

## Original Article

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# Outcome of Standardized Case Management of Under-5 Children with Severe Acute Malnutrition in Three Hospitals of Dhaka City in Bangladesh

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### Abstract

**Objects:** A hospital based descriptive study was carried out among under-5 children suffering from severe protein-energy-malnutrition (PEM)

**Methodology:** This was a descriptive analytical study conducted during June 2002 to May 2003 in three purposively selected hospitals of Dhaka city, Bangladesh.

**Results:** Mean±SD age of the children was 15.1±10.9 months, majority being under three years (91.5%), 47.2% were female, and 51% did not receive or complete immunization according to their age. No significant age and sex difference was found among the admitted children in different hospitals. Most of their parents were illiterate (mothers 71%, fathers 56%) with low family income and social status. Marasmus cases were 61%, followed by kwashiorkor 25% and marasmic kwashiorkor 14%. The children were managed broadly according to standard protocol based on the guideline of World Health Organization but adopted/modified by the individual hospitals. Overall outcome of the patients were: recovery 62.4%, default 21.4%, death 13.7% and transfer 2.6%. Mean duration of hospital stay was 14.2±9.9 (ranging from 0 to 59) days. Recovery rate was better among male (67.3%) than female (56.8%) children,  $p=0.033$ . Default rate was higher among female (27.3%) than male (16.1%) children,  $p=0.007$ . Case fatality rate was highest (40%,  $p=0.001$ ) in children suffering from septicaemia.

**Conclusion:** Evidences of faulty case management practices viz. over use of intravenous fluids and blood transfusion, inappropriate diets, less use of micronutrients, incorrect antibiotics were observed occasionally in all the three hospitals. Updated and comprehensive treatment guidelines need to be implemented, and every hospital should review its own clinical management procedures and performance with a view to improving practice.

**Key words:** Case management; protein-energy-malnutrition; severe acute malnutrition under-five children

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### Introduction

Protein energy malnutrition (PEM) is a multi deficiency state that includes a range of conditions, the most severe forms of which are marasmus, kwashiorkor, and marasmic kwashiorkor. First recognized in the 20<sup>th</sup> century, PEM's full impact has been revealed only in recent decades. Geographically, more than 70% of PEM children live in Asia, 26% in Africa and 4% in Latin America and Caribbean<sup>1</sup>. PEM is a

significant public health problem in developing countries like Bangladesh and is one of the most common causes of mortality and morbidity among children throughout the world<sup>2</sup>. The latest national nutrition survey<sup>3</sup> found that 10% of under-5 children were severely underweight [weight-for-age (WAZ) <-3] and 4% were severely wasted [weight-for-height (WHZ) <-3]. Previous studies found that severely underweight and -wasted children had an approximately eight-fold<sup>4</sup> and little more than nine-fold<sup>5</sup> increased risk of mortality respectively. Stunting, severe wasting, and intrauterine growth restriction together are responsible for 2.2 million deaths per year and 21% of disability-adjusted life-years for children younger than 5 years<sup>5</sup>.

Considering the magnitude of the problem, the seriousness and complicated condition, and the management and outcome, the children with severe PEM should be properly and promptly treated in a suitable health facility. It was seen over the last five decades of twentieth century that the median case fatality rate was remained unchanged over this period at 20-30%, with even higher rates (50-60%) for oedematous cases<sup>6</sup>. Death commonly occurs within first 48 hours after hospital admission and has been attributed to faulty case management. However, in general, when the necessary resources are present (such as antibiotic, ingredients for feeds, electrolyte/mineral solution and adequate staff to supervise regular feeds), and when standard guidelines are followed, the case fatality rate of 20-50% have fallen to <10% in some centres. According to guideline of World Health Organization (WHO)<sup>2</sup> a death rate of >20% is unacceptable, 11-20% is poor, 5-10% is moderate, 1-4% is good and <1% is excellent. It has been shown in the International Centre for Diarrhoeal Diseases and Research, Bangladesh (icddr,b) that use of a standardized protocol resulted in a 47% reduction in mortality in the management of severe PEM with diarrhoea<sup>7</sup>. No change in severity on admission occurred and the reduction in mortality was ascribed to some modification in case management of severe PEM notably the routine prescribing of broad spectrum antibiotics on admission, blood transfusion for severe anaemia, withholding of iron in the first week, avoidance of intravenous rehydration and cautious re-feeding with low sodium diets.

