus infections in 31 countries, out of which 2 653 (99.9%) were in Brazil[8,9]. Hence, women who are either currently pregnant or are planning to get pregnant must be aware about Zika virus and its potential consequences.

Brunei Darussalam is a Southeast Asian country with a crude birth rate of 15.2 births per 1 000 population[10]. It has remained free of the virus as of March 2018[5], even though both Aedes aegypti and Aedes albopictus has been established in the country[11,12]. Many of its neighbouring countries have reported increasing Zika positive cases[13], for instance a large outbreak in Singapore in 2016[14] and a Zika-associated case of microcephaly reported in Vietnam[15].

The Ministry of Health in Brunei Darussalam have initiated education campaigns since August 2016 to increase public awareness on Zika, through media advertisements, press releases, travel advisories, website coverage, and school cleaning campaigns[16-18]. We conducted this study to assess the levels of knowledge, attitudes and practices (KAP) of Zika virus among pregnant women in Brunei Darussalam and to determine the factors associated with knowledge on Zika virus.

2. Material and methods

2.1. Design and subjects

A cross-sectional paper-based survey was conducted between February to June 2017, at all 8 maternal and child healthcare centres in Brunei-Muara district (where 69.3% of the country’s population resides). The inclusion criteria were: (1) women aged 18 years and above who are pregnant at the time of data collection; (2) long- and short-term Brunei residents; and (3) able to read or write in English or Malay (the official and local language in Brunei Darussalam) languages.

A modification of stratified systematic sampling approach was used whereby (1) a target number of participants was set for each healthcare centre, based on the population size of its catchment area, and then (2) on every researcher’s visit to each healthcare centre, every second patient registered for consultation was invited to participate in the study until the targeted number was reached. Trained interviewers explained the study to the potential participants, obtained inform consent, and addressed any queries relating to the questionnaire or study.

Ethical approval was obtained from the Research Ethics Committee of Pengiran Anak Rashidah Saa’datul Bolkiah Institute of Health Sciences (PAPRSB IHSREC), Universiti Brunei Darussalam (Reference no: UBD/IHS/B3/8), following guidelines from the Declaration of Helsinki.

2.2. Data collection instrument

The main data collection tool of the study was a pre-tested self-administered questionnaire, adapted from the WHO Zika KAP survey resource pack[19]. It was initially prepared in English and then translated into Malay language. A pre-test was conducted on 12 individuals and some contextual changes were made on the final version of the questionnaire. It consists of 5 main sections: socio-demographic characteristics, knowledge, attitudes, self-reported prevention practices against mosquito breeding and bites, and sources of information for Zika virus.

The knowledge section consisted of 28 items on the groups of people who can get Zika, mode of transmission, signs and symptoms, whether if it is possible to prevent or treat Zika, if everyone infected exhibits symptoms, population groups at risk of Zika-related complications, and the effect of Zika on unborn foetus. For each question, participants can answer either yes, no, or don’t know. During analysis, the correct responses were scored as 1 while incorrect or don’t know responses were scored as 0. These scores were totalled up to a maximum of 28 points, where higher scores indicate higher knowledge level. For statistical analysis, these total scores were divided into 2 groups: 0-14 and 15-28 points, using the midpoint as the cut-off point[20].

The attitude section consisted of 8 items on self-perceived risk as well as their reasons and opinions of whether Zika is an important issue, who should be responsible to prevent Zika transmission, whether women should delay pregnancy plans due to Zika, whether pregnant women should postpone unnecessary travel to Zika-affected countries, and whether they would encourage their husbands to practice safe sex or abstinence if he has recently travelled to Zika-affected countries. Attitude questions were measured using a 5-point Likert scale, which ranges from strongly agree to strongly disagree.

The prevention practice section consisted of questions on prevention practices against mosquito bites (4 items) and against mosquito breeding (5 items). Participants were asked to report the frequency of these prevention practices based on 6 options: “Not at all”, “Rarely”, “Sometimes”, “Often”, “Always”, and “Not available”. During analysis, these responses were respectively scored as 0, 1, 2, 3, 4, and 0. These scores were totalled together to give a maximum score of 36 points, with higher scores indicating higher mosquito preventive practice. For statistical analysis, these total scores were divided into 2 groups: 0-18 and 19-36 points, using the
midpoint as the cut-off point[20]. There was 1 questionnaire with incomplete responses in one or more questions, thus it was excluded from the point totalling process and subsequent regression analysis.

