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Prevalence and Determinants of Diarrhea among Children under Five in Sub-Saharan Africa: Evidence from Demographic and Health Surveys of 35 Sub-Saharan Countries

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Abstract

This study provides a comprehensive analysis of diarrheal prevalence and its determinants across 35 Sub-Saharan African (SSA) countries using the latest DHS data. Weighted analyses were performed, and multilevel logistic regression was applied to account for clustering effects. The prevalence of diarrhea was 15%. Higher odds of diarrhea were associated with younger child age, suboptimal immunization, malnutrition, lower maternal education, maternal employment, and lower household wealth index. Additionally, limited media exposure was identified as a significant risk factor, highlighting the role of health communication in disease prevention. Although the cross-sectional design does not establish causality, the findings underscore the need for integrated interventions, including maternal education programs, expanded media-based public health campaigns, improved water and sanitation infrastructure, and enhanced immunization services. Strengthening media-driven health education could play a crucial role in mitigating diarrheal disease, improving child health outcomes, and supporting child survival efforts across SSA. In contrast, the study provides valuable insights into the determinants of childhood diarrhea; its cross-sectional design limits causal interpretation.

Keywords

Diarrhea, Demographic Health Surveys, Sub-Saharan Africa, Children Under Five, Multilevel Regression

1. Introduction

The region of Sub-Saharan Africa (SSA) has the highest child mortality rate in the world. Globally, the under-five mortality rate declined from 93 per 1000 live births in 1990 to 38 per 1000 in 2019. However, in SSA, it only dropped from 184 per 1,000 in 1990 to 74 per 1000 in 2021. Despite this substantial decrease in mortality, SSA still lags in achieving one of the targets under the third Sustainable Development Goal (SDG), which aims to reduce under-five mortality to at most 25 deaths per 1000 live births in all countries by 2030. Diarrhea remains the third leading cause of death among children aged 1 - 59 months and a principal cause of malnutrition in children under five. Each year, approximately 1.7 billion childhood diarrheal cases are reported worldwide, resulting in the deaths of about 443,832 children under the age of five. According to the World Health Organization (WHO), diarrhea is defined as the passage of three or more loose or liquid stools per day, indicating abnormally high stool fluid content or an unusual increase in the daily frequency of defecation. Children suffering from diarrhea may face dehydration, electrolyte imbalances, malnutrition, a higher susceptibility to other infectious diseases, and delayed physical and mental development. Furthermore, diarrhea disrupts the proper absorption of essential nutrients—such as carbohydrates, proteins, and minerals—thereby exacerbating malnutrition.

In recent years, numerous interventions—ranging from improved access to clean water and sanitation facilities to vaccination campaigns and community education programs—have been implemented worldwide to curb the prevalence and impact of diarrhea in children. Yet the burden of diarrhea remains high in Sub-Saharan Africa (SSA), largely due to poverty, inadequate sanitation and water facilities, poor hygiene practices, and low vaccination coverage. These factors facilitate the transmission and persistence of pathogens that cause diarrhea. Additionally, weak health systems, limited access to healthcare services, and delayed treatment contribute to increased morbidity and mortality among affected children. The economic toll on families is also substantial: caregivers often lose income while attending to sick children, and the cost of treatment can plunge them further into poverty [1]. This cycle—where poverty fuels inadequate sanitation and nutrition, leading to more frequent illnesses—demonstrates the need for broad-based approaches that address both economic and health challenges.

Moreover, inadequate quantities and poor quality of drinking water, coupled with insufficient sanitation facilities, cause the deaths of millions of the world's poorest individuals from diarrheal diseases each year [2] [3]. Previous studies have shown that a high prevalence of diarrhea in under-five children is tied to numerous socio-demographic factors, including child age [4], maternal education [5]-[7], maternal awareness [8] [9], low socioeconomic status [6], drinking water distance and source [10], latrine and hand-washing facilities [11] [12], breastfeeding [13], place of residence [14] [15], child stool disposal methods [16], household size [17], number of under-five children in a household [18], maternal age [19], and maternal employment status [20]. Addressing these underlying factors and reinforcing healthcare systems are critical to reducing diarrhea-related morbidity and mortality in children under 5.

With less than a year remaining until the 2025 deadline of the Global Action Plan for the Prevention and Control of Pneumonia and Diarrhea (GAPPD)—an initiative aimed at significantly reducing child deaths from pneumonia and diarrhea—it is evident that more focused interventions and research in SSA are needed. In particular, climate-related factors such as extreme rainfall or drought may further complicate efforts to reduce diarrheal illnesses, as they affect water quality, sanitation infrastructure, and pathogen transmission. Hence, this study was conducted to analyze the prevalence of diarrhea and its associated factors among children under five across SSA. By leveraging a continent-wide analysis, this study aims to identify risk factors for diarrheal diseases, enabling relevant stakeholders to develop more targeted and context-specific intervention strategies based on regional environmental conditions. Although individual studies in specific sites or countries have yielded extensive information on diarrhea prevalence and its determinants, limited research has provided comprehensive estimations of under-five diarrhea across all of SSA. Consequently, this study seeks to elucidate the regional context and bolster evidence-based policy-making and public health strategies aimed at safeguarding young children from the severe consequences of diarrhea.

