Diarrhoea prevalence, characteristics and outcome among children admitted into the emergency ward of a tertiary hospital in Southern Nigeria

Anthony O. Atimati, Fidelis E. Eki-Udoko

Department of Child Health, University of Benin/University of Benin Teaching Hospital, Benin City, Edo State, Nigeria

Abstract

Diarrhoea is a leading cause of morbidity and mortality in children, particularly in developing nations. The majority of cases can be successfully managed at home, but a few cases may necessitate admission to the emergency ward. The purpose of this research is to determine the prevalence, characteristics, outcome, and associated factors among those admitted. After obtaining consent, all children who presented with diarrhoea within a year were recruited for the study. A semi-structured interviewer-administered questionnaire was used to collect biodata, diarrhoea treatment, and outcome information from caregivers. The Statistical Package for Social Sciences (SPSS) version 21 was used to analyze the data. A total of 164 of the 5,087 children seen were admitted for diarrhoea, resulting in a 3.2% prevalence. A higher proportion of the participants were males, aged 0-24 months, and were not exclusively breastfed. A third of the participants had diarrhoea in the previous year, with a higher proportion having 1-2 episodes. The case fatality rate was 2.4%. The prevalence of diarrhoeal admissions is low, as is the case fatality rate. Stool frequency, hydration status, and socioeconomic class were all significant predictors of fatal diarrhoea outcomes. Recurrent episodes of diarrhoea were significantly associated with maternal education and attendance at day care centers.

Introduction

Diarrhoeal diseases continue to be a leading cause of morbidity and mortality in children, particularly in developing countries. Diarrhea is the second leading cause of death in children under the age of five. It is defined as the passage of three or more loose or liquid stools in less than 24 hours, or more frequent passage than the individual is used to.[1,2]

Diarrhoea has been reported to kill 2,195 children per day, which is more than the combined deaths from malaria, acquired immunodeficiency syndrome (AIDS), and measles.[2] A little more than half a million (525,000) children under the age of five die each year from diarrhoeal diseases.[1] The annual episodes of childhood diarrhoea cases amounted to 2.5 billion globally, with children under the age of three experiencing an average of 3 episodes annually in low income countries. In a national survey in Nigeria, the prevalence of diarrhoea in children under the age of five was 13%, with regional and seasonal variations. The prevalence was higher in Northern Nigeria and among children aged 6-11 months and 12-23 months.[3] Diarrhoea is caused by gastrointestinal tract infection caused by microorganisms (viruses, bacteria, parasites) ingested in food and water. Pathogen transmission from person to person and through contaminated objects has also been implicated

in the oral transmission of causative organisms to the gastrointestinal tract. This has been linked to a lack of safe water, as well as poor sanitation and personal hygiene. The common causative organisms of diarrhoea in children include rotavirus, *Escherichia coli* (ETEC), *campylobacter jejuni*, *cryptosporidium*, salmonella species, *vibrio cholera*, *entamoeba histolytica*, and adenovirus in developing countries.[4] Non-infectious causes of diarrhea include lactose intolerance, celiac disease, inflammatory bowel disease (e.g., ulcerative colitis), irritable bowel syndrome, chronic pancreatitis, hyperthyroidism, bile acid diarrhea, and a variety of medications.[5]

Malnutrition predisposes children to increased frequency and severity of diarrhoea, whereas diarrhoea can lead to malnutrition through a variety of mechanisms, including loss of nutrients in stools and vomitus, increased metabolic demand, and poor appetite.[6,7] Malnutrition has been reported to contribute to roughly half of mortality in children under the age of five. Poor breastfeeding practices associated with diarrheal diseases include a lack of exclusive breastfeeding and early initiation of breastfeeding. Controlling diarrhoea entails improving hand washing practices, rotavirus vaccination, providing safe water, improving sanitation and personal hygiene, and improving breastfeeding practices.

