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Immunization Coverage of Pregnant Women with Tetanus Toxoid Vaccine in Dormaa East District-Brong Adaro Region, Ghana

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Abstract

This paper examines the immunization coverage of Tetanus toxoid vaccine in the Dormaa East District and then assesses the reasons for the low coverage in the district as to whether it is as a result of the attitude of health staff, knowledge of beneficiaries on its importance or the accessibility of the health facilities.

Our findings suggest that, most beneficiaries fail to get immunized due to the reasons that they are not treated well by health workers on their visit to the immunization Centres. The beneficiaries are also unaware of when to be immunized and do not see the relevance of being immunized. Getting access to the vaccination centre is another cause for dropping-out in the course of immunization.

It is recommended to the stakeholders to design and implement appropriate and relevant immunization programmes that will serve to improve EPI service utilization in the Dormaa East District Health Administration by embarking on routine educational campaign at both antenatal and postnatal sessions and child welfare clinics. There is the need to stress on the total number of times mothers need to visit the clinic to complete the immunization and the importance of being immunized.

Also mother's immunization for tetanus toxoid vaccine should be given equal attention by all health workers just like the immunization for their children during antenatal care attendance.

The health staffs should also try making the beneficiaries feel good when they appear for their service. Enough immunization service centers should be made available close to the various communities to enable the people get quick access to it.

Keywords: maternal and neonatal tetanus, Tetanus Toxoid immunization and regression analysis.

1. Introduction

Neonatal tetanus (NNT) is an acute disease presenting initially with loss of ability to suck, followed by generalized rigidity and painful muscle spasms as the disease progresses. The disease is caused by tetanus toxin produced by Clostridium tetani. The commonest port of entry for the tetanus spores is the unhealed umbilical cord. Most (90%) cases of neonatal tetanus develop symptoms during the first 3–14 days of life with the majority presenting at 6–8 days. Mortality tends to be very high in the absence of medical treatment where case of fatality approaches 100%, with hospital care 10–60% of NT cases dies, depending on the availability of intensive care facilities (Roper et. al, 2007).

Roper et al.(2007) presented neonatal tetanus as a consequence of unsafe umbilical cord care practices and according to Odent (2008), it should rather be presented as a complication of an intervention; early cord cutting. If there is no rush to intervene, some hours later the cord becomes thin, dry, hard, and is ensanguined. Then, it can be cut without any need for cord care practices and the risk of neonatal tetanus is eliminated.

Cord cutting is originally a ritual inseparable from myths (eg, the widespread belief that the colostrum is harmful) that lead to early mother-newborn separation. If it were possible to neutralize the effects of such deep-rooted beliefs and rituals, there would be no excuse to separate the neonate from the mother (Odent, 2008).

Maternal tetanus is defined as tetanus during pregnancy, or within 6 weeks of the end of pregnancy (whether pregnancy ended with birth, miscarriage, or abortion), and has the same risk factors and means of prevention as neonatal tetanus. In the early 1990s it was estimated to account for about 5% of maternal mortality, or 15,000 – 30,000 deaths every year (Fauveau et al. 1993; WHO et. al 2000). In 1999, the elimination of maternal tetanus

was added to the goals of the elimination programme for neonatal tetanus, and the initiative was renamed the Maternal and Neonatal Tetanus Elimination Program (WHO et al., 2000)

Maternal and neonatal tetanus (MNT) are important causes of maternal and neonatal mortality, claiming about 180 000 lives every year in 48 developing countries which are in Africa and Asia. In these countries maternal and neonatal tetanus persist as public-health problem although the disease could be prevented by maternal immunization with tetanus toxoid vaccine, and aseptic obstetric and postnatal umbilical-cord care practices (Roper et. al, 2007).

Neonatal tetanus was estimated to be responsible for over half a million neonatal deaths globally in early 1980s (Roper et. al, 2007) and Estimates suggest that these deaths have been reduced, but still some 130,000 babies died around the year 2004 from this very preventable disease (WHO, 2004). Most of the deaths from neonatal tetanus occur in a limited number of large countries with low coverage of facility births and tetanus toxoid immunization.

The high number of maternal deaths in some areas of the world reflects inequities in access to health services, and highlights the gap between rich and poor. Almost all maternal deaths (99%) occur in developing countries. More than half of these deaths occur in sub-Saharan Africa and almost one third occur in South Asia.

