

Diarrhoea In The Under-Fives: Constraints Encountered By Care Providers In Its Management

Article Review by Bodzewan Emmanuel Fonyuy
Ph.D In Public Health, Texila American University
Email: ebodzewan@gmail.com

Abstract

Diarrhoea continues to be one of the major causes of dehydration in the under-five population especially in the developing countries; resulting in high infant mortality rate, particularly in sub-Saharan Africa. Diarrhoea resulting to dehydration kills more children under five years of age than malaria, AIDS, measles and tuberculosis. It is actually the second leading cause of death in children under five in the world and responsible for 1.9 million deaths per year, following pneumonia, which kills 2 million per year. As such deaths via diarrhea represent 17% of deaths among children under-five; out of a total of 11 million deaths annually. This mostly results from the consumption of contaminated food and drinking of water from doubted sources. World-wide, around 1 billion people lack access to improve water and 2.5 billion have no access to basic sanitation. The objectives of the study were:

- ✓ *To assess the knowledge of care providers in identifying cases with dehydration in the under-fives.*
- ✓ *To assess their practices toward the adequate management of dehydration in the under-fives.*
- ✓ *To find out the difficulties encountered in its proper management.*
- ✓ *To propose practical solutions in order to curb its occurrence.*

A descriptive cross-sectional design was employed, in which primary data was collected from a sample in the study population in order to collect baseline data to be a representative of the study population during the study period, in order to assess the knowledge of care providers of Mankon Medicalized Health Centre and Nkwen Medicalized Health Centre in the assessment and management of dehydration in the under-fives.

Data was collected from care-providers of both Mankon and Nkwen Medicalised Health Centres who had served in these health facilities for at least six months and who are versed with the causes of dehydration in the under-fives, its clinical manifestations and the adequate implementation of proper management.

The convenient sampling technique for this study in which all the eight (8) care providers managing clinical cases in the medical ward and the twelve (12) care providers managing clinical cases in the paediatric ward of both Mankon and Nkwen Medicalised Centres were involved in the study and questionnaire administered to them.

A structured questionnaire was designed to collect primary data from respondents. This instrument was structured as such to tailor the specific objectives of the study:

Results show that; out of the 22 respondents, 11 (50%) were Nursing Assistants (NA), 2.0 (9.09%) were State Enrolled Nurses (SEN), then 8.0 (36.36%) were State Registered Nurses (SRN) and 1.0 (4.54%) a Bachelor in Nursing Science degree (BNSc).

Six nurses have worked for between 6-12 months, 7 nurses for between 1-5 years, 3 nurses for between 5-10 years and 4 nurses for between 20 years and above. Out of the 22 Care-providers, 13 (59.09%) suggested that dehydration is excessive loss of fluid from the body, while 9.0 (40.90%) of the respondents thought that dehydration is loss of body fluids and electrolytes. However, all the 22 respondents presented similar causes and clinical pictures and state that dehydration is classified into 3 types in terms of severity.

All the 22 respondents identified 3 types of dehydration and offered specific solutions as to each of them. They equally attribute specific length of time required to manage each type of dehydration. The 22 participations also thought that to properly manage this condition, appropriate tools (urinary bag or any calibrated bowl) should be used to estimate the amount of fluid lost.

On the clinical manifestations of dehydration, 49 responses were gotten as follows, 11 (23.40%) could not distinguish signs and symptoms as to mild, moderate and severe dehydration, 12 (25.53%) stated difficulties as regard to management approaches, while 24 (51.06%) related their difficulties to mother's compliancy.

All the respondents suggested similar causes and clinical pictures and classified it into three types. All of them above implies that with the knowledge on dehydration, nursing staff can easily reverse this condition with less fatality using specific management approach corresponding to the degree of dehydration, and prevent complications.

Health advice offered to mothers by nurses on the management approaches at home fall under four items viz: O.R.S., water and fluid, nutrition and hygiene. 18 (33.96%) provided health talks on hygiene. If faeco-oral infections should be avoided, hygienic measures must be implemented, 14 (26.41%) nurses advocated on the use of O.R.S which should be taken at home.

