TMJ
Original research
Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

OPEN ACCESS JOURNAL

Usage of Oral Rehydration Salts and Other Treatments in Management of Diarrhoea Among Children Under-Five Years Attending Primary Health Care Facilities in Dar es Salaam

Sechelela Vicent[1], Ritah F. Mutagonda[1]*, Manase Kilonzi[1], Wigilya P. Mikomangwa[1], Hamu J. Mlyuka[1], Alphonce I. Marealle[1], George M. Bwire[2]

[1]Department of Clinical Pharmacy and Pharmacology, School of Pharmacy, Muhimbili University of Health and Allied Sciences, P.O. BOX 65001, Dar es Salaam, Tanzania
[2]Department of Pharmaceutical Microbiology, School of Pharmacy, Muhimbili University of Health and Allied Sciences, P.O. BOX 65001, Dar es Salaam, Tanzania

***Corresponding author:**

Dr. Ritah F. Mutagonda

Muhimbili University of Health and Allied Sciences

P. O. Box 65001

Dar es Salaam, Tanzania

Email: rmutagonda@muhas.ac.tz

TMJ
Original research
Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

OPEN ACCESS JOURNAL

Abstract

Background

Diarrhoeal disease is highly preventable and easily manageable, yet it remains a significant cause of childhood mortality in Tanzania. Since dehydration caused by acute diarrhoea is the main contributor to mortality, key measures to treat diarrhoea include rehydration using oral rehydration salts (ORS) and zinc supplements. Therefore, this study aimed to assess ORS use, pediatric zinc and antibiotics in the management of diarrhoea in children under-five years attended at the primary health care facilities in Dar es salaam, Tanzania. Also, factors associated with antibiotics usage were determined.

Methods

A cross-sectional study was conducted from March to September 2019. Ten dispensaries were selected from five Dar es salaam municipalities in Tanzania. A total of 301 children under-five years with diarrhoea were enrolled. Information on socio-demographic characteristics was obtained by asking the parents/guardians, whereas clinical characteristics, laboratory results, diagnosis, and treatment were extracted from children's files. The information obtained was recorded in the structured questionnaire. Data were analyzed using statistical package for social science (SPSS) software, version 22.0. Descriptive statistics were used to summarize the information collected. The multivariable logistic regression was used to determine factors associated with antibiotics use in diarrhoea management, whereby $p<0.05$ was considered statistically significant.

Results

Of 301 children enrolled, 85.7% had acute watery diarrhoea. ORS and pediatric zinc were prescribed to 75.1% and 48.8% of children, respectively. At least one antibiotic was prescribed to more than half (66.8%) of the enrolled children. The odds that antibiotics were prescribed in the management of children with acute watery diarrhoea was less compared to those with bloody or persistent diarrhoea (AOR 0.1 (95% CI 0.02 – 0.3) $p< 0.01$). Also, children attending the health facilities in Ilala municipality had 2.1 (AOR (95%CI 1.2 – 3.8) $p = 0.014$) times odds of being given antibiotics compared to those who were attended at other health facilities located in other municipalities.

Conclusion

ORS usage in managing diarrhoea among children under-five years is much higher than the use of pediatric zinc. A high incidence of antibiotics use in acute watery diarrhoea management was observed, which is against recommended guidelines. The study recommends continuing education to health care providers and the community on proper management of diarrhoea in children under five years.

Keywords: *Diarrhoea, children under-five, pediatric zinc and oral dehydration salts.*

Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

Introduction

Diarrhoea is the second leading cause of child mortality globally and mostly results from contaminated food and water sources. Globally, there are nearly 1.7 billion childhood diarrhoeal disease cases, which results in around 525,000 children mortality annually (1). Prevalence of diarrhoea among children under-five in Tanzania was reported at 16.4 % in 2016, whereby it was the fifth killer disease, causing approximately 9% of deaths annually (2). The majority of deaths from diarrhoeal disease are of children below two years of age, where it was reported that 24% of infants aged 1 to 11 months died due to diarrhoea (3, 4).

