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Factors associated with diarrheal diseases in under-five children: a case control study at arthur davison children's hospital in Ndola, Zambia

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ABSTRACT

Diarrhea is one of the leading causes of high mortality and morbidity rate among under five children worldwide. Worldwide mortality estimates ranges from 1.5 to 5.1 million deaths per year, especially in developing countries. The main objective of this study was to establish factors associated with diarrheal diseases in children less than five years at Arthur Davison Children's Hospital in Ndola, Zambia. **Method**: A case-control study was conducted in the infectious and non-infectious wards at Arthur Davison Children's Hospital in Ndola, Zambia from November 2016 to July 2017. Cases were children with diarrhea and controls were children without diarrhea but with other conditions or simply normal and came for review. **Results**: Total of 112 children with 56 cases and 56 controls participated in the study. Independent factors which were significantly associated with diarrhea after adjusting for confounders were poor hand washing practices by parent or caregiver (OR=0.101, 95% CI[0.022,0.462], lack of exclusive breastfeeding (OR= 0.136, CI[0.029,0.631]) and times of admission for diarrhea (OR=0.18, CI[0.004,0.084]).**Conclusion**: It was found that poor hand washing practices among parents or caregiver was significantly associated with diarrhea in under five children of age at Arthur Davison Children's Hospital, Zambia. Measure should be put in place to educate women about the importance of washing hands with soap after using the toilet and after changing the baby clothes. Further studies are needed in order to help curb the factors that influence diarrhea in under-five children.

Keywords: Diarrhea, Risk Factors, Under five Children, Zambia

Introduction

Diarrhea is an increase in the frequency or volume of stool greater than 250 grams per day. It can be classified as either acute or chronic diarrhea [1]. The global under five mortality rates for diarrhea have decreased significantly from 4.5 million to 1.8 million annually and acute diarrhea is a very big problem in children's health in developing countries [2]. Some would disagree that there has been a decline in diarrhea mortality, because in some of the countries the mortality rate is still high especially in developing countries[3]. Diarrheal diseases are one of the leading causes of mortality and morbidity of children under the age of five in the world and often results from contaminated food and water sources. Globally about 780 million individuals lack access to clean drinking water and 2.5 billion to good sanitation. This account for about 1 in 9 child deaths worldwide, killing around 760 000 children every year and about 2,195 children every day more than diseases like AIDS, malaria, and measles[4].It was estimated that 15% of under-five child deaths worldwide and of which about two million deaths annually, making diarrhea has the second killer of children globally [5].It was concluded in one study that the risk factors of diarrhea among children included their age, sex, geographic location, drinking contaminated water, and low economic status of their parents [6]. People in these areas did not have access to clean water and inappropriate breastfeeding practices.

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The study done in north Sudan, reported that diarrhea was associated with child's age, gender, and social status in which boy were more affected than girls because they like to explore different things [6].Another similar study done in 2004, recommended the use of oral rehydration salts (ORS) and zinc supplements, increased amounts of fluids, and also continued feeding for treatment of acute diarrhea. Encouraged use of ORS to treat acute diarrhea in homes, in order to prevent dehydration and reduce children mortality. It was concluded that use of oral rehydration salts (ORS) reduce diarrhea mortality by up to 93 % although in sub-Saharan Africa only about one in three children with diarrhea receives ORS and below 5 % for Zinc supplements [13][3].In Zambia there is increased burden of Rotavirus disease among under five children, with the introduction of rotavirus vaccines to prevent childhood deaths and hospitalizations [7]. Despite this measures diarrhea remains the main killer of children in Zambia, causing approximately nine percent of deaths in children below the age five [7]. Rotavirus is the most common cause of severe diarrhea in children worldwide, accounting for 3,600 Zambian children's death below the age of five and that is approximately 40% mortality [7]. The objectives of the study were to establish risk factors associated with diarrhea among children below the age of five years who presented at Arthur Davison Children's Hospital in Ndola.

Methodology

Study site

The study was done at Arthur Davison Children's Hospital located within the Copperbelt province of Zambia. It is the biggest Children hospital in Zambia which receives referrals from different parts of the country.

Study design

The study utilized a case-control study design, focusing on the factors associated with diarrheal diseases in children less than five years of age.