2. Methods

2.1. Data Source, Study Setting and Population

This study utilized the most recent Demographic and Health Survey (DHS) data collected from 35 sub-Saharan African (SSA) countries between 2011 and 2024. The DHS is nationally representative and typically administered every five years, generating population and health indicators at both the regional and national levels. Each participating country employed standardized DHS questionnaires, which were pretested and adapted to local contexts, and data were collected by trained enumerators on key indicators such as mortality, morbidity, fertility, and maternal and child health.

A two-stage stratified sampling technique was used in each DHS. In the first stage, enumeration areas (EAs) were randomly selected based on each country's most recent population and housing census. In the second stage, households within each EA were randomly chosen for detailed interviews. Across all countries, various datasets—covering men, women, children, births, and households—were compiled. For this particular analysis, we extracted data from the Kids' Record (KR file), focusing on children under 5 years of age. In total, 360,172 weighted observations were included, representing children who had experienced diarrhea in the two weeks preceding each survey. Children with missing data on key covariates were excluded, and complete-case analysis was conducted (Table 1).

2.2. Study Variables and Definitions

Dependent variable

Diarrhea was defined as the dependent variable and identified by a maternal

Table 1. List of sub-Saharan countries and their demographic and health survey's year.

Region	Country	Survey year	Weighted sample size
Central	Angola	2015-16	12,669
West	Benin	2017-18	12,686
West	Burkina Faso	2021	11,855
East	Burundi	2016-17	12,813
West	Cameroon	2018	9442
Central	Congo Democratic Republic	2013-14	17,017
West	Chad	2014-15	16,810
East	Comoros	2012	3099
Central	Congo	2011-12	7751
West	Côte d'Ivoire	2021	9156
East	Ethiopia	2016	10,417
Central	Gabon	2019-21	5873
West	Ghana	2022	8315
West	Gambia	2018	8362
West	Guinea	2018	7202
East	Kenya	2022	16,883
West	Liberia	2019-20	4866
South	Lesotho	2023-24	2258
East	Madagascar	2021	11,632
West	Mali	2018	9566
East	Malawi	2015-16	16,548
West	Mauritania	2019-21	11,266
East	Mozambique	2022-23	9396
West	Nigeria	2018	30,881
West	Niger	2012	12,268
South	Namibia	2013	4588
East	Rwanda	2019-20	8020
West	Sierra Leone	2019	8893
West	Senegal	2023	9504
South	South Africa	2016	3444
West	Togo	2013	6286
East	Tanzania	2022	10,497
East	Uganda	2018-19	14,493
East	Zambia	2018	9361
South	Zimbabwe	2015	6055

response to the question, "Has your child had diarrhea in the last two weeks?" A child whose caregiver answered "Yes" was classified as having diarrhea.

Independent variables

The independent variables were classified as individual and community-level variables. Individual-level factors were maternal age, educational status of the mother, maternal employment status, wealth index, number of under 5 children, water source, toilet facility, nutritional status (wasting, stunting and underweight), Immunization status, age of the child, sex of the child, intake of vitamin A in the last six months, time to get water source, sanitation practices and media exposure. Distance to health facility, place of residence, community educational status, community poverty level and SSA region were considered as community-level factors.

Operational definitions

- Media exposure: Media exposure was created from three variables (frequency of listening to the radio, watching television and reading newspapers or magazines). In this study, women who listened to radio watched television, or read newspapers/magazines were considered as having exposure to media (coded 'yes') and otherwise labelled as not having media exposure (coded "no").
- Wealth index: In the DHS, an asset-based approach was used to calculate the wealth index. The collected information was on ownership of a range of durable assets (e.g., television, radio, vehicles, bicycles, motorcycles, watches, agricultural land and farm animals) and housing characteristics (e.g., the source of drinking water, type of toilet, shared facilities, roofing material, wall and floor materials and cooking fuel). These scores were derived using principal component analysis and ranked into the poorest, poorer, middle, richer, and richest categories. The wealth quintiles are expressed in terms of quintiles of individuals in the population rather than quintiles of individuals at risk for any health or population indicator.
- Immunization status: A child is classified as "fully vaccinated" if they have received one dose of BCG vaccine, three doses each of polio vaccine, pentavalent vaccine (DTP-hepB-Hib), and pneumococcal conjugate vaccine (PCV), two doses of Rotavirus vaccine, and one dose of measles vaccine. Otherwise, if any of these criteria are not met, the child is considered "not fully vaccinated".
- Nutritional status: Based on WHO criteria, stunting was operationalized as height-for-age Z scores < -2; wasting was defined as weight-for-height Z scores < -2; and underweight was defined as weight-for-age Z scores < -2. For the purpose of this study, each of the three nutritional indicators was coded separately as binary variables, with "1" coded for stunting, wasting and underweight, whereas "0" was used as the code for the absence of stunting, wasting and underweight.
- Improved source of water: If the source of water is piped into a dwelling, piped to yard/ plot, public tap/standpipe, piped to neighbor, tube well or borehole, protected well, protected spring, rainwater and bottled water while the other sources

are unimproved.

