Original Article

Utilization of Immunization Service and Predictors among Under 3-Year-Old Children in Urban Slums of Chanmyathazi Township, Mandalay, Myanmar

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Objective: To identify the prevalence of immunization and predictors of utilization of immunization service among under-3-year-old children in urban slums of Chanmyathazi Township, Mandalay. The outcome variables used for the present study were whether the child received complete types of EPI immunization, immunization with timeliness and utilization of immunization service.

Materials and Methods: A cross-sectional community surveys by using cluster sampling was applied to select 429 primary caregivers of under-3-year-old children. Face to face interview was conducted using four parts of structured questionnaire. Chi-square test and multiple logistic regression were performed to examine factors associated with utilization of immunization.

Results: The prevalence of the children with complete and partial type of immunization according to national schedule were 24.1% and 64.8%, respectively, whereas 11.1% of them were never immunized. Regarding timeliness, 26.5% of the immunized children had the timely vaccinations, while about three-quarters (73.5%) had delayed immunization. In terms of utilization of immunization status, 23% of the caregiver utilized the service with quality immunization and 77% of them did not utilize the service. In multiple logistic regression analysis, child age (AOR 3.49, 95% CI 1.63 to 7.50), income (AOR 6.36, 95% CI 2.35 to 17.18), migration status (AOR 3.28, 95% CI 1.05 to 10.29), ANC visit (AOR 4.77, 95% CI 1.55 to 14.67), receiving additional vaccine (AOR 6.27, 95% CI 2.72 to 14.44), and having immunization card (AOR 3.15, 95% CI 1.33 to 7.46) were significantly predicted for the utilization of the immunization service (p-value <0.05).

Conclusion: This study found that a comprehensive maternal and child health care system that promote ANC together with immunization uptake and health promotion programs on additional vaccine for preventable diseases such as Rotavirus infection and Japanese encephalitis in the community level is needed. Using appropriate software to keep health records in form of electronic registration for slum migrants is also needed.

Keywords: Immunization, Utilization, Slum, Under 3-year-old children, Myanmar

J Med Assoc Thai 2018; 101 (8): 1085-92
Website: http://www.jmatonline.com

Early routine childhood immunization is described as one of the most cost-effective interventions public health. It plays an important role in reducing child mortality and incidence of lifelong diseases amongst the immunized populations[1]. It is estimated that complete immunization alone can prevent between two and three million deaths each year[2]. Despite the efforts to progress vaccination services in some countries, the World Health Organization [WHO] revealed that globally about 22.6 million of under-one-year-old children did not obtain the third dose of Diphtheria Pertussis Tetanus Vaccine [DTP3] vaccine in 2012[3].

In low and middle-income countries [LMIC], vaccine-preventable diseases cause 10 million deaths among under-five-years-old children every year. Globally, only three-quarters of the child population have access basic vaccination[4]. Vaccine coverage rates are most commonly used as health indicators for evaluation and monitoring of immunization program achievements. Nevertheless, satisfactory improvement of coverage may not have a direct correspondence with disease protection. Instead, timely immunization is essential to protect the child from diseases in early life when the child is prone to vaccine preventable diseases. The timeliness of the vaccination is critical to attain the highest level of immunity to prevent the target diseases[5,6].

Ministry of Health and Sport in Myanmar is implementing an Expanded Program of Immunization [EPI] program to achieve 90% coverage countrywide

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How to cite this article: Lae WL, Jayasvasti I, Mongkolchati A, Jayasvasti M. Utilization of immunization service and predictors among under 3-year-old children in urban slums of Chanmyathazi Township, Mandalay, Myanmar. J Med Assoc Thai 2018;101:1085-92.

and at least 85% coverage in all districts locally in 2016[2]. National vaccine coverage is estimated to be 76%. To protect the entire population or to achieve herd immunity, immunization coverage for highly infectious diseases such as measles is needed to be 90% to 95%[7]. Complete immunization coverage is lower in informal settlements of the metropolitan poor, especially in areas with temporary mobile populations compared to other urban areas[8]. Furthermore, shortage of health facilities and immunization programs are common in near slum settings[9]. In 2014, the WHO and its partners acknowledged that children in deprived informal settings were identified as a priority group for targeted interventions to progress vaccination coverage[10]. Because of its high population density and continuous influx of a new pool of infectious agents with the immigrating population, urban slum areas are prone to outbreaks of infectious diseases[11]. The present study aimed to identifying factors associated with childhood immunization of slum-dwelling population. The benefit of the present study was to have deeper understanding of the factors contribution on immunization status, completion of types of EPI vaccines, timeliness and utilization of immunization service, and achieving the target for timely complete immunization of urban slum of Myanmar. In addition, the present study intended to make health information available to support health policy makers to develop better health service, especially for vulnerable communities.

