




# Association between Sociodemographic Factors and Diarrhea in Children Under 5 Years in Rwanda

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**Abstract:** Diarrheal disease is the second leading cause of mortality and morbidity in children under 5 years old worldwide, and is the most common cause of malnutrition in sub-Saharan Africa. In Rwanda, diarrhea is the third leading cause of death in children under 5 years old. This study examined the association between sociodemographic factors and diarrhea in children under 5 years using the data of 7,474 households in the 2014-2015 Rwanda Demographic and Health Survey. Overall prevalence of diarrhea in this study was 12.7% in children. An increased risk for diarrhea was found for children aged 12-23 months (odds ratio (OR)=4.514), those with a low economic status (OR=1.64), those from the Western province (OR=1.439), those with poorly-educated mothers (OR=5.163), and those with families engaged in agricultural activities (OR=1.624). In conclusion, sociodemographic factors significantly affect the risk of developing diarrhea in children under 5 years in Rwanda. Designing and implementing health education promoting awareness of early interventions and rotavirus vaccination are essential to reduce diarrheal diseases for the Rwandan community.

**Key words:** Diarrhea, children, Rwanda

Diarrheal disease is the second leading cause of morbidity and mortality in children under 5 years, worldwide. According to the World Health Organization (WHO), around 1.7 billion cases of diarrhea in children are reported annually, which result in 525,000 child deaths per year [1]. Around the world, 780 million people live without clean water, about 2.5 million people live in an environment with poor sanitation, and are from developing countries such as South-Asia and sub-Saharan Africa where the majority of children experience at least 3 episodes of diarrhea each year [1]. According to a study published in 2016, the burden of diarrhea is still a challenge and a cause of death in both adults over 70 years and children under 5 years [2].

In Rwanda, a small landlocked country in Central-East Africa with a population of 12.5 million, diarrheal disease is ranked as the third leading cause of mortality in children under 5 years and was responsible for 18.3% of childhood deaths in 2015. Additionally, around 45% of the population

in Rwanda are under 18 years old, making this a significant concern [3]. Diarrheal disease increases the country and family's economic burden. A study conducted in Rwanda showed that the burden of diarrheal disease was 101 US dollars per family per year, despite 93% of the general population being covered by health insurance [4]. Another study showed that the risk factors of diarrhea in children under 5 years were lack of clean water and inadequate hygiene and sanitation [5]. Therefore, there is a need to determine the implications of sociodemographic factors in the development of diarrhea in vulnerable groups to increase community awareness regarding prevention measures of diarrhea, as well as management and treatment, in the hopes of decreasing morbidity and mortality in this population. The aim of this study was to assess the association between sociodemographic factors and diarrhea in children under 5 years in Rwanda.

The study was a secondary data analysis of the 2014-2015 Demographic and Health Survey (DHS)—a population-based health survey in Rwanda. The study included data from 7,474 households with women between 15-49 years old who had children under 5 years. The Rwanda DHS was conducted using 3 different questionnaires: (1) household questionnaire, (2) women's questionnaire, and (3) men's questionnaire. The children's health information was collected using the house-

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hold questionnaire on the household's characteristics from both parents. This study was performed by using the household's datasets which recorded the sociodemographic characteristics of households with a live childbirth within the past 5 years. Before performing the research, the abstract of the study was sent to the DHS program to obtain approval to use the data from Rwanda. All DHS data were treated anonymously and confidentially.

Among 7,474 women with children less than 5 years old, 4,192 (56.1%) were 25-34 years old (Table 1). Regarding the mother's education level, 14.2% were never educated. For the province of residence, 25.1% of women were from the Western province, 24.6% were from the Southern province, 24.6% were from the Eastern province, 13.9% were from the North province, while 11.7% were from Kigali city. Majority of the women resided in rural areas (78.1%) compared to urban areas (21.9%). According to the wealth index category, most of the women were living in the poorest category (23.8%), followed by the poorer category (20.9%), the middle category (19.0%), the richer category (17.1%), and the richest category (19.1%). Regarding marital status, the majority of women were either married (53.6%) or were unmarried but lived with their partner (28.9%). Among 7,474 children, 50.4% were male and 49.6% were female. Of 3615 children with data for age, 11.7% were < 6 months old, 9.8% were 6-11 months old, 20.7% were 12-23 months old, 20.9% were 24-34 months old, and 36.9% were 35-59 months old. Diarrhea was reported in 12.7% of the children.

There was a significant association between diarrhea and the mother's age, marital status, province of residence, type of residence, education level of the mother and father, wealth index, and occupation with a *P*-value less than 0.05 (Table 1). There was no association found between literacy, religion, and number of children in the households.

