

# Severe acute malnutrition in Asia

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## Abstract

*Severe acute malnutrition (SAM) is a common condition that kills children and intellectually maims those who survive. Close to 20 million children under the age of 5 years suffer from SAM globally, and about 1 million of them die each year. Much of this burden takes place in Asia. Six countries in Asia together have more than 12 million children suffering from SAM: 0.6 million in Afghanistan, 0.6 million in Bangladesh, 8.0 million in India, 1.2 million in Indonesia, 1.4 million in Pakistan, and 0.6 million in Yemen. This article is based on a review of SAM burden and intervention programs in Asian countries where, despite the huge numbers of children suffering from the condition, the coverage of interventions is either absent on a national scale or poor. Countries in Asia have to recognize SAM as a major problem and mobilize internal resources for its management. Screening of children in the community for SAM*

*and appropriate referral and back referral require good health systems. Improving grassroots services will not only contribute to improving management of SAM, it will also improve infant and young child feeding and nutrition in general. Ready-to-use therapeutic food (RUTF), the key to home management of SAM without complications, is still not endorsed by many countries because of its unavailability in the countries and its cost. It should preferably be produced locally from locally available food ingredients. Countries in Asia that do not have the capacity to produce RUTF from locally available food ingredients can benefit from other countries in the region that can produce it. Health facilities in all high-burden countries should be staffed and equipped to treat children with SAM. A continuous cascade of training of health staff on management of SAM can offset the damage that results from staff attrition or transfers. The basic nutrition interventions, which include breastfeeding, appropriate complementary feeding, micronutrient supplementation, and management of acute malnutrition, should be scaled up in Asian countries that are plagued with the burden of malnutrition.*

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## Introduction

Asia is home to the largest number of children under 5 years of age with severe acute malnutrition (SAM), which is a major impediment to optimal human capital development [1]. The World Health Organization (WHO)/UNICEF diagnostic criteria for SAM in children 6 to 59 months old include any of the following: weight-for-height z-score  $< -3$  SD of WHO child growth standards, presence of bilateral pedal edema, and mid-upper-arm circumference (MUAC)  $< 115$  mm [2]. Nearly 20 million children globally suffer from SAM, which is one of the top three nutrition-related

causes of death in under-five children. A child with SAM is 10 times more likely to die than a well-nourished child. Estimates of the number of deaths directly attributable to SAM vary from 0.5 to 2 million annually [3]. Even up to the end of the 20th century, the case fatality rate for SAM among under-five children ranged from 20% to 50% in many centers [3]. The vast majority of children suffering from SAM are located in Africa and Asia. India alone is home to more than 8 million children with SAM [4], while Africa has 5.6 million children with SAM. In facility-based treatment of SAM, the initial stabilization phase focuses on restoring homeostasis and treating medical complications and usually takes 2 to 7 days of inpatient treatment; the rehabilitation phase focuses on rebuilding wasted tissues and may take several weeks [5]. Although facility-based treatment is available in most countries, it is expensive, is inconvenient to the family as it requires prolonged hospitalization, and has limited outreach. Community-based management of SAM can complement facility-based treatment by expanding outreach, limiting facility expenses, and allowing treatment at home, thereby decreasing the burden on families. When community-based management is properly combined with a facility-based approach, the result is a reduction in mortality down to around 5% [6]. This article is based on a review of SAM burden and intervention programs in Asian countries, where, despite the huge numbers of children suffering from the condition, the coverage of interventions is poor.

## Methods

This article is based on a review of literature on SAM in Asian countries. The literature included the gray literature as well as program reports on SAM and

community-based management of acute malnutrition (CMAM) published by both governmental organizations and nongovernmental organizations (NGOs). In addition, the paper includes the results of a survey done specifically on programmatic aspects of SAM. The survey was done from May to July 2012 with the use of a questionnaire sent to respondents in eight countries in Asia, one respondent in each country. The respondents were purposively selected for their track record and ongoing work on SAM. Opinions made are of the authors and not of the organizations they represent. The questionnaire contained questions related to the burden of SAM in the countries; the availability of SAM management guidelines; policy, programs, availability, and use of ready-to-use therapeutic food (RUTF); the presence of functional CMAM programs; constraints on management of SAM both in facilities and in the community; and recommendations regarding management of SAM (see the **annex**). The data from the questionnaires were compiled and summarized.

## Results and discussion

The prevalence rates of SAM and moderate acute malnutrition (MAM), defined as weight-for-height z-score between  $-2$  and  $-3$  SD, among children under 5 years of age are shown in **table 1** [7–17].