Study population

The study included 56Cases which were children with diarrhea and 56 controls comprising children without diarrhea but presenting with other conditions or simply normal but came for review.

Sample size

A pilot study was conducted with 30 cases and 30 controls to obtain information to compute the sample size. Source of drinking water, as one of the risk factors was used to compute for the sample size where P_1=Case prevalence size = 73% and P_2=control prevalence size=43%, f (αβ) was taken as 10.51 at power 90% and significant level at 5% which resulted in minimum value of 52.

Variables

A standardized questionnaire was developed from some questionnaires that had been used previously in similar studies. The study considered three areas for risk factors of diarrhea such as; socioeconomic characteristics of household: marital status of a mother, residence status, and number of occupants in a household, occupation of mother and father, electricity and refrigerator in a home, type of a toilet, and type of a house, kitchen and radio in home. Child demographic and behavioral characteristics included: Sex of the child, age, child spacing, exclusive breastfeeding, co-morbidity, rotavirus vaccination, child hand washing, diarrhea occurrence in two weeks, times of diarrhea, number of admission, management of diarrhea, fever in last two weeks and child feeding methods. Caregiver practices associated with diarrhea were derived from variables such as: gender of parent or caregiver, religion, mother's and father's education, age of mother and father, HIV status of mother and father, source of drinking water, water treatment, storage of water, hand washing practices by parent or caregiver and duration of breastfeeding.

Ethical consideration

Permission was granted by Tropical Disease Research Centre (TDRC) Ethics Committee and Arthur Davison Children's Hospital to conduct the study.

Data Entry and Analysis

Data was entered using Microsoft excel and then exported to SPSS version 16.0 for analysis. The Chi square test was used to determine associations between selected risk factors and diarrhea. Independent factors associated with diarrhea were further analyzed using multivariate logistic in order to rule out confounders. A result yielding a *P-value* of less than 5% was considered to be statistically significant.

Results

A total of 112 respondents with 56 cases and 56 controls under the age of five years participated in the study.

Table1: shows child demographic and behavioral characteristics; exclusive breastfeeding *P-value*=<0.001, co-morbidity *P-value*=<0.001, hand washing practices *P-value*=<0.001, times of diarrhea *P-value*=<0.001, admission for diarrhea and management *P-value*=<0.001. All the factors except gender *P-value*=0.846, age *P-value*=0.130, child spacing *P-value*=1.000and feeding method *P-value*=0.850were significantly associated with diarrhea.

Table 2: shows socioeconomic characteristics of household; residence status *P-value*=<0.001, occupants *P-value*=<0.001, work of mother and father *P-value*=<0.001, electricity *P-value*=<0.001, type of toilet and house *P-value*=<0.001 and *P-value*=0.002 respectively, kitchen and radio *P-value*=<0.001, marital status of mother and refrigerator in home *P-value*=<0.043 and *P-value*=<0.001 respectively. All were significantly associated with diarrhea.

Table 3: shows caregiver practices related factors associated with diarrhea; gender *P-value*=0.001, education of father and mother *P-value*=<0.001, age of mother *P-value*=<0.001, HIV status of mother *P-value*=<0.010, source and treatment of water *P-value*=<0.001, storage of water *P-value*=<0.001, hand washing practices and duration of breastfeeding *P-value*=<0.001, all were significantly associated with diarrhea except for age of father *P-value*=0.093, HIV status of father and religion *P-value*=0.428 and *P-value*=0.170 respectively.

Table 4: shows factors independently associated with diarrhea. The Adjusted odd ratios after excluding water treatment, duration of breastfeeding, type of house and lack of kitchen. Children who lacked exclusive breastfeeding were 13% more likely to have diarrhea compared to children breastfed. Those children who were admitted more were 18% more likely to have diarrhea. It was also determined that children whose mothers or caregiver lacked good hand washing practice were 10% more likely to develop diarrhea compared to those who had mothers or caregivers who possessed good hand washing practices.