Multivariate logistic analysis was conducted to demonstrate the relationship between sociodemographic factors and diarrheal diseases in children under 5 years old (Table 2). The variable with a *P*-value less than 0.05 in the bivariate analysis was included in the multivariate analysis. Children aged between 24-34 months, 12-23 months, and 35-59 months were 2.652, 4.514, and 2.340 times more at risk for diarrhea than those < 6 months, respectively. Considering the wealth index of the family, children in the poorer and poorest categories were 1.64 and 1.592 times more at risk to develop diarrhea than children from the richest category, respectively. The risk of devel-

**Table 1.** Association of sociodemographic characteristics of respondents with diarrhea

Variables	Diarrhea		<i>P</i> *
	Total	Yes (%)	
Mother's age (yr)			
15-19	142	17 (12)	0.028
20-24	1,281	187 (14.6)	
25-34	4,192	488 (11.6)	
35-49	1,859	213 (11.5)	
Marital status			
Never in union	642	95 (14.8)	0.030
Married	4,009	439 (11)	
Living with partner	2,160	2,71 (12.5)	
Widowed	145	18 (12.4)	
Divorced	190	34 (17.9)	
Separated	328	48 (14.6)	
Province			
Kigali city	875	76 (8.7)	<0.001
South	1,841	228 (12.4)	
West	1,879	274 (14.6)	
North	1,039	113 (10.9)	
East	1,840	214 (11.6)	
Residence			
Urban	1,635	168 (10.3)	0.010
Rural	5,839	737 (12.6)	
Mother's education level			
Uneducated	1,067	145 (13.6)	<0.001
Primary	5,355	669 (12.5)	
Secondary	853	86 (10.1)	
Higher	199	5 (2.5)	
Wealth index			
Poorest	1,780	271 (15.2)	<0.001
Poorer	1,565	226 (14.4)	
Middle	1,421	162 (11.4)	
Richer	1,277	130 (10.2)	
Richest	1,431	116 (8.1)	
Occupation			
Not working	498	46 (9.2)	0.028
Professional	381	28 (7.3)	
Sales	712	90 (12.6)	
Agricultural	5,499	703 (12.8)	
Domestic	93	9 (9.7)	
Manual job	289	29 (12.1)	
Literacy			
Cannot read at all	1,653	231 (14)	0.098
Able to read only parts of a sentence	651	73 (11.2)	
Able to read whole sentences	5,155	601 (11.7)	
Visually impaired	6	0	
Religion			
Catholic	2,683	325 (12.1)	0.0698
Protestant	3,636	446 (36.3)	
Adventist	898	98 (10.9)	
Muslim	163	21 (12.9)	
Jehovah's Witness	48	8 (16.7)	
No religion	39	7 (17.9)	
Other	2	0	

(Continued to the next page)

**Table 1.** Continued

Variables	Diarrhea		P*
	Total	Yes (%)	
Number of living children			
0	105	12 (11.4)	0.840
1	3,358	399 (11.9)	
2	3,146	391 (12.4)	
3	796	97 (12.2)	
4	53	6 (11.3)	
5	9	0	
7	7	0	
Child's age (month)			
<6	423	33 (7.8)	<0.001
6-11	354	60 (16.9)	
12-23	747	181 (24.2)	
24-34	757	109 (14.4)	
35-59	1,334	76 (5.7)	
Child's sex			
Male	3,766	476 (12.6)	0.156
Female	3,708	429 (11.6)	
Husband/partner's education level			
Uneducated	1,134	154 (13.6)	<0.001
Primary	4,778	587 (12.3)	
Secondary	619	49 (7.9)	
Higher	270	13 (4.8)	

\*, Chi-square test applied.

oping diarrhea was 1.439 times higher in children from the Western province compared to children from Kigali city. The occupation of the women in the family was found to have an impact on diarrhea in children. Children from families working in agricultural activities were 1.624 times more at risk than those from families with a mother who did not work and remained at home. In the case of uneducated women, their children were 5 times more at risk for developing diarrhea when compared with those whose mothers completed higher education.

