



# Factors That Motivate and Militate Undocumented Migrants to Vaccinate Their Children in Sabah, Malaysia

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## Abstract

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**BACKGROUND:** Undocumented migrant families face many challenges in bringing their children for vaccination. The recent outbreak of poliomyelitis in Sabah among undocumented migrant children highlights the gap in vaccination coverage among these populations.

**AIM:** This study aimed to determine the factors that influence undocumented migrants in Sabah to vaccinate their children.

**METHODS:** This is a cross-sectional study using a questionnaire developed based on the findings from a qualitative study. This study was conducted in 15 districts of Sabah among the mothers of undocumented migrant children. Multiple Logistic Regression was done to find out the significant factors that influence undocumented migrants to vaccinate their children.

**RESULTS:** A total of 942 responses were collected during the study. About 78.7% of the respondents attended health facilities to vaccinate their children. Only the legal status of the undocumented migrant (adjusted odds ratio [aOR] = 0.15 [95% CI: 0.52–0.43]) remains a significant militating factor for undocumented migrants to vaccinate their children. Two factors, parental trust in health-care providers and vaccines (aOR = 18.24 [95% CI: 8.42–39.51]) and good support system (aOR = 2.65 [95% CI: 1.77–3.97]), remain significant motivating factors that influence undocumented migrants to vaccinate their children. Those who had visited the health facilities for an antenatal check-up (aOR = 25.93 [95% CI: 17.07–39.39]) and delivery (aOR = 93.63 [95% CI: 34.77–257.81]), with income of more than RM 1000 (aOR = 6.09 [95% CI: 3.66–10.12]) have a higher prevalence to bring their children for vaccination.

**CONCLUSION:** In the best interest of public health and to prevent the further re-emergence of vaccine-preventable diseases in Sabah, it is important to address these factors to improve vaccine uptake among undocumented migrant children.

## Introduction

Malaysia has been recorded to have an increased number of non-citizens residing in Malaysia from 2010 to 2019. The annual population growth rate of non-citizens is more than the growth rate of Malaysian citizens, whereby in 2019, the annual growth rate of citizens is 1.1%. The annual population growth rate of non-citizens is 3.6% [1]. A total of 2.7 million non-citizens are estimated to be living in Malaysia in 2020 [2]. Malaysia has a 152,000 refugee population, mainly Rohingya refugees, and is a destination country for human trafficking [3]. However, these non-citizen statistics in Malaysia include only those with documents to prove their origin nationality. However, many undocumented migrants are residing in Malaysia, but their exact figure is unknown because they are considered a “hidden” population [4]. Of the 13 states in Malaysia, Sabah exhibits the highest number of

non-Malaysian citizens [5]. They vary in nationality, background, and origin. Many of them come to Sabah looking for job opportunities, especially in palm oil plantations [5]. Sabah is in the northern part of Borneo and is one of Malaysia’s main tourist attractions places. This is primarily due to Sabah being home to Mount Kinabalu, the highest mountain peak in Southeast Asia, and the many beautiful islands off its coastline [6]. However, Sabah’s long coastline makes it difficult to control migrant movement into Sabah [7].

Most of the undocumented migrants in Sabah are stateless people. These stateless people will be addressed as undocumented migrants throughout this paper. Convention on the Status of Stateless Persons defines a stateless person as someone “who has no documents and any other evidence to prove their nationality for generations and is not accepted as a citizen by any country” [8]. Most of the stateless people in Sabah come from descendants of Filipino refugees of the 1970s and children born out of illegal marriages

between undocumented migrants and natives [9]. Some of the stateless people are the migratory people who are commonly seen living in the islands and coastal areas of Sabah and are known to be *Sama dilaut* or *Bajau Laut* [10]. Undocumented migrant children residing in Sabah bring a significant challenge to have optimized vaccine coverage. This evidence can be shown by the recent outbreak of poliomyelitis cases after 27 years in Sabah [11]. Among the four reported cases, three of them were undocumented migrant children. Undocumented migrant children are kept undetected from health surveillance and immunization coverage data. Malaysia has been known to have large populations of stateless people in Asia and the Pacific [10].

All undocumented migrants have the right to equitable access to disease prevention such as immunization [12] based on international treaties and conventions. However, many factors prevent an undocumented migrant from accessing health-care facilities [10], primarily due to government policies [12], [13]. In 2015, the Ministry of Health, Malaysia released an order to charge non-citizens in Malaysia differently than Malaysians, including childhood vaccination [14]. These undocumented migrants are highly vulnerable compared to the host population. Undocumented migrant families must endure many problems to support their children [15]. Undocumented migrant children are subjected to severe consequences due to conflicting international responsibilities and national priorities [12]. They are usually not vaccinated because they do not have permanent residence [16]. When we exclude migrants from preventive health, especially in providing undocumented migrant children with the vaccine, it can lead to high hospital costs and control measures [17], [18]. Nevertheless, it also risks the host population [18].

The success of an immunization program depends on multiple factors, and social determinants influence the immunization program in a country [19]. The social determinants of health are the main culprit of health inequities [20]. One component that is part of the social determinants is social exclusion. Social exclusion is the people at risk of being excluded from accessing essential health and education, leading to health inequalities [21]. These include undocumented migrants, ethnic minority groups, refugees, and stateless and physically or mentally disabled people [22]. Factors like socioeconomic status such as occupation, household income, and education are crucial in determining immunization access [23]. Besides that, gender, living condition, awareness, and religion influence immunization [24]. Other factors such as the unfriendly staff, lack of time, poor awareness among the parents, fear of the vaccine's side effects, and loss of daily income have also been barriers to childhood immunization [25]. However, the factors that influence undocumented migrants to

vaccinate their children might differ from the average population. Knowing the factors that can improve vaccination coverage among these undocumented migrants is the way forward to prevent more outbreaks of vaccine-preventable diseases in Sabah. We have to change the traditional approach of a supply-oriented immunization program to a more people-centered and comprehensive approach, taking into account complexity and the factors influencing vaccination uptake [26]. Thus, this study aimed to find factors that prevent and motivate undocumented migrants to vaccinate their children.

