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Risk Factors to Persistent Dysentery among Children under the Age of Five in Rural Sub-Saharan Africa; the Case of Kumi, Eastern Uganda

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ABSTRACT

Introduction: *Dysentery, otherwise called bloody diarrhoea, is a problem of Public Health importance globally, contributing 54% of the cases of childhood diarrhoeal diseases in Kumi district, Uganda. We set out to assess the risk factors associated with the persistently high prevalence of childhood dysentery in Kumi district.*

Methods: *We conducted an analytical matched case-control study, with the under five child as the study unit. We collected quantitative data from the mothers or caretakers of the under five children using semi-structured questionnaires and checklists and qualitative data using Key informer interview guides. Quantitative data was analysed using SPSS while qualitative data was analysed manually.*

Results: *Under fives living in a household of more than 5 people had a 19.2 times higher risk of developing dysentery (OR 19.2, CI 4.4–90.1), and children from households with boiled their drinking water were less than 1% less likely to develop dysentery (OR <0.001, CI 0.1–0.5). There was neither difference between households that used piped water and the development of dysentery (OR 1.1, CI 0.1–8.2), nor households which had another child that had ever had dysentery in the household and having dysentery (OR 3.2, CI 0.3–40.4). Major dysentery risk factors were over-crowding and big family sizes but these were still un-known to the majority of the people, yet people tended to avoid safe water sources like piped water and protected wells or springs due to long distances, high piped water connecting costs and high water bills.*

Conclusion: *Whereas most mothers were knowledgeable of the causes and prevention of dysentery, they did not actually practice what they knew. Sustained campaigns on dysentery prevention and control by the government and other stakeholders are needed.*

Keywords

Childhood dysentery, Knowledge/Awareness, Water source, Kumi town council, Case-control studies, Mothers/Caretakers.

Introduction

While dysentery is a public health problem among children in Kumi district in Uganda, the reasons for its persistence in the region were not known. Dysentery, otherwise known as bloody diarrhoea among children is of public health importance globally, [1] and in Kumi district, diarrhoeal diseases were the 4th leading cause of morbidity among under fives in 2006/2007. In particular Kumi Town Council in the previous 3 years had the highest prevalence dysentery among children below 5 years despite the district measures put in place such as community health education and promotion, and prompt and appropriate case management of bloody diarrhoea in the health centres [2]. Additionally, the district was carrying out routine water quality surveillance and reported improving district latrine coverage to 60% the same year. In spite of all these measures in place, there were more cases of dysentery being reported among under 5 children, of which 57% were from

Kumi town council alone and the risk factors surrounding this were not known. This study was conducted to evaluate the risk factors of persistent dysentery in children below 5 years of age. The few studies in Africa revealed that dysentery was significantly higher in female children but decreased with increasing age [3]. Also improved case management reduced mortality rates but had not had a great impact in reduction of bloody diarrhoea among children [4]. Elsewhere dysentery was associated with households that lived in poverty and overcrowded conditions, large families and residences in agricultural settlements [5,6]. However, in East Africa from 1967 to 1997, the determinants of diarrhoea morbidity were education level of household head, obtaining water from surface sources or wells and per capita water used for cleaning [7].

In Nigeria, mothers needed to be encouraged to use ORS when their children had diarrhoea, of the prevalence, causes, and the management of dysentery in children [8]. Availability of piped water in a crowded household was significantly associated with increased death from bloody diarrhoea in Brazil [6]. A Kampala district survey showed that people who used municipal water supplies and those who boiled their drinking water were significantly less likely to report episodes of bloody diarrhoea than those who used other water sources and/or did not boil their drinking water [9]. However, in Kumi town council, piped water coverage was at 70% but water accessibility stood at 30% [10]. Therefore in this study we set out to establish the risk factors to persistent occurrence of dysentery among children aged five and below, with particular emphasis in child and mother socio-demographics, knowledge of mother/care taker on dysentery and water-related hygiene factors.

