Immunisation coverage and its determinants among Rohingya refugee children in Malaysia

Hanan Al-Haroni, AbdulRahman Muthanna, Mohd Nasir Mohd Desa, Meram Azzani

Background and objective
The displacement of populations due to humanitarian emergencies has an adverse impact on the global elimination of vaccine-preventable diseases. However, the level of immunisation coverage among Rohingya refugee children remains unknown. Therefore, this study investigated immunisation coverage and its determinants among Rohingya refugee children in Malaysia.

Methods
A cross-sectional study was conducted from September to November 2020 among the guardians of 243 Rohingya refugee children studying under the sponsorship of the King Salman Humanitarian Aid and Relief Center, Malaysia.

Results
Among the 243 children, 90 (37%) were unimmunised, 147 (60.5%) were partially immunised and only 6 (2.5%) were fully immunised. The country of child's birth, the child's age and access to healthcare services were significantly associated with unimmunisation (all $P<0.05$).

Discussion
This study found low immunisation coverage among Rohingya refugee children in Malaysia. Given the low level of coverage, a public health intervention, such as a vaccination program, for this refugee population is necessary.

CHILDHOOD IMMUNISATION is one of the World Health Organization's (WHO) strategies to reduce childhood mortality and vaccine-preventable diseases (VPDs).[1] Immunisation can be described as a process whereby people are protected against illness caused by microorganisms.[2]

Although immunisation is one of the most reliable, low-cost and high-impact public health interventions for disease prevention, VPDs continue to be a major cause of illness and mortality among children worldwide.[3] In 2021, the number of completely unvaccinated children increased by 5 million since 2019.[4] In South Asia, approximately 1.9 million child deaths in 2002 were attributed to vaccine-preventable infections, such as meningitis, sepsis and pneumonia.[5] Furthermore, the displacement of people has led to the breakdown of immunisation programs in many regions.[6]

One of the primary health concerns in emergencies that involve the movement of many people from their homes is to prevent communicable diseases, because refugees and migrants often originate from countries with low vaccination coverage.[7] Refugees are people who have fled war, violence, conflict or persecution to find refuge in another country and have crossed an international border. According to the United Nations High Commissioner for Refugees (UNHCR), there were 59.5 million forcibly displaced persons worldwide by the end of 2014.[8] This number is growing, interrupting routine healthcare, restricting access to recommended vaccinations and creating a population at high risk of VPDs.

Approximately 1.5 million Rohingya are living in Myanmar and across South-East Asia. The Rohingya people have been seeking refuge in Malaysia since the 1980s because of humanitarian and political issues. However, the crisis in Rakhine State, Myanmar, in 2017 resulted in the displacement of more Rohingya people to Malaysia and neighbouring countries.[9] Initially, Rohingya refugees and asylum seekers were given temporary shelter in camps. Around the same time, the UNHCR processed the Rohingya refugees and asylum seekers for resettlement. However, many are now living in urban settings in host communities in Malaysia.[10] As of February 2020, official figures show that 101,010 Rohingya refugees and asylum seekers are registered with the UNHCR in Malaysia.[11]

Although several factors play an integral role in the health and wellbeing of Rohingya children, their vaccination status can have a significant impact on them and the nationals of their host country. Recently, Malaysia has seen a significant increase in VPDs despite a persistent high immunisation coverage of above 90%. Outbreaks of VPDs such as measles and diphtheria still occur, even though Malaysia's target for vaccination coverage is 95%,[3] which is higher than the 90% national vaccination coverage target set by the WHO in its Global Immunization Vision and Strategy (GIVS) 2006–2015.[12] In December 2019, the WHO's report on

VPDs in Malaysia showed that measles cases had increased from 334 in 2008 to 1981 in 2018.[13] Similarly, in 2018, 892 pertussis cases were reported, compared with 11 in 2008.[14] UNHCR Malaysia works with non-governmental organisations (NGOs) to implement a vaccination program for refugee Rohingya children,[10] but the level of immunisation coverage remains unknown. Although vaccination programs for refugees are more cost-effective than responses to outbreaks, refugees do not have free access to healthcare in Malaysia. However, they do have access, at a discounted rate, to public and private healthcare facilities.

