

# Health services, pregnancy history and tetanus toxoid vaccination uptake among pregnant women in Cambodia

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## ABSTRACT

**Introduction:** This study aimed to determine the coverage of tetanus toxoid vaccination (TT) among pregnant women in Cambodia, and its association with health services and pregnancy factors.

**Methods:** A cross-sectional study was conducted by utilising the data from the Cambodia Demographic Health Survey (CDHS). The records of 5901 pregnant women who fulfilled the inclusion criteria were reviewed. Multiple logistic regression was used to identify the association on the influence of health services and pregnancy factors on incomplete TT vaccination while controlling other co-variables. Adjusted odds ratio (aOR) and 95% confidence interval (95%CI) was reported.

**Results:** More than one-third of the respondents had incomplete TT vaccination (38.25%, 95%CI: 37.00, 39.48%). Health services as well as pregnancy factors were statistically associated with incomplete TT vaccination such as received antenatal care (ANC) from other health personnel beside midwife (aOR=1.83; 95%CI: 1.49, 2.24), had <ANC visits (aOR=1.76; 95%CI: 1.53, 2.03), being late for the first ANC visit (aOR=1.65; 95%CI: 1.41, 1.92), unwanted pregnancy (aOR=1.30; 95%CI: 1.11, 1.51), aged ≥30 years at delivery (aOR=1.45; 95%CI: 1.15, 1.46) while controlling other factors like; including age, occupation, husband's age, occupation, financial status, maternal age at delivery, birth order, wanted pregnancy and accessing health facility.

**Conclusion:** More than one-third of pregnant women in Cambodia had not completed tetanus toxoid vaccination. Health services and pregnancy related factors had significance role on incomplete tetanus toxoid vaccination.

## KEYWORDS:

*Cambodia, health services, pregnancy history, tetanus toxoid vaccination*

## INTRODUCTION

Maternal and neonatal tetanus is often considered as a silent killer.<sup>1</sup> The World Health Organisation-United Nations Children's Fund (WHO-UNICEF) estimates of tetanus toxoid vaccination coverage in South East Asia for 2013 included Brunei Darussalam (99%), Thailand (99%), Malaysia (97%), Singapore (97%), Indonesia (92%), Philippines (89%), Lao

People's Democratic Republic (87%), Cambodia (86%), Myanmar (75%), and Viet Nam (59%).<sup>2</sup> Maternal tetanus is defined as tetanus that occur during pregnancy or within six weeks after the end of pregnancy. Neonatal tetanus is defined as tetanus that occur within 28 days of life among neonates. Tetanus among neonates usually occur among infant born to unvaccinated mother and infection of unhealed umbilical stump from non-sterile instruments.<sup>3</sup> Worldwide, an estimated number of neonate death was between 180,000 and 300,000 annually.<sup>4</sup> Antenatal care (ANC) practice does not only provided maternal cares but also informs and encourages pregnant women on the advantages of health facility delivery as well as the principle of clean cord care and importance of vaccines.<sup>5,6</sup> ANC provides the convenient opportunity for vaccination among pregnant women. However, expensive expense causes insufficient ANC.

Previous studies and reports indicated a low coverage of tetanus toxoid (TT) in Cambodia. Only 62.4% of pregnant women received two or more TT injection during pregnancy.<sup>7</sup> Many reports and research identified the influence of geographic settings and socioeconomic factors on tetanus coverage. In addition, access to adequate health services was the important factor that affects vaccination. Previous studies found that the distance from home to vaccination providers significantly affected immunisation rates.<sup>8,9</sup> However, those findings provided only the descriptive information.<sup>10</sup> Exploration on the magnitude of the problems and factors associated with incomplete tetanus toxoid is still limited in Cambodia. Therefore, this study aimed to describe tetanus toxoid vaccination pattern and identify the relationships of health services as well as pregnancy factors associated with incomplete tetanus toxoid vaccination among pregnant women in Cambodia. The hope is these findings will be evidence-based health for policymaking and designing intervention programs to improving low tetanus uptake among pregnant women in Cambodia.

## MATERIALS AND METHODS

### Study design

This cross-sectional study was utilised the data of the Cambodian Demographic and Health Survey 2014.

### Population and samples

We performed two-stage cluster sampling method to select the participants which represent the whole pregnant women population. The inclusion criteria were women aged between

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15 and 49 years old, pregnant and gave birth between 2009-2014 and had completed data on tetanus vaccination. There were 5901 records of individuals who were selected for the analysis.