Keywords: Sanitation, Diarrhoea, Dehydration, Under-fives, Oral Rehydration solution, Hypervolemia, Fluid Replacement Therapy

Introduction

Diarrhoea continues to be one of the major causes of dehydration in the under-five population especially in the developing countries; resulting in high infant mortality rate, particularly in sub-Saharan Africa (UNICEF, 2009). Diarrhoea resulting to dehydration kills more children under five years of age than malaria, AIDS, measles and tuberculosis. It is actually the second leading cause of death in children under five in the world and responsible for 1.9 million deaths per year, following pneumonia, which kills 2 million per year (UNICEF, 2009). As such deaths via diarrhea represent 17% of deaths among children under-five; out of a total of 11 million deaths annually. This mostly results from the consumption of contaminated food and drinking of water from doubted sources. World-wide, around 1 billion people lack access to improve water and 2.5 billion have no access to basic sanitation (Sarah Cumberland, 2009).

In a healthy person, total body water constitutes about 60% of the 75% of the body's weight. Because fluid is the main constituent of the body, the importance of body's fluid balance is readily apparent.

Hypo-hydration or dehydration is an excessive loss of body fluid from diverse compartments. However, in physiological terms, it entails a deficiency of fluid within an organism and occurs whenever the total output of fluid exceeds the total intake regardless of the underlying cause.

Dehydration can be caused by a wide range of diseases causing impairment of water homeostasis in the body through the skin, respiratory tract, gastro intestinal tract and the urinary system. Among these diseases, diarrhoea diseases seem to be the first leading cause of dehydration. Diarrhoea is defined as the passage of three or more loose or liquid stools per day, it is usually a symptom of an infection in the intestinal tract which can be caused by a variety of bacterial, viruses and parasites. Infection is spread through eating contaminated food or drinking contaminated water or even from person-to-person as a result of poor hygiene practices.

Paediatric dehydration is frequently the result of gastro-enteritis characterized by vomiting and diarrhea, however, other causes may include poor oral intake due to disease such as stomatitis, or osmotic diuresis from uncontrolled diabetes mellitus.

Hypotonic dehydration is the primary loss of electrolytes, sodium in particular in extra-cellular fluid, osmotic pressure changes resulting in extra cellular fluid moving into the intra cellular compartment. This then lead to a decrease of sodium from its normal range (136 – 144 mm d/l). It may be due to water over load or too much 5% dextrose. Volume depletion can be concurrent with hypo-natremia characterized by

plasma volume contraction with free water excess. An example is a child with diarrhea who has been given tap water to replace diarrhea losses, free water is replenished, but sodium and other solutes are not. Treatment here entails replacement using sodium chloride (Normal saline) infusion to re-instate the status-quo to normal.

Hypertonic (hypernatremic) dehydration refers to the surplus of sodium in intracellular fluid that can result from excess water loss or an overall excess of sodium. This condition could arise from excessive saline or Ringer's lactate infusion with true dehydration (different from volume depletion). Plasma volume contracts with disproportionate free water loss. An example is a child with diarrhea whose fluid losses have been replenished with hypertonic solution – Baking soda or improper dilute infant formula. Volume depletion has been restored, but free water has not. Treatment deals with administration of 5% dextrose infusion.

Symptoms of mild dehydration are noticeable after 3% to 5% of one's normal water volume has been lost. Initially, one experiences dry mouth, thirst, loss of appetite and dry skin which can be followed by constipation; decrease urine output (oliguria); unexplained tiredness, discomfort and irritability of the neuromuscular system and headache associated with dizziness when standing up.

Symptoms of moderate dehydration become apparent when 5% to 10% of normal water volume has been lost. There may be no urine output (anuria) ; Slightly sunken fontanelles and eyes; decrease tears; loss of elasticity or stretchiness of the skin; sudden weight loss; depressed respiration; decreased oxygenation; symptoms of lethargy; convulsion, spasms; lethargy (hypoactive reflex) drowsiness and extreme insomnia.

