

Full Length Research Paper

Missed opportunities in the diagnosis and management of protein energy malnutrition among children under 5 years in Wakiso district, Uganda

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Protein energy malnutrition (PEM) is one of the leading causes of death among children below 5 years in Uganda. It develops after acute childhood illnesses despite children having received treatment from health facilities. This study assessed knowledge and practices of health workers in the diagnosis and management of PEM, which was used to establish missed opportunities to prevent severe acute malnutrition (SAM) in its management. This was a cross sectional descriptive study that used questionnaires and observation of health workers at Health Center IV (HCIV) in Wakiso district, Uganda. The clinical nutrition diagnosis of the children was then obtained. There were 44 health workers that assessed 225 children. Most of the health workers 32 (72.7%) had education in PEM management and over 60% of them knew the forms of PEM, clinical signs of kwashiorkor and marasmus and the factors that predispose to PEM. Health workers did not weigh 56 (24.9%) of the children, 193 (86%) children had no height taken and only 32 (14.2%) had mid upper arm circumference measured. The weight for height of 223 (99.2%) and weight for age of 109 (93%) children was not calculated. Only 38 (16.89%) were examined for edema and 40 (17.78%) for muscle wasting. Health workers diagnosed only 21 (9%) children with malnutrition, while researchers found 94 (31.9%) with malnutrition. Children who missed opportunity to have malnutrition diagnosed at the health facility were 73 (32.9%). The knowledge of health workers on PEM is adequate, but their practice is inadequate. There is missed opportunity to diagnose and manage PEM among children who present with acute illnesses at the health centers, hence missed opportunity to prevent SAM.

Key words: Uganda, protein energy malnutrition, missed opportunity, health workers.

INTRODUCTION

Malnutrition is the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions (WHO). The term protein energy malnutrition (PEM) includes marasmus, kwashiorkor, and intermediate states of marasmic-kwashiorkor. Children may present with a mixed picture of marasmus and kwashiorkor, or milder forms of malnutrition (Scheinfeld et al., 2012).

In 2000, world health organization (WHO) estimated that malnourished children were 181.9 million (32%) in

developing countries. In addition, an estimated 149.6 million children under 5 years are malnourished when measured in terms of weight for age. The same report indicated that in South Central Asia and Eastern Africa, about half of the children have growth retardation due to PEM (WHO/Nutrition for Health and Development (NHD), 2000).

PEM has been identified as the most lethal form of malnutrition indirectly or directly causing annual death of at least 5 million children worldwide. Estimates indicate

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that 35.8% of pre-school children in developing countries are under weight, 42.7% are stunted and 9.2% are wasted (Onis et al., 1993). These children are at a higher risk of morbidity, mortality and carry adverse mental health consequences through their lives. A study carried out in Nigeria, estimated a mortality rate of 40.1% which although lower than the WHO estimate of 60%, is still very high and marasmic-kwashiorkor was found to be associated with higher case fatality rate than other types of PEM (Ubesie et al., 2012). In addition, the relative risk of mortality, because of low weight-for-age is elevated for each cause of death and for all-cause mortality (Caulfield et al., 2004).

In Uganda, it is estimated that 11% of children are born already stunted and about 16% of children are wasted at birth due to high fertility rates, young maternal age, short birth interval and malnutrition (Uganda Demographic and Health Survey (UDHS), 2006). Malnutrition directly and indirectly contributes 60% of child mortality in Uganda and PEM is one of the greatest single contributors to childhood mortality in the country, although it is rarely listed as a direct cause (UHSSIP 2010/11-2015).

Poor access to nutritious foods in context of rising food prices is a common cause of malnutrition (Onis et al., 1993). A malnourished child has poor immunity leading to compromised resistance to illnesses, therefore he falls ill, and the malnourishment worsens (United Nations Children Fund (UNICEF), 1998).

Nutritional status of children is determined by history, clinical examination and anthropometric measurements; height-for-age, weight-for-age, weight-for-height, head circumference, mid-upper arm circumference, and skin fold thickness which is compared to WHO reference charts (Antwi, 2011).

Integrated Management of Acute Malnutrition (IMAM) is a strategy by Ministry of Health Uganda to address acute malnutrition and focuses on integration of management of acute malnutrition into on-going routine health services at all levels of the health infrastructure and recommends that routine nutrition assessment and management should be incorporated in all treatment, care and support services (Charlette et al. 1996). The integrated guidelines also contain the necessary information on the factors that lead to malnutrition, proper diagnosis and management of malnutrition (Elamin, 2010).