Materials and Methods

A cross-sectional community surveys was conducted on 352 primary caregivers with children aged under-3-years-old in urban slum area of Chanmyathazi Township, Mandalay, Myanmar between April 3 and May 12, 2017. The estimated sample size was calculated by the following formula.

$n = Z^2 P(1 - P) / d^2$

Z = standard normal deviation set as 1.96 corresponding 95% confidence interval [CI]

Q = 1 - P

P = 0.5 (to get the maximum number of the sample size to answer the primary outcome we provided P as 0.5 because the present study was in slum where the prevalence of complete immunization was unknown)

$n = 384 \pm 10\% = 422$

According to the results from the formula, the estimated sample size was 422 caregivers with under-3-year-old children from the study area. The researchers collected the present study information from the 429 caregivers with under-3-year-old children as the whole study population in the area was small. However, questionnaires from 77 respondents had to be removed for data analysis because of incomplete information.

The primary caregivers who agreed to participate in the present study and had under-3-years-old children with no convulsions or Central Nervous System disorders or not taking immunosuppressive drugs or steroids were recruited. The data were collected by face to face interview using a structured interview questionnaire. There were four parts in the questionnaire. The first part was predisposing factors such as socio-demographic characteristics, knowledge and perception towards immunization, the second was enabling factors such as accessibility and availability towards immunization as well as utilization of health services, the third part was reinforcing factors such as health volunteer, family, and social support towards immunization, and the fourth part assessed the child's immunization status. The statistical analyses were performed using SPSS Window 21. Descriptive statistics was used to compute mean, median, standard deviation, quartile deviation, frequency, percentage for describing the distribution. Chi-square test was used to access the association between predisposing factors, enabling factors, reinforcing factors, and utilization of immunization service. Lastly, multiple logistic regression was applied to discover the predictors by adjusting confounding factors. The Ethical Committee from the Faculty of Graduate Studies, Mahidol University approved the present study (approval code 2017/052.0803, date: 8 March 2017) and both written form and verbal consent were obtained from the participants before proceeding with questionnaires.

Results

The data were collected from 429 respondents. However, only the data of 352 were used to analyze because incomplete information. The socio-demographic information showed that 90.7% of the caregivers were female, while 9.3% were male. The mean age of the respondents was 31-years-old (18- to 86-years-old) with a standard deviation ±9.9 years. Regarding caregiver relationship to child, 84.8% of the respondents were parents, whereas 15.2% of them were non-parents such as grandparents or siblings. The study results indicated that 99.1% of the respondents were Buddhist, while only 0.9% was Non-Buddhist. Concerning education, 7.2% of the caregiver had no education at all, while 92.8% had formal education. The result revealed that 46.4% of the caregivers were housewives and followed by 21.4%

being self-employed, 11.2% being daily-worker, and 21.0% being others (civil servant, company worker). In terms of monthly household income, more than half of the respondents (63.6%) were high income (≥200,000 kyats = ≥ US$ 150) and the rest was low income (<200,000 kyat = < US$ 150). The study data showed that 20.7% of the respondents had recent migration status (moved to the area within 12 months), whereas 79.3% of them had no family movement. The percentage of family with equal to or more than two children is 57.1% and the remainder was 42.9% with only one child. In terms of child birth order, more than half of the children (55%) were the second or more birth order, whereas the rest (45%) were the first child as shown in Table 1.

In terms of knowledge towards immunization, nearly two-thirds of the caregivers (61.3%) had fair knowledge about childhood immunization, symptoms of vaccine preventable diseases, and mode of transmissions. Regarding perception, more than half of the caregivers (62.5%) had moderate perception composed of disease susceptibility, severity, benefits, and barriers to service utilization, while the respondents with low and high perception were 17.7% and 19.8%, respectively, as shown in Table 2.

The present study found that 24% of children had received all types of recommended doses of the routine EPI vaccines, while 64.8% of them had missed at least one dose, and 11.1% of the children were never immunized at the time of data collection. Only 26.5% of the immunized children were with correct timeliness, whereas the others (73.5%) did not have vaccination with timeliness. In terms of utilization of immunization service, 23% of the caregivers had utilized immunization service, while 77% did not use the service (Table 3).