## Methods

This study is a cross-sectional study that was done based on the themes obtained from a qualitative study to identify the barriers and motivating factors that influence undocumented migrants' decision to vaccinate their children [27]. The qualitative study was done only in one district in Sabah. Five barriers and motivating factors were identified. Based on the qualitative study, a questionnaire-based, cross-sectional study was conducted covering the whole of Sabah.

### Participants

The start-off point to find the respondents was the health clinics located in the selected study sites. The undocumented migrants with children who visit the clinic for any reason were selected to partake in the study. The undocumented migrants could visit the clinic either to bring their sick children for treatment, check jaundice levels for their children, or even receive a vaccination. All those who agree to answer the questionnaire were included in the study.

### Inclusion criteria

The respondent was the mother of an undocumented migrant child with the below-mentioned criteria:

- a. Have children up to 18 years old.
- b. Ever and never attended health clinics in Sabah for infant and child vaccination services.
- c. Voluntarily agree to partake in the study.
- d. Lived in Sabah for at least 1 month.
- e. An undocumented child was admitted to the hospital due to vaccine-preventable diseases from June 2021 to December 2021.
- f. Lives in the area with a vaccine-preventable disease outbreak during the study period.
- g. Age of more than 18 years old.

**Exclusion criteria**

Mother of an undocumented migrant child who:

- a. Did not return the consent form
- b. Fail to answer the questionnaire.

**Sample size**

The sample size was determined based on the individual-level predictors of childhood immunization completeness among migrants (Hu *et al.*, 2018). According to Hu *et al.* [23], the individual-level predictors of childhood immunization completeness are the sex of the child, place of delivery, mother’s age, mother’s education, antenatal clinic visit, monthly household income, number of children and distance to the nearest immunization clinics. However, in our opinion, the place of delivery is the most significant factor determining childhood immunization among undocumented migrants in Sabah. If a child is born in a hospital or health clinic, they will be registered in the national healthcare system, the *iKelahiran*. This is important to trace back the child for immunization; also, this data is used as the denominator to count the immunization coverage. Therefore, the sample size was determined by the place of delivery. Based on the study by Hu *et al.*, those born at home had about 40% lower odds of being vaccinated [23]. The sample size was calculated using Epi Info (Fleiss method with the

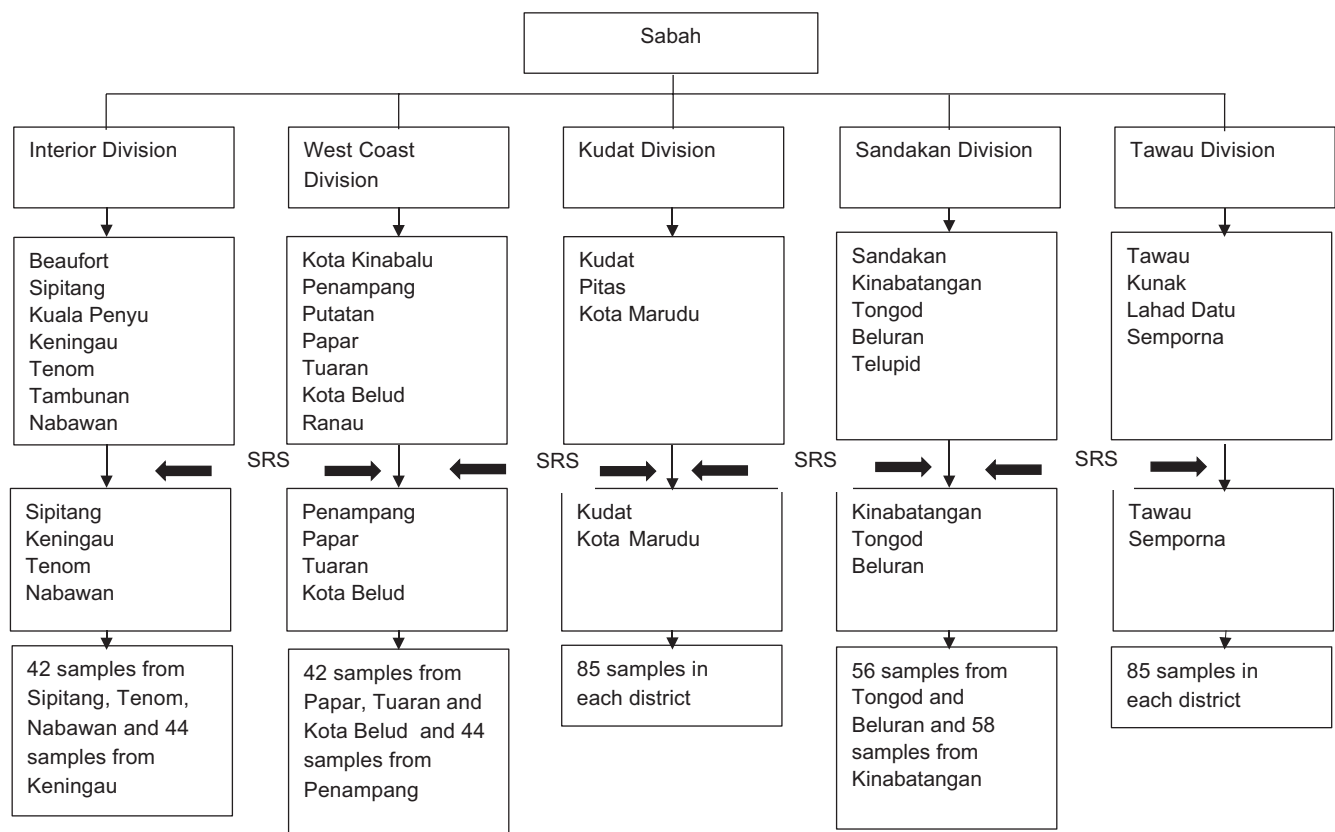
correction factor). Based on the value of a confidence level of 95%, power of 80%, the ratio of 1 in each group, the probability of an outcome in unexposed 79%, and OR of 0.6, 339 samples in each group are needed to be able to reject the null hypothesis (678 in total). The final sample size was 850, considering 20% of the non-response rate.