### Afghanistan

Despite decades of political unrest, the Islamic Republic of Afghanistan has long recognized the problem of undernutrition and has devised policies and strategies to address the problem. For example, the National Public Nutrition Policy and Strategy for the years 2010–13 has recently been developed [18]. It has seven

TABLE 1. Prevalence of severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) among children under 5 years of age in Asian countries

Country and reference	SAM (%)	MAM (%)	SAM (no.)
Afghanistan [7]	7.2	13.9	399,312
Bangladesh [8]	4	15.6	588,280
Bhutan [9]	2	6	1,420
Cambodia [10]	3	5	44,760
India [11]	6.4	19.8	8,190,656
Indonesia [12]	6	14	1,294,740
DPR Korea [13]	0.5	5.2	11,860
Lao PDR [14]	7	7	47,810
Myanmar [14]	2.1	8	83,076
Nepal [14]	2.6	13	91,156
Pakistan [15]	7	10	1,499,260
Sri Lanka [16]	3	15	56,790
Timor-Leste [17]	7	18.6	13,510
Yemen [14]	15	17	626,850

strategic areas: surveys and surveillance, micronutrients, maternal and child feeding, community-based food security, emergency supplementary feeding, management of severe malnutrition, and nutrition communication and education. The government has also developed guidelines for management of SAM. With support from UNICEF, the Government of Afghanistan is currently implementing CMAM in 13 provinces affected by drought and rising food prices, procuring nutrition supplies for the prevention and treatment of malnutrition, and also conducting regular field monitoring and supportive supervision of nutrition activities at the provincial, district, and community levels. Until March 2013, the coverage of the CMAM program was 5,366 children under 5 years of age with SAM, and 482 children were admitted to therapeutic feeding units (TFUs). Additionally, the CMAM program includes a referral component that facilitates treatment of complicated cases in TFUs established in district and provincial hospitals [19]. The case fatality rate in children with SAM admitted to hospitals is around 6%.

### Bangladesh

Bangladesh has the sixth-highest number of children suffering from SAM in Asia. The country has formulated national guidelines for the treatment of severely malnourished children, which, however, are yet to be implemented throughout the country. When these guidelines are followed, treatment of children with complicated SAM can be effective in up to 88% of cases, even with minimum incremental expenditure [20]. Home care of children with SAM has been shown to be 1.6 times and 4 times more cost effective than day care and inpatient care, respectively [21]. Clinical scientists at the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) have implemented a treatment protocol for children with SAM and diarrhea that resulted in a 50% reduction in the case fatality rate [22]. This treatment protocol, published prior to the WHO guidelines but based on similar principles of care, is now being implemented successfully for facility-based management of SAM in Bangladesh and in many other places. In addition, Bangladeshi scientists have developed a standardized diet protocol for rapid catch-up growth during nutritional rehabilitation using low-cost, culturally appropriate, nutritious food (*khichuri* and *halwa*) based on locally available ingredients [23] enriched with essential micronutrients for growth and development.

In the southern region of Bangladesh, a pilot CMAM program initiated by an NGO has shown a high recovery rate (92%), even at the *upazila* (subdistrict) level [24]. The Sixth Five Year Plan of the government emphasizes SAM as an important deterrent of child health, while the operational plan of the newly established National Nutrition Services (NNS) includes SAM

as an action item. Despite all these positive steps, there is no national program to take care of the more than half-million children living with SAM and the close to 2 million children with MAM. A few pilot activities using imported RUTF have shown promising results; however, cost and sustainability are major constraints. RUTFs based on locally available food ingredients have recently been developed and produced in the country by the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). The national guidelines and the training modules for CMAM have been developed by the government. In the national CMAM guidelines, the term “nutritional treatment” has been used in place of “ready-to-use therapeutic food” (RUTF). The Government of Bangladesh has replaced the vertically managed National Nutrition Program with the NNS in an effort to mainstream nutrition as part of the Health, Population and Nutrition Sector Development Program (2011–16). Implementation of direct or nutrition-specific interventions will be guided by the NNS Operational Plan. The provision of community-based nutrition services will be scaled up, and the food and nutrition policies and plans will be implemented [25]. The recommended interventions for implementation include promotion of exclusive breastfeeding for 6 months and continued breastfeeding up to 2 years; introduction of complementary foods of adequate nutritional quality and quantity after the age of 6 months; and improved hygiene practices, including hand washing, micronutrient supplementation, salt iodization, growth-monitoring and promotion, and management of SAM [25].

### Bhutan

Bhutan has made substantial progress in the past four decades, especially in the social sector. Bhutan is well on track on achieving the MDG targets. It has made notable progress in enhancing the the proportion of people with sustainable access to sanitation and safe drinking water and halving underweight among under-five children [26]. A Health Trust Fund has been established in an effort to find an innovative and sustainable financing mechanism for the priority components of primary healthcare [27]. Emphasizing the importance of access to basic health and education, the UNICEF program in Bhutan focuses on four key areas: health and nutrition; education; rural water supply and environmental sanitation; and advocacy, social mobilization, and communication. Nutrition has been included as a strategic priority to improve the overall nutritional status of the population, reduce child mortality and improve child health, and improve maternal health, with emphasis on reducing maternal mortality. In Bhutan, the prevalence of SAM is 2%, and there is no policy or guideline available for management of SAM; the government is focusing on attainment of food

security in order to address malnutrition.

