

ORIGINAL ARTICLE

Determinants of incomplete immunization among hill tribe children aged under two years in Myanmar

Sein Lei Than¹, Aroonsri Mongkolchati² and Orapin Laosee²

¹ M.P.H.M., ASEAN Institute for Health Development, Mahidol University, Thailand

² Ph.D., ASEAN Institute for Health Development, Mahidol University, Thailand

Corresponding author: Aroonsri Mongkolchati Email: aroonsri.mon@mahidol.edu

Received: 23 May 2016 Revised: 1 September 2016 Accepted: 7 September 2016

Available online: September 2016

Abstract

Than S.E., Mongkolchati A. and Laosee O.

Determinants of incomplete immunization among hill tribe children aged under two years in Myanmar.

J Pub Health Dev. 2016;14(2):17-31

Immunization coverage is still a major concern in many third world countries especially in remote areas. In Myanmar, the hill tribe region is regarded as one of vulnerable, tangible outreach areas. The immunization coverage in mountainous areas were quite low compared to other areas of Myanmar. A cross-sectional study was conducted to examine the immunization status of children under two years of age, to describe factors towards incomplete immunization, and to determine the association between the factors and incomplete immunization of children under two years of age. Multi-stage stratified sampling was used to enroll a total of 330 respondents in rural and urban areas of the rocky regions. Mothers who has under two years old child were interviewed by trained health staffs. Chi-square test and multiple logistic regression were applied to determine factors associated with immunization.

The results indicated that one-fourth (25.8%) of children had incomplete immunization. The incomplete immunization prevalence was high in urban areas (57.6%) and rural areas (42.4%). After adjusting for confounding factors, the results showed that occupation (AOR=2.18, 95%CI=1.27-3.76), perception (AOR=2.37, 95%CI=1.01-5.56), place of vaccination (AOR=2.63, 95%CI=1.53-4.51) and the person sent for vaccination (AOR=2.40, 95%CI =1.33-4.35) were significantly (P -value < 0.05) associated with incomplete immunization and the strongest predictor was volunteer help (AOR=3.15, 95%CI =1.47-6.76).

In conclusion, the accessibility of immunization services is still in demand to increase immunization coverage in mountainous zones in Myanmar. It is also revealed that the role of volunteers need to be strengthened for enhancement of immunization coverage. Health information among ethnic groups should be in dialect for better understanding about the benefits of immunization.

Keywords: children health, immunization, hill tribe regions, incomplete immunization

ปัจจัยที่มีผลต่อความไม่สมบูรณ์ของการรับบริการวัคซีน ของเด็กอายุต่ำกว่า 2 ขวบ ที่อาศัยบริเวณพื้นที่ภูเขา ในประเทศไทย

ชินเลล์ ตัน¹ อรุณศรี มงคลชาติ² และอรพินท์ เล่าชี²

¹ M.P.H.M. สถาบันพัฒนาสุขภาพอาชีวิน มหาวิทยาลัยมหิดล ประเทศไทย

² Ph.D. สถาบันพัฒนาสุขภาพอาชีวิน มหาวิทยาลัยมหิดล ประเทศไทย

บทคัดย่อ

ชินเลล์ ตัน อรุณศรี มงคลชาติ และอรพินท์ เล่าชี²

ปัจจัยที่มีผลต่อความไม่สมบูรณ์ของการรับบริการวัคซีนของเด็กอายุต่ำกว่า 2 ขวบ

ที่อาศัยบริเวณพื้นที่ภูเขา ในประเทศไทย ว.สาธารณสุขและการพัฒนา 2559;14(2):17-31

ความครอบคลุมในการรับวัคซีนยังคงเป็นปัญหาในประเทศไทยกำลังพัฒนาโดยเฉพาะอย่างยิ่งในบริเวณพื้นที่ภูเขาและพื้นที่ห่างไกลของประเทศไทย กระทรวงสาธารณสุขในเขตพื้นที่ดังกล่าวยังเป็นประชากรกลุ่มเสี่ยง ความครอบคลุมการรับรับบริการวัคซีนในพื้นที่ภูเขายังมีจำนวนต่ำกว่าเป้าหมายเมื่อเทียบกับพื้นที่อื่นๆ ในประเทศไทย การศึกษาครั้งนี้เป็นการแบบภาพตัดขวาง มีวัตถุประสงค์เพื่อศึกษาถึงปัจจัยที่มีผลต่อความไม่สมบูรณ์ของการรับบริการวัคซีนของเด็กอายุต่ำกว่า 2 ขวบ ที่อาศัยบริเวณพื้นที่ภูเขา ประเทศไทย มีผู้เข้าร่วมวิจัยมีทั้งสิ้นจำนวน 330 คน ในเขตพื้นที่ภูเขานั้นในเขตเมืองและชนบท โดยทำการสุ่มตัวอย่างแบบชั้นภูมิ โดยเป็นสัดส่วนตามจำนวนของประชากรในพื้นที่เป้าหมาย โดยจะทำการสัมภาษณ์ นารายาที่มีเด็กอายุต่ำกว่า 2 ขวบ ยกเว้นนารายาตั้งครรภ์ที่ไม่สามารถล็อตต์ต่อได้ การศึกษาครั้งนี้ใช้การทดสอบแบบไคสแควร์และการทดสอบอิสติกพหุคุณ เพื่อทวนย้ำปัจจัยตัวแปรต้นที่มีผลต่อตัวแปรตาม