Diarrhoea-related mortality has previously been linked to severe dehydration and electrolyte derangement, but bacterial sepsis has recently been reported as a contributor to mortality with increasing frequency. This emphasizes the importance of oral rehydration solutions and antibiotics in the treatment of diarrhoea. Zinc as an adjunct therapy in diarrhoea management has been shown to reduce the duration of diarrhoeal episodes while increasing the interval between diarrhoeal episodes. Most cases of diarrhoea can be successfully treated at home with Oral Rehydration Therapy (ORT), with only a few cases requiring treatment in an emergency ward with intravenous fluid and antibiotics.[8]

A two-year retrospective study conducted by Onyearugha *et al.*[9] in an Eastern Nigerian tertiary hospital among under-five children admitted to the emergency ward for diarrhoea found an 11.2% prevalence of diarrhoea and a 22% case mortality rate. A four-year retrospective study of 394 children admitted to the emergency ward of a tertiary hospital in Port-Harcourt, Nigeria, found a 3.6% case mortality rate but no information on the prevalence of diarrhoea.[10] Because these studies are retrospective, the possibility of missing data may be a limitation. Yilgwan *et al.*[11] found a 2.6% prevalence of diarrhoea in a prospective study of children with diarrhoea seen in the DTTU (Diarrhoea Treatment and Training Unit) of a tertiary hospital in Northern Nigeria. The subjects' outcomes were not evaluated.

The purpose of this study is to determine the prevalence of diarrhoea, its characteristics, outcome, and associated factors among children admitted to the paediatric department's emergency unit over a 12-month period.

Materials and Methods

This is a cross-sectional descriptive study that was conducted in the children's emergency unit of the University of Benin Teaching Hospital in Benin from October 2018 to September 2019. The Children's Emergency Unit has 30 beds and includes a casualty and inpatient component. Each month, 150 to 200 patients are admitted. All children who presented with diarrhoea during this time period and whose parents consented were enrolled in the study. A semi-structured interviewer-administered questionnaire was used to collect data. Biodata, frequency of diarrhoea, stool

characteristics, episodes of diarrhoea within the last year, hand washing habit, attendance at day care centers, exclusive breastfeeding, sources of water, and treatment received prior to presentation were obtained. The hydration status, treatment, and outcome were also recorded. Oyedeji *et al's* description of socioeconomic class using the educational status and occupation of the parents was utilized.[12]

The patients' weights were determined using an infant weighing scale (for infants) and a standard weighing scale (for older children). For infants and older children, height was measured using an infantiometer and a stadiometer, respectively.

The collected data was entered and summarized using the IBM SPSS* version 21 software (IBM Corp, Armonk, NY, USA).

Means and standard deviation were used to analyze quantitative data, while proportions and percentages were used to summarize qualitative data. The chi square test was used to examine the relationship between various socio-demographic parameters such as age, gender, maternal age, maternal education, and socioeconomic class and diarrhoea recurrence and outcome. Significant values were defined as p-values less than 0.05 at the 95% confidence level.

The caregivers provided written informed consent, and the University of Benin Teaching Hospital's Research and Ethics committee provided ethical approval.

Results

During the study period, a total of 5087 children were seen, with a total of 164 presenting with diarrhoea. Diarrhoea was found in 3.2% of the population, with males accounting for 56.1% of the total. The children's ages ranged from 3 months to 12 years, with those aged 0-24 months constituting the majority (84.8%) of the participants. Table 1 shows the sociodemographic characteristics of the study population.

A higher proportion (56.7%) of the children who had diarrhoea during the study period were not exclusively breastfed. Similarly, a higher proportion of subjects were children of tertiary educated mothers from upper socioeconomic classes.

A third (32.9%) of the subjects had diarrhoea in the previous year, with the majority having 1-2 previous episodes. A higher proportion of participants had diarrhoea for less than 7 days before presenting to the hospital. During the dry season, there were more diarrhoea episodes (56.1%). The average stool frequency was 4.82 ± 2.42 times per day.

Only one subject received zinc treatment as part of their home treatment. The vast majority of subjects (97.6%) were either discharged or transferred to a paediatric ward for ongoing care, while four died, bringing the case fatality rate to 2.4%. Table 2 shows the characteristics of the diarrhoea, home treatment, and outcome.

Table 3 shows the relationship between the outcome of diarrhoea and some socio-demographic and clinical variables. Death from diarrhoea disease was statistically associated with socioeconomic class (p = 0.012), state of hydration (p = 0.0001), and daily stool frequency (p = 0.004). Low socioeconomic status, severe dehydration, and daily stool frequency of up to seven times or more were all associated with a higher risk of death.

Table 4 shows the relationship between increased diarrhoea recurrence and some sociodemographic factors. Diarrhoea recurrence was associated with maternal education (p = 0.037) and day care center attendance (p = 0.009). There was no significant relationship between diarrhoea recurrence and subjects' age (p = 0.149), exclusive breastfeeding practice (p = 0.644), maternal age

(p = 0.165), socioeconomic class (p = 0.226), or hand washing after toilet use (p = 0.670).