### Cambodia

The Ministry of Health of Cambodia has developed the National Nutrition Strategy 2008–2015, which is linked with the Strategic Framework for Food Security and Nutrition in Cambodia 2008–2012, the Cambodia Nutrition Investment Plan 2008–2015, and the food security and support program [28]. It also established the National Nutrition Program in 1995 to combat malnutrition and to strengthen vitamin A and iron–folate supplementation, deworming, and salt iodization. The National Nutrition Program is primarily implemented through hospitals and health centers, the latter also providing outreach services. The national interim guidelines for the management of acute malnutrition have been developed by the Cambodian government with technical support from organizations including Valid International, the Centers for Disease Control and Prevention (CDC), WHO, and UNICEF. There is no national policy on management of SAM in Cambodia.

### India

The Tenth Plan of the Government of India has set specific nutrition goals to intensify nutrition and health education for the improvement of infant and child feeding and caring practices. It plans to bring down the prevalence of underweight children under 3 years from the current level of 47% to 40% and to reduce the prevalence of severe malnutrition in children 0 to 59 months of age by 50% [29]. In this context, the government, in collaboration with UNICEF and WHO, has prepared operational guidelines on facility-based treatment of children with SAM [30]. On a national scale, training on facility-based management of SAM is provided to medical officers, nurses and nutritional counselors, and health staff working in nutrition rehabilitation centers and pediatric wards of district hospitals. Under the national rural health mission, nutrition rehabilitation centers have been set up in health facilities in many districts. Under the Integrated Child Development Scheme, severely malnourished children (based on weight-for-age criteria) are referred to nearby health centers and provided supplementary food (about 800 kcal and 20 to 25 g protein per day) for 300 days in a year. The norm for non-severely malnourished children is 500 kcal and 12 to 15 g protein per day. Mothers of malnourished children are asked to attend the centers and are provided with a 2-week ration of roasted cereal–pulse mixes with instructions instead of commercially available RUTF. Several states in the country have demonstrated successful implementation of RUTF made of locally available food products to treat and manage SAM in a cost-effective

manner [31]. Children with SAM are followed up every 2 weeks for growth-monitoring, health checkups for a period of 3 months, and supplies of instant food rations provided. In India, cereal- and legume-based *khichuri* has been well accepted (77%) compared with conventional RUTF (58%) [32]. A recent Indian study has shown that children with uncomplicated SAM can be effectively treated by providing indigenous RUTF through outpatient treatment centers [33]. Despite the presence of 8 million children with SAM in India, there is no national program on management of SAM using RUTF. To avoid misconception, Sachdev and colleagues have clearly stated that “RUTF should be used only as therapeutic and not supplementary feeding, above six months of age, and for a limited time period (4–8 weeks) until the child recovers from SAM, which should be defined in explicit treatment protocols” [34].

### Indonesia

In 2008, the Indonesian Ministry of Health regulation on obligatory minimum service standards specified achievement of 100% coverage for treatment of SAM [35]. In Indonesia, the main intervention implemented to address high levels of undernutrition is community-based growth monitoring in integrated health posts (*posyandu*). The policy is that all children under five are regularly weighed at the *posyandu*, preferably once per month, the weight is plotted on the “road to health” (*kartu menuju sehat*) growth chart or on the chart in the mother and child health book, and mothers of faltering children are counseled. Children from poor families are given supplementary food at the *posyandu* in the form of fortified blended food for those aged 6 to 11 months and fortified biscuits for those aged 12 to 23 months. If a child has not gained weight for the previous 2 consecutive months or has fallen below weight-for-height z-score  $-3$  SD (below the red line), the child is referred to the local health facility. The health facility provides further examination, including weight-for-height assessment to confirm SAM and medical checkups. Based on the results, the child is provided with treatment, either supplementary feeding or therapeutic feeding.

### Democratic People's Republic of Korea

A silent emergency of undernutrition defines the reality for many children in the Democratic People's Republic of Korea, where 68,225 children were acutely malnourished and 10,234 were severely affected, according to the results of a national survey [24]. The Korean Government started implementing CMAM in 14 children's homes and 4 counties in 2008, whereas inpatient treatment of SAM in the 10 provincial pediatric hospitals has been going on for more than 12 years. At

the moment of the national survey, CMAM was being implemented in 29 counties and 14 children's homes, while inpatient treatment of SAM was in progress in 12 provincial hospitals and at least 29 county hospitals. The number of CMAM counties targeted was, however, reduced after March 2012 due to lack of funding [24]. Besides these activities, in 2011 and 2012 children aged 6 months to 6 years in at least 85 counties spread over 9 provinces received nutritious meals. In March 2013, consultants from icddr,b and UNICEF organized a workshop on local adaptation of CMAM guidelines, a training course for trainers on management of SAM in Pyongyang, and a case management course for pediatricians from 10 provincial hospitals in Hamhung.