Although most outbreaks of polio and measles worldwide do not occur among displaced people, there remains a risk of VPDs being transmitted by these vulnerable groups. In fact, recently, outbreaks of such diseases have occurred among refugees, including the re-emergence of polio in Syria and several measles outbreaks in Syria and neighbouring countries. The spread of VPDs among displaced populations and susceptible host communities can also be seen in other regions, such as the outbreak of polio in 2013 in refugee camps along the Kenya–Somalia border that then spread into surrounding communities. As more displaced people have migrated out of camps and into urban environments, and given the unique challenges of locating such populations, distinctive approaches to achieving increased vaccination coverage in non-camp populations are required.[9]

Malaysia hosts some 181,000 refugees and asylum-seekers. 85% are from Myanmar, including some 103,000 Rohingyas and 45,650 are children below the age of 18.[15] From 2015 onward, non-Malaysians have been required to pay a minimal fee for immunisation. Meanwhile, the UNHCR has been working with partners to secure and support registered refugees and asylum seekers in Malaysia. The UNHCR is the main agency in charge of refugee health issues[16] and, in Malaysia, provides free vaccines for non-Malaysian citizens during outreach programs, mopping-up events and supplemental immunisation activities. Vaccinations are mostly provided by NGO clinics in partnership with the UNHCR, such as the vaccination program for Myanmar refugees living in the Ampang area in July 2010. Only a few NGOs operate vaccination outreach clinics in Malaysia due to the costly cold storage requirements for vaccines and the complex administrative registration regulations for refugees and migrant communities. Moreover, due to the complicated social and policy environment for refugees and asylum seekers in Malaysia, little is known about their immunisation status. Therefore, the aim of this study was to evaluate immunisation coverage and its determinants among Rohingya refugee children studying under the sponsorship of the King Salman Humanitarian Aid and Relief Center (KSHARC), Malaysia.

Methods

A cross-sectional study was conducted from 20 September to 20 November 2020 among guardians of 243 Rohingya refugee children in receipt of a KSHARC sponsorship. The study was conducted in the Ampang district of Kuala Lumpur, where the KSHARC sponsors three schools (the Ar-Rabbaniyah, Abu bakr as-Siddiq and Nusrataldeen schools), each of which has a different population size. Kuala Lumpur is Malaysia's capital city and is geographically divided into 11 districts, including Ampang. The children's guardians were recruited by convenience sampling. The required sample size of 249 was estimated using a single proportion formula for the prevalence of unimmunisation, P=14.1% with a 95% confidence interval (CI), and a marginal error of 5%.[17] To be eligible for inclusion in the study, the guardians had to be responsible for the care of a Rohingya refugee child aged 3–14 years (school age) and studying under the sponsorship of the KSHARC. Guardians who were caring for more than one child sponsored by KSHARC were excluded from the study. The guardians were asked to bring the child's vaccination card, if available, to the school, where the study tool was administered by the researcher and her assistant.

Ethics approval was obtained from the Ethics Review Committee of MAHSA University (RMC/EC42/2020) and from KSHARC. The study participants were informed about the nature and purposes of the study, and that their participation was voluntary. Written consent was obtained from the participants before data collection.

Data were collected using a structured questionnaire from a previous study after obtaining permission from the author.[18] The questionnaire was translated to the Rohingya language. Backward and forward translation was conducted, and the questionnaire was pretested with 30 participants to ensure that it was suitable for the purposes of the present study. The questionnaire consisted of four parts: sociodemographic characteristics; knowledge of child immunisation; barriers associated with immunisation; and children's vaccination records. Part 1 collected data on sociodemographic characteristics, including the guardian's age, sex, education level, marital status, occupation, household income, the number of children in the household, the guardian's relationship with the child concerned and the age and sex of the child. Part 2 contained questions to ascertain the level of knowledge regarding child immunisation among guardians. A total score of less than the median was considered to show inadequate (poor) knowledge regarding child immunisation, whereas a total score higher than the median was considered to indicate adequate (good) knowledge. Part 3 assessed the barriers associated with immunisation, which were carefully selected from the literature. These barriers included the place of delivery, access to healthcare services, cost of vaccination, speaking the local language (Malay), fear of arrest and source of vaccination information. With regard to access to healthcare services, all the participants were asked whether they thought they could access healthcare services if they needed them. Responses to this question of 'yes, very easily' and 'yes, easily' were considered to denote having access, whereas answers of 'yes, but hardly' (healthcare services could be accessed, but with difficulty; for example, cost of transportation) and 'no' were categorised

as indicating the presence of barriers to access.[19] Part 4 assessed the children's vaccination records. Those who agreed to participate in the study were asked to come to school and bring the child's vaccination card with them, if it was available. Another appointment was made for guardians who forgot to bring their child's vaccination card. If a guardian could not come to the school, the researcher and her assistant went to their home to administer the questionnaire.

