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Tetanus Toxoid Injection During Last Pregnancy Among Women in Reproductive Age in Nepal

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Abstract: Tetanus toxoid injection is important as one mandatory vaccine for pregnant women to prevent maternal and neonatal tetanus. This study purposed to examine the barriers of not receiving tetanus toxoid vaccine among women of reproductive age in Nepal. This study used the secondary data using "Multiple Indicators Clusters Survey" round 6 in 2019. Total sample of this study are 2,494 women of reproductive aged 15 to 49 years. The data analysis was done for univariate, bivariate, and multivariate using binary logistic regression. The results in this study revealed that increasing child ever born (CEB) as the main predictor for not receiving TT vaccine, following by higher educational level and wealth index. In conclusion, the TT vaccine is a critical intervention to prevent maternal and neonatal tetanus. Understanding the determinants of TT vaccination coverage, ensuring accessibility to the vaccine, and addressing knowledge gaps among pregnant women are essential for improving TT vaccination rates during pregnancy.

Keywords: Nepal; Pregnant Women; Tetanus Toxoid

Introduction

Tetanus toxoid (TT) vaccination is crucial in developing countries, particularly for pregnant women, to prevent maternal and neonatal tetanus. There is evident that tetanus toxoid (TT) vaccination during pregnancy is a crucial preventive measure to protect both the mother and the newborn from tetanus. The World Health Organization (WHO) recommends the TT vaccine for pregnant women in many countries (Yaya et al., 2020). The vaccine has been shown to be effective in preventing maternal tetanus deaths (Nguegang et al., 2021; Awosan & Hassan, 2018). In addition, maternal immunization with TT-containing vaccines is a cornerstone in preventing both maternal and neonatal tetanus (Islam et al., 2022). It is crucial for pregnant women to receive the TT vaccine to ensure immunity against tetanus for both themselves and their newborns (Shaikh, 2022; Jamil et al., 2022).

Several studies have highlighted the determinants and predictors of TT vaccination coverage during pregnancy. Factors such as iron uptake during pregnancy, living standards, and access to healthcare services have been associated with the odds of poor TT immunization(Doraivelu et al., 2019; El-Adham et al., 2022; Liyew & Ayalew, 2021; Coleman et al., 2022; Wales et al., 2020). Furthermore, knowledge about tetanus and the TT vaccination has been identified as a crucial determinant of TT vaccination use among pregnant women (Chanie et al., 2021; Merritt et al., 2020; Tseng et al., 2022).

The safety and immunogenicity of the TT vaccine during pregnancy have also been addressed. There is no evidence to indicate that TT administered during pregnancy is teratogenic (Khodr et al., 2017; Dhia & Biaee, 2017; Liang et al., 2018). Moreover, the TT vaccine has been coadministered with other vaccines during pregnancy, such as the tetanus, diphtheria, and acellular pertussis (Tdap) vaccine, to confer passive immunity to

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infants for the first several months of life (Egan et al., 2023; Oduyebo et al., 2022; Khan et al., 2018). In Ethiopia, studies have highlighted determinants of poor TT immunization, emphasizing the need for improved vaccination uptake among mothers who recently gave birth (Gebremedhin et al., 2020; Zhang et al., 2022).

Additionally, factors affecting maternal tetanus vaccination in Egypt have been explored, shedding light on the challenges and barriers to vaccination in developing country settings (Ahmed & El-Berrawy, 2019). Furthermore, a systematic review and meta-analysis in Ethiopia emphasized the importance of TT vaccination coverage among childbearing women, providing insights into associated factors and the need for improved vaccination strategies(Nigussie et al., 2021; Zhou et al., 2023). These studies collectively underscore the significance of TT vaccination in developing countries and the necessity for targeted interventions to enhance vaccination uptake among pregnant women.

The research in Ethiopia has identified determinants of vaccination dropout among children, emphasizing the importance of maternal TT vaccination in completing the vaccination schedule for children (Chanie et al., 2021; Kharbanda et al., 2016; Yu et al., 2016). This highlights the indirect benefits of maternal TT vaccination on childhood immunization, further emphasizing its importance in developing country contexts. Overall, these studies underscore the critical role of TT vaccination in developing countries, particularly for pregnant women, and emphasize the need for targeted strategies to improve vaccination coverage and uptake in these settings.

