ORIGINAL RESEARCH

Nigerian Journal of Paediatrics 2024; Volume 51(2): 85-92.
https://dx.doi.org/10.4314/njp.v51i2.02.

Antibiotic Use in Home Treatment of Childhood Diarrhoea in Uyo, Nigeria

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Abstract

Background: Diarrhoea is a common reason for hospitalisation among under-fives. Caregivers often administer medications, including antibiotics before hospitalisation.

Objective: To determine the pattern of antibiotic use by caregivers before hospitalisation of under-fives with diarrhoeal diseases.

Methods: This was a descriptive, cross-sectional study of under-fives admitted for diarrhoea at the University of Uyo Teaching Hospital, Uyo. A validated semi-structured questionnaire was used to obtain information on diarrhoeal illness in the children and home treatment by caregivers.

Results: One hundred under-five children were enrolled in the study. Of these, 75 (75.0%) had acute watery diarrhoea, 22 (22.0%) had dysentery, and 3 (3.0%) had persistent diarrhoea. Caregivers administered antibiotics to 32 (32.0%) children. Twenty-five children (78.1%) received a single antibiotic, while 7 (21.9%) received multiple antibiotics. Metronidazole 10/39 (25.6%), Amoxicillin 9/39 (23.1%) and Cefuroxime 5/39 (12.8%) were the most frequently administered antibiotics. The rate of antibiotic use was high in children of high social class and those with dysentery. The association between diarrhoea type and unwarranted antibiotic use by caregivers was statistically significant ($\chi^2 = 4.127$; $p = 0.04$).

Conclusion: About one-third of the caregivers administered antibiotics in home treatment of childhood diarrhoea. Metronidazole, amoxicillin and cefuroxime were the most frequently used antibiotics. Antibiotic use was related to social class and children with dysentery. The type of childhood diarrhoea was significantly associated with unwarranted use of antibiotics.

Key words: Antibiotics, Diarrhoea, Home treatment, Under-five children.

Introduction

Diarrhoea disease is a preventable and treatable condition but ranks second among the causes of under-five morbidity and mortality globally. An estimated 1.7 billion cases of childhood diarrhoea occur annually, with 525,000 deaths.[1] Most diarrhoea-related childhood deaths occur in sub-Saharan Africa and Asia.[2]

Rotavirus, heat-stable enterotoxin-producing *E coli*, *Shigella* and *Cryptosporidium* are the common causes of childhood diarrhoea.[3] Infections by these agents are usually due to ingestion of contaminated food or drink. Depending on the infectious agents, damage to the gut enterocytes could result in the release of enterotoxins or direct invasion. These events disrupt the delicate balance between the absorptive and secretory processes within the bowel, resulting in profuse loss of fluid and electrolytes.[4]

The World Health Organization (WHO) recommends using low osmolality oral rehydration salt (ORS), zinc supplementation and optimum feeding to reduce diarrhoea-related morbidity and mortality in children. Prompt institution of these simple, cost-

effective interventions by caregivers at home will facilitate recovery and militate against fatal outcomes in about 90% of under-fives with diarrhoea disease.[5]

Antibiotics can be used as an adjunct to fluid therapy during professional consultations in special conditions like cholera, dysentery, septicaemia, newborns, immunocompromised children, and when indicated by stool examination results.[6] Rational use of antibiotics for childhood diarrhoea in the country has been quite challenging. For example, a facility-based study on antibiotic prescriptions by healthcare providers among under-fives with acute watery diarrhoea in Cross River State, Nigeria, revealed 78.6% inappropriate antibiotic prescriptions.[7] This high rate of inappropriate prescription of antibiotics among health workers for childhood diarrhoea in formal facility settings makes it imperative to examine antibiotic use among caregivers in the home management of diarrhoea. This study aimed to assess antibiotic use in the home management of diarrhoea among under-fives admitted on account of diarrhoea in the University of Uyo Teaching Hospital (UUTH), Uyo, Nigeria.

Methods

Study design

This was a descriptive, cross-sectional study conducted between January 2013 and December 2015.

Setting of the study

The study was conducted in the Children's Emergency Unit (CHEU) of the UUTH. It is a 24-bed unit manned by two consultants, residents' doctors on rotation, house officers and nurses. There is a Diarrhoea Treatment and Training Unit in CHEU where under-fives with diarrhoea diseases are managed, and their caregivers are trained on the prevention and treatment of the disease. The conditions commonly encountered in the CHEU are upper respiratory tract infections, bronchopneumonia, diarrhoea diseases, and malaria.[8]

Target population

These included children below five years of age admitted on account of diarrhoeal disease within the study period.