Hospital management is an important component of a comprehensive approach to the problem of severe

malnutrition. Successful management of the severely malnourished child does not require sophisticated personnel. It does, however, require that each child be treated with proper care and affection and that each phase of treatment be carried out properly by appropriately trained and dedicated health workers. When this is done, the risk of death can be substantially reduced and the opportunity for full recovery greatly improved.

Very few hospitals in Bangladesh have started standardized case management protocol as suggested by WHO: appropriate feeding, micronutrient supplementation, broad spectrum antibiotic therapy, less use of intravenous fluids for rehydration and careful management of complications and associated other conditions. Moreover, extremely few reports have been described the outcome/effect of those protocolized treatment of severe PEM in different hospitals. This study aimed at exploring the type of PEM, characteristics of patients and treatment outcome of standardized case management in three hospitals in the capital of Bangladesh.

### Methodology

**Study design:** This was as a descriptive analytical study and the detailed method is described below. The study was conducted at three hospitals of Dhaka city in Bangladesh, which were selected purposively for convenience of data collection and getting adequate number of sample of severe PEM cases. Brief descriptions of these hospitals are given below:

**Ad-din Hospital:** Ad-din Hospital is a 250 bedded low cost, maternal and child care hospital with a 20 beds nutrition rehabilitation unit at Moghbazar, Dhaka. The severe PEM cases are admitted in the nutrition unit and treated according to a management protocol based on WHO guidelines<sup>2</sup>.

**Dhaka Shishu Hospital (DSH):** It is a tertiary level paediatric hospital that provides care to the children from all over the country. It has 305 beds which include surgical and medical in-patients and is equipped with well organized modern diagnostic facilities, intensive care unit and special care baby unit. There is also a 20 bed nutrition unit for severe PEM cases which is run by a trained nutritionist with other auxiliary staff using a protocol based on WHO guidelines<sup>2</sup>.

**Institute of Child and Mother Health (ICMH):** It is located in Matuail, Dhaka, a tertiary level multipurpose institute, whose vision is to guide and lead the county

in child and mother health by combined community and hospital based services on curative and preventive aspects. Severely malnourished children are admitted and treated in the paediatric ward using a standardized protocol based on the WHO guidelines<sup>2</sup>.

### Study subject

Randomly selected 388 under-5 children with severe PEM (severe acute malnutrition) who were admitted into these hospitals, during June 2002 to May 2003 after fulfilling the following inclusion and exclusion criteria: i) weight for height <70% of reference median or <- 3 z score or ii) bipedal oedema or iii) MUAC < 110 mm were included and children with secondary malnutrition were excluded. Information was collected by using a pretested data collection checklist.

### Sample size:

In this study, total 388 malnourished children admitted first time in three hospitals of Dhaka City were enrolled as cases.

### Sampling technique, data collection and ethical clearance

Permission from the Academic Council of the National Institute of Preventive and Social Medicine and respective hospital authorities was taken to carry out the study. The respective hospital authorities allowed us to use their hospital records for the same purpose. After taking permission from the hospital's authority, medical records of the severe PEM patients during the period of one year were given serial numbers and the studied serial numbers were compiled following simple random sampling. A checklist was developed by using the selected variables. The checklist was pretested on 10 completed records/files of severe PEM patients (discharged successfully at Ad-din Hospital). The checklist was then finalized after necessary modification based on findings of pretesting.

### Data processing, analysis and interpretation

Individual checklist was checked for correctness and consistency by comparing with the original medical record and mistakes, if any, were corrected immediately. The data were entered into computer using SPSS for Windows (version 10.2; SPSS Inc., Chicago, IL, USA) and necessary data cleaning was done. First, frequency tables were produced for different variables and cross tables were produced accordingly. Then, mean values were produced for continuous variables. Finally appropriate statistics such as chi-square, group "t" test, etc. were applied as and when necessary.

