Factors Associated with Childhood Diarrhea in Rwanda: A Secondary Data Analysis of the Rwanda Demographic and Health Survey 2014-15

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Abstract

Background
Diarrheal diseases remain an important cause of morbidity among children, particularly in children under five years old, in low- and middle-income countries where it causes nearly 1.7 billion cases every year.

Methods
We used a quantitative cross-sectional design. This study aimed to explore the determinants of child diarrhea among under five-year children in Rwanda. A deep analysis of the 2014-2015 Rwanda Demographic and Health Survey (RDHS), with multivariate logistic regression, using stata13 was performed. The 2014-2015 Survey was the fifth standard national survey, implemented by the National Institute of Statistics of Rwanda (NISR) in a period of six months from November 2014 to April 2015.

Results
A sample of 2841 children under five years old were included. Chi-square test and logistic regression were performed. A significance level of 0.05 at 95% CI was considered. Child age and wealth index showed a strong association with diarrhea. Children in the age groups of 6-11, 12-23, 24-35 months were at higher risk of diarrhea than children aged 48-59 months, OR: 5.0 [3.1-8.2], P-value: 0.001; OR: 7.6, CI [4.7-12.2], P-value: 0.001; OR:3.8 [2.3-6.2], P-value: 0.001 respectively. Moreover, children from poorest and poorer families were twice more at risk of diarrhea than children from richest families. OR: 2, CI [1.3-2.9], P-value: 0.001.

Conclusion
The study concluded that low wealth index, and child age less than 35 months were important risks for under-five child diarrhea.

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Key words: determinants, under five years children, diarrhea

Introduction

Diarrhea is the loss of three or more loss of liquid stools per day, or more frequently than is normal for the individual. [1,2] Diarrhea is a high burden disease and accounts for nine percent of all deaths among children under five years old worldwide.[3] Diarrhea causes nearly 1.7 billion cases every year.[4] The global burden of diarrheal disease and deaths varies in developed and developing countries with half of all diarrheal deaths occurring in the African region.[5]. Children living in poor areas have higher case-fatality rates compared to children living in the developed world due to poor access to safe water, sanitation, hygiene, urgent medical care and effective hygiene and sanitation measures.[6–8] The prevalence and correlates for diarrhea vary with geographical area, and between countries.[9] Diarrheal diseases are associated with socioeconomic status, especially with mother's educational status. Poor environmental sanitation and hygiene, inadequate water supplies and poverty.[10]

The 2012 Declaration on scaling up treatment of diarrhea and pneumonia from donors, industry and non-governmental organizations (NGOs) called on all high burden countries and the international community to provide the resources, political will and focused action needed for ending preventable childhood pneumonia and diarrhea deaths.[11] In line with this declaration, Rwanda has made health sector reforms and reinforced specific programs such as expanded program of immunization, the fight against diseases including diarrhea, the integrated management of childhood illness, and the high impact interventions at the community level.[12]

Moreover, vaccine against rotavirus responsible for diarrhea has been introduced in Rwanda routine immunization program in 2012. Nevertheless the Rwandan Ministry of Health still lists diarrhea as the third (after malaria and pneumonia) among top ten causes of under five children morbidity with prevalence of 20 percent in 2014 in all health centers nationwide.[1] There is a paucity of information about the determinants of diarrhea in under-five years old children in Rwanda. This study intended to do a deep analysis of the RDHS data and find the determinants of childhood diarrhea, in Rwanda.

Methods

A cross-sectional study design with a deep analysis of the dataset from the Rwanda Demographic and Health Survey 2014-2015 was used. The 2014-2015 Survey was the fifth standard national survey, implemented by the National Institute of Statistics of Rwanda (NISR) in a period of six months from November 2014 to April 2015. The main objective of the 2014-15 RDHS was to obtain information on demographic and health indicators, including family planning; maternal mortality; infant and child mortality; nutrition status of mothers and children; antenatal care, delivery, and postnatal care; childhood diseases; and pediatric immunization. In addition, the survey measured indicators such as domestic violence, the prevalence of anemia and malaria among women and children, and the prevalence of HIV infection in Rwanda. A total of 12,793 households were selected and 12,699 completed the Household Questionnaire, yielding a response rate of 99.9 percent. In the 12,699 households surveyed, 13,564 women age 15-49 were identified as being eligible for the individual interview; interviews were completed with 13,497 of these women, yielding a response rate of 99.5 percent.[14]

In this study, we included a population of 2,841 children under five years old from the individual record file (IR). Bivariate analysis with Chi–square test was performed to assess the association factors Multivariate analysis was performed with logistic regression model to assess the relative effect of the risk factors on diarrhea.

Descriptive statistics were used to summarize the data. We used Chi-square test to evaluate the association between sociodemographic factors and child diarrhea. A significance level of 0.05 at 95% confidence interval was considered. The data was analyzed using Stata 13.
Logistic regression analysis was used to assess the determinants of under-five child diarrhea. For variables that showed association (P≤0.05) in bivariate analysis, useful variables that define diarrhea were subsequently identified

Ethical considerations
This study used a secondary data analysis of the RDHS 2014-2015. The Survey has been approved by the Rwanda National Ethics Committee (RNEC). The researchers have been authorized to download and use Survey data from the Archives of Demographic and Health Surveys (DHS) Program.