Sampling methods

Following parental consent, consecutive under-fives admitted on account of diarrhoea to the Children's Emergency Unit of UUTH within the study period were enrolled.

Sample size

The sample size was based on a total sampling approach, in which all eligible children admitted on account of diarrhoea within the study period were included following the caregiver's consent.

Data collection tools

Data was obtained using a validated, semi-structured, proforma.[9] Information were obtained from the caregivers on the child's biodata, duration, frequency and severity of diarrhoea, the presence of blood in stool, nutritional history, home management of diarrhoea, immunisation history and social class. The children's social classes were determined using Oyedeji's social classification, where parental occupation and educational level were scored.[10] The information obtained on home management of diarrhoea included the use of recommended home fluids, low osmolality ORS, zinc tablets, antibiotics and other medications. Antibiotic use was considered to be warranted if the child had dysentery, persistent diarrhoea, septicaemia or was immunocompromised. It was considered unwarranted if it was used without clinical indication.

Ethical issues

Approval for the conduct of this study was obtained from the Health Research Ethics Committee of the UUTH. Parental consent was also obtained prior to the enrolment of the children in the study.

Data management

The data was entered and analysed using *Microsoft Excel*® 2007. The children's characteristics were described using frequency and percentage. Descriptive and inferential statistics were used in the analysis. The Chi-Square test was used for the significance of categorical variables and was deemed statistically significant if p-value was < 0.05.

Results

One hundred caregivers with their under-five children admitted on account of diarrhoeal disease participated in the study. Most of the children, 66 (66.0%), were aged 6 - 23 months, as shown in Table I. There were 46 females and 54 males. The mean age of the females was 16.5 ± 14.1 months, while that of the males was 16.4 ± 14.0 months.

Table I: Frequency distribution of diarrhoea cases by age groups

Age group (months)	*Frequency*	*Percentage*
0 – 5	15	15
6 – 11	31	31
12 – 23	35	35
24 – 35	8	8
36 – 59	11	11

The majority of the children, 75 (75.0%), had acute watery diarrhoea, while 22 (22.0%) had dysentery, as shown in Table II. The association between type of diarrhoea and antibiotic use was not statistically significant (Fisher's exact = 0.241). Caregivers administered nine different antibiotics for home management of childhood diarrhoea. A total of 32 (32.0%) caregivers administered antibiotics to the children. Of this number, 25 (78.1%) administered a single antibiotic, while 7 (21.9%) administered two different antibiotics (multiple antibiotics) in the course of the illness.

Table II: Type of diarrhoea and antibiotic use by caregivers

Type of diarrhoea	*Number of children*	*Number treated with antibiotics*	*Percentage*
Acute watery	75	21	28.0
Dysentery	22	10	45.4
Persistent	3	1	33.3

Table III: Antibiotic use in home treatment of childhood diarrhoea

Antibiotics	Frequency	Percentage
Metronidazole	10	25.6
Amoxicillin	9	23.1
Cotrimoxazole	5	12.8
Cefuroxime	4	10.2
Tetracycline	4	10.2
Ceftriaxone	3	7.7
Ampicillin	2	5.2
Erythromycin	1	2.6
Chloramphenicol	1	2.6

Thus, the total number of antibiotics used by the caregivers for home management of diarrhoea was 39. The most frequently used antibiotics were metronidazole 10/39 (25.6%), amoxicillin 9/39 (23.1%) and cotrimoxazole 5/39 (12.8%). Other antibiotics of note were tetracycline 4/39 (10.2%) and ceftriaxone injection 3/39 (7.7%), as seen in Table III.

Most of the children, 55 (55.0%), belonged to the middle social class. Antibiotic use was highest in children of the upper social class (9/23; 39.1%) and lowest among those of the middle social class, (15/55; 27.2%). The rate of multiple antibiotic use was relatively higher in the upper and middle social classes when compared to the lower social class, as shown in Table IV. An injectable antibiotic (ceftriaxone) was administered to children of the upper social class who received multiple antibiotics. The association between social class and antibiotic use was not statistically significant (χ^2 = 0.2315; p = 0.891).