Diarrhoea can be classified according to the clinical pattern as: i) Acute watery diarrhoea (i.e. diarrhoea without blood lasting less than 14 days); ii) Persistent diarrhoea (i.e. diarrhoea lasting 14 days or more); and iii) Acute bloody diarrhoea (i.e. diarrhoea with blood lasting less than 14 days). During the diarrhoeal episode, water and electrolytes are lost through liquid stools that can leave the body dehydrated. Water and electrolytes are also lost through vomiting, sweating, urination and breathing. Dehydration is the most severe threat posed by diarrhoea and it occurs when these losses of water and electrolytes are not replaced (5). It was previously reported that acute watery diarrhoea was the most typical cause of diarrhoeal deaths among children under-five in Tanzania, where it accounts for 70.7%, followed by persistent diarrhoea (17.1%) and acute bloody diarrhoea (17.1%) (3).

To reduce diarrhoea-related childhood deaths, Tanzania updated the guideline on acute diarrhoea clinical treatment as per WHO recommendations. The use of low-osmolality oral rehydration salts (ORS), zinc supplementation, increased amounts of appropriate fluids, and continued feeding are encouraged (5). Since dehydration caused by acute diarrhoea is the main contributor to mortality, treatment with ORS and zinc has proven effective. There is evidence that ORS may reduce diarrhoea specific mortality by up to 93 % (6). Also, zinc supplementation has been found to reduce diarrhoeal episodes' duration and severity and the likelihood of subsequent infections for 2–3 months (7). Antibiotic is only recommended in cases of persistent diarrhoea, dysentery, cholera, pseudomembranous colitis, and in exceptional circumstances like severe malnutrition, HIV/AIDS, and in newborns (8).

Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

Adherence to the standard treatment guideline is essential to the reduction of childhood diarrhoea-related mortality. Some studies from diarrhoea prevalent countries have shown poor adherence to the recommendations mentioned with variable proportions of irrational antibiotic prescriptions in managing acute watery diarrhoea in children under-five. A previous study assessing antibiotic prescribing practice for diarrhoea management in Moshi, Northern Tanzania, reported that 54.4% of children with acute watery diarrhoea were prescribed antibiotics inappropriately (9). In Kenya, 34.2% of diarrhoea visits to health facilities had either over-prescription, under-prescription, or inappropriate antibiotic choice (10). Studies on mismanagement of childhood diarrhoea have also been reported in Nigeria, India, China and Thailand (11–14). Factors said to be associated with antibiotics use in the management of childhood diarrhoea included diarrhoea frequency > 3 times per 24 h (11) and presence of other symptoms such as respiratory infections, fever, gastroenteritis and blood in stool (9, 10, 13). WHO guidelines unequivocally discourage the use of antibiotics for treating acute diarrhoea as they will be of no effect in most cases due to non-bacterial etiology (15). Over 90% of deaths from diarrhoea in children under-five would be prevented by correct management (16) and hence it is essential to monitor adherence to the standard treatment guideline frequently. Therefore, this study aimed to assess use of ORS, pediatric zinc and antibiotics in the management of diarrhoea in children under-five years attended at the primary health care facilities in Dar es salaam, Tanzania. Also, factors associated with antibiotics usage were determined.

Methods

Study design and Site

This was a cross-sectional study covering public primary health facilities in the five Dar-es-salaam municipalities, namely Kinondoni, Ilala, Temeke, Ubungo and Kigamboni, from March to September 2019. A simple lottery method was used to select two public dispensaries in each municipality. The ten selected primary health facilities were Kiwalani, Kipawa, Keko, Chang'ombe, Hannasif, Kabangwa, Mjimwema, Kibada, Mabibo and Manzese. These public primary health facilities are government properties; treatment of children under-five is free and hence provides health care to most children.

Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

Study population, sample size and sampling technique

A total of 301 children attending outpatient clinics with diarrhoea aged 1-59 months were enrolled from the selected public primary health facilities. The sample size was obtained using the statistical formula for cross-sectional studies. A consecutive sampling technique was used to attain the required sample size in each facility. All consented guardians or parents who came to the outpatient department with children under-five who had diarrhoea were enrolled in the study. Following the completion of the informed consent process, socio-demographic characteristics such as age and sex of the child were collected by interviewing parents/guardians. Other information on clinical features, laboratory results, diagnosis, and treatment provided was obtained from the patients' files. A structured questionnaire was used to record all relevant data collected for the study.

Ethical consideration

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences (MUHAS) Senate Research and Publications Committee. The aim of this study was clearly explained to all parents or guardians of the children involved. Permission to conduct this study at the selected dispensaries was granted by the respective District Medical Officers and the primary health facilities' in-charges. The written consent from a parent/guardian was sought before enrolling children.