**Study area**

This study was conducted in the State of Sabah, Malaysia. Sabah consists of five administrative divisions: the Interior Division, West Coast Division, Kudat Division, Sandakan Division, and Tawau Division. The divisions are divided into 26 districts. Each district has a district health office and clinics under them. To generalize the result finding to the whole Sabah, all five divisions were selected to partake in the study. However, simple random sampling (SRS) was done to choose at least half of the districts under each administrative division using Statistical Package for Social Science (SPSS) software. Hence, each division had to recruit 170 respondents (Figure 1).

**Data collection**

The data collection was done from July 2021 to December 2021. A study assistant was identified from each study site to help in data collection. The assistants



\* SRS–Simple Random Sampling

Figure 1: Summary of Sampling Method for Study Site Selection

were the staff nurse working at the clinic from the selected districts. The questions were read out to the respondents by the study assistants rather than given to them to answer themselves due to poor literacy among undocumented migrants. The assistants then selected the answer to the questionnaire based on the response given by the respondents. Before the data collection, the details of the study were explained to the mother (undocumented migrant). A consent form was given to them to get approval. Once the respondent approved, the questions were then asked.

### **Measures**

The questionnaire was divided into four parts:

- a. Part I consisted of sociodemographic characteristics. This part had 14 questions comprising of mother's age, mother's education level, country of origin of mother, mother's marital status, country of origin of the partner, number of years of stay in Sabah, number of children  $\leq 18$  years old, number of children born in Sabah, place of delivery, number of antenatal clinic visits, monthly household income, distance to the nearest immunization clinic, number of children have been vaccinated and finally the history of vaccinating their children.
- b. Part II assessed the factors that prevent and motivates undocumented migrants to vaccinate their children. The questions are designed based on the main themes obtained from qualitative study to investigate the barriers and motivating factors that influence undocumented migrant parents to vaccinate their children. The respondents were given two options to answer (yes or no).
- c. Part III consisted of questions determining the best strategies to increase vaccine uptake among undocumented migrant children. The respondents were allowed to choose more than one strategy. The respondents were given two options to answer (yes or no).
- d. Part IV consisted of the details of the vaccination received by the firstborn of the respondents. Only the firstborn vaccination history was taken as the respondents that were enrolled were required to have at least one child who is less than 18 years old. So even mothers who just welcomed their first baby and were only 1 month old also were included in the study. Three options were given to choose from; complete, incomplete, or not received. These options are selected based on the age of the child and the Malaysia National Immunisation Programme (NIP) schedule [28]. For example, if the child is 5 months old, the child should have received BCG (1 dose), Hepatitis B (2 doses), and Dtap/Hib/IPV (3 doses). Hence, if the child has been

injected with BCG, it is taken as COMPLETE. If the child receives only one dose of Hepatitis B, it is taken as INCOMPLETE. If the child has never received any Dtap/Hib/IPV dose, then the NOT RECEIVED option was selected. Some vaccines are only given in the immunization schedule from a specific year. For example, the measles vaccine for 6-month-old children in Sabah was only implemented in 2016. Therefore, all those born before 2016 were selected as complete as the vaccine was not available at that time. The not received option is only selected for those eligible for the vaccination but who did not receive the vaccine at all. To see the accuracy of the history of vaccination of the child, the child's clinic card or any documentation related to the proof of vaccination given was reviewed if it was available.

### **Analysis**

Statistical Package for Social Science (SPSS) software version 28.0 was used to analyze. Descriptive statistics using the mean/median and the percentage were done for the questions in part I (socio-demography characteristics) section. For the items in part II, the percentage of the respondents who answered yes/no for each question was determined. To find the significant factors preventing and motivating undocumented migrants to vaccinate their children when the respondents answered Yes to any of the questions in each category, they will be considered to have the relevant factors as the barriers or motivating factors. For example, there are three questions devoted to knowing the presence of financial barriers. Hence, if the respondents answered Yes to any of the three questions, they will be considered to face financial barriers. For the questions in part III, the percentage of the respondents who answered yes/no for each strategy was determined. The types of vaccination received by the respondents' children were presented in frequency and proportion based on the types of vaccines in part IV. A Chi-square test was done to compare the changes in the vaccine completeness after the change of fee for the vaccination services beginning in 2015. To find the predictors for undocumented migrants' use of vaccination services, multiple (binary) logistic regression (MLR) was used. Simple Logistic Regression (SLR) was done first to find the significant factors, followed by the MLR.

### **Ethical approval**

Ethical approval was obtained from the Medical Research and Ethics Committee (MREC), the Ministry of Health Malaysia (NMRR-20-1637-55954), and the Ethical Committee of University Malaysia Sabah (UMS).

