



REVIEW ARTICLE

Review on the seroprevalence of neglected tropical diseases affecting the indigenous community in Malaysia (from 2010-2022)

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ABSTRACT

The indigenous community in Malaysia also known as Orang Asli have preserved their unique cultural identity in the face of rapid national development and modernization efforts. Over the years, poverty alleviation has become a central pillar of Malaysia development. In this review, seroprevalence report from the Orang Asli and their health status about neglected tropical diseases were collated and analyzed. The review will show the potential areas of research for future development. Specifically, the review will cover a 12-year period preceding the onset of COVID-19 pandemic, offering critical insights into the community health landscape. In depth discussion on the unique impact of the pandemic covering healthcare access, socioeconomic dynamics and community resilience. Analysis revealed the burden of parasitism is high in the community and the sustainability of certain basic access such as clean water and education remains a challenge. Different approaches to improve future intervention strategies were also discussed. The review can contribute to essential knowledge for policymakers, researchers, healthcare providers interested in enhancing the well-being of the Orang Asli community.

Keywords: Vector borne diseases; neglected tropical diseases; vaccines; Orang Asli; seroprevalence.

INTRODUCTION

The Orang Asli community makes up less than 1% of the Malaysian population of approximately 30 million. This community is uniquely retaining their lifestyle despite modernization and resides in the forest fringe area or rural areas (61%) and the middle of the jungle (37%) and only a small number of them are found in or close to an urban area (2%). The Orang Asli is still considered one of the most impoverished groups in the country. With 18 or more ethnicities identified living in the Peninsula Malaysia, the diverse community each has its language and unique lifestyle. The classification of poverty in this community was reported to be 50.9% poor, and 15.4% hardcore poor. They are a largely socio-economically disadvantaged population and many efforts have been put in place to support their community development as well as the healthcare system.

The Orang Asli tend to be poorly educated compared to other major Malaysian ethnic groups (non-Orang Asli), and less than half of the Orang Asli population are literate. As reported in 2008, 40% of Orang Asli students failed to continue their studies in secondary education, for those who continued secondary education, half dropped out and failed to complete secondary education. Poor education results in several drawbacks in their population (Idrus, 2011).

The average life expectancy of Malaysia's general population of females and males was 77.2 years and 72.5 years respectively (World Health Organization, 2021) whereas for the Orang Asli female and males were 54 years and 52 years respectively (Masron *et al.*, 2013).

The nearly 20 years difference in life expectancy between the Orang Asli and the general population in Malaysia shows a lag in the Orang Asli's health status, especially among females. The higher mortality rate in the Orang Asli population was due to several reasons, including lack of medical facilities, distrust of modern medication and strong belief in traditional healers, making it difficult for the acceptance of scientifically proven medication by the Orang Asli despite the attempts to modernize the community. These factors contribute to a comparatively lower life expectancy among Orang Asli females when compared to non-Orang Asli females, often linked to maternal mortality due to childbirth complications or inadequate maternal health, as indicated by Phua (2015).

Poor academic performance in the Orang Asli also disadvantaged them in their careers. Their belief in preserving life close to nature, and their preferred nomadic lifestyle and forest source-based activities. Owing to the high poverty in the Orang Asli, imbalanced diet and malnutrition often experienced by children and poor personal hygiene put the Orang Asli at a higher risk of infectious diseases including helminths, intestinal parasitic infection, malaria, tuberculosis etc. (Gurpreet, 2009; Al-Delaimy *et al.*, 2014; Chin *et al.*, 2016; Wong *et al.*, 2016). Nevertheless, it has been reported that Orang Asli adults also experience obesity, hypertension, diabetes and impaired glucose tolerance (Tuan Abdul Aziz *et al.*, 2016).

In Hotez *et al.*, (2007), the impact of neglected tropical infectious diseases affects the poorest of the poor and is known as a major disabling condition for these communities. The Orang Asli communities in the Peninsula Malaysia have been afflicted with

several infectious diseases, and their foraging lifestyle may also expose them to other diseases as well. Continuous surveillance and study of the spillover of diseases from the wild animals in the forest to the Orang Asli living in the forest fringe areas are considered biosafety surveillance.