Results

Socio-demographic characteristics of respondents
More than a quarter 734 (25.8%) of all children included in the study were in the age group between 11-23 months and 247 (8.7%) were between 48 and 59 months. The study population had slightly more males than females. 1440 (50.7%) children were males while 1401 (49.3%) were females. Nearly three quarters (73.3%) of children's mothers were between 19 and 34 years. The largest proportion of children's mothers 72.1% (2049) had attained their primary education while 14.1% (402) had no formal education. A

large proportion (83.3%) of participants resided in the rural area while 16.7% were in urban area. Socioeconomic status was classified into 5 categories where poorest and poor were 24% and 22% respectively (Table1).

Table1. Household socio-demographic characteristics of respondents

Variables	Number	Percentage (%)
Child age (in months)		
Mean age=24		
<6	349	12.3
6-11	429	15.1
11-23	734	25.8
24-35	623	21.9
36-47	459	16.2
48-59	247	8.7
Total	**2841**	**100**
Child sex		
Male	1,440	50.7
Female	1,401	49.3
Total	**2841**	**100**
Maternal age (in years)		
≤18	29	1.0
19-34	2082	73.3
≥35	730	25.7
Total	**2841**	**100**
Maternal education		
No education	402	14.1
Primary	2049	72.1
Secondary	324	11.4
Higher	66	2.3
Total	**2841**	**100**
Residence		
Urban	474	16.7
Rural	2,367	83.3
Total	**2841**	**100**
Employment		
Yes	2,451	86.4
No	387	13.7
Total	**2,839**	**100**
Wealth index		
Poorest	683	24.1
Poorer	628	22.1
Middle	554	19.5
Richer	485	17.1
Richest	491	17.3
Total	**2841**	**100**
Province		
Kigali city	328	11.7
Southern	669	23.8
Western	619	22.0
Northern	415	14.8
Eastern	781	27.8
Total	**2813**	**100**

Environmental characteristics of the households
Households using improved sources of water were 1940 (70.1%) as compared to (29.9%) who used non improved sources of water. The households with improved toilet facility represent 71%. Around two thirds (60.4%) of the households used above 15 minutes for a round trip to obtain water for domestic use, and 782 (27%) use to spend around 15 minutes or less. The majority (77.9%) of households were built with non-improved floor material like earth or sand (Table 2).

Table 2. Environmental characteristics of the households

Variables	Frequency	Percentage
Source of water		
Improved	1940	70.1
Non improved	827	29.9
Total	**2766**	**100**
Toilet availability		
Available	2,120	78.2
Not available	593	21.9
Total	**2713**	**100**
Types of toilet facility		
Improved	1767	71.0
Non improved	721	29.0
Total	**2488**	**100**
Main floor material		
Improved	621	22.1
Non improved	2188	77.9
Total	**2809**	**100**

Bivariate analysis for associations with child diarrhea

Chi-square test was performed and variables including wealth index, child age and maternal education showed a statistically significant association with under five child diarrhea (P-value < 0.001). Household floor material also showed some association with diarrhea (P-value<0.05).

Table 3. Association of sociodemographic, and environmental factors with child diarrhea

Variables	Had diarrhea			P-value
	Yes	No	Total	
	n (%)	n (%)	n (%)	
Child age (in months)				
<6	23 (0.8)	325 (11.5)	349 (12.3)	
7-11	76 (2.7)	353 (12.4)	429 (15.1)	
12-23	181 (6.4)	553 (19.5)	734 (25.8)	.001***
24-35	85 (3.0)	538 (19.0)	623 (21.9)	
36-47	29 (1.0)	430 (15.1)	459 (16.2)	
48-59	9 (0.3)	239 (8.4)	247 (8.7)	
Maternal age (in years)				
≤18	5 (0.2)	24 (0.8)	29 (1.0)	
19-34	300 (10.6)	1781(62.7)	2082 (73.3)	.673
≥35	97 (3.4)	633 (22.3)	730 (25.7)	
Child sex				
Male	216 (7.6)	1224 (43.1)	1440 (50.7)	.238
Female	187 (6.6)	1214 (42.7)	1401 (49.3)	
Family size				
<5	165 (5.8)	1057 (37.2)	1221 (43.0)	
5 to 7	189 (6.7)	1109 (39.1)	1299 (45.7)	.815
8 to 10	45 (1.6)	256 (9.0)	301 (10.6)	
≥11	3 (0.1)	16 (0.6)	20 (0.7)	
Wealth index				
Poorest	123 (4.3)	560 (19.7)	683 (24.0)	
Poorer	99 (3.5)	529 (18.6)	628 (22.1)	.001***
Middle	72 (2.5)	482 (17.0)	554 (19.5)	
Richer	63 (2.2)	423 (14.9)	485 (17.1)	
Richest	46 (1.6)	445 (15.7)	491 (17.3)	
Residence				
Urban	60 (2.1)	414 (14.6)	474 (16.7)	.369
Rural	343 (12.1)	2025 (71.3)	2367 (83.3)	
Maternal education				
No formal education	74 (2.6)	324 (11.5)	398 (14.2)	
Primary	289 (10.2)	1740 (61.8)	2049 (72.1)	.001***
Secondary and higher	35 (1.2)	351 (12.5)	66 (13.7)	
Household floor materials				
Non improved	330 (11.7)	1858 (66.2)	2188 (77.9)	.014**
Improved	65 (2.3)	556 (19.8)	621 (22.1)	
Shared toilet				
No	280 (10.3)	1840 (67.8)	2120 (78.1)	.229
Yes	90 (3.3)	503 (18.6)	593 (21.9)	