Table 1. Distribution of respondents by socio-demographic characteristics (n = 429)

Socio-demographic characteristics	Number (%)
Caregiver Gender	
Male	40 (9.3)
Female	389 (90.7)
Caregiver age group	
<31 years	212 (49.4)
≥31 years	217 (50.6)
Median (QD): 31 (5.5), min 18, max 86	
Relationship to the child	
Parent	364 (84.8)
Non-parent	65 (15.2)
Religion	
Buddhist	425 (99.1)
Others (Hindu, Muslim)	4 (0.9)
Caregiver's education	
Primary and below	187 (43.6)
Middle and above	242 (56.4)
Caregiver's occupation	
Self-employed/daily-worker	140 (32.6)
Housewife and other	289 (67.4)
Family income (n = 418)	
<200,000 Myanmar kyats	145 (34.7)
≥200,000 Myanmar kyats	273 (65.3)
Median (QD): 200,000 (75,000) kyats, min 60,000 kyats, max 1,000,000 kyats	
Migration status	
Yes	89 (20.7)
No	340 (79.3)
Median (QD): 7 (9) years, min 1 month, max 62 years	
Number of children in family	
<2 children	184 (42.9)
≥2 children	245 (57.1)
Median (QD): 2 (1), min 1, max 10	
Child birth order	
<2nd child	193 (45.0)
≥2nd child	236 (55.0)
Median (QD): 2 (1), min 1st, max 10th	

QD = quartile deviation

Table 2. Number and percentage for level of knowledge and perception (n = 429)

Knowledge level	Number (%)
Poor (<60%)	83 (19.3)
Fair (60% to 80%)	263 (61.3)
Good (>80%)	83 (19.3)
Knowledge score; median (QD): 2 (1), min 1, max 11	
Perception level	
Low (<42 score)	76 (17.7)
Moderate (43 to 52 score)	268 (62.5)
High (>53 score)	85 (19.8)
Perception score; median (QD): 48 (4), min 33, max 60	

QD = quartile deviation

Table 3. Number and percentage of immunization status

Immunization Status	Number (%)
Type of immunization (Outcome 1) (n = 352)	
Full (yes)	85 (24.1)
Partial (no)	228 (64.8)
Not immunized at all (no)	39 (11.1)
Timeliness (Outcome 2) (n = 313)	
Yes (full or partial with timeliness)	83 (26.5)
No (full or partial without timeliness)	230 (73.5)
Utilization of immunization service (Outcome 3) (n = 313)	
Yes (full with timeliness)	72 (23.0)
No (full with no timeliness & partial with/without timeliness)	241 (77.0)

In terms of predisposing factors, six variables, child age, migration, caregiver relationship, household income, child birth order, and number were related to utilization of immunization service. The respondents with equal or above 18-months-old children were four times likely to fail having utilization of immunization service compared to those with under-18-months-old children. Similarly, non-parent caregivers were four times more likely not to have the service utilization than the parents. The respondents with low income were seven times less likely to utilize the service than those with high income. Non-migrant respondents were three times more likely to use children immunization service compared to the migrant respondents. Furthermore, the caregivers with first or one child were more likely to utilize immunization service than the other caregiver. The respondents with children who had immunized with other vaccines apart from the routine immunization were 9.9 times more likely to have routine immunization with correct timeliness than those children without additional vaccines. The analysis result showed that the caregivers with children who received four or more maternal antenatal care [ANC] visits were seven times more likely to utilize the immunization service than other respondents. Additionally, the caregivers with home delivered children were two times less likely to have utilization of immunization service than those with children who delivered at health facilities as shown in Table 4.

Table 5 presented the significant predictors of utilization of immunization service after adjusting the other variables. The most significant predictors

Table 4. Association between the factors and utilization of immunization service (n = 313)