The barriers to receiving the tetanus toxoid (TT) vaccine, particularly among pregnant women in developing countries, have been a subject of research. Studies have highlighted determinants of vaccination dropout among children, revealing that mothers who hadn't received TT vaccination during pregnancy were less likely to complete vaccination than those who received tetanus toxoid vaccination (Chanie et al., 2021; Sato & Fitan, 2020). Additionally, research in The Gambia has shown that the current utilization rate for adequate intermittent preventive treatment with sulfadoxine-pyrimethamine and tetanus toxoid immunization during pregnancy is very low, indicating challenges in achieving universal levels of vaccination (Barrow et al., 2022; O'Leary et al., 2018; Shafiq et al., 2017).

Furthermore, a study in Egypt emphasized the importance of determining the barriers of maternal TT vaccination in developing countries to strengthen the program and improve maternal and newborn health(Ahmed & El-Berrawy, 2019; Togora et al., 2014). In Ethiopia, knowledge and uptake of the TT vaccine among reproductive age women have been assessed, revealing that barriers to access, especially to the monovalent tetanus vaccine, pose challenges in achieving universal coverage of the vaccine(Gelaw et al., 2022; Xu et al., 2021; Teshale & Tesema, 2020). Moreover, regional disparities have been identified as contributing to the coverage of the tetanus toxoid vaccine among women aged 15–49 years in Indonesia, indicating that geographical factors may act as barriers to vaccination(Arifin et al., 2021).

The determinants of TT vaccine uptake among pregnant women in Sudan have been investigated, shedding light on factors associated with maternal TT vaccination, which can provide insights into the barriers to vaccination in similar settings(Ibrahim et al., 2023). Additionally, a study in Pakistan has shown that increasing the frequency of antenatal care visits may improve tetanus toxoid vaccination coverage in pregnant women, suggesting that healthcare access and utilization play a crucial role in vaccination uptake (Iqbal et al., 2020; Sherley & Newton, 2020). This study aimed to examine the factors associated with barriers to access Tetanus Toxoid (TT) injection among women of reproductive age in Nepal.

Method

Multiple Indicator Cluster Survey 2019 in Nepal was done by collaboration between Government of Nepal, National Planning Commission, Central Bureau of Statistics, and United Nations Children's Fund. This current study used secondary data from Multiple Indicators Cluster Survey (MICS) 6 which is nationally representative for urban-rural of seven provinces. MICS utilizes Computer-Assisted Personal Interviewing (CAPI) and the data collection application was based on the CSPro (Census and Survey Processing System) software version 6.3.

The fieldwork was done from May to November, 2019. The dataset is available at https://mics.unicef.org/surveys and can be accessed after registration is approved. The ethical approval was accepted by Nepal Central Bureau of Statistics (CBS) as per the Statistical act (1958) in September 2018. The unit of analysis of this study are women of reproductive aged 15 to 49 years old with total eligible respondents were 2,494 women. The dependent variables of this study are ever received tetanus toxoid injection during last pregnant (yes/no). The independent variables include age group, educational level, wealth index, marital status, ownership of health insurance, child ever born and place of residence. The analysis was done using univariate, bivariate (using Chi-Square test), and multivariate using binary logistic regression. The data analysis was tested using STATA software version 17.

Result and Discussion

The results in this study consisted of univariate, bivariate (using Chi-Square test), and multivariate analysis (using Binary Logistic Regression). Table 1 below describes the univariate analysis as general characteristics of the respondents.

Table 1. General characteristics of the respondents

Variables (n = 2,494)	Frequency	Percentage
Any tetanus toxoid injection during last pregnancy		
Yes	2,346	94.07
No	146	5.93
Age group		
15-19	248	9.94
20-24	940	37.69
25-29	736	29.51
30-34	386	15.48
35-39	130	5.21
40-44	34	1.36
45-49	20	0.80
Marital status		
Currently married	2,488	99.76
Formerly married	6	0.24
Educational level		
None	497	19.93
Basic	760	30.47
Secondary	1,033	41.42
Higher Secondary	204	8.18
Wealth index		
Poorest	722	28.95
Second	525	21.05
Middle	472	18.93
Fourth	471	18.89
Richest	304	12.19
Place of residence		
Urban	1,374	55.09
Rural	1,120	44.91
Have health insurance		
Yes	125	5.01
No	2,369	94.99
Child ever born		
One or two children	1,876	75.22
More than two children	618	24.78

It was revealed among 2,494 women of reproductive age, around 6% of them did not receive the tetanus toxoid (TT) injection during their last pregnancy. According to their age, the majority of them were in aged 20 to 24 years old (37.69%). Almost all of them were currently married during the survey time (99.76%), graduated from secondary school (41.42%), poorest wealth index (28.95%), residence in urban area (55.09%), not having health insurance (94.99), and have one or two children ever born (75.22%).

