

## ORIGINAL ARTICLE

## THE FACTORS OF PRIMARY CHILDHOOD IMMUNIZATION UPTAKE AMONG THE URBAN POOR CHILDREN IN MALAYSIA

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## ABSTRACT

*Reducing childhood immunization coverage has led to re-emerging of vaccine-preventable diseases among young children. This study aimed to identify the prevalence and predictors of complete childhood immunization among the low socioeconomic urban households' children in Malaysia. A nationwide survey data from the National Health and Morbidity Survey (NHMS) 2016 was utilized to extract 2668 completed data of respondents who had a household income of less than RM 4,000 and living in urban areas were included in the analysis. The children's home-based cards were used to verify the data on the primary childhood immunization status. Related data from the household and child health modules were extracted three levels of analysis were conducted using SPSS Version 25 that were descriptive analysis, bivariate analysis and multivariable analysis. The prevalence of complete primary childhood immunization uptake was 89.5%. Mothers of 20 to 29 years old, 30 to 39 years old, and 40 years old and above had 2.704 (aOR=2.704, 95% CI:1.255-5.827), 3.305 (aOR=3.305, 95% CI:1.526-7.160), 3.058 (aOR=3.058, 95% CI:1.165-8.029) higher odds of having children with complete childhood immunization status compared to those younger. Meanwhile, mothers who were self-employed, students and utilized private healthcare facilities had 0.2773 (aOR=0.273, 95% CI:0.138-0.540), 0.063 (aOR=0.063, 95% CI:0.014-0.288) and 0.200 (aOR=0.200, 95% CI:0.118-0.338) lower odds towards complete primary childhood immunization uptake among their children. Below global recommended coverage of complete primary immunization uptake was observed among the urban poor children. Mothers who were young, self-employed, students and utilizing private healthcare facilities should be targeted to improve immunization coverage among children or urban localities.*

**Keywords:** Childhood immunization, Predictors, Urban poor, Malaysia

## INTRODUCTION

Globally, childhood immunization has been one of the most successful public health interventions to prevent and eradicate vaccine-preventable diseases (VPDs). The immunization program has achieved multiple big milestones such as the eradication of smallpox, lowering the global incidence of polio by 99%, and reducing illness and complications of other vaccine-preventable diseases, such as measles, pertussis, diphtheria, tetanus, and whooping cough.<sup>1</sup>

Most national programmes were based on the World Health Organisation (WHO) Expanded Programme on Immunisation (EPI), which was established in 1974 after the success of smallpox eradication to ensure that all children from all countries can benefit from life-saving vaccines.<sup>2</sup> The current global strategy for vaccination is The Global Vaccine Action Plan (GVAP) with the mission to improve health by 2020 and beyond by providing full benefits of immunization to everyone with a minimum target of 90% immunization coverage.<sup>3</sup>

National Immunization Programme (NIP) in Malaysia started in the 1950s, it was included in the Maternal

and Child Health Programmes (MCH). Vaccines are introduced into the national immunization schedule in stages, with primary childhood immunization programme referring to those given to children below two years of age. To date, vaccines used in the programme protect against 12 major childhood diseases, including the six diseases recommended in the EPI. Based on the national immunization schedule, children aged 12 months will be expected to receive 8 or 9 immunization that is Bacillus Calmette-Guérin (BCG), Hepatitis Dose 1, 2 & 3, Diphtheria-Tetanus-Pertussis-Haemophilus Influenza B Dose 1, 2, and 3, and Measles-Mumps-Rubella one dose before 2016, or two doses after 2016. Vaccination was given for free to all under NIP for all children in Malaysia regardless of citizenship status. In 2015 onwards, non-Malaysian had to pay for the vaccination but for a minimal fee.