### **Lao People's Democratic Republic**

One of the core priorities of the Government of the Lao PDR is to decrease high levels of malnutrition by creating an enabling environment for growth and development. With this view, the government, along with the Food and Agriculture Organization and other development partners, formulated the National Nutrition Policy in 2008, and a National Nutrition Strategy and a National Plan of Action for Nutrition in 2009, that together provide a framework for improving nutrition in the country [36]. UNICEF, working with the government, is providing training to build capacity to treat and prevent malnutrition at the facility as well as at the community level. As a result of these initiatives, the government and its development partners have devised a 12-month strategy of urgent interventions targeting around 200,000 children with acute malnutrition. This strategy includes the dispatch of therapeutic feeding kits to severely affected areas and training of health staff and volunteer community workers, who will carry out screening and assessment of the most severely malnourished children [37]. However, the government has not initiated any specific program addressing SAM as a nationwide approach.

### **Myanmar**

Myanmar aims to ensure optimum nutrition to its citizens for attainment of full life expectancy. To achieve this goal, the Nutrition Section of the Department of Health is implementing nutrition promotion activities throughout the country [38]. As a part of this process, the government has developed a 5-year Strategic Plan for Child Health Development for 2010–14 that will help intensify the implementation of programs for treatment of MAM and SAM. There are also national and subnational programs on facility-based and community-based management of SAM, which also cover post-disaster SAM situations. However, these services are currently implemented in only about 30 out of

330 townships. The following services are provided through the Nutrition Section of the Department of Health: growth monitoring and promotion (GMP) for children under 3 years of age; community nutrition centers (CNCs) for moderately malnourished children in urban areas; hospital nutrition units for children with SAM; and community-based nutrition programs comprising GMP, CNCs, and village food banks for malnourished children in rural areas.

The Government of Myanmar has prioritized combating post-disaster SAM situations rather than controlling SAM in routine non-disaster situations. For example, both governmental and nongovernmental organizations provide RUTF to manage SAM only in disaster-affected areas. The government has not yet developed any national policy to treat and manage SAM, and there is no national training course for healthcare professionals on management of SAM. Nevertheless, the National Nutrition Centre and Nutrition Cluster Group developed "Interim guidance on management of acute malnutrition" after the cyclone disaster to guide people operating at the community and health-facility levels [39]. This guidance aims to prevent acute malnutrition among children under 5 years of age and pregnant and lactating women, to effectively manage acutely malnourished infants, children, and pregnant and lactating women by providing supplementary and therapeutic programs; to prevent micronutrient deficiencies through supplementation; and to support and promote appropriate infant-feeding practices in the affected areas. In December 2011, icddr,b, in collaboration with WHO, organized training workshops on management of acute malnutrition for the Department of Health in Yangon and Naypyitaw.

### **Nepal**

The prevalence of SAM increased in the country during 2001–2006 but remained constant in 2006–2011, while the prevalence of acute malnutrition has fluctuated around ten percent [40]. The Government of Nepal has established various nutritional services at different levels of the health service. The Ministry of Health and Population has designed and implemented nutrition programs to control child malnutrition, such as growth-monitoring and promotion at primary healthcare centers, health posts and sub-health posts, and outreach clinics [41]. The Ministry of Health and Population has also developed intervention programs such as Community-Based Integrated Management of Childhood Illness (CB-IMCI). The Ministry of Health and Population has worked toward integration of community-based nutrition activities with other health and development programs, such as Decentralized Action for Children and Women, the Community-Based New-Born Care Package, Early Childhood Development,

and the CB-IMCI program. The Ministry of Health and Population and UNICEF have been piloting CMAM, starting with one district in 2008, and 11 of 75 districts of Nepal now have CMAM programs running. Children with SAM are also treated in 16 Nutrition Rehabilitation Homes in hospitals throughout the country.

The CMAM program in Nepal has designed different training packages for health care professionals on management of SAM. For example, a district-level training course for 5 days has been arranged for district supervisors, technical staffs of hospitals and In-charge of Primary Health Care Centres (PHC) and Health Posts (HP), and four days of training is provided to all health workers from district health institutions. Medical officers, staff nurses, senior auxiliary nurse midwife (ANM), ANM, senior auxiliary health worker (AHW), AHW from district hospitals and district health offices and PHCs receive four days training on stabilization care of SAM; community/village health workers and maternal and child health workers participate in 3 days training. Female community health volunteers (FCHV) also receive 2 days training on management of SAM.

Besides the government programs and activities on CMAM, the World Food Programme, the Save the Children Alliance, the US Agency for International Development (USAID), UNICEF and others have played vital roles in improving nutrition programs in Nepal. The Government of Nepal is providing RUTF imported and supplied by UNICEF for treatment of SAM [30]. National guidelines adapted from international guidelines were introduced in Nepal in 2009 for the pilot CMAM. The two medical protocols, "National medical protocol for the CMAM" and "Treatment guidelines for outpatient treatment in CMAM" are used in this program [40]. However, there is no national policy on management of SAM or CMAM.