Symptoms of severe dehydration are apparent when the cardiac and respiratory rates increase to compensate for decrease plasma volume and blood plasma. These manifests through tachycardia, weak and rapid pulse, tachypnea and hyperpnea. At about 10% to 15% fluid loss or above, muscles are plastic; vision may dim, tangling of limbs (paresthesia); anuria is evident; deeply sunken fontanelles and eyes. Because of the complicating nature of this stage, the following can result: delirium, disorientation, unconsciousness, pulmonary oedema, hallucination, seizure and coma (Angelucci D. *et al.*, 1993).

The cholera outbreak in Cameroon and Zimbabwe highlights failure in the global fight against an old enemy. This is not only symptomatic of the breakdown of water and sanitation infrastructures, but also the restricted availability of simple life-saving treatment-Oral Rehydration Salts (ORS) solution. While a little can be done in short term to improve access to safe water and appropriate sanitation treatment with ORS solution for cholera – an acute intestinal infection that causes severe diarrhea has become more widely available to those afflicted (Sarah Cumberland, 2009).

Cholera outbreaks occurred in Africa in November 2010, killing more than 600 people in Cameroon and neighboring Nigeria. This issue of clean water in Africa remains unresolved in many areas. Cameroon's extreme North and North Regions are characterized by limited access to portable water and absence of latrines – these are the strong contributing factors to the cholera outbreak. According to Mirabell Akwei, a nurse treating cholera victims, around two-thirds of the people treated with cholera in Mokolo (Extreme North Cameroon) have been children (Jeremy Sprigge, 2010).

According to the Center for Disease Control and Prevention (CDC) Atlanta (2010), for children younger than 5 years, the annual incidence of diarrhea illness is approximately 1.5 billion, while deaths are estimated between 1.5 and 2.5 million. Though these numbers are staggering, they represent an improvement from the early 1980s when death rate was approximately 5 million per year.

In the United States of America, pediatric dehydration, particularly that due to gastro-enteritis is a common emergency in department complaints. Approximately 200,000 hospitalization and 300 deaths per year are attributed to gastro-enteritis each year.

According to Dr Chaignat from the WHO's Global Task Force on Cholera Control, a possible 80% of those afflicted could have been treated successfully with ORT. She says, severe cases may need intravenous fluid, but most people can be saved by ORS.

In 2009, diarrhea disease was the third leading cause of death in low income countries causing 6.9% of death overall. In children under-fives, it is the second leading cause of death following pneumonia. Out of 1.9 million children killed by diarrhea disease in 2009, 80% were under two years of age.

The Nigeria's Health Ministry reported that over 6.000 cases have been reported since June 2010 and more than 350 people have died and the infection threatens to spread. In Cameroon, the outbreak has killed more than 200 people and another 2500 cases of cholera have been diagnosed in June 2010 (Sprigge, 2010).

Information gotten from the Cameroon Ministry of Public Health was that, throughout the year 2010, 10.759 cases of cholera have been identified, 10,112 treated cases and 657 deaths. The following eight regions were affected: Centre, Far North, Littoral, North, North West, West, South West and South. The Far North Region registered 88% of the total cases.

At the Bamenda Regional Hospital, a second level referral health facility for the region, dehydration occurs secondary either to malnutrition (kwashiorkor, marasmus) or infectious diseases (gastro- enteritis, meningitis, tuberculosis). Out of the various degrees of dehydration, the commonest ones (mild to moderate) are successfully managed with no deaths registered. However, the severe type that common in outbreaks such as cholera occurs mostly seasonally when floods occur or when the water table gets high; as the prognosis is very dramatic. The following represents the gravity in the under-five age group from January 2006 to December 2010 as concern severe dehydration.

In 2008, out of 26 children who presented with dehydration in the pediatric unit, 6 cases died.

In 2009, out of 35 cases, 1 death occurred; in 2008, no severe case was presented; in 2010, 10 patients presented with no death registered. In 2011 and 2012, 59 cases and 44 cases were admitted with 4 and 3 deaths respectively (Hospital Records, 2012).