Data handling and statistical analysis

Data were initially compiled in an MS Excel spreadsheet and statistical analyses were performed using Statistical Package for Social Sciences (SPSS) software, version 22.0 (IBM Corporation, Somers, NY, USA). Descriptive statistics were calculated and summarized in frequency and proportions. Factors contributing to antibiotics use were determined using multivariable logistic regression. Statistical analyses focused on variables potentially associated with antibiotics (dichotomous outcome, yes/no) for the diarrhoeal episodes P values <0.05 were considered statistically significant.

Results

Socio-demographics and clinical presentation of children

About half of the children included in the study were aged more than 1 year (median age; 17.15 months, age range; 1 - 48 months), and the majority (51.2%) were male. Most (33.9%) of these children were from Temeke municipality. Majority (97.3%) of children had diarrhoea in less than 14 days and for most (62.5%), the frequency of loose stool was more than three times in a day. About 60.1% of these children had other symptoms and diarrhoea, whereby more than 30% were reported to have fever, as indicated in **Table 1**.

Table 1: Socio-demographic and clinical characteristics (N = 301)

Variable	Frequency	Percentages
Study area (Districts)		
Ilala	83	27.6%
Kigamboni	60	19.9%
Kinondoni	14	4.7%
Temeke	102	33.9%
Ubungo	42	14.0%
Gender		
Female	147	48.8%
Male	154	51.2%
Age (months)		
1 – 12	150	49.8%
13 – 24	98	32.6%
25 – 59	53	17.6%
Duration of diarrhoea (days)		
< 14	293	97.3%
> 14	8	2.7%
Frequency of loose stool per day		
< 3	113	37.5%
> 3	118	62.5%
Other symptoms		
None	120	39.9%
Fever only	93	30.9%
Fever and cough	31	10.3%
Cough	19	6.3%
Others	38	12.6%

Management of diarrhoea based on the type of diarrhoea

The majority (85.7%) of children had acute watery diarrhoea. In managing all types of diarrhoea 75.1% were given ORS and antibiotics were given to more than half (66.8%) of the children. Majority of children who were given antibiotics were those who had acute bloody diarrhoea (94.3%) and persistent diarrhoea (100%) (**Table 2**).

Table 2: Commonest drugs used in management of diarrhoea in children under-five based on the type of diarrhoea (N = 301)

Drugs given	Type of diarrhoea			Overall
	Acute Watery (n = 258)	***Acute Bloody (n = 35)***	***Persistent (n = 8)***	
ORS	75.2%	74.3%	75.0%	75.1%
Antibiotics	62.8%	94.3%	100%	66.8%
Pediatric zinc	49.2%	45.7%	50.0%	48.8%

Pattern of antibiotic use in management of diarrhoea among children under-five

Nine different antibiotics were used in the management of children under-five with diarrhoea. The most familiar antibiotics used alone were co-trimoxazole (48.3%) and erythromycin (23.4%). Fourteen (7%) children were given a combination of two antibiotics, as indicated in **Table 3**.

Table 3: Pattern of antibiotic prescriptions in management of diarrhoea in children under-five years (N = 201)

Pattern of antibiotics prescriptions	Number prescribed	Percentage
Co-trimoxazole	97	48.3
Erythromycin	47	23.4
Metronidazole	26	12.9
Amoxicillin	15	7.5
Gentamycin injection	2	1.0
Amoxicillin + Gentamycin injection	2	1.0

Erythromycin + Benzyl penicillin injection	1	0.5
Erythromycin + Co-trimoxazole	1	0.5
Erythromycin + Metronidazole	3	1.5
Metronidazole + Amoxicillin	2	1.0
Metronidazole + Ampicillin/Cloxacillin	1	0.5
Metronidazole + Ceftriaxone injection	1	0.5
Metronidazole + Cephalexin	1	0.5
Metronidazole + Co-trimoxazole	2	1.0

Factors associated with the use of antibiotics in management of diarrhoea in children

The proportion of children receiving antibiotics was significantly lower among children with acute watery diarrhoea than those with persistent or bloody diarrhoea ($p < 0.01$) (**Table 4**). The odds that antibiotics were given in the management of children with acute watery diarrhoea was 0.1 (95% CI, 0.02 – 0.3) times the odds of children with bloody or persistent diarrhoea. Children who were attended at the dispensaries in Ilala municipality had 2.1 (95% CI 1.2 – 3.8) times the odds of being given antibiotics to manage diarrhoea compared to those attended at other public primary health facilities in other municipalities. Other variables such as age, gender, frequency of loose stools per day, laboratory tests performed, and other symptoms did not influence antibiotics use.