To date, some publications have reported the prevalence of infectious diseases among the Orang Asli and the risk factors involved in contracting the disease. A comprehensive review of the parasitic infections among Orang Asli communities has been published for findings up to the year 2009 (Lim *et al.*, 2009), this review will analyze the papers published from 2010 to 2020 for seroprevalence of neglected tropical diseases and summarize the findings and review the impact of the COVID-19 pandemic affecting the communities from 2020 to 2022 on the impact of their healthcare access, socioeconomic status and community resilience. The review will also highlight the gaps and potential future research to be conducted that may improve the features of future research and surveillance in the future post-pandemic.

METHODOLOGY

Search Strategy

This review was performed using PubMed database with keywords “Orang Asli” and “Malaysia” to identify quantitative research articles pertaining to the seroprevalence of tropical infectious diseases and associated factors among the community within the timeframe of 2010 to 2020. Inclusion criteria that were established the search to articles were: (a) inclusion of the Orang Asli population as their study samples; (b) occurred within Malaysia; (c) addressed various outcomes of neglected infectious diseases, and social and cultural factors; d) provides seroprevalence data on the infectious diseases. All publications were manually screened to determine the journals that fulfil the criteria. Initial screening was done based on the title

of articles, then examined abstracts, and finally investigated full articles to identify articles to be included in this review. The search strategies obtained a total of 231 hits. After applying filtering of the publication date from the year 2010 to 2020, 118 publications were yielded and screened for duplicates. Based on eligibility, a total of 41 journals were selected for this review. Of these, 77 articles were excluded for failing to meet the criteria. Articles were recorded into the Excel spreadsheet. Figure 1 shows the search process.

Data Extraction

Data were organized under the following headings (a) diseases, b) sample size, c) prevalence, and d) risk and factors. (Supplementary Table S1).

RESULTS AND DISCUSSION

Over the 12 years, a total of 52 reports stating the seroprevalence and incidence of neglected tropical diseases from the Orang Asli community were compiled and reviewed. Eleven of the publications were removed because they do not report on the seroprevalence level and 41 seroprevalence data were analyzed accordingly. Adhering to the terminology of diseases used during publication, the seroprevalence data was compiled and presented in chronological order of publication year and level of seroprevalence.

In Figure 2, the trend of publication for the Orang Asli is mainly parasitic infections and more recently, covering tickborne diseases such as Lyme diseases. In Figure 3, the level of seroprevalence was depicted according to the burden of disease among Orang Asli. Parasitic infections represent the highest burden of seroprevalence throughout this review, namely helminthiasis, sarcocystosis, soil-transmitted helminthiasis, and other intestinal parasites including *Necator americanus* (Ngui *et al.*, 2012), *Trichiura trichiuris* (Al-Delaimy *et al.*, 2014; Chin *et al.*, 2016; Muslim *et al.*, 2019), *Ascaris*