Malaysia used to be one of the countries with immunization coverage of above 95% for most of childhood immunization. But recently, vaccination coverage has been fluctuating and even, reducing in trend. For example, the second dose of measles

vaccine (MCV2) coverage went down from a stable 99% in 2014 to 2017 to 90% in the year 2018.<sup>4</sup> As a result, Malaysia is facing an increased incidence of vaccine-preventable diseases, for example, measles cases in Malaysia rise from 195 cases in 2013 to 1958 cases in 2018, that is a 10 times fold of cases in only five years. Death cases are also increasing from 0 death in 2013 to 6 deaths caused by measles in 2018. On top of that, Malaysia is also facing re-emerging of eliminated vaccine-preventable diseases where Malaysia reported its first polio case on 8th December 2019 after 27 years, since the last case in 1992 and after 19 years since Malaysia was declared polio-free in 2000. Factor attributed to the outbreak by the officials was poor vaccine coverage.<sup>5</sup>

Poor childhood immunization uptake globally has been linked to low socioeconomic communities and poor urban populations where a decrease of coverage was found to be correlated directly with the decrease of wealth and lower immunization coverage was observed in the urban poor in many countries,<sup>6</sup> and this results in VPDs cases and outbreaks in poor urban populations.<sup>7</sup> City residents are vulnerable to the threat of poverty with very limited access to a comfortable shelter, clean water, and proper disposal of waste and excrement.<sup>8</sup> Thus, by using secondary data from the National Health and Morbidity Survey, this study aimed to determine the predicting factors of complete primary childhood immunization uptake among children of the low socioeconomic urban household in Malaysia.

## METHOD

The study used secondary data from the National Health and Morbidity Survey (NHMS) 2016: Maternal and Child Health,<sup>9</sup> a national level population-based survey pertaining to maternal health, as well as child health and development. The survey imposed stratified random sampling, covering all states in Malaysia. All respondents in the National Health and Morbidity Survey 2016: Maternal and Child Health fulfilling the inclusion criteria of household income less than RM4,000, and living in the urban locality were selected.

Data was collected using structured questionnaire with face-to-face interview using mobile device. The questionnaire was pre-tested and available in two languages (Bahasa Melayu or Malay and English), containing four different modules: Household, maternal health and nursing, and child health modules. Only the two modules concerning immunization practices and factors contributing to them were chosen, that were the household and child health modules. Information obtained were verified accordingly based on the children's home-based cards.

The independent variables included in this study were categorized to child factors (sex, ethnicity, citizenship), parental factors (age of mother, marital status of mother, education of mother, occupation of mother, age of father, education of father, occupation of father, beliefs towards vaccination) and healthcare facilities utilized for vaccination. The dependent variable of complete immunization uptake was categorized into complete and incomplete based on the primary immunization status according to the national vaccination schedule, verified with the home-based cards.

Data was analysed using IBM Statistical Analysis of Social Sciences System (SPSS) Version 25.0. Three levels of analysis were done; descriptive statistics analysis, bivariate analysis using Chi-square test or Fisher exact test was used to measure associations between two categorical variables, and multivariable analysis using multiple binary logistic regression to determine predictors of complete immunization uptake. Those independent variables with  $p < 0.25$  from the bivariate analysis were chosen to be analysed in the multivariable logistic regression. A level of significance of 0.05 with a confidence interval of 95% was used in all analyses.

Ethical approval was obtained to carry out this research from Medical Research and Ethics Committee (MREC), (reference no. NMRR-20-724-54592) and formal permission was obtained from the Director General of Health Malaysia and director of the Institute for Public Health. All data collected from the registry were kept confidential and used solely for this research and publication.

## RESULTS

A total of 2668 data was extracted, giving a response rate of 89.0%. The background characteristics of the respondents were as depicted in Table 1, with 89.5% of respondents completing their children's childhood immunization status. The sample was dominated by children of Malay ethnic (72.1%) and of Malaysian citizen (96.7%). The mean age of the mothers was 30.71 (5.55) and were mostly married (99.8%), housewives (62.7%) and received secondary education (65.2%) as the highest education level. Meanwhile, the mean age of the fathers was 34.11 (6.8), and mostly worked in the private sector (50.3%) and had education level up to secondary education (67.1%). More than 98 % of the respondents' believed vaccine is protective, prevents infectious disease, and is safe. The most utilized healthcare facility was the government healthcare facilities (93.6%), with 3.2% of the respondents utilized private healthcare facilities, and 3.2% of the respondents did not utilize any healthcare facilities for vaccination.