ผลการศึกษาครั้งนี้พบว่า เด็กจำนวนมากกว่า 1 ใน 4 (25.8%) ได้รับวัคซีนไม่ครบถ้วนสมบูรณ์ ความชุกของความไม่ครอบคลุมของการรับบริการวัคซีนสูงในพื้นที่ภูเขาระหว่างเขตเมือง (57.6%) และในชนบท (42.4%). ผลการวิเคราะห์ด้วยการทดสอบอิสติกพหุคุณโดยได้ควบคุมตัวแปรกวนแล้วพบว่า อาชีพ (AOR=2.18, 95%CI=1.27-3.76) การรับรู้ของนารายา (AOR=2.37, 95%CI=1.01-5.56) สถานที่ในการรับบริการวัคซีน (AOR=2.63, 95%CI=1.53-4.51) และบุคคลผู้พ่อไปรับการบริการวัคซีน (AOR=2.40, 95%CI =1.33-4.35) มีผลต่อความไม่สมบูรณ์ของการได้รับวัคซีนในประชากรกลุ่มที่ทำการศึกษา และพบว่า ปัจจัยที่มีผลสูงสุดคือการช่วยเหลือของอาสาสมัครประจำหมู่บ้าน (AOR=3.15, 95% CI =1.47-6.76) อย่างมีนัยสำคัญทางสถิติ (p -value < 0.05)

การศึกษาครั้งนี้สรุปได้ว่า การเข้าถึงการให้บริการทางด้านวัคซีนในพื้นที่ภูเขาระหว่างเขตเมืองและชนบท ความชุกของการรับรู้ความสามารถในการให้ความช่วยเหลือของอาสาสมัครประจำหมู่บ้านมีความจำเป็นอย่างยิ่งในการเพิ่มการเข้าถึงการบริการดังกล่าว นอกจากนี้การปรับปรุงด้านการสื่อสารในกลุ่มชาติพันธ์จะช่วยเพิ่มพูนการรับรู้และความเข้าใจในการรับบริการและเพิ่มการเข้าถึงการบริการได้ครอบคลุมทั่วถึงมากยิ่งขึ้น

Keywords: สุขภาพเด็ก การบริการวัคซีน พื้นที่ภูเขา การไม่ครบถ้วนการรับบริการวัคซีน

Introduction

Childhood immunization is a preventive health behavior that is directed toward the child by the parent¹. Vaccinations can provide a reduction in human grief and an increase in life expectancy². It is expected to avoid between 2 and 3 million deaths each year. Immunization is the most effective health investment as it is considered as major backers to public health³. Immunization help children from vaccine-preventable diseases such as illness, disability and deaths including tuberculosis, diphtheria, pertussis, tetanus, hepatitis B, pneumonia, meningitis, measles and polio. Immunization lessen morbidity and mortality along with children⁴ from vaccine preventable diseases that can protect up to 24% of the 10-12 million of yearly deaths of children under 5 years. However, the coverage is still a major concern in many third world countries especially in resource poor areas^{5, 6} and the remote areas where incomplete immunizations and non-uptake of immunization services are poorly understood. Insufficient immunization levels against childhood diseases remain a trivial for public health concerns in resource-poor areas of the globe, like Mozambique. It may be the one of the evidence why measles epidemics keep on occurring in Mozambique despite of the reported 80% measles vaccination coverage⁷. The primary source for the epidemic is failure to support vaccines to susceptible children on program⁸. Immunization is a long history of victory⁹. Global Vaccine Action Plan (GVAP) is a roadmap to protect millions of deaths through equally accessibility to vaccination whereas unmet need still occurs in 72 poorest countries. Countries aim vaccination coverage of over 90% nationwide and more than 80% in every district in 2020. Even

though immunization services have been built up globally, there is continuing distress to the failure to accomplish coverage.