Table 2 below shows the correlation between all independent variables with TT injection. It was found that some variables including age group, educational level, wealth index, and number of children ever born have significantly associated with TT injection. However, others independent variables including marital status, place of residence, and health insurance ownership did not significantly associate with TT injection.

The multivariate analysis results (Table 3) showed below revealed that the respondents who graduated from basic, secondary, and higher secondary were decrease the likelihood for not receiving TT injection by 46%, 77%, and 93%, respectively. Moreover, those who from household with middle, fourth, and richest wealth index also decrease the tendency for not receiving TT injection by 51%, 52%, and 72%, respectively.

Table 2. The correlation between each predictors and TT injection

Characteristics	Yes	No	Total
Age group***			
15-19	236 (95.16)	12 (4.84)	248 (100)
20-24	896 (95.32)	44 (4.68)	940 (100)
25-29	702 (95.38)	34 (4.62)	736 (100)
30-34	349 (90.41)	37 (9.59)	386 (100)
35-39	114 (87.69)	16 (12.31)	130 (100)
40-44	32 (94.12)	2 (5.88)	34 (100)
45-49	17 (85.00)	3 (15.00)	20 (100)
Marital status			
Currently married	2,341 (94.09)	147 (5.91)	2,488 (100)
Formerly married	5 (83.33)	1 (16.67)	6 (100)
Educational level***			
None	424 (85.31)	73 (14.69)	497 (100)
Basic	710 (93.42)	50 (6.58)	760 (100)
Secondary	1,009 (97.68)	24 (2.32)	1,033 (100)
Higher Secondary	203 (99.51)	1 (0.49)	204 (100)
Wealth index***			
Poorest	649 (89.89)	73 (10.11)	722 (100)
Second	493 (93.90)	32 (6.10)	525 (100)
Middle	450 (95.34)	22 (4.66)	472 (100)
Fourth	454 (96.39)	17 (3.61)	471 (100)
Richest	300 (98.68)	4 (1.32)	304 (100)
Place of residence			
Urban	1,302 (94.76)	72 (5.24)	1,374 (100)
Rural	1,044 (93.21)	76 (6.79)	1,120 (100)
Have health insurance			
Yes	121 (96.80)	4 (3.20)	125 (100)
No	2,225 (93.92)	144 (6.08)	2,369 (100)
Child ever born ***			
One or two children	1,810 (96.48)	66 (3.52)	1,876 (100)
More than two children	536 (86.73)	82 (13.27)	618 (100)

According to child ever born, women with more than two children ever born were 2.27 times more likely

for not receiving TT injection compared to women with one or two children. However, other predictors such as age group, marital status, place of residence, and ownership of health insurance did not show any significancy to receiving TT injection. Pseudo R2 for the model is 0.1221 which means that the model 12.21% explains the receiving TT injection.

Table 3. The binary logistic regression analysis

Variables (n = 2,494)	Received tetanus toxoid injection		
	Adj. OR	95% Conf. interval	p-value
Age group			
15-19 (ref)			
20-24	0.86	0.44 – 1.69	0.668
25-29	0.64	0.31 – 1.34	0.237
30-34	0.86	0.40 – 1.88	0.709
35-39	0.91	0.37 – 2.23	0.841
40-44	0.28	0.06 – 1.45	0.131
45-49	0.62	0.14 – 2.65	0.516
Marital status			
Currently married (ref)			
Formerly married	2.12	0.17 – 25.92	0.555
Educational level			
None (ref)			
Basic	0.54	0.36 – 0.82	0.004
Secondary	0.23	0.13 – 0.40	0.000
Higher Secondary	0.07	0.01 – 0.55	0.011
Wealth index			
Poorest (ref)			
Second	0.67	0.42 – 1.05	0.083
Middle	0.49	0.29 – 0.82	0.006
Fourth	0.48	0.27 – 0.86	0.013
Richest	0.28	0.09 – 0.83	0.021
Place of residence			
Urban (ref)			
Rural	0.76	0.53 – 1.10	0.150
Have health insurance			
Yes (ref)			
No	1.08	0.37 – 3.13	0.882
Child ever born			
One to two children (ref)			
More than two children	2.27	1.46 – 3.56	0.000

Pseudo R2 = 0.1221, Log likelihood = -492.97

Similarly, in Sierra Leone, women with primary and higher educational levels had lower odds of receiving TT immunization compared to those with no formal education (Yaya et al., 2020). Moreover, in Ethiopia, it was reported that women whose husbands had a secondary or tertiary educational status were more likely to take TT protective dose immunization compared to those with lower educational levels (Gessesse et al., 2021).