The prevalence of diarrhea was found to be 12.7% in children under 5 years, which is slightly lower than the 2010 DHS findings of 13.1% [6]. It is also lower than a cluster study conducted in the health facilities in Nyarugenge District, Rwanda which showed a 26% prevalence of diarrhea [5]. The decrease in diarrhea prevalence in Rwanda may be due to the increasing access to clean water and improved sanitation in communities, and the increased access to medical services due to better health insurance coverage for the general population. The prevalence of diarrhea in Rwanda is also lower compared to the nomadic population in Ethiopia, which showed a 26.1%

**Table 2.** Multivariate logistic regression analysis of diarrhea with sociodemographic factors

Variables	Odds ratio	95% CI	P*
Child's age			
<6 m <sup>a</sup>	1		
6-11	1.404	0.85-2.30	0.180
12-23	4.514	3.04-6.68	<0.001*
24-34	2.652	2.65-4.23	<0.001*
35-59	2.340	1.58-3.45	<0.001*
Marital status			
No longer living together <sup>a</sup>	1		
Married	0.837	0.59-1.17	0.306
Living with partner	0.869	0.61-1.22	0.421
Widowed	0.895	0.49-1.62	0.715
Divorced	1.352	0.82-2.22	0.237
Wealth index			
Poorest	1.592	1.15-2.19	0.005*
Poorer	1.640	1.19-2.24	0.002*
Middle	1.274	0.92-1.76	0.143
Richer	1.109	0.80-1.53	0.528
Richest <sup>a</sup>	1		
Mothers' education level			
Uneducated	5.163	1.16-22.92	0.031*
Primary	4.736	1.09-20.54	0.038*
Secondary	4.098	0.94-17.75	0.059
Higher <sup>a</sup>	1		
Type of residence			
Urban <sup>a</sup>	1		
Rural	0.760	0.52-1.09	0.139
Province			
Kigali city <sup>a</sup>	1		
South	1.232	0.87-1.72	0.226
West	1.439	1.03-2.00	0.032*
North	1.144	0.79-1.64	0.467
East	1.193	0.85-1.67	0.305
Occupation			
Not working <sup>a</sup>	1		
Professional	1.007	0.58-1.73	0.979
Sales	1.316	0.69-2.49	0.401
Agricultural	1.624	1.00-2.62	0.048*
Domestic	1.160	0.74-1.80	0.511
Manual job	1.317	0.53-3.23	0.548
Husband's education level			
Uneducated	1.517	0.75-3.03	0.238
Primary	1.483	0.76-2.89	0.248
Secondary	1.059	0.53-2.10	0.870
Higher <sup>a</sup>	1		

<sup>a</sup>, reference; \*, P-value <0.05.

prevalence according to another study [7]. Findings also show that there was a lower prevalence of diarrhea in Northern (14.5%) and Eastern parts (22.5%) of Ethiopia [8,9].

In this study, significant association between diarrhea and age was found, as children aged 12-23 months were 4 times

more at risk of developing diarrhea than those aged <6 months, which was similar to the results of a study done in Pakistan [10]. Younger infants would be protected against diarrheal diseases by different mechanisms such as maternal antibodies obtained through breastfeeding. The children become less protected by maternal antibodies after weaning.

Living in the Western province was also found to be riskier for developing diarrhea, as this part of Rwanda is situated near lake Kivu, and some families residing here use the contaminated water from the lake for drinking and food preparation.

The children from poor families had a higher risk of developing diarrhea than children from middle, richer, and richest families. This is likely due to inadequate hygiene and sanitation, lack of clean water, lack of knowledge on diarrhea prevention, inappropriate disposal of stool, and living near unsafe ponds and wells [5]. Families involved in agricultural activities were found to be at higher risk of diarrhea due to soil-transmitted parasites, as the farmers use contaminated water for crop irrigation and food preparation. A study done in India shows a close relationship between irrigation water quality and the incidence of diarrhea in farming households [11].

A mother's lack of education was found to increase the risk for the development diarrhea in children, since an educated mother is more likely to be empowered to take care of her children and her family, which is the expectable result. Previous studies have shown that highly educated mothers' children were at low risk of morbidity and mortality due to diarrhea because they have necessary knowledge and practice good hygiene and sanitation [10,12]. Therefore, educated mothers are very important for the wellbeing and health status of children under 5 years and are significant predictors of good development of their children [13].

WHO recommends the rotavirus vaccination in children for protection against diarrhea. Rotavirus vaccine was introduced in Rwanda in 2012 and since its introduction, the number of cases of non-bloody diarrhea decreased by 17-29% and the active surveillance of the rotavirus showed a reduction of 61-70% of gastroenteritis cases in 2013-2014 in every age group [14]. The mortality associated with the rotavirus has decreased considerably since the introduction of its vaccine in Rwanda [15].

In conclusion, this study found that among various sociodemographic factors, the child's age, wealth index, education attainment of the mother, province of residence, and the family's involvement in agricultural activities are closely related to the risk of developing diarrhea in children less than 5 years in

Rwanda. Children from a poor family had a higher risk compared to more well-off families, and mothers with lower educational attainment placed their children at higher risk of diarrhea. To decrease diarrheal morbidity and mortality, designing and implementing health education and promoting awareness of simple early interventions to treat children with diarrhea are essential in the Rwandan community.

## CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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