The special concern for Expanded Programs of Immunization (EPI) in Myanmar is the firming up of immunization services¹⁰. Many diseases demands 80%-100% immunization (e.g. Measles requires 95% of the population to be vaccinated¹¹ when pertussis needs at least 80% coverage). Myanmar is trying to fulfill MDG 4 to reduce two thirds the mortality rate among children under 5 years by promoting immunization programs and measles control. Nonetheless, young children have incomplete immunizations for many reasons that are mostly unaware of benefits of immunization or lack of concern for severity of side effects¹². The factors for the children to be immunized were the distance, mother's literacy, knowledge and perception of vaccine preventable diseases and immunization schedule and transportation charges¹³. Robison S.G showed that most of children who missed a vaccine were provider encounters¹⁴. Provider unwillingness to pass immunization during sick visits is a distinguishable barrier to timely immunization¹⁵.

The main barriers for immunization are in convenient clinic hours, employment conflicts, lack of transportation, long waiting periods, in combination with lack of knowledge and motivation sometimes chaotic home environments¹². There are two main issues for underutilization of vaccination. The first is a lack of supplies (e.g. Needles and syringes) at health care facilities. The second is that some mothers in low coverage areas feel that they do not receive enough health-related information¹⁶.

In Myanmar, immunization coverage is still low in some areas for example the mountainous areas or catchment areas. Secondly, 256 (76%) districts reported more than 10% drop-out rate. Measles is one of the diseases prevalent for children. It is always becoming outbreaks at least 1 in 4 to 5 years and it is severe if it occurs¹⁷. The mortality and morbidity due to measles infection is high while it can be prevented by vaccination. The immunization coverage in 2014 in hill tribe region was range between 70 to 80% of all antigens¹⁷ and it is still regarded as one of low uptake areas in Myanmar. In addition, in the mountainous areas are regarded as one of tangible, socioeconomically outreach areas for entry of all health facilities counting immunization. There still many factors has not been explored and limited studies have been done for the rural and hill tribe population.

There are many studies^{1, 3, 12, 14, 16, 18-22} which identified factors affecting utilization of immunization services. A study from Thailand identified that incomplete immunization was mainly because of barriers in accessibility to utilize it²³. A research study conducted in China has been shown poor knowledge on immunization programs and the cost of transportation to get to the nearest health centers to immunize their children²⁴. Another study from India pointed out that it was because of lack of concern for getting vaccine-preventable diseases and lack of information due to inadequate education²⁵ and the parents are anxious about the side effects of immunization³.

This research study was aimed to examine the immunization status of children under two years of age, to describe factors towards incomplete immunization, and to determine the association between

the factors and incomplete immunization of children under two years of age. The benefits of the study is for deeper knowledge contribution on achieving the target for immunization coverage in hill tribe regions and outreach areas of Myanmar.

Methods

A community-based, cross-sectional study was conducted in Nyung Shwe Township, Southern Shan State, Myanmar. It was overcrowded (population density 197.2 sq mile) with low socio-economic settings with many ethnic groups and it was one of low immunization uptakes than other states and regions²⁶. The mothers who had the child between 18 -24 months were recruited.

The sample size calculation was calculated by 99% confidence interval with allowable error with 0.05, estimated prevalence of incomplete immunization 13%²⁷ in Myanmar and total 330 mothers were included in this study. Data collection was conducted from March to May 2015.

The sampling technique was multi-stage stratified sampling for both urban and rural areas of that rocky regions. The study area was like a semi-urban area of Myanmar which have both urban and rural areas. Urban in that regions mean the center of the town which is near to the health facility. Rural in that region mean the peripheral area of the town which is approximately 50-100 km far away from the health facility. From that, 330 mothers from each households were chosen (50% equally sample from both rural and urban areas to compare with the outcome results). The data for the clusters and household lists where under 2 years old children The data were additional paper record, hospital record books, immunization record

books, township profile, details of village and village tracts and the household lists which all permission from all the rural health centers from permission with the coordination of Township Medical Officer and the approval of Local Authority. Written form and verbal consent also were taken from the respondents, participation was completely voluntary.

Reliability test was conducted in 30 subjects and it was revised for more understanding. Translation was done from English to Myanmar language. The reliability of knowledge and perception part was 0.61 and 0.73 respectively. Ethical clearance obtained from Mahidol University and the approval from the Local Government Unit and Authority in Myanmar. To reduce selection bias, researcher select only one child per household. The children with special treatment were excluded for this study as they were not given according to immunization schedule. Immunization cards from mothers and immunization record books from rural health centers were matched to reduce information bias.