Methods

We therefore, carried out an analytical prospective case-control study in Kumi town council of children aged 2-59 months who were matched for age, sex and residence at a ratio of 1 case to 2 controls, over a period of 2 months. We calculated the sample size using Schlesselman JJ, 1982 formula, with observed access to piped water to under fives in Kumi town council who developed dysentery being 30%, with an Odds Ratio of 4.0 and access to piped water for the under-fives that did not develop dysentery being 63%. We sought ethical approval from Makerere University School of Public Higher Degrees Research and Ethics Committee (2006/HD/7182U), and permission from the district. We also obtained informed consents for all study participants, both the mothers/care takers and the key informers. We interviewed 63 mothers of under five children, 21 of whom had dysentery clinically diagnosed as visible bloody diarrhoea not lasting more than 14 days and abdominal cramps, while 42 children did not suffer dysentery in the previous 2 months. Check list observation was done for each household for more quantitative data while 5 key informers were interviewed for the qualitative data. Cases were recruited as they presented at the health facilities in the town council. Quantitative data management and analysis was done using EPINFO 3.2.2 and SPSS 16.0 exportation and the findings were presented as proportions, cross-tabulations, tables and frequencies. The qualitative was analyzed manually using a Manifest-Content Analysis and summarized into a matrix, diagram, flow chart, or narrative / verbatim where appropriate and interpreted.

Results

Most (52.4%) of the cases were below one year of age and most (68.3%) of the children were male. Also most of the cases were from Central (47.6%) and Kabata (38.1%) parishes of Kumi town council. The majority (84.1%) of the mothers interviewed was between 20–45 years of age, and 93.7% were solely housewives with no definite business or employment. However, most mothers for the cases (76.2%) were of Primary level while most of the mothers for the controls (52.4%) were of Secondary and Tertiary levels of education (Table 1).

Variable		Cases n=21 (%)	Controls n = 42 (%)	Total n=63 (%)
Age of child	Less than 1 year	11 (52.4)	22 (52.4)	33 (52.4)
	1-2 years	5 (23.8)	12 (28.6)	17 (27.0)
	2-3 years	3 (14.3)	4 (9.5)	7 (11.1)
	3-4 years	2 (9.5)	4 (9.5)	6 (9.5)
Sex of child	Female	7 (33.3)	13 (31.0)	20 (31.7)
	Male	14 (66.7)	29 (69.0)	43 (68.3)
Parish	Aterai	1 (4.8)	2 (4.8)	3 (4.8)
	Kabata	8 (38.1)	16 (38.1)	24 (38.1)
	Central	10 (47.6)	20 (47.6)	30 (47.6)
	Okouba	2 (9.5)	4 (9.5)	6 (9.5)
Age of mother	Less than 20 years	5 (23.8)	5 (11.9)	10 (15.9)
	20-45 years	16 (76.2)	37 (88.1)	53 (84.1)
Education level of mother	None	3 (14.3)	0 (0.0)	3 (4.8)
	Primary	16 (76.2)	20 (47.6)	36 (57.1)
	Secondary and Tertiary	2 (9.6)	22 (52.4)	24 (38.1)
Occupation of mother	Business person	0 (0.0)	2 (4.8)	2 (3.2)
	House wife	20 (95.2)	39 (92.9)	59 (93.7)
	Not employed	1 (4.80)	1 (2.4)	2 (3.2)

Table 1: Demographic characteristics of the under fives and their mothers/caretakers.

Table 2 shows that 87.3% (n=55) of both the cases and controls were on immunization schedule or had been fully immunized, and the average age of the 87.3% above was 1 year and 4 months. Most (95.2%) of the mothers were earning less than 20 US Dollars per month. Amongst the cases, 76.2% of them had more than 5 people in their households while 55% had two children of under five years in their households. The most common average child spacing (66.7%) was 1–2 years (Table 2).

In addition, table 3 above shows that children less than one year of age were 1.9 times more likely to develop dysentery than the other age groups less than five years but this was not significant (95% CI 0.2944-5.1772 and P-value=0.7784). Children from households with 5 or more people were 19 times more likely to have one of them with dysentery (95% CI 4.3772–90.078 and P-value=0.0001) while children who had their immunization charts were 0.3 times

less likely to have had dysentery in the previous 2 months (95% CI 0.6977–1.5138 and P-value=0.1006) (Table 3).