As a result, mothers seem not to detect mild and moderate dehydration and management approaches towards it. Furthermore, during the management of various types, the investigator could not accurately distinguish mild dehydration from moderate one, nor from severe dehydration, as the treatment approaches were focused on intra venous administration of either isotonic solutions-5% dextrose, normal saline or Ringer's lactate, or hypertonic solution -10% dextrose, 5% dextrose in normal saline (Hastings *et al.*, 1994)

Study objectives

General objective

To ascertain the knowledge of care providers in the prompt recognition and adequate management of dehydration in the under-five age group.

Specific objectives

- ✓ To assess the knowledge of care providers in identifying cases with dehydration in the under-fives.
- ✓ To assess their practices toward the adequate management of dehydration in the under-fives.
- ✓ To find out the difficulties encountered in its proper management.
- ✓ To propose practical solutions in order to curb its occurrence.

Study hypothesis

Health care providers, who are knowledgeable on the causes of dehydration in the under-fives, its clinical manifestation and are provided with adequate resources for the implementation of proper management, would successfully treat such cases with less mortality than those who are not.

Methodology

Study design

It was a descriptive cross-sectional design, in which primary data was collected from a sample in the study population in order to collect baseline data to be a representative of the study population during the study period, in order to assess the knowledge of care providers of Mankon Medicalized Health Centre and Nkwen Medicalized Health Centre in the assessment and management of dehydration in the under-fives.

Study population

The study was carried out in the care providers of both Mankon and Nkwen Medicalised Health Centres who had served in these health facilities for at least six months and who are versed with the causes of dehydration in the under-fives, its clinical manifestations and the adequate implementation of proper management.

Sample size and sampling procedure

The convenient sampling technique for this study in which all the eight (8) care providers managing clinical cases in the medical ward and the twelve (12) care providers managing clinical cases in the paediatric ward of both Mankon and Nkwen Medicalised Centres were involved in the study and questionnaire administered to them.

Primary data collection tool

A structured questionnaire was designed to collect primary data from respondents. This instrument was structured as such to tailor the specific objectives of the study as follows:

- Knowledge on dehydration.
- Management of dehydration.
- Health education, advice given to mothers on discharge.
- Proposed solutions to salvage the situation.

Method for data analysis

Data was coded using a coding guide developed for the study and entered in CsPro, cleaned and exported to SPSS windows version 16.0 for analysis. Descriptive statistics was employed to analyze the households' perceptions and practices. Bivariate analysis was used to evaluate the association between explanatory and outcome variables.

Method for data presentation

Data collected was analyzed using the SPSS software and presented in graphics and frequency tables.