Based on the content of the vaccination card, the outcome variable (immunisation coverage) was categorised as follows:

- fully immunised: a child who had received one dose of Bacillus Calmette–Guérin (BCG) vaccine, three doses of pentavalent vaccine (combination vaccine for diphtheria, tetanus, pertussis, polio, and *Haemophilus influenzae* type b [DTaP-IPV/Hib]), three doses of hepatitis B (HepB) vaccine and one dose of measles vaccine (WHO)[20]
- partially immunised: a child who had missed any of the above vaccinations or one or more doses of a vaccine
- unimmunised: a child who had not received a single dose of vaccine.

In the data analysis, the outcome variable was divided into two categories: full/partial immunisation and unimmunisation.[17] The WHO definition of a fully vaccinated child is one who has received one dose of BCG vaccine, three doses of DTaP-IPV/Hib vaccine, three doses of HepB vaccine and one dose of measles vaccine.[21] Hence, the booster dose was not considered in this study.

All data were analysed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Both descriptive and inferential statistics were used in the data analysis. In the descriptive analysis, data are presented as the mean and standard deviation (SD) for continuous variables and as frequencies and percentages for categorical variables. The presence of an association between the independent factors and the outcome was assessed using univariate and binary logistic regression analysis. All variables with a $P<0.05$ in the univariate analysis, as well as those considered as strong confounders (ie access to healthcare and education level)[3,22] in the literature, were included in the final binary logistic regression model, which was developed to identify the significant determinants of unimmunisation among Rohingya refugee children. $P<0.05$ (two-sided) was considered an indicator of statistical significance.

Results

In all, 243 guardians took part in the study (response rate was 97.5%). With regard to the sociodemographic characteristics of the participants, 225 (92.6%) guardians were married and 18 (7.4%) were widowed or divorced; 145 (59.7%) were illiterate, 80 (32.9%) had a primary education and only 18 (7.4%) had a secondary or higher education. Most guardians (n=211; 86.8%) were working and 32 (13.2%) were unemployed. The mean age of the guardians was 32.45±8.23 years, and 122 (50.2%) were male and 121 (49.8%) were female. The mean household income was 1100.04 ± 531.94 Malaysian ringgit (RM) with an SD of RM. As regards the number of children in the household, the minimum was 0 and the maximum was 10, with a mean of 3.11±1.61. The mean age of the children was 6.55±2.61 years. With regard to the guardians' knowledge of child immunisation, 162 (66.7%) had good knowledge, whereas 81 (33.3%) had poor knowledge (Table 1).

With regard to the potential barriers to child immunisation, the analysis revealed that of the 243 children, only 52 (21.4%) were born in Myanmar, whereas 191 (78.6%) had been born in Malaysia. Most children (n=223; 91.8%) had been born in a healthcare facility, with only 20 (8.2%) born at home. More than half the guardians (n=159; 65.4%) were able to speak the Malay language, although 84 (34.6%) were not. Out of the 243 guardians, 72 (29.6%) reported having access to a healthcare facility; 171 (70.4%) reported having no access. Most (n=213; 87.7%) stated that vaccines are expensive, although 30 (12.3%) stated that vaccines are cheap. Sixty-one (25.1%) guardians stated that they always feared being arrested; 123 (50.6%) sometimes feared being arrested, 10 (4.1%) seldom had any fear of being arrested and 49 (20.2%) never feared being arrested. Most guardians (n=182; 74.9%) received immunisation information from their friends or neighbours, with only 31 (12.8%) receiving immunisation information from healthcare staff and 30 (12.3%) receiving immunisation from the radio, television or newspaper.

Based on information from the children's vaccination cards, 90 (37%) Rohingya refugee children were unimmunised, 147 (60.5%) were partially immunised and only 6 (2.5%) were fully immunised.