**Table 1a: Descriptive findings (N=2668)**

Characteristics	Mean $\pm$ SD	n	%
<b>Sex of child</b>			
Male		1400	52.5
Female		1268	47.5
<b>Ethnicity of child</b>			
Malay		1923	72.1
Chinese		208	7.8
Indian		119	4.5
Other Bumiputra		312	11.7
Others		106	4.0
<b>Citizenship of child</b>			
Malaysian citizen		2580	96.7
Non-Malaysian		88	3.3
<b>Age of mother</b>	30.71 $\pm$ 5.55		
<20 years old		53	2.0
20-29 years old		1203	45.1
30-39 years old		1256	47.1
>40 years old		156	5.8
<b>Marital status of mother</b>			
Married		2663	99.8
Single/widowed/divorced		5	0.2
<b>Education level of mother</b>			
No formal education		70	2.6
Primary education		392	14.7
Secondary education		1740	65.2
Tertiary education		466	17.5
<b>Occupation of mother</b>			
Public sector		278	10.4
Private sector		439	16.5
Self-employed		191	7.2
Housewives		1727	64.7
Unemployed		25	0.9
Student		8	0.3
<b>Age of father</b>	34.11 $\pm$ 6.86		
<20 years old		11	0.4
20-29 years old		758	28.4
30-39 years old		1403	52.6
>40 years old		496	18.6
<b>Education level of father</b>			
No formal education		70	2.6
Primary education		430	16.2
Secondary education		1791	67.1
Tertiary education		377	14.1

Table 1b: Descriptive findings (N=2668)

Characteristics	Mean±SD	n	%
<b>Occupation of father</b>			
Public sector		512	19.2
Private sector		1341	50.3
Self employed		784	29.4
Househusband		1	0.0
Unemployed		27	1.0
Student		3	0.1
<b>Childhood immunization uptake</b>			
Complete		2387	89.5
Incomplete		93	3.5
Not vaccinated		3	0.1
Not sure		185	6.9
<b>Healthcare facilities used for vaccination</b>			
Government		2498	93.6
Private		85	3.2
No facilities used		85	3.2
<b>Belief towards vaccination</b>			
		<b>Yes [n (%)]</b>	<b>No [n (%)]</b>
Belief vaccine is protective		2637 (98.8)	31 (1.2)
Belief vaccine prevents infectious disease		2627 (98.5)	41 (1.5)
Belief vaccine is safe		2624 (98.4)	44 (1.6)

The distribution of immunization uptake according to the types of vaccine is shown in Table 2, with BCG vaccine given at birth being the highest childhood immunization uptake, accounting for

94.4% of respondents. Meanwhile, the lowest uptake was observed for MMR vaccine at 12 months old, which accounted for only 89.8% of respondents.

Table 2: Distribution of childhood immunization uptake according to types of vaccines (N=2668)

Childhood immunization uptake	Yes		No		Not sure	
	n	%	n	%	n	%
BCG	2518	94.4	150	5.6	0	0
HepB1	2516	94.3	150	5.6	2	0.1
HepB2	2463	92.3	14	0.5	191	7.2
HepB3	2433	91.2	42	1.6	193	7.2
DTaP-Hib-IPV1	2460	92.2	17	0.6	191	7.2
DTaP-Hib-IPV2	2455	92.0	23	0.9	190	7.1
DTaP-Hib-IPV3	2440	91.5	38	1.4	190	7.1
MMR	2397	89.8	85	3.2	186	7.0

The findings of the bivariate analysis are tabulated in Table 3, with mother’s occupation (p<0.001), father’s occupation (p=0.002), belief vaccine is

protective (p<0.001), the vaccine prevents infectious disease (p<0.001), the vaccine is safe (p<0.001) and utilization of healthcare facilities for

vaccination ( $p < 0.001$ ) were significantly associated with complete childhood immunization uptake.

