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Diarrheal Factors among Children under Five Years of Age on Health Systems Performance in Western Kenya: A Descriptive Cross-Sectional Study

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ABSTRACT

Diarrhea is a leading cause of morbidity and mortality among children under five years in Kenya. The study investigated diarrheal factors and health systems performance among children under five years in Migori County of western Kenya. A descriptive cross-sectional study was conducted utilizing questionnaires, interview guides and focus group discussions for data collection. Descriptive statistics and chi-square goodness of fit test was applied for univariate analyses. On examining variables associated with outcome of interest, binary logistic regression model was advanced. Out of the 334 children, majority (58%) were female, [X^2 (1, N=334) =11.04, p = 0.002] with a mean age of 32 months. Bivariate and multivariate analyses revealed the variables which were significant in predicting the outcome. They included; latrine ownership (*COR*=1.56: CI= 1.14,1.79 ; p = 0.003) and (*AOR*= 1.25 (*CI* = 1.08, 1.67; p = 0.002), presence of flies on latrine (*COR*=0.22: CI= 0.11,0.67; p = 0.005) and (*AOR*=0.17: CI= 0.09,0.52; p = 0.003) and practicing OD (*COR*=0.38: CI= 0.24,0.53; p = 0.006) and (*AOR*= 0.21 (*CI* = 0.18,0.47; p = 0.005). Regression modeling had significant prediction performances X^2(3, N=334 = 19.75, p=0.003) for factors associated with performance of the health systems. The regression modelling *(Y=mx+b)* on factors (*Y*=102.489, R^2 = 0.826) proved that they were significantly good predictors of the outcome variable. The study concluded that diarrheal factors significantly predicted the response variable. The researchers concluded for a more specific focus on risk factors attributed to diarrhea and found to influence performance of health systems.

Key words: diarrheal, factors, health systems, performance, under-five

INTRODUCTION

Diarrhea refers to the physiological phenomenon characterized by the frequent excretion of loose stool, occurring three or more times within a span of 24 hours (WHO, 2018). The health system encompasses a comprehensive network of organizations, institutions, and resources that collectively strive to enhance the provision of healthcare services with the ultimate goal of improving overall health outcomes (WHO, 2014). In the global context diarrhea pose a significant public health challenge, exerting a substantial impact on both the health service providers and infrastructure with the occurrence of over 2 billion cases and a significant number of death worldwide (WHO, 2018; Woldu, Bitew, & Gizaw, 2016).

The incidence of morbidity and mortality caused by diarrhea were closely associated with the lack of adequate access to safe drinking water and inadequate sanitation infrastructure (Getachew et al., 2018). Numerous scholarly investigations have documented a correlation between outbreaks of diarrheal disease and various factors such as, socio-economic status,

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behavioral and environmental, urbanization, water safety and food quality standards (Rahmawati, Panza, & Lertmaharit, 2012; Kotloff et al., 2013). Factors relating to the access of clean and safe water were also a public health concern (Shine et al., 2020; Randremanana et al., 2016). The study also noted that putting pressure on the health systems, slow down their others routine service delivery so as to respond to the emergency of diarrhea infections (Ansari et al., 2012). In the context of Kenya, it was established that diarrhea had made health systems to stretch beyond its limits in terms of limited resources so as to contain the occurrence and effects associated with diarrhea infections (Ayuk et al., 2018). Approximately 88% of cases of diarrhea can be attributed to inadequate environmental conditions, primarily stemming from substandard management of excreta (Ayuk et al., 2018).

MATERIALS AND METHODS

Study Design

Descriptive cross-sectional study design was employed to effectively depict the existing conditions within a specific population, capturing a snapshot of the situation as it naturally unfolded. The research was conducted at a specific juncture, encompassing a representative sample from the entirety of the population under scrutiny.

Study Setting

The research was conducted in Migori County, a captivating region located in the western part of the Republic of Kenya, nestled within the beautiful geographical boundaries of this diverse country. The participants were drawn from eight distinct administrative units regarded as Sub-Counties, each with its own unique identity and characteristics. These sub-counties are Suna East, Suna West, Uriri, Awendo, Rongo, Nyatike, Kuria West, and Kuria East.

Study Population

Migori County reported about 58,188 cases of diarrhea during the year 2018, whereby 29,704 (51.05%) cases of diarrhea were for children under five years and 28,484 (48.95%) cases were above five years (DHIS, 2018).

Target Population

The study targeted 29,704 (51.05%) children under five years who suffered from diarrheal conditions and had visited a health facility for treatment or management during the completed year 2018.