- Community educational status: The aggregate educational attainment of individual women within a cluster—categorized as primary, secondary, or higher education—was used to determine the overall educational status of women within the cluster. Clusters were categorized into two groups: 1) higher proportion of women with education (above the national median value) and 2) lower proportion of women with education (below the national median value).
- Community poverty level: The proportion of individuals classified as poor or poorest was aggregated to determine the overall poverty status within the cluster. Based on the national median value, clusters were categorized into two groups: 1) a higher proportion of poor/poorest mothers and 2) a lower proportion of mothers within a cluster.

2.3. Data Analysis Procedure

Statistical analyses were conducted using STATA version 17. To restore the data's representativeness, individual weights (v005) were applied. Specifically, v005 was derived by multiplying the household weight (hv005) by the inverse of the individual response rate for women in the stratum, then dividing by 1,000,000 to obtain individual sample weights [21]. Because DHS data are obtained through multistage stratified cluster sampling, individuals within the same cluster often share similar characteristics more so than individuals in different clusters. To account for this clustering effect, the Intraclass Correlation Coefficient (ICC) and Median Odds Ratio (MOR) were calculated:

$$ICC = VA/(VA + VI) \tag{1}$$

where VA represents community-level (cluster) variance and VI represents individual-level variance. The ICC indicates the proportion of overall variance in under-five diarrhea prevalence attributable to between-cluster differences.

$$MOR = exp\left[\sqrt{((2 \times VA) \times 0.6745)}\right] \approx \exp\left(0.95\sqrt{VA}\right) \tag{2}$$

where VA is the cluster variance, and 0.6745 is a statistical constant used to adjust for the median difference in the standard normal distribution. MOR represents the median odds ratio between a randomly chosen individual in a high-risk cluster and an individual in a low-risk cluster.

Multilevel models are a statistical technique that is used to analyze data with hierarchical or clustered structures. Based on the values of these measures, the use of a multilevel logistic regression model is more appropriate than an ordinary logistic regression. In statistical analysis, ignoring clustering effects can lead to an overstatement of statistical significance. By leveraging such models, we can better understand the nature of clustering and its impact on statistical significance, thereby ensuring the validity of our results. In the bivariable multilevel logistic regression analysis, variables having a $p < 0.2$ were considered for the multivariable analysis. For the multilevel logistic regression analysis, four models were constructed. The first model is a null model, devoid of explanatory factors. The second model (model

I) includes individual-level variables, the third (model II) incorporates community-level variables, and the fourth (model III) includes both individual and community-level variables simultaneously. The aforementioned models were compared using deviance (−2Log-likelihood ratio), and the best-fit model was identified as the one with the lowest deviance. Finally, the adjusted odds ratio (AOR) was presented with its 95% confidence interval (CI) to assess the strength and statistical significance of the associations.

3. Results

3.1. Characteristics of the Study Population

A total weighted sample of 360,172 under-five children was included in this study. Of these, 181,527 (50.4%) were male, and 114,175 (31.7%) were in the age group 7 - 24 months. Overall, 48.9% of mothers were in the age group 25 - 34 years. More than one-third of the mothers (38.0%) had no education, and almost two-thirds (65.9%) were employed. In terms of family size, the majority of respondents (82.5%) had two or fewer under-five children in the household, while 17.5% had three or more. Household economic indicators showed that 44.1% of households belonged to the poor wealth index category. Environmental and sanitation factors indicated that 46.3% of households had improved sanitation facilities, while 71.2% had access to an improved water source. Nevertheless, more than half (55.8%) of respondents required at least 30 minutes to reach a water source. Regarding nutritional status, 116,696 (32.4%) children were stunted, 34,216 (9.5%) were wasted, and 76,717 (21.3%) were underweight. At the community level, 51.3% of children lived in communities with a "high" overall educational level, while 51.6% resided in communities characterized by "low" poverty (Table 2).

Table 2. Characteristics of the study population in SSA.

Variable	Category	Weighted Frequency	Percent (%)
Child gender	Male	181,527	50.4
	Female	178,645	49.6
Child age (in months)	0 - 6	45,022	12.5
	7 - 12	39,619	11.0
	13 - 24	74,556	20.7
	25 - 59	200,976	55.8
Immunization status	Fully vaccinated	210,340	58.4
	Not fully vaccinated	149,832	41.6
Vitamin A in the last 6 months	Yes	197,014	54.7
	No	163,158	45.3
Nutritional status	Wasting	34,216	9.5
	Stunting	116,696	32.4