Table IV: Distribution of children who received antibiotics according to their social classes

Social Class	*Number of children*	*Single antibiotic use*	*Multiple antibiotic use (two antibiotics each)*	*Total number that received antibiotics*	*Percentage antibiotic use*
Upper	23	6	3	9	39.1%
Middle	55	12	3	15	27.2%
Lower	22	7	1	8	36.4%
Total	100	25	7	32	

Table V: Relationship between diarrhoea and home treatment with antibiotics

Type of diarrhoea	*Received antibiotics*	*Did not receive antibiotics*	*Total*
Diarrhea disease requiring antibiotic use	12	12	24
Diarrhea disease not requiring antibiotic use	55	21	76
Total	67	33	100
$\chi^2 = 4.127$; p = 0.04			

Table VI: Warranted versus unwarranted antibiotic use and some clinical features

Clinical outcomes	*Warranted antibiotic use*	*Unwarranted antibiotic use*	*Chi-Square; p – value*
Time to hospital visit			
Within 72 hours	6 (30.0%)	14 (70.0%)	0.25; 0.61
Beyond 72 hours	5 (38.5%)	8 (61.5%)	
Bowel motion frequency			
Severely dehydrated	5 (35.7)	9 (64.3)	0.062; 0.83
Not severely dehydrated	6 (31.6)	13 (68.4)	
Bowel motion frequency			
≤5	8 (50.0)	8 (50.0)	3.88; 0.048
>5	3 (17.6)	14 (82.4%)	

Discussion

The findings in this study showed that over two-thirds of the children with diarrhoea diseases had acute watery diarrhoea, about a quarter had dysentery, and 3% had persistent diarrhoea. The pattern of diarrhoeal illness observed in this study is similar to what has been previously reported in the countries and regions of the world where childhood diarrhoea is endemic.[11] These forms of diarrhoea are associated with a high risk of morbidity and mortality. Appropriate management of each of them is necessary to avert death in the affected children. While fluid replacement and zinc supplementation remain the key strategy for managing acute watery diarrhoea, antibiotic therapy in addition to zinc supplementation and fluid replacement are crucial in children with dysentery and persistent diarrhoea.[12]

Dysentery often follows invasion and damage of the gut's lining by virulent microbial agents. The main dysenteric agents in children are *Shigella dysenteriae*, *Salmonella typhi*,

Campylobacter jejuni, entero-haemorrhagic and entero-invasive *Escherichia coli*.[13] Occasionally, it is caused by parasitic agents like *Entamoeba histolytica*.[13] Given the variety of dysenteric microbial agents in children, the choice of antibiotic should be guided by the results of stool culture and sensitivity. However, when stool culture and sensitivity results are unavailable to guide treatment, management of childhood dysentery should be based on empirical antibiotics informed by epidemiological studies in a given setting.[14] Persistent diarrhoea, like dysentery, is caused by a variety of infectious agents, and antibiotic therapy is needed for this category of patients. As with dysentery, empirical antibiotic therapy for persistent diarrhoea is based on a good understanding of the most likely pathogens, their antimicrobial susceptibility pattern and safety profile.[14] Empirical therapy is usually instituted pending the availability of stool culture and sensitivity results.

In this study, the use of antibiotics was highest among children with dysentery, with metronidazole, amoxicillin and cotrimoxazole being the most frequently used antibiotics in the home management of childhood diarrhoea. This pattern of antibiotic use is similar to the report of Ekwochi *et al.*[15] among under-fives admitted in a tertiary facility in Enugu. Udoh *et al.,* [7] in an audit of the case management of acute watery diarrhoea among under-fives in primary and secondary health facilities in Cross River State, Nigeria, reported an overall antibiotic prescription of 78.6% with metronidazole, cotrimoxazole and gentamicin ranking topmost. This is very similar to the pattern of antibiotic use reported in this study. Metronidazole has remained at the top of the list of antibiotics used for childhood diarrhoea in the study area. Efunshile *et al.* [16] reported an overall antibiotic prescription of 86.9% in two health centres in Abakiliki with ciprofloxacin, metronidazole and gentamicin being the most frequently used antibiotics. The pattern of antibiotic use reported in this study is slightly different from that of Efunshile *et al.* [16] This might be due to differences in study settings, temporal variation in causative agents and antibiotic sensitivity. Metronidazole is an antibiotic that has been frequently abused in home and facility-based management of childhood diarrhoea. The perceived efficacy of the drug in managing childhood diarrhoea was the main reason attributed to its use by caregivers.[15]

Most of the children in this study belonged to the middle social class, but antibiotic use was highest among children of the high social class and least in those of the middle social class. The high purchasing power of caregivers of high social class could explain the relatively high frequency of antibiotic use in children of this social class. Children of the middle and low social classes who had multiple antibiotics all received oral forms of antibiotics. Still, those of the high social class received ceftriaxone, which is an injectable antibiotic. Ceftriaxone is more expensive than the oral formulations of antibiotics received by those in the middle and low social classes. The injectable route of antibiotic administration involves the cost of procuring the items for constituting the drug and services of skilled medical personnel that will either administer the medication intramuscularly or intravenously. It is, therefore, not surprising that the children who received the injectable antibiotic were all of high social class. Injectable ceftriaxone is usually indicated in children with severe diarrhoea illnesses due to gram-negative bacteria for whom rapid onset of action of medications is desired.[17] As much as possible, this drug should be reserved for inpatient use where the optimum framework for antibiotic stewardship can be observed.