Sample Size Determination

The determination of the sample size for this study was based on the statistical formula proposed by Fisher *et al*. (1998).

$$n = \frac{Z^2 p(1-p)}{d^2}$$

Where;
n= required sample size (minimum size for a statistically significant survey)
p = proportion of diarrhea (assumed prevalence value of diarrhea of 28%)
Z= standard score corresponding to 95% confidence level (and is thus equal to 1.96)
d = margin of error acceptable/ measure of precision (estimated at 5% and is thus equal to 0.05).

$$n = \frac{1.96^2 \text{x } 0.28 \text{ x } 0.72}{0.05^2}$$

= 309 *(add 10% survey non-response and item non-response)*
= 340

Sampling Procedures

The data for the diarrhea cases under five years for the year under study was obtained from the under five health registers of the 282 different categories of health facilities in Migori County. The lead CHVs for respective link health facilities were present to ensure that live cases only were obtained to form the sampling frame. The researcher clustered the County into eight administrative units namely Sub Counties. The samples from each cluster were obtained proportionally to form the required sample size. The researcher developed a sampling frame by listing all cases alive in each cluster by assigning them random numbers. The researcher wrote the random numbers for each cluster on pieces of paper, folded them to ensure the random numbers are not visible. Thereafter the researcher selected samples for each cluster by placing them in eight different containers representing the eight clusters, shook them and then blindfolded eight different lead community health volunteers who randomly picked the corresponding number of samples for each cluster.

Data Analysis

Quantitative data analysis

The researcher employed Statistical Package for Social Sciences (SPSS Version 25.0) and Microsoft Excel software to conduct data analysis. On univariate analyses the study employed Descriptive and Chi-square goodness of fit fitness test to investigate the interplay between the variables, specifically examining the relationship of frequencies or distribution. A binary logistic regression analysis was performed to examine the relationship between the independent and dependent variables, with a significance level set at less than 0.05. The individuals who demonstrated statistical significance during bivariate analysis and met the necessary requirements and assumptions for multivariate logistic regression were selected to be part of the final logistic regression model.

Qualitative data analysis

The data obtained through qualitative methodologies, namely Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs), were meticulously transcribed in their entirety using the Microsoft Word software. In order to uphold the utmost precision of the transcribed documents, the research team diligently verified the congruity between the transcripts and the corresponding audio recordings. The qualitative data underwent rigorous analysis through the method of content analysis, which allowed for the identification and exploration of emerging themes.

RESULTS

Socio-Demographic Characteristics

As shown in Table 1, a significant majority (58%) of the children under five years were identified as female with a statistically significant association among their sexes X^2 (1, N=334) = 11.04, p = 0.003). The average age was found to be 31.85 months, with a standard deviation of 0.67. The maximum age was six times the minimum age and almost twice the average age. The standard deviation for the age variable of children under five years was <1.0 (SD= 0.67) with a coefficient of variation of 2.11%. The findings suggest that there was a limited range of variation and dispersion in the data, indicating a higher level of consistency and predictability in the responses provided by the participants regarding the age of children under five years. The analysis of age distribution revealed that the age group with the highest proportion (25%), fell within the range of 35 to 47 months. Conversely, the age group (< 11) months exhibited the lowest percentage (13%). The chi-square test, X^2 (4, N=334) = 13.61, p = 0.014 revealed a statistically significant relationship among their age groups.

Table 1: Descriptive statistics for the children under five years

Variable	Category	f	%	df.	x^2	*p-value*
Sex	Male	140	42	1	11.04	0.003
	Female	194	58			
Age (months)	0-11	43	13	4	13.61	0.014
	12-23	51	15			
	24 -35	81	24			
	36 -47	84	25			
	48- 59	75	23			

In reference to Table 2, the average age of the caretakers in the study was 32.81 years, with a standard deviation of 0.86 while the age range spanned 38 years. The standard deviation for the age was less than 1.0 (SD= 0.86) with a coefficient of variation of 2.62% , indicating a low variability, low degree of dispersion and thus a more consistency and predictable responses from the respondents as regards to age. The age distribution revealed that the caretaker population was proportionately distributed across different age groups. Interestingly, the largest proportion of caretakers (29%), fell within the age group of individuals older than 49 years. On the other hand, the smallest proportion (8%), consisted of individuals younger than 20 years old. The study unveiled a noteworthy and statistically significant correlation between the ages of the participants, X^2 (4, N=334) = 18.77, p = 0.021). The majority of the respondents 241 (72%) were married with no statistically significant relationship among their marital status, X^2 (2, N=334) =10.59, p = 0.054. There was a significant relationship among the levels of education, X^2 (3, N=334) =0.88, p<0.001with more than a half (56%) having no formal education. A higher proportion (90%) of the respondents belonged to Christianity with no statistically significant relationship among their religion, X^2 (2, N=334) =11.64, p=0.073. A significant percentage (76%) of the respondents were found to reside in the rural areas of the county with a statistical significant relationship among their area of residence, X^2 (1, N=334) =9.32, p=0.004. Concerning occupation, the majority of the respondents (74%) were housewives, however there was no significant relationship among their occupations, X^2 (4, N=334) =21.28, p = 0.063.