Specific immunisation coverage, based on the children's vaccination cards, for each vaccine among the Rohingya refugee children was as follows. More than half the children (60.5%) were immunised against BCG. With regard to the HepB vaccine, 99 (40.7%) children were unimmunised, 57 (23.5%) had had the first dose, 77 (31.7%) had had the second dose and 10 (4.1%) had had the third dose. Considering the pentavalent vaccine, 135 (56%) children were unimmunised, with 29 (11.9%), 70 (28.8%) and 9 (3.7%) children having had the first, second and third doses, respectively. With regard to the MMR vaccine, 192 (79%) children were unimmunised and 51 (21%) had had the first dose. Based on these data, we determined the immunisation coverage among the Rohingya refugee children in this study to be as follows: 153 (63%) fully/partially immunised and 90 (37%) unimmunised.

The determinants of immunisation status were first evaluated individually using univariate binary regression analysis (Table 2). Then, those factors that were significantly associated with immunisation status in the univariate analysis were included in the final multivariate regression model (Table 3). Other factors that were identified as strong confounders in the literature (ie access to healthcare and guardian's education)[3,23] were also included in the final model, even if they were not significant. The dependent variable was computed as a categorical variable (full/partial immunisation and unimmunisation).[17]

The univariate analysis revealed five factors that were significantly associated with immunisation status: the place of birth, the guardian's age, the child's age, the country of the child's birth and the cost of vaccination (all $P<0.05$; Table 2). The remaining factors evaluated were not significantly associated with immunisation status (Table 2).

The final regression model is presented in Table 3. With regard to the effect of the country of birth on immunisation status, children born in Myanmar were 40-fold more likely to be unimmunised than children born in Malaysia (odds ratio [OR] 40.04; 95% CI: 10.63, 150.75; $P<0.001$). In addition, the probability of being unimmunised increased with child's age (OR 1.19; 95% CI: 1.02, 1.39; $P=0.027$). Those children whose guardians had no access to a healthcare facility were threefold more likely to be unimmunised than children whose guardians had access to a healthcare facility (OR 3.43; 95% CI: 1.31, 8.97; $P=0.012$). The result of the Hosmer–Lemeshow test showed that the model had a satisfactory goodness of fit.

Discussion

The present study identified a high prevalence (37%) of unimmunised children among Rohingya refugee children aged 3–14 years. This level of immunisation is poor compared with the results of previous studies conducted in other countries. For example, in Thailand, a study among Myanmar migrant children reported that 60.7% of the participants had incomplete immunisation, with approximately 39.3% having a complete immunisation record.[24] The higher immunisation coverage among Myanmar migrant children in Thailand could be attributed to the implementation of a school-based immunisation program for migrant children on the Thailand–Myanmar border.[25] There is no such school-based immunisation program for migrants and refugees in Malaysia, even though unvaccinated children may represent a public health risk to schools, and the lack of such programs may be one reason for the high number of unimmunised refugee children in such communities in the country. Another study conducted among refugees in Kenya reported much higher full immunisation coverage (14%)[26] than in the present study (in which the full immunisation coverage was 2.5%).

The immunisation coverage in the present study was also lower than that reported in a study in slum areas in India, which found that 74.7% of children were fully immunised, 11.1% were partially immunised and 14.1% were not immunised.[17] Another study from Denmark found that 33% of asylum-seeker children had not been vaccinated, 7% had been partially vaccinated and 60% had been adequately vaccinated.[27]

With regard to the guardians' knowledge of immunisation, more than half the guardians (n=162; 66.7%) in the present study had good knowledge of immunisation. This result is similar to that reported in a study from Iraq, in which approximately 66% of parents were found to have adequate knowledge.[18]

Conversely, most refugee parents in many countries have inadequate or limited immunisation knowledge. For example, a study in Thailand revealed low levels of immunisation awareness among Myanmar migrants.[25] In addition, a study conducted in Mozambique showed that 28.2% of children had insufficient vaccination and that there was poor knowledge of immunisation among mothers.[28] The high level of immunisation awareness among the guardians in our study may be due to the context (ie living in Malaysia, where many vaccination and health information resources are available via television and regular vaccination advocacy campaigns).