### Pakistan

In Pakistan, nutrition has not been fully integrated into the national health system. There is no nutrition policy at either the federal or the provincial level to deal with malnutrition in emergency and nonemergency situations, and there is no high-level nutrition authority. A nutrition section in the Planning and Development Division of the Health Ministry has now been created to integrate the multidisciplinary programs of nutrition into planning and also to be responsible for coordination, monitoring, and evaluating the different nutrition programs. Due to the presence of a huge burden of malnutrition, "National guidelines for the management of acute malnutrition" among children under 5 years of age and pregnant and lactating women have been formulated by the Ministry of Health. Also, the Pakistan Integrated Nutrition Strategy Operational Plan has been formulated to successfully implement

the CMAM program nationwide. The program is implemented in all provinces and regions by provincial and regional Nutrition Cells, Department of Health. CMAM was started in October 2008 in the province of Khyber Pakhtunkhwa to serve flood-affected areas and was scaled up from 2009 to 2011 to include 14 central, southern, and northern districts of Khyber Pakhtunkhwa and one agency of the Federally Administered Tribal Areas. Since 2012, the CMAM program has received direct support from district health facilities and has been integrated into seven health facilities of one district as a non-emergency pilot with the help of UNICEF [42]. CMAM currently is implemented in 831 CMAM sites. To sustain management of SAM, the Department of Health, with help from UNICEF, is conducting CMAM training across the country.

The four components of CMAM in Pakistan are community outreach (screening, referral, follow-up, and community mobilization), outpatient treatment of SAM without complications with home-based administration of RUTF, inpatient treatment of SAM with complications in stabilization centers, and management of MAM through a supplementary feeding program. The Government of Sindh has taken the initiative to provide a high-density diet or a locally produced RUTF (formulated by the Nutrition Support Program) and has demonstrated successful rehabilitation of children with SAM; 92% of children with SAM achieved median weight-for-height in 5 months [43]. Under the CMAM initiative, 365 supplementary feeding program/outpatient therapeutic program sites (353 sites in health facilities and 12 sites in refugee camps) of Khyber Pakhtunkhwa and one agency of the Federally Administered Tribal Areas (8 sites in health facilities) and 11 stabilization centers were established to provide services to around 8 million people [44].

### Sri Lanka

The 2006 Sri Lanka Demographic and Health Survey found that 22% of children under 5 years of age were underweight and up to 15% and 18% were suffering from acute (wasting) and chronic (stunting) malnutrition, respectively. SAM affects approximately 57,000 children in Sri Lanka. With the documentation of high rates of acute malnutrition in children under five, the Ministry of Health established a Nutrition Rehabilitation Program [45], which was introduced and implemented in phases covering the districts and integrated into the routine healthcare system. The government has also formulated policy and guidelines for management of SAM. Children with SAM are given RUTF and those with MAM are given 100 g (450 kcal) of high-energy biscuits provided by UNICEF [46] which has now been replaced by 100g (390 kcal) of supplementary food named Thriplosa. The nutrition rehabilitation

program in Batticaloa, Jaffna, Kilinochchi, Mullaitivu, and Trincomale districts, with support from UNICEF, has achieved coverage of 95%, successfully rehabilitating more than 1,700 children suffering from SAM. In Jaffna District, global acute child malnutrition fell from 30% in March 2007 to 11% in February 2008, and SAM dropped from 6.7% to 2.8% during the same period [45].

The Government of Sri Lanka has formulated a National Nutrition Policy (NNP) (2009–2013) whose goal is to address the continuing problem of child undernutrition, regional disparities in nutritional indicators and emerging nutrition problems and its impact on national economy and development. It addresses nutrition related issues by ensuring optimum growth throughout the life cycle, ensuring food safety for all citizens especially the vulnerable populations through effective interventions; also strengthening partnership, research, monitoring and evaluation. Broad implementation strategies are direct food assistance, the integrated package of maternal health and nutrition services under the Ministry of Healthcare and Nutrition (MOHN), and poverty reduction programs [47]. NNP is updated in 2013 and will be revised in 2018. A multi-sector action plan for nutrition was launched in 2013, under the theme ‘Vision 2016 Sri Lanka, A Nourished Nation’ by the National Nutrition Council of the government of Sri Lanka. It is a collective effort of 16 government ministries as the government of Sri Lanka has recognized the best approach to solve the nutrition issues in the country is through a multi-sectoral approach. Apart from these policies, there are several programmes in operation directed towards combating malnutrition such as megadose vitamin A supplementation from 6 to 60 months at 6 monthly intervals, iron supplementation for preterm and low birth weight babies, iodine fortified salt, zinc supplementation during diarrheal illness, growth monitoring and identification of growth faltering and implementation of IYCF guides.