Use of ORS, zinc and antibiotics among children under-five with acute watery diarrhoea

Out of 258 (85.7%) children with acute watery diarrhoea, only 23% were given ORS and pediatric zinc. Besides, others were given either ORS combined with pediatric zinc and antibiotics (24%), antibiotics only (21%), ORS with antibiotics (16%), or; ORS only (12.0%). A few were given pediatric zinc and antibiotics (2%), while others were not given any treatment (2%), as shown in **Figure 1**.

Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

Table 4: Factors associated with the use of antibiotics in children under-five

Variable	Children treated with antibiotics		Bivariate analysis		Multivariable analysis	
	Frequency (n/N)	Proportion (%)	Odds ratio (95% CI)	P-value	Odds ratio (95% CI)	P-value
Study area (Districts)						
Ilala	64/83	77.1%	1.9 (1.1 – 3.6)	0.020	2.1 (1.2 – 3.8)	0.014
Kigamboni	42/60	70.0%	1.2 (0.7 – 2.2)	0.554	*	
Kinondoni	7/14	50.0%	0.2 (0.2 – 1.4)	0.181	0.5 (0.2 – 1.6)	0.237
Temeke	62/102	60.8%	0.7 (0.4 – 1.1)	0.115	0.8 (0.4 – 1.5)	0.493
Ubungo	26/42	61.9%	0.8 (0.4 – 1.5)	0.471	*	
Gender						
Female	94/147	63.9%	0.8 (0.5 – 1.3)	0.308	*	
Male	107/154	69.5%	Reference			
Age (months)						
1 – 12	100/150	66.7%	1.1 (0.7 – 1.8)	0968	*	
13 – 59	101/151	66.9%	Reference			
Frequency of loose stool per day						
< 3 times	74/113	65.5%	1.1 (0.7 – 1.8)	0.712	*	
> 3 times	127/188	67.6%	Reference			
Other symptoms						
Absent	80/150	66.7%	1.0 (0.6 – 1.6)	0.974	*	
Present	121/181	66.9%	Reference			
Type of diarrhoea						
Acute watery diarrhoea	160/258	62.0%	0.1 (0.02 – 0.3)	0.000	0.1 (0.02 – 0.3)	0.000
Other types	41/43	95.3%	Reference			
Laboratory tests						
Yes	127/188	67.6%	1.1 (0.7 – 1.8)	0.712	*	
No	74/113	65.5%	Reference			