The maternal mortality ratio in developing countries is 240 per 100 000 births versus 16 per 100 000 in developed countries (Conde-Agudelo et al., 2004; Patton et. al., 2009). There are large disparities between countries, with few countries having extremely high maternal mortality ratios of 1000 or more per 100 000 live births. There are also large disparities within countries, between people with high and low income and between people living in rural and urban areas. The risk of maternal mortality is highest for adolescent girls under 15 years old (Conde-Agudelo et al., 2004; Patton et al., 2009).

1.1 Intervention

Tetanus toxoid vaccination of pregnant women to prevent neonatal tetanus was included in WHO's Expanded Program on Immunization (EPI) a few years after its inception in 1974. By contrast with the notable gains in child immunization achieved in the 1980s, only 27% of pregnant women were receiving at least two doses of tetanus toxoid by 1989 (WHO, 1994). In recognition of the substantial burden of neonatal tetanus in developing countries, the 1989 World Health Assembly (WHA) adopted a resolution to eliminate neonatal tetanus by 1995, through the increased availability of tetanus toxoid and clean deliveries, and improved surveillance (WHO, 1990; WHO and WHA 1989). The elimination of neonatal tetanus was defined as less than 1 case per 1000 livebirths in every district (WHO, 1993).

Tetanus vaccine is an inactivated toxin (toxoid) that was produced in 1924 and became commercially available in 1938. In the late 1940s, it was combined with diphtheria and pertussis vaccines to produce the DTP triple vaccine used in many childhood immunization programmes. Tetanus toxoid was administered in two or more doses during pregnancy to prevent neonatal tetanus and in the mid-1970s, tetanus toxoid vaccination was included in the WHO's Expanded Programme on Immunization (Schofield et al, 1961). Base on the latest WHO and UNICEF global estimates, the vaccine MNT was introduced as part of routine immunization in over 1000 countries by the end of 2009 (WHO,2008).

1.2 Immunization Coverage and its affected factors

GHS (2002) reported that in spite of several attempts over the years to improve EPI, the national immunization coverage has been low and WHO (2004) found that geographical access to immunization services is one of the key challenges confronting the programme in Ghana. The most affected are those that share the Volta Basin. These are the Volta, Eastern, Ashanti, BrongAhafo and Northern Region. Apart from the Volta Basin, other regions have areas or districts that are not adequately covered by immunization due to access difficulties.

To assess the causes of low tetanus toxoid (TT) vaccination coverage in pregnant women a mixture of quantitative and qualitative methods are adopted and Sheikh (2007) found out that out of random sample of 362 women who had delivered during the previous 3 months, 87% recalled receiving 2 doses of TT. The reason for non-vaccination was poor knowledge about the importance of TT (32% of women) or the place and time to get vaccinated (18%). The low coverage was due to lack of awareness about the importance of vaccination among the public and misconceptions about TT vaccination.

Manjunath and Pareek (2003) studied on immunization coverage based on Knowledge, Attitudes, Perceptions and Expectations and their results showed that majority of the mothers expressed favorable attitudes and satisfaction regarding the programme. Though many are aware of the importance of vaccination in general, specific information about importance of completing the schedule and knowledge about vaccine preventable

diseases other than poliomyelitis is very limited. Accessibility, misconceptions and beliefs among the mothers of partially immunized children and lack of information among not at all immunized group are the main reasons of non-immunization. It is deduced that enhancing the maternal knowledge about the vaccine preventable diseases, the importance of completing the immunization schedule through interpersonal mode and overcoming accessibility problems would improve immunization coverage (Manjunath and Pareek, 2003).

The most essential element of every immunization encounter is to treat the caretaker or client with respect, explain when and where to return or the next vaccination date. Most of the reasons for drop out can be solved, if only health workers communicate correct messages to caretakers and communities and have good attitude (GHS, 2000). Some people do not go for next immunization because they are dissatisfied with the services they have received for such reasons as rudeness on the part of service provider and unauthorized fees charged by health workers (GHS, 2003).

GHS (2005) report indicated those barriers such as inadequate understanding of immunization and insufficient demand for immunization services by families and communities, limited access to immunization services for communities in hard-to-reach areas, inadequate numbers of health staff to provide services to very large and scattered communities have hampered the delivery of services to many target populations.

In Ghana, general performance in recent years in immunization as measured by Penta III coverage dropped from 89.3% in 2009 to 87.1 % in 2010. The drop in coverage was in all the regions with the exception of Ashanti Region. Neonatal mortality has shown little decline and there is the need to concentrate efforts in reducing this further (GHS, 2010). An assessment of the activities of the programme therefore is vital in realizing the extent to which the immunization service, which is regarded as a child survival intervention, is being utilized by the target population in the respective districts.