Lastly, the information section of the questionnaire included questions on where/from whom they first hear about Zika, and also from where/whom they would like to have updates on Zika. The Cronbach’s alpha (a measure of internal consistency and reliability) for knowledge, attitudes and prevention practice sections were 0.87, 0.70, and 0.76, respectively.

### 2.3. Statistical analysis

Descriptive analyses were carried out and tests (Chi-square, Fisher’s Exact, independent t and Mann-Whitney) were used to determine any group differences for knowledge and prevention practice. Multiple logistic regression analyses were conducted to determine any association between knowledge score groups and socio-demographic factors. Independent variables were first analysed using simple logistic regression, and those with P-value < 0.1 were then included into the multiple logistic regression model. All analyses were done using R (ver.3.4.1) statistical software[21]. A P-value of < 0.05 was considered statistically significant.

### 3. Results

#### 3.1. Socio–demographic characteristics

A total of 234 completed surveys were collected and Table 1 summarized their demographic characteristics. Their median age was 28.0 years (range=19-42 years, IQR=7) and most are of Malay ethnicity (87.2%, n=204). More than half of the participants (59.8%, n=140) have attained at least a tertiary school education. The majority lived in land settlements (94.0%, n=220) and a large proportion (43.2%, n=101) lived in households with 5 to 8 members. In addition, 32.1% (n=75) reported a monthly household income of less than BND $1,000, while 43.2% (n=101) reported between BND $1,000 and BND $3,000.

#### 3.2. Knowledge

The median knowledge score was 13, out of a possible score of 28 (Table 2). Categorising the sum of knowledge scores into 2 groups (0-14 and 15-28 points) showed that 64.5% of the participants (n=151) scored between 0-14 points, while 35.5% (n=83) scored between 15-28 points. A large majority of participants were able to answer correctly that Zika is transmitted by mosquito bites (92.7%, n=217), fever is a symptom of Zika (88.5%, n=207), Zika is preventable (79.9%, n=187), pregnant women are at high risk of getting health complications from Zika (90.2%, n=211), and Zika affects everyone (75.2%, n=176). Also, 64.1% (n=150) of the participants answered correctly that pregnant women with Zika are at risk of giving birth to a baby with microcephaly. Only 34.6% (n=81) and 15.0% (n=35) answered correctly that Zika can be transmitted sexually and that there were no specific treatment for Zika, respectively.

### Table 1

| Demographic characteristics | Knowledge score (n=234) | Practice score (n=233) |
|----------------------------|------------------------|-----------------------|
|                            | 0-14 [n (%)]          | 15–28 [n (%)]         | P-value   | 0-18 [n (%)]          | 19–36 [n (%)]         | P-value   |
| Age group (years)          |                        |                       |           |                        |                       |           |
| < 25                       | 53(22.6)               | 46(86.8)              | 7(13.2)   | 17(32.1)               | 36(67.9)              |           |
| 25 – 28                    | 58(24.8)               | 33(56.9)              | 25(43.1)  | 9(15.8)                | 48(84.2)              | 0.073     |
| 28 – 32                    | 60(25.6)               | 36(60.0)              | 24(40.0)  | 17(28.3)               | 43(71.7)              |           |
| ≥32                        | 63(26.9)               | 36(57.1)              | 27(42.9)  | 10(15.9)               | 53(84.1)              |           |
| Racial status*             |                        |                       |           |                        |                       |           |
| Malay                      | 204(87.2)              | 136(66.7)             | 68(33.3)  | 45(22.2)               | 158(77.8)             | 0.687     |
| Others                     | 25(10.7)               | 10(40.0)              | 15(60.0)  | 7(28.0)                | 18(72.0)              |           |
| Highest education attained |                        |                       |           |                        |                       |           |
| Secondary school & below   | 94(40.2)               | 71(75.5)              | 23(24.5)  | 21(22.6)               | 72(77.4)              | 1.000     |
| Tertiary school & above    | 140(59.8)              | 80(57.1)              | 60(42.9)  | 32(22.9)               | 108(77.1)             |           |
| Town*                      |                        |                       |           |                        |                       |           |
| Water village              | 14(6.0)                | 9(64.3)               | 5(35.7)   | 2(14.3)                | 12(85.7)              | 0.653     |
| Land village               | 220(94.0)              | 142(64.5)             | 78(35.5)  | 51(23.3)               | 168(76.7)             |           |
| No. of household members*  |                        |                       |           |                        |                       |           |
| 1-4 people                 | 39(16.7)               | 24(61.5)              | 15(38.5)  | 7(18.4)                | 31(81.6)              |           |
| 5-8 people                 | 101(43.2)              | 62(61.4)              | 39(38.6)  | 22(21.8)               | 79(78.2)              | 0.597     |
| Monthly average household income* |                |                       |           |                        |                       |           |
| < B$1 000                  | 75(32.1)               | 58(77.3)              | 17(22.7)  | 18(24.0)               | 57(76.0)              |           |
| B$1 000 – B$3 000          | 101(43.2)              | 67(66.3)              | 34(33.7)  | 18(18.0)               | 82(82.0)              | 0.371     |
| > B$3 000                  | 55(23.5)               | 23(41.8)              | 32(58.2)  | 15(27.3)               | 40(72.7)              |           |