The research instruments were the structured questionnaires which consisted of 96 Questions in 4 parts; predisposing factors (60 questions), enabling factors (15 questions), need factors (4 questions) and immunization status (17 questions). Predisposing factors were socio-demographic characteristics of mothers which were respondent's age, religion, and ethnicity, respondent's education, occupation and family income, knowledge and perception toward immunization. The enabling factors were accessibility and availability for immunization, source of information, maternal history. The need factors were social and family support for immunization. Maternal and Child Health (MCH) books or immunization cards from

mothers and MCH records and immunization record books from rural health centers were study instruments of this study. Complete immunization refers to the child who received BCG 1 dose(2 months), pentavalent (Diphtheria, Pertussis, Tetanus, combined with Hepatitis B and Haemophilus Influenza type B(Hib)) vaccine 3 doses (2 to 6 months), oral polio vaccine 3 doses(2 to 6 months) and measles vaccine 2 doses (9 and 18 months respectively) received at correct timing according to WHO. Incomplete immunization means the child miss injection at least one of recommended vaccine with delayed or incorrect timing according to WHO guidelines or the child never get any vaccine recommended from EPI.

The data were entered and analyzed by SPSS Statistical analysis programs version 21. Descriptive statistics was used to examine each of the factors and outcome. Chi-square tests were used to identify the association of immunization and each independent variables. Significant variables ($p<0.05$) and theoretical variables were entered to full model and final model of multiple logistic regression to determine the predictors of immunization status of children.

Results

More than half of the respondents (51.2%) were less than 29 years old. The greater part of ethnic groups were Inntha (83.6%) and the rest was other ethnic groups (Myanmar, Shan, Pa-O, Khayin, Garyaka, Danu, Tong yoe). The half of respondents were from urban (50%). The vast majority were married (98.2%). The family member lower than 4 people was about 68.5%.

Regarding mother's education, majority were classify as low education (68.2%). The non-profes-

sional workers (farmers, house wives and all kinds of paid workers) were 44.7% and the professional workers (such as company workers or civil servants) were 55.5% correspondingly. In terms of family

income, more than half of respondents (50.3%) were low income (<100,000 kyats = <US\$ 90) and the residue was high income ($\geq 100,000$ kyats = \geq US\$ 90) as shown in table 1.

Table 1 Distribution of respondents by Socio-demographic characteristics (n=330)

Socio-demographic characteristic	Number	Percentage
Age (years)		
<29	169	51.2
≥29	161	48.8
Median=29, QD=4.5, Min=18, Max=44		
Ethnic groups		
Major ethnic groups(Innthar)	276	83.6
Other ethnic groups	54	16.4
Study areas		
Urban	165	50
Rural	165	50
Marital status		
Married	324	98.2
Others(Divorced, Widow)	6	1.8
Total family members		
<4	226	68.5
≥4	104	31.5
Median=4, QD=1, Min=2, Max=15		
Mother's education		
High education	105	31.8
Low education	225	68.2
Mother's occupation		
Non-professional workers	147	44.5
Professional workers	183	55.5
Family income		
<100,000 kyats=<US\$ 90 (low)	166	50.3
≥100,000 kyats= ≥US\$ 90 (high)	164	49.7
Median=100,000 kyats, QD=35,000, Min=30,000, Max=1,000,000		

For the outcome measures, the complete immunization was 74.2% and incomplete immunization was 25.8% as shown in table 2. The incomplete immunization was mostly in urban areas (57.6%) and rural areas (42.4%). The causes for incomplete immunization was because of the fact that more than two-thirds of mothers (78.2%) were poor knowledge and on immunization, transmission and symptoms of

vaccine-preventable diseases and the conditions of the children after immunization. However, 21.8% had good knowledge. The greater number of respondents (78.2%) were low perception consists of susceptibility, severity, benefits and barriers of immunization whereas only few respondents (21.8%) had good perception as shown in table 3 below.