## Results

### **Sociodemographic characteristics of the respondents**

A total of 942 responses were collected during the study period. The median age of the respondents is 30 years old. Most respondents are originally from Indonesia (48.6%) and the Philippines (47.9%). The respondents have been in Sabah for a median of 13 years, and they have at least two children under 18 years old. A total of 78.7% of the respondents attended health facilities to vaccinate their children. The majority of the respondents' children were born in Sabah, and only 3.5% have children born in their place of origin. A median of 2 children has been brought to the health facilities to be vaccinated by the respondents (Table 1).

**Table 1: Sociodemographic characteristics of the respondents**

| No. | Variables                                       | Used Vaccination Services, n (%) |            | Median (IQR) |
|-----|-------------------------------------------------|----------------------------------|------------|--------------|
|     |                                                 | Yes                              | No         |              |
| 1.  | Mother's Age (in years)                         |                                  |            | 30.00 (9)    |
| 2.  | Mother's Education Level                        |                                  |            |              |
|     | None                                            | 270 (36.4)                       | 147 (73.1) |              |
|     | Primary education                               | 350 (47.2)                       | 45 (22.4)  |              |
|     | Secondary and tertiary education                | 121 (16.3)                       | 9 (4.5)    |              |
| 3.  | Country of Origin of Mother                     |                                  |            |              |
|     | Philippine                                      | 327 (44.1)                       | 124 (61.7) |              |
|     | Indonesia                                       | 395 (53.3)                       | 61 (30.3)  |              |
|     | Others                                          | 19 (2.6)                         | 16 (8.0)   |              |
| 4.  | Mother's Marital Status                         |                                  |            |              |
|     | Married                                         | 712 (96.1)                       | 160 (79.6) |              |
|     | Widowed/Divorced/Separated                      | 14 (1.9)                         | 29 (14.4)  |              |
|     | Never Married                                   | 15 (2.0)                         | 12 (6.0)   |              |
| 5.  | Country of Origin of the Partner                |                                  |            |              |
|     | Philippine                                      | 279 (37.7)                       | 113 (56.2) |              |
|     | Indonesia                                       | 371 (50.1)                       | 64 (31.8)  |              |
|     | Malaysia                                        | 80 (10.8)                        | 7 (3.5)    |              |
|     | Others                                          | 11 (1.5)                         | 17 (8.5)   |              |
| 6.  | Years of Stay in Sabah                          |                                  |            | 13 (15)      |
| 7.  | Number of Children Aged ≤ 18 Years Old          |                                  |            | 2 (2)        |
| 8.  | Number of Children Born in Sabah                |                                  |            | 2 (2)        |
| 9.  | Place of Delivery                               |                                  |            |              |
|     | Home                                            | 177 (23.9)                       | 152 (75.6) |              |
|     | Health Facilities                               | 316 (42.6)                       | 9 (4.5)    |              |
|     | Some at Home and Some at Health Facilities      | 239 (32.3)                       | 16 (8.0)   |              |
|     | None born in Sabah                              | 9 (1.2)                          | 24 (11.9)  |              |
| 10. | Antenatal Clinic (ANC) Visits                   |                                  |            |              |
|     | Yes                                             | 623 (84.1)                       | 34 (16.9)  |              |
|     | No                                              | 118 (15.9)                       | 167 (83.1) |              |
| 11. | Monthly Household Income                        |                                  |            |              |
|     | <RM 500                                         | 171 (23.1)                       | 115 (57.2) |              |
|     | RM 500-1000                                     | 380 (51.3)                       | 65 (32.3)  |              |
|     | >RM 1000                                        | 190 (25.6)                       | 21 (10.4)  |              |
| 12. | Distance to the Nearest Immunization Clinic     |                                  |            |              |
|     | <1 km                                           | 76 (10.3)                        | 9 (4.5)    |              |
|     | 1 km–5 km                                       | 275 (37.1)                       | 49 (24.4)  |              |
|     | >5 km                                           | 310 (41.8)                       | 73 (36.3)  |              |
|     | Do Not Know                                     | 80 (10.8)                        | 70 (34.8)  |              |
| 13. | The Number of Children Who Have Been Vaccinated |                                  |            | 2 (1)        |

### **Factors that prevent and motivate undocumented migrants to vaccinate their children**

The majority of them agree that they vaccinate their children because they fear of the child might fall ill (87.2%). The following other motivating factors are the belief that the vaccine is good for their children (86.4%)

advice from the nurses (84.5%), unable to pay hospital fees if the child falls ill (76%), acceptance of healthcare facilities even though the child is not documented (70.6) and finally due to advise by the doctors (70.3%) (Table 2). The majority, agree that they could not vaccinate their children because their children do not have any legal documents (83.1%). The following other militating factors that they agree to have are that the mother does not have any legal documents (78.5), they are unable to pay for the vaccine (76.8%), fear of being caught by the authorities (74.2%), increased in the price of the vaccine (74.6%) and finally unable to pay for the transportation (61.1%) (Table 3). The agreed-upon percentage for each question (Yes option) was averaged based on each theme. The highest agreeable average of the barriers was the legal status (78.6%), followed by the COVID-19 pandemic (76.2%), financial barriers (70.8%), physical barriers (41%), and finally, the language barrier (16.7%). Most respondents agree to vaccinate their children due to parental trust in healthcare providers and vaccines (80.4%), followed by fear of diseases (78.6%), having a good support system (70%), vaccine accessibility (51.6%), and finally due to social influence (49%).

