PREDICTING FACTORS AND ATTITUDE TOWARDS WOLBACHIA-INFECTED AEDES MOSQUITOES IN MALAYSIA

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ABSTRACT

To ensure environmental sustainability without dengue, many of dengue control techniques have been introduced including Wolbachia-infected Aedes mosquitoes. This technique is still new in Malaysia and will be expanded as applied by the Ministry of Health, Malaysia. Therefore, this study is very important to governments, professionals, and industries which involved with this technique by taking advantage of the influence of predictor factors with the public's attitude towards this technique. The findings can also be used as a reference for the continuous research aspect, developing more effective risk and regulatory communication strategy with the implementation of policies related to this technique. If this technique is not acceptable due to high-risk assumptions, the authorities may deliver the information on the advantages of this technique or take action not to proceed with this technique. Therefore, this study aims to assess the public's attitude and the interaction of predictor factors towards this technique. Results of the study showed that the public has a positive attitude by ranked highly benefit for this technique and rated highly religious and trust in key actors. The public also claimed this technique is at moderate risk because they are more inclined towards nature and more cautious in evaluating new technologies such as this technique.

Keywords: *Wolbachia*-infected *Aedes* Mosquitoes, Attitude, Predictor Factors, Malaysia.

INTRODUCTION & LITERATURE REVIEW

Infecting *Aedes* mosquitoes with *Wolbachia* bacteria is a biological technique to control the vector of dengue. Male *Aedes* mosquitoes are infected with laboratory produced *Wolbachia* bacteria, which cause genetic defects (Lee et al., 2015). Infected *Aedes* mosquitoes are then released into the environment to mate with uninfected female *Aedes* mosquitoes so their life cycles continue. After mating, cytoplasmic incompatibility occurs wherein embryonic development will fail at the early stage or no offspring will survive (Ong, 2016). As *Wolbachia* bacteria spread to the population of mosquitoes, the life span of *Aedes* mosquitoes is shortened. The Institute for Medical Research Malaysia analysed 156 pools of *Aedes* mosquito's positive infected with *Wolbachia* bacteria from various habitats from seashore, islands and housing areas. The analysis used multiplex polymerase chain reaction (PCR) and gene sequencing. The results reveal 100% homology of *Aedes* mosquitoes positively infected with *Wolbachia* bacteria isolated from various habitats (Lee et al., 2015). *Wolbachia* bacteria were successfully bred in a

population of *Aedes* mosquitoes. However, this new technique has not been verified as clearly effective in reducing dengue problems in Malaysia. Whether the technique comes with a risk in the future remains unclear, and expected outcomes of implementing this technique are unidentified. The implementation of this technique hinges on Malaysians' support or rejection. Public acceptance reflects Malaysians' attitude and intention to support the technology (Pin, 2009). If this technique is regarded as acceptable and beneficial, then responsible parties such as governments, industries, policy makers and scientists can proceed with its implementation. Future continuous research on this technique is strongly encouraged. This study particularly aims to examine Malaysians' attitudes towards *Wolbachia*-infected *Aedes* mosquitoes and explore predicting factors which influence their positive attitudes.

Conceptual Framework

The model of attitude (Amin & Hashim 2015) clearly presents the aspects of attitude towards genetically modified (GM) *Aedes* mosquito as dengue control technique. Pardo et al. (2002) and Bronfman et al. (2009) also provided guidelines in evaluating attitude towards science and technology especially in the biotechnology field. These studies are appropriate because dengue control techniques are classified under the science and technology disciplines leading to biotechnology research. The conceptual framework on predicting factors and attitude towards *Wolbachia*-infected *Aedes* mosquitoes consists of three major constructs. The first construct is the general factors which consist of i) trust in key actors, ii) attitude towards nature versus material, iii) attitude towards technology and iv) religiosity. The second construct is the specific factors which comprise i) perceived benefits and ii) perceived risks. The main construct of this study refers to attitude towards *Wolbachia*-infected *Aedes* mosquitoes in Malaysia.

Trust in key actors is the public's willingness to believe and accept towards authorities with ability and integrity to provide any information delivered by authorities (Zhou et al., 2018; Mustapa et al., 2019). Arham et al. (2018) reported that trust in key actors is positively associated with the attitude towards dengue control techniques. Amin & Hashim (2015) highlighted that the public trusting in key actors will perceive and evaluate many benefits associated by expressing positive attitude towards GM *Aedes* mosquito technique.

Attitude towards nature versus material is a bipolar statement that reflects the public's preferences towards nature or material values in their assessment (Amin et al., 2018). Amin & Hashim (2015) clarified that people who tend to prioritise materialistic values have low risk perceptions of GM Aedes mosquito. Amin et al. (2018) also emphasised that materialistic people tend to view the development of xenotransplantation as beneficial and less risky.

Attitude towards technology is studied to investigate public acceptance of technology (Gaskell et al., 2003). Those who tend to focus on the negative effects of technology are likely to perceive high risks associated with biodiesel-based production (Amin et al., 2017). This relationship is also supported by previous findings, wherein individuals with negative attitude towards science and technology have high moral concern with regard to the GM *Aedes* mosquito, regarding the technique as risky (Amin & Hashim, 2015).

Religiosity is a subjective term that refers to the orientation of belief and obedience in religion to determine the direction in everyday life (Worthington Jr et al., 2003). This factor shows no relationship in determining the public acceptance of the GM *Aedes* mosquito technique (Amin & Hashim, 2015). Nonetheless, Amin & Hashim (2015) and Amin et al. (2018) demonstrated that Malaysians are highly religious, so they view GM Aedes mosquito and xenotransplantation as high risk.