Discussion

The purpose of this study was to determine the prevalence of diarrhoea, as well as the characteristics and risk factors for recurrent diarrhoeal episodes in children admitted to the emergency department. This study's diarrhoea prevalence was 3.2%, which is comparable to the 2.6%[11] reported in a Teaching Hospital in Northern Nigeria. It was, however, lower than the 7.8% found in a Ugandan study.[13] The low prevalence obtained from our study may be attributed to the fact that it is a hospital-based study conducted in the children's emergency ward, which manages primarily complicated cases of diarrhoea and diarrhoeal cases with comorbidities. Milder cases of the disease would have been treated at home or in a primary or secondary health care facility. The higher prevalence reported in the Ugandan study may be attributed to the duration of the study. While this study lasted 12 months, the Ugandan study only lasted 4 months. It is well understood that diarrhoeal diseases do not occur uniformly throughout the year. If the study was conducted during the peak season for diarrhoeal diseases, seasonal variations could account for a higher prevalence. This is supported by this study, which found a higher proportion of diarrhoeal cases during the dry season. Seasonal variation was also reported in a study from Northern Nigeria,[14] but it was only examined on a quarterly basis and revealed peak diarrhoea episodes between January and March and July and September. Children under the age of five are more susceptible to diarrhoea, and those aged 24 months and under are particularly vulnerable. In this study, 84.8% of the subjects were 24 months or younger. In West Bengal, Gupta *et al.*[15] found a similar prevalence of 83.4% among that age group. Younger age groups, particularly those aged 6 to 23 months, have been identified as a risk factor for diarrhoea in children.[16] Unsterilized feeding utensils, bottle feeding, and poor food hygiene have also been identified as contributing factors.

A higher proportion of study participants had not been exclusively breastfed. This finding is consistent with the findings of Gupta *et al.*[15] in West Bengal and Yilgwan *et al.*[11] in Jos, where a higher proportion of non-exclusively breastfed under-five children developed diarrhoea than exclusively breastfed children. Similarly, studies have found a link between not exclusively breastfeeding and an increased risk of developing diarrhoea.[17-21] Breastfeeding has been shown to reduce diarrhoea incidence, prevalence, hospitalizations, diarrhoeal mortality, and all-cause mortality.

A third of the participants were found to have recurrent diarrhoea within a year. This is comparable to the findings of Shati *et al.*[18] in Saudi Arabia and Omole *et al.*[22] in North-western Nigeria, where 30% of study subjects experienced more than one episode of diarrhoea within one year and three months, respectively. Each episode of diarrhoea is associated with nutrient loss, either through stools or vomiting. In some cases, there is a loss of appetite, result-

Table 1. Socio-demographic characteristics of subjects.

Parameter	Frequency	Percentage
Age (months)		
0 − 24	139	84.8
25 − 59	19	11.6
≥60	6	3.6
Gender		
Male	92	56.1
Female	72	43.9
Maternal age (yrs)		
20 − 30	67	40.9
31 − 40	68	41.5
41 − 50	26	15.8
>50	3	1.8
Maternal educational status		
No formal education	3	1.8
Primary	16	9.8
Secondary	46	28.0
Tertiary	99	60.4
Socioeconomic class		
Lower	27	16.5
Middle	57	34.7
Upper	80	48.8
Exclusive breastfeeding		
Yes	71	43.3
No	93	56.7
Day care centre attendance		
Yes	59	36.0
No	105	64.0

Table 2. Characteristics of diarrhoea, home treatment and outcome of treatment among study subjects.

Characteristic	Frequency (n=164)	Percentage
Previous diarrhoea episodes		
Yes	54	32.9
No	110	67.1
Number of previous episodes (n=54)		
1 − 2	41	75.9
3 − 4	10	18.5
5 − 6	3	5.6
Bloody stools		
Yes	19	11.6
No	145	88.4
Duration of diarrhoea (Mean = 3.63±3.47days)		
<7	139	84.8
7 − 13	16	9.7
≥14	9	5.5
Hand washing		
No	30	18.3
Yes	134	81.7
Seasonality		
Dry	92	56.1
Wet	72	43.9
Hydration status		
Well-hydrated	41	25.0
Mild dehydration	43	26.2
Moderate dehydration	61	37.2
Severe dehydration	19	11.6
Home treatment *		
None	52	28.9
Antibiotics	65	36.1
ORS	62	34.4
Zinc	1	0.6
Outcome		
Discharged	89	54.3
Transferred	71	43.3
Died	4	2.4

*multiple entries.