#### Factors of interest

The main outcome variable of this study was tetanus toxoid vaccination uptake (complete/incomplete). Dependent variable was categorised into incomplete TT (coded as 1) referring to had <2-time during their latest pregnancy (no injection or only one doses of TT) against completed TT vaccination (coded as 0) which referred to at least two TT injections. Health services including health insurance, health facility for ANC, health providers, pregnancy factors covering birth order, age at first birth, and wanted pregnancy. Socio-economic factors of which ages of women and spouses, education, financial status was considered as independent factors.

#### Statistical analysis

A simple logistic regression was carried out to identify the association of each independent variable with incomplete tetanus toxoid vaccination uptake. The independent variable that had p-value <0.25 were processed to the multivariable analysis using the multiple logistic regression to identify the association between health services, pregnancy history factors and incomplete tetanus toxoid vaccination when controlling other covariates. The magnitude of association was presented as adjusted odds ratio (aOR), 95% confidence interval (95%CI) and a statistically significant level was p<0.05.

#### Ethical consideration

This study was approved by the Ethics Committee in Human Research of Khon Kaen University, Khon Kaen, Thailand (Reference no. HE622190).

## RESULTS

Among the 5,901 respondents, their average age was 28.78±6.22 years old and almost all were married. About a quarter were illiterate (25.11%), and almost half finished only primary education (49.38%). Their mean age of the spouses was 32.13±7.31 years old. Less than a quarter were from the household with less deficiency wealth category (22.25%), 34.94% were self-employed and 45.42% had spouse working in agricultural sectors. Most of them did not have health insurance (83.83%). Almost all had health services from public health facilities (92.32%) and services provided by midwives. About 80% of respondents had ANC first visit before 12 weeks and received >4 visits. Almost two-third had health expense problems (63.09%) whereas the permission, distance, accompanied person to health facility were not a serious problem. Concerning pregnancy factors, the average age at first birth was 21.77±3.98 years old, whereas the average age at the latest delivery was 27.07±5.96 years old. Most of them wanted to have more children (85.01%). However, half terminated pregnancy by abortion. About two-third had less than two years birth interval from the first delivery. Nearly half made decision on health service utilisation by themselves (41.81%).

As high as 38.25 % (95%CI: 37.00, 39.48) had incomplete tetanus toxoid vaccination during their latest pregnancy (Table I).

Our univariate analysis performed by using simple logistic regressions revealed that independent variables that were potentially associated with incomplete TT were ages of women, education, occupation, financial status, residence, literacy, spouse's age, education, occupation, health insurance, health facility for ANC, first ANC visit, number of ANC visit, accessibility to health services, maternal age at delivery, birth order, wanted pregnancy and terminated pregnancy. The factors that had p-value <0.25 in the bivariate analysis were processed to the multiple variable analysis (Table II).

The multiple logistic regression indicated factors that were statistically associated with incomplete TT was received ANC from other health beside midwife (aOR=1.83, 95%CI: 1.49, 2.24), had less than 4 ANC visits (aOR=1.76, 95%CI: 1.53, 2.03), being late for the first ANC visit (aOR=1.65, 95%CI: 1.41, 1.92) and did not to pregnant (aOR=1.30, 95%CI: 1.11, 1.51), Mother whose ages were 30 years or older at delivery (aOR=1.45, 95%CI: 1.15, 1.46) when controlling other factors including age, occupation, husband's age, occupation, financial status, maternal age at delivery, birth order, wanted pregnancy and accessing health facility (Table III).

## DISCUSSION

This study observed that 38.25% of Cambodian pregnant women had incomplete tetanus toxoid vaccination. Therefore, the proportion of complete TT during pregnancy in this study was similar with many studies reported the coverage of two times TT vaccination during pregnancy was between 33 to 68%.<sup>11-13</sup> Our study also identified the linkage between health service factors and incomplete tetanus toxoid uptake. Those who received ANC provided by other health personnel not midwife were 1.83 times more likely to have incomplete tetanus toxoid than those who got ANC provided by midwife. This finding was similar to other studies which revealed that health care provider was one of the predictors on the coverage of tetanus toxoid vaccination.<sup>14-17</sup> However, another study in rural Bihar reported that having nurse as a provider was the predictor of receiving two TT doses.<sup>17</sup> This may be due to the packages of health services were mostly provided by midwife and nurse especially the ANC.<sup>18</sup> In case of ANC provided by other health personnel beside midwife, they might get the service at private sectors, the pregnant women would have missed the chance to be reminded about the ANC package which included TT vaccination.<sup>19,20</sup> Moreover, the result also indicated that had ANC <4 times and late first ANC visit had influence on incomplete tetanus toxoid. Other studies agreed that ANC was strongly associated with tetanus toxoid immunization among pregnant women.<sup>12,13,21,22</sup> Late first ANC made pregnant women having shorter time to get services, resulted in getting <4 ANC visits. ANC is the source of knowledge to TT injection.<sup>12,21</sup> Therefore, the new recommendation of ANC package is minimum eight time, and the first visit schedule should be taken at least within 12 weeks of gestation.<sup>23</sup> Another finding of this study was that the pregnant women