### Results

A total of 388 children from three paediatric hospitals [149 (38.4%) from Ad-din hospital, 138 (35.6%) from DSH and 101 (26.0%) from ICMH] were studied and analyzed. The mean±SD age of the children was 15.1±10.9 months, and 180 (46.4%), 127 (32.7%) and 81 (20.9%) were <12, 12 to 23 and 24 to 59 months old respectively, 183 (47.2%) were female, and 51% did not receive or complete immunization according to their age. No significant age and sex difference was found among the children in different hospitals. Table 1 shows the distribution of children by type of PEM and hospital, associated illnesses and sex. It also reflects female preponderance for marasmic kwashiorkor (p=0.039); but not for marasmus and kwashiorkor. Approximately 70% father were day labourer or rickshaw puller and 10% were unemployed, 56% fathers and 71% mothers were illiterate and almost all were from the poorest socioeconomic background (detailed data are not shown). No significant association was found between type of PEM and parental education level or occupation. Twenty children had sign of vitamin A deficiency: xerosis 7, keratomalacia 7, Bitot's spot 2, corneal ulcer 2, and others 2. All received the standard treatment according to the WHO guidelines<sup>2</sup> with minor modification by the individual hospitals. In addition to common treatment as per WHO standard, 143 (36.9%) received emergency care, 28 (33.0%) received oxygen inhalation, 122 (31.4%) oro-pharyngeal suction, 59 (12.2%) nothing by mouth, 35 (9.0%) injection sodi bi carb, 22 (5.7%) nasogastric tube suction, 23 (5.9%) warming, 21 (5.4%) intravenous glucose, and 9 (2.3%) received 10% glucose orally. The additional treatment (those are not distinctly mentioned in the WHO guideline) and type of fluid therapy received by the PEM children are described in Table-II.

The mean±SD weight gain and hospital stay of the marasmic, marasmic kwashiorkor and kwashiorkor children were 10.6±9.1, 10.8±12.7 and 7.0±7.7 g/kg/d, and 13.8±9.9, 15.5±11.1 and 14.4±9.0 respectively. Of the 388 malnourished children 242 (62.4%) recovered, 83 (21.4%) were defaulted or took early discharge, 53 (13.7%) died and 10 (2.6%) were transferred to other hospital (Table-III). No significant difference in the outcome of treatment was observed with respect to age and type of PEM, but a higher rate of recovery among the male children (p=0.33) and default among female children (p=0.007) were observed. Table-IV shows the

**Table I**  
*Distribution [N (%)] of PEM children admitted in different hospitals, their sex and associated illnesses*

	Marasmus n= 237	Marasmic kwashiorkor n=55	Kwashiorkor n=96	Total N=388
<b>Hospital</b>				
Ad-din Hospital	86 (57.7)	16 (10.7)	47 (31.5)	149 (100)
Dhaka Children Hospital	75 (54.4)	26 (18.8)	37 (26.8)	138 (100)
Institute of Child and Mother Health	76 (75.2)	13 (12.9)	12 (11.9)	101 (100)
<b>Associated disease</b>				
ALRTI	106 (60.9)	26 (14.9)	42 (24.1)	174 (100)
Diarrhoea	85 (66.9)	16 (12.6)	26 (20.5)	127 (100)
Feeding mismanagement	5 (38.5)	0 (0.0)	8 (61.5)	13 (100)
Septicaemia	37 (67.3)	5 (9.1)	13 (23.6)	55 (100)
Tuberculosis	6 (60.0)	3 (30.0)	1 (10.0)	10 (100)
Congenital diseases	8 (61.5)	2 (15.4)	3 (23.1)	13 (100)
<b>Sex</b>				
Boys	127 (62.0)	22 (10.7)	56 (27.3)	205 (100)
Girls	110 (60.1)	33 (18.0)*	40 (21.9)	183 (100)
P value	0.710	0.039	0.213	

Table-I parenthesis indicates percentage; PEM: protein energy malnutrition; P value reached from chi square analysis

**Table-II**  
*Additional treatment (those are not distinctly mentioned in the WHO guideline) and type of fluid therapy received by the PEM children [N (%)]*