Because Rohingya refugees and asylum seekers have been residing in Malaysia over the past few decades, most of the children in the present study had been born in a healthcare facility (n=223, 91.8%), with only 20 (8.2%) being born at home. The number of children born in a healthcare facility in the present study is higher than that reported by a study among the refugee population in Kakuma, Kenya, which found that 167 (27%) children were delivered at hospital, compared with 447 (73%) who were born at home.[26] This difference may be due to the availability of healthcare facilities in

Table 1. Guardians' knowledge of immunisation (n=243)

Statement	Correct answer n (%)	Incorrect answer n (%)
1. Vaccination prevents disease	239 (98.3)	4 (1.7)
2. Vaccination is for all ages	163 (67)	80 (33)
3. There are different types of vaccines	172 (70.7)	71 (29.3)
4. Active immunisation is a killed or weakened form of a disease-causing agent	237 (97.5)	6 (2.5)
5. Passive immunisation is an antibody from someone who was infected with the disease	74 (30.5)	169 (69.5)
6. In some health situations, vaccines should not be given	194 (79.8)	49 (20.2)
7. Vaccines need to be stored at more than 8°C and do not freeze	160 (65.8)	83 (34.2)
8. The product should be used within 72 hours of the seal being broken	204 (83.9)	39 (16.1)
9. There is a uniform immunisation guideline for paediatric patients younger than two years	38 (15.6)	205 (84.4)
10. Vaccination is harmful	215 (88.4)	28 (11.6)
Minimum and maximum knowledge score (3-10) with a median score is 7.		

Table 2. Determinants of immunisation status: Univariate regression analysis

Variable	Unadjusted OR	95% CI	*P*-value
Marital status			
Married	Reference		
Widow/divorced	0.804	0.291, 2.222	0.673
Education level of guardian			
Secondary/university	Reference		
Primary	0.613	0.215, 1.743	0.359
Illiterate	0.828	0.308, 2.225	0.709
Occupation of guardian			
Employed	Reference		
Unemployed	0.977	0.453, 2.108	0.953
Child's sex			
Male	Reference		
Female	1.223	0.723, 2.069	0.452
Guardian's age	1.054	1.019, 1.089	0.002
Child's age	1.392	1.239, 1.564	<0.001
Number of children	1.129	0.961, 1.327	0.139
Income	1.000	1.000, 1.001	0.857
Guardian's knowledge of immunisation	0.645	0.363, 0.147	0.135
Child's country of birth			
Malaysia/other (except Myanmar)	Reference		
Myanmar	24.568	9.834, 61.377	<0.001
Child's place of birth			
Healthcare facility	Reference		
At home	4.329	1.599, 11.723	0.004
Guardian speaks the Malay language			
Yes	Reference		
No	1.158	0.669, 2.005	0.601
Access to health service			
Yes	Reference		
No	1.252	0.699, 2.244	0.449
Cost of vaccination			
Cheap	Reference		
Expensive	0.417	0.192, 0.905	0.027
Fear of arrest			
Never	Reference		
Seldom	1.255	0.311, 5.065	0.750
Sometimes	1.229	0.614, 2.459	0.560
Always	1.119	0.508, 2.467	0.780
Source of vaccination information			
Radio, television, newspaper	1.837	0.649, 5.199	0.252
Friends or neighbours	1.260	0.559, 2.840	0.577
Healthcare worker	Reference		

P<0.05 was considered significant.
CI, confidence interval; OR, odds ratio.

Malaysia versus Kenya (eg there is only one hospital in the Kakuma district).[26] In addition, in Malaysia, there are free refugee clinics that are coordinated by the UNHCR along with the Obstetrics and Gynecological Society of Malaysia.[29]

In the present study, more than half the guardians (n=159; 65.4%) could speak the Malay language, but 84 (34.6%) could not, which may create a communication barrier when it comes to accessing health services. Fewer guardians in the present study did not have a language barrier than in a study conducted in Thailand, in which 81.3% of mothers had no language barrier and only 18.7% had a language barrier.[24]

In the present study, 72 (29.6%) guardians reported having access to a healthcare facility and 171 (70.4%) reported encountering difficulties accessing a healthcare facility. Access to healthcare services in Malaysia is low compared with Jordan according to a study conducted among Syrian refugees, which found that 56.1% of refugees had access to health facilities, compared with 43.9% who did not.[19] This difference in access may be because Malaysia is not a participatory state of the 1951 Convention Relating to the Status of Refugees and its 1967 Protocol.[30]

Most guardians in the present study stated that they received vaccination information from their friends or neighbours. This could be due to inadequate access to healthcare services. Moreover, the abovementioned language barrier could hinder access to healthcare facilities, a factor not seen among refugees in the Jordan-based study.[19] Furthermore, 25.1% of guardians in the present study revealed a continual fear of being detained, with 50.6% expressing concern about getting arrested sometimes. This finding is in line with a study in Sweden of undocumented immigrants.[31]