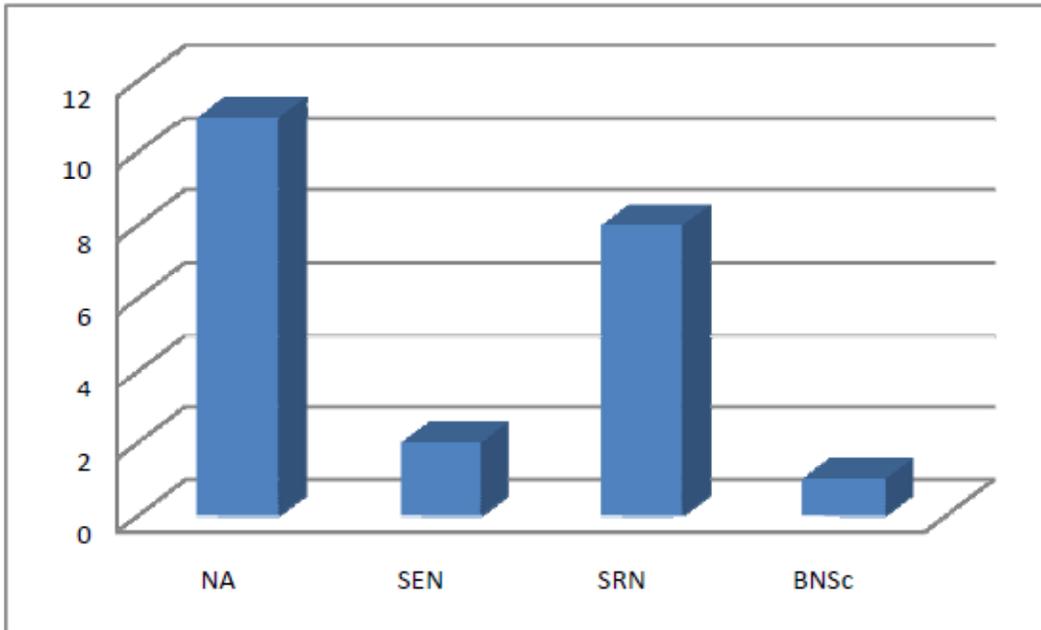


Figure 1. Distribution of Respondents according to professional grade

From figure 1, out of the 22 respondents, 11 (50%) were Nursing Assistants (NA), 2.0 (9.09%) were State Enrolled Nurses (SEN), then 8.0 (36.36%) were State Registered Nurses (SRN) and 1.0 (4.54%) a Bachelor in Nursing Science degree (BNSc).

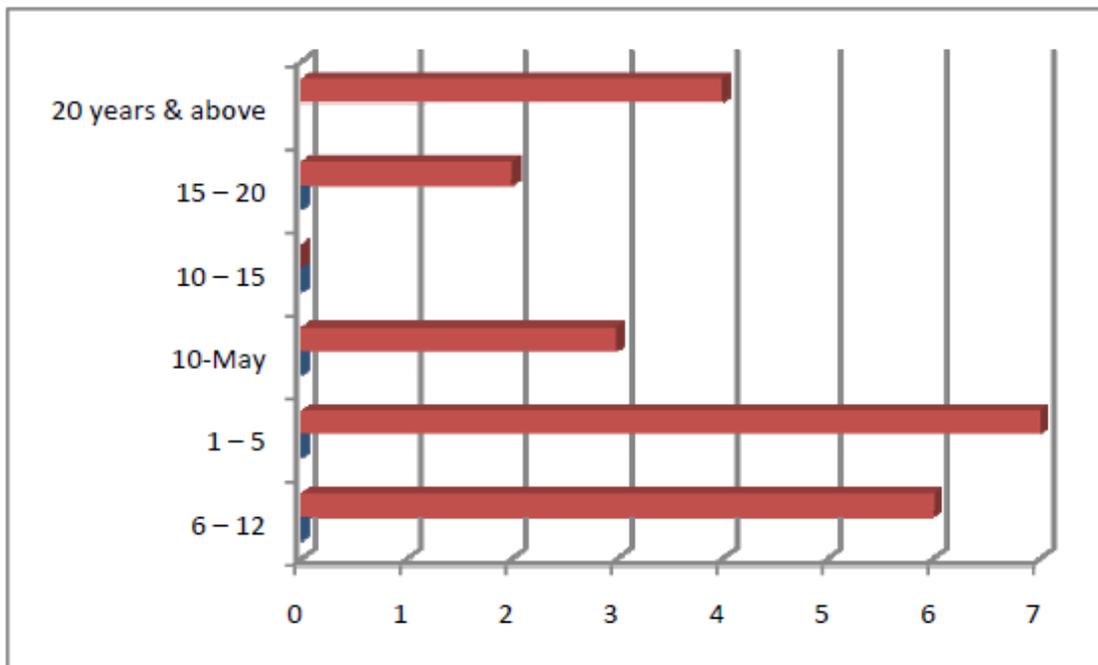


Figure 2. Distribution of participants according to duration in service

In Figure 2, 6 nurses have worked for between 6-12 months, 7 nurses for between 1-5 years, 3 nurses for between 5-10 years and 4 nurses for between 20 years and above.