	Marasmus	Marasmic kwashiorkor	Kwashiorkor	Total
<b>Treatment received</b>				
Immediate emergency care	91(63.6)	22(15.4)	30(21.0)	143(100)
Nothing per oral	42 (71.2)	6 (10.2)	11 (18.6)	59 (100)
Oxygen inhalation	83 (64.8)	20 (15.6)	25 (19.5)	128 (100)
Oropharyngeal suction	78 (63.9)	20 (16.4)	24 (19.7)	122 (100)
Nasogastric suction	16 (72.7)	1 (4.5)	5 (22.7)	22 (100)
10% glucose orally	5 (55.6)	3 (33.3)	1 (11.1)	9 (100)
I/V glucose	17 (81.0)	2 (9.5)	2 (9.5)	21 (100)
Inj. Sodi bi carb	22 (62.9)	5 (14.3)	8 (22.9)	35 (100)
Warming	14 (60.9)	7 (30.4)	2 (8.7)	23 (100)
<b>Type of fluid</b>				
Intravenous fluid	55 (66.3)	10 (12.0)	18 (21.7)	83 (100)
ReSoMal	19 (43.2)	9 (20.5)	16 (36.4)	44 (100)
ORS	8 (80.0)	1 (10.0)	1 (10.0)	10 (100)
Mixed	27 (71.1)	6 (15.8)	5 (13.2)	38 (100)

outcome of the PEM children by associated disease/problem. Death rate was significantly high among the children with septicaemia (p=0.001). It was found that most of the (64%) mortality occurred within first 3 days (Table 5). Of all children, most 240 (61.8%) had mild-, 99 (29.3%) had moderate-

and 5 (1.5%) had severe anaemia. Proportion of death was high among the children with severe anaemia (40.0%) followed by moderate anaemia (14.1%), mild anaemia (13.4%), whereas recovery rate was higher among the children having no anaemia (68.0%).

**Table-III**  
*Outcome [N (%)] of children by age, sex and type of undernutrition*

Variable	Outcome of treatment				Total N=388
	Recovered n=242	Transferred n=10	Death n=53	Defaulter n=83	
<b>Age in months</b>					
<11	113 (62.8)	5 (2.8)	29 (16.1)	33 (18.3)	180 (100)
12-23	82 (64.6)	4 (3.1)	12 (9.4)	29 (22.8)	127 (100)
24-35	27 (56.3)	0 (0.0)	6 (12.5)	15 (31.3)	48 (100)
36-47	15 (57.7)	1 (3.8)	6 (23.1)	4 (15.4)	26 (100)
48-59	5 (71.4)	0 (0.0)	0 (0.0)	2 (28.6)	7 (100)
Mean ± SD	15.2±11.0	14.2±9.8	14.3±11.0	15.7±10.5	15.1±10.9
<b>Sex</b>					
Male	138 (67.3)*	9 (4.4)*	25 (12.2)	33 (16.1)	205 (100)
Female	104 (56.8)	1 (0.5)	28 (15.3)	50 (27.3)*	183 (100)
P value	0.033	0.026	0.373	0.007	
<b>Type of PEM</b>					
Marasmus	144 (60.8)	7 (3.0)	34 (14.3)	52 (21.9)	237 (100)
Marasmic kwashiorkor	35 (63.6)	0 (0.0)	8 (14.5)	12 (21.8)	55 (100)
Kwashiorkor	63 (65.6)	3 (3.1)	11 (11.5)	19 (19.8)	96 (100)
P value	0.693	0.426	0.768	0.907	

**Table-IV**  
*Outcome [N (%)]\* of PEM children by associated disease pattern/problem*

Associated disease	Outcome of treatment				Total	P value
	Recovered	Transferred	Death	Defaulter		
ALRTI	115 (66.1)	3 (1.7)	19 (10.9)	37 (21.3)	174 (100)	0.344
Diarrhoea	86 (67.7)	2 (1.6)	16 (12.6)	23 (18.1)	127 (100)	0.439
Feeding mismanagement	11 (84.6)	0 (0.0)	0 (0.0)	2 (15.4)	13 (100)	0.324
Septicaemia	24 (43.6)	2 (3.6)	22 (40.0)*	7 (12.7)	55 (100)	0.001
Tuberculosis	7 (70.0)	1 (10.0)	0 (0.0)	2 (20.0)	10 (100)	0.296
Congenital diseases	8 (61.5)	1 (7.7)	2 (15.4)	2 (15.4)	13 (100)	0.654

\*Few children had more than one associated diseases, so total number will not mach to 388

**Table V**  
*Distribution of PEM children by time of death (day from admission)*

Time of death (day)	Frequency (n)	%
1-3	34	64.2
4-7	6	11.3
8-11	8	15.1
12-15	1	1.9
>16	4	7.5
Total	53	100.0

### Discussion

Children with severe PEM (for last few-years also known as severe acute malnutrition) are at risk of life threatening problems and they need careful assessment, special treatment and management with regular feeding and monitoring. Their treatment in hospital should be well organized and given by special trained staff. The inpatient management of these very sick children and their outcome of management in terms of mortality and morbidity pose a major challenge to health care providers at the facilities. Most of these children do however recover from their life threatening conditions if they are taken care through a standard protocol. Unless there is careful supervision and timely treatment, case fatality in those facilities/centres is inevitably high. Even with protocolized treatment, recovery may take several weeks with other long term complications if not the staff concerned are adequately trained. This can add greatly to the treatment cost burden of that facility and the country.