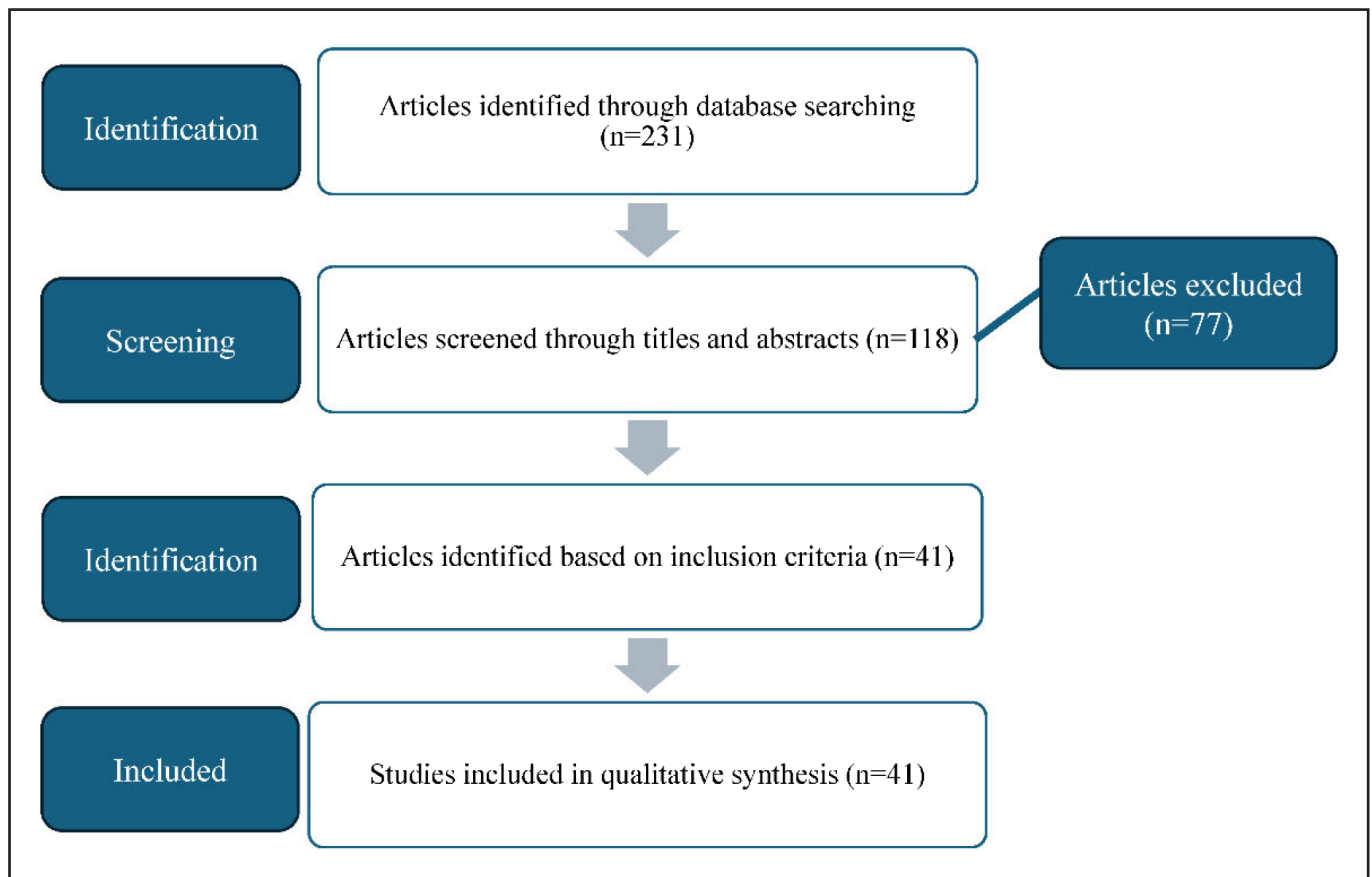
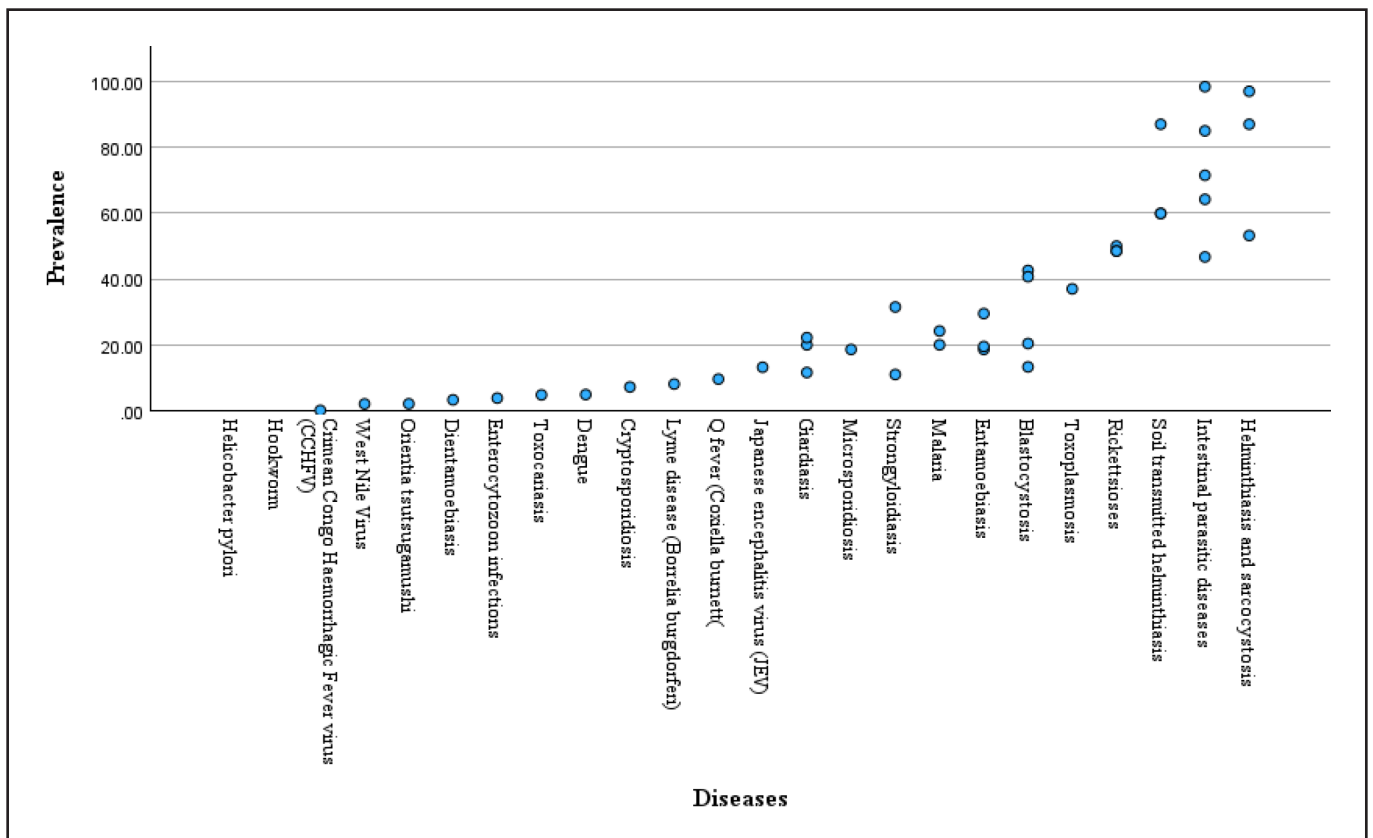