#### **Timor-Leste**

Timor-Leste is developing its National Strategic Development Plan (2011–30) and continues to focus on its identified national priorities, which include nutrition. Significant achievements have been made in reducing mortality among infants and children under five. The national multisectoral program on Promoting Sustainable Food and Nutrition Security has been developed in collaboration with the Ministries of Health, Agriculture, and Fisheries. This program builds upon existing programs and pilots, such as school-feeding and CMAM [48]. The CMAM program implements treatment and management of acute malnutrition, piloting integration of CMAM into the health system, and

growth-monitoring and promotion activities linked to integrated community health services. CMAM has been scaled up countrywide and has treated 1,454 children with SAM [49].

#### **Vietnam**

Vietnam has achieved remarkable success in various social and economic indicators that have led to the reduction of child malnutrition. In 2010, wasting prevalence moved down from the average to the low level of public health significance [50]. The government has recognized that acute malnutrition is still prevalent and that this nutrition index is more closely associated with morbidity and mortality than the other indices of weight-for-age (underweight) and height-for-age (stunting). Interim guidelines on integrated management of acute malnutrition have been formulated with the purpose of streamlining care for children with acute malnutrition [51]. There is no national policy on management of SAM in Vietnam. Local institutes are trying to develop RUTFs using locally available food ingredients.

#### **Yemen**

Yemen is one of the world’s major humanitarian crises, with more than half the population affected and a third targeted for humanitarian aid. The majority of Yemen’s population do not have access to safe water and sanitation, about 4.9 million people are severely food insecure, and 431,000 people have been displaced from their homes [52]. According to UNICEF, 60% of the internal refugees (around 300,000) are children. This dire situation contributes to the country’s high rates of malnutrition, where almost 1 million children under five are suffering from acute malnutrition and more than 250,000 have life-threatening SAM [53]. UNICEF recently reported a death rate of about 0.44% in children with SAM, with or without complications. To combat this huge malnutrition situation, the government developed “Guidelines for the management of the severely malnourished in Yemen” in 2008. To provide basic nutrition services by community volunteers, the “National guideline for community health volunteer program” has also been recently developed. UNICEF is promoting an integrated and comprehensive approach to address malnutrition in Yemen, with a strong community component. The number of centers providing nutrition interventions grew from 330 in 2010 to 543 in 2012. The Nutrition Cluster trained health professionals from government departments, NGOs, and UN agencies. Training of trainers for nutrition in emergency programming has been completed. Training has also been provided on management of SAM and MAM [53]. More than 1,000 community volunteers

were trained on screening of children and counseling of parents, which are integral components of CMAM.

### Constraints to management of SAM and implementation of CMAM in Asian countries

Asian countries face huge constraints to effective management of SAM, both in hospitals and in the community. The constraints highlighted in the responses to the questionnaire sent to eight Asian countries are shown in **tables 2, 3, and 4**. Almost every country acknowledges that the majority of children with SAM with complications cannot be accommodated in hospitals and may not even be brought to health facilities, primarily due to lack of resources—a finding that corroborates a previous report [6]. In three out of eight countries, many families cannot afford for their

wage-earning members to stay with their malnourished children in the hospital for several weeks for the treatment to be completed. Therefore, treatment at home can provide a practical solution for children to receive continuity of care after discharge, which also reduces the risk of children contracting deadly hospital-acquired infections [1]. Home treatment also increases the time available to mothers and caretakers to spend with the family and reduces the risk of possible neglect of siblings, thus preventing sibling malnutrition. Four out of eight countries with a high SAM burden reported unwillingness of parents to provide sufficient time and care to SAM children as well as stay with their children with SAM in health facilities for treatment. In such a scenario, community and family empowerment may play a vital role in managing SAM.

Treatment of SAM in many Asian countries is still limited to traditional, center-based inpatient care, with obviously limited coverage. Most of the intensive

TABLE 2. Severe acute malnutrition (SAM) in Asian countries

Country	Prevalence and case fatality rate	Programs, policies, or guidelines	CMAM program	Use of RUTF
Afghanistan	Prevalence 0.5%–0.6% CFR 6%	NP, SN, P, G, NTC, WG	Program present. 5,848 children admitted in 2013	Mostly procured through UNICEF and distributed by NGOs; no locally made RUTF
Bangladesh	Prevalence 4% CFR 15%	NP, G, NTC, WG	Pilot CMAM projects run by international NGOs but no national program	Only in small pilot projects; RUTF developed from locally available food ingredients
India	Prevalence 6.4% CFR 20%–40%	NP, G, NTC, WG	None	Locally made RUTF: high-calorie cereal mix containing milk, flour, sugar, and cooking oil; Nutrimix containing wheat flour, pulses, sugar or jaggary, and oil
Indonesia	Prevalence 4.9% CFR NA	NP, SN, P, G, NTC, WG	Program present. 42,702 children with SAM in 2012; 9,467 hospitalized up to April 2013	UNICEF provides RUTF in 2 districts; no locally made RUTF
Myanmar	Prevalence 1.1% CFR < 20%	NP, SN, G, NTC, WG	Program implemented in only 30 of 330 townships	Mostly distributed during disasters; no locally made RUTF
Nepal	Prevalence 2.6% CFR NA	NP, SN, G, NTC, WG	Program present.	Imported RUTF is distributed by government and UNICEF; no locally made RUTF
Pakistan	Prevalence 5.8% CFR NA	NP, SN, P, G, NTC, WG	Program present. Coverage data available only from Khyber Pakhtunkhwa Province (2.8%)	Imported RUTF is distributed by government and NGOs; no locally made RUTF
Sri Lanka	Prevalence 2.8% CFR NA	NP, P, G, NTC, WG	None	Imported RUTF is distributed by government; no locally made RUTF