Appropriate feeding, micronutrient supplementation, broad spectrum antibiotic therapy, less use of intravenous fluids for rehydration and careful management of complications and associated other conditions, are factors that can reduce death, morbidity and cost of treating those children. Very few centres in Bangladesh practice protocolized management of severe PEM. The centres used WHO ten steps<sup>2</sup> to manage severe PEM showed death rate of <10%<sup>8,9</sup>. Findings of such study may be utilized to create awareness among the health managers, policy makers, politicians, non government organizations and others in fully adopting and implementing the standard protocol for the management of severe PEM. A simplified protocol for use in the primary healthcare centres may also be designed. This study has been

undertaken to gather information with a view to fulfill these needs.

In this descriptive study, where data were collected retrospective, the author tried to collect data regarding different aspects of case management of severe PEM as recorded and thus tried to identify the reasons of variations in overall outcome of treatment despite the use of standardized protocol. Although marasmic patients predominantly had been treated in ICMH, kwashiorkor patients in Ad-din and marasmic-kwashiorkor in DSH, but in all the three hospitals most of the children were with marasmus. In a study conducted by Talukdar et al<sup>10</sup>, in the former Institute of Post Graduate Medical Research, Dhaka, it was found that majority were marasmus (64.5%) cases among the studied severe PEM patients. But study in Nigeria by Ashworth et al<sup>11</sup>, reported that kwashiorkor cases formed the largest proportion of admissions (66%). From different literatures, it was observed that marasmus patients were predominant in Asian countries and oedematous/kwashiorkor cases among the African countries<sup>12</sup>.

Among the associated illnesses observed in this study, acute lower respiratory tract infection (ALRTI) and diarrhoea were the commonest, which was also observed in studies by Talukdar et al<sup>10</sup>, Khin et al<sup>13</sup>, and others<sup>14-17</sup>. Incidence of ALRTI increased as the nutritional status deteriorated resulting in impaired immune status. Similarly, diarrhoea and malnutrition are common in young children of developing countries and it was seen that malnutrition is a determining factor in diarrhoeal duration and it has accounted for higher mortality among severely malnourished children<sup>18</sup>. Incidence of ALRTI and diarrhoea especially persistent one, are also interrelated with various socioeconomic factors (like low family income, low educational status, large family size etc), unsanitary behaviours, lack of breast feeding, incorrect diet and faulty weaning etc<sup>13</sup>. Associated illnesses greatly affect the outcome of treatment as seen in this study death rate was high in septicaemia.

In this study, it was found that the children below the age of 2 years were the most vulnerable. Akbar et al<sup>19</sup>, has shown that 88% of the malnourished children were below the age of 36 months. Overall proportion of male and female children in this study was equal (52.8% and 47.2% respectively). Majority of the fathers of the study children were poor considering their professions and monthly income (data not shown).

Children's of rickshaw-pullers, day labourers, housewives etc., were significantly more vulnerable to develop severe PEM. Especially, poverty, as well as ignorance are considered as the predisposing factors in the development of PEM<sup>22-22</sup>, 71% of mothers and 56% of father were illiterate in the present study. In another study 74% of fathers and 93% of mothers of malnourished children were found illiterate<sup>10</sup>.

Immunization status in these children showed that there was gross lack of adequate immunization, only 49% cases were fully immunized. One study<sup>21</sup> showed higher recovery rate among the children with complete immunization and higher death rate with partial immunization. Control of infectious diseases, e.g. ALRTI, diarrhea, measles, etc, break the cycle of malnutrition and infection in developing countries.

It was also observed that predominating diet prescribed in DSH was F-75 whereas in Ad-din and ICMH were F-75 and F-100, and milk-sugar-oil respectively. The weight gain of the patients recovered was almost similar to that found by Wheeler et al<sup>23</sup> and Talukder et al<sup>10</sup>. It was observed that significantly better weight gain was among the patients with marasmus and marasmic kwashiorkor children than the children who had kwashiorkor ( $p < 0.05$ ). Because kwashiorkor children gained weight after oedema fluid loss.