Table1: Child demographic and behavioral characteristics

Factors	Case[n%]	Controls[n%]	P-Values
Exclusive breastfeeding			<0.001
Yes	38(67.9)	11(19.6)	
No	18(32.1)	45(80.4)	
Co-morbidity			<0.001
Yes	13(23.2)	26(46.4)	
No	43(76.8)	30(53.6)	
Hand washing practices			<0.001
Poor	46(82.1)	11(19.6)	
Good	10(17.9)	45(80.4)	
Times of diarrhea			<0.001
More often	52(92.9)	19(38.9)	
Less often	4(7.1)	37(66.1)	
Admission for diarrhea			<0.001
More often	49(87.5)	4(7.1)	
Less often	7(12.5)	52(92.9)	
Management of diarrhea			<0.001
Home	41(73.2)	19(33.9)	
Health facility	15(26.8)	37(66.1)	
Gender			0.846
Male	35(62.5)	34(60.7)	
Female	21(37.5)	22(39.3)	
Child age(year)			0.130
0-2	30(53.6)	22(39.3)	
3-5	26(46.4)	34(60.7)	
Child spacing			1.000
Yes	27(48.2)	27(48.2)	
No	29(51.8)	29(51.8)	
Fever			0.850
Yes	28(50)	19(33.9)	
No	28(50)	37(66.1)	
Child feeding methods			0.850
Hand	27(48.2)	26(46.4)	
Other instruments	29(51.8)	30(53.6)	

Table 2: Socioeconomic characteristics of household

Factors	Cases[n%]	Controls[n%]	*P*-value
Marital status of mother			0.043
Single	23(41.1)	13(23.2)	
Married	33(58.9)	43(76.8)	
Residence status			<0.001
Rural	42(75)	15(26.8)	
Urban	14(25)	41(73.2)	
Occupant			<0.001
>5	48(85.7)	19(33.9)	
<5	8(14.3)	37(66.1)	
Work of mother			<0.001
Housewife	46(83.6)	25(44.6)	
Working	9(16.4)	31(55.4)	
Occupation of father			<0.001
Not working	29(53.7)	2(3.6)	
Working	25(46.3)	54(96.4)	
Lack of electricity			<0.001
Yes	42(75)	17(30.4)	
No	14(25)	39(69.6)	
Type of toilet			<0.001
Pit latrine	48(85.7)	19(33.9)	
Flush toilet	8(14.3)	37(66.1)	
Type of House			0.002
Not of bricks	13(23.6)	2(3.6)	
Made of bricks	42(76.4)	54(96.4)	
Lack of Kitchen			<0.001
Yes	42(75)	14(25)	
No	14(25)	42(75)	
Lack of Radio			<0.001
Yes	42(75)	21(37.5)	
No	14(25)	35(62.5)	
Lack of refrigerator			<0.001
Yes	42(75)	17(30.4)	
No	14(25)	39(69.6)	

Table3: Caregiver practices associated with diarrhea

Factors	Cases[n%]	Controls[n%]	P-values
Gender			0.001
Male	19(33.9)	5(8.9)	
Female	37(66.1)	51(91.1)	
Mothers education			<0.001
Didn't complete grade 12	46(82.1)	20(35.7)	
Completed grade 12	10(17.9)	36(64.3)	
Age of Mother			<0.001
<20	25(45.5)	2(3.6)	
>20	30(54.5)	54(96.4)	
HIV status of Mother			0.010
Reactive	11(20)	2(3.8)	
Not reactive	44(80)	51(96.2)	

Father education			<0.001
Didn't complete grade 12	37(67.3)	17(30.4)	
Completed grade 12	18(32.7)	39(69.6)	
Source of drinking water			<0.001
Not piped	44(78.6)	15(26.8)	
Piped	12(21.4)	41(73.2)	
Water treatment			< 0.001
Not treated/boiled	47(83.9)	22(39.3)	
Treated/boiled	9(16.1)	34(60.7)	
Cover drinking water			<0.001
Sometimes	46(82.1)	18(32.1)	
Always	10(17.9)	38(67.9)	
Hand practices			<0.001
Poor	41(73.2)	6(10.7)	
Poor	15(26.8)	50(89.3)	
Duration of breastfeeding(Months)			<0.001
< 6	25(44.6)	5(8.9)	
>6	31(55.4)	51(91.1)	
Religion			0.170
Christian	52(92.9)	55(98.2)	
Others	4(7.1)	1(1.8)	
Age of father			0.093
<20	5(8.9)	1(1.8)	
>20	51(91.1)	55(98.2)	
HIV status of father			0.428
Reactive	4(7.5)	2(3.9)	
Non-reactive	49(92.5)	49(96.1)	