*5 were missing, **2 were missing, ***3 were missing; ^ Water settlement is defined as towns that are situated as least partly near a large area of water.
Table 2
Knowledge on Zika virus infection among pregnant women in Brunei Darussalam.

| Knowledge questions on Zika virus | Correct response | No. of correct responses (%) |
|----------------------------------|------------------|-----------------------------|
| **Median knowledge score (Min-max)** | 13 (0-27) |
| 0-14 points | 151 (64.5) |
| 15-28 points | 83 (35.5) |

The following groups can get Zika:
- Only males: False (131, 58.0%)
- Only females: False (124, 53.0%)
- Only pregnant women: False (100, 42.7%)
- Everyone: True (176, 75.2%)

A person can get Zika by the following ways:
- From mosquito bite(s): True (217, 92.7%)
- From drinking polluted water: False (70, 29.9%)
- Through sexual intercourse: True (81, 34.6%)
- Through coughing and sneezing: False (80, 34.2%)
- From a blood transfusion: True (70, 29.9%)
- From mother to child transmission: True (135, 57.7%)

The following are the signs and symptoms of Zika:
- Fever: True (207, 88.5%)
- Headache: True (159, 67.9%)
- Rash: True (118, 50.4%)
- Muscle/joint pain: True (116, 49.6%)
- Conjunctivitis (red eyes): True (77, 32.9%)
- Convulsions or fits: False (63, 26.9%)
- Bleeding: False (56, 23.9%)
- It is possible to prevent Zika: True (187, 79.9%)
- There is a specific treatment for Zika: False (35, 15.0%)
- Everyone who gets Zika show symptoms: False (31, 13.2%)

The following group(s) is at high risk of getting health complications from Zika:
- Pregnant women: True (211, 90.2%)
- Women who are planning to get pregnant: True (92, 39.3%)
- Males of all ages: False (52, 22.2%)
- Females of all ages: False (65, 27.8%)
- Everyone has equal risk: False (44, 18.8%)

If a pregnant woman has Zika, her foetus/baby is at risk of:
- Being stillborn: False (52, 22.2%)
- Being born prematurely: False (42, 17.9%)
- Being born with microcephaly: True (150, 64.1%)

*Interquartile range = 7.

As shown in Table 3, most participants (71.4%, n=150) first heard about Zika through the media (radio, television or newspapers), followed by social media (9.0%, n=19) and SMS/WhatsApp (5.2%, n=11). Media remained as the top preference for participants to get updates on Zika (74.4%, n=174), with a significant percentage also observed in health workers (44.0%, n=103), government announcements (43.2%, n=101), social media (38.0%, n=89), and SMS/WhatsApp (26.1%, n=61). Only 25.2% of the participants (n=59) reported that they had enough information about Zika virus.

When comparing socio-demographic variables (Table 1) between the 2 groups based on the sum of knowledge scores (0-14 versus 15-28 points), significant differences were detected for age (P<0.001), racial status (P=0.011), and average monthly household income (P<0.001). Multiple logistic regression results (Table 4) show that people who scored 15-28 points were more likely to be 25 years old or older, had an average monthly household income of more than BND$ 3 000[Adj. OR=4.06 (95% CI: 1.81, 19.44)], and not of Malay ethnicity[Adj. OR=3.32 (95% CI: 1.35, 8.55)]. When compared with participants who were 18-24 years old, those between 25-27 years old had the highest odds of scoring 15-28 points for knowledge[Adj. OR=4.68 (95% CI: 1.80, 13.51)].