Regarding outcome of treatment, it was observed in this study that overall recovery rate was higher among the male children, whereas the rate of defaulter was higher among the female children. Although it was not statistically significant, the death rate was found higher among the female children and it could be due to the fact that less attention was given to female children by parents or there was gender discrimination. With standardized protocol<sup>2,9</sup> mortality among the severely malnourished children admitted to hospitals with or without associated problems was lowered as shown by many studies. In a study done by Talukdar et al<sup>10</sup> mortality rate was 4.5%. In another study done by Ahmed et al<sup>7</sup> in ICDDR,B, it was shown that mortality rate among the severe PEM children on standardized protocol treatment was 9% compared to 17% among the children with non-protocol treatment and there was a 47% reduction in mortality. A review of survey responses from 79 treatment centers throughout the world done by Schofield et al<sup>6</sup>, had shown unusually high mortality among the severe PEM cases (10-30%) and a likely cause of these high

mortality was suggested to be faulty case management practices.

The standardized protocol ensures a comprehensive treatment regimen that is simple, practical and prescriptive and applicable in almost everywhere, easily understood by trainee physicians and nurses and removes a large amount of discretions in management decisions by prewritten guidelines. WHO manual for the management of severe malnutrition had given emphasis on the ten steps to recovery describing initial phase of stabilization followed by rehabilitation phase and follow up phase. This manual provides practical guidelines and seeks to promote the best available therapy so as to reduce the risk of death, shorten the length of time spent in hospital and facilitate rehabilitation and full recovery.

Treatment of dehydration is an important issue in the management of severe PEM as it differs in pathophysiology from normal nourished children. It was also found that death rate was higher among the children treated with intravenous fluids and higher recovery rate among the children with oral rehydration therapy, which was advocated in the WHO manual. Over hydration was found to be one of the most important causes of mortality in severe PEM patient as shown in many studies<sup>7,21,24</sup>.

The outcome was significantly associated with complications, recovery rate was higher in less complicated cases and rate of death was higher with complications developed during the course of treatment. It was also found that among the fatal cases more than three fifth (64.2%) happened within 1-3 days of admission. This might be due to the fact that severe PEM cases were usually associated with many acute problems such as, hypoglycaemia, hypothermia, septicaemia etc<sup>1, 2</sup>.

The study revealed some important facts, despite it had limitations of retrospectiveness and incompleteness in the available PEM patients records. The findings might be area specific and so generalization of the results with the whole country population should not be made. In these hospitals, medical record system was not good enough to collect all the information required.

### Conclusion

There were preponderance of marasmus and younger age group. Management of PEM was not satisfactory in some respects. Incomplete and faulty recording

systems with avoidance of negative findings were observed in all the three hospitals having some unrecorded and inconsistent data. Satisfactory treatment of PEM should result in mortality of 5% or less (WHO accepted cut-off level) and results in three hospitals (>10%) were still far from this target. Evidences of faulty case management practices in these hospitals (in some cases) like choice of initial antibiotic therapy, treatment of dehydration, dietary management, micronutrient supplementation etc. were seen and might be the reason for such high mortality among the children admitted with severe PEM.

### Recommendations

Improvement in record keeping and documentation of all data in all the hospitals will result in better accountability and thus case management. Proper practice of the standardized case management protocol according to WHO/National guideline for the management of severe PEM in all the health facilities is necessary. The management should include slower and oral rehydration than rampant use of intravenous fluid, offering therapeutic diet frequently over day and night (preferably by using culturally acceptable local inexpensive foods), routine broad-spectrum antibiotics to all cases, micronutrient supplementation except iron in first week (e.g. vitamin A, folic acid, zinc, potassium, magnesium etc.) with careful management of complications etc. Efforts should be taken to lower the death rate and to shorten hospital stay. Improvement of knowledge of medical and paramedical workers may be done through short term training courses and in the longer term by updating and modifying courses and curriculum.