### **Sociodemographic factors influencing the undocumented migrant parents to vaccinate their children**

Binary logistic regression was done to identify sociodemographic characteristics that influence the decision of undocumented migrant mothers to vaccinate their children. Seven sociodemographic factors remain significant factors influencing their decision to vaccinate their children. These include the mother's marital status ( $p = 0.009$ ), the number of children born in Sabah ( $p < 0.001$ ), place of delivery ( $p < 0.001$ ), antenatal clinic visits ( $p < 0.001$ ), the distance to the nearest vaccination clinic ( $p < 0.001$ ) and the number of children has been vaccinated ( $p < 0.001$ ) (Table 4). Those who deliver their children at health facilities in Sabah vaccinate their children greater than undocumented migrants who have never delivered children in Sabah. Those who had gone to a clinic for antenatal follow-up have a higher prevalence of bringing their children for vaccination than those who have never had an antenatal follow-up. Those with a monthly household income of more than RM 1000 and RM 500-RM1000 household income have a greater prevalence to vaccinate their children when compared to those who earn less than RM 500.

As for the factors that motivate and militate, only three factors remained significant toward vaccinating their children (Table 5). Those afraid of going to the clinic due to fear of being asked for documents and being caught by the authorities have an 85% greater risk of not vaccinating their children (Table 5). Those who trust the healthcare providers on their advice and the benefit of vaccination have a greater chance of

**Table 2: Factors That Militate Undocumented Migrants to Vaccinate Their Children**

| Themes            | No  | Questions                                                                                                     | Yes n (%)  | No n (%)   |
|-------------------|-----|---------------------------------------------------------------------------------------------------------------|------------|------------|
| Financial barrier | 1.  | I did not vaccinate my children because I could not afford the vaccine.                                       | 723 (76.8) | 219 (23.2) |
|                   | 2.  | I did not vaccinate my children because I could not afford the transportation fare.                           | 576 (61.1) | 366 (38.9) |
|                   | 3.  | I did not vaccinate my children because the price of vaccines has increased when compared to before           | 703 (74.6) | 239 (25.4) |
| Legal status      | 4.  | I did not vaccinate my children because I did not have legal documents.                                       | 739 (78.5) | 203 (21.5) |
|                   | 5.  | I did not vaccinate my children because my children do not have legal documents.                              | 783 (83.1) | 129 (16.9) |
|                   | 6.  | I did not vaccinate my children because I was afraid of being caught by the authorities.                      | 699 (74.2) | 243 (25.8) |
| Language barrier  | 7.  | I did not vaccinate my children because I did not understand the information given to me by the health staff. | 161 (17.1) | 781 (82.9) |
|                   | 8.  | I did not vaccinate my children because I did not understand the national language.                           | 153 (16.2) | 789 (83.8) |
| Pandemic          | 9.  | I did not vaccinate my children because I'm afraid my child might contract COVID-19.                          | 718 (76.2) | 224 (23.8) |
| Physical barrier  | 10. | I did not vaccinate my children because of poor weather.                                                      | 374 (39.7) | 568 (60.3) |
|                   | 11. | I did not vaccinate my children because I had to care for my other children/family members.                   | 344 (36.5) | 598 (63.5) |
|                   | 12. | I did not vaccinate my children because I had to work.                                                        | 440 (46.7) | 502 (53.3) |

taking the vaccine. Also, one of the other significant motivating factors is the good support system (Table 5).

### ***Predictors of undocumented migrant parents to vaccinate their children***

Binary Logistic Regression was done with all the sociodemographic factors, barriers, and motivators to find the final predictors of undocumented migrant parents vaccinating their children. The same seven sociodemographic factors are found to be predicting undocumented migrant parents to vaccinate their children. None of the barriers and motivating factors was found to be predicting the use of vaccination services by undocumented migrants.

### ***Strategies to increase vaccine uptake among the undocumented migrant children***

About 86% of the respondents say that giving the vaccine for free will increase vaccine uptake among undocumented migrant children. Whereas 69% agree that reducing the price of the vaccine will increase the uptake of childhood vaccination by undocumented migrants.

### ***History of vaccination of the firstborn of the respondents***

BCG vaccine has the highest percentage of completed vaccine status (75.4%) among the children of the respondents, followed by HBV (68.7%), Measles (62.2%), DtaP/HiB/IPV (61.2%), and the lowest was the MMR vaccine (52.9%). There are significant differences in vaccination status between those born before 2015 and those born from 2015 onwards (Table 6). Most children with completed vaccination status are observed among those born from 2015 onwards.

## **Discussion**

A previously published study [23] showed that the individual-level predictors of childhood immunization completeness among migrants are the sex of the child, the place of delivery, the mother's age, the mother's education, antenatal clinic visit, monthly household income, the number of children and distance to the nearest immunization clinics. Our study also has almost similar results among undocumented migrants. Household income is one of the factors that influence vaccination uptake by undocumented migrants. Migrants who have better socioeconomic has a higher tendency to get the vaccine [29], [30], [31], [32]. However, undocumented migrants usually do not have a permanent income and are only hired for cheap labor [33]. Therefore, they are paid less than the minimum wage. However, based on the findings of this study, undocumented migrants bring their children for vaccination despite having severe financial constraints. They want the child to be free of illness as hospital admission cost is even more expensive than the vaccine.