CFR, case fatality rate; CMAM, community-based management of acute malnutrition; G, guideline; NA, not available; NGO, nongovernmental organization; NP, national program; NTC, national training course; P, policy; RUTF, ready-to-use therapeutic food; SN, subnational, state, or regional program; WG, World Health Organization guideline



treatment for children with complicated SAM is delivered in high-dependency inpatient units at high cost, leading to a scarcity of provisions and creating barriers to accessing care that limits program coverage [54]. The key obstacles identified by all respondents include inadequate capacity of health systems at all levels and across all elements of service delivery, workforce, and health information systems, and access to essential medicines, health financing, leadership, and governance (tables 3 and 4). India, Indonesia, and Bangladesh have recommended improving facility-based treatment of SAM. Lack of trained staff, their competencies and motivation, and excess workloads are not conducive to appropriate management of SAM in six of eight countries. Additionally, identification of children with SAM in the community, along with appropriate referral and management, is important for achieving adequate levels of coverage [54]. A recent UNICEF report states that 60% of Pakistani children with SAM were identified by community health workers and referred to outpatient services with a referral slip, which resulted in a 92% recovery rate [42]. Appropriate screening and referral remain largely ignored or neglected in Asian countries. The basic tenets of good health systems—human resources, finance, adequate supply of medicines, good governance, etc.—also apply to appropriate management of SAM. Unfortunately, most countries in Asia that have a high burden of SAM also have inadequate health systems.

The key nutritional component of treatment of SAM in the community is RUTF. However, RUTF is yet to be endorsed by governments in India and Bangladesh, mostly due to concerns about cost, sustainability, and its “alien” nature, since it has to be imported, except

in India where there is a franchise for producing it locally. In countries where RUTF is being used on a small scale, much of it is imported by NGOs and international agencies. Anecdotal observations suggest that RUTF is consumed by other family members, and acceptability by children can be an issue in many communities. Moreover, lack of data from trials on the efficacy of RUTF in Asian countries is also a factor against endorsement of RUTF. There is also an increased resistance against RUTF, which stems largely from the unfounded beliefs that it will down-play breastfeeding, that SAM can be treated with local, non-ready-to-use foods alone, and that there is a fear of aggressive commercialization of RUTF that requires bulk production and dispensing in sachets. Among all the countries included in this review, the prototype RUTF (Plumpy’Nut) can be produced locally only in India. Since 2007, researchers at icddr,b have been advocating for developing RUTF from locally available food ingredients. In 2012, with support from UNICEF, they developed two recipes for RUTE, one based on rice and lentils and the other on chickpeas [55]. RUTFs based on local recipes and conforming to international standards are currently being tested for efficacy in a randomized, controlled trial in Bangladesh. If the results show that the local RUTFs are efficacious and cost effective, governments in Asia will be more likely to accept them for use in CMAM. Not only will the cost of food be reduced, but the overall cost of treating SAM is expected to decrease substantially because of the reduced length of stay in hospital. More children with SAM will be discharged early and advised to continue treatment at home, with provision of locally produced RUTF rations. As successful local production occurs where demand is high and the product is purchased by the government, NGOs, or international agencies,

TABLE 3. Constraints to implementation of severe acute malnutrition (SAM) program in facilities

Constraint	Countries
Low coverage	Afghanistan, Bangladesh
Lack of monitoring system	Afghanistan, Nepal, Sri Lanka, Pakistan
Shortage of health staff	Afghanistan, India, Nepal, Sri Lanka, Pakistan, Bangladesh
Turnover of trained health staff	Afghanistan, Indonesia, Myanmar, Bangladesh
Lack of motivation of staff	Afghanistan, Indonesia, Pakistan
Family members reluctant to stay in facility	India, Myanmar, Nepal, Bangladesh
Shortage of space	Afghanistan, India, Indonesia, Bangladesh
Lack of policy	Indonesia
Lack of coordination	Indonesia
Financial and logistic constraints	Myanmar, Bangladesh, Sri Lanka, Pakistan

TABLE 4. Constraints to implementation of severe acute malnutrition (SAM) program in communities