Table 2 Prevalence of incomplete immunization of children under 2 years

Immunization status	Study areas (Number & Percentage)		Total (%)
	Urban	Rural	
Incomplete immunization	49(57.6)	36(42.4)	85
Complete immunization	116(47.3)	129(52.7)	245
Total	165(50)	165(50)	330(100)

Table 3 Distribution of respondents by level of knowledge and perception (n=330)

Level	Number	Percentage
Knowledge		
Poor knowledge(<35)	258	78.2
Good knowledge(≥ 35)	72	21.8
Perception		
Low perception(<74)	72	21.8
High perception(≥ 74)	258	78.2
Total	330	100

There was significant association in knowledge of mothers and the immunization status of children ($p=0.024$). Regarding occupation, non-professional workers were 1.7 times more likely to incomplete immunization than professional workers with the statistically significant p value=0.021. The mothers with poor knowledge are 2.2 times more likely to be incomplete immunization than the mothers with good knowledge. Regarding perception of mothers, the mothers with high perception are 3.4 times less likely to be incomplete immunization than the mothers with low perception. This study found out there was significant association between perception of mothers and immunization status ($p=0.002$) as shown in table 4. Concerning place of immunization, there was strongly significant between accessibility

and immunization status of children ($p<0.001$). The children taken at other places to vaccinate are 3.1 times more likely to be partially immunized than the children immunized in rural health center. In terms of person sent to vaccination post, non-mothers were 2.5 times to be incomplete immunization of their children than mothers. It was strongly significant between person sent to vaccination and the immunization status of children ($p=0.001$) as shown in table 4. There was almost 30% incomplete immunization even with volunteer's help and 11% partially immunized without the help of volunteer. There was 3 times to be partially immunized even with the volunteer's presence. There was strong association between volunteer help and the immunization status of child as shown in table 4 below.

Table 4 Association between study factors and immunization status

Study factors	Total sample	Immunization status				Crude OR (95%CI)	P-value		
		Incomplete		Complete					
		n	%	n	%				
Age groups									
<29	169	51	30.2	18	69.8	1.614(.978-2.665)	0.061		
≥29	161	34	21.2	27	78.9	1			
Study areas									
Urban	165	49	29.6	116	70.3	1.514(0.920-2.491)	0.103		
Rural	165	36	21.8	129	78.2	1			
Ethnicity									
Major ethnic groups (Inntha)	276	70	25.4	206	74.6	1.132(0.588-2.178)	0.711		
Other ethnic groups	54	15	27.8	39	72.2	1			
Occupation									
Non-professional workers	147	47	32	100	68	1.793(1.090-2.950)	0.021*		
Professional workers	183	38	20.8	145	79.2	1			
Knowledge									
Poor(<35)	184	74	28.7	184	71.3	2.230(1.111-4.475)	0.024*		
High(≥35)	72	11	15.3	61	84.7	1			
Perception									
Low(<74)	258	77	29.8	181	70.2	3.403(1.557-7.438)	0.002**		
High(≥74)	72	8	11.1	54	88.9	1			
Places for immunization									
Rural Health Center	214	38	17.8	176	82.2	3.155(1.894-5.255)	<0.001***		
Other places	116	47	40.5	69	59.5	1			
Person sent for vaccination post									
Mothers	257	55	21.4	202	78.6	2.562(1.473-4.456)	0.001***		
Non-mothers	73	30	41.1	43	58.9	1			
Volunteer help									
Yes	243	74	30.5	169	69.5	3.025(1.519-6.024)	0.002**		
No	87	11	12.6	76	87.4	1			

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

After adjusting the confounding factors, table 5 show that the present significant predictors of immunization status of children under 2 years of age. The significant predictors were occupation of mothers, perception of mothers, place of vaccination, person sent for vaccination post and volunteer help. Professional workers were 2.1 times more likely to immunize their child than non-professional workers (95%CI, 1.26-3.76, $p<0.01$). Low perception of mothers were 2.3 times less likely to complete immunization than the mothers with high perception (95%CI, 1.01-5.55, $p<0.05$). The place of immuniza-

tion was strongly significant in this study ($p<0.001$). Person sent to vaccination also significantly associated with immunization status of child ($p<0.01$). The non-mothers who took their children for vaccination are 2.4 times less to complete the immunization than the mothers (95%CI, 1.32-4.34). The children immunized at rural health centers were 2.6 times higher chances of complete immunization than the children immunized other places ($p<0.001$). The volunteer help also involve as a strongest predictor for this study with the significant value (AOR=3.15, $p<0.01$).