There is a great opportunity of preventing and treating malnutrition in children attended to by health workers during acute illnesses. Children develop malnutrition few weeks after they have been attended to at the health facility which could have been prevented by the health worker managing the mild-moderate PEM or by advising the care takers/mothers on proper nutrition during sickness and recovery. Despite the Ministry of Health providing guidelines on identification and management of malnutrition in sick children, health workers attend to sick children without a nutritional focus (Elamin, 2010).

The study had an aim of assessing the knowledge and practices of health workers on PEM so as to establish

missed opportunities in its early diagnosis and management. Preventing PEM from progressing to severe acute malnutrition (SAM) in or after acute childhood illnesses is a great challenge to the health systems, yet few studies are available to establish the magnitude of the problem.

METHODOLOGY

It was a descriptive cross sectional study in which health workers in the five Health Centre IVs (HCIV's) in Wakiso district were interviewed to determine their knowledge on PEM. It also observed them as they managed children with acute childhood illnesses, in particular assessing the ability of the health workers to identify PEM, treat and advise care takers on its prevention.

The study participants included all the clinical officers and nurses involved in treatment of children under five years at outpatient clinics, pediatric wards and nutrition clinics. At each health facility, 9 health workers looked after under five children during the time of the study making a sample size of 44 respondents. The questionnaire was administered by a research assistant, while observations were carried out by the investigators.

The study tools included a questionnaire administered that collected demographic characteristics and knowledge of health workers attending to children below five years. A check list was filled in as the health workers were being observed as they managed the children and a child assessment form on which nutritional parameters measured were recorded by the investigators.

The questionnaire was pre-tested among a few health workers in Mulago hospital Uganda and the adjustments made. Informed and written consent was obtained from the health workers and the children care takers. The Institutional Review Board (IRB) approval was obtained from Makerere University College of Health Sciences.

Data analysis

Data was entered into EPI Data version 3.1 and then exported to Statistical Package for Social Sciences (SPSS) version 16 for analysis. Continuous variables were summarized using means and standard deviations, while categorical variables were summarized using frequencies. Wakiso district is located in Central Uganda, coordinates 00°24'N 32°29'E.

RESULTS

Knowledge of health workers

Of the respondents interviewed, 32 (72.7%) had ever received continuing medical education (CME) or training in PEM and agreed that PEM was a common condition among children.

Respondents' knowledge in the management of PEM

All the respondents could not categorize the management of PEM into stabilization and rehabilitation phases, but they could explain how to manage PEM.

Health workers practice

Twenty two percent of the children were assessed in

Wakiso Health Centre and Kasangati Health Centre, 20% were assessed in Namayumba Health Centre and 18% were assessed in each of the health centers, Ndejje Health Centre and Buwambo Health Centre.

Availability of instruments

Of the 5 visited health centres, 2 (40%) had ready-to-use therapeutic foods (RUFT) for treatment of PEM, 3 (60%) had mid upper arm circumference (MUAC) tapes, 3 (60%) had height boards; all the health centers did not have the ministry of health IMAM guidelines 2010, while all the health centers had weighing scales.

Advice to care takers

Majority of the children's care takers 181 (80.44%) were advised on nutrition of the child during illness and 113 (50.2%) of the children's caretakers were advised about child feeding when the children recovers from the illness.

Child assessment by the researchers

Of all the children assessed in the study, 50 (22%) were from Wakiso HCIV, 50 (22%) from Kasangati HCIV, 44 (20%) from Namayumba HCIV and 40 (18%) from each of the health centers Ndejje and Buwambo.

Physical examination of the children

On physical examination, 19 (8.4%) had edema, 54 (24.0%) had wasting, 34 (15.1%) had hair changes, 43 (19.1%) had skin changes, 40 (17.8%) had Apathy and 14 (6.2%) had wizen monkey look.

Different diagnoses of the children made by the health workers

Of the assessed children, only 9% of the children were diagnosed with malnutrition by the health workers, while malaria and respiratory tract infections were the most common illnesses in the health centers with a total of 64%.

Nutritional diagnosis of the children as assessed by the researchers

Of the children assessed, 131 (58%) had good nutritional status, 6 (2%) had kwashiorkor, 42 (19%) had marasmus, and 4 (2%) had marasmic-kwashiorkor, while 42 (19%) had low weight for age.