Finally, in the present study, most guardians stated that vaccines are expensive, which is in accordance with a study conducted in Australia that revealed that financial difficulties prevented refugees from accessing healthcare services.[22]

The multivariate binary logistic regression analysis revealed that some

of the factors considered were not significantly associated with immunisation coverage, including the guardian's age. This finding is consistent with the results of a study conducted in East China among socioeconomically disadvantaged recent migrants.[24] The place where the child was born was also not significantly associated with immunisation coverage. This finding is in contrast to the findings of the study conducted in China.[24] The reason for the lack of association between place of birth and immunisation coverage in our study may be the language barrier, which could prevent mothers from receiving health education about the benefits of vaccination after birth. In addition, the guardian's education level was not significantly associated with immunisation coverage in the present study, which is in contrast to a study in Bangladesh that found that childhood vaccination was markedly increased with increasing education levels of mothers.[23] The cost of vaccines was also not significantly associated with immunisation coverage.

Conversely, significant determinants of unimmunisation in the present study were access to healthcare services, the child's age and the child's country of birth. Access to healthcare services was significantly associated with a higher percentage of immunisation. The children whose guardians had no access to healthcare services were threefold more likely to be unimmunised than their peers whose guardians had access to a healthcare service. This finding is similar to that reported by a study conducted in Bangladesh,[23] which found that the vaccination coverage rate was significantly associated with easy access to healthcare services. This can be considered a legal barrier (ie lack of legal status in Malaysia) rather than an individual barrier (ie language and cultural barriers).

In the present study, the child's age was also significantly associated with immunisation status, with younger children having better vaccination coverage than older children. This may be because the younger children were born in Malaysia, where there is better availability of health services and therefore a higher chance of being vaccinated. However, our results appear to contrast those of a study among Syrian refugee children living in Berlin, Germany. In that study, the Syrian refugee children generally had a low rate of full immunisation, and this low rate was particularly apparent among younger (<5 years) children, who had a lower rate of adequate coverage than older children (27.8% vs 73.7%, respectively).[32] This could be because the recent conflict in Syria has adversely affected immunisation rates among younger children.

Finally, the country of birth was significantly associated with immunisation status among the Rohingya refugee children. Immunisation coverage was better for children born in Malaysia or a country other than Myanmar. It is presumed that, compared with Myanmar, Malaysia provides better healthcare and, as a result, there is a higher immunisation rate. In addition, there have been disruptions in primary healthcare services as a result of Myanmar's emergency situation. The finding in our study is similar to that of a study conducted in China, which reported that immunisation programs are used better among long-term migrants.[33]

Table 3. Determinants of immunisation status: Multivariate regression model

Variable	Adjusted OR	95% CI	*P*-value
Country of birth			
Malaysia/other (except Myanmar)	Reference		
Myanmar	40.047	10.638, 150.757	<0.001
Place of child's birth			
Healthcare facility	Reference		
At home	0.745	0.073, 7.650	0.804
Guardian's age	1.039	0.997, 1.082	0.068
Child's age	1.194	1.020, 1.398	0.027
Access to health service			
Yes	Reference		
No	3.438	1.317, 8.978	0.012
Educational level of guardian			
Secondary/university	Reference		
Primary	0.380	0.113, 1.277	0.118
Illiterate	0.335	0.109, 1.028	0.056
Cost of vaccination			
Cheap	Reference		
Expensive	3.017	0.496, 18.346	0.231

P<0.05 was considered significant.

CI, confidence interval; OR, odds ratio.

Study limitations and strengths

The key strength of this study lies in its collection and analysis of primary data that can be used as baseline information for intervention programs and further investigations. However, the study also has some limitations. First, the study population was conveniently sampled from KSHARC, which thus affects the generalisability of the results to all refugees in Malaysia. However, it was necessary

to collect the data using convenience sampling to approach our calculated sample size based on the age-inclusive criteria. Another limitation of our study is that the data were collected using a questionnaire, which may have led to information bias. However, we confirmed the data on immunisation coverage by referring to the information provided on the immunisation card to ensure accuracy.