Table 2: Descriptive statistics of caretakers

Variable	Category	n(%)	df	x^2	*p-value*
Age (Years)	<20	25(7)	4	18.77	0.021
	20- 29	56(17)			
	30-39	73(22)			
	40-49	82(25)			
	>49	98(29)			
Marital status	Married	241(72)	2	10.59	0.054
	Single	84(25)			
	Others	9(3)			
Highest level of education	No formal education	187(56)	3	14.88	<0.001
	Primary education	96(29)			
	Secondary education	38(12)			
	Tertiary education	13(3)			
Religion	Christians	302(90)	2	11.64	0.073
	Muslim	22(7)			
	Others	10 (3)			
Area of residence	Urban	80(24)	1	9.32	0.004

	Rural	254(76)			
Occupation	House wife	248(74)	4	21.28	0.063
	Privately employed	31(9)			
	Civil servant	41(12)			
	NGO employed	9(3)			
	Others	5(2)			

More than three quarters (82%) of the study respondents owned a latrine with a statistically significant relationship among the latrine ownership, X^2 (1, N=334) =12.87, p<0.001. A significant percentage (71%, n=275) was found utilizing traditional type of latrine followed by VIP latrine (24%) and the least were pour flush (3%) and other types (3%) with a relationship between these variables found to be statistically significant ,X^2 (3, N=275) =42.05, p=0.003. Presence of flies in or around the latrine was high (93%, n=275) among the households owning latrines with a statistically significant relationship among the response in regard to presence of flies, X^2 (1, N=334) =11.84, p=0.002. Despite majority of the respondents owning a latrine, open defecation (96%) was observed to be significantly high with their frequencies being significantly different, X^2 (1, N=334) =12.05, p<0.001. The study revealed that majority of the respondents (75%) did not have hand washing facilities/stations at their household levels and this revealed an insignificant relationship among their frequencies, X^2 (1, N=334) =13.06, p = 0.066. There was no significant relationship among the methods of refuse disposal, X^2 (3, N=334) =26.87, p=0.082 as the study confirmed that open field or crude dumping (59%) as a refuse disposal method was majorly practiced. More than a half (53%) of the respondents indicated springs as their main source of drinking water ,however the relationship between these variables was not significant, X^2 (7, N=334) =56.33, p=0.058. Majority (89%) of the respondents confirmed that it took more than 30 minutes to collect water from the source and this had a significant relationship among the time taken to fetch water,X^2 (1, N=334) =9.08, p=0.016. On the distance one has to travel to fetch water, more than a half (62%) indicated travelling more than one kilometer, having significant relationship, X^2 (2, N=334) =13.12, p=0.007. It was established that the highest number (83%) of respondents experience intermitted water supply throughout the year with a non significant relationship among the frequencies, X^2 (1, N=334) =12.61, p=0.074 (Table 3).

Table 3: Descriptive statistics on environmental characteristics

Variables	Category	n(%)	df	x^2	*p-value*
Ownership of latrine	Yes	275(82)	1	12.87	<0.001
	No	59(18)			
Type of latrine	VIP latrine	65(24)	3	42.05	0.003
	Traditional pit	194(71)			
	pour flush	8(3)			
	Others	8(3)			
Presence of flies	Yes	256(93)	1	11.84	0.002
	No	19(7)			
Open defecation	Yes	264(96)	1	12.05	<0.001
	No	11(4)			
Provision of hand washing facility	Yes	85(25)	1	13.06	0.066
	No	249(75)			
Methods for refuse disposal	Compost pit	81(24)	3	26.87	0.082
	Open field	197(59)			
	Burning	51(15)			
	Burying	5(2)			

Main source of drinking water	Rain catchment	23(7)	7	56.33	0.058
	Piped system	7(2)			
	Spring	176(53)			
	Shallow well	76(23)			
	Borehole	7(2)			
	River	21(6)			
	Lake	18(6)			
	Others	6(2)			
Time taken to fetch water	< 30 Minutes	36(11)	1	9.08	0.016
	>30 Minutes	298(89)			
Distance to the water source	< 0.5 KM	51(15)	2	13.12	0.007
	0.5-1.0 KM	75(23)			
	>1.0 KM	208(62)			
Status of water supply	Intermitted	276(83)	1	12.61	0.074
	Continuous	58(17)			

As shown in Table 4, the main source of income for majority of the household heads were from Casual laborers (55%) with a significant relationship, X^2 (3, N=334) =21.86, *p* = 0.028 .Regarding monthly income per household head, more than a third (44%) were earning below ksh.10, 000.00. The relationship between the household monthly income variables was statistically significant, X^2 (5, N=334) =43.31, *p*=0.015. Finally the study revealed that a large number (63%) of the households were 'poor' as pertains to wealth index with a significant relationship, X^2 (2, N = 334) = 15.01, *p*=0.039.