**Table 3a: Association between independent variables and complete childhood immunization uptake (N=2668)**

Variables	Complete Immunization		$\chi^2$ (df)	p-value
	No n (%)	Yes n (%)		
<b>Gender of child</b>			0.005 (1)	0.945
Male	148(10.6)	1252(89.4)		
Female	133(10.5)	1135(89.5)		
<b>Ethnicity of child</b>			4.693 (4)	0.320
Malay	209(10.9)	1714(89.1)		
Chinese	24(11.5)	184(88.5)		
Indian	8(6.7)	111(93.3)		
Other Bumiputera	26(8.3)	288(91.7)		
Others	14(13.2)	92(86.8)		
<b>Citizenship of child</b>			0.931 (1)	0.335
Malaysian	269(10.4)	2311(89.6)		
Not Malaysian	12(13.6)	76(86.4)		
<b>Age of mother</b>			5.108 (3)	0.164
Lower than 20 years old	10(18.9)	43(81.1)		
20-29 years old	131(10.9)	1072(89.1)		
30-39 years old	127(10.1)	1129(89.9)		
Greater than 40 years old	13(8.3)	143(91.7)		
<b>Marital status of mother</b>				1.000 <sup>a</sup>
Married	281(10.6)	2382(89.4)		
Not married	0(0.0)	5(100.0)		
<b>Mother's education</b>			3.572 (3)	0.312
No formal education	12(17.1)	58(82.9)		
Primary education	41(10.5)	351(89.5)		
Secondary education	177(10.2)	1563(89.8)		
Tertiary education	51(10.9)	415(89.1)		
<b>Mother's occupation</b>			27.854 (5)	<0.001*
Public sector	24(8.6)	254(91.4)		
Private sector	47(10.7)	392(89.3)		
Self-employed	35(18.3)	156(81.7)		
Housewife	168(9.7)	1559(90.3)		
Unemployed	3(12.0)	22(88.0)		
Student	4(50.0)	4(50.0)		

Note: \*Significant  $p < 0.05$ , (<sup>a</sup>) Fisher exact

**Table 3b: Association between independent variables and complete childhood immunization uptake (N=2668)**

Variables	Complete Immunization		$\chi^2$ (df)	p-value
	No n (%)	Yes n (%)		
<b>Age of father</b>			4.959 (3)	0.175
Lower than 20 years old	2(18.2)	9(81.8)		
20-29 years old	94(12.4)	664(87.6)		
30-39 years old	134(9.6)	1269(90.4)		
Greater than 40 years old	51(10.3)	445(89.7)		
<b>Father's education</b>			6.957 (3)	0.073
No formal education	10(14.3)	60(85.7)		
Primary education	38(8.8)	392(91.2)		
Secondary education	181(10.1)	1610(89.9)		
Tertiary education	52(13.8)	325(86.2)		
<b>Father's occupation</b>				0.002 <sup>a *</sup>
Public sector	34(6.6)	478(93.4)		
Private sector	137(10.2)	1204(89.8)		
Self-employed	105(13.4)	679(86.6)		
Househusband	0(0.0)	1(100.0)		
Unemployed	5(18.5)	22(81.5)		
Student	0(0.0)	3(100.0)		
<b>Vaccine is protective</b>				<0.001 <sup>a *</sup>
Yes	265(10.0)	2372(90.0)		
No	16(51.6)	15(48.4)		
<b>Vaccine prevents infectious disease</b>				<0.001 <sup>a *</sup>
Yes	266(10.1)	2361(89.9)		
No	15(36.6)	26(63.4)		
<b>Vaccine is safe</b>				<0.001 <sup>a *</sup>
Yes	260(9.9)	2364(90.1)		
No	21(47.7)	23(52.3)		

Meanwhile, the predictive model for complete childhood immunization among children of low socioeconomic urban household in Malaysia is illustrated in Table 4. Mothers aged between 20 - 29 years old, 30 - 39 years old and more than 40 years old were having 2.704 (95% CI:1.255-5.827), 3.305 (95% CI:1.526-7.160) and 3.058 (95% CI:1.165-8.029) higher odds towards complete childhood immunization among their children respectively compared to those less than 20 years old. Meanwhile, mothers who were self-employed, was

a student and utilizing private healthcare facilities had 0.273 (95% CI:0.138-0.540), 0.063 (95% CI:0.014-0.288) and 0.200 (95% CI:0.118-0.338) lower odds of having children with complete immunization status respectively. The overall classification accuracy based on the model was 92.7%. Nagelkerke's R square showed that 33.4% of the variation was explained by the final model. The area under the curve for the ROC curve was 0.755, with a 95% confident interval was between 0.720 and 0.790, indicating a good model fit to the data.