Table 3. Association between outcome of diarrhoea and some socio-demographic and clinical parameters.

Parameters	Outcome		χ^2 /F	p-value
	Survived (n%)	Died (n%)		
Sex				
Female	69(95.8)	3(4.2)		
Male	91(98.9)	1(1.1)	1.636	0.320
Age (months)				
1 − 24	135(97.1)	4(2.9)		
25 − 59	19(100)	0(0.0)	0.566	0.692
≥60	6(100)	0(0.0)		
Socioeconomic class				
Lower	24(88.9)	3(11.1)		
Middle	56(98.2)	1(1.8)	7.501	0.012*
Upper	80(100)	0(0.0)		
Previous diarrhoea				
No	108(98.2)	2(1.8)		
Yes	52(96.3)	2(3.7)	0.541	0.462
Exclusive breastfeeding				
No	89(95.7)	4(4.3)		
Yes	71(100)	0(0)	3.130	0.770
State of hydration				
Well-hydrated	41(100)	0(0.0)		
Mild dehydration	43(100)	0(0.0)	14.19	<0.0001*
Moderate dehydration	61(100)	0(0.0)		
Severe dehydration	15(78.9)	4(21.1)		
Diarrhoea duration (days)				
1 − 6	137(98.6)	2(1.4)		
7 − 13	14(87.5)	2(12.5)	7.616	0.052
≥14	9(100)	0(0.0)		
Stool frequency (per day)				
1 − 6	132(99.2)	1(0.8)		
≥7	28(90.3)	3(9.7)	8.417	0.004*

*p <0.05.

Table 4. Factors associated with recurrent diarrhoeal episodes.

Parameters	Previous diarrhoea episodes n(%)		χ^2	p-value
	Yes	No		
Age (months)				
1 − 24	42(30.2)	97(69.8)		
25 − 59	10(52.6)	9(47.4)	3.803	0.149
≥60	2(33.3)	4(66.7)		
Exclusive breastfeeding				
Yes	22 (40.0)	49 (60.0)		
No	32 (34.4)	61 (65.6)	0.214	0.644
Maternal age (yrs)				
20 − 30	16 (23.9)	51 (76.1)		
31 − 40	26 (38.2)	42 (61.8)	5.257	0.165
41 − 50	10 (38.5)	16 (61.5)		
>50	2 (66.7)	1 (33.3)		
Maternal education				
None/Primary	4 (17.4)	19 (82.6)		
Secondary	13 (25.5)	38 (74.5)	6.520	0.037*
Tertiary	37 (41.1)	53 (58.9)		
Socioeconomic class				
Lower	5 (18.5)	22 (81.5)		
Middle	19 (33.3)	38 (66.7)	3.30	0.226
Upper	30 (37.5)	50 (62.5)		
Handwashing practice				
Yes	43 (32.1)	91 (67.9)		
No	11 (36.7)	19 (63.3)	0.233	0.670
Day-care attendance				
Yes	27 (45.8)	32 (54.2)		
No	27 (25.7)	78 (74.3)	6.875	0.009*

*p-value < 0.05.

ing in inadequate nutrient intake. Recurrence can thus result in impaired nutrition, stunted growth, and malnutrition. There is a well-established link between diarrhoea and childhood stunting. A 20-year series of cohort studies found that the likelihood of stunting is directly proportional to both the cumulative incidence and the longitudinal prevalence of diarrhoea, with each five episodes increasing the odds of being stunted by the age of two by 13%.[23]

The duration and severity of diarrhoea influence the outcome of diarrhoeal diseases. Infectious diarrhoea is classified as acute or persistent based on its duration. Persistent diarrhoea is defined as lasting 14 days or more and is associated with an increased risk of malnutrition and mortality. 5.5% of the participants in this study had persistent diarrhoea. Age, previous episodes of diarrhoea, malnutrition, and feeding pattern are all factors that have been linked to an increased risk of persistent diarrhoea. These factors, however, were not considered in this study.