** Variables not included in the final model.*

Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

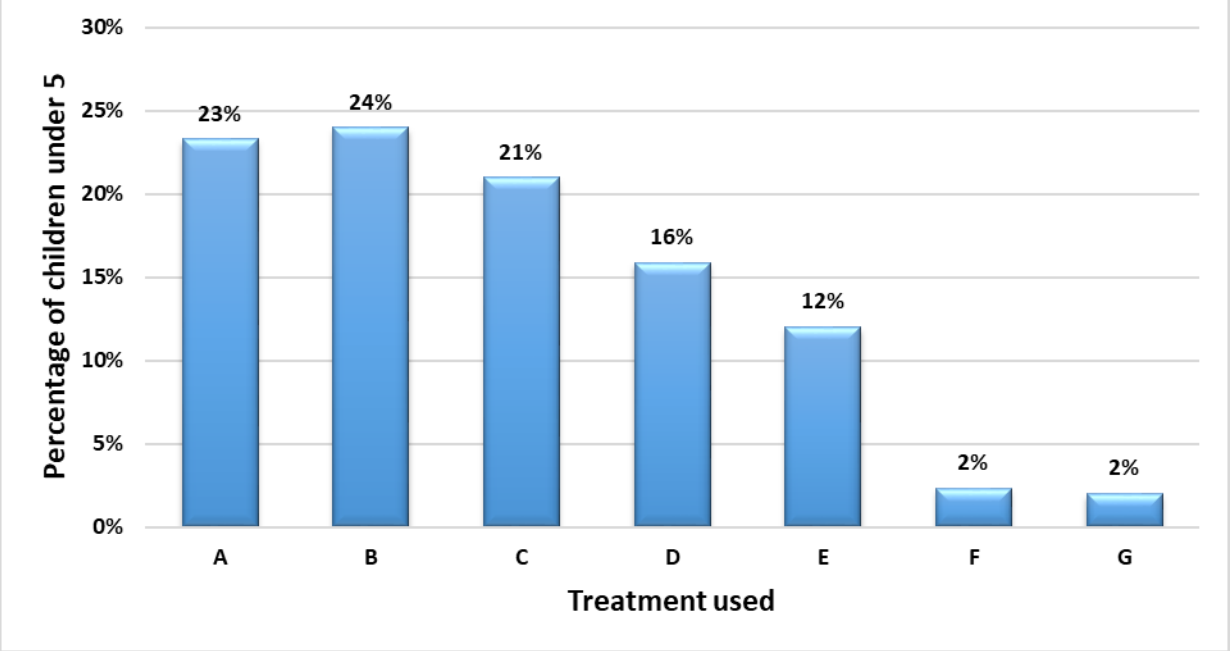

Figure 1: Distribution of ORS, zinc and antibiotics among children under-five with acute watery diarrhoea (N = 258) *(A = ORS+Ped Zinc, B = ORS+Ped Zinc+Antibiotics, C=Antibiotics, D=ORS + Antibiotics, E=ORS only, F= Ped Zinc+Antibiotics, G = No treatment given)*

Discussion

This study assessed the management of diarrhoea among children below five years of age attended at the public dispensaries located in Dar es salaam region. The main focus was to determine the provision of ORS and pediatric zinc as recommended by the WHO and the Tanzania standard treatment guidelines and to evaluate the correct use of antibiotics in managing diarrhoea among children under-five years. Significant findings included the inadequate provision of pediatric zinc and overuse of antibiotics to manage diarrhoea in children. The misuse of antibiotics for the treatment of diarrhoea is alarming in this era of antibiotic resistance.

ORS and pediatric zinc were prescribed to about 75% and almost 50% of the children who had diarrhoea (Table 2). The proportion of ORS and pediatric zinc use observed in this study was higher than that reported in Tanzania in 2015; 45% and 18% for ORS and pediatric zinc,

respectively (17). The increase in the use of both ORS and pediatric zinc can be attributed to the ongoing national campaign under the National Control of Diarrhoeal Disease program in Tanzania, whose main aim is to reduce diarrhoeal related deaths and morbidity in children under five years of age through prevention and effective case management using ORS and proper feeding. Despite the improvement observed, pediatric zinc provision is still low compared to ORS and this has been consistently reported in most studies (17, 18). Previous zinc studies have demonstrated the therapy to be effective in reducing the period of illness and reoccurrence of diarrhoea (7, 19); hence its coverage should be equally promoted as ORS use in managing diarrhoea.

The majority of children in this study had acute watery diarrhoea, whereby it was observed that ORS and pediatric zinc combination was prescribed to almost half (47%) of these children (Figure 1). In this study, ORS and pediatric zinc use are higher than the 13.4% reported on the Demographic and Health Survey study in Tanzania in 2015 – 2016 (20). The observed coverage of ORS and pediatric zinc among children under-five is similar to what was reported in Kenya (42.2%) and Uganda (46.8%) (18). According to the WHO and Tanzania guidelines, the correct management of acute watery diarrhoea is using ORS and Zinc without other drugs such as antibiotics. Regrettably, compliance with WHO recommendations and standard treatment guideline was observed in only 23% of the prescriptions for children with acute watery diarrhoea (Figure 1). Most (63%) of children with acute watery diarrhoea had one or more antibiotic(s) prescribed when there was no indication for it. The use of antibiotics in managing children with acute watery diarrhoea has also been reported in previous studies from most African countries where 68-95% of these children received antibiotics (9, 11, 21, 22). Training of health care providers to treat diarrhoea in children with ORS and zinc has been suggested to improve the quality of care (4).