Continued

	Underweight	76,717	21.3
Maternal age (years)	15 - 24	101,929	28.3
	25 - 34	176,124	48.9
	35 and above	82,119	22.8
Maternal education	No formal education	136,865	38.0
	Primary	124,259	34.5
	Secondary	86,081	23.9
	Higher	12,966	3.6
Maternal employment	Employed	237,353	65.9
	Not employed	122,819	34.1
Number of children under five years old	≤2	297,142	82.5
	>2	63,030	17.5
Wealth index	Poorest	78,878	21.9
	Poorer	79,958	22.2
	Middle	73,475	20.4
	Richer	67,712	18.8
	Richest	60,149	16.7
Media exposure	Yes	236,273	65.6
	No	123,899	34.4
Sanitation	Improved	166,760	46.3
	Un improved	193,412	53.7
Water source	Improved	256,442	71.2
	Un improved	103,730	28.8
Toilet facility	Improved	214,663	59.6
	Un improved	145,509	40.4
Time to get a water source	<30 minutes	159,196	44.2
	≥30 minutes	200,976	55.8
Community-level education	Low level	175,404	48.7
	High level	184,768	51.3
Community-level poverty	Low level	185,849	51.6
	High level	174,323	48.4
SSA region	East Africa	123,159	34.2
	West Africa	177,358	49.2
	South Africa	16,345	4.5
	Central Africa	43,310	12.0

Continued

Residence	Urban	110,933	30.8
	Rural	249,239	69.2
Distance to health facility	Big problem	159,556	44.3
	Not big problem	200,616	55.7

3.2. Random Effect Analysis

The results of the random-effects model showed that there was significant clustering of diarrheal disease among children under five across communities. In the null model, the ICC value was 0.139, indicating that 13.9% of the overall variation in diarrheal disease among under-five children was due to differences between clusters, whereas the remaining 86.1% was attributed to individual differences. The MOR generated from the null model also indicates the inter-cluster variation in diarrheal disease. The median odds ratio (1.34) from the null model is interpreted as follows: when two individuals with the same characteristics (covariates) are randomly selected from different clusters, the individual from the higher-risk cluster has 34% higher odds of experiencing diarrheal disease compared to the individual from the lower-risk cluster. When comparing models, the best-fitting model was the final model, which had the lowest deviance (**Table 3**).

Table 3. Model comparison and random effect analysis result.

Parameters	Null model	Model I	Model II	Model III
ICC (%)	13.9	12.8	13.5	12.1
MOR	1.34	1.29	1.32	1.27
Log-Likelihood	−493,091	−293,084	−473,123	−189,698
Model fitness				
Deviance	94,356.44	43,071.54	84,588.19	38,706.52

3.3. Factors Associated with Diarrheal Diseases

The overall prevalence of diarrhea in this study was 15.0%. The highest prevalence of diarrhea was in Burundi (22.5%), followed by Senegal (22.2%), while the lowest prevalence was in Sierra Leone (7.1%) (**Figure 1**). The odds of diarrhea were 3.11 times higher (AOR = 3.11, 95% CI: 2.86 - 3.35) and 2.57 times higher (AOR = 2.57, 95% CI: 2.38 - 2.75) in children aged 7 - 12 and 13 - 24 months, respectively, as contrasted to children aged 0 - 6 months. Conversely, the odds of diarrhea were 12% lower in children aged 25 - 59 months compared to children aged 0 - 6 months. The model revealed that children who were not fully immunized had a 6% (AOR = 1.06; 95% CI: 0.97 - 1.16) higher odds of having diarrhea compared to fully immunized children. Regarding nutritional status, children who experienced wasting (AOR = 1.53; 95% CI: 1.47 - 1.71), stunting (AOR = 1.36; 95% CI: 1.24 - 1.47) and underweight (AOR = 1.48; 95% CI: 1.32 - 1.66) had