The influence of education on vaccination decisions has been a subject of interest in various contexts. Research has shown that lower education levels can act as a barrier to vaccine acceptance, as evidenced by studies on COVID-19 vaccination in Saudi Arabia (Al-Gethami et al., 2021; Bagalb et al., 2022). Additionally, the impact of healthcare provider recommendations on vaccination decisions has been highlighted, with pregnant women being more likely to receive pertussis or influenza vaccination when recommended by healthcare providers (Kilich et al., 2020).

Furthermore, the coverage of tetanus toxoid immunization among childbearing women was reported to be low in Ethiopia, indicating potential gaps in vaccination uptake related to educational disparities (Nigussie et al., 2021). Similarly, in Pakistan, increasing the frequency of antenatal care visits was associated with improved tetanus toxoid vaccination coverage among pregnant women, suggesting the importance of healthcare access and utilization in vaccination uptake (Iqbal et al., 2020).

Overall, the evidence suggests that the education level of pregnant women plays a significant role in their decision-making regarding TT vaccination. Addressing educational disparities and enhancing knowledge through targeted health education interventions may be crucial in improving vaccination coverage among pregnant women. Based on the provided references, the wealth index has been identified as a significant determinant of tetanus toxoid (TT) vaccine uptake among pregnant women. Studies have shown that a higher wealth quintile is associated with increased odds of receiving TT immunization (Anatea et al., 2018; Yaya et al., 2020).

For example, a study in Sierra Leone found that a higher wealth quintile increased the odds of receiving TT immunization (Yaya et al., 2020). Similarly, in Ethiopia, it was reported that women's wealth index can impose variations in immunization coverage, indicating the influence of economic status on vaccination uptake (Anatea et al., 2018). Additionally, research in Sudan revealed that about 40% of pregnant women received three or more doses of the TT vaccine, indicating potential disparities in vaccination coverage related to wealth status (Ibrahim et al., 2023).

Furthermore, the urban-rural differential in the association between the household wealth index and anemia among women of childbearing age in Ethiopia has been investigated, highlighting the influence of economic status on health outcomes (Assefa et al., 2020). Additionally, a study in northwest Ethiopia reported that women residing in urban areas were more likely to have TT protective dose immunization compared to their rural counterparts, indicating potential disparities

in vaccination coverage based on residential location and economic status (Gessesse et al., 2021).

Overall, the evidence suggests that the wealth index plays a significant role in the uptake of the TT vaccine among pregnant women. Addressing economic disparities and ensuring equitable access to vaccination services may be crucial in improving vaccination coverage among pregnant women, particularly in developing country settings. Based on the provided references, the number of children ever born to women has been associated with the uptake of the tetanus toxoid (TT) vaccine during pregnancy. A study in Sierra Leone reported that the prevalence of receiving TT immunization during women's last pregnancy was 96.3%, and that of taking at least two doses was 82.12% (Yaya et al., 2020).

Additionally, a study in Sudan found that about 40% of pregnant women received three or more doses of the TT vaccine, suggesting that women with multiple children may have higher vaccination coverage. Furthermore, a study in Ethiopia reported that the utilization of TT immunization was 39.2% (Anatea et al., 2018), indicating that the number of children ever born may influence vaccination uptake among reproductive-age women.

The association between the number of children ever born and TT vaccination coverage may be influenced by various factors, including the cumulative exposure to antenatal care services, maternal awareness of the importance of vaccination, and healthcare-seeking behavior. Additionally, the role of healthcare provider recommendations and the influence of social and cultural factors on vaccination decisions may also contribute to the observed association.

According to results of this study, the children ever born is the most influencing factor associated with prevalence of TT injection, following by educational level, and wealth index. It can be reflexed that information about importance of TT vaccine is crucial to be provided with free of charge. Also, the awareness of women who have children more than two to still regularly go to health centre for antenatal care.

Conclusion

In conclusion, the TT vaccine is a critical intervention to prevent maternal and neonatal tetanus. Understanding the determinants of TT vaccination coverage, ensuring accessibility to the vaccine, and addressing knowledge gaps among pregnant women are essential for improving TT vaccination rates during pregnancy. As found in this study, increasing educational level and wealth index can improve the prevalence of TT vaccine. Moreover, having more children ever born can increase for not receiving TT vaccine. Further study can include more potential predictors and add with qualitative study to provide more elaboration of barriers for receiving TT vaccine. This study cannot be generalized to other setting and time different as well as the limitation of predictors due to using secondary data.

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