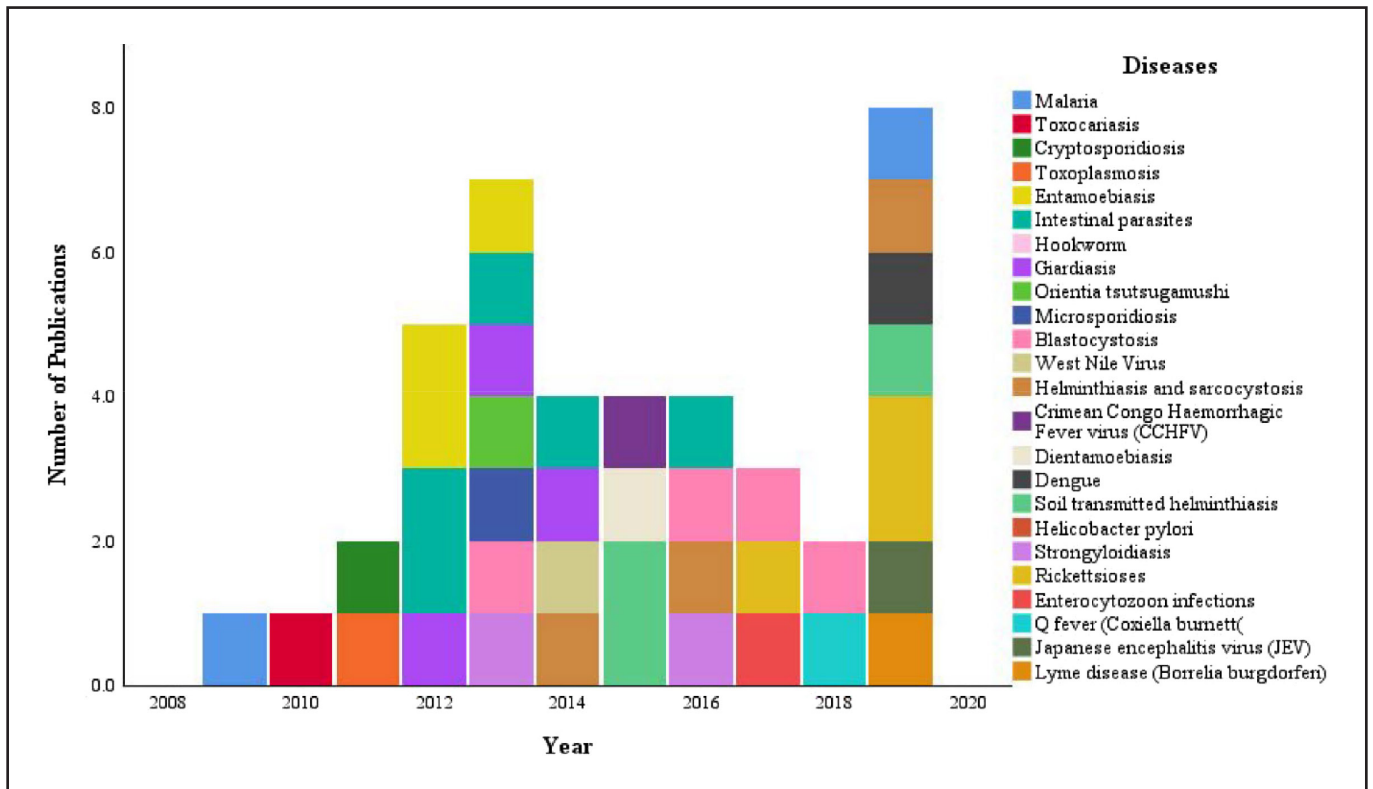