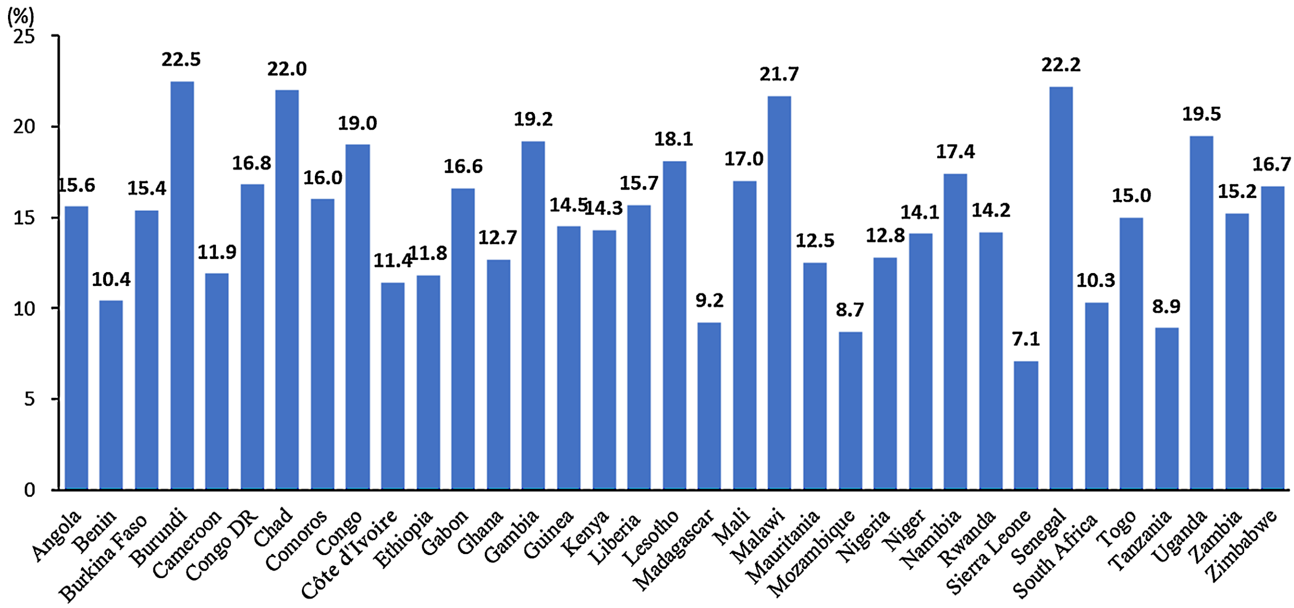

Figure 1. Prevalence of diarrhea among children five by country.

a 53%, 36% and 48% higher odds, respectively, of having diarrhea compared with children who were not classified as experiencing wasting, stunting and underweight.

The odds of diarrhea were 36% (AOR = 1.36, 95% CI: 1.33 - 1.40) and 20% (AOR = 1.20, 95% CI: 1.18 - 1.23) higher in children whose mother's age is 15 - 24 and 25-34 years, respectively, as compared to mothers aged 35 - 49 years. Children whose mothers had no education, primary education, or secondary education had about 1.75 (AOR = 1.75; 95% CI: 1.63 - 1.88), 1.67 (AOR = 1.67; 95% CI: 1.55 - 1.80) and 1.45 (AOR = 1.45; 95% CI: 1.34 - 1.55) times higher odds of developing diarrhea compared to children of mothers with higher level of education, respectively. The odds of developing diarrhea among children of working mothers increased by 14% (AOR = 1.14; 95% CI: 1.12 - 1.17) as compared to those of children of non-working mothers. The odds of diarrheal disease decreased by 12% (AOR = 0.88; 95% CI: 0.85 - 0.92) in children from households having two or more children.

The odds of developing diarrhea among children from the poorest, poorer, middle, and richer households increased by 16% (AOR = 1.16; 95% CI: 1.12 - 1.21), 13% (AOR = 1.13; 95% CI: 1.09 - 1.18), 6% (AOR = 1.06; 95% CI: 1.02 - 1.10) and 9% (AOR = 1.09; 95% CI: 1.05 - 1.13) as compared to the richest households, respectively. The prevalence of diarrhea among under-five children whose mothers had media exposure was 15% lower than that of their counterparts (AOR = 0.85; 95% CI: 0.81 - 0.89). Children residing in households with unimproved sanitation, water sources, and toilet facilities had a 1.08 (AOR = 1.08; 95% CI: 1.00 - 1.17), 1.14 (AOR = 1.14; 95% CI: 1.03 - 1.26) and 1.19 (AOR = 1.19; 95% CI: 1.10 - 1.30) times greater prevalence of experiencing diarrhea than their counterparts, respectively. The odds of developing diarrhea increased by 3% (AOR = 1.03; 95%

CI: 1.01 - 1.05) among children whose mother took 30 or more minutes to get drinking water when compared with children whose mother took less than 30 minutes. With respect to the SSA region, East Africa and Central Africa had 1.16 (APR = 1.16, 95% CI: 1.12 - 1.19) and 1.23 times greater prevalence of diarrhea among children under the age of 5 years than in South Africa, respectively (Table 4).

Table 4. Multilevel regression analysis of diarrhea among children under five in SSA.

Variables	Diarrhea		Odds ratio	
	Yes (%)	No (%)	COR (95% CI)	AOR (95% CI)
Child gender				
Male	27,411 (15.1)	154,116 (84.9)	1.06 (1.01 - 1.10)	1.08 (1.03 - 1.12)
Female	26,618 (14.9)	152,027 (85.1)	1	1
Child age (in months)				
25 - 59	24,318 (12.1)	176,658 (87.9)	0.85 (0.79 - 0.92)	0.88 (0.82 - 0.95)*
13 - 24	28,182 (37.8)	46,374 (62.2)	2.54 (2.36 - 2.73)	2.57 (2.38 - 2.75)*
7 - 12	16,798 (42.4)	22,820 (57.6)	3.10 (2.87 - 3.35)	3.11 (2.86 - 3.35)*
0 - 6	6,978 (15.5)	38,043 (84.5)	1	1
Immunization status				
Not fully vaccinated	31,761 (15.1)	178,579 (84.9)	1.15 (1.08 - 1.23)	1.17 (1.10 - 1.24)*
Fully vaccinated	20,677 (13.8)	129,155 (86.2)	1	1
Vitamin A in the last 6M				
Yes	29,946 (15.2)	167,068 (84.8)	1.10 (1.07 - 1.13)	1.03 (0.99 - 1.08)
No	24,311 (14.9)	138,847 (85.1)	1	1
Wasting				
Yes	7,151 (20.9)	27,065 (79.1)	1.52 (1.37 - 1.70)	1.53 (1.47 - 1.71)*
No	43,352 (13.3)	282,604 (86.7)	1	1
Stunting				
Yes	19,605 (16.8)	97,091 (83.2)	1.36 (1.25 - 1.49)	1.36 (1.24 - 1.47)*
No	30,921 (12.7)	212,555 (87.3)	1	1
Underweight				
Yes	15,190 (19.8)	61,527 (80.2)	1.47 (1.32 - 1.65)	1.48 (1.32 - 1.66)*
No	35,715 (12.6)	247,740 (87.4)	1	1
Maternal age (years)				
15 - 24	18,041 (17.7)	83,887 (82.3)	1.41 (1.33 - 1.49)	1.36 (1.33 - 1.40)*
25 - 34	26,242 (14.9)	149,882 (85.1)	1.25 (1.22 - 1.28)	1.20 (1.18 - 1.23)*
35 - 49	10,840 (13.2)	71,279 (86.8)	1	1