Table 5 Predictive factors associated with incomplete immunization (Final model)

Variable	AOR (95%CI)	P value
Occupation		
Non-professional workers	2.180(1.267-3.761)	0.005**
Professional workers	1	
Perception		
Low(<74)	2.373(1.014-5.557)	0.046*
High(≥ 74)	1	
Places for immunization		
Rural Health Center	2.627(1.528-4.515)	<0.001***
Other places	1	
Person sent for vaccination		
Mothers	2.401(1.326-4.349)	0.004**
Non-mothers	1	
Volunteer help		
Yes	3.154(1.472-6.757)	0.003**
No	1	

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

Table 6 Reasons for incomplete immunization (n=330)

Reasons	Number	Percentage
1. Fever	21	6.4
2. Travelling	5	1.5
3. Previous Mumps, Rubella vaccine(National Immunization Days mop-up immunization)	5	1.5
4. Missed visits or place or schedule	47	14.2
5. Migration	2	0.6
6. Few days to term at time of immunization	2	0.6
7. Previous DPT(Diphtheria-Pertussis-Tetanus vaccine)	1	0.3
8. Mother unavailable	1	0.3
9. Diarrhea	1	0.3
10. No reason(complete immunization)	245	74.2
Total	330	100

Discussion

This study found that the incomplete immunization was 25.8% and mostly in urban areas (57.6%) and rural areas (42.4%). The researcher counted timeliness of immunization as one of conditions for complete vaccination for the reason that the timing is very important for the children to get enough immunity to protect the specific disease²⁸. Conversely, timely vaccination coverage for all vaccines were lower than the coverage regardless of timing regardless of timing²⁹. Compared to the studies in Nigeria³⁰ and Pakistan³¹ showed that complete immunization were only 32.4% and 39% respectively. The result of previous study conducted in Yangon, former city of Myanmar was 50% incomplete immunization and also 50% complete immunization in 2009. So, compared to the results of this study, immunization coverage was much improved in 2015. However, there is still

prerequisite to increase the coverage as expected. The reasons for incomplete immunization were exposed as shown in Table 6 above. The reasons for incomplete immunization in urban areas were that the place of immunization was kept changing in every month for the mothers who cannot know the correct place of vaccination to bring their children immunized. In rural areas, the only reason of partially immunized children was difficulty in access of immunization services while most parents used the transportation especially boat which depended mainly on the weather conditions. It reflected that mothers refused to take child to vaccination on times³².

In this study, there is no significant relation between ethnicity and the immunization status of children as expected and results coincide with the studies^{2, 33}. This study contradict with the previous studies which found that the ethnic group had significant

association with immunization status of children^{13, 34}. There is no significant association found between age of mothers with incomplete immunization status of child matched with other studies^{2, 35}. This found out that there is no significant relation between religion and immunization status of children in consistent with several studies^{35, 36}. The occupation display the ample evidence that associated with the incomplete immunization alike with the studies³⁷ and controversial with the study in Myanmar in 2009 and Nepal in 2013. The non-professional workers who had low education and knowledge were mostly farmers, house wives and all kinds of jobs so they had poor concern and unaware of advantages of immunization. Whereas professional workers such as company workers or civil servants who were educated and they utilized the immunization services.

In terms of knowledge, it was statically associated with incomplete immunization. It may be due to vaccine information sheet explained vaccine poorly³⁸. The answers were parallel with present study, respondents answered that the health information not spread to all ethnic groups for immunization and not noticeably reasonable. Nonetheless, other studies shown that no relationship between knowledge and immunization status³⁹. The results of this study showed that there was strongly significant association between perception of mothers and immunization status of children. The association between perception and the incomplete immunization are described as a circle of logical outcome. The low perception mothers were negative attitudes and practices on immunization. This study coincide with the previous study³⁹ but one study from Laos argued that there was no association.

Furthermore, the two independent variables, such as place of immunization and person sent for vaccination were strongly related with the incomplete immunization. The similar outcomes with the previous study in the Yangon 2009 and opposed the results with other studies from the Nepal 2013 and Laos 2011. It can be assumed that mothers who knew their children vaccination schedule and the correct place for immunization than family members, relatives or others. Therefore, the strongest predictor was the volunteer help. Volunteer enhanced public awareness also required for community⁴⁰. Even with the help of volunteer, this study found that the child immunization status was not complete for many reasons. It uncovered that the community trust to volunteers was weak because of the fact that the volunteers were not active in immunization activities in some villages and the information they provided were not up to date. The volunteers are not paid workers till now in Myanmar and they were unavailable to include in all kinds of health activities due to the reason that they engage in other work too to earn money.