Conclusion

This study identified low immunisation coverage among Rohingya refugee children in Malaysia, which could be improved if the identified barriers are addressed and proper policies are put in place to overcome these barriers. Owing to livelihood insecurity and the challenges that hinder easy access to health facilities, Rohingya refugee children are at risk of not being immunised. The analysis of the participants' sociodemographic characteristics showed that children who were born in Malaysia had higher immunisation coverage than those born in Myanmar. However, there is still a need to adopt more measures to vaccinate refugee children. Vaccinating the refugee population will not only benefit the Rohingya refugees, but also the host country in terms of general public health. More research is needed to gain a consistent understanding of this issue and, as a result, to inform policymakers, as well as to facilitate collaboration and responsibility sharing. On the whole, the Rohingya refugee immunisation program requires responsibility-sharing arrangements across key players and a clear framework to be successful.

Authors

Hanan Al-Haroni MBBCh, Master of Public Health, PhD candidate, Department of Community Medicine, Faculty of Medicine, Bioscience and Nursing, MAHSA (Malaysian Allied Health Sciences Academy) University, Bandar Saujana Putra, Selangor, Malaysia

AbdulRahman Muthanna PhD, Postdoctoral Researcher, Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia

Mohd Nasir Mohd Desa PhD, Associate Professor, Department of Biomedical Sciences, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia

Meram Azzani PhD, Senior Lecturer, Department of Public Health Medicine, Faculty of Medicine, Universiti Teknologi MARA, Sungai Buloh Campus, Selangor, Malaysia; Consultant, Centre of Occupational Safety, Health and Wellbeing, Universiti Teknologi MARA, Kampus Puncak Alam, Selangor, Malaysia

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Correspondence to:
meram@uitm.edu.my