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### References

1. WHO Global Database on Child Growth and Malnutrition/2000.
2. World Health Organization. Management of severe malnutrition: a manual for physicians and other senior health workers; WHO, Geneva, 1999.
3. National Institute of Population Research and Training (NIPORT), Maitra and Associates, and Macro International. 2012. Bangladesh Demographic and Health Survey 2011. Dhaka, Bangladesh and Calverton, Maryland, USA: National Institute of Population Research and Training, Maitra and Associates, and Macro International
4. Pelletier DL, Frongillo EA Jr, Schroeder DG, Habicht JP. A methodology for estimating the contribution of malnutrition to child mortality in developing countries. *J Nutr* 1994;124: 2047S-2081S.
5. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet* 2008;371:243-260
6. Schofield C and Ashworth A. Why have mortality rates for severe malnutrition remained so high? *Reviews/Analysis; Bull WHO* 1996; 74 (2): 223-29.
7. Ahmed T, Ali M, Ullah MM, Choudhury IA, Haque ME, Salam MA, et al. Mortality in severely malnourished children with diarrhoea and use of a standardised management protocol. *Lancet* 1999; 353:1919-22.
8. Schofield C and Ashworth A. Severe Malnutrition in Children: High case fatality rates can be reduced. *Africa Health*, September 1998, 17-18.
9. Ashworth A, Jackson A, Khanum S, Schofield C. Ten steps to Recovery. *Child Health Dialogue*. 2<sup>nd</sup> and 3<sup>rd</sup> quarter (issues 3 and 4) 10-12.
10. Talukdar MQK, Kabir ARML, Kawsor CA, Feeding pattern, sociodynamics, clinical spectrum and recovery of severely malnourished children, A study of 155 cases. *Bangladesh J of Child Health* 1988;12:14-21.
11. Ibekwe VE, Ashworth A. Management of protein energy malnutrition in Nigeria; an evaluation of the regimen at the Kersey Nutrition Rehabilitation centre, Nigeria. *Trans Roy Soc Trop Med Hyg* 1994;88:594-95.
12. Khanam S, Ashworth A, Huttly SRA, Controlled trial of three approaches to the treatment of severe malnutrition. *Lancet* 1994;344:1728-32.



13. U KM, Khin M, Wai NN, Hman NW, Myint TT, Butler T . Risk Factors for the Development of Persistent Diarrhoea and Malnutrition in Burmese Children. *Int J Epidemiol* 1992;21;1021-9.
14. Kaushik PV, Singh JV, Bhatnagar M, Garg SK, Chopra H. Nutritional correlates of acute respiratory infections. *Indian J Mat Child Health* 1995;6:71-2.
15. Chhabra P, Garg S, Mittal SK, Chhabra SK. Risk factors for acute respiratory infections in underfives in a rural community. *Indian J Matern Child Health* 1997;8(1):13-7.
16. Singh LBM, Singh R, Lalawmpuia, War E, Singh SB, Singh SI. Malnutrition and diarrhoea contributing to under-five mortality. 10 Dec 2001 P13 [www.capgan.org/malinf](http://www.capgan.org/malinf).
17. Hossain MI, Dodd NS, Ahmed T, Miah GM, Jamil KM, Nahar B et al. Experience in managing severe malnutrition in a government tertiary treatment facility in Bangladesh. *J Health Popul Nutr* 2009;27:72-9.
18. Huffman SL, Martin L. Child nutrition, birth spacing, and child mortality. *Ann N Y Acad Sci* 1994 Feb 18;709:236-48.
19. Amin MR, Begum KA, Bano N, Ehsan MA, Akbar MS. Socio-economic determinants and biochemical status of severely malnourished children. *Dhaka Shishu Hosp J* 1991;7:70-77.
20. Gupta S. The Short Text book of Paediatrics, 8<sup>th</sup> edition 1998 Jaypee Brother 1989; 100-102.
21. Khanum S. Factors contributing to protein energy malnutrition in Urban Dhaka, *Bangladesh Journal of Child Health* 1985;9:80-89.
22. Nahar B, Ahmed T, Brown KH, Hossain MI. Risk factors associated with severe underweight among young children reporting to a diarrhoea treatment facility in Bangladesh. *J Health Popul Nutr* 2010;28(5);473-86.
23. Wheeler E, Khanum SI. Nutrition and malnutrition in Bangladesh. Published by Save The Children Fund (UK) 1986, p 39, 58, 60.
24. Golden MHN, Ramdath D. Free radicals in the pathogenesis of kwashiorkor. *Proc Nutr Soc* 1987;47:53-68.