One of the main determinants of antibiotics prescribing in children was the type of diarrhoea (Table 3) and co-trimoxazole was the commonest prescribed antibiotic, as shown in Table 3. While all children who had persistent diarrhoea were prescribed antibiotics, previous research has reported no benefit in using antibiotics for persistent diarrhoea. Inappropriate use of antibiotics has been associated with the development of persistent diarrhoea and antibiotic resistance (23, 24). In the previous study conducted to evaluate the outcome of

children under the age of 5 years who were treated for persistent diarrhoea, it was observed that the use of antibiotics significantly hindered the recovery (25). While ORS and pediatric zinc and proper diet are recommended, persistent diarrhoea has been reported to be responsible for 32–62% diarrhoea associated deaths of young children in low- and middle-income countries, including Tanzania (3) Research should be conducted in different areas to explore the best intervention in managing persistent diarrhoea, especially in children under five years of age.

This study's limitations include the study sites, which were primary health facilities in Dar es salaam, so generalization of the findings should be made cautiously. Secondly, since it was a cross-sectional study, we relied on the available data, mainly based on the doctors' diagnosis and patient files. Also, the prescribers or dispensers' factors that could have influenced the misuse of antibiotics for the treatment of diarrhoea were not explored. Therefore, we could not account for the high use of antibiotics observed among children attended at Ilala dispensaries.

Conclusion

Usage of ORS in the management of diarrhoea among children under-five years is much higher than pediatric zinc use. High incidence of using antibiotics in acute watery diarrhoea management has been observed against the guideline recommendations. The study recommends continuing education to health care providers and the community on proper management of diarrhoea in children under five years.

Ethics approval and consent to participate

Ethical clearance was obtained from the MUHAS Senate Research and Ethics Committee. The aim of this study was clearly explained to all parents or guardians of the participants involved. Permission to conduct this study at the selected dispensaries was granted by the respective District Medical Officers and the primary health facilities' in-charges. The written consent from a parent/guardian was sought before enrolling participants.

Competing interests

The authors declare that they have no competing interests.

Published by OJS
Doi: 10.4314/tmj.v31i4.399.g255

Authors' contributions

SVL participated in conception, research design, data collection and data analysis. RFM participated in research design, data analysis and interpretation, and drafting the manuscript. MK, WPM, HJM and AIM participated in research design and manuscript revising. GMB contributed in revising the manuscript. All authors read and approved the final manuscript.

Acknowledgements

We thank the District Medical Officers, the in-charges of the primary health facilities, the parents/guardians and the children for all the co-operation they gave to us during the study period.

Availability of data and materials

The datasets used and analyzed during the current study is available from the corresponding author on a reasonable request.

Funding

Not applicable.

List of Abbreviations

ORS	Oral Rehydration Salt
WHO	World Health Organization
CDD	Control of Diarrhoeal Disease
MUHAS	Muhimbili University of Health and Allied Sciences

Reference

1. World Health Organization (WHO). **Diarrhoeal disease, 2017**. https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease. Accessed 1st March 2020.
2. Liu L, Oza S, Hogan D et al. **Global, regional, and national causes of child mortality in 2000-13, with projections to inform post-2015 priorities: an updated systematic analysis**. Lancet. 2015; 385(9966): p. 430-40.
3. Rahman AE, Moinuddin M, Molla M, Worku A, Hurt L, Kirkwood B, et al. **Childhood diarrhoeal deaths in seven low- and middle-income countries**. Bull World Health Organ. 2014; 92:664–671.
4. Fischer Walker CL, Taneja S, LeFevre A, Black RE, Mazumder S. **Appropriate Management of Acute Diarrhea in Children Among Public and Private Providers in Gujarat, India: A Cross-Sectional Survey**. Glob Health Sci Pract. 2015;3(2):230–41.
5. World Health Organization (WHO). **Child health, 2020**. https://www.afro.who.int/health-topics/child-health. Accessed 15th March 2020.
6. Munos Melinda K, Fischer W, Christa L, Black Robert E. **'The effect of oral rehydration solution and recommended home fluids on diarrhoea mortality'**. Int J Epidemiol. 2010; 39:i-75–87.
7. Bhutta ZA, Bird SM, Black RE, Brown KH, Gardner JM, Hidayat A, et al. **Therapeutic effects of oral zinc in acute and persistent diarrhea in children in developing countries: pooled analysis of randomized controlled trials**. American Journal of Clinical Nutrition. 2000; 72(6):1516–22.
8. NICE. **Diarrhea and vomiting caused by gastroenteritis**. Clinical Guideline, London: RCOG Press. 2009;1-174.
9. Gwimile JJ, Shekalaghe SA, Kapanda GN, Kisanga ER. **Antibiotic prescribing practice in Management of Cough and/or Diarrhoea in Moshi municipality, northern Tanzania: cross-sectional descriptive study**. Pan Afr Med J. 2012; 12:103.
10. Rhee C, Aol G, Ouma A. et al. **Inappropriate use of antibiotics for childhood diarrhea case management — Kenya, 2009–2016**. BMC Public Health. 2019; 19:468.
11. Efunshile AM, Ezeanosike O, Nwangwu CC, König B, Jokelainen P, et al. **Apparent overuse of antibiotics in the management of watery diarrhoea in children in Abakaliki, Nigeria.** BMC Infect Dis. 2019;19(1):275.