Recommendations

The results from the present study showed that occupation, knowledge, perception, place of immunization, person sent to vaccination post and volunteer help were related with the immunization status ($p<0.05$). These findings highlight the following recommendations: 1) Policy makers in department of health should be strengthened the policy focusing more on the comprehensive immunization programs to mountainous areas, 2) Health information department should provide health education program for the advantages of immunization programs to improve the

knowledge and perception of mothers for the benefits of immunization 3) Health information should be well spread to community and minority ethnic groups with their own languages for obviously comprehension and recognition. 4) Places of immunization should be stable and consistent to specific place in urban areas for mothers to remember well 5) Volunteers should have trained well for the active participation in immunization activities and knowledge management for update information about vaccination. Volunteers should be paid workers as well.

Acknowledgements

The authors firstly thank to the Norwegian (NMFA scholarship) for the grant for this study. We are grateful for all the respondents who participated in this study. The authors heartfelt thanks to all health staffs from Nyung Shwe Township for their kind assistance in difficulty transportation and bad weather during data collection. Special thanks to all the rural health centers in that township for supporting the immunization record books for counterchecking.

Conflict of interest

The author declare no conflict of interest.

References

1. Gore P, Madhavan S, Curry D, McClung G, Castiglia M, Rosenbluth SA, et al. Predictors of childhood immunization completion in a rural population. *Soc Sci Med*. 1999;48(8):1011-27.
2. Bondy JN, Thind A, Koval JJ, Speechley KN. Identifying the determinants of childhood immunization in the Philippines. *Vaccine*. 2009;27(1):169-75.
3. Bugvi AS, Rahat R, Zakar R, Zakar MZ, Fischer F, Nasrullah M, et al. Factors associated with non-utilization of child immunization in Pakistan: evidence from the Demographic and Health Survey 2006-07. *BMC public health*. 2014;14(1):232-7.
4. de Timóteo Mavimbe JC, Muquingue HN, Braa J, Bjune G. Immunization coverage in Mozambique: From concepts to decision-making. *Health Policy*. 2006;79(1):92-100.
5. Jani JV, De Schacht C, Jani IV, Bjune G. Risk factors for incomplete vaccination and missed opportunity for immunization in rural Mozambique. *BMC public health*. 2008;8(1):161-6.
6. Babalola S. Determinants of the uptake of the full dose of diphtheria-pertussis-tetanus vaccines (DPT3) in Northern Nigeria: a multilevel analysis. *Matern Child Health J*. 2009;13(4):550-8.
7. Jani JV, Jani IV, Araújo C, Sahay S, Barreto J, Bjune G. Assessment of routine surveillance data as a tool to investigate measles outbreaks in Mozambique. *BMC infect dis*. 2006;6(1):29-32.
8. Henderson DA, Dunston FJ, Fedson DS, Fulginiti VA, Gerety RJ, Guerra FA, et al. The measles epidemic: the problems, barriers, and recommendations. *JAMA*. 1991;266(11):1547-52.
9. Sanou A, Simboro S, Kouyaté B, Dugas M, Graham J, Bibeau G. Assessment of factors associated with complete immunization coverage in children aged 12-23 months: a cross-sectional study in Nouna district, Burkina Faso. *BMC Int Health Hum Rights*. 2009;9(Suppl 1):S10.
10. Henderson RH, Sundaresan T. Cluster sampling to assess immunization coverage: a review of