DISCUSSION

This study identified the knowledge and practices of health workers in the 5 HCIVs of Wakiso district Uganda. All the health workers who manage sick children at the health facilities were interviewed and observed as they attended to the children. The study was able to identify missed opportunities to prevent mild-moderate PEM from progressing to SAM. This is because there was missed diagnosis of PEM among the children, hence no action was taken to treat the PEM or prevent it from progressing to SAM. The study participants were 44 with a mode age category of 30 to 39 years. The health workers were all adults of different qualifications and with diverse experiences in healthcare. Most of the respondents were females 31 (70.5%), which is the same trend in other health facilities in the country. Majority of the health workers involved in the care of children were registered nurses 18 (40.9%), 17 (38.6%) clinical officers and 3 (6.8%) enrolled nurses. This explains why they had adequate knowledge in the diagnosis and management of PEM since malnutrition is one of the topics taught in their training schools. Nursing aids 2 (4.5%) and village health team (VHT) members 2 (4.5%) were mainly involved in the immunization of children and also in anthropometric recordings of malnourished children and because they have little training, some cases of mild-moderately malnourished children were not diagnosed at immunization. Most 31 (70.5%) of the health workers are in some form of marital union which agrees with the Uganda demographic and health survey (UDHS, 2006) that 49% of women and 50.1% of men between 15 and 49 years are married (Table 1).

Knowledge

Majority of the respondents 32 (72.7%) have ever had a training and CME in the diagnosis and management of PEM. This is why most of the health workers had adequate knowledge on the factors that lead to PEM among children, the forms of PEM, the clinical signs of PEM and management of PEM (Tables 2 to 4).

Most of the respondents reported low social economic conditions, ignorance of parents about importance of child nutrition, child abuse, improper weaning practices and infections like measles and diarrhea, use of bottle-feeding with diluted and dirty formula predisposing the child to infection and reduction of breastfeeding as major factors leading to malnutrition (Table 2). Kikafunda et al. (1998) reported that similar factors cause malnutrition. These same factors are also found in the IMAM Guidelines (2010) for the health workers to appreciate. Understanding the factors that lead to PEM is very important, because its health helps the health workers to promote good nutrition by helping to remove the basic causes of malnutrition (Kavishe, 1998).

The study found that majority of the respondents knew

Table 1. Demographic data of the health workers.

Characteristic	Frequency (n = 44)	Percentage (%)
Age (years)		
20-29	13	29.4
30-39	20	45.5
40-49	7	16.0
50-59	3	6.8
60-69	1	2.3
Sex		
Male	19	43.2
Female	25	56.8
Marital single		
Single	13	29.5
Married	31	70.5
Qualification		
Nursing assistant	2	4.5
clinical officer	17	38.6
Dispenser	1	2.3
Enrolled nurse	3	6.8
Nursing officer	18	40.9
Senior anesthetic	1	2.3
VHT	2	4.5

the different forms of PEM with the least known being marasmus 34 (68%) (Table 2). It is important for the health workers to know the different form of PEM, because they cannot diagnose the types which they do not know. The clinical signs of kwashiorkor and marasmus were mentioned by over 60% of the health workers (Table 3) which is good, because knowing the clinical signs of kwashiorkor and marasmus is essential in the diagnosis of PEM especially in differentiating the two forms for proper management.

Although the IMAM guidelines categorizes management of acute PEM into stabilization and rehabilitation phase, the study revealed that the health workers knew most of the things done in the management of SAM, but none of them knew about the different phases of management of malnutrition, which are well articulated in the IMAM guidelines. Stabilization phase in the management of SAM is very important and lack of the earlier mentioned knowledge may affect the health workers ability to manage SAM in that they may not manage the emergency complications first and hence lead to mortality of some of the children (Ashworth, 2001). This could be because the health workers do not have the IMAM guidelines at the health facility to help them keep up to date with information (Table 4).

More than 60% of the respondents had adequate knowledge on nutritional health education to give the

caretakers in order to promote good nutrition of the children (Table 4) and the information given was found to be the same recommended by the IMAM guidelines 2010, although some of the information was not widely known by the respondents especially the importance of breast feeding 26 (52%), yet the IMAM guidelines takes breast feeding to be important in the prevention of SAM. This is attributed to lack of the IMAM guidelines at the health facilities for the health workers to keep reminding themselves of the key points in the management of malnutrition.