Variable		Cases n=21 (%)	Controls n=42 (%)	Total n=63 (%)
Monthly income of home	20 US Dollars and above	0 (0.0)	3 (7.2)	3 (4.8)
	Less than 20 US Dollars	21 (100.0)	39 (92.9)	60 (95.2)
No. of people in the household	5 or more people	16 (76.2)	6 (14.3)	22 (34.9)
	Less than 5 people	5 (23.8)	36 (85.7)	41 (65.1)
No. of children under 5 years in the household	One	1 (5.0)	25 (59.5)	26 (41.3)
	Two	11 (55.0)	16 (38.1)	27 (42.9)
	Three	6 (30.0)	1 (2.4)	7 (11.1)
	Four	2 (10.0)	0 (0.0)	2 (3.2)
Average child spacing	1 -2 years	18 (85.8)	26 (61.9)	44 (69.9)
	Over 2 years	3 (14.2)	16 (38.1)	19 (30.1)
Immunization status of child	Immunized and with immunization chart	17 (81.0)	38 (90.5)	55 (87.3)
	Immunized but had no chart	4 (19.0)	3 (7.1)	7 (11.1)
	Had never been immunized	0 (0.0)	1 (2.4)	1 (1.6)
	Those that had immunization chart (s)	18 (85.7)	37 (88.1)	55 (87.3)
	Checked above chart to see whether the Immunization was on schedule	18 (100.0)	37 (100.0)	55 (87.3)
	Average age as confirmed from the Immunization charts	1.27 (1 year 3 months)	1.38 (1 year 5 months)	1.33 (1 year 4 months)
	Presence of open sewage channel nearby	0 (0.0)	1 (2.4)	1 (1.6)

Table 2: Socio-economic characteristics of mothers/caretakers to the under fives.

Variable (Social factors)	Cases n=21 (%)	Controls n=42 (%)	OR	95% CI (p value)
Age of child				
Less than 1 year	11 (33.3)	22 (66.7)	1.9984	0.2944-5.1772 (p=0.7784)
1-2 years	5 (29.4)	12 (70.6)		
2-3 years	3 (42.9)	4 (57.1)	Fisher's exact	0.6789
3-4 years	2 (33.3)	4 (66.7)	Fisher's exact	1.0000
Age of mother				
20-45 years	16 (30.2)	37 (69.8)	0.4324	0.0872 - 2.1935
Less than 20 years	5 (50.0)	5 (50.0)		(p=0.2229)
No. of people in the household				
5 or more people	16 (72.7)	6 (27.3)	19.2000	4.3772-90.078*
Less than 5	5 (12.2)	36 (87.8)		(p=0001)
Has immunization chart				
Yes	15 (28.8)	37 (71.2)	0.3441	0.6977-1.5138
No	6 (54.5)	5 (45.5)		(p=0.1006)
Variable (Knowledge factors)				
Had ever heard about dysentery				
No	6 (50.0)	6 (50.0)	2.4174	0.5648-10.3489
Yes	15 (29.4)	36 (70.6)		(p=0.1699)
Had another child that had ever had dysentery in the household				
Yes	13 (54.2)	11 (45.8)	4.5693	1.3245-16.4776*
No	8 (20.5)	31 (79.5)		(p=0.0057)

Table 3: Social and Knowledge of the mothers/caretakers of the under-fives.

In separate interviews of key informers, we learnt that the problem of overcrowded households was the major contributing factor to the persistent diarrhoeal diseases, in particular dysentery in Kumi town council, and one of the participants said;

"An entire commercial building here can have up to 8 single rooms, 4 on each side with a minimum of 5 people per room, a father, a mother and at least 3 children, making a total of at least 40 people on that block, yet these are old Indian built buildings that have never been renovated and have at most only 2 toilets, imagine all that mess in our area." [Key Informer, Clinical officer and In-charge of a Health Centre level III].

Another key informer added that;

"The problem is that these single rooms are located behind the commercial buildings where the front is the selling area and in the rear are the residences. They are cheap and cost only 5,000/= (2 US Dollars) per month for renting. The problem gets worse when children come back from school." [Key Informer, Public health nurse, Kumi district water department].