Figure 1. Flowchart of search and inclusion/exclusion criteria for the publications.



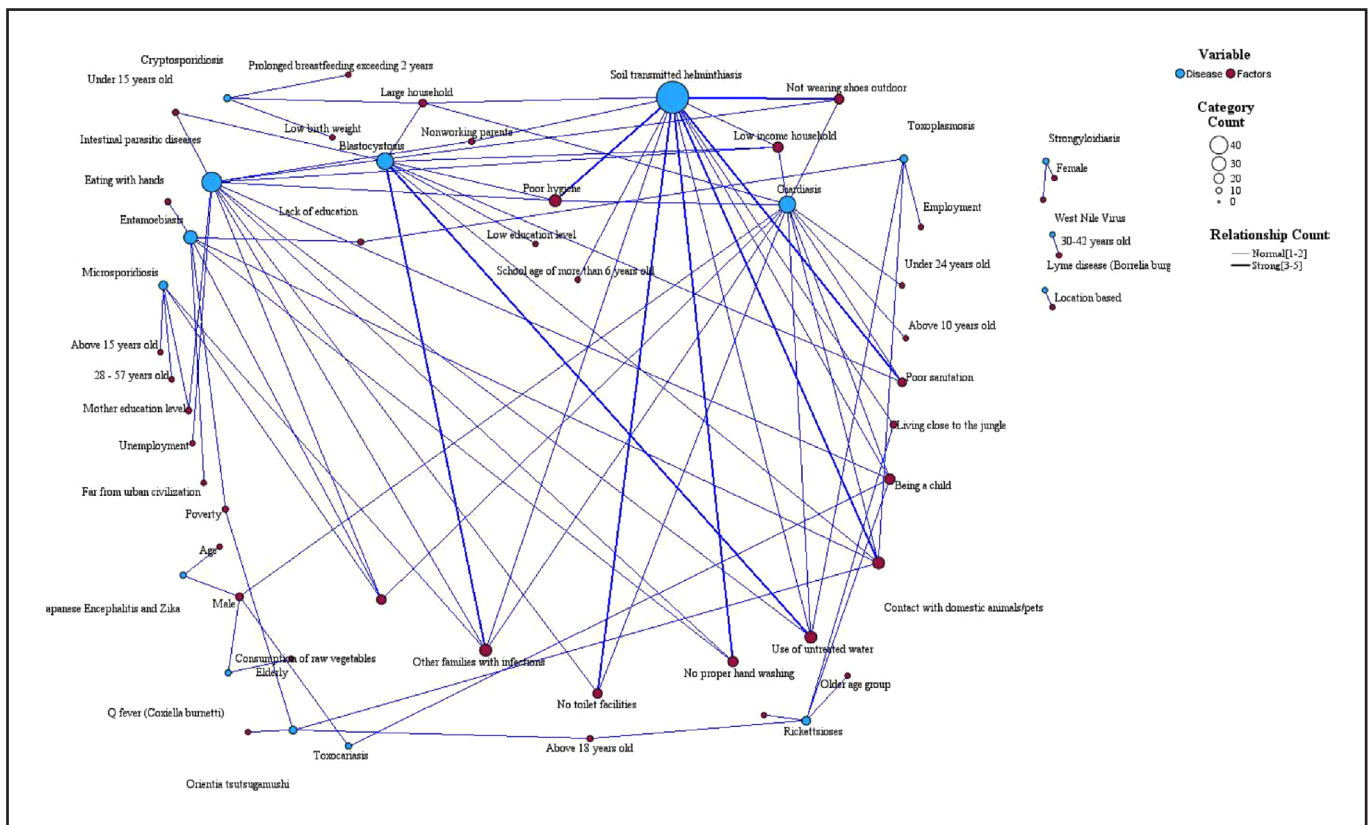


Figure 4. Relationship map of disease prevalence and factors associated with the diseases.