Practice of health workers

All the health centers visited had weighing scales; however, a significant number 56 (24.9%) of children were not weighed contrary to the recommendations of the WHO (1999) guidelines that recommends to weigh all the children that come to the health centre for growth monitoring. In addition, weight is important in determining low weight for age and wasting (Antwi, 2011), hence this contributes to missed diagnosis in the identification of PEM and it may be due to too much worker load, because the same health workers care for children and adults (Table 5).

Most 3 (60%) of the health centers had MUAC tapes. Those centers that did not have them cannot measure the mid upper arm circumference of the children which is an important parameter in the diagnosis of PEM leading to missed diagnosis. Furthermore, even those centers that had the MUAC tapes were not using them as evidenced by the low numbers 32 (14.2%) of children whose MUAC was measured (Table 5). This poor practice contributes to missed diagnosis of PEM, hence missed opportunity to prevent mild-moderate PEM from progressing to SAM. This probably may be due to lack of knowledge on how to use the MUAC tapes, heavy work load or not knowing how to diagnose malnutrition using MUAC.

Of the health centers visited, 3(60%) had height boards which means that the health centre that did not have them could not measure height of the children, yet measurement of height is an important parameter in the diagnosis of underweight and stunted growth (WHO, 1999). However, even those centers that had the boards were not measuring the height since just 32 (14.2%) of the children had their height measured. It is most likely that the health workers think it is not important to measure height of the children or they are too busy to do it (Table 5).

The study revealed that all the five health centers visited did not have the IMAM Guidelines (2010). In addition to that, all the health workers interviewed had never seen the guidelines. This explains the knowledge gaps in the diagnosis and management of PEM since they do not have any references. These guidelines were adapted and published in 2010 to address issues of

Table 2. Respondents' knowledge on the factors that lead to malnutrition and the different forms of PEM.

Factors that lead to protein energy malnutrition among children below 5 years	Frequency of those who knew (n = 44)	Those who knew (%)
Ceasing or reduction of breastfeeding	31	62
Improper weaning practices like introduction of supplementary food abruptly	34	68
Use of bottle-feeding with diluted and dirty formula predisposing the child to infection	29	58
Low social economic conditions	40	80
Ignorance of parents about the importance of child nutrition	39	78
Infection like measles, Pertusis and diarrhea	34	68
Child abuse (neglect)	36	72
Respondents knowledge of the forms of PEM		
Kwashiorkor	43	86
Marasmus	34	68
Marasmic-kwashiorkor stunted growth	39	78
Low weight for age	36	72

Table 3. Respondents' knowledge on the clinical signs of kwashiorkor and marasmus.

Characteristic	Frequency (n = 44)	Percent	
Kwashiorkor	Edema	30	60
	Apathy	34	68
	Hair changes	40	80
	Skin changes	37	74
Marasmus	Severe wasting	37	74
	Baggy pants	31	62
	Old man' s look	35	70
	Increased appetite	32	64

malnutrition and guide health workers to manage PEM (malnutrition) properly; yet by August 2012, the book had not reached the health workers in health centers which are close to the Ministry of Health headquarters. This affects service delivery, because if the health workers had the guidelines, they would try to follow them and look out for malnutrition in every child they encounter.

Although RUFT is the recommended treatment for severely malnourished children by the MOH Uganda and WHO, only two of the visited health centers had RUFT in their stock. This implies that those health centers without RUFT will not be able to manage the children diagnosed with SAM and will refer them to the centers that have these facilities. Referral of these children may not save their life since some caretakers may not have transport to go to the referral site due to high poverty levels (UDHS, 2006), leading to increased mortality rate.

Observation from the study also found out that only 16 (7.1%) weight for age and 2 (0.89%) weight for height of the children were calculated using standard charts, yet the WHO (1999) management of severe malnutrition manual considers them to be important in the diagnosis

of stunted growth and wasting. This could be attributed to heavy work load and lack of WHO standard charts where to compare the values got (Table 5). This leads to missed diagnosis of PEM.