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References

1. World Health Organization (WHO). Immunization (online). Available at: www.who.int/news-room/facts-in-pictures/detail/immunization [Accessed 26 April 2023].
2. Debie A, Lakew AM, Tamirat KS, Amare G, Tesema GA. Complete vaccination service utilization inequalities among children aged 12–23months in Ethiopia: A multivariate decomposition analyses. Int J Equity Health 2020;19(1):65.
3. Lim KK, Chan YY, Noor Ani A, Rohani J, Siti Norfadhilah ZA, Santhi MR. Complete immunization coverage and its determinants among children in Malaysia: Findings from the National Health and Morbidity Survey (NHMS) 2016. Public Health 2017;153:52–57.
4. WHO. Immunization coverage. WHO, 2022. Available at: www.who.int/news-room/fact-sheets/detail/immunization-coverage [Accessed 20 April 2023].
5. Centers for Disease Control and Prevention (CDC). Vaccination preventable deaths and the global immunization vision and strategy, 2006–2015. MMWR Morb Mortal Wkly Rep 2006;55(18):511–15.
6. De Vito E, Parente P, De Waure C, Poscia A, Ricciardi W. A review of evidence on equitable delivery, access and utilization of immunization services for migrants and refugees in the WHO European Region. Copenhagen: WHO Regional Office for Europe, 2017.
7. Koop DG, Jackson BM, Nestel G. Results of the expanded program on immunization in the Macedonian refugee camps. Am J Public Health 2001;91(10):1656–59.
8. United Nations High Commissioner for Refugees (UNHCR). (2015). 10 infographics that show the scale of global displacement. Retrieved from: www.unhcr.org/innovation/10-infographics-that-show-the-scale-of-the-global-displacement-crisis/ [Accessed 14 February 2021].
9. Redpath N. The impact of vaccination programs on forcibly displaced Rohingya children to reduce rates of communicable infections within Bangladesh [MSc thesis]. University of North Carolina at Chapel Hill, 2018. Available at https://cdr.lib.unc.edu/concern/masters_papers/8w32r7792 [Accessed 14 April 2023].
10. Chuah FLH, Tan ST, Yeo J, Legido-Quigley H. Health system responses to the health needs of refugees and asylum-seekers in Malaysia: A qualitative study. Int J Environ Res 2019;16:1–21.
11. UNHCR. Figures at a glance in Malaysia. UNHCR, 2020. Available at: www.unhcr.org/figures-at-a-glance-in-malaysia.html [Accessed 10 March 2020].
12. WHO. Global immunization vision and strategy 2006-2015. Geneva: WHO; 2005. Available at: https://apps.who.int/iris/handle/10665/69146
13. WHO. Measles reported cases and incidence, Malaysia [Online]. Available at: https://immunizationdata.who.int/pages/incidence/MEASLES.html?CODE=MYS&YEAR= [Accessed 14 February 2021].
14. WHO. Pertussis reported cases and incidence. Malaysia. Available at: https://immunizationdata.who.int/pages/incidence/pertussis.html?CODE=MYS&YEAR= [Accessed 26 April 2023].
15. Malaysia MERCY. United Nations High Commissioner for Refugees (UNHCR), Malaysia data. Available at: www.unhcr.org/countries/malaysia [Accessed 26 April 2023].
16. UNHCR. Available at: www.unhcr.org/what-we-do/protect-human-rights/public-health [Accessed 26 April 2023].
17. Gupta P, Prakash D, Srivastava JP. Determinants of immunization coverage in Lucknow district. N Am J Med Sci 2015;7(2):36–40.
18. Al-Iela OQB, Bahari MB, Salih MR, Al-Abbassi MG, Elkalmi RM, Jamshed SQ. Factors underlying inadequate parents' awareness regarding pediatrics immunization: Findings of cross-sectional study in Mosul–Iraq. BMC Pediatr 2014;14(1):29.
19. Ay M, Arcos González P, Castro Delgado R. The perceived barriers of access to health care among a group of non-camp Syrian refugees in Jordan. Int J Health Serv 2016;46(3):566–89.
20. WHO. The Global Health Observatory. Full immunized child rate. Available at: www.who.int/data/gho/indicator-metadata-registry/imr-details/3376 [Accessed 8 August 2023].
21. WHO. 2018. Immunization Coverage [Online]. Available at: www.who.int/news-room/fact-sheets/detail/immunization-coverage [Accessed 14 February 2021].
22. Sheikh-Mohammed M, Macintyre CR, Wood NJ, Leask J, Isaacs D. Barriers to access to health care for newly resettled sub-Saharan refugees in Australia. Med J Aust 2006;185(11–12):594–97.
23. Mansour Z, Hamadeh R, Rady A, et al. Vaccination coverage in Lebanon following the Syrian crisis: Results from the district-based immunization coverage evaluation survey 2016. BMC Public Health 2019;19(1):58.
24. Munsawaengsub C, Hlaing EE, Nanthamongkolchai S. Factors influencing immunization status of Myanmar migrant children among 1–5 years in Mahachai District, Samutsakorn Province, Thailand. J Med Sci 2011;2:1093–99.
25. Kaji A, Parker DM, Chu CS, et al. Immunization coverage in migrant school children along the Thailand–Myanmar border. J Immigr Minor Health 2016;18(5):1038–45.
26. Lomuria K, Nyakio N, Oyugi E, Ransom JA. Factors associated with full immunization coverage among children up to 12 months, Kakuma Mission Hospital, Turkana County, Kenya. J Refug Glob Health 2019;2(2):1–5.
27. Nakken CS, Skovdal M, Nellums LB, Friedland JS, Hargreaves S, Norredam M. Vaccination status and needs of asylum-seeking children in Denmark: A retrospective data analysis. Public Health 2018;158:110–16.

28. Jani JV, De Schacht C, Jani IV, Bjune G. Risk factors for incomplete vaccination and missed opportunity for immunization in rural Mozambique. BMC Public Health 2008;8(1):161.
29. Ismail Y. More than 300 make use of first free clinic for refugee women in Kuala Lumpur. UNHCR, 2007. Available at: www.unhcr.org/news/latest/2007/9/46eea2334/300-use-first-free-clinic-refugee-women-kuala-lumpur.html [Accessed 14 February 2021].
30. Equal Rights Trust. Equal only in name: The human rights of stateless Rohingya in Malaysia. London: Stroma Ltd, 2014.
31. Godoy-Ramirez K, Byström E, Lindstrand A, Butler R, Ascher H, Kulane A. Exploring childhood immunization among undocumented migrants in Sweden – following qualitative study and the World Health Organizations Guide to Tailoring Immunization Programmes (TIP). Public Health 2019;171:97–105.
32. Fozouni L, Weber C, Lindner AK, Rutherford GW. Immunization coverage among refugee children in Berlin. J Glob Health 2019;9(1):010432.
33. Hu Y, Li Q, Chen E, Chen Y, Qi X. Determinants of childhood immunization uptake among socio-economically disadvantaged migrants in East China. Int J Environ Res Public Health 2013;10(7):2845–56.

correspondence **ajgp@racgp.org.au**