This paper intends to assess possible reasons that might account for the low immunization coverage of tetanus toxoid vaccine among pregnant women in Brong-Ahafo Region, Ghana in particular the Dormaa East District, using regression analysis. This paper we hope, will serves as a source of information for district health managers for health planning activities and other stakeholders in the reformulation of strategies where necessary to achieve set targets.

1.3 Research Questions

1. What are the coverage levels and drop-out rates for recommended antigens?
2. What is the knowledge level of pregnant women on tetanus immunization?
3. What is the level of accessing tetanus immunization services in the district?
4. What is the attitude of health staff toward pregnant women?
5. What ways is tetanus immunization status of pregnant women recorded?

2. Method

Multiple linear regression was used to analyze the reasons that amount to the low immunization coverage of tetanus toxoid vaccine in the Dormaa East District based on the primary data collected using a designed questionnaire.

The administration of the questionnaire was done randomly to pregnant women in the various health centers visited. The questionnaire, which is structured based on the objective of the study is in English and was translated into the local language of the community where necessary in order to get the clear view of the respondents.

The study population included all pregnant women and women with children less than 24 months within the catchments area of the District. The sampling frame comprised pregnant and nursing mothers with children under-24 months who have been registered for the immunization.

Multi – stage sampling technique was applied because the populations have been divided in clusters; each of the clusters is again sub-divided into required and manageable groups before the sample is extracted. The district was divided into three sub-districts and simple random sampling technique was used to select two (2) communities from each of the sub-districts. In each district, names of large communities were written on equal sized papers, folded and thoroughly shaken to avoid bias in the selection process.

Purposive sampling method was used to select one major clinic from the six selected communities and the first fifty (50) pregnant women and women with children 0-24 months who were met at the first visit were selected

for the questionnaire administration. In all response were sought from three hundred pregnant (300) women and other women with children 0-24 months.

2.1 Regression Analysis

Regression analysis is a statistical technique for estimating the relationships among variables. It includes many techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. Thus regression analysis is used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships

If a regression function is linear in the parameters we term it a linear regression model, otherwise, the model is called non-linear. Linear regression models with more than one independent variable are referred to as multiple linear models (Scot, 2012).

Linear Regression Model

In linear regression for modeling say n data points, there is always one independent x_1 and two parameters β_0 *and* β_1, and then an error term ε given by

$$y = \beta_0 + \beta_1 x_1 + \varepsilon \quad (1)$$

Multiple Linear Regression Models

The general formula for multiple linear regressions is given by

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta x_p + \varepsilon \quad (2)$$

Where

y = is termed the "dependent" or "endogenous" variable;

β_0 = the constant

$\beta_1, \beta_2, \beta_3 \ldots \beta_p$ the effects of the independent variable on the dependent variable.

x_1, Table 1 below shows the frequency distribution of how the beneficiaries responded in the survey. x_2, $x_3 \ldots x_p$ are termed the "independent," "explanatory," or "exogenous "variables;

and ε = the general error term.

2.1.1 Underlying Assumption

Classical assumptions for regression analysis include:

- The sample is representative of the population for the inference prediction
- The error is a random variable with a mean of zero conditional on the explanatory variables
- The independent variables are measured with no error
- The predictors are linearly independent
- The errors are uncorrelated
- The variance of the error is constant across observations

These assumptions imply that the parameter estimates will be unbiased, consistent and efficient in the class of linear unbiased estimators. It is important to note the actual data rarely satisfies the assumptions (Fotheringham and Wong, 1991).

Diagnostics

Once regression model has been constructed, it may be important to confirm the goodness of fit of the model and the statistical significance of the estimated parameters. Commonly used checks of goodness of fit include R-squared, analyses of the pattern of residuals and hypothesis testing. Statistical significance can be checked by an F-test of the overall fit followed by t-test of individual parameters.

3. Results and Discussion

This section will discuss the findings from the primary data collected and the analysis of the results. Analysis will be made up of descriptive statistics and regression.

Preliminary Analysis is performed to verify as to whether there is missing data, incorrect type and coding of data and cross-checked after entering them for analysis.

3.1 Frequency Distribution of Respondents

Based on the findings, 34% were between the ages of 20-29 years. The least contribution came from those who are forty and above age, i.e. 7.3%. It was found that, 46.7% of the beneficiaries are married and 41% of them are not, 3.7% have been divorced and 3.0% are widowed. Majority of the respondents have very little educational background, i.e. 59.7% of them have only achieved junior high certificate, 23.7% have senior high certificate, 3.7 have tertiary certificate and 13% have none. On the employment status, 59.3% are unemployed, 15.3% are self-employed, and 9% are salary workers.