Factors	Total sample	Utilization of immunization service		Crude OR (95% CI)	*p*-value
		Yes, n (%)	No, n (%)		
Child age					
<18 months	162	55 (34.0)	107 (66.0)		
≥18 months	151	17 (11.3)	134 (88.7)	4.052 (2.223 to 7.385)	<0.001***
Relation to child					
Parents	272	69 (25.4)	203 (74.6)	1	
Others	41	3 (7.3)	38 (92.7)	4.305 (1.288 to 14.391)	<0.018*
Income					
<200,000	103	6 (5.8)	97 (94.2)	7.732 (3.223 to 18.551)	<0.001***
≥200,000	204	66 (32.4)	138 (67.6)	1	
Migration					
Yes	60	5 (8.3)	55 (91.7)	3.962 (1.522 to 10.319)	0.005**
No	253	67 (26.5)	186 (73.5)	1	
Child number					
<2 children	134	39 (29.1)	95 (70.9)	1	
≥2 children	179	33 (18.4)	146 (81.6)	1.816 (1.068 to 3.088)	0.028*
Birth Order					
<2nd child	142	40 (28.2)	102 (71.8)		
≥2nd child	171	32 (18.7)	139 (81.3)	1.703 (1.002 to 2.895)	0.049*
Receiving additional vaccine before					
Yes	50	32 (64.0)	18 (36.0)		
No	263	40 (15.2)	223 (84.8)	9.911 (5.080 to 19.337)	<0.001***
ANC visits					
<4 visits	89	5 (5.6)	84 (94.4)	7.169 (2.782 to 18.473)	<0.001***
≥4 visits	224	67 (29.9)	157 (70.1)	1	
Delivery place					
At home	112	16 (14.3)	96 (85.7)	2.317 (1.256 to 4.276)	0.007**
Health Facility	201	56 (27.9)	145 (72.1)		
Having immunization card					
Yes	208	61 (29.3)	147 (70.7)	1	
No	105	11 (10.5)	94 (89.5)	3.546 (1.775 to 7.086)	<0.001***

ANC = antenatal care; OR = odds ratio; CI = confidence interval

* *p*-value <0.05, ** *p*-value <0.01, *** *p*-value <0.001

Table 5. Predictive factors associated with utilization of immunization service using multiple logistic regression (final model)

Factors	Adjusted OR (95% CI)	*p*-value
1. Child age		
<18 months	1	
≥18months	3.491 (1.625 to 7.500)	<0.001***
2. Caregiver age		
<31 years	1	
≥31 years	1.652 (0.810 to 3.367)	0.167
3. Caregiver relationship to child		
Parent	1	
Non-parent	3.378 (0.722 to 15.803)	0.122
4. Income		
Low	6.358 (2.353 to 17.183)	<0.001***
High	1	
5. Migration		
Yes	3.275 (1.053 to 10.189)	0.40*
No	1	
6. ANC visit		
<4visits	4.771 (1.552 to 14.667)	0.006**
≥4 visits	1	
7. Person assisted delivery		
Doctor	1	
Midwife/nurses	0.795 (0.352 to 1.796)	0.581
Others	2.416 (0.502 to 11.635)	0.271
8. Receiving additional vaccines before		
Yes	1	
No	6.269 (2.721 to 14.441)	<0.001***
9. Having immunization card		
Yes	1	
No	3.145 (1.326 to 7.461)	0.009**
10. Education		
Low	0.633 (0.251 to 1.597)	0.333
High	1	
11. Occupation		
Self-employed	1.169 (0.433 to 3.156)	0.758
Daily-worker	0.28 (0.079 to 0.990)	0.048
Other	0.475 (0.196 to 1.149)	0.99
Housewife	1	

ANC = antenatal care; OR = odds ratio; CI = confidence interval

* *p*-value <0.05, ** *p*-value <0.01, *** *p*-value <0.001, Remark: Hosmer-Lemeshow goodness of fit (significant level: 0.597)

were child age, family income, ANC visit, receiving additional vaccine before migration, and having immunization card. The caregivers with children aged 18-months-old or above were 3.5 times less likely to have utilization of immunization service (95% CI 1.625 to 7.500, *p*-value <0.001) compared with those with under-18-months-old children. Likewise, the respondents from low income households were 6.3 times more likely to fail having utilization of immunization service (95% CI 2.353 to 17.183, *p*-value <0.001) compared to those from high in come family. Migration status was found significantly associated in the present study outcome. Migrant children were more than three times less likely to have timely and complete immunization than others (95% CI 1.053 to 10.189, *p*-value <0.001). Furthermore, the caregivers with children who received four or more maternal ANC visits were 4.7 times more likely to utilize the immunization service than other respondents (95% CI 1.552 to 14.667, *p*-value <0.001).

The caregivers with children who received additional vaccines were 6.2 times more likely to utilize immunization service compared to the caregivers with children who were not additionally vaccinated (95% CI 2.721 to 14.441, *p*-value <0.001). Having immunization card was also found to be a significant predictor of utilization of immunization service among the caregivers. The respondents with cards were three times more likely to utilize the immunization service than others (95% CI 1.326 to 7.461, *p*-value <0.001).