Knowledge on Dehydration

Table 1. Distribution of Respondents for Knowledge on Dehydration

Definition of Dehydration	Clinical pictures of dehydration	Types of dehydration	Frequency	Percentage
Excessive loss of body fluids caused by vomiting, diarrhea, burns, hyperperspiration, poor in-take of fluids, gastro-enteritis and renal failure.	Thirsty, dry skin, weakness, sunken eyes and fontanelle decrease in skin turgor, irritability, confusion and coma	3	13	59.09
Excessive loss of body fluids and electrolytes caused by vomiting, diarrhea, electrolytes imbalance, infection gastro-enteritis and food poisoning.	Sunken eyes and fontanelle, restlessness, weight loss, flabby abdominal muscles, no urine, no tears, unconsciousness, irritability, dry gum and lips, confusion and coma.	3	9	40.90
Total			22	100

The table above shows that out of the 22 respondents, 13 (59.09%) suggested that dehydration is excessive loss of fluid from the body, while 9.0 (40.90%) of the respondents thought that dehydration is loss of body fluids and electrolytes. However, all the 22 respondents presented similar causes and clinical pictures and state that dehydration is classified into 3 types in terms of severity.

Management of Dehydration in Under-Fives.

Table 2. Respondents Knowledge of the Management According to Severity

Type of dehydration	Type of solution	Duration of treatment	Tools used to estimate amount of fluid lost	N°. of participants.
Mild dehydration	ORS	4 – 6 hours	Fluids & electrolytes	22
Moderate dehydration	Normal Saline	8 – 12 hours	Chart or urinary bag	22
Severe dehydration	Ringer Lactate	24 – 48 hours	Or any calibrated bowl	22

From table IV, all the 22 respondents identified 3 types of dehydration and offered specific solutions as to each of them. They equally attribute specific length of time required to manage each type of dehydration. The 22 participations also thought that to properly manage this condition, appropriate tools (urinary bag or any calibrated bowl) should be used to estimate the amount of fluid lost.

Health advice to mothers on discharge.

Table 3. Distribution of Respondents' Proportion of Management Approach per Variable.

Variables	Management approach at home	Frequency of Respondents	%
O.R.S	- Keep O.R.S. at home - Prepare O.R.S. - Freely drink O.R.S. - Continue rehydration with O.R.S.	14	26.41
Water & fluids	- Give enough fluids - Give good variety of fluids & rich food. - Boil water before drinking	12	22.65
Nutrition	- Continue breast feeding. - Proper handling of food before consumption. - Avoid food poisoning. - Provide balance diet.	9	16.98
Hygiene	- Wash feeding utensils. - Hand washing before feeding and after toileting. - Keep environment clean. - Frequent change of linen	18	33.96
Total		53	100

The table portrays that, health advice on management approach was offered on the following items: O.R.S. water and fluids, nutrition and hygiene in the following proportions: 18 (33.96%) of the respondents provided health talks on hygiene, followed by 14 (26.41%) of the respondents who offered health talks on O.R.S., then 12 (22.65%) of the respondents highlighted on water and fluid and 9 (16.98%) of the respondents offered health talks on nutrition.

Difficulties encountered in the management of dehydration in the under-fives.

Table 4. Respondents' difficulties encountered with regard to the various practices.

Items	Difficulties	Frequency	%
Signs and symptoms	Not distinguished as to mild, moderate and severe dehydration	11	23.40
Management approaches	- In-availability of fluid measuring tools. - Use of bed pan, plastic bag and bucket to collect output. - Amount of IV fluid per body weight and per duration not defined. - Mode of preparation and storage condition of ORS not stated.	12	25.53
Mother's compliancy	- Knowledge deficit. - Emptying of urine container without evaluation. - Mothers allow infants to vomit or urinate on the linen.	24	51.06
Total		49	100

From the table, it shows that out of the 22 respondents 49 responses were gotten as follows, 11 (23.40%) could not distinguish signs and symptoms as to mild, moderate and severe dehydration, 12

(25.53%) stated difficulties as regard to management approaches, while 24 (51.06%) related their difficulties to mother's compliancy.

