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# Prevalence and Factors Associated with Diarrhea among Children under-five years Vaccinated with Rotavirus Vaccine (ROTARIX) in the Wa Municipality of Ghana

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**ABSTRACT:** The weight of diarrheal diseases amongst children below-five years is more in low income countries in comparison to high income countries. It is responsible for about 10% of all morbidity and mortality cases for children under five years in Ghana. The study was conducted to determine the factors related to the prevalence of diarrhea among children below five years vaccinated with rotavirus vaccine (ROTARIX). This study was a community-based analytical cross-sectional study. A multistage sampling technique was employed in selecting 396 mothers/caretakers with children under-five years. We collected the data was using a structured questionnaire. We analyzed the data using SPSS version 22. The following test were used in determining the association between the dependent and independent variables i.e Pearson's chi-square test ( $p < 0.05$ ) and marginal effect with corresponding 95% confidence interval. The results showed that, more than 90% of the children under-five years were covered for rotavirus vaccination however with some inconsistencies in rota 1 and rota 2. The findings further revealed that children who took two doses were less likely to suffer diarrhea infection compared to children who received only one rotavirus vaccination. Due to Rotavirus vaccination, there has been to a drastic decline in diarrhea among children who have receive the complete dose. The findings showed that the factors including marital status, sex of a child and number of dosage of rotavirus vaccine received were statistically significant ( $p < 0.05$ ) and associated with incidence of diarrhea. We recommend the increase in public education of households' on the importance of complete dosage of rotavirus vaccination for their children, and adequate sanitation by health educators.

**KEYWORDS:** Diarrhea, Vaccination, Rotavirus.

## I. INTRODUCTION

Diarrhea is one of the most serious diseases that affects people all over the world (Frida, Atiena, & Habtu, 2017). Diarrhea affects around 4 billion people worldwide, and it is responsible for about 20% of mortality in children under the age of five (Akwas & Joshua, 2015). In most low income countries, it is normal for a kid to experience 3–5 episodes of diarrhea yearly. This has resulted in an approximately 800,000 fatalities each year for children below five years of age (Dorota, Agnieszka, Renata, & Malgorzata, 2016). In 2015, it was estimated that about 5.9 million children below five years had died, this translates into a global mortality rate of 42.5 per 1000 live births (WHO, 2016). Diarrhea was responsible for almost 19% of all pediatric fatalities in Africa (WHO, 2009). Diarrhea is responsible for 25% of death for children under the age of five in Ghana, with over 9 million incidents happening each year (Binka et al., 2011). Even though episodes of diarrhea are regular for children under the age of five in Ghana, there is a difference in frequency between urban (10.5%) and rural (12.8%) locations (Child Health and Early Development, 2015). The causes of diarrheal disease in children below five year are complex, and the comparative significance of each component varies as a result of interactions between environmental, socioeconomic and behavioral variables (WHO, 2009). Socio-demographic variables are some of the determinant elements that determine the occurrence of diarrheal illnesses in many developing nations, such as Ghana (Kuitunen & Boadi, 2005). These socio-demographic variables; Maternal and child age, access to hygienic practices, sanitary facilities, constant eating food from streets, and fly infestations, are all factors to consider (Kuitunen & Boadi, 2005). Diarrhea is also more common in the second half of an infant's life, when the



child’s immunity is compromised and increase exposure to contaminated weaning foods (Bako, Egwuda, & Terru, 2017).

In the Wa Municipality, there is a greater disparity between rotavirus vaccination coverage and diarrhea prevalence among children under the age of five. Between 2012 and 2016, the prevalence of diarrhea was lower than the rate of vaccination coverage. However, the percentage of diarrhea cases increased from 2012 to 2016, at the same time as Rota vaccination coverage increased, which was unexpected (WMHA Annual reports, 2016).

## II. OBJECTIVE

We undertook this study to determine the factors associated with the occurrence of diarrhea among children below five years vaccinated with rotavirus vaccine (ROTARIX).

## III. METHODOLOGY

**Place of Study:** the study was conducted in the Wa Municipality of the Upper West Region for mothers/ caregivers of children under-five years

**Study Design:** Community-based Cross-sectional Study

**Duration of Study:** 6 months

**Method of Study:** We employed a multi-stage sampling technique to select and interview study participants. A community was randomly selected from each of the seven sub districts within the Wa municipality. Using the estimated population of the sub districts data from Ghana Statistical Service, quota of the sample size was therefore assigned to the seven selected communities. We used the estimated number of households in the community to divide by the sample quota for specific communities to attain the sampling interval for the selection of respondents. In household where there were more than one child, simple random sampling was used to select the child for the study.