Table 3
Access to information on Zika virus infection among pregnant women in Brunei Darussalam.

| Questions on information access | n (%) |
|---------------------------------|-------|
| From where Zika was first heard (n=210) |       |
| Family                          | 10(4.8) |
| Friends or neighbours           | 0(0.0)  |
| Community meeting/leaders       | 10(4.5) |
| Religious leader                | 0(0.0)  |
| Health workers                  | 7(3.3)  |
| Private doctor                   | 1(0.5)  |
| Media                           | 150(71.4) |
| Social media                     | 19(9.0) |
| SMS/WhatsApp                    | 11(5.2) |
| Government announcement          | 9(4.3)  |
| Do not know                      | 1(0.5)  |
| Others                           | 1(0.5)  |

*Preferred to get update information from

| Family                          | 35(15.0) |
| Friends or neighbours           | 22(9.4)  |
| Community meeting/leaders       | 10(4.3)  |
| Religious leader                | 3(1.3)   |
| Health workers                  | 103(44.9) |
| Private doctor                   | 30(12.8) |
| Media                           | 174(74.4) |
| Social media                     | 89(38.0) |
| SMS/WhatsApp                    | 61(26.1) |
| Government announcement          | 101(43.2) |
| Do not know                      | 4(1.7)   |
| Others                           | 5(2.1)   |

Have enough information about Zika
- Yes                          | 59(25.2) |
- No                           | 138(59.0) |
- Do not know                   | 36(15.4) |
- Missing                       | 1(0.4)   |

*Only those who gave one answer was included in this table, ^ Multiple responses were allowed.

3.3. Attitudes

Table 5 shows the participant’s attitudes towards Zika virus. A majority of the participants (88.0%, n=206) agreed that Zika is an
important issue. When asked about their risk of getting Zika within the next 6 months, the participants reported their risk as did not know (51.7%, n=121), high (9.8%, n=23), medium (13.3%, n=31), low (13.7%, n=32) or none (11.5%, n=27). Most agreed that it is the responsibility of the individual themselves (91.5%, n=214), health workers (88.0%, n=206), and the government (86.8%, n=203) to prevent their community from getting Zika virus infection. While 90.2% (n=211) agreed that pregnant women should postpone unnecessary travel to Zika-affected countries, only 37.6% (n=88) agreed that women should avoid getting pregnant in the next 6 months due to Zika. Lastly, 82.5% (n=193) agreed that they would encourage their husbands to practice safe sex or consider abstinence for 6 months after the trip.

3.4. Prevention practices

The median prevention practice score was 23, out of a possible score of 36 (Table 6). Categorising these scores into 2 groups (0-18 and 19-36 points) showed that 77.3% of the participants (n=180) scored between 19-36 points, while 22.7% (n=53) scored between 0-18 points. Most participants reportedly wore covering clothes (98.3%, n=230) and used mosquito repellent or spray on their body (90.6%, n=212). Also, a majority reportedly conducted general prevention practices against mosquito breeding (85.9%–99.6%). No significant differences were detected when comparing the socio-demographic variables between the 2 groups of prevention practice scores (0-18 versus 19-36 points) (Table 1).

4. Discussion

We found a lack of knowledge on Zika virus infection among pregnant women attending government maternal and child healthcare centres in Brunei-Muara district, Brunei Darussalam. This finding is similar to other studies conducted among pregnant women.[22-25] On one hand, a high percentage of our study participants knew that Zika virus is transmitted through mosquito bites (92.7%), when
compared to those from other similarly Zika-unaffected areas (90.5% in Greece[26] and 66.9% in Northern Nigeria[27]). Also, 64.1% of the participants knew of the relationship between Zika infection during pregnancy and microcephaly, which is within the range of that reported in Greece (47.1%)[26] and Northern Nigeria (80.7%)[27]. However, on the other hand, only 34.6% answered correctly that Zika virus could be transmitted sexually. This finding is similar to that reported in numerous other studies in countries where documented Zika virus transmission was either absent[26,27] or present[22,24,28]. The WHO has recommended that areas with no active Zika virus transmission (such as Brunei Darussalam) should ensure that men and women returning from areas with known Zika virus transmission adopt safer sex practices or consider abstinence for at least 6 months upon return, in order to prevent Zika virus transmission through sexual transmission[29]. This highlights the need to promote awareness on Zika virus for pregnant women, in particular on the possible transmission modes.