Of the children observed, 38 (16.89%) of them were examined for edema, 40 (17.78%) for muscle wasting, 40 (18%) for hair changes and 113 (50.2%) for skin changes. This means that the health workers were not looking out for the signs of PEM and the children with PEM can be missed. This is probably, because the health workers assume that the children do not have PEM since they do not have the classical picture of malnutrition (Table 5). All the children that were diagnosed with PEM had SAM and could not be missed since it is seen instantly.

Majority of the children's caretakers 181 (80.44%) were advised on nutrition of the child in sickness and most of 113 (50.2%) of them were advised on nutrition of the child after recovery which was good since PEM and deficiencies in the macronutrient stores of fat and somatic protein are common in critically ill infants and children (Pollack et al., 1982). However, the information given was

Table 4. Respondents' knowledge on the management of PEM and nutritional education to be given to the caregivers.

Respondents' knowledge of the management of PEM	Frequency of those who knew (n = 44)	Those who knew (%)
Prevention and treatment of hypoglycemia and hypothermia	34	68
Treatment/Prevention of dehydration	34	68
Correction of electrolyte imbalance	30	60
Treatment/prevention of infection	33	66
Starting on cautious feeding on RUFT	42	84
Micronutrient supplementation (VIT A, folic acid and zinc)	42	84
Plan to complete immunization	35	70
Sensory stimulation (toy to play with)	39	78
Plan for return date, follow up and growth monitoring	40	80
Respondents' knowledge of nutritional education to be given to the caregivers		
Nutrition healthy education on child feeding and meals planning	42	84
Tell her the importance of gardening in her yard if she has land	28	56
Advice on when to return for follow up (growth monitoring)	32	64
The importance of hygienic preparation and storage of food	39	78
Importance of breastfeeding	26	52
Immunization	33	66
The danger of bottle feeding	36	72
Exclusive breast feeding up to 4-6month and addition of complementary food thereafter	37	74

Table 5. Anthropometric measurements and physical examination of the children which were done by the health workers.

Characteristic	Frequency (n = 225)	Percentage
Anthropometric measurements done		
Children Weighed	169	74.4
Children measured height	32	14.1
Children measured MUAC	32	14.1
Children whose weight for age was calculated	16	7.0
Children whose weight for height was calculated	2	0.4
Children's appetite test done	1	0.4
Physical examination of the children		
Children whose feet were press to check for edema	38	16.7
Children whose skin was pinched on the upper arm to feel for Muscle wasting	40	17.6
Children whose mothers were asked their age	208	92.1
Children whose Hair changes were noted	40	17.6
Children whose Skin changes were checked	114	50.2

scanty. For example, most of them were told to give the child good food and not told the type of food to give or the reason for proper nutrition during illness, yet good health education improves the knowledge and behavior of caregivers' regarding child nutrition (Kapurura and Beke, 2013).

Child assessment by data collectors

Majority 177 (78.9%) of the children assessed were from

2 months to 2 years and most 122 (54.2%) were females. The children involved in the study were assessed immediately as they left the health worker's consultation room and 145 (64%) of the children had weights between 6 and 11.9 kg, 193 (85.8%) of the children were between 60 and 99 cm in height, while 200 (88.9%) had MUAC between 11 and 16.9 cm. These parameters (weight and height) were utilized with age and physical examination to determine the nutritional status of the children using the WHO standard charts for boys and girls differently (Table 6).

Table 6. Demography and anthropometric measurements of children assessed by the researchers.

Characteristic	Frequency (n = 225)	Percentage
Age (year)		
Less than 1	69	32.9
1-2	104	46.0
3-4	55	24.5
4-5	6	2.6
Sex		
male	103	45.8
female	122	54.2
Weight (kg)		
3-5.9	20	8.6
6-8.9	69	30.3
9-11.9	76	33.6
12-14.9	38	16.8
15-17.	19	8.3
18-20.9	3	1.3
Height (cm)		
50-59	17	7.4
60-69	50	21.7
70-79	62	27.4
80-89	41	18.1
90-99	38	16.6
100-109	11	7.4
MUAC (cm)		
8.7 -10.9	6	2.4
11-12.9	53	23.3
13-14.9	91	40.3
15-16.9	56	24.8
17-19.9	19	8.3

The study identified missed opportunity to prevent mild to moderate PEM from progressing to SAM by examining the observed children and comparing the nutritional diagnosis of the health workers with that of the researchers. As per the diagnoses got from the children's books, 144 (64%) of them were diagnosed with malaria and respiratory tract infections which is understandable since they are the commonest diseases at health centers and malaria is responsible for more illnesses and death than any other single disease in Uganda (UDHS, 2006).