Table 4: Descriptive statistics on socio-economical factors

Variable	Category	n	%	df	x^2	p-value
Main source of income	Earned income	57	17	3	21.86	0.028
	Self-employment	75	23			
	Casual laborers	184	55			
	Others	18	5			
Household monthly income (Ksh)	< 10,000	148	44	5	43.13	0.015
	10,000 –19,000	123	37			
	20,000 – 29,000	24	7			
	30,000 – 39,000	19	6			
	40,000 – 49,000	13	4			
	>50,000	7	2			
Wealth index	Poorer	43	13	2	15.01	0.039
	Poor	210	63			
	Middle	81	24			

The bivariate analysis on socio-demographic and health systems performance variables was conducted to determine their association as summarized in Table 5. Sex of the child had no statistically significant association with health systems performance. Male as a reference category, the female children were 1.66 times more likely to experience poor health systems than male children (*COR* = 1.66; *CI* = 0.94, 1.98; *p* = 0.073). This shows that at 95% confidence interval sex of a child is a possible risk factor for poor health systems but not statistically significant.

Ages of the children were significantly associated with performance of health systems. In reference to age group (0-11months), as the age of the child increased, the likelihood of experiencing poor health systems reduced significantly. Among the children aged (12-23 months), their *COR* was 0.78(*CI* = 0.57, 0.92; *p*=0.006). The *COR* for children aged (24-35 months) was 0.57(*CI* = 0.41, 0.66; *p*=0.004). For children aged (36-47 months) their *COR* was 0.38(*CI* = 0.28, 0.47; *p*=0.002) and finally those aged (48-59 months) it was 0.19(*CI* = 0.11, 0.32; *p*<0.001). The study established that at 95% confidence interval, age was a statistically significant promoter factor of good health systems.

Based on the age group of less than 20 years, as the age of the caretakers increased, the likelihood of experiencing poor health systems decreased significantly. The *COR* values for age groups (20-29 years), (30-39 years), (40-49years) and (over 49 years) were; 0.53(CI = 0.34, 0.79; *p*=0.005), 0.48(CI = 0.26, 0.67; *p*=0.003), 0.34(CI = 0.22, 0.41; *p*=0.002) and 0.27(CI = 0.23, 0.34; *p*<0.001) respectively. The association between the age and health system performance was statistically significant, thus establishing that at 95% CI, age of the caretaker was a factor for promoting good health systems.

Highest level of education completed had a significant associated with health systems performance. Caretakers who had attained primary education were 0.49 times less likely to experience poor health systems than those without formal education (*COR* = 0.49; *CI* = 0.31, 0.57; *p* = 0.006). Meanwhile those with secondary education were 0.34 times less likely to experience poor health systems than those without formal education (*COR* = 0.34; *CI* = 0.22, 0.45; *p* = 0.003). Finally those with tertiary level of education were 0.23 times less likely to experience poor health systems than those without formal education (*COR* = 0.23; *CI* = 0.16, 0.28; *p*<0.001). These showed that the level of education was a significant factor in determining health systems performance, more so the study reveals that at 95% CI, age was a promoter factor for good health systems.

Area of residence among the children was significantly association with performance of health systems. Urban area as a base, the odds of experiencing poor health systems for those living in rural areas increased by 45% (*COR* = 1.45; *CI* = 1.22, 1.57; *p*=0.021), thus at 95% CI, the study reveals that area of residence was a statistically significant risk factor for poor health systems.