- experience with a simplified sampling method. Bull World Health Organ. 1982;60(2):253.
11. Cohen R, Havlin S, Ben-Avraham D. Efficient immunization strategies for computer networks and populations. *Phys Rev Lett.* 2003;91(24):247901.
12. Lieber MT, Colden FYC, Colón AL. Childhood immunizations: A parent education and incentive program. *J Pediatr Health Care.* 2003;17(5):240-4.
13. Maekawa M, Douangmala S, Sakisaka K, Takahashi K, Phathammavong O, Xeuatvongsa A, et al. Factors affecting routine immunization coverage among children aged 12-59 months in Lao PDR after regional polio eradication in western Pacific region. *Biosci Trends.* 2007;1(1):43-51.
14. Robison SG. Incomplete Early childhood immunization and missing fourth DTaP Immunization; Missed opportunities and Missed Visits. *ISRN Prev Med.* 2013.
15. Santoli J, Szilagyi P, Rodewald L. Barriers to immunization and missed opportunities. *Pediatric annals.* 1998;27(6):366-71.
16. Streerwand P, Chowdhury A, Ramos-Jimenez P. Quality of vaccination services and social demand for vaccinations in Africa and Asia. *Bull World Health Organ.* 1999;77(9):722-30.
17. Annual Public Health Statistics [press release]. May 2014.
18. Tadesse H, Deribew A, Woldie M. Predictors of defaulting from completion of child immunization in south Ethiopia, May 2008–A case control study. *BMC pub health.* 2009;9(1):150.
19. Paulussen TGW, Hoekstra F, Lanting CI, Buijs GB, Hirasing RA. Determinants of Dutch parents' decisions to vaccinate their child. *Vaccine.* 2006;24(5):644-51.
20. Bowie C, Mathanga D, Misiri H. Poverty, access and immunization in Malawi—a descriptive study. *Malawi Med J.* 2007;18(1):19-27.
21. Vassiliki P, Ioanna K, Artemis V, Eleni K, Aglaia Z, Attilakos A, et al. Determinants of vaccination coverage and adherence to the Greek national immunization program among infants aged 2-24 months at the beginning of the economic crisis (2009-2011). *BMC pub health.* 2014;14(1):1192.
22. Omer SB, Salmon DA, Orenstein WA, deHart MP, Halsey N. Vaccine refusal, mandatory immunization, and the risks of vaccine-preventable diseases. *N Engl J Med.* 2009;360(19):1981-8.
23. Canavati S, Plugge E, Suwanjatuporn S, Sombat-rungjaroen S, Nosten F. Barriers to immunization among children of migrant workers from Myanmar living in Tak province, Thailand. *Bull World Health Organ.* 2011;89(7):528-31.
24. Zhang X, Wang L, Zhu X, Wang K. Knowledge, attitude and practice survey on immunization service delivery in Guangxi and Gansu, China. *Soc Sci Med.* 1999;49(8):1125-7.
25. Angadi M, Jose AP, Udgiri R, Masali K, Sorganvi V. A Study of Knowledge, Attitude and Practices on Immunization of Children in Urban Slums of Bijapur City, Karnataka, India. *J Clin Diagn Res.* 2013;7(12):2803-8.
26. Ministry of Health M. Health in Myanmar 2014.
27. Immunization EPo. EPI Multiyear plan 2012-2016 [2014 Aug 15].
28. Papers WP. Summary of WHO Position Papers - Recommended Routine Immunizations for Children. (updated 30 May 2014).

29. Li Q, Hu Y, Zhong Y, Chen Y, Tang X, Guo J, et al. Using the Immunization Information System to determine vaccination coverage rates among children aged 1–7 years: A report from Zhejiang Province, China. *Int J Environ Res Public Health.* 2014;11(3):2713-28.
30. Fatiregun AA, Okoro AO. Maternal determinants of complete child immunization among children aged 12–23 months in a southern district of Nigeria. *Vaccine.* 2012;30(4):730-6.
31. Usman HR, Akhtar S, Habib F, Jehan I. Redesigned immunization card and center-based education to reduce childhood immunization dropouts in urban Pakistan: a randomized controlled trial. *Vaccine.* 2009;27(3):467-72.
32. Shiyalap K, Siharath D, Chamroonsawasdi K. Maternal utilization of immunization services for their children aged 2-5 years in Sanakham District, Vientiane Province, Lao PDR. *J Pub Health.* 2004;2(3):38-43.
33. Matsuda D. Beliefs about immunization and children's health among childbearing mothers in Nepal. Unpublished Senior Honors Thesis Submitted to the Program in Human Biology, Stanford University. 2002.
34. Dominguez SR, Parrott JS, Lauderdale DS, Daum RS. On-time immunization rates among children who enter Chicago public schools. *Pediatrics.* 2004;114(6):e741-e7.
35. Pandey S, nim Lee H. Determinants of child immunization in Nepal: The role of women's empowerment. *Health Educ J.* 2012;71(6):642-53.
36. Odusanya OO, Alufohai EF, Meurice FP, Ahonkhai VI. Determinants of vaccination coverage in rural Nigeria. *BMC Pub health.* 2008;8(1):381.
37. Mapatano MA, Kayembe K, Piripiri L, Nyandwe K. Immunisation-related knowledge, attitudes and practices of mothers in Kinshasa, Democratic Republic of the Congo. *S Afr Fam Pract.* 2008; 50(2):61-e.
38. Downs JS, de Bruin WB, Fischhoff B. Parents' vaccination comprehension and decisions. *Vaccine.* 2008;26(12):1595-607.
39. Munsawaengsub C, Hlaing EE, Nanthamongkolchai S. Factors influencing immunization status of Myanmar migrant children among 1-5 years in Mahachai District Samutsakorn Province Thailand. *J Med Medical Sci.* 2011;2(9):1093-9.
40. Azubuike MC, Ehiri JE, editors. *Public Health Practice-Action on low immunization uptake.* World Health Forum; 1998: Geneva: World Health Organization, 1980-1998.