Continued

Maternal education				
No formal education	22,857 (16.7)	114,009 (83.3)	1.84 (1.71 - 1.97)	1.75 (1.63 - 1.88)*
Primary	19,384 (15.6)	104,875 (84.4)	1.67 (1.56 - 1.79)	1.67 (1.55 - 1.80)*
Secondary	12,826 (14.9)	73,255 (85.1)	1.57 (1.45 - 1.68)	1.45 (1.34 - 1.55)*
Higher	1,323 (10.2)	11,644 (89.8)	1	1
Maternal employment				
Employed	37,502 (15.8)	199,852 (84.2)	1.09 (1.07 - 1.11)	1.14 (1.12 - 1.17)*
Not employed	18,668 (15.2)	104,150 (84.8)	1	1
No. of under-5 children				
>2	9,202 (14.6)	53,828 (85.4)	0.88 (0.84 - 0.92)	0.88 (0.85 - 0.92)*
≤2	48,434 (16.3)	248,708 (83.7)	1	1
Wealth index				
Poorest	12,936 (16.4)	65,942 (83.6)	1.26 (1.22 - 1.30)	1.16 (1.12 - 1.21)*
Poorer	12,873 (16.1)	67,085 (83.9)	1.22 (1.17 - 1.25)	1.13 (1.09 - 1.18)*
Middle	11,021 (15.0)	62,454 (85.0)	1.14 (1.10 - 1.18)	1.06 (1.02 - 1.10)*
Richer	10,495 (15.5)	57,217 (84.5)	1.13 (1.08 - 1.17)	1.09 (1.05 - 1.13)*
Richest	8,180 (13.6)	51,968 (86.4)	1	1
Media exposure				
Yes	32,606 (13.8)	203,667 (86.2)	0.84 (0.81 - 0.89)	0.85 (0.81 - 0.89)*
No	19,700 (15.9)	104,199 (84.1)	1	1
Sanitation				
Unimproved	29,205 (15.1)	164,207 (84.9)	1.12 (1.09 - 1.14)	1.10 (1.04 - 1.17)*
Improved	23,013 (13.8)	143,747 (86.2)	1	1
Water source				
Unimproved	17,530 (16.9)	86,199 (83.1)	1.14 (1.03 - 1.26)	1.14 (1.03 - 1.26)*
Improved	37,184 (14.5)	219,258 (85.5)	1	1
Toilet facility				
Unimproved	24,300 (16.7)	121,209 (83.3)	1.19 (1.10 - 1.30)	1.19 (1.10 - 1.30)*
Improved	30,482 (14.2)	184,180 (85.8)	1	1
Time to get water source				
≥30 minutes	31,352 (15.6)	169,624 (84.4)	1.01 (1.02 - 1.03)	1.03 (1.01 - 1.05)*
<30 minutes	24,039 (15.1)	135,157 (84.9)	1	1
Community level education				
Low level	26,661 (15.2)	148,742 (84.8)	1.01 (0.96 - 1.06)	0.99 (0.94 - 1.04)
High level	27,900 (15.1)	156,868 (84.9)	1	1

Continued

Community-level poverty				
Low level	28,435 (15.3)	157,414 (84.7)	1.02 (0.97 - 1.07)	0.98 (0.93 - 1.03)
High level	26,148 (15.0)	148,175 (85.0)	1	1
SSA region				
East Africa	19,582 (15.9)	103,577 (84.1)	1.15 (1.11 - 1.18)	1.16 (1.12 - 1.19)*
West Africa	25,185 (14.2)	152,173 (85.8)	1.02 (0.99 - 1.05)	0.97 (0.95 - 1.01)
Central Africa	7,709 (17.8)	35,601 (82.2)	1.30 (1.26 - 1.34)	1.23 (1.19 - 1.27)*
South Africa	2,354 (14.4)	13,991 (85.6)	1	1
Residence				
Rural	38,383 (15.4)	210,856 (84.6)	1.01 (0.99 - 1.03)	0.97 (0.94 - 1.01)
Urban	16,307 (14.7)	94,626 (85.3)	1	1
Distance to health facility				
Big problem	24,093 (15.1)	135,463 (84.9)	1.02 (1.01 - 1.03)	1.02 (1.00 - 1.04)
Not big problem	29,691 (14.8)	170,925 (85.2)	1	1

a. P-value < 0.05.