Table 5: Association between socio-demographic and health systems performance

Variables	COR	*p-value*	95% C.I for EXP(B)	
			Lower	Upper
Sex				
Male (ref)	1.00			
Female	1.66	0.073	0.94	1.98
Age of the child (months)				
0-11(ref)	1.00			
12-23	0.78	0.006	0.57	0.92
24-35	0.57	0.004	0.41	0.66
36-47	0.38	0.002	0.28	0.47
48-59	0.19	<0.001	0.11	0.32
Age of the caregiver (years)				
<20 years(ref)	1.00			
20 - 29 years	0.53	0.005	0.34	0.79
30 - 39 years	0.48	0.003	0.29	0.67
40 - 49 years	0.34	0.002	0.22	0.41
>49 years	0.27	<0.001	0.23	0.34
Highest level of education				
No formal education (ref)	1.00			
Primary education	0.49	0.006	0.31	0.57

Secondary education	0.34	0.003	0.22	0.45
Tertiary education	0.23	<0.001	0.18	0.28
Area of residence				
Urban(ref)	1.00			
Rural	1.45	0.021	1.22	1.57

Tabulation in Table 6, summarizes the determination of associations between environmental and health systems performance variables. Ownership of a latrine had a statistically significant association with performance of health systems. The household who did not own a latrine were 1.56 times more likely to experience poor health systems than those who owned a latrine (*COR* = 1.56; *CI* = 1.14, 1.79; *p*=0.003). At 95% CI, it shows that; not owning a latrine is a significant risk factor contributing to poor health systems.

The association between the type of latrine and health systems performance had mixed findings. Referring to a Ventilated Improved Pit (VIP) latrine, households owning traditional pit latrines were 1.49 times more likely to experience poor health systems than those who own a VIP latrine (*COR* = 1.49; *CI* = 0.88, 1.97; *p*=0.067). The study reveals that at 95% CI, using traditional pit latrine is a potential risk factor for poor health systems but not statistically significant. Those utilizing pour flush latrines were 0.54 times less likely to experience poor health systems compared to those who own a VIP latrine (*COR* = 0.57; *CI* = 0.32, 0.85; *p*=0.013).This indicates that at 95% CI, using a pour flush latrine is a statistically significant factor for good health systems. Finally those who owned other types of latrines were 1.54 times more likely to experience poor health systems than those who own a VIP latrine (*COR* = 1.54; *CI* = 0.96, 1.68; *p*=0.059). This reveals that at 95%CI, owning other types of latrine is potential risk of poor health systems but not statistically significant.

Presence of flies in or around the latrine was significantly associated with the performance of health systems. The odds of poor health systems among those whose latrines did not have flies in or around the latrines was reduced by 62% compared to those who had flies in or around the latrines (*COR* = 0.22; *CI* = 0.11, 0.67; *p* = 0.005).This is an indication that at 95% CI, latrines free of flies in or around them is a statistically significant factor for good health systems.

Practice of Open Defecation (OD) was significantly associated with the performance of health systems. The odds of poor health systems among those households who did not practice OD were 0.38 times less than those who practiced OD (*COR* = 0.38; *CI* = 0.24, 0.53; *p*=0.006).This is an indication (95% CI) that Open Defecation Free (ODF) environment is a statistically significant factor promoting health systems performance.

Time taken to fetch water from the main source was not significantly associated with health systems performance. Comparing with < 30 minutes, those who took > 30 minutes were 1.65 times more likely to experience poor health systems than those who travel for < 30 minutes (*COR* = 1.65; *CI* = 1.41,1.92; *p*=0.008). This is an indication that travelling more than 30 minutes to fetch water is a significant risk for poor health systems.

The distance to water source was significantly associated with the performance of health systems. In reference to < 0.5 KM, those who travel between a half to one kilometer to fetch water were 1.63 times more likely to experience poor health systems than those who travel less than a half a kilometer (*COR* = 1.63; *CI* = 1.45, 1.73; *p*=0.014). Those who travel more than 1.0 KM were 1.78 times more likely to experience poor health systems than those who travel less than a half a kilometer (*COR* = 1.78; *CI* = 1.53, 1.89; *p*=0.012). The study shows that at 95% CI, travelling more than a half a kilometer to fetch water is a potential risk of poor health system.

Table 6: Association between environmental variables and health system performance

Variables	COR	95% C.I for EXP(B)		p-value
		Lower	upper	
Ownership of latrine				
Yes(ref)	1.00			
No	1.56	1.14	1.79	0.003
Type of latrine				
VIP latrine(ref.)	1.00			
Traditional pit latrine	1.49	0.88	1.97	0.067
Pour flush	0.57	0.32	0.85	0.013
Others	1.54	0.96	1.68	0.059
Presence of flies				
Yes(ref.)	1.00			
No	0.22	0.11	0.67	0.005
Practice of open defecation.				
Yes(ref)	1.00			
No	0.38	0.24	0.53	0.006
Time taken to fetch water				
< 30 Minutes(ref)	1.00			
>30 Minutes	1.65	1.41	1.92	0.008
Distance to the water source				
< 0.5 KM(ref)	1.00			
0.5-1.0 KM	1.63	1.45	1.73	0.014
>1.0 KM	1.78	1.53	1.89	0.012

The bivariate analysis on socio-economic factors and health systems performance is illustrated in Table 7 below. The main sources of income for the household head were significantly associated with health systems performance. In reference to salaried income, the self employed head of household were 1.32 times more likely to experience poor health systems than those who were salaried (*COR* = 1.32; *CI* = 1.27, 1.61; *p*=0.011). The casual labourers were 1.53 times more likely to experience poor health systems than those who were salaried (*COR* = 1.53; *CI* = 1.38, 1.78; *p*=0.014). Those with other sources of income were 1.69 times more likely to experience poor health systems than those who were salaried (*COR* = 1.69; *CI* = 1.46, 2.04; *p*=0.023). Theses indicated that at 95% CI, source of income is a statistically significant risk factor of poor health systems.