Another important factor that influences undocumented migrants to vaccinate their children is the history of antenatal care and place of delivery. Those born in health facilities and caregivers who have attended antenatal follow-up have a higher possibility of vaccinating their children [23]. This study's findings also showed that the place of birth of children in Sabah and the presence of antenatal follow-up in health facilities predict the vaccination of undocumented migrant children. The frequency of healthcare use is also one of the determinants of childhood immunization uptake [32]. Our study also shows that one of the predictors is the number of children who have been to the clinic for vaccination. This could be due to the

**Table 3: Factors That Motivate Undocumented Migrants to Vaccinate Their Children**

| Themes                                             | No  | Question                                                                                                       | Yes n (%)  | No n (%)   |
|----------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------|------------|------------|
| Social influence                                   | 1.  | I vaccinate my children because my family/friends advise me to do so.                                          | 374 (39.7) | 568 (60.3) |
|                                                    | 2.  | I vaccinate my children because all my other family members and friend do so.                                  | 557 (59.1) | 385 (40.9) |
| Fear of disease                                    | 3.  | I vaccinate my children because I do not want my child to fall sick.                                           | 821 (87.2) | 121 (12.8) |
|                                                    | 4.  | I vaccinate my children because I would not be able to pay the hospital fees if my children were hospitalized. | 716 (76.0) | 226 (24.0) |
| Parental trust in healthcare providers and vaccine | 5.  | I vaccinate my children because the doctor has advised me to do so                                             | 662 (70.3) | 280 (29.7) |
|                                                    | 6.  | I vaccinate my children because the nurses have told me to do so.                                              | 796 (84.5) | 146 (15.5) |
|                                                    | 7.  | I vaccinate my children because I believe the vaccine is good for my children.                                 | 814 (86.4) | 128 (13.6) |
| Good support system                                | 8.  | I vaccinate my children because the clinic accepts mothers who do not have legal documents.                    | 654 (69.4) | 288 (30.6) |
|                                                    | 9.  | I vaccinate my children because the clinic vaccinates children without legal documents.                        | 665 (70.6) | 277 (29.4) |
| Vaccine accessibility                              | 10. | I vaccinate my children because the nurses come to our homes to vaccinate them.                                | 325 (34.5) | 617 (65.5) |
|                                                    | 11. | I vaccinate my children because I can reschedule my vaccination appointment if I miss it.                      | 646 (68.6) | 296 (31.4) |

**Table 4: Sociodemographic Factors Associated with Undocumented Migrant Parents to Vaccinate Their Children (Binary Logistic Regression)**

| Variable                                        | Adj. OR | (95% CI OR) | X <sup>2</sup> stat. (df) <sup>a</sup> | p-value             |
|-------------------------------------------------|---------|-------------|----------------------------------------|---------------------|
| Mother's Marital Status                         |         |             |                                        |                     |
| Never Married                                   | 7.69    | 1.06; 55.55 | 9.38 (2)                               | 0.009               |
| Married                                         | 6.31    | 1.91; 20.85 | 4.08 (1) <sup>b</sup>                  | 0.043 <sup>b</sup>  |
| Widowed/Divorced/Separated                      | 1.00    |             | 9.11 (1) <sup>b</sup>                  | 0.003 <sup>b</sup>  |
| Number of Children Born in Sabah                | 0.66    | 0.52; 0.83  | 13.48 (1)                              | <0.001              |
| Place of Delivery                               |         |             |                                        |                     |
| Home                                            | 4.70    | 1.40; 15.71 | 26.37 (3)                              | <0.001              |
| Health Facilities                               | 23.24   | 5.91; 91.40 | 6.30 (1) <sup>b</sup>                  | 0.012 <sup>b</sup>  |
| Some at Home and/Some at Health/Facilities      | 9.68    | 2.30; 40.76 | 20.28 (1) <sup>b</sup>                 | <0.001 <sup>b</sup> |
| None Born in Sabah                              | 1.00    |             | 9.57 (1) <sup>b</sup>                  | 0.002 <sup>b</sup>  |
| Antenatal Clinic (ANC) Visits                   |         |             |                                        |                     |
| Yes                                             | 4.23    | 2.31; 7.74  | 22.99 (1)                              | <0.001              |
| No                                              | 1.00    |             |                                        |                     |
| Monthly Household Income                        |         |             | 11.99 (2)                              | 0.002               |
| RM 500-1000                                     | 2.42    | 1.32; 4.44  | 8.20 (1) <sup>b</sup>                  | 0.004 <sup>b</sup>  |
| >RM 1000                                        | 3.38    | 1.42; 8.05  | 7.57 (1) <sup>b</sup>                  | 0.006 <sup>b</sup>  |
| <RM 500                                         | 1.00    |             |                                        |                     |
| Distance to the Nearest Immunization Clinic     |         |             |                                        |                     |
| <1 km                                           | 1.28    | 0.39; 4.22  | 26.33 (3)                              | <0.001              |
| 1 km – 5 km                                     | 1.39    | 0.73; 2.67  | 0.17 (1) <sup>b</sup>                  | 0.683 <sup>b</sup>  |
| Do Not Know                                     | 0.21    | 0.10; 0.44  | 1.00 (1) <sup>b</sup>                  | 0.318 <sup>b</sup>  |
| >5 km                                           | 1.00    |             | 17.28 (1) <sup>b</sup>                 | <0.001 <sup>b</sup> |
| The Number of Children Who Have Been Vaccinated | 7.65    | 5.09; 11.49 | 171.02 (1)                             | <0.001              |

Adj. OR: Adjusted odds ratio; <sup>a</sup>Likelihood ratio (LR) test. <sup>b</sup>Wald test.

advice from health-care workers during the antenatal follow-up and post-delivery to bring their children for vaccination.