**Table 4: Predictors for complete childhood immunization uptake**

Variables	$\beta$	SE	aOR	95% CI		p-value
				Lower bound	Upper bound	
Intercept	1.936	0.475				
Age group of mothers						
<20 years old	Ref					
20-29 years old	0.995	0.392	2.704	1.255	5.827	0.011*
30-39 years old	1.196	0.394	3.305	1.526	7.160	0.002*
$\geq$ 40 years old	1.118	0.493	3.058	1.165	8.029	0.023*
Occupation of mothers						
Public sector	Ref					
Private sector	-0.589	0.326	0.555	0.293	1.050	0.07
Self-employed	-1.298	0.348	0.273	0.138	0.540	<0.001*
Housewives	-0.241	0.297	0.786	0.439	1.407	0.418
Unemployed	16.449	3448.204	13918792	0.000	-	0.996
		0.779				
Student	-2.773		0.063	0.014	0.288	<0.001*
Utilization of healthcare facilities						
Government						
Private	Ref					
No facilities used	-1.609	0.267	0.200	0.118	0.338	<0.001*
	-36.935	4994.571	0.000	0.000	-	0.994

\*Significant  $p < 0.05$ , Nagelkerke R Squared (0.334), ROC curve:0.755

## DISCUSSION

Despite the considerably high coverage of complete primary childhood immunization status among the children of the urban poor identified in this study, the coverage was still below the global recommended level of 90%. However, there has been very limited literature exploring childhood immunization uptake specifically to the urban low socioeconomic population in Malaysia for comparison purposes. Compared to other studies involving low socioeconomic population globally in Delhi, India<sup>10</sup> and Nairobi, Kenya,<sup>11</sup> the prevalence reported in this study was higher, indicating the potentially high national childhood vaccination coverage in Malaysia compared to those of India and Kenya. Living in the urban and being raised in economically disadvantaged households put these children at the double burden of not receiving complete primary immunization.

Nevertheless, the prevalence of complete primary childhood immunisation reported in this study was slightly higher from the general findings from the National Health and Morbidity Survey 2016 which was reported at 86.4%.<sup>12</sup> However, both were lower than other related previous local studies. In two separate cross-sectional studies conducted in the district of Hulu Langat, Selangor and Seremban, Negeri Sembilan, a prevalence of 98.2%<sup>13</sup> and 98.1%<sup>14</sup> were reported respectively. However, the slightly different operational definition used between these studies may have contributed towards the different coverages reported, with this

study incorporated element of verification from the children's home-based cards compared to self-reporting.

Meanwhile, the BCG vaccines that were given at birth reported the highest prevalence of vaccination uptake, followed by the first dose of Hepatitis B given at birth, and the second dose of Hepatitis B given at 2 months old, with the lowest prevalence of immunization uptake was seen for MMR vaccines given at 12 months of age. Similar findings were reported in a cross-sectional local study conducted in a health clinic in Negeri Sembilan, Malaysia on adherence to vaccination among mothers with children under 5 years old who visited the clinic, with BCG vaccination demonstrated the highest percentage of adherence (96.8%), followed by the first dose of Hepatitis B vaccination (97.1%), and the second dose of Hepatitis B vaccination (88.5%). MMR vaccines given at 12 months of age had the lowest percentage of adherence, reported at only 64.9%.<sup>14</sup> The high uptake of BCG and Hepatitis B vaccines was most likely related to the time they were given in the immunization schedule, which was routinely given post-delivery prior to discharge from hospitals. Furthermore, the second dose of Hepatitis B was given at the same time as the mother's 1-month post-delivery appointment. Meanwhile, the low uptake towards MMR may be due to loss to follow-up as the MMR vaccine was given at 12 months, the last one given in the primary immunization series as well as the many taboos postulated with MMR

vaccine such as the development of autism among children.