Household monthly income (Ksh) was significantly associated with health systems performance. In reference to less than Ksh 10,000.00, as the household monthly income increased, the likelihood of health systems being poor decreased significantly. Among the household with monthly income of between ksh.10, 000.00 to 19,000.00, the *COR* was 0.68 (*CI* =0.51, 0.94; *p*=0.007). *COR* for households with monthly income range of ksh.20, 000.00 to 29,000.00 was 0.54(*CI* = 0.45, 0.69; *p*=0.005). *COR* for households with monthly income between of ksh.30, 000.00 to 39,000.00 was 0.42(*CI* = 0.31, 0.56; *p*=0.003).*COR* for households with monthly income of ksh.40, 000.00 to 49,000.00 was 0.31(*CI* = 0.27, 0.43; *p*=0.003) and finally the *COR* for households with monthly income over ksh.50, 000.00 was 0.28(*CI* = 0.23, 0.37; *p*<0.001). This showed that at 95% CI, household monthly income is statistically significant promoter factor of good health systems.

Wealth index for the household had a statistically significant association with health systems performance. In reference to poorer, those households considered to be poor were 0.87 times less likely to experience poor health systems than those who were poorer (*COR* = 0.87; *CI* = 0.62, 0.97; *p* = 0.018). Those considered to be middle were 0.62 times less likely to experience poor health systems than those who were considered poorer (*COR* = 0.62; *CI* = 0.55, 0.69; p<0.001). The study indicated that wealth index is significant factor that promotes good health systems.

Table 7: Association of socio-economic and health systems performance variables

Variables	COR	95% C.I for EXP(B)		*p-value*
		lower	upper	
Main source of income.				
Salaried (ref)	1.00			
Self-employment	1.32	1.27	1.61	0.011
Casual labourer	1.53	1.38	1.78	0.014
Others	1.69	1.46	2.04	0.023
Household monthly income (Ksh)				
< 10,000 (ref)	1.00			
10,000 –19,000	0.68	0.51	0.94	0.007
20,000 – 29,000	0.54	0.45	0.69	0.005
30,000 – 39,000	0.42	0.31	0.56	0.003
40,000 – 49,000	0.31	0.27	0.43	0.003
>50,000	0.28	0.23	0.37	<0.001
Wealth index for the household				
Poorer (ref)	1.00			
Poor	0.87	0.62	0.97	0.018
Middle	0.62	0.55	0.69	<0.001

At multivariable logistic regression analysis (Table 8), latrine ownership still had a statistically significant association with odds ratio adjusted from 1.56 (CI = 1.14, 1.79; p = 0.003) to 1.25 (CI = 1.08, 1.67; p = 0.002). This finding indicates that households without access to a latrine were 1.25 times more susceptible to encountering inadequate health conditions in comparison to their counterparts who had latrines. Based on the 95% CI, this indicates that not owning a latrine is a statistically significant risk factor for poor health systems.

Odds ratio (OR) for the presence of flies in or around the latrine was adjusted to 0.17 (*CI* = 0.09, 0.52; p = 0.003) from a COR of 0.22 (*CI* = 0.11, 0.67; p = 0.005) and the association with health systems performance remained statistically significant. This meant that at 95% CI, absence of flies in or around the latrine is a statistically significant factor for good health systems.

The OR for open defecation practices was adjusted to 0.21(*CI* = 0.18, 0.47; p = 0.005) from 0.38 (*CI* = 0.24, 0.53; p = 0.006) and the association remained statistically significant. This revealed that those whose households ensured open defecation free (ODF) environment were 0.21 times less likely to experience poor health systems than those who practiced open defecation (OD). In addition, the study shows that ODF environment is a statistically significant factor for good health systems.