The trust in healthcare providers and trust in the vaccine safety and efficacy plays shows as a crucial motivating factor for undocumented migrants to vaccinate their children in our study. Other studies also have shown that trust in vaccine efficacy is one of the significant predictors of parents having the intention to vaccinate their children as well [34], [35], just like the findings in our study. Another study by Han *et al.* among migrant children in China shows that primary caregivers who trust in immunization safety had a two times higher chance of being vaccinated than those who felt the vaccine was unsafe [36]. Our study respondents trust that the vaccine will bring more benefit to their children than harm. Parents make decisions by balancing disease risks against the risks of vaccine-related adverse events [37]. Undocumented migrants are willing to vaccinate their children, even though they do not have any documentation. However, the distance of the nearest healthcare services to receive the vaccine also determines the caregiver's vaccination attendance [38]. Our study shows that those who stay near the clinic vaccinate their children more when compared to those who stay far. According to Hu *et al.*, those near the nearest immunization clinic

**Table 5: Motivating and Militating Factors Associated with Undocumented Migrant Parents to Vaccinate Their Children (Binary Logistic Regression)**

| Variable                                           | Adj. OR | (95% CI OR) | X <sup>2</sup> stat. (df) <sup>a</sup> | p-value |
|----------------------------------------------------|---------|-------------|----------------------------------------|---------|
| Legal status                                       |         |             |                                        |         |
| No                                                 | 6.74    | 2.35; 19.33 | 11.26 (1)                              | <0.001  |
| Yes                                                | 1.00    |             |                                        |         |
| Parental trust in healthcare providers and vaccine |         |             |                                        |         |
| Yes                                                | 18.24   | 8.42; 39.51 | 78.91 (1)                              | <0.001  |
| No                                                 | 1.00    |             |                                        |         |
| Good support system                                |         |             |                                        |         |
| Yes                                                | 2.65    | 1.77; 3.97  | 20.95 (1)                              | <0.001  |
| No                                                 | 1.00    |             |                                        |         |

Adj. OR: Adjusted odds ratio; <sup>a</sup>Likelihood ratio (LR) test.

had two times higher odds of being vaccinated when compared to those one staying far [23].

Another significant motivator for undocumented migrant parents to vaccinate their children in Sabah is the presence of a good support system around them. These include family support and support from healthcare providers. Healthcare providers at the health centers and hospitals in Sabah have worked tirelessly to maintain these undocumented migrants' trust, put their fears at rest, and encourage them to bring their children for vaccination. The outcome of this effort can be seen in the higher percentage of vaccine coverage among those undocumented migrant children born from 2015 onward despite the increase in the vaccine price since 2015 [14]. One of the motivating factors for undocumented migrants to visit the clinic is knowing that the healthcare providers accept them no matter their legal status, which has been proved in this study. A study shows that when healthcare providers display empathetic and listening behavior, undocumented migrant women feel empowered and trust clinicians and

**Table 6: Vaccination Status of The Firstborn of The Respondents**

| Variable     | n   | Born before 2015 (%) | Born from 2015 onwards (%) | X <sup>2</sup> statistics (df) | p-value |
|--------------|-----|----------------------|----------------------------|--------------------------------|---------|
| BCG          |     |                      |                            | 18.678 (2)                     | <0.001  |
| Complete     | 686 | 38.9                 | 61.1                       |                                |         |
| Incomplete   | 19  | 52.6                 | 47.4                       |                                |         |
| Not received | 205 | 55.6                 | 44.4                       |                                |         |
| HBV          |     |                      |                            | 18.041 (2)                     | <0.001  |
| Complete     | 618 | 38.8                 | 61.2                       |                                |         |
| Incomplete   | 77  | 46.8                 | 53.2                       |                                |         |
| Not received | 205 | 55.6                 | 44.4                       |                                |         |
| DtaP/Hib/IPV |     |                      |                            | 18.795 (2)                     | <0.001  |
| Complete     | 533 | 38.1                 | 61.9                       |                                |         |
| Incomplete   | 106 | 39.6                 | 60.4                       |                                |         |
| Not received | 232 | 54.7                 | 45.3                       |                                |         |
| Measles      |     |                      |                            | 8.937 (2)                      | 0.011   |
| Complete     | 541 | 41.6                 | 58.4                       |                                |         |
| Incomplete   | 86  | 36.0                 | 64.0                       |                                |         |
| Not received | 243 | 51.4                 | 48.6                       |                                |         |
| MMR          |     |                      |                            | 20.384 (2)                     | < 0.001 |
| Complete     | 446 | 41.7                 | 58.3                       |                                |         |
| Incomplete   | 125 | 1.2                  | 68.8                       |                                |         |
| Not received | 272 | 54.0                 | 46.0                       |                                |         |

<sup>a</sup>Chi-square test for independence. BCG: Bacillus Calmette–Guérin, Hep B: Hepatitis B, DtaP/Hib/IPV: Diphtheria, tetanus, acellular pertussis/Haemophilus influenzae type B/Inactivated poliomyelitis vaccine, MMR: Measles, Mumps, Rubella

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reduce their fear of visiting the clinic [39]. An empathetic dialogue with the parents about vaccinations helps build a solid relationship between the health-care providers and the parents [40]. This is shown by the evidence that the number of children vaccinated is one of the predictors of childhood vaccination uptake by undocumented migrants. This is because undocumented migrants feel welcomed to the clinic and have a pleasant experience vaccinating them. The healthcare providers working in the clinic were ever ready to attend to the need of the migrants and reschedule the appointments if they missed bringing their children for vaccination.

In this study, the respondents' firstborn children's vaccination status showed that the BCG vaccine has the highest completed vaccine status. This could be because BCG only requires one dose to be considered a completed dose. However, all the other vaccines need more than one dose. Another reason is that the BCG vaccine is administered the moment a child is born at a health facility by the hospital staff regardless of their legal status. Frequent mobility by these undocumented parents due to the possibility of being caught by the immigration authorities limits their access to health-care facilities to get immunization [4], [41]. This barrier is also found to be the reason why undocumented migrant parents fail to bring their children for vaccination in countries with free healthcare services [18]. This leads to incomplete vaccination histories among undocumented children, just like in our study.