Still in table 3, mothers whose households that had ever had a child with dysentery were 4.6 times more likely to have another child with dysentery (95% CI 1.3245-16.4776 and P-value=0.0057), while mothers who had never heard about dysentery were 2.4 times more likely to have a child with dysentery but this was not significant (95% CI 0.5648–10.3489 and P-value=0.1699).

Variable	Cases n=21 (%)	Controls n=42 (%)	OR	95% CI
Those who used piped water in their homes				
Yes	6 (42.9)	8 (57.1)	1.6556	0.3877-6.6717
No	15 (30.6)	34 (69.4)		(p=0.3912)
Boiled water before drinking it				
No	16 (42.0)	17 (58.0)	4.7093	1.2938-18.1904*
Yes	5 (16.7)	25 (83.3)		(p=0.0073)
Used water-guard in drinking water as alternative to boiling the water				
Yes	8 (33.3)	16 (66.7)	1.0023	0.3275-3.6952
No	13 (33.3)	26 (66.7)		(p=1.0000)

Distance of the water source from the home				
500 m and over	14 (48.3)	15 (51.7)	3.6218	1.0886-12.8169*
Less than 500 m	7 (20.6)	27 (79.4)		(p=0.0203)

Table 4: Water and hygiene factors.

As shown in table 4 above, mothers who used piped water in their homes were 1.6 times more likely to have an under five child with dysentery (95% CI 0.3877-6.6717 and P-value=0.3912), and there was almost no difference between households which used water guard in drinking water as an alternative to boiling it and those who did not in having a having a child with dysentery in their home (95% 0.3275-3.6952 and P-value=1.0000) but all were not significant.

However, children under five years whose mothers did not boil their drinking water were 4.7 times more likely to develop dysentery than those who did (95% CI 1.2938-18.1904 and P-value= p=0.0073). Households that were 500 metres or more from the water source were 3.6 times more likely to have an under five child with dysentery than those that were less than 500 metres from the water source (95% CI 1.0886-12.8169 and P-value= 0.0203). (Table 4).

This was further emphasized by one key informer who narrated that;

"The water and hygiene situation is also alarming in many homes and this is even extended down to the places where they collect water, but when it comes to drinking water they harvest rain water believing that it's free of disease organisms. Also our mothers avoid the safe water sources like piped water and protected springs due to long distances and costs of connecting to water and payment of water bills, in preference to the free rain water and the freely provided water guard products from the Ministry of Health through the district. I suggest that the authorities put in place bylaws to enforce proper hygiene practices since this actually worked in Kidongole sub-county which is not far from here in enforcing latrine usage." [Key Informer, Focal person for Water and Sanitation department, Kumi Town Council]

Discussion

We set out to find the risk factors to persistent dysentery in under five children and we found out that most mothers/caretakers of the dysentery cases were Primary level school drop outs with no definite occupation. These two, however, were not significant risk factors to dysentery contrary to a study in Uganda in 2009 where a mother attaining secondary or higher level of education was found to be a protective factor from acute diarrhoea in children aged 0–5 years in Uganda [11]. The findings on place of residence suggests that children in urban areas have a significantly higher risk than their rural counterparts consistent with findings in Congo [12] but contradicting those reported in Eritrea [13]. Children less than one year of age were more likely to develop dysentery than other age groups less than five years though not significant but this was in line with in an Asian island population by where the infection rate for Shigella was highest in children less than one year old and in another [14-16]. At about six months of age, an infant's maternal immunity has deteriorated and is also developmentally ready for complementary foods and if they are not appropriately given an infant's growth and immunity may falter, predisposing them to persistent diarrhoeal diseases like dysentery. Similar studies also show that the risk of having diarrhoea reached its peak at 6-11 months and then began to fall with increasing age of children [13]. This is also the peak when malnutrition sets in, making it even a more important risk factor for persistent diarrhoea in this particular age-group of children [17].