**Table I: Tetanus toxoid vaccination uptake among pregnant women in Cambodia (n=5,901)**

	Number	Percentage	95%CI
Tetanus toxoid vaccination (During Last Pregnancy)			
At least two time (Complete)	3644	61.75	60.52, 63.00
Less than two time (Incomplete)	2257	38.25	37.00, 39.48

**Table II: Univariate analysis for factors associated with incomplete TT of sample among the pregnant women in Cambodia (n=5900)**

Factors	Number	% Incomplete TT	Crude OR	95%CI	p-value
<b>Socio-Economic Factors</b>					
Age (Year)					0.004
<30	3,406	10.13	1		
≥30	2,495	11.78	1.18	1.00, 1.39	
Educational Attainment					<0.001
≥Secondary school	2,184	5.72	1		
≤Primary school	3,717	13.83	2.64	2.15, 3.23	
Marital status					0.011
Married	5,558	10.56	1		
No Married	343	15.16	1.51	1.11, 2.05	
Occupation					<0.001
With skill	2,428	7.87	1		
Without skill	3,473	12.90	1.73	1.45, 2.07	
Spouse Age					0.001
<35	3,936	9.40	1		
≥35	1,965	13.69	1.52	1.29, 1.80	
Spouse Education					<0.001
≥Secondary school	2,812	6.54	1		
≤Primary school	3,089	10.83	2.46	2.06, 2.95	
Spouse Occupation					<0.001
With skill	3,114	8.54	1		
Without skill	2,787	13.38	1.65	1.40, 1.95	
Financial Status					<0.001
Rich	2,530	6.76	1		
Poor	3,371	13.88	1.22	1.16, 1.27	
Residence					<0.001
Urban	1,628	7.56	1		
Rural	4,273	12.08	1.68	1.36, 2.06	
Literacy					<0.001
Can read some	4,420	8.39	1		
Cannot read at all	1,481	18.10	2.41	2.03, 2.85	
<b>Health Services Factors</b>					
Health insurance coverage					0.037
No	4,947	10.45	1		
Yes	954	12.79	1.25	1.01, 1.55	
ANC first visit					<0.001
Appropriate (<4 month)	4,622	6.38	1		
Late visit (≥4months)	1,279	26.90	5.39	4.54, 6.40	
ANC visit time					<0.001
Adequate (≥4times)	4,391	5.97	1		
Not adequate (<4 times)	1,510	24.97	5.24	4.42, 6.22	
Health Facility for ANC					
Public	5,566	10.82	1		
Private	335	11.04	1.02	0.72, 1.45	
ANC provided by					<0.001
Midwife	5,405	7.97	1		
Beside midwife	496	41.94	8.33	6.79, 10.21	
Accessibility to Health services: permission to go health facility					0.001
No problem	4,656	8.59	1		
Have problem	1,245	11.43	1.37	1.10, 1.70	
Accessibility to Health services: Distance to health facility					<0.001
No problem	3,786	9.88	1		
Have problem	2,115	12.58	1.30	1.10, 1.54	
Accessibility to Health services: Go alone to health facility					<0.001
No problem	3,420	9.50	1		
Have problem	2,481	12.66	1.37	1.17, 1.62	

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**Table II: Univariate analysis for factors associated with incomplete TT of sample among the pregnant women in Cambodia (n=5900)**

Factors	Number	% Incomplete TT	Crude OR	95%CI	p-value
Accessibility to Health services: Getting money for treatment		0.167			
No problem	2,562	10.10	1		
Have problem	3,723	11.25	1.12	0.94, 1.34	
<b>Pregnancy History</b>					
Maternal age 1st birth					<0.001
≥20	4,075	9.18	1		
<20	1,826	14.51	1.67	1.41, 1.98	
Maternal age at delivery					<0.001
<30	4,054	9.52	1		
≥30	1,847	13.70	1.50	1.27, 1.78	
Birth order					<0.001
≥3rd	3,898	8.49	1		
1st & 2nd	2,003	15.38	1.95	1.65, 2.31	
Wanted pregnancy					<0.001
Now	5,015	9.95	1		
Later	886	15.80	1.69	1.38, 2.08	
Interval from marriage to first birth					0.021
≤1year	2,144	9.61	1		
≥2year	3,757	11.53	1.22	1.02, 1.46	
Terminated Pregnancy					0.016
Never	4,222	10.21	1		
Ever	1,679	12.39	1.24	1.04, 1.48	
<b>Social Cultural Factor</b>					
Decide on respondent health care					0.801
Co-decide with partner	3,567	10.46	1		
Decide alone	2,334	11.40	1.10	0.93, 1.30	