Constraint	Countries
Low coverage	Afghanistan, Indonesia, Myanmar, Nepal, Bangladesh
Monitoring	Afghanistan, Sri Lanka
Access to facility	Afghanistan, Nepal, Bangladesh
Lack of partnership	Afghanistan
Lack of guidelines	India
Lack of trained health staff	India, Indonesia, Nepal, Pakistan, Bangladesh
Shortage of supplies	India, Bangladesh
Lack of community awareness of SAM	Indonesia, Nepal, Sri Lanka, Pakistan, Bangladesh
Poverty and social problems	Indonesia, Nepal
Financial and logistic constraints	Myanmar, Nepal, Sri Lanka, Pakistan

social marketing can play a crucial role to increase demand for the product among the general population [56]. In the initial stage, ensuring the quality of local RUTF can be a challenge. This can be partially overcome if there is a network of laboratories accredited to test and analyze RUTF as part of a wider quality assurance program. To address all these problems, the CMAM approach must be designed in such a way that the communities will be responsible for identifying and treating malnourished children effectively with a proper combination of facility-based and home treatment [6]. Pakistan, Nepal, and Vietnam have shown interest in producing RUTF locally.

Community mobilization is an ongoing community awareness-creating process that involves assessing community capacity, community sensitization, identification of malnourished children with proper referral, follow-up care of malnourished children, and laying the foundation for community ownership [57]. Understanding the need, respondents from Afghanistan, Pakistan, Myanmar, and Indonesia recommended improving community mobilization and sensitization for effective management of SAM. Monitoring helps programs focus on corrective measures in areas of lower performance [58]. The lack of staff with skills in monitoring is a constraint; respondents from Afghanistan, Myanmar, and Nepal recommended supportive supervision and continuous monitoring and evaluation of activities at the community level, with appropriate and timely feedback.

## Recommendations

It is a shame that nearly 20 million children today suffer from SAM, most of them in Asia. Despite advances in all sciences, more than a million children die of SAM annually, again, many of them in Asia. Much of the effort to control SAM is now directed toward Africa, as is logical. However, Asia has the largest burden of SAM and deserves concerted attention, efforts, and resources to tackle the problem. The following recommendations are made to control the problem of SAM in Asia:

- » Countries in Asia have to recognize SAM as a major problem that not only kills and maims children, but grossly undermines development. Even low- and middle-income countries have internal resources that should be mobilized for management of SAM.
- » Screening of children for SAM and appropriate referral and back referral require good health systems. Countries in Asia should carefully look at their

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health systems. Improving grassroots services will not only contribute to improving management of SAM, but also improve infant and young child feeding and nutrition in general.

- » RUTF, the key to home management of SAM without complications, should be produced locally from locally available food ingredients. There are now examples of such RUTFs that can be produced on a large scale. Countries that do not have the capacity to produce RUTF locally can import RUTFs from other countries in the region.
- » Hospitals in all high-burden countries should be staffed and equipped to treat children with SAM.
- » There should be a continuous cascade of training of health staff on management of SAM. Only such a continuous process of training can offset the damage that results from staff attrition and transfers.
- » Basic nutritional interventions, which include breastfeeding, appropriate complementary feeding, micronutrient supplementation, management of acute malnutrition, should be scaled up in countries that are plagued with the burden of malnutrition. As shown in the *Lancet* Series on Maternal and Child Nutrition [59], such scaling up of nutrition intervention can reduce SAM prevalence by more than 60%.
- » Since community-based preventive and treatment strategies for SAM have been the subject of only a few studies, robust experiments in this area should also be prioritized to further simplify management [60].

## Authors' contributions

Tahmeed Ahmed conceptualized the paper; Tahmeed Ahmed, Muttaquina Hossain, Mustafa Mahfuz, and Nuzhat Choudhury wrote the first draft; all authors contributed data and critically reviewed the draft.

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## Annex A

### Questionnaire on Severe Acute Malnutrition

1. How is SAM defined in your country—based on weight-for-height/length z-score or MUAC or edema? Check all that apply.
2. What is the prevalence of SAM among U-5 children based on last national/regional survey?
3. Is there any national program on management of SAM?
4. Is there any subnational or state or regional program on management of SAM?
5. Is there any national policy on management of SAM?
6. Is there any national guideline on management of SAM?
7. Is there any national training course for healthcare professionals available on management of SAM?
8. Are WHO guidelines on management of SAM followed in hospitals?
9. What is the case fatality rate of children admitted to hospitals with SAM? Mention percentage here.
10. Is there any community-based management of SAM program in your country?
11. What is the coverage or number of children under SAM program, if there is any?
12. Is RUTF (ready-to-use therapeutic food) used for SAM management in your country?
13. Is RUTF distributed under Government or NGO run programs? Check all that apply.
14. Is any RUTF made of local food ingredients available? YES NO
15. If, yes, what is the composition of local RUTF? List ingredients below.
16. What are the constraints in management of SAM in hospitals? List 3–5 major issues below.
17. What are the constraints in management of SAM in the community? List 3–5 major issues below.
18. What could be done to overcome those constraints?