(Chin et al., 2016), *Giardia* (Al-Mekhlafi et al., 2013), *Ancylostoma* (Ngui et al., 2012), *Toxocara* (Romano et al., 2010). A total of 22 different infectious diseases were reported from the Orang Asli community. The most reported prevalence were intestinal parasite infections. Disease burden was associated with 97% of the study cohort. The results were compiled and stratified based on diseases and the risk factors that are significant contributors to the prevalence of the disease. The parasitic infections among the Orang Asli were previously reviewed by Phua (2015) highlighting the clinical challenges when diagnosing the population.

In Figure 4, a relationship map of diseases and the factors reported by each publication were tabulated and presented. The highest risk factors were attributed to the use of untreated water, presence of other infected family members, poor hygiene and contact with domestic animals or possible vectors of the parasites or pathogens. Following that, the second rank of risk factors was due to 'being a child' which is for children aged 12 years and below, no handwashing after outdoor activities, and low-income household. Thirdly, the ranked risk factors are consumption of raw vegetables, toilet facilities and not wearing shoes outside the house. In the highest ranking, the four factors are common traits and lifestyles of the Orang Asli community. The use of untreated water among the Orang Asli community is also due to the location of their homes, whereby it is near forest or agricultural sites. Certain sites are remote and may not have proper access to clean water or have limited clean water supply, therefore, relying on natural resources for water supply is part of their daily life (Ngui et al., 2011). In 2018, the Office of the United Nations High Commissioner for Human Rights (OHCHR) has recommended the Government of Malaysia to ensure the Orang Asli have access to continuous and sustainable water and sanitation services as clean water is a human right while the country (Heller, 2018). In this report for the Human Rights to Water and Sanitation, the water facilities are available however are not functional or too difficult to maintain without proper training

that the Orang Asli lacks. One major initiative on the provision of clean water to these communities was carried out in 2018, known as Communities for Purewater (CUP). The initiative has benefitted 3000 villages from Perak, Pahang, Sabah and Sarawak. In a study on the well-being of Orang Asli using a multidimensional poverty index, authors reported that 83% of the OA community in their study are still deprived of schooling while 49% are lacking basic assets (Abdullah et al., 2019) and livelihood support materials. The poverty eradication agenda within the community has not been progressing. Many of the surveillance reports also noted the high absenteeism in schools among school children (Abdul Manaf & Abdullah, 2021). The presence of other family members with infection also showed that the community stays together and tends to have large families. The average size of an OA family is 4.9 members per household, however, the observation that several families stay live together in a house has been reported (Sadaka et al., 2020). Since the OA lives in forestry or resettlement areas, many of these are nearby forestry or agriculture economy-based areas. The preservation of their nature and culture as hunter-gatherers remains part of their identity despite the urbanization of their homes. Contact with animals or pets is part of their lifestyle; therefore, key efforts are being made to provide awareness of infectious diseases from potential vectors, including their domesticated pets. A study by (Khoo et al., 2016; Lim et al., 2020) reported the detection of *Coxiella* and *Rickettsia* in ticks infecting the domesticated pets of the Orang Asli, which are causative agents of spotted fever in humans and cats, or the potential of ticks harboring *Rickettsia* sp. from wild boars that the OA hunts as food.