Table 8: Association of diarrheal influencing factors with outcome variable

Variable	Bivariate regression			Multivariate regression		
	COR	95%CI	*p-value*	AOR	95%CI	*p-value*
Ownership of latrine	1.56	(1.14,1.79)	0.003	1.25	(1.08,1.67)	0.002
Presence of flies on latrine	0.22	(0.11,0.67)	0.005	0.17	(0.09,0.52)	0.003
Practice of OD	0.38	(0.24,0.53)	0.006	0.21	(0.18,0.47)	0.005

The evaluation of the significance of the full model was conducted using the Omnibus Tests of Model Coefficients. The results indicated a chi-square value of 19.75, with a corresponding *p-value* of 0.003. The aforementioned findings indicate that the comprehensive model exhibited a noteworthy level of predictive accuracy, as evidenced by the statistically significant performance of [x^2(3, N=334 = 19.75, p = 0.003)]. The research findings indicate that the comprehensive model exhibited a significant deviation from a model that only includes a constant or lacks any predictors. Consequently, the model demonstrated a noteworthy capacity to forecast the outcome variable, as evidenced by the statistical analysis presented in Table 9.

Table 9: Omnibus tests of model coefficients

Description		Chi-square	df	Sig.
Step 1	Step	19.75	2	0.003
	Block	19.75	2	0.003
	Model	19.75	2	0.003

Evaluation of the strength of association of the model was performed based on **Nagelkerke's R^2*. The strength of the association composed of three independent variables and the dependent variable as summarized in Table 10. The prediction on the outcome variable had an R^2 of .83. This revealed that 83% of the variance in health systems performance was predicted by independent variables, 17% of the variance in outcome variable was unexplained by the regression model and the predictor variables had a large effect on the outcome variable. Based on the findings, the researcher reached the conclusion that the model exhibits a noteworthy capacity to predict the dependent variable. However, it is plausible that there exist additional independent variables that could potentially serve as significant predictors.

Table 10: Model summary

Step	-2 Log likelihood	Cox & Snell R Square	*Nagelkerke* R Square
1	127.753	0.798	0.826

The model has demonstrated a strong level of fit, as evidenced by the inability of the *Hosmer* and *Lemeshow* test to reject the hypothesis of model appropriateness (Ho: The model adequately fits the data). The chi-square value of 15.112 and a *p-value* of 0.104 further support this finding. The obtained *p-value* of 0.104, as indicated in Table 11, suggests that the model exhibits a reasonable fit to the observed data.

Table 11: Hosmer and Lemeshow goodness of fit test

Step	Chi-square	df	Sig.
1	15.112	2	.104

As demonstrated in Table 12, the magnitude of the relationship between each independent variable and the dependent variable was conducted by utilizing the Variables in the Equation table. The regression equation was computed by utilizing the Wald ratio (slope) for each of the independent variables.

$$Y\text{=mx+b}$$

Whereas; Y: Dependent variable, m: Slope, x: Independent variable, b: Constant

$$Y = (21.776*1.25+22.439) + (24.113*0.17+22.439) + (18.348*0.21+22.439)$$

$$Y = 102.489$$

Therefore, the regression analysis for this set of independent variables and dependent variable proved that independent variables were good predictors of the variable of interest as the value for the coefficient of determination was significantly sufficient ($R^2 = 0.826$) thus 83% of the changes in outcome variable is predicted by the independent variable and hence the model is a good fit for the given data.

Table 12. Model predicting the likelihood of diarrheal factors on health systems performance

Variables in the equation	B	S.E.	Wald	95%CI	sig.
Ownership of latrine	1.25	.104	21.776	(1.08,1.67)	.002
Presence of flies on latrine	0.17	.161	24.113	(0.09,0.52)	.003
Practice of open defecation	0.21	.107	18.348	(0.18,0.47)	.005
Constant	0.88	.119	22.439	(0.46,0.95)	.008

Qualitative Result

It was noted that a large number of respondents had a perception that, diarrhea is as a result of poor sanitation and hygiene. They added that drinking contaminated water also causes diarrhea. This indicated that the participants really understood the causes of diarrhea in children. A male respondent during Focus Group Discussion (FGD) noted;

> "*Our water points are not protected and thus get contaminated easily and if we don't boil the drinking water we will have diarrhea".*

A Key Informant Interview (KII) respondent added;

> *"Some household don't own latrines and they are attempted to practice open defecation which when it rains, the feces are washed away and end up at water bodies such as rivers and unprotected wells. This indeed makes water to be contaminated. More so many households don't consider treating water and thus cause diarrhea".*

The same sentiments were verified by another KII respondent who emphasized that;

> "*Some household have designated areas for Open defecation especially for children and vulnerable groups. During household visits we observed that children defecate around the houses and kitchen gardens. We also observed open defecation in small bushes near the houses, which we noted that they were being used by adults".*

FGD participant noted that;

> *"Not washing hands before feeding the child can cause diarrhea. Some of us we eat without washing our hands even after visiting the latrine. Dirt hands can easily bring diarrhea to our children".*