Rational use of antibiotics in children with diarrhoea is usually guided by stool culture and sensitivity results or empirical treatment by healthcare providers based on the sensitivity

pattern of common pathogenic isolates from stool cultures in a given setting. Where these guiding principles are not adhered to, irrational use or abuse of antibiotics becomes inevitable. This is evident by the statistically significant association between type of diarrhoea and unwarranted antibiotic use observed in this study. A good proportion of the children who received antibiotics could have been managed without it. This implies that most of the caregivers were likely not to be aware of antibiotic indications in managing childhood diarrhoea. This observation corroborates the finding of Ekwochi *et al.,* [15] in which caregivers' low knowledge level was associated with antibiotic use in under-fives. Besides the antibiotic misuse noted in this study, four of the children were treated with tetracycline. Tetracycline is contraindicated in young children as it causes permanent yellowish discolouration of the teeth and adversely affects bone development.[18] The use of tetracycline by some caregivers in this study buttresses the need for rational antibiotic use and consultation of healthcare workers in decision-making on antibiotic use for treating childhood diarrhoea.

Antibiotic use in home management of childhood diarrhoea was not significantly associated with disease severity and time-to-presentation for subsequent care in health facilities. These are important clinical factors that can influence the outcome of diarrhoea in young children. However, the association between unwarranted antibiotic use and passages of more than five loose stools per day was near statistical significance. Prolonged antibiotic use without clinical indications could result in the clearance of normal gut flora, and potentiate the proliferation and colonisation of the gut by pathogenic microbes, which could lead to dysbiosis. This altered gut microbial ecosystem often results in disordered neural and humoral functions, leading to gastrointestinal disturbances like diarrhoea. This will invariably prolong the duration of illness, worsen disease severity, increase the risk of the emergence of antibiotic-resistant bacteria, unnecessary cost, a significant incidence of adverse events and poor treatment outcomes.[17]

The higher the frequency of stooling, the more fluid children should receive to prevent dehydration. Rather than give more fluid, caregivers tended to give more antibiotics to the children. Efunshile *et al.* [16] in Abakiliki reported a statistically significant association between the passage of four or more loose stools and antibiotic use. The misplaced emphasis on antibiotics rather than fluid replacement in the home management of childhood diarrhoea portends great danger to the children as dehydration, hypovolaemic shock, and death could ensue.[19]

Unwarranted antibiotic use in childhood diarrhoea is partly due to the notion that medication is needed for every illness.[20] This misconception about the management of childhood illnesses not only increases the cost of care but also increases the risk of the emergence of antibiotic resistance in the setting. Unwarranted use of antibiotics in the home management childhood of diarrhoea is often associated with non-initiation or delayed initiation of home fluid, the occurrence of diarrheal-related complications, late presentation in the health facility for subsequent care and increased likelihood of a fatal outcome.[9]

Since the unwarranted use of antibiotics in home management of childhood diarrhoea has been attributed to poor knowledge of caregivers about the disease and indications for antibiotic use, there is a need to enlighten caregivers on home management of childhood diarrhoea. This will bridge the knowledge gap and improve antibiotic stewardship and treatment outcomes in under-fives with diarrhoea.[21,22]

Conclusion

Metronidazole, amoxicillin, and cotrimoxazole were the commonly administered antibiotics in children with diarrhoeal diseases. The rate of antibiotic use was higher among children of

high social class and those with dysentery. The type of diarrhoea was significantly associated with unwarranted antibiotic use. Efforts to promote rational use of antibiotics in the case management of childhood diarrhoea to avert the possible occurrence of antibiotic resistance are needed.

Acknowledgements: The authors wish to thank the staff of the Children's Emergency Unit of the UUTH and the caregivers of the children for their support during the study.

Authors Contributions: UE conceived and designed the study. EL analysed and interpreted the data. UE and EL drafted the manuscript. OF, UK, and IE revised it for sound intellectual content. All the authors read and approved the final draft of the manuscript.

Conflict of Interests: None declared.

Funding Supports: The authors received no funding for the research and publication of this article.

Accepted for publication: 27th April 2024.

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