The advantages of surveillance among the Orang Asli communities also benefit OneHealth. The One Health approach integrates the essential drivers of human, animal and environmental health. These communities will continue to stay in the forest fringe areas and practice a certain level of hunting-gathering activities from the forest for many years to come. Surveillance among this

community could be important for pandemic preparedness because the reservoir for many major pandemic outbreaks is associated with viruses found in bats or from the wild. In 2002, the Severe Acute Respiratory Syndrome (SARS) Coronavirus was reportedly originated from the civet cats, and the transmission of the virus to the local market was through the sales of bush meat in the rural market (Koh *et al.*, 2021). For Middle Eastern Respiratory Syndrome Coronavirus (MERS CoV), the reservoir of the virus was found to be from dromedary camels (Mohd *et al.*, 2016) and more recently, the SARS CoV 2 pandemic, the transmission of the virus was through the pangolin with the reservoir of the virus from the bats (Zhao *et al.*, 2020). Surveillance of the henipaviruses and filoviruses among these communities could be an indicator of the possible presence of the viruses in a country, and therefore, has a very impactful consequence on national safety and security. In the PREDICT project, findings have been reported from their surveillance activities with the Orang Asli communities. The project reported four known coronaviruses in 15 people, one known influenza in one person and one known coronavirus from chickens and one coronavirus from rats. Two new novel coronaviruses were reported in 3 bats from the study (Medicine, 2021). The Orang Asli community is considered the closest community living in forestry areas, although some tribes have advanced into urban development (Sukri *et al.*, 2022), not all communities lived in complete isolation from the developed areas, as they occasionally travel from their communities to sell their harvests or handicrafts, or even to obtain grocery supplies.

As previously reviewed, education remains one of the main challenges for the community. The Ministry of Education Malaysia took over the administration of education for the Orang Asli children's school from the Department of Orang Asli (JAKOA). as education did not improve their condition (Masron *et al.*, 2013). In 2006, the Malaysian government launched a policy and allocation to help provide opportunities for equal footing and modernizing their life (MOE, 2006), whilst protecting their beliefs. Despite these efforts, their culture and environment remain an issue for improving their quality of life in terms of exposure to vector- and vector-borne diseases. Children of the Orang Asli have higher incidence of malnourishment, anaemic as well as intestinal parasitism in a few studies (Al-Mekhlafi *et al.*, 2005). In addition, previous report has also indicated intestinal parasitism as the predictor for childhood malnutrition (Al-Mekhlafi *et al.*, 2013). Various initiatives and efforts have been in place to increase the health and wellbeing of the community, including introduction of fruit basket program for the poorer community. The program was catered to those that was unable to obtain proper meals per day, however, the study by Mas-Harithulhadih-Agus *et al.* (2021), reported that the Orang Asli children are five times more unlikely to be successful in the Food Basket Programme. However, prevalence of parasitic infections especially of high-risk factors of 'being a child' in the Orang Asli community, in addition to parasitic infections such as giardiasis were a predictor for under nourishment status of the Orang Asli children (Al-Mekhlafi *et al.*, 2005).

In some studies, the association of the diseases was reported to the level of education among the Orang Asli women. Gerberding (2004) has highlighted the role of women in infectious diseases, whereby many diseases implication such as malaria affects women more than men. Women are also more susceptible to many other diseases such as STD, tuberculosis, and tropical parasitic disease such as schistosomiasis due to their daily activities such as washing, cleaning the house and other house chores. In the OA community, the number of women to men ratio is 0.95: 1 (JAKOA, 2023). The Orang Asli female are married at the average age of 22 in comparison to 26 years old for the women in the whole of Malaysia (SyedHussain *et al.*, 2017). The life expectancy of the Orang Asli women is at 54 years old, which is 20 years shorter than the non-Orang Asli women in the country at 78 (Masron *et al.*, 2013; DOSM, 2021), and 30.8% of the OA population become widowers at 65, compared to 14.4%

of the total in Peninsula Malaysia (SyedHussain *et al.*, 2017) with 2 to 3 times higher Maternal Mortality Rate (MMR) from 2006 to 2008 indicating a possible need to direct the community's attention towards women's health.

From the year 2020 to 2022, publications of the Orang Asli community for these two years did not fall into the inclusion criteria. Mainly, due to the COVID-19 pandemic, surveillance data and studies could be affected. Instead, a few publications were reviewed for the impact of COVID-19 on the resilience of this community (Idrus *et al.*, 2021) the Orang Asli experienced economic hardship as well as food insecurity which have also been highlighted in Nicholas & Baer (2007). Idrus *et al.* (2021) reported within the first year, the pandemic threat to the community was taken very seriously, and barricades and checkpoints in the villages were set up. Their vulnerability was not only reflected in the economic and food security limitation, but also challenges in their knowledge and education in the pandemic were also severely affected. During the pandemic, the Orang Asli community also received financial support with an allocation of MYR 25 million for food and shelter, among the vulnerable communities in Malaysia which also includes senior citizens and the disabled.