Discussion

The present study found that only 23% of the caregivers had utilized the service with timely and complete immunization. The coverage result was quite low compared to not only previous immunization study in hill tribe region of Myanmar, but also national EPI coverage target set at 95% nationally, with minimum 80% in every region for all antigens[12,13]. Likewise, the South zone of Nigeria where five of six States studied was located, the full immunization coverage was 36%[14]. The main reasons for incomplete immunization given by some caregivers were travelling during the immunization time, being busy, and child was having fever. Moreover, in the present study, most children were delayed one to two months from the recommended age for vaccination. Thirty-nine children were never immunized at the time of this study. Not only the immunization coverage but also timely vaccinations are still needed to be developed with systematic health strategies.

The caregivers with younger children (younger than 18-months-old) were more likely to complete utilize immunization service than the other group. It is possible that caregiver's attention to their children immunization decreased as the child age increases. The present result is similar to other immunization studies conducted in Greece and Iran[15,16].

The present study found that the utilization of immunization service was low in low-income households, which also related to poor education or occupation that does not recognize the importance

of proper immunization. The present study result is in line with other studies[5,17-19]. Migration was found as a significant predictor of immunization service utilization in the present study. Due to migration, families move from one community to another community, and lose track of time and follow-up for vaccination, or forget the immunization cards. The children may not be registered in the new place for immunization, which is an obstacle to utilize the local immunization service. This finding agrees with many previous studies[20-23]. The present study showed that increased ANC visits (four or more) have positive impact on the immunization service utilization. Those child caregivers had learnt good child health and knew the harmful effects of non-immunization compared to other caregivers. This result agreed with many previous immunization studies[6,21,24-26].

The present study also found that the utilization of routine immunization service was significantly associated with receiving the additional vaccines such as Japanese encephalitis and hepatitis B. The caregivers who had additional vaccines to their children were more likely to have higher knowledge towards immunization. Additionally, the majority of them delivered their children in hospital, which made them closer to the health service and get more information on immunization from the health staffs compared to the other respondents[27]. In the present study, 59% of the caregivers had the immunization card. There was a strong association between having immunization card and the immunization service utilization status. Caregivers with the cards were more likely to be aware and remember the immunization schedule and the next vaccination appointments, which similar to previous study[28,29]. To reduce selection bias, the present study recruited every primary caregiver with children aged under-three-years-old who agreed to participate in the study from the area. To minimize the respondent's recall bias, the child immunization status was confirmed by immunization card or health facility record. The strength of the present study is that it is the first study of EPI immunization study in caregivers living in slum in Myanmar. In terms of limitations, as the interviews were conducted to all primary caregivers, some male respondents did not know or remember the maternal history of children such as the ANC visits. In addition, the study did not include and count the new pneumococcal conjugate vaccine [PCV] in vaccination schedule. That vaccine was introduced by the Ministry of Health and Sport [MOHS] in early 2017, when the study conceptual framework was already confirmed to use the previous national immunization schedule.

In Conclusion, the present study revealed that the prevalence of the utilization of quality immunization was 23%, whereas the majority (77%) had no utilization. The utilization of immunization service, timely, and complete immunization status were quite poor in this slum areas compared to other regions of Myanmar. This immunization study in slum showed that it is needed to take attention to not only immunization coverage but also timeliness vaccination in informal settlements. The finding of the present study suggested that not only strengthening of Effective Health Information Management Systems with a focus on slum migrants is required but also keeping health records in forms of electronic registration by using appropriate software that will reduce dependency of immunization card. The study also indicated that a comprehensive maternal and child health care system that promotes ANC service to educate parents about proper immunization together with immunization uptake is required.

What is already known on this topic?

MOHS in Myanmar implements an EPI program (multi-years plan 2012 to 2016) to achieve 90% countrywide and at least 85% in districts.

The prevalence of EPI national coverage reported by WHO was estimated at 76% in 2014, and lower coverage among vulnerable populations such as urban slum area.

What this study adds?

Knowledge of the prevalence of timely complete EPI immunization status and childhood immunization status in urban slum of Myanmar. Those areas are the one with temporary migrant population (both registered and non-registered HH), with poor socioeconomic status, prone to outbreaks, with low immunization coverage in metropolitan settlements, and with indigenous community.

The children in slum informal settings are seen as a priority group identified by WHO and their partners for targeted interventions to progress immunization coverage.

This study provided the predictors of childhood immunization, specially to meet the target for timely complete immunization among the caregivers in urban slum of Myanmar.

Acknowledgement

The investigators would like to thank the care-

givers of under-3-years-old children who participated in this study as well as all health staffs from urban health center for supplying information for the study.

Potential conflicts of interest

The authors declare no conflict of interest.

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