Logistic regressions to assess the risks for under five child diarrhea

In the final logistic regression model, age and wealth index showed a consistency of association with diarrhea. Children in the age groups of 12-23, 24-35, 6-11months were more likely to experience diarrhea than children aged 48-59 months, OR: 7.6, CI [4.7-12.2], P-value: 0.001; OR: 3.8 [2.3-6.2], P-value: 0.001; OR: 5.0 [3.1-8.2], P-value:0.001respectively. Children from poorest and poorer families were also more at risk of diarrhea than children from richest families. OR: 2, CI [1.3-2.9], P-value: 0.001.

Table 4. Multivariate analysis output

Variables	Full model		Reduced model	
Child age (in months)	OR [95% CI]	p	OR [95% CI]	p
48-59	1.0		1.0	
0-6	1.6 [0.8-3.0]	0.147	1.7 [0.9-3.1]	0.109
6-11	5.1 [3.1-8.3]	0.000***	5.0 [3.1-8.2]	0.000***
12-23	7.6 [4.7-12.3]	0.000***	7.6 [4.7-12.2]	0.000***
24-35	3.8 [2.3-6.2]	0.000***	3.8 [2.3-6.2]	0.000***
36-47	1.8 [1.1-3.0]	0.029**	1.8 [1.1-3.0]	0.029
Wealth index				
Richest	1.0		1.0	
Poorest	1.8 [1.1-3.2]	0.029**	2.0 [1.3-2.9]	0.001***
Poorer	1.8 [1.0-3.1]	0.046**	2.0 [1.3-3.0]	0.001***
Middle	1.3 [0.8-2.4]	0.316	1.4 [0.9-2.2]	0.133
Richer	1.3 [0.8-2.0]	0.350	1.3 [0.9-2.1]	0.183
Maternal education				
Tertiary	1.0			
No education	1.6 [1.0-2.6]	0.064		
Primary	1.4 [0.9-2.1]	0.161		
Household floor material				
Improved	1.0			
Non-improved	0.9 [0.6-1.5]	0.769		

Discussion

In this study, we used multivariate logistic regression analysis to assess the effect of variables including child age, wealth index, maternal education, and household floor material on childhood diarrhea. The findings revealed that child age is significantly associated with diarrhea (P-value<0.001). The risk of diarrhea increases with child age where 12-23 months were the pick age with a higher likelihood for diarrhea that than the age range of 48-59 months. Moreover, the risk was fivefold among children in the age range between six to eleven months. These findings are supported by some studies which concluded that children aged between six months to two years have high risk for diarrhea. The risk reduces as the child grows older.[15–17]. Younger child age exposure to diarrhea has been linked to underdeveloped immune system that is incapable of mounting an effective immunological response to the diseases. As the child grows older, the development of the immunity after repeated exposure reduces susceptibility to the diseases [18]. In addition, young children tend to ingest material while crawling. These materials may be contaminated and cause diarrhea illness.

This study also concluded that low socioeconomic status as indicated with the wealth index is associated with diarrhea. These findings are consistent with other studies from low-income countries, where children from poor families were at higher risk of diarrhea. Poorest and poorer families are less likely to have the financial resources to buy healthy or enough food.[19,20] The evidence generated from a systematic review of literature also revealed that young age of the child (usually <24 months), and low socioeconomic status are the risk factors of acute childhood diarrhea.[17]

Conclusion

Diarrhea is one of the top ten causes of child illness among under five years old children in Rwanda. This study therefore identified important determinants of under five children diarrhea and concludes that low socioeconomic status, and younger child age category are the potential determinants of under-five diarrhea.

Recommendations

Based on the study findings, efforts to strengthen families with under-five children should be undertaken to increase their social economic status and to ensure appropriate nutrition of their children.

Limitations of the study

The study focused on a population of children aged between 0-59 months. This population is believed to be at the highest risk of diarrhea. The study was limited by some factors related the nature of RDHS datasets. The role of hand washing in prevention of diarrhea has been highlighted in the literature. However, the RDHS did not collect data on hand washing practice.

Conflict of interest

The authors declare that there is no conflict of interest.

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