The Malaysia National COVID-19 Immunization Program was rolled out for the national immunization against COVID-19. The acceptance of vaccines for this community was well received by the tribe. In the WHO report, the previous measles outbreaks in 2019 in the close-knit community prompted a mass vaccination of the community (WHO, 2021) and resulted in a good health response. The coordinated effort by local JAKOA and the Ministry of Health Malaysia, the Department of Education, Forestry, and many other parties to persuade the tribal leader to permit COVID-19 vaccination without relocating the tribe deeper into the forest, thereby mitigating the risk of infectious disease transmission within the community. The imperative to access the tribe for the provision of essential medical care, particularly addressing unsafe home births and malnutrition, is paramount for the well-being of women and children in the community.

The challenge to the social development of Orang Asli has been an ongoing issue despite the number of programs initiation to increase the level of education, health, income and participation in social development programs. The role of agencies in monitoring the welfare of the Orang Asli is managed by JAKOA. The cultural and environmental factors are the main factors that contributed to the lack of participation of the Orang Asli community as well as governance factors. Over the past 10 years, JAKOA receives an annual budget for the community enhancement activities and urbanization of the areas. Still, the isolated communities of the OA that are highly inaccessible to water, medical and food are living below the poverty line. The provision of basic necessities is not sustained in the community, due to the lack of technical know-how and knowledge in maintaining some of the facilities provided. In addition, being physically isolated and their risk of exposure to the vectors of diseases from the wild and the potential of spread of a new type of virus may also seem possible. On the other hand, with the COVID-19 pandemic, their isolation from the general population, limits their economic resources although it can prevent the transmission of the virus into the community. Nonetheless, the fear of infection with SARS CoV-2 could also prompt the community to move farther into the forest, making accessible healthcare difficult for those in need.

Overall, despite the multiple challenges to the advancement of the Orang Asli community, progress can still be seen as part of the development of human capital in the community (JAKOA, 2021). The potential importance of targeted education for the women of the Orang Asli community in hygiene and neglected tropical diseases could also catalyze the improvement of the community's self-awareness. In addition, although there is only a limited vaccine developed against neglected tropical diseases, the vaccine programs would likely be most beneficial for these neglected communities. In the current landscape, the vaccine for parasitic diseases such as

hookworm could benefit this community, who is living in extreme poverty conditions. In this review, the Orang Asli community is considered the 'bottom billion' (Hotez et al., 2009) whereby they are infected with multiple helminths such as hookworm and schistosomes and the subsequent impact of these diseases is not measured in fatalities, but the opportunities for community growth through the loss of economic activities, education and well-being especially for children and women (Hotez, 2009). Globally, there are a few entities that drive the development of vaccines for neglected tropical diseases and currently moving toward human clinical trials through product development partnerships (Beaumier et al., 2013). With the current advancement in the use of mRNA vaccine technology for COVID-19, mRNA vaccine has been proposed as a way forward to control parasitic diseases (Versteeg et al. (2019). The challenges in vaccine development for parasitic diseases have been well described (Zawawi & Else, 2020), noting the complexity of the biology of parasites, the diseases that affect the lower and middle-income countries and poor communities, the disease of low fatality and limitations to the conventional vaccine platforms which does not appeal in terms of economic returns (Berndt et al., 2007). Multiple considerations of using mRNA platform for a vaccine against parasitic diseases was highlighted in (Versteeg et al., 2019) including generating profiles of desired vaccines such as rapid development, and potent immune response. However, the cost of production is considered high, although it is becoming more affordable over the time.

CONCLUSION

Despite efforts to improve the quality of life among the Orang Asli community through various approaches, neglected tropical diseases (NTDs) remain a significant burden on health. Vaccination against NTDs can be an effective and cost-effective strategy to reduce the burden of disease in the community. The significant contribution to improving quality of life could potentially overcome other obstacles in advancing the community. Therefore, a comprehensive assessment of the impact of vaccines against NTDs should cover efficacy, safety, accessibility, and affordability. Prevention of disabilities, reduction of healthcare costs, and overall improvement of quality of life through vaccination against NTDs can significantly contribute to the health and well-being of the community.

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