Perceived benefits and risks are important predicting factors for attitude (Rowe, 2004). Hansen et al. (2003) found that perceived benefits and risks are complex and difficult to conceptualise separately as these factors have an inverse relationship. Frewer (2017) highlighted that when an individual perceives high benefits, the perceived risks are low. Perceived benefits are the major predicting factors, and perceived risks are indirectly related to the determination of attitude towards GM *Aedes* mosquito (Amin & Hashim 2015), biodiesel-based products (Amin et al., 2017) and xenotransplantation (Amin et al., 2018). To the contrary, Mustapa et al. (2019) showed that when perceived benefits are high, the risk of pharmacogenomic techniques is perceived moderate.

Attitude is based on the beliefs, feelings and tendencies of socially relatively behaviour towards an important subject, collection, event or symbol (Hogg & Vaughan, 2005). Kaliyaperumal (2004) stated that attitudes are awareness-raising processes related to knowledge and expressed through actions that are shaped to practice. Knowledge is a process of encouragement to change attitudes that play a vital role among humans in managing the environment with focus (Mahmud & Siarap, 2013). Practice or behaviour is the action prompted by good knowledge and attitude (Kaliyaperumal, 2004). Therefore, good attitudes can encourage individuals to add to or use existing knowledge to form a practice.

METHOD

Research data were collected by survey using random sampling techniques from September 2016 to September 2017 on 399 adult respondents (aged 18 years and above) in Klang Valley, Malaysia. Respondents were stakeholders, including groups of scientists (academicians, researchers and implementing officers) involved in dengue control and public groups living in hotspots in Klang Valley according to the statistics issued by the Ministry of Health, Malaysia. Selecting Klang Valley is logical as here is the main state which is the driving force for Malaysia's economic development (Prime Minister's Department, 2012) and where the high population density causes dengue cases. Based on validated studies (Amin & Hashim 2015; Amin et al., 2017 & 2018; Mustapa et al., 2019), a multidimensional instrument was designed to measure the predicting factors and attitude towards *Wolbachia*-infected *Aedes* mosquito technique. All items for this instrument were measured using a 7-point Likert scale. The content validity of the instrument was carried out through a group and closed discussion with a seven-member panel. The members are experts in environmental management, sustainability governance, environmental science and society. The instrument underwent second validity from language and content experts in environmental science. Afterwards, the research instrument was distributed to respondents, but before they answered the questionnaire, the researcher provided information related to this technique. Ethical approval was obtained following the Guidelines for the Ethical Review of Clinical Research or Research Involving Human Subjects from the Ministry of Health, Malaysia.

RESULTS AND DISCUSSION

Malaysians in the Klang Valley region claimed to have high trust in key actors (scientists, governments and industries) and rated the benefits of *Wolbachia*-infected *Aedes* mosquitoes as high (mean scores of 5.51 and 5.19) which translated to highly positive attitude towards the technique (mean score of 5.23) (see Table 1). The findings show little difference across respondents' attitude towards GM *Aedes* mosquito. They expressed a positive attitude towards

this technique but showed a moderate level of perceived benefits and trust in key actors (Amin & Hashim, 2015). The respondents were keenly trust in key players in terms of delivering information and implementing dengue control using this technique until they view the technique as beneficial. The respondents perceived moderate risks (mean score of 4.43) and expressed a moderate attitude towards nature versus material (mean score of 3.91) and technology (mean score of 4.74). This finding is in line with that of Amin & Hashim (2015) who highlighted moderate perceptions of the risks towards GM *Aedes* mosquito as well as moderate attitudes towards nature versus material and technology. Of note, the respondents tended to see low risk on dengue control techniques, yet they were cautious to accept new technology because they were more inclined towards nature than material. The religiosity score of this study is unsurprising. Respondents acknowledged they as highly religious (mean score of 6.07). This outcome is expected because past studies show that Malaysians are highly religious as they practice their religion everyday (Amin & Hashim, 2015; Amin et al., 2017 & 2018; Mustapa et al., 2019). This statement is explained by items referring to the importance of religion, praying, reading a religious book, the notation that nothing is happening without God's will and religion offering peace and comfort when sorrows and misfortune strike.

Table 1
ATTITUDE TOWARDS *WOLBACHIA*-INFECTED *AEDES* MOSQUITOES IN MALAYSIA

Components	Mean Score ± Standard deviation	Interpretation
Trust in key Actors	5.51±0.94	High
Attitude towards Nature vs. Material	3.91±1.42	Moderate
Attitude towards Technology	4.74±1.38	Moderate
Religiosity	6.07±1.09	High
Perceived Benefits	5.19±1.05	High
Perceived Risks	3.57±1.23	Moderate
Attitude towards WiAM	5.25±1.09	High

Note: 1-2.99: Low; 3.00-5.00: Moderate; 5.01-7.00: High

CONCLUSION

Overall, Malaysians in the Klang Valley region openly received *Wolbachia*-infected *Aedes* mosquitoes as a dengue control technique. With high levels of perceived benefits, trust in key actors and religiosity, Malaysians exhibited positive attitude towards the technique. However, they remain careful about accepting this technique given that perceived risks were rated moderate. The findings of this study are important so that the *Wolbachia*-infected *Aedes* mosquitoes' technique can be implemented commercially to control dengue in ensuring environmental sustainability. This study can be extended with further analysis, such as correlation, regression and structured equation models, to define the relationship between the identified predicting factors and attitudes. This study also contributes to the literature on predicting factors attitude studies, and the findings can be applied to other disciplines of knowledge as well.

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