Only 21 (9%) of the children were diagnosed with malnutrition by the health workers which is low since in Uganda, 47% children under 5 years are stunted, 7% are wasted and 17% are under weight (UDHS, 2011). The researchers diagnosed 42 (18.7%) children with under-

weight, 4 (1.8%) with marasmic-kwashiorkor, 42 (18.7%) with marasmus and 6 (2.7%) with kwashiorkor. These findings correlate to the prevalence rate found by Kikafunda et al. (1998), where 3.8% children had kwashiorkor, 24.1% were underweight and 19.5% of unhealthy children had marasmus both in rural and urban areas in central Uganda. This study was done in HCIVs, while the aforementioned study was done in a home setting and although Wakiso district is also in Central Uganda; it is more of an urban area so these differences account for the slight changes in the prevalence rates of PEM (malnutrition). In total, 94 (41.9%) children had malnutrition after assessment by the researchers. These findings confirm that the number of the children with malnutrition was higher than what was diagnosed and treated by the health workers. It is important to carry out ongoing training and supervision and also to identify and address the health workers' individual difficulties, because a study in Gambia showed that even after training, severe malnutrition was both under-diagnosed and wrongly diagnosed by trained nurses (Hamer et al., 2004).

From the study findings therefore, 73 (32.9%) of the children were not diagnosed with malnutrition and they left the consultation rooms with no idea that they need to improve their diet, hence an opportunity to prevent their PEM from progressing to SAM was missed when they visited the health facility with acute illness. Unlike the study done in Rwanda where the under diagnosis of malnutrition in infants and young children was due to the use of incorrect growth references for measuring nutritional status (Binagwaho et al., 2011), this study found out that the health workers do not follow the IMAM guidelines which recommend the integration of management of malnutrition into the on-going routine health services at all levels of the health infrastructure and routine nutritional assessment to be incorporated in all treatment, care and support services.

Conclusion

The researchers set out to find the knowledge and missed opportunity to prevent mild to moderate PEM from progressing to SAM in the management of PEM among children less than 5 years by health workers of Wakiso district and it was carried out in the five HCIVs of the district. It is evident from the study that the knowledge of the health workers in the diagnosis and management of PEM is adequate, but the nutritional education given to care takers is inadequate. Despite the health workers having good knowledge on PEM, they do not put in practice what they know. In addition, the health centers in Wakiso district do not have all the equipments necessary for management of PEM. The study found out that there is a huge magnitude of missed opportunity to diagnose and treat PEM among children who present with acute

illnesses at the HCIVs.

RECOMMENDATIONS

- 1) The Ministry of Health Wakiso district needs to train health workers in the diagnosis and management of PEM using the IMAM Guidelines (2010) and build the capacity of health workers in clinical malnutrition in order to reduce missed opportunity to diagnose PEM at health centers.
- 2) Proper messages on Information Education Communication (IEC) materials on the diagnosis and management of PEM should be availed and displayed in clinics where children are treated.
- 3) The Ministry of Health Wakiso district should provide all the necessary equipment to facilitate the health workers to diagnose and treat PEM.
- 4) Another research should be done to identify reasons for the disparity between the knowledge and practice of health workers in Wakiso district.
- 5) The Ministry of Health should employ a nutritionist to assess the nutritional status of all children who come to the health centers and make a nutritional diagnosis since the health workers have too much work load, because they care for children and adults.

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ABBREVIATIONS

CME, Continuing medical education; **DHO**, district health officer; **HCIV**, health center IV; **HW**, health worker; **HC**, health centre; **IMAM**, integrated management of acute malnutrition; **ITC**, inpatient therapeutic care unit; **MAM**, moderate acute malnutrition; **MESAU-MEPI**, medical education for equitable services to all Ugandans-medical education partners' initiative; **MOH**, ministry of health; **MUAC**, mid upper arm circumference; **NHD**, nutrition for health and development; **OTC**, outpatient therapeutic care unit; **PEM**, protein energy malnutrition; **RUFT**, ready-to-use therapeutic foods; **SAM**, severe acute malnutrition; **SFP**, supplementary feeding programs; **UDHS**, Uganda demographic and health survey; **UHSSIP**, Uganda health survival strategy and investment plan; **VHT**, village health team; **WHO**, world health organization.

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