Discussion of results

Looking at their duration in the service, 6.0 (27.27%) have worked for between 6-12 months, 7.0 (31.82%) have worked for between 1-5 years, 4.0 (18.18%) have worked from 20 years and above. This inequality distribution of the duration in the service signifies that those who are present in high frequency (high percentage) have worked for 1-5 years, and must have developed more skills and knowledge in the recognition and management of dehydration. Moreover, they could manage this condition with less fatality if they are provided with adequate resources. For those that have worked for 20 years and above, though the percentage is low, the number is however still significant, reason being that, throughout their professional career, they had also acquired more in the identification and management of dehydration in this age group.

Knowledge on dehydration

The distribution of respondents on knowledge of dehydration enunciated their definitions as follows: 13 (59.09%) nurses defined it as excessive loss of body fluids caused by vomiting, diarrhea, poor intake and renal failure, while 9.0 (40.90%) nurses defined it as excessive loss of body fluids and electrolytes caused by vomiting diarrhea, electrolytes imbalance and gastro enteritis. These definitions imply that, for dehydration to occur, they must be alteration in the functioning of one organ responsible for fluid homeostasis. Examples here include gastro enteritis which is infection of the gastro-intestinal tract characterized by vomiting and diarrhea, renal failure stands to be the inability of the kidneys to selectively retain water and electrolytes. Moreover, poor intake can be related to any abnormality of the oral cavity such as stomatitis. These organs are responsible for fluid and electrolytes balance ((Methen., 2000). All the respondents suggested similar causes and clinical pictures and classified it into three types. All of them implied that with the knowledge on dehydration, nursing staff can easily reverse this condition with less fatality using specific management approach corresponding to the degree of dehydration, and prevent complications (Bresee J.S. *et al.*, 2003) or reverse acute dehydration (Angelucci D. *et al*, 1993).

Management of dehydration in the under fives

Presenting data according to severity, all the 22 respondents identified three types of dehydration and offered specific solutions to each of them. They equally specified the length of time required to manage each type that varies from 4 hours to 6 hours for mild dehydration, using ORS; often managed at home, from 8 hours to 12 hours for moderate dehydration using Normal Saline, and from 24 hours to 48 hours for severe dehydration using Ringer's Lactate. These two forms are mainly managed in health facilities. Normal Saline and Ringer's Lactate usually given intravenously are used only for severe dehydration. However, the ORS may be administered by Naso-gastric tube if necessary. The aim of this treatment according to Angelecci D et al., (1993) is to reverse acute dehydration. The differences in duration imply that the management depends on how severe the condition is. Regardless of the severity, each child presenting with dehydration should be treated in less than 48 hours (2 days) (Glass. R. et al., 2003).

Tools used to evaluate input and output are also a valuable elements in managing this condition as they help to attain the expected outcome (results), that is to maintain fluid and electrolyte balance ((Metheny. 2000).

Health advice to mothers on discharge.

Health advice offered to mothers by nurses on the management approaches at home fall under four items viz: O.R.S., water and fluid, nutrition and hygiene. 18 (33.96%) provided health talks on hygiene. If faeco-oral infections should be avoided, hygienic measures must be implemented, 14 (26.41%) nurses

advocated on the use of O.R.S which should be taken at home. This solution had shown to be very effective in treating dehydration (WHO, 2006). 12.0 (22.65%) highlighted on water and fluid replacement. This is to enhance fluid and electrolytes balance ((Metheny. N.M.,2000) thereby not only rehydrate the child, but also in decreasing the duration of the diarrhea (Pediatric Update, 1994).

9.0 (16.98%) laid emphases on nutrition that should be well conserved, well cooked and given at short intervals basis, this goes in line with the BRAT routine meal advocated by Pillitteri (1995) as a protocol for providing a balanced diet while replacing fluid and electrolytes during acute episode of diarrhea in children. This shows that when all these variables are put together, the management of this condition will be very effective and will induce no fatality.

Difficulties encountered in the management of dehydration in the under-fives

Difficulties encountered by nurses in the management of dehydration in the under-fives fall within 3 items namely: difficulties to distinguish the manifestations of each type 11 nurses (23.40%), difficulties in management approaches 12 nurses (25.53%) and difficulties related to mothers compliancy 24 nurses (51.06%). These difficulties are linked and may have negative impact in the health status of the child. The inability to differentiate signs and symptoms and the mother's compliance would influence the management approaches.