A major problem that undocumented parents have to vaccinate their children is the fear of bringing their children for vaccination due to their legal status. They are always afraid of being caught by authorities due to a lack of documentation. More than half of undocumented children in Denmark visit charity health clinics due to infectious diseases [42]. They usually face high socioeconomic disadvantage and elevated risks of contracting communicable diseases. This emphasizes the need to vaccinate undocumented migrant children. However, they cannot acquire the best preventive healthcare service due to the lack of documentation. Our result shows that the respondents have at least two children born in Sabah. However, even children born in Sabah do not acquire birth certificates due to undocumented migrants' inability to produce legal marriage certificates and pay the hospital bill [43]. So the hospitals would not issue proof of birth to these undocumented migrants if they could not pay the hospital fees [43]. Birth registration is the most important measure that needs to be looked into to prevent statelessness in line with Article 7 of the Convention on the Child's Rights [43]. Having a legal document also is very important to identify the actual immunization coverage in Sabah. According to UNHCR Malaysia, many Filipino Muslim refugee children have become undocumented even though they have been eligible to be granted residence permits [43]. As a result,

the children do not have access to health services and education [43].

The obstacles to immunization for undocumented migrant children are quite different from average populations. The factors that influence the undocumented migrant's decision to vaccinate their children can be divided into modifiable and non-modifiable factors. The non-modifiable factors are the sociodemographic factors such as the mother's marital status, distance to the nearest clinic, and number of children born in Sabah which we are not able to control and change. However, we can increase the uptake of the vaccine among undocumented migrant children if we address the modifiable factors such as the national policies and healthcare service providers' attitudes. Addressing these determinants can improve vaccine uptake among undocumented migrant children. Promotion strategies by the respective clinics should be initiated to encourage other undocumented migrants to bring their children for vaccination. The healthcare providers should engage those undocumented migrants that actively visit the clinic for vaccination and use them as the vaccine "advocators." Undocumented migrant mothers are strong and resourceful [44]. They care for their children and others despite many difficulties in their life [44]. Hence, these mothers can motivate other mothers to bring their children for vaccination.

Undocumented migrants' problems cannot be solved solely through healthcare. Undocumented migrants could not afford to get healthcare services at private care due to the fee and policies of the particular private care whereby they do not accept patients without legal documents unless it is an emergency condition that needs urgent care [45]. Therefore, we must make public healthcare services, especially primary health care affordable for them. According to World Health Organization, one of the 10 global threats that have been identified in 2019 is having weak primary health care [46]. We need strong primary health care to ensure universal health coverage and to increase vaccine uptake among these marginalized populations. Strong primary health care should be not disease-centered, but it should meet all the people's health needs by addressing the social and environmental determinants of health through multi-sector engagement and policy development. If we see historically, the first anti-vaccine movement was formed in 1866 by a low socioeconomic group of people because they could not afford to pay for the vaccine when the Vaccination Acts were passed between 1840 and 1853 [47]. Hence, making the vaccine affordable is important to increase the uptake among underprivileged groups such as undocumented migrants. Even the Thirteenth General Programme of Work (GPW 13) by WHO aims to achieve 1 billion people to benefit from UHC by improving access to essential medicine, vaccines, and medical devices [48]. We must build the national and state's capacity to ensure equitable delivery of the vaccine.



Recently, the Sabah state government, together with United Nations Children's Fund (UNICEF), has agreed to initiate the Child-Friendly City (CFC) in Sabah [49]. This is an excellent move to meet the rights and needs of all children regardless of their status. Following this agreement, UNICEF has started to visit the islands where undocumented migrants reside to ensure that every child receives immunization [50]. Furthermore, it is essential to involve the non-governmental organization (NGO) in delivering the vaccines to the migrants [42], [51] as undocumented migrants may be more comfortable dealing with NGOs instead of government health facilities. In Norway, undocumented migrants are only offered a minimum right to healthcare. Therefore, NGOs provide free health services [44].

This research provides a direction to understanding the multifactorial reasons undocumented migrants face to bring their children for vaccination. The study findings will not be only helpful for public health but also policymakers. Immunization is a shared responsibility of policymakers, healthcare service providers, and the community. Advocacy, research, and engagement with national and local policymakers are ways to attain the most excellent health potential for these populations and, at the same time, protect our people. However, future studies need to be done to assess the barriers and drivers that health-care providers, especially at the public health clinics have, to deliver vaccination services to these undocumented migrant communities in Sabah. This is important to ensure necessary measures are taken to address both sides' barriers and motivating factors. However, the limitation of the study should be taken into consideration. Since the pandemic was still ongoing, the respondents were obtained from those who received the COVID-19 vaccine and undocumented migrants who attended the clinic to either receive a vaccine or bring their sick children from treatment. We may not have detected all the determinant factors that influence undocumented migrant parents to vaccinate their children.

## Conclusion

Vaccination is vital for children, and it is the most cost-effective way of preventing many diseases. This study has shown the factors that influence undocumented migrants to vaccinate their children. We all need to understand better these factors to address immunization inequities and reach marginalized populations with what they need. Understanding the patient factors that influence vaccination uptake is crucial to delivering a successful vaccination program. Not having a legal document is one of the significant barriers to getting immunization and other healthcare services. The Malaysian Government should ensure

proper documentation of these people and grant them legal job opportunities, education, and public services. Health-care providers in Sabah need to continue to have functional ignorance and informal solidarity toward these undocumented migrants to motivate them to vaccinate their children.

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