**Data Collection Method:** We used a structured questionnaire to obtain information from the selected respondents through interviews. We excluded children who had no records of vaccination and/or aged above 5 years the study. We took dat from the child’s health booklet (immunization card), using a structured questionnaire. In addition, follow up responses (primary data) were asked from the caregivers of these children in relation to the respondents’ socio-demographic characteristics, water and sanitation situation, and the rates of diarrhea among the children.

**Data Analysis:** We cleaned the data using Microsoft excel 2010 and transferred the final dataset to social science system version. SPSS 22.0 for data analysis.

**Ethical Approval:** We obtained ethical clearance from Ghana Health Service through the Ethics Committee of the Navrongo Health Research Centre (NHRCIRB290).

## IV. EXPERIMENTAL RESULTS

### Background information of mothers/caretakers

Approximately 98% of respondents were females. Majority (92.7%) of respondents were married and about 72% had achieved some form of formal education. For employment, about 47% of respondents were employed in the informal sector. In terms of location, majority (50.5%) of them lived in rural areas, 38.4% lived in urban areas and 11.2% live in semi-urban areas, within the municipality. Respondents were either Christians or Muslims with percentages of 42.7% and 46.5 respectively. By ethnic distribution, Waalas (54.6%) were the most common respondents, followed by Dagaaba (41.9%) and others (3.5 percent). In addition, it was determined that 49.5 percent of the respondents' children were females, while the remaining 50.5 percent were males. Children aged 0-11 months account for 53.3 percent of the total, while those aged 12 to 23 months account for 46.7 percent (Table 1).

Table 1: Characteristics of Respondents (n=396)

Variable	Frequency (n)	Percent (%)
<b>Sex of respond. (mothers/caretakers)</b>		
Male	10	2.5
Female	386	97.5
<b>Age group of respond.(mothers/caretakers)</b>		
15-24years	109	27.5
25-34years	221	55.8
>35	66	16.7
<b>Marital status of mothers/caretakers</b>		



Married	367	92.7
Never married/single	29	7.3
<b>Level of education of mothers/caretakers</b>		
None/never attended school	113	28.5
Primary/Secondary	180	45.5
Tertiary	103	26.0
<b>Religious affiliation of mothers/caretakers</b>		
Christianity	169	42.7
Muslim	184	46.5
Traditionalist	43	10.8
<b>Occupation of mothers/caretakers</b>		
Formal	103	26
Informal	184	46.5
Unemployed	109	27.5
<b>Monthly income earnings</b>		
No monetary earnings	134	33.8
Monetary earnings	262	66.2
<b>Residence of mothers/caretakers</b>		
Urban	152	38.3
Semi-urban	44	11.2
Rural	200	50.5
<b>Ethnic group of mothers/caretakers</b>		
Dagaaba	166	41.9
Waala	216	54.6
Other	14	3.5
<b>No. Child&gt;5yrs under the care of respondents</b>		
One	257	64.9
More than one	139	35.1
<b>Sex distribution of under fives</b>		
Male	200	50.5
Female	196	49.5
<b>Age dist. of under -fives (In completed months)</b>		
0-11 months	211	53.3
12-23 months	185	46.7

Source: Field Survey (2018)

**Prevalence of Diarrhea among children vaccinated with Rotavirus Vaccine**

Table 2 indicates almost 50% of the children still experienced bouts of diarrhea even after receiving Rota vaccine within the period of survey. It was discovered that 9.1% experienced diarrhea once, majority (18.4% & 17.9%) experienced diarrhea twice and thrice in the past six months.

**Table 2: Prevalence of Diarrhea (n=396)**

Diarrhea	N (%)
<b>Diarrhea Episodes</b>	



Yes	195 (49.2)
No	201(50.8)
<b>Number of diarrhea episode</b>	
Once	36 (9.1)
Twice	73 (18.4)
Three times	71 (17.9)
Four times	10 (2.5)
Five times	5 (1.3)

**Socio-economic and demographic characteristics of mothers/caretakers and prevalence of diarrhea among children vaccinated with rotavirus Vaccine**

On the one hand, marital status (p=0.046), sex of the kid (p=0.035), and rotavirus vaccine doses (p0.001) were statistically significant (p0.05) among the respondents. In terms of home location, 48 percent of rural respondents, 47.5 percent of urban respondents, and 55.5 percent of peri-urban respondents indicated their children had diarrhea in the previous six months. However, at 5% (P-value > 0.05), the chi-square test value (1.38) was not significant. Because their individual P-values are greater than 5%, similar observations were made for ethnicity, age, education, occupation, source of drinking water, and toilet facility use (0.05).