A KII respondent stated;

> *"Poor refuse disposal, lack of hand washing facilities at the household level, poor food hygiene such as not covering foods contribute to diarrhea not only to children but also to adult population".*

DISCUSSION

At multivariable analysis, latrine ownership had a statistically significant association with the outcome variable. The study revealed that those households which did not own a latrine had high chances of realizing poor health systems in reference to latrine owned households. This is attributed to the fact that when one doesn't own a latrine they are likely to practice open defecation where fecal matter is exposed to the open grounds or environment. The feces are then likely to be washed away during rain runoff and will access water sources thus causing water source contamination. In the event that water for drinking is not subjected to any form of treatment, definitely the household members are prone to diarrhea infections. When they are sick they will seek medical services at health facilities and at this point in time the health systems are subjected to unnecessary pressure of handling the diarrheal cases and this will negatively affect performance of the systems regarding quality of service offered, accessibility and efficiency. Once all these happens then the health systems becomes weak in terms of its functions and goals, hence termed as poor health system. This indicates that not owning a latrine is a statistically significant risk factor for poor health systems. This finding concurs with a study by Melese *et al*. (2019), whereby latrine utilization was realized to have association with diarrhea among children and was statistically significant. Lack of latrine may be attributed to economical status of the household, collapsing soil or hard rocks hindering its digging and construction.

The presence of flies on latrines had a statistically significant association with the response variable. The study confirmed that households free of or without flies on their latrines were less likely to experience poor health systems. Flies are very important component in fecal-oral transmission route as they accelerate the transmission of the diarrhea causing agents. They carry pathogens from the latrines, access uncovered foods and deposit the pathogens on the food. When the food is consumed without re-heating to kill the microorganisms then the consumers will have diarrhea infection which will force them to visit health facilities for management or treatment. These treatment and management events will end up straining the health systems, hindering its proper functioning and thus becomes a poor health system in reference to its functionality and goals or outcomes. Contrary if there are no flies on latrines it means no diarrhea infections are likely to occur through the mentioned process but instead the health systems performance will be maintained. This means that absence of flies on latrines is a statistically significant factor for promoting good health system. Concurrence with this is the study by Alemu, Mezgebu, and Akilew (2014) which found out that diarrhea infections had an association with flies found on the latrine floors. Absence in this context implies good cleanliness of the latrines hence absence of smell which attracts the flies. The VIP latrine is a good example of latrines that can minimize smell and hence don't attract flies. When the latrines are not hygienically kept they become sources of infections.

Open defecation practices had a statistically significant association with the outcome variable. The study revealed that those households with open defecation free (ODF) environment were less likely to experience poor health systems than those who practiced open defecation (OD). Open defecation free environment will not attract flies which are agents of transmission of diarrhea infections. This means household members will not contract the disease and hence will not exert any pressure to the health systems. However if open defecation is practiced it means fecal matter will finally contaminate water sources and drinking the water without treatment will result to diarrheal infection. The sick population will have to visit health facilities for treatment and on the process exert unnecessary pressure on the health system causing it to strain so as to handle extra load thus reducing its efficiency, accessibility and quality of service delivery. This indicates a risk factor emanating from diarrhea due to open diarrhea, which in turn will have an influence on heath systems performance. The findings are in line with Degebasa, Weldemichael, and Marama (2018) whose findings revealed 34% of the household who did not implement proper hygiene and good sanitation practiced open defecation then experiencing high prevalence of about thirteen percent. This showed that those households with presence of feces had high chances of having diarrhea than without feces at their compounds. Also concurring with this was the study of Alelign, Asegidew, and Abera (2016) which revealed that feces presence was more likely to cause diarrhea. Practice of open defecation could be attributed to lack of latrine, fear of children to use the latrine due to unfriendly size of the aperture and even distance from the house to the latrine especially when one need to use the latrine at night. All these and many more hindrances lead to open defecation.

CONCLUSION

The increase in diarrhea cases has greatly contributed to exerting pressure on health systems performance. Reducing diarrhea conditions is imperative in maintaining or improving health systems performance. With increase in factors contributing to diarrhea infections of diarrhea, the affected household members will be compelled to seek treatment or management for diarrheal related conditions at the health facilities, thus causing unnecessary pressure on the health systems performance. On the other hand eliminating or avoiding factors contributing to diarrhea will reduce diarrhea cases consequently maintain or improving health systems performance. These findings have a significant implication in health systems performance as they highlight the need for the county government to ensure that more efforts are put in diseases prevention and control. This will enable the health systems to function at minimal interference from pressures likely to be experienced from handling more cases at any given time.

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