Three factors were identified to predict complete primary childhood immunization uptake among the urban poor community in Malaysia which were mother's age, mother's occupation, and utilization of healthcare facilities. Young mothers, as well as those who were self-employed, still studying and utilizing the private healthcare services had less likelihood to have children with complete primary immunization status. Similar findings reporting the important role of the young mother was also reported by Zamzaireen and colleagues,<sup>14</sup> with mothers who were more than 25 years old were 2.7 times more likely to adhere to the immunization schedule than those less than 25 years old. According to a related longitudinal study involving first-time expectant mothers concluded that, despite the relatively positive beliefs and perceptions towards childhood vaccines, with good intentions to get their new-born vaccinated as recommended among the respondents, they planned to delay the recommended vaccinations or were undecided primarily influenced by the information obtained from socially available sources, rather than information provided by a healthcare professional.<sup>15</sup>

On the other hand, self-employed mothers, as well as those who were still studying were also had less likelihood the have children with complete primary immunization status. Self-employed and student mothers may have their own schedules and targets that are difficult to be rescheduled to go for their child's appointment for vaccination whereas mothers in the public sector have the ease of taking time off for vaccination appointments. A study by Noor Ani et al.<sup>16</sup> based on the same data utilized in this study had demonstrated, 'no time' and 'forgotten' were among the frequent personal reasons reported for incomplete or non-uptake of immunization among children.

The utilization of private healthcare services was also found to predict incomplete primary childhood immunization in this study. The results are in line with findings reported from a study in Canada,<sup>16</sup> as well as in Brazil,<sup>17</sup> with government healthcare facilities used for vaccination to be associated with complete immunization and children who received vaccinations from public immunisation providers were more likely to be completely vaccinated. In Malaysia, private healthcare providers are not bound to follow the government immunization schedule and may have different schedules and also vaccine stocks.<sup>18</sup> This can be the cause of those who utilized private healthcare facilities having fewer odds of complete immunization.

## CONCLUSIONS

The findings of this study highlight the inadequate prevalence of complete immunization uptake take among children of the urban poor households, which still fell short of the target of the World Health Organization's Global Vaccine Action Plan of 90% vaccination uptake for all childhood vaccinations by the year of 2020.

Based on the predictors identified, strategy can be made to improve vaccination process including schedule and follow up at private healthcare facilities. A more comprehensive public private partnership might be beneficial in monitoring vaccination follow up and coverage. For example, a combined online database on immunization that can be accessible for both public and private practitioners. This will benefit the private practitioners in getting more clients as the public will be more confident for proper centralized documentation and follow-up for their children and in turn, benefit the Ministry of Health for ease of follow-up of incomplete vaccination cases as there will be a complete database on immunization status for all children utilizing both public and private healthcare facilities.

Also, there is an urgent need for interventions and health education programmes targeting those at risk among the urban poor community, particularly mothers who are young, self-employed, still studying and utilizing the private healthcare services, particularly with the increasing vaccine refusal community in Malaysia.

Being the first study of its kind focusing specifically on the urban poor community in Malaysia, the findings of this study provide a crucial baseline information for reference and expansion of future research. The usage of national data from a nationwide survey may ensure representation of the urban low socioeconomic population in Malaysia. However, the utilization of secondary data due to the implementation of the Movement Control Order (MCO) in light of the Covid-19 pandemic, may not give the true picture of the current situation related to the subject matter.

## ACKNOWLEDGEMENT

The authors would like to thank the Director General of Health, Malaysia for his permission to use the data from the National Health and Morbidity Survey 2016 and to present this paper. The authors also would like to express our sincere thanks to the Institute for Public Health, National Health of Institutes (NIH) for their cooperation and assistance with this study.