4. Discussion

These findings are interpreted below in light of existing literature and regional context. This study aimed to determine the prevalence of diarrhea and its associated factors among children under five in SSA. The two-week period prevalence of childhood diarrhea morbidity in this study was 15.0%. This finding is higher than that of studies conducted in Mesoamerica (13.0%) [4], Vietnam (11%) [22], and India (5%) [23]. Conversely, this finding is lower than that of studies conducted in Yemen (29.1%) [24], Afghanistan (26.2%) [5], and India (25.2%) [25]. This dissimilarity is possibly attributable to a difference in socio-demographic characteristics, location, climate, improved water sources and the presence of improved toilet facilities.

The odds of developing diarrheal diseases are higher in children who were aged 7 - 12 and 13 - 24 months compared to children aged 0 - 6 months. This finding is in agreement with other studies [26]-[29]. This high odds ratio for childhood diarrhea prevalence might be attributed to the introduction of supplementary feeding after six months of age. Children who started supplementary feeding have a high probability of feeding on unhygienic foods that might have paved the way to diarrheal diseases. After six months of age, children are more likely to bring infectious agents to their mouths due to the development of hand-mouth coordination, which increases the risk of diarrheal diseases at this stage. Conversely, the odds of diarrheal disease among children aged 25 - 59 months are reduced by 12% as compared to children aged 0 - 6 months. The possible explanation for this result is that older children are more likely to resist diarrheal diseases because of the more developed immunity compared to younger children. Another important finding of this study is the significant association between routine immunization and reduced risk of diarrhea. Fully immunized children were less likely to experience diarrhea compared to those partially or not vaccinated. This finding supports the protective role of immunization, particularly against vaccine-preventable diseases such as measles and rotavirus. Also, the current study showed that children who were malnourished (*i.e.*, experiencing wasting, stunting and underweight) were likely to experience diarrhea. The plausible explanation for this is that malnutrition among children generally denies them the essential micronutrients needed to combat childhood-related diseases such as diarrhea. Malnutrition enables diarrheal infections to occur more frequently and for longer periods, with about a 38% increase in frequency and a 73% increase in length accounting for a doubling of the diarrhea burden in malnourished children [4].

This study showed that children of young mothers had a higher risk of diarrhea than those of older mothers. This finding is in line with other studies conducted in low- and middle-income countries [30] [31]. A possible explanation could be that older women have greater experience in childcare, while younger mothers may have less understanding and knowledge about diarrheal disease, its mode of transmission, and the spread of pathogens within the household compared to older mothers. Therefore, health education interventions should target young mothers as a key audience to prevent diarrhea among children under five. The level of education of mothers was linked to a higher prevalence of diarrhea in their children. Diarrhea was almost twice as common in children whose mothers had no formal education. This is not surprising considering that education enables women to be well informed about how to find and utilize appropriate child health information [32]. Furthermore, approximately one-half of the mothers in the survey had no formal education. This finding is not surprising because a UNESCO assessment indicated that Africa has the highest rates of school exclusion, particularly among women. Additionally, it has been demonstrated that the increased economic burden in subregions of Africa translates into families' incapacity to provide formal education for their children. Also, cultural factors may explain the high prevalence of uneducated women. Until recently, most women in Africa's subregions were primarily expected to undertake domestic chores, meaning they were expected to stay at home and handle all domestic responsibilities. The same cultural practices in Africa encouraged early marriages, depriving women of formal education [33] [34]. The present study also showed that children of mothers who are currently employed had higher odds of developing diarrhea compared to those of non-working mothers. This finding is in line with other studies in Ethiopia and some sub-Saharan countries [14] [18]. This could be because working mothers may not have enough time to care for their children, as they spend most of their time working to support their family, whereas non-working mothers typically have more time to care for their children and minimize their exposure to contaminated objects. Due to the cross-sectional nature of the DHS data, the temporal sequence between exposure and outcome cannot be determined. For example, the observed association between media exposure and reduced diarrhea risk may be confounded by unmeasured socioeconomic factors or health-seeking behavior. Reverse causation is also possible, where households with frequent childhood illnesses might engage more with health media.