There was also a positive relationship between the number of people in the household and the development of dysentery in under fives and this was statistically significant. This pattern resembles a study on children of northern Israel who lived in poverty and overcrowding and were found to be associated with dysentery [5]. Overcrowding was further explained in all the key informer interviews. The risks of dysentery morbidity associated with the number of children remains highly significant after adjusting for all the socio-economic and environmental variables in the model. Mothers who had 5 or more children in their homes where 19 times more likely to have a child with dysentery among them as compared with mothers who had less than 5 children in their homes. The Ministry of Health of Uganda and Kumi district emphasized Family Planning practices in addition to the other earlier discussed measures in the prevention and control of dysentery in under-fives [2] From our findings, children under five from households that had ever had a child with dysentery were 4.6 times more likely to also have dysentery. This is because such families in Kumi town council, as also found in Saudi Arabia, have living rooms in which the children often came together and remain in close contact to play during waking hours promoting the spread of the diarrhoeal disease [18].

In our study, most mothers were knowledgeable of the causative factors and symptoms of dysentery but none of them included poverty as one of the influencing factors to dysentery in under-fives. This was contrary to early to other studies in the same district where diarrhoeal diseases and low latrine coverage were attributed to poverty in Kapir sub-county in Kumi district [19]. We found that 95.2% of the mothers were earning less than 20 US Dollars per month which was in agreement with other studies in Uganda where low income earners were found significantly and negatively associated with the occurrence of diarrhoea in a member of the household [9] with similar findings in studies elsewhere that the household economic status was significantly associated with the prevalence of diarrhea [13]. This could be explained by the recent history of resettling following a prolonged dry season and recovery from cattle rustling by the neighbouring Karamajong ethnic tribe that predisposed them to the highest levels of poverty.

We also noted that households of under fives who resided 500 metres or more from their water source were 3.6 times more likely to have an under five child with dysentery probably due to the fact that households to depend on less safe sources due to the long distances between the water sources and the home, consequently

decreasing the volume of safe water used for hygiene purposes [20,21]. The chances of domestic water contamination are higher when water is drawn manually than when the source of water is mechanized [22] leading to acquisition of life threatening pathogens associated with persistent forms of bloody diarrhoea and dysentery.

As further revealed in our study findings above, the use of municipal water supplies and boiling of drinking water in a household significantly makes it less likely for an under five child to report an episode of bloody diarrhoea than using other water sources and/or not boiling their drinking water [23]. These could explain the principal routes of transmission of infectious diarrhoeal disease "faecal-oral cycle" that is fueled by the five Fs namely field, feaces, flies, food/fluid (drinking contaminated water) and fingers (unwashed hands preparing food or going into the mouth) as a result of water contamination that may be due to improper disposal of refuse as a result of open field defecation [24].

Despite the available services, health education on hygiene and promotion of boiling drinking water by the district, the messages have been neglected/ignored by the mothers/caretakers of the under fives, opting for the low cost measures of direct consumption of harvested rain water and waiting for the freely provided water guard tablets, as was the case in Thailand [25]. This predisposed the children dysentery and consequent persistence of dysentery in the district. The other Fs that were not emphasized in Kumi were flies (spreading disease from faeces to food and water or directly to people), food (eating contaminated food) and floor/fields (the contamination of soil and crops with human faecal matter) [24]. There were no other significant risk factors of dysentery revealed in our study such as availability of a toilet in the vicinity of the household.

Conclusion and Recommendations

A history of a child with dysentery and having more than 5 people in a household were risk factors to having a child with dysentery. Residing 500 metres or more from the water source and neglecting the boiling of drinking water in preference to cheaper methods were also risk factors to child dysentery. Overcrowding as a risk factor was still un-known to the majority of the people in Kumi, and indeed the mothers who did not know this were more likely to have their under-five children develop dysentery. In this study, a child being less than one year of age, having no piped water or toilet in the household and non-use of water guard tablets were not risk factors to dysentery in under-fives.

There is a need of vigorous and sustained community health campaigns on dysentery among under-fives by the district local government and other stakeholders. We also recommend the district leadership and other key stakeholders mobilize communities to construct bigger homes to avoid overcrowding and reduce the distances of households from safe water sources by allowing free access/connection to safe piped water, and to reduce the monthly water bills. Re-emphasis of improved water quality through treatment of water sources in the effort to achieving target 10 of the 7th Millennium Development Goal of halving by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation.

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