The case fatality rate of 2.4% in this study is comparable to the 2.0% fatality rate reported in the Global Enteric Multicentre Study (GEMS), which included children aged 0-59 months with moderate to severe diarrhoea in seven African and Asian countries.[24,25] A higher prevalence of 14.1% was reported in a study from Mauritania. Early presentation to the hospital, as demonstrated by a mean duration of diarrhoea of 3.63 days prior to presentation, ensures prompt management and a lower risk of death. Furthermore, in the Mauritania study, poor quality of health care, poor hygiene and sanitation, and presentation of complicated cases were reported as possible factors accounting for increased mortality. The association of diarrhoeal death with lower socioeconomic class of study participants is not surprising. A high burden of diarrhoeal diseases has been linked to a lack of access to urgent health care, a lack of safe water and sanitation, and a low income. The risk of dying from diarrhoeal diseases increases when appropriate treatment is delayed, and children from low-income households are especially vulnerable.[26] Children from low-income households are more likely to become malnourished, and malnutrition has been linked to an increase in diarrhoeal mortality.

In this study, diarrheal death was also linked to severe dehydration and a daily stool frequency of seven or more. Death from diarrhoeal diseases has been attributed primarily to fluid and electrolyte loss, resulting in dehydration and electrolyte imbalance. During diarrhoeal episodes, the volume and frequency of stools are important determinants of hydration status. It is not surprising, then, that there was a link between death as a result of the disease and the passage of stools seven or more times per day. This also explains why all of the deceased children were severely dehydrated. This study found an unexpected link between repeated episodes of diarrhoea and higher maternal educational status. Higher maternal educational status has been associated with a lower risk of diarrhoeal recurrence.[27] Diarrhoea recurrence is associated with factors such as malnutrition, poor sanitation and hygienic practices, and limited access to health care services such as vaccination, all of which are expected to be more prevalent, but not always so, in mothers with a lower educational background. A possible explanation for our findings is a dissociation between knowledge and practice of hand washing, which invariably results in poor hand washing practices and an increased risk of diarrhoea.[28] Additionally, highly educated mothers are more likely to be engaged in different occupations, which may necessitate the use of house help and day care centers in the care of their children. This is supported by the findings of Barros *et al.*,[29] who discovered that use of day care centers was more prevalent in mothers with higher educational status, and the risk of diarrhoea was significantly higher in children cared for in day care centers than in children cared for at home. This risk

was linked to the group care provided to children in day care centers. This study also found a statistically significant link between recurrent diarrhoea and day care center attendance. In the setting of day care centres the occurrence of diarrhoea in a child poses a risk of infection to other children due to transfer of pathogenic organisms from the carers attending to the sick child or from contact with contaminated surfaces. The transmission of organisms within children can raise the risk of recurrence.

Conclusions

The prevalence of admission for diarrhoeal diseases is low, as is the case fatality rate. Stool frequency, hydration status, and socioeconomic class were all significant predictors of fatal diarrhoea outcomes. Recurrent episodes of diarrhoea were significantly associated with maternal education and attendance at day care centers. To reduce death from diarrhoea diseases, children with high stool frequency and severe dehydration should be rehydrated promptly and adequately. To prevent recurring diarrhoea in children, day-care facilities should be monitored for proper hygiene.

References

1. World Health Organization. Diarrhoeal diseases; 2017. Accessed on August 2021. Available from https://www.who.int/news-room/fact-sheets/detail/diarrhoeal-disease
2. World Health Organization. Why children are still dying and what can be done. Geneva. Switzerland: World Health Organization/ United Nations Children's Fund; 2009. Accessed September, 2021. Available from: http://whqlibdoc.who.int/publications/2009/9789241598415_eng.pdf
3. National Population Commission (NPC) [Nigeria] and ICF International. Nigeria Demographic Survey, vol. 538; 2019. Accessed September, 2021. Available from: https://www.dhsprogram. com/pubs/pdf/FR359/FR359.pdf
4. Ugboko HU, Nwinyi OC, Oranusi SU, Oyewale JO. Childhood diarrhoeal diseases in developing countries. Heliyon 2020;6:e03690. Erratum in: Heliyon. 2020 Jun 10;6(6):e04040.
5. Nemeth V, Pfleghaar N. Diarrhea. [Updated 2021 Nov 29]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK448082/
6. Patwari AK. Diarrhoea and malnutrition interaction. Indian J Pediatr 1999;66:S124-34.
7. Soboksa NE, Gari SR, Hailu AB, Mengistie Alemu B. Childhood Malnutrition and the Association with Diarrhea, Water supply, Sanitation, and Hygiene Practices in Kersa and Omo Nada Districts of Jimma Zone, Ethiopia. Environ Health Insights 2021;15:1178630221999635.
8. Wasihun AG, Dijene TA, Teferi M, et al. Risk factors for diarrhoea and malnutrition among children under the age of 5years in Tigray Region of Northern Ethiopia. Plos One 2018;26:e0207743.
9. Onyearugha CN, Okoronkwo NC, Onyemachi PE. Prevalence of diarrhea and its associated risk factors in children aged 1–60 months at Aba, South East Nigeria. Eastern J Med Sci 2020;5:40-43.
10. Yaguo Ide LE, Alex-Hart BA. Diarrhoea and co-morbidities seen at University of Port Harcourt Teaching Hospital, Nigeria.