In this study, a higher risk of diarrhea was observed among children under five from lower wealth index households. This finding is consistent with findings in Iraq [35] and India [36]. In general, children in poor households may face a level of social and health inequalities that can predispose them to preventable health conditions. The high odds of diarrheal diseases in these groups of children can be explained by the fact that economically marginalized families may face challenges in accessing health services, although this was not found to be statistically associated with diarrhea risk in our analysis. Another possible justification for this finding is that poor households are likely to experience inconsistent nutritional supplies and live in unhygienic neighborhoods, which increases the risk of exposure to the microbial agents that cause diarrhea. It was also found that families with two or more under-five children were less likely to have diarrhea than those with only one child. This finding is contrary to previous studies which had suggested that, as the number of children under five increases, the probability of occurrence of diarrheal diseases is high [37] [38]. This inconsistency may be due to those households with a high number of under-five children being more familiar with the sequel of childhood diarrheal diseases; the more experience and knowledge they gain about the transmission of diarrheal diseases, the less likely their subsequent children are to develop diarrhea. Consistent with the faecal-to-oral contact being the main transmission pathway, we find that improved sanitation and toilets play an important role. Flush toilets are particularly effective in mitigating temperature-induced diarrhea risks and for children residing in households with flush toilets, the diarrhea risk caused by temperature shocks drops by 75% [39]. Flush toilets reduce the risk of direct and indirect contact with faeces by piping waste out of the household's plot (or community) for disposal [40] [41]. This implies that building up and connecting people to sewerage systems would prove particularly valuable. A lot of research has gone into developing and implementing strategies to provide safe water and sanitation for all. One main insight has been that there is no one-size-fits-all solution. The role of state and private actors as well as the effectiveness of different approaches depends on local technological, financial, institutional, social, and environmental factors [42].

This study also showed that children from households that spend more than 30 minutes fetching drinking water were more vulnerable to diarrhea compared to those who spend less than 30 minutes. This finding is in agreement with other studies [43]. In fact, water supply sources do not necessarily guarantee access to clean drinking water, but the time burden of water fetching might influence the volume of water collected by households as well as time spent on child care. Additionally, the association of a higher risk of diarrhea with public standpipe water can be explained by water contamination during transportation. Hence, improvements in ease of access and quality of water are recommended as preventive measures to control diarrhea [44].

5. Strengths and Limitations

Unlike previous studies that focused on individual countries or smaller regions, this study provides a comprehensive analysis of diarrheal prevalence and its determinants across 35 Sub-Saharan African countries using the latest DHS data. By integrating data from the most recent survey cycles (2011-2024), this study captures more recent trends in diarrheal disease prevalence and risk factors in SSA. To ensure accurate and reliable estimates, the data were appropriately weighted. To account for clustering effects and to improve the accuracy of our standard errors and estimates, we used multilevel modeling. Consistent with previous research, this study finds that younger children and those with inadequate immunization are at higher risk of diarrhea. However, our findings also reveal that maternal employment and media exposure play a significant role, which has been less explored in prior studies.

Despite the strengths mentioned above, the cross-sectional nature of this study precluded the establishment of a cause-and-effect relationship. All information about diarrhea was provided by mothers, which could introduce recall bias and subjectivity. In addition, by merging DHS data from different countries, important contextual differences between countries might be overlooked, which may influence the variables being measured. Since DHS data for each nation were not collected simultaneously, temporal changes may go unnoticed, leading to biased comparisons. Furthermore, the definition of full immunization included some vaccines (e.g., rotavirus, pneumococcal) that were not universally available across all DHS survey years. This may have introduced misclassification bias when comparing countries or years, and future studies should consider restricting analyses to harmonized antigens available across all datasets. Moreover, this study did not examine potential interaction effects between key determinants, such as maternal employment, education level, and media exposure. Future research should explore how these factors interact to influence child health outcomes, as this may yield a more nuanced understanding of the pathways underlying childhood diarrhea risk.

6. Conclusions

The prevalence of childhood diarrhea in sub-Saharan Africa was high. Children's age, immunization status, nutritional status, maternal age, maternal occupation, maternal education, wealth index, media exposure, sanitation, water sources, toilet facilities, time to get water, and certain SSA regions were significantly associated with diarrhea. To prevent diarrhea in the region, policymakers and stakeholders should strengthen public health interventions by addressing the factors associated with diarrhea.

Immunization was found to be associated with reduced odds of diarrheal diseases. This finding highlights the importance of comprehensive immunization programs. Strengthening and promoting immunization efforts can be an effective strategy for reducing the burden of diarrheal diseases in the region. Given the strong link between maternal media exposure and reduced childhood diarrhea, mass media interventions can effectively improve child health. In this study, media exposure encompassed general sources such as radio, newspapers, and television, which may indirectly shape maternal awareness of hygiene and disease prevention. Governments and health organizations should expand media-based campaigns on hygiene, diarrhea prevention, and sanitation. Integrating local radio and television into community health programs can enhance health information dissemination. Additionally, mobile health applications and SMS-based messaging have proven effective, with mobile phone messaging programs identified as a promising tool for reducing diarrhea [45]. By adopting a multi-platform approach that incorporates both traditional and digital media, policymakers can maximize outreach and ensure that critical health messages reach diverse populations, ultimately contributing to the reduction of diarrheal diseases among children. Given the geographic and socioeconomic heterogeneity across SSA, region-specific strategies should also be considered. For example, Central and East Africa, which showed higher diarrhea prevalence, may benefit from targeted investments in sanitation infrastructure and maternal health education. Conversely, regions with lower prevalence may offer best practices to inform effective interventions elsewhere.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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