Our findings showed that knowledge on Zika virus were associated with age, household income and race. In agreement, one study found that knowledge on Zika virus was negatively associated with younger pregnant women in the United States[24]. This could possibly be due to less exposure or access to health-related information. Also, our results for household income suggest a role of socio-economic status (SES). Several studies have shown that SES correlates positively with knowledge scores[30,31] and this was also observed in similar surveys on dengue[32]. People with higher SES could have better access and comprehension of information on Zika virus. Lastly, we found that knowledge scores were positively associated with non-Malays. Malays constitute 65.7% of Brunei Darussalam’s population, while Chinese (10.3%) and other races (24.0%) form the minority of the population[10]. Foreign expatriates, in particular, could be more knowledgeable on Zika virus and possibly more interested on the topic than locals, as no Zika cases have been reported at the time of writing this article. Thus, our findings suggest that future education campaigns on Zika should target on pregnant women who are younger, Malays and those of lower SES status.

Also, we observed that only 25.2% of the participants reported having enough information on Zika virus, in agreement to that reported in another similarly Zika-unaffected country (13.1%)[26]. Also, a significant percentage of participants would like to get updates on Zika virus from healthcare professionals. Other studies have shown that recommendations from healthcare providers are an important factor for pregnant women[33,34], and this has been also reported for Zika virus[22,35]. Hence, Zika virus education and awareness among pregnant women could be done more effectively through disseminating information via healthcare workers at antenatal clinic settings. As face-to-face clinic time with patients can be limited, other effective ways include using providing educational brochures and updating websites with information endorsed by organisations (such as the Ministry of Health or WHO)[35]. Importantly, providing information to the public would only increase their knowledge level for a particular disease, only if the members of the public understand and is able to make decisions based on the information. As it is known that the health literacy level of an individual plays a major role in his/her ability to assess and apply health information given to them[36]. Future studies involving health literacy assessment on Zika virus should thus be conducted at the community level[37].

When compared to knowledge scores, we observed a higher level of self-reported prevention practices against mosquito bites and breeding. Our reported percentages are higher than that of a similar study in Greece[26]. Brunei Darussalam has a hot and wet climate throughout the year, and Aedes mosquitoes can be detected locally[11,12]. Dengue, another mosquito-borne disease, is also endemic in the country. Hence, Zika virus transmission through mosquitoes can be considered as the main transmission mode in Brunei Darussalam. Our findings may reflect the existing prevention practices against existing mosquito-borne diseases.

This study has several limitations. Firstly, the low sample size of this study could potentially lead to lack of study power to identify true associations and also generalizability issues to all pregnant women in the Brunei-Muara district. The former can be seen in the wide confidence level ranges for the regression analysis results. Data collection for this study was carried out concurrently with a similar study on the general adult population (submission under review) and it was a post-hoc decision to analyse the pregnant women dataset separately. Hence, the study results should be interpreted with caution. Secondly, it should be noted that the choice of cut-off points for the 2 groups in the regression analysis could have an effect on the results. As there were no known criteria to categorize the responses, we decided to use the mid-point as the cut-off point, following a similar study on dengue[20]. Separate sensitivity analyses using different cut-off points were also conducted separately (results not shown), yielding similar results. Future studies could be conducted to determine a suitable cut-off point for similar KAP questionnaires. Lastly, as the prevention practices were all self-reported, there could potentially be a certain degree of bias.

In conclusion our study observed on lack of knowledge on Zika virus infection among pregnant women attending government maternal and child healthcare centres in Brunei Darussalam, in particular that Zika virus could be sexually transmitted. Providing Zika education to pregnant women at the maternal and child healthcare centres (such as through posters and brochures), would be a feasible step to increase their knowledge on the virus. Our study findings are useful for policy makers and health professionals to plan, implement and evaluate specifically Zika awareness programmes both at local and regional levels. Such programmes, emphasizing on transmission modes and prevention among pregnant women, is warranted. Qualitative research could complement this study in exploring the facilitators and barriers of KAP on Zika virus infection among pregnant women.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

The authors would like to thank all primary healthcare staff involved and medical students from PAPRSB IHS for their kind assistance during data collection. We would also like to thank Berliana Devianti Putri for her assistance with data analysis, as well as Dr Hjh Rafidah Hj Gharif, Dr Suwarni Hj Md Diah, Dr Faezane Irdayati Idris, Nurul Amirah Hj Abdul Latif, and Dr Hjh Halimaturrardiah DDS Hj Metussin for their assistance in questionnaire translation and data collection.
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