JAMPS 2019;21:1-9

11. Yilgwan CS, Okolo SN. Prevalence of diarrhea disease and risk factors in Jos University Teaching Hospital, Nigeria. Ann Afr Med 2012;11:217-21.

12. Oyedeji GA. Socio-economic and cultural background of hospitalised children in Ilesha. Niger J Paediatr 1985;12:111-117.

13. Nakawesi JS, Wobudeya E, Ndeezi G, et al. Prevalence and factors associated with rotavirus infection among children admitted with acute diarrhea in Uganda. BMC Paediatrics 2010;10:69.

14. Jiwok JC, Adebowale AS, Wilson I, et al. Patterns of diarrhoeal disease among under-five children in Plateau State, Nigeria, 2013–2017. BMC Public Health 2021;21:2086.

15. Gupta A, Sarker G, Rout AJ, et al. Risk correlates of diarrhea in Children under 5 years of age in slums of Bankura, West Bengal. J Glob Infect Dis 2015;7:23–29.

16. Mulatya DM, Ochieng C. Disease burden and risk factors of diarrhoea in children under five years: Evidence from Kenya's demographic health survey 2014. Int J Infect Dis 2020;93:359–66

17. Ogbo FA, Agho K, Ogeleka P, et al. Infant feeding practices and diarrhoea in sub-Saharan African countries with high diarrhoea mortality. PLoS One 2017;12:e0171792.

18. Shati AA, Khalil SN, Asiri KA, et al. Occurrence of diarrhea and feeding practices among children below two years of age in southwestern Saudi Arabia. Int J Environ Res Public Health 2020;17:722.

19. Rohmah H, Hafsah T, Rakhmilla LU. Role of exclusive breastfeeding in preventing diarrhea. Althea Med J 2015;2:463.

20. Dairo MD, Ibrahim TF, Salawu AT. Prevalence and determinants of diarrhoea among infants in selected primary health centres in Kaduna north local government area, Nigeria. Pan Afr Med J 2017;28:109.

21. Lamberti LM, Fischer Walker CL, Noiman A, et al. Breastfeeding and the risk for diarrhoea morbidity and mortality. BMC Public Health 2011;11:S15.

22. Omole VN, Wamyil-Mshelia TM, Aliyu-Zubair R, et al. Knowledge and prevalence of diarrhoeal disease in a suburban community in North Western Nigeria. Sahel Med J 2019;22:114-20.

23. Checkley W, Buckley G, Gilman RH, et al. Multi-country analysis of the effects of diarrhoea on childhood stunting. Int J Epidemiol 2008;37:816–30.

24. Levine MM, Nasrin D, Acacio S, et al. Diarrhoeal disease and subsequent risk of death in infants and children residing in low-income and middle-income countries: analysis of the GEMS case-control study and 12-month GEMS-1A follow-on study. Lancet Glob Health 2020;8:e204-14.

25. Ahmed MLCB, Weddih A, Benhafid M, et al. Hospitalizations and deaths associated with diarrhoea and respiratory diseases among children aged 0 – 5 years in a Referral hospital of Mauritania. Trop Med Infect Dis 2018;3:103.

26. Lwin KS, Nomura S, Yoneoka D, et al. Associations between parental socioeconomic position and health-seeking behaviour for diarrhoea and acute respiratory infection among under-5 children in Myanmar: A cross-sectional study. BMJ Open 2020;10:e032039.

27. Aluisio AR, Maroof Z, Chandramohan D, et al. Risk Factors associated with recurrent diarrheal illnesses among children in Kabul, Afghanistan: A prospective cohort study. PLoS One 2015;10:e0116342.

28. Taddese AA, Dagnew B, Dagne H, Andualem Z. Mother's handwashing practices and health outcomes of under-five children in northwest Ethiopia. Pediatric Health Med Ther 2020;11:101–8.

29. Barros H, Lunet N. Association between child-care and acute diarrhoea: a study in Portuguese children. Rev Saude Publica 2003;37:603-8