Table 1: Frequency Distribution of Respondents

Variables	**Frequency**	**Percent**	**Cummulative Percent**
Age of Respondents			
Under 19	102	34	34
20-29	135	45	79
30-39	41	13.7	92.7
40 and above	22	7.3	100
Total	300	100	
Marital status			
Married	140	46.7	46.7
Single	123	41	87.7
Divorced	11	3.7	91.3
Widowed	9	3	94.3
Other	17	5.7	100
Total	300	100	
Educational level			
Primary-junior high	179	59.7	59.7
Senior high	71	23.7	83.3
Tertiary	11	3.7	87
None	39	13	100
Total	300	100	
Occupational status			
Unemployed	178	59.3	59.3
Self-employed	46	15.3	74.7
Employee	27	9	83.7
Trader	27	9	92.7
Other	22	7.3	100
Total	300	100	

Table 1 above shows the frequency distribution of how the beneficiaries responded in the survey.

3.2 Regression Analysis

In regression modeling analysis, it begins in the saturated state where all the variables are included in the model building. The insignificant variables are ignored in the reduction state in order to attain a good and reduced form of model with all variable being significant or close to significant in order to achieve the objective. The table below gives the reduced form of the regression built with the various variable coefficients and significant values.

Table 2: Coefficients of Regression Parameters

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	T	Sig.
(Constant)	1.488	.223		6.674	.000
Satisfaction	.111	.039	.159	2.829	.005
Distance	.140	.042	.186	3.312	.002
Records	-.046	.038	-.068	-1.204	.089
Importance	.052	.031	.194	2.681	.026
Treatment	.106	.014	.152	1.930	.013

Dependent Variable: Reasons

The table 2 above displays the parameter estimates of the variables and their statistical significance

3.2.1 Determination of the regression equation for the data

From the above, the regression equation is $y = 1.488 + 0.111x1 + 0.140x2 - 0.046x3 + 0.052x4 + 0.106x5 + \varepsilon$

Where y Represents the reasons for drop-out or fails to be immunized

$x1$ Represents the satisfaction of the respondents to treatment they receive

$x2$ Represents the distance respondents travel to the immunization center

$x3$ Represents records keeping on beneficiaries

$x4$ Represents respondents knowledge on the importance of being immunized

$x5$ Represents the treatment they receive from health staff or workers

Hypothesis

$H_0 : \beta_1 = \beta_2 = \beta_3 \ldots = \beta_6 = 0$ (Attitude of health staff, knowledge of respondent and accessibility to facilities have no effect on the immunization coverage)

$H_1 : \beta_1 \neq \beta_2 \neq \beta_3 \ldots \neq \beta_6 \neq 0$ (Attitude of health staff, knowledge of respondent and accessibility to facilities have effect on the immunization coverage)

Significance level

α = 0.05 (Assuming the alpha or acceptance level is 0.05)

3.2.2. Test Statistic(s) and Rejection Region(s)

From table 2, beneficiaries' satisfaction towards service and treatment they receive, distance they travel to immunization center, their knowledge of the relevance of being immunized and treatment of health staff towards them are statistically significant since their p-values 0.005, 0.002, 0.026 and 0.013 are less than 0.05. Since their *p*-values are less than 0.05, we reject the null hypothesis. Hence conclude that at α = 0.05 level of significance, there exists enough evidence to say that the attitude of health staff, knowledge of respondents on the relevance of being immunized, and accessibility of health centre or service contribute towards the low immunization coverage of beneficiaries in the Dormaa East District.

Records keeping on beneficiaries are statistically not significant since the p-value is 0.089 is greater than 0.05 hence we fail to reject the null hypothesis indicating that there is no enough evidence to say records keeping on beneficiaries have effect on the immunization coverage

3.2.3. Goodness of Fit Test

Table 3: Analysis of variance for reduced model

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	14.001	5	2.800	4.796	.000
	Residual	171.666	294	.584		
	Total	185.667	299			

a. Predictors: (Constant), Treatment, Importance, Records, Satisfaction, Distance

b. Dependent Variable: Reasons

Hypothesis

$H_0 = \beta$ (The model does not fit the data set well)

$H_1 \neq \beta$ (The model fits the data set well)

Significant level

$\alpha = 0.05$ (Assuming the alpha or acceptance level is 0.05)

Since p-value $0.000 \leq 0.05$, we fail to reject the null hypothesis and hence conclude that the regression model fit the data set therefore the reasons for immunization failure has a linear relationship with the attitude of health staff, knowledge level of beneficiaries and accessibility of health centre or service.