However, it was determined that married respondents dominated the sample, with 171 of them reporting diarrhea in their children. Furthermore, those who stayed unmarried were 37, with 24 of them reporting that their children had diarrhea in the previous six months. Respondents with other marital status (widows and divorced) were 58 and 30 of them indicated their children had suffered diarrhea. The chi-square test value (3.98) is significant at 5% (P-value < 0.05) and this indicates a significant association between marital status and diarrhea prevalence. The prevalence of diarrhea differs among boys and girls under -five years (table 3).

**Table 3: Socio-Economics and Demographics Characteristics of Mothers and Incidence of Diarrhea**

Variable	Diarrhea		X <sup>2</sup>	P-value
	No (%)	Yes (%)		
<b>Residential status</b>				
Urban	58(47.5)	64(52.5)		
Peri-urban	41(55.5)	33(44.5)		
Rural	96(48.0)	104(52.0)	1.38	0.449
<b>Ethnicity</b>				
Dagaaba	64(52.5)	58(47.5)		
Waala	101(47.0)	115(53.0)		
Others	30(51.7)	28(48.3)	1.18	0.554
<b>Age (Yrs)</b>				
15-24	35(40.2)	52(58.8)		
25-34	113(50.9)	109(49.1)		
35 +	47(54.0)	40(46.0)	3.86	0.146
<b>Age of child</b>				
0-11 months	42(31.6)	91(68.4)	25.5	P<0.001
12-23 months	78(60.5)	51(39.5)		



24-60months	75(56.0)	59(44.0)		
<b>Marital status</b>				
Married	171(47.6)	188(52.4)	3.99	0.046
Single	114(69.9)	113(30.1)		
<b>Educational Status</b>				
None	90(47.4)	100(52.6)		
Basic	79(41.6)	73(58.4)		
Tertiary	26(48.1)	28(51.1)	0.74	0.68
<b>Occupation</b>				
Formal	44(42.7)	59(57.3)		
Informal	96(52.1)	88(47.9)		
Unemployed	55(50.5)	54(49.5)	2.45	0.29
<b>Child sex</b>				
Female	86(43.8)	110(56.2)		
Male	109(54.5)	91(45.5)	4.46	<b>0.035</b>
<b>Number rotarix doses received</b>				
One doses	32(82.1)	7(17.9)		
Two doses	163(45.6)	194(54.4)	18.7	<b>P&lt;0.001</b>
<b>Source of water</b>				
Dug well/spring	19(48.7)	20(51.3)		
Piped water	176(49.2)	181(50.8)	0.005	0.94
<b>Have toilet facility</b>				
Yes	154(51.0)	148(49.0)		
No	41(43.6)	53(56.4)	1.56	<b>0.044</b>

**Logistic regression of Socio-economic and demographic characteristics of mothers/caretakers and the incidence of diarrhea among children vaccinated with rotavirus vaccine**

We included all the independent variables that were statistically significant ( $p < \alpha$ -value) at the bivariate level into multivariate analysis. Socioeconomic and examples of demographic variables including the child’s age and sex marital status of caregiver, number of doses of Rota vaccine received by a child and whether the household owned a toilet facility with p-values less than 0.05, were considered for the modeling.

The results from the multiple logistic regression analysis indicated that age of child, number of doses of the vaccine received by a child and whether household owned a toilet facility were the significant consistent predictors of the prevalence of diarrhea among the children. Children aged 0-11months and vaccinated with rotarix were 3times more likely to suffer from diarrhea compared to children above 12 months [OR = 2.5; 95% CI (1.50-4.31);  $p = 0.001$ ]. Children from households without toilets were 2 times more likely to suffer from diarrhea compared to children from households with toilet facilities [(OR = 1.7; 95% CI ((1.02-2.84) ;  $p = 0.041$ ]. Comparatively, children who received just one dose of rota vaccine had a 16% increased likelihood of suffering from diarrhea [OR = 0.16; 95% CI ((0.06-0.38);  $p < 0.001$ ]. The rest of the independent contributory variables were statistically not significant ( $p \geq 0.05$ ) (table 4).