Table 4: Results of logistics analysis

Factor	Unadjusted OR(95%CI)	Adjusted OR (95%CI)
Lack of exclusive breastfeeding		
Yes	0.048(0.006-0.384)	0.136(0.029-0.631)
No	1	1
Admission for diarrhea		
More often	0.03(<0.001-0.047)	0.18(0.004-0.084)
Less often	1	1
Hand practices		
Poor	0.023(0.02-0.274)	0.101(0.022-0.462)
Good	1	1
Water treatment		
Not treated/boiled	0.165(0.024-1.119)	
Treated/boiled	1	
Duration of breastfeeding(months)		
<6	16.828(0.907-312.154)	
>6	1	
Type of House		
Not of bricks	0.061(0.003-1.238)	
Made of bricks	1	
Lack of kitchen		
Yes	9.109(0.847-97.970)	
No	1	

Discussion

The present study focused on the factors associated with diarrheal diseases in under five children at Arthur Davison Children's Hospital, Ndola, Zambia. It was determined that lack of exclusive breastfeeding for six months, poor personal hygiene with parents or caregiver and often admission for diarrhea were significantly associated with diarrhea. The study showed that lack of exclusive breastfeeding for six month is a risk factor, in a similar study it was concluded that the risk factors of diarrhea among children included inappropriate breastfeeding practices contributed to the burden of disease [6].This was consistent with the current finding. Another study it was found that factors associated with diarrhea included: mother's education level higher than primary school, covered well or borehole as a source of drinking water and duration of breastfeeding less than six months [8]. The difference in finding could be due to different study population those from rural or urban area. Mothers, who had attained secondary or higher level of education, covered well or borehole and duration of breastfeeding greater than six months were found protective factors [11]. Some finding is in congruent with finding in the present study and the difference could be attributed different socio-economic status of household. The result from the study shows poor personal hygiene with parents or caregiver as a risk factor for diarrhea disease. A study carried in India, the author observed the increase in the cases of diarrheal diseases mostly during crawling and this is high in the rural settlements [8]. Children fingers are usually contaminated due to improper personal hygiene; this is consistent with our finding. The study done in Ghana showed that the good sanitation was not directly connected to the occurrence of diarrheal diseases. The author observed that it may be due to differences in culture of waste management and seasonal variation [9]. This finding contradicts with our finding that poor hygiene is directly connected with diarrheal diseases. It was also found that children whose mothers did not attend formal education were more likely to develop diarrhea compared to children whose mothers did not attend any formal education and it contradicts with present findings. Similar findings from Ghana and Nigeria also showed that the prevalence of diarrhea varies according to education status of children's mothers, which is relatively high among children whose mothers had no education [9]. This difference in finding can be due different levels of education.In Kenya a study conducted in different areas the results was that spring and wells water sources is subject to microbiological contamination at sites and source. In the same study, it was concluded that Zambia also faces similar challenges of water contamination [10].These findings are different with present study and can be due to different locations and water treatment methods. Studies in Ethiopia, author thought because of the inclusion of only rural children and the difference in provision health service between rural and urban population. It was concluded that maternal education status had a significant role in the contribution to preventing diarrheal morbidity [11]. These findings contradict with the present study; can be due different socioeconomic status. Literatures show that the education status of family members, occupational status of mothers and fathers, family size, household economic status, age of children, and other socioeconomic factors contribute to diarrheal disease [12]. These differences in findings can be due different socioeconomic status. The present study concluded that often admission for diarrhea was significantly associated with diarrhea. In a similar study, it was found that diarrheal diseases is widespread more especially with children living with HIV making it even more deadly a result of dehydration, weakened immunity and malnutrition; this increase hospitalization and more prone infectious diseases[4]. This finding is in line with the present study, most children who are often hospitalized were prone to having diarrhea. This can be concluded due to different health care practices and availability of Oral rehydration salt (ORS) and zinc supplements in health facilities.

Study limitation

A bias encountered was no response arising from the low response rate from the cases and also selection of controls.

Conclusion

Poor hand washing practices by parents or caregiver was significantly associated with diarrhea. Aggressive measure should be put in place to educate women about the importance of exclusive breastfeeding for six months. The appropriate hand washing practices with soap. Encourage the use of ORS and zinc supplements.

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