Guidelines for nursing care is disrupted because measuring of fluid intake and output is inadequate. The clients' fluid intake may not be effective because the client and relatives are not knowledgeable on the fact that the nurse needs a record of all fluid entering the body and all fluids output so they may not know the quantity (fluid based food) and amount of fluid to take in further more. They often discard the output without the knowledge of the care provider who is as the role model (Dorthea Orem) and needs to offer total or partial care delivery to the patient. As a nutritional assessment (dietary plant) is not carried out to identify imbalances and food preferences. The nurse cannot initiate teaching. It is in this light that Metheny N.M, (2000) advocated that nurse should pay attention to certain parameters when assessing a client's fluid and electrolytes status (intake and output of fluid, urine concentration, skin turgor and degree of moisture in oral cavity, etc).

Recommendations

The recommendations go to three (3) resource areas viz: the nursing staff, the health facilities and the Ministry of Public Health.

The nursing staff.

- The nurses should regularly undergo refresher courses so as to be upgraded on the norms and standards of management of childhood dehydration.
- They should be drilled on the newly developed skills in IMCI.
- They should teach carers on how to identify signs of dehydration in children and provide them with first line treatment.

To the health facilities.

* Should provide appropriate case detection instruments to the health care providers to enhance the proper identification and prompt management of cases of dehydration the under-five population.

* They should endeavour to implement policy guidelines as laid down by the Ministry of Public Health for implementation at the operational level.

* They should encourage critical thinking among, capacitate the junior staff with tangible practical measures and provide capacity building opportunities via the regular organization of Seminars workshops.

To the ministry of public health.

- The Ministry of Public Health should provide WHO with official figures on devastating effects of the dehydration in the under-fives more especially when it is associated with outbreaks such as cholera ; for logistical and financial assistance to be provided when need arises.
- The Ministry of Public Health should draw more attention on dehydration in under-fives as is the case with other diseases notably tuberculosis, malaria, HIV/AIDS etc)

References

- [1] Angelucci D. Todaro A. (1993): *Reversing acute dehydration Nursing*.
- [2] Cumberland, David A.K, Lain H. Wilson, Richard J. Leaver, Antonia B. (2009): *Care of the critically ill patient in the Tropics and Sub-tropics* (first edition, pp. 76, 81-83).
- [3] Hillie T (2006) Nanotechnology, water, and Development. Dillon, Meridian institute.
- [4] Hoxie NJ, Davis JP, Vergeront JM, Nashold RD, Blair KA (1997) Cryptosporidiosis-associated mortality following a massive waterborne outbreak in Milwaukee, Wisconsin. *Am J Public Health* 87: 2032-2035.
- [5] Hunter P (1997) *Waterborne Diseases*. Epidemiology and Ecology. Chichester: Wiley.
- [6] Kumar SG, Jayarama S (2009) Issues related to sanitation failure in India and future perspective. *Indian J Occup Environ Med* 13: 104.
- [7] Mac Kenzie WR, Hoxie NJ, Proctor ME, Gradus MS, Blair KA, et al. (1994). A massive outbreak in Milwaukee of cryptosporidium infection transmitted through the public water supply. *N Engl J Med* 331: 161-167.
- [8] Meinhardt PL (2010) Recognizing water borne disease and the health effects of water pollution: American Water Works Association and Amot Ogden Medical center.
- [9] Sprigge N.M., (2010): *Fluids and electrolytes balance: Nursing consideration* (second edition), Philadelphia: Lippincott.
- [10] Pandve HT (2008) Environmental sanitation: An ignored issue in India. *Indian J Occup Environ Med* 12: 40.
- [11] United Nation Children's Fund (2009): *Dehydration in the under-fives*.
- [12] World Health Organization (2003) *Guidelines for Drinking water Quality*, 3rd edn.
- [13] World Health Organization (2010): *Integrated Management of Childhood Illness: Treat the child*.