4. Conclusion

The research examined the immunization coverage of Tetanus toxoid vaccine in the Dormaa East District. The objectives were to evaluate the reasons for the low coverage in the district as to whether it is as a result of the attitude of health staff, knowledge of beneficiaries on its importance or the accessibility of the health facilities.

Our findings suggest that, most beneficiaries fail to get immunized due to the reasons that they are not treated well on their visit to the immunization Centres. We also found that, beneficiaries were unaware of when to be immunized and do not see the relevance of being immunized. Again, getting access to the vaccination Centres to be immunized was another thing to talk of on the part of other beneficiaries hence dropping-out in the course of immunization.

It is recommended to the stakeholders to design and implement appropriate and relevant immunization programmes that will serve to improve EPI service utilization in the Dormaa East District health Administration by embarking on routine educational campaign on both antenatal and postnatal sessions and child welfare clinics stressing the total number of times mothers need to visit the clinic to complete the immunization and the importance of being immunized.

Also mother's immunization for tetanus toxoid vaccine should be given equal attention by all health workers just like the immunization for their children during antenatal care attendance.

As a matter of urgency, the health workers or staff should try making the beneficiaries feel good when they appear for their service. Enough immunization service centers should be made available close to the various communities to enable the people get quick access to the centers.

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Appendix

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The purpose of this questionnaire is to Research on the immunization coverage of pregnant women with tetanus toxoid (TT) vaccine.

Please **tick (√)** the answer that is most appropriate for you.

Section A. Demographic Data

1. Age.

[1] Under 19 [2] 20 – 29 [3] 30 – 39 [4] 40 and above

2 Marital status.

[1] Married [2] Single [3] Divorced [4] Widowed [5] Other

3 Number of children.

[1] One [2] two [3] More than two [4] [5] None

4 Occupational status.

[1] Unemployed [2] Self-employed [3] Employee [4] Trader [5] Other

5 Highest level of education

[1] Primary- junior high [2] Senior high [3] Tertiary [4] None

6. Religious affiliation.

[1] Christian [2] Muslim [3] Traditionalist [4] Buddhism [5] others

Section B. General Knowledge on TT Immunization

7. What results in your immunization failure?

[1] Lack of information [2] Lack of motivation [3] Obstacle

8. Are you aware of the tetanus toxoid immunization?

[1] Aware [2] Not Aware [3] Neutral

9. How were you informed about the TT immunization?

[1] TV [2] Radio [3] Friends/Relatives [4] Health worker

10. How is TT immunization important your own point of view?

[1] It protects the mother and the unborn child [2] Government needs it

[3] It is required by health workers [4] don't know

11. How often do you attend ANC?

[1] Always attend [2] sometimes [3] Never [4] Neutral

Section C. Accessibility of Service to Patients

12. Which health facility do you attend?

[1] Government facility [2] Private Facility [3] Herbalist [4] None

13. How far is the immunization center from your place of residence?

[1] Very Far [2] Far [3] Not Far [4] Neutral

14. What is your means of transportation to the immunization center?

[1] On foot [2] Bicycle [3] Motor cycle [4] Vehicle

15. Do you pay for immunization services rendered to you?

[1] Always [2] Sometimes [3] Never

16. What is your Immunization status?

[1] Fully immunized [2] partially immunized [3] Not immunized

Section D. Attitude of Health Staff towards Patients

17. How do you assess the level of treatment of the health staff?

[1] Very good [2] Good [3] Neutral [4] Bad [5] Very bad

18. To what extent do you agree to this, health staff provides you with all the necessary facilities to enhance immunization in good atmosphere?

[1] Strongly agree [2] Agree [3] Neutral [4] Disagree [5] Strongly disagree

19. In general, how would you rate your satisfaction to the level of service for the TT immunization?

[1] Highly satisfy [2] satisfy [3] Neutral [4] Dissatisfy [5] Highly dissatisfy

Section E. Records Keeping On Patients

20. Are you provided with immunization cards which guarantee your service?

[1] Yes [2] No

21. How many vaccines have you received?

[1] TTI [2] TT2 [3] TT3 [4] TT4 [5] TT5

22. Do you always visit the ANC with your immunization cards?

[1] Always [2] Sometimes [3] Never

23. Does the health staff make record of you on a visit to the facility?

[1] Yes [2] No

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