**Table III: Multivariable analysis of factors associated with incomplete TT, by using multiple logistic regression (n=5,901)**

Factors	Number	% incomplete TT	Crude OR	Adj OR	95%CI	p-value
<b>Health Services</b>						
ANC provided by						<0.001
Midwife	5,405	35.87	1	1		
Other health personnel beside midwife	496	64.11	3.19	1.83	1.49, 2.24	
ANC visit						<0.001
Adequate (≥4times)	4,391	32.45	1	1		
Inadequate (<4 times)	1,510	55.10	2.55	1.76	1.53, 2.03	
ANC first visit						<0.001
Appropriate(<4months)	4,622	33.10	1	1		
Late visit (≥4 month)	1,279	56.84	2.66	1.65	1.41, 1.92	
<b>Pregnancy History</b>						
Wanted pregnancy						0.001
Now	5,015	36.61	1	1		
Later	886	47.52	1.69	1.30	1.11, 1.51	
Maternal age at delivery						<0.001
<30	4,054	35.42	1	1		
≥30	1,847	44.45	1.45	1.29	1.15, 1.46	

aged 30 years and older for the first delivery were more likely to have incomplete tetanus toxoid uptake. Many studies reported that tetanus immunisation during pregnancy was affected by maternal age at delivery.<sup>11,22,24</sup> It could be due to unwanted pregnancy as well. Unintentional to have baby was associated with ANC contact.<sup>25-27</sup> ANC contact does not only provide maternal cares but also informs on advantages and encouraging health facility delivery, the principle of clean cord care and importance of vaccines.<sup>5,6</sup>

## CONCLUSION

More than one third of pregnant women in Cambodia had incomplete tetanus toxoid vaccination. Health services and pregnancy factors had influences on incomplete tetanus toxoid vaccination. Therefore, maternal health programs especially ANC should be strengthened and more effort put on the readiness of women to be pregnant in terms of information and services.

This study was a cross-sectional analysis that could show only the association. Using secondary, some variables are missing into analysis because of difference objectives and as well as difference data collection.

## CONFLICT OF INTEREST

No conflicts of interest to declare.