Variable	Wald	p-value	Adjusted Odds Ratio (95% C.I.)
<b>Sex of child</b>			
Male	*Ref		
Female	3.498	0.061	0.663 (0.43-1.02)
<b>Age child (months)</b>			
0-11	12.048	0.001	2.543 (1.50-4.31)
12-23	*ref		
<b>Marital status</b>			
Single	2.777	0.096	1.921 (0.89-4.14)
Married	*Ref		
<b>Household toilet</b>			
Yes	*Ref		
No	4.169	0.041	1.702 (1.02-2.84)
<b>No rotarix doses received</b>			
2doses	*Ref		
1dose	16.457	0.000	0.157 (0.06-0.38)



#### IV. DISCUSSION

We conducted this study on households who were either permanent or non-permanent resident at their homes at the time of this survey. We sought to estimate the factors associated with the prevalence of diarrhea among children under-five years vaccinated with rotavirus vaccine (ROTARIX) in the Wa Municipality of Ghana.

##### *Prevalence of diarrhea*

Even though the Rotavirus vaccine was introduced in Ghana 2012, Diarrhea among children below five years still remains a major burden in the study area. The results of the present study revealed that 49.2% of children in the municipality, vaccinated with rotavirus vaccines had experienced diarrhea six months prior to the conduct of the study. Though the study retrospectively reflected on a lengthier duration to effectively assess the impact of the vaccine, the prevalence of diarrhea was quite high as compared to the 15.2% of the rate of prevalence of diarrhea two weeks subsequent to the study in the Wa Upper Region, findings from the Ghana Demographic and Health Survey (GDHS, 2014). Attributably, the cause of the high prevalence of diarrhea in the area of study could not have rotavirus infection the most Significant cause.

##### *Factors of associated with diarrhea vaccinated with Rotavirus vaccine*

When compared to children of single mothers, married respondents' children were 20.9 percent less likely to get diarrhea. This is not startling because married women are more likely to receive spousal assistance that contributes to the necessary attention for the child's health. It also showed that most families completely delegated child care to the woman, who is frequently denied access to health services due to her subjection to domestic chores (Topuzoglu et al., 2007). This indicates that a single parent will be overburdened because she will be both a mother and a father. As a result, the child may receive less attention, particularly in the area of diarrhea control.

In the Wa Municipality, we discovered that the sex of a child has a strong association with diarrhea infection, with boys being 12.5 percent further likely to suffer from diarrhea compared to girls. Schlagenhauf et al. had similar findings in a 2010 study to investigate the differences in gender in travel-associated sickness, finding that females had a higher risk to diarrhea than males (Schlagenhauf et al, 2010). In studies in Bangladesh and Sudan, however, the risk of diarrhea changes by gender, with males being more at risk than females (Chowdhury et al. 2015; Mitra et al. 2000 & Siziya et al. 2013).

Rotavirus vaccine has a strong negative impact on diarrhea infection, therefore children who have received both doses are less likely to acquire diarrhea than children who have not received both doses. Those who have not finished the dosage have a 38.9% higher chance of experiencing diarrhea than those who have finished it. This observation is similar to what has been observed in a variety of circumstances (Payne et al. 2015). When compared to children who were not vaccinated, a complete dose of rotavirus vaccination was found to be significantly related with an 18% to 20% decline in diarrhea (Payne et al., 2015). This indicates that rotavirus vaccination is a key immunization activity that has the potential to drastically reduce diarrhea in children.

For Children living in households having access to modern toilets are at a lower risk of suffering from diarrhea compared to those who practice open defecation. This observation is in consistent with the priori expectation. This means that access to toilet facilities in the Wa Municipality contributes significantly to reduction of diarrhea. A inconsistent with the findings of a study by Ayuk, Leonie & Nchang, (2015) in Tiko-Cameroon. In this study, the age of a child was a constant significant determinant of diarrhea. Shikur & Dessalegn, 2014 found similar results in a study in Ethiopia.

#### V. CONCLUSION

In conclusion the findings of the study showed that, marital status, sex of a child and number of doses of rotavirus vaccine received were statistically significant ( $p < 0.05$ ) and in association with diarrhea incidence. It is recommended that health information workers should undertake public education of at the households' level on the importance of receiving full dosage of rotavirus vaccination, and ensuring a good sanitation.



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