REFERENCES

1. Okwo-Bele JM, Cherian T. The expanded programme on immunization: A lasting legacy of smallpox eradication. *Vaccine* 2011; **30** (29): SUPPL. 4.
2. Keja K, Chan C, Hayden G, Henderson RH. Expanded programme on immunization. *World health statistics quarterly Rapport trimestriel de statistiques sanitaires mondiales* 1988; **41**(2):59-63.
3. WHO. Global Vaccine Action Plan 2011-2020, 2017. <https://www.who.int/publications/i/item/global-vaccine-action-plan-2011-2020> (accessed 10 May 2021).
4. WHO. Routine immunization: Regional and country profiles 2019. <https://www.euro.who.int/en/health-topics/disease-prevention/vaccines-and-immunization/data-and-statistics/routine-immunization-regional-and-country-profiles> (accessed 10 May 2021)
5. WHO. Polio Outbreak in Malaysia 2020. <https://www.who.int/westernpacific/emergencies/polio-outbreak-in-malaysia> (accessed 5 Oct 2020)
6. Restrepo-Méndez MC, Barros AJD, Wong KLM, et al. Inequalities in full immunization coverage: Trends in low-and middle-income countries. *Bulletin of the World Health Organization* 2016; **94**(11):794-805A.
7. Crocker-Buque T, Mindra G, Duncan R, et al. Immunization, urbanization and slums: A systematic review of factors and interventions. *BMC Public Health* 2017; **17**(1):556.
8. Mayan SNA, Nor RM. The Resistance of the Urban Poor in Selangor, Malaysia to Get Out of the Shackles of Poverty. *International Journal of Academic Research in Business and Social Sciences* 2020; **10**(9):602-11.
9. Institute for Public Health. National Health and Morbidity Survey 2016 (NHMS 2016): Maternal and Child Health. Vol. I: Methodology and General Findings 2016. <https://iku.moh.gov.my/images/IKU/Document/REPORT/2016/NHMS2016ReportVolu mell-MaternalChildHealthFindingsv2.pdf> (accessed 20 Dec 2020).
10. Devasenapathy N, Jerath SG, Sharma S, et al. Determinants of childhood immunisation coverage in urban poor settlements of Delhi, India: A cross-sectional study. *BMJ Open* 2016; **6**(8): e013015.
11. Mutua MK, Kimani-Murage E, Ettarh RR. Childhood vaccination in informal urban settlements in Nairobi, Kenya: Who gets vaccinated? *BMC Public Health* 2011; **11** (6).
12. Lim KK, Chan YY, Noor Ani A, et al. Complete immunization coverage and its determinants among children in Malaysia: findings from the National Health and Morbidity Survey (NHMS) 2016. *Public Health* 2017; **153**:52-7.
13. Che Abdullah A, Afiah NM. Practice of Childhood Immunizations Among Parents and Their Associated Factors in Hulu Langat, Selangor, Malaysia. *International Journal of Public Health and Clinical Sciences* 2016; **3**(6): 94-104.
14. Zamzaireen Z, Muhamad H, Faisal I. Predictors of Adherence Toward Childhood. *International Journal of Public Health and Clinical Sciences* 2017;**4**(5):111-24.
15. Weiner JL, Fisher AM, Nowak GJ, et al. Childhood Immunizations First-Time Expectant Mothers' Knowledge, Beliefs, Intentions, and Behaviors. *American Journal of Preventive Medicine* 2015; **49**(6): S426-34.
16. Dummer TJB, Cui Y, Strang R, Parker L. Immunization completeness of children under two years of age in Nova Scotia, Canada. *Canadian Journal of Public Health* 2012; **103**(5):363-7. <https://pubmed.ncbi.nlm.nih.gov/23617989/>.
17. Barata RB, de Almeida Ribeiro MCS, de Moraes JC, et al. Socioeconomic inequalities and vaccination coverage: Results of an immunisation coverage survey in 27 Brazilian capitals, 2007-2008. *Journal of Epidemiology and Community Health* 2012; **66**(10): 934-41.
18. Ahmad NA, Jahis R, Kuang Kuay L, Jamaluddin R, Aris T. Primary Immunization among Children in Malaysia: Reasons for Incomplete Vaccination. *Journal of Vaccines & Vaccination* 2017; **8**(3).

<https://www.longdom.org/open-access/primary-immunization-among-children-in-malaysia-reasons-for->

[incomplete-vaccination-2157-7560-1000358.pdf.](https://www.longdom.org/open-access/primary-immunization-among-children-in-malaysia-reasons-for-incomplete-vaccination-2157-7560-1000358.pdf)