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## REFERENCES

- World Health Organization. Protecting all against Tetanus: Guide to sustaining maternal and neonatal tetanus elimination (MNTE) and broadening tetanus protection for all populations Geneva 2019 [cited 2020 17 December,]. Available from: [https://www.who.int/immunization/diseases/tetanus/Protecting\\_All\\_Against\\_Tetanus\\_final\\_draftV4\\_23Jan\\_web.pdf?ua=1](https://www.who.int/immunization/diseases/tetanus/Protecting_All_Against_Tetanus_final_draftV4_23Jan_web.pdf?ua=1).
- World Health Organization. WHO vaccine-preventable diseases: monitoring system. 2020 global summary: World Health Organization; 2020 [cited 2021 10 February,]. [Available from: [https://apps.who.int/immunization\\_monitoring/globalsummar](https://apps.who.int/immunization_monitoring/globalsummar).
- World Health Organization. Tetanus: Key facts 2018 [cited 2019 08 April,]. Available from: <https://www.who.int/news-room/factsheets/detail/tetanus>.
- World Health Organization. Maternal immunization against tetanus: integrated management of pregnancy and childbirth. World Health Organization, Geneva, Switzerland 2014 [cited 2020 17 December,]. Available from: [http://www.who.int/reproductivehealth/publications/maternal\\_perinatal\\_health/immunization\\_tetanus.pdf](http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/immunization_tetanus.pdf).
- World Health Organization. WHO recommendation on tetanus toxoid vaccination for pregnant women 2020 [cited 2020 17 December,]. Available from: <https://extranet.who.int/rhl/topics/preconception-pregnancy-childbirth-and-postpartum-care/antenatal-care/who-recommendation-tetanus-toxoid-vaccination-pregnant-women>.
- Koenig MA, Roy NC, McElrath T, Shahidullah M, Wojtyniak B. Duration of protective immunity conferred by maternal tetanus toxoid immunization: further evidence from Matlab, Bangladesh. *Am J Public Health* 1998; 88(6): 903-7.
- National Institute of Statistics, Directorate General for Health, ICF International. Cambodia demographic and health survey 2014. Phnom Penh, Cambodia, and Rockville, Maryland, USA: National Institute of Statistics, Directorate General for Health, ICF International 2015.
- Abdool Z, Naidoo K, Visser L. Competency level assessment of healthcare practitioners in managing diabetes and diabetic eye disease in the district health system of Limpopo province, South Africa. *African Vision and Eye Health Journal* 2021; 79(1): a569.
- Cao L, Zheng JS, Cao LS, Cui J, Duan MJ, Xiao QY. Factors influencing the routine immunization status of children aged 2-3 years in China. *PLoS One* 2018; 13(10): e0206566.
- Health Achievement in 2017 and Direction for year 2018 Cambodia Ministry of Health: Ministry of Health.; 2018.
- Aljedry ZAHS, Shaib AA, Al-Shamahy HAH, Al-Jaufy AY. Tetanus Immunization among Pregnant Women Coverage Rate and Rate of protection at the time of Delivery. *Universal Journal of Pharmaceutical Research* 2019; 4(1): 12-6.
- Naeem M, Khan MZ-U-I, Abbas SH, Adil M, Khan A, Naz SM, et al. Coverage and factors associated with tetanus toxoid vaccination among married women of reproductive age: a cross sectional study in Peshawar. *J Ayub Med Coll Abbottabad* 2010; 22(3): 136-40.
- Singh A, Pallikadavath S, Ogollah R, Stones W. Maternal tetanus toxoid vaccination and neonatal mortality in rural north India. *PLoS ONE* 2012; 7(11): e48891.
- Strassberg ER, Power M, Schulkin J, Stark LM, Mackeen AD, Murtough KL, et al. Patient attitudes toward influenza and tetanus, diphtheria and acellular pertussis vaccination in pregnancy. *Vaccine* 2018; 36(30): 4548-54.
- Pathirana J, Nkambule J, Black S. Determinants of maternal immunization in developing countries. *Vaccine* 2015; 33(26): 2971-7.
- Wilson RJ, Paterson P, Jarrett C, Larson H. Understanding factors influencing vaccination acceptance during pregnancy globally: a literature review. *Vaccine* 2015; 33(47): 6420-9.
- Thind A. Determinants of tetanus toxoid immunization in pregnancy in rural Bihar. *Trop Doct* 2005; 35(2): 75-7.
- Guidelines on Minimum Package of Activities For Health Center Development 2008 -2015. Phnom Penh, Cambodia: Ministry of Health; 2007.
- World Health Organization. WHO vaccine-preventable diseases: monitoring system: 2016 global summary. Geneva: World Health Organization; 2016.
- World Health Organization. WHO recommendations on maternal health: guidelines approved by the WHO Guidelines Review Committee. Geneva: World Health Organization; 2017.
- Rooshermiatie B, Nishiyama M, Nakae K. Factors associated with TT (tetanus toxoid) immunization among pregnant women, in Saparua, Maluku, Indonesia. *Southeast Asian J Trop Med Public Health* 2000; 31(1): 91-5.
- Maral I, Baykan Z, Aksakal F, Kayikcioglu F, Bumin M. Tetanus immunization in pregnant women: evaluation of maternal tetanus vaccination status and factors affecting rate of vaccination coverage. *Public Health* 2001; 115(5): 359-64.
- World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience: World Health Organization; 2016.
- Rahman M. Tetanus toxoid vaccination coverage and differential between urban and rural areas of Bangladesh. *East Afr J Public Health* 2009; 6(1): 26-31.
- Sibiya M, Ngxongo T, Reddy P, Ghuman S, Borg D, O'Connor L. Timing of first antenatal care attendance and associated factors among pregnant women in an obstetric health facility in eThekweni district, KwaZulu-Natal Province, South Africa. *African Journal for Physical Activity Health Sciences* 2018; 24(2): 181-92.
- Gebremeskel F, Dibaba Y, Admassu B. Timing of first antenatal care attendance and associated factors among pregnant women in Arba Minch Town and Arba Minch District, Gamo Gofa Zone, South Ethiopia. *J Environ Public Health* 2015; 2015: 971506.
- Alemu Y, Aragaw A. Early initiations of first antenatal care visit and associated factor among mothers who gave birth in the last six months preceding birth in Bahir Dar Zuria Woreda North West Ethiopia. *J Reprod Health* 2018; 15(1): 203.