12. Gu J, Zhao J, Huang Y, et al. **Use of antibiotics by urban and rural residents in Heilongjiang Province, China: cross-sectional study**. Tropical Med Int Health. 2015;20(12):1815–22.
13. Pathak D, Pathak A, Marrone G, Divan V, Stålsby Lundborg C. **Adherence to treatment guidelines for acute diarrhoea in children up to 12 years in Ujjain, India - a cross sectional prescription analysis**. BMC Infect Dis. 2011; 11(32) doi:10.1186/1471-2334-11-32.
14. Osatakul S, Puetpaiboon A. **Appropriate use of empirical antibiotics in acute Diarrhoea: a cross-sectional survey in southern Thailand**. Ann Trop Paediatr. 2007; 27(2):115–22.
15. World Health Organization (WHO). **Antibiotic resistance, 2018**. http://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance. Accessed 15th March 2020.
16. World Health Organization (WHO). **The treatment of diarrhoea. A manual for physicians and other senior health workers, 2005**. https://apps.who.int/iris/bitstream/handle/10665/43209/9241593180.pdf;jsessionid=4336832006D060C68BA230F40A3B1A22?sequence=1. Accessed 4th September 2020.
17. Masanja H, Mongi P, Baraka J, Jackson B, Kisisiwe Y, Manji K, Iriya N, John T, Kimatta S, Walker N, Black RE. **Factors associated with the decline in under five diarrhoea mortality in Tanzania from 1980-2015**. J Glob Health. 2019; 9(2):020806.
18. Schroder K, Battu A, Wentworth L, Houdek J, Fashanu C, et al. **Increasing coverage of pediatric diarrhoea treatment in high-burden countries.** J Glob Health. 2019; 9(1):0010503.
19. Lazzerini M, Wanzira H. **Oral zinc for treating diarrhoea in children**. Cochrane Database Syst Rev. 2016;12:CD005436.
20. Ministry of Health/National Bureau of Statistics. **Tanzania Demographic and Health Survey and Malaria Indicator Survey** (TDHS-MIS) 2015 - 16. Dar es Salaam, Tanzania, and Rockville, Maryland, USA: MoHCDGEC, MoH, NBS, OCGS, and ICF. 2016.
21. Kobayashi M, Mwandama D, Nsona H, Namuyinga RJ, Shah MP, et al. **Quality of Case Management for Pneumonia and Diarrhoea among Children Seen at Health Facilities in Southern Malawi**. Am. J. Trop. Med. Hyg. 2017; 96(5):1107–1116.

22. Udoh EE, Meremikwu MM. **Antibiotic prescriptions in the case management of acute watery diarrhoea in under-fives.** International Journal of Contemporary Pediatrics. Int J Contemp Pediatr. 2017; 4(3):691-695.
23. Das SK, Faruque ASG, Chisti MJ, Malek MA, Salam MA, Sack DA. **Changing trend of persistent diarrhoea in young children over two decades: observations from a large diarrhoeal disease hospital in Bangladesh**. Acta Paediatr. 2012; 101: e452–e457.
24. Lima AA, Guerrant RL. **Persistent diarrhoea in children: epidemiology, risk factors, pathophysiology, nutritional impact, and management**. Epidemiol Rev. 1992; 14:222–242.
25. Mahfuz M, Alam MA, Islam SB, Naila NN, Chisti MJ, Alam NH, Sarker SA, Ahmed T. **Treatment outcome of children with persistent Diarrhoea admitted to an Urban Hospital, Dhaka during 2012-2013**. BMC Pediatr. 2017;17(1):142.