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Research Application Summary

Severe acute malnutrition and post-treatment outcomes among children in Uganda

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Abstract

Severe Acute Malnutrition (SAM) is reported to affect 19 million children under five years worldwide. About 5% of children younger than five years in Uganda are wasted and 2% of these children are said to be severely wasted. Community based management of Acute Malnutrition is endorsed by UN as the public health approach to treatment of SAM. Studies suggest that children who are previously cured of SAM remain at risk of relapse of SAM, morbidity, mortality and growth faltering. There is no systematic follow up and monitoring of children treated and discharged from SAM treatment. The shift from hospital based to community based SAM treatment requires estimation of SAM burden for planning purposes. The current guideline for estimating incidence rate is the use of a universal incidence correction factor multiplied by prevalence rate. This incidence rate is then use to estimate SAM burden. This approach could under- or overestimate SAM burden thus affecting effective programme planning because of context specific factors. The aim of this literature review is to highlight the challenges of the current guidelines for estimating SAM incidence and SAM burden and their implications for programme planning. This review elucidates the post-treatment outcomes among children aged 6-59 months and the long term effects of SAM treatment on children in developing countries. This review also highlights programmatic and research gaps if addressed would enhance the operational response to SAM in developing countries. Research method for this study was a literature review and content analysis. Published articles on SAM incidence, post-treatment outcomes estimation of SAM incidences and burden were identified on Pubmed, Google search, Google scholar and websites of the Nutrition field exchange networks like CMAM forum and ENN. Publications on WHO and UNICEF websites were also reviewed. Experts were contacted to identify published and unpublished references. The review found that HIV infection, discharge from treatment when not fully recovered, not fully vaccinated for age, low dietary intake of oil, seasonality of food insecurity and severity of SAM at admission increased risk of post-treatment relapse, death and morbidity. Children with history of SAM treatment had linear growth deficits, functional deficit of weaker hand grip and less able to perform an exercise test compared with their control. These children have a high risk of Non-Communicable Diseases. The

literature also revealed no prospective studies have been conducted on SAM incidence; however few secondary analyses have been conducted to determine SAM incidence. A meta-analysis showed that incidence correction factor varied across three West African countries; thus the recommended incidence correction factor of 1.6 could not be generalised to every context. Context specific estimation of SAM burden is needed to address operational needs. The relationship between wasting and stunting and the indicative risk of NCD is a great concern which needs further investigations.

Key words: Incidence correction factor, relapse, risk factors, severe acute malnutrition

Résumé

La Malnutrition aiguë sévère (SAM) est signalée pour avoir affecté plus de 19 millions d'enfants de moins de cinq ans dans le monde entier. Environ 5% d'enfants de moins de cinq ans en Ouganda sont touchés et 2% de ces enfants sont dit être sévèrement affectés. La gestion communautaire de la malnutrition aiguë est approuvée par l'ONU comme l'approche de santé publique pour le traitement de la SAM. Des études suggèrent que les enfants qui sont déjà guéris de SAM demeurent à risque de rechute de la SAM, de la morbidité, de la mortalité et des problèmes de croissance. Il n'y a pas de suivi systématique des enfants traités et guéris par le traitement SAM. Le passage à l'hôpital de basé vers la communautaire de base pour le traitement SAM exige une estimation du SAM à des fins de planification. La recommandation actuelle pour estimer le taux d'incidence est l'utilisation d'un facteur de correction d'incidence universelle multiplié par le taux de prévalence. Ce taux d'incidence est alors utilisé pour estimer le fardeau de SAM. Cette approche pourrait sous-estimer ou surestimer la charge de SAM affectant ainsi une planification efficace du programme en raison de facteurs spécifiques au contexte. Le but de ce travail est de mettre en évidence les défis des lignes directrices actuelles pour estimer l'incidence de SAM, ses charges et ses implications pour la planification des programmes. Cet avis élucide les résultats post-traitement chez les enfants de 6-59 mois et les effets à long terme du traitement de SAM sur les enfants dans les pays en développement. Cet avis met également en évidence les lacunes de la programmation et de recherche si elles sont abordées amélioreraient la réponse opérationnelle à SAM dans les pays en développement. La méthode de recherche utilisée pour cette étude était une revue des écrits et une analyse de contenu. Les articles publiés sur l'incidence de SAM, les résultats des estimations post-traitement des incidences SAM et de la charge ont été identifiés sur Pubmed, recherche Google, Google scholar et des sites d'Internet des réseaux d'échange sur le terrain de la nutrition comme forum PCMA et ENN. Les publications sur les sites Web de l'OMS et de l'UNICEF ont également été examinées. Les experts ont été contactés pour identifier les références publiées ou non. L'examen a révélé que l'infection par le VIH, le rejet d'un traitement lorsqu'on n'est pas complètement rétabli, ne pas être complètement vaccinés selon l'âge, le faible apport alimentaire de l'huile, la saisonnalité de l'insécurité alimentaire et de la gravité du SAM à l'admission, risque accru de post-traitement des rechutes, et s'en suit la mort et la morbidité. Les enfants ayant des antécédents de traitement de SAM avaient des déficits de croissance linéaire, des déficits fonctionnels d'adhérence plus faible de la main et moins en mesure d'effectuer un test d'exercice par rapport à leur contrôle. Ces enfants ont un risque élevé

de maladies non transmissibles. Les écrits ont également révélé aucune étude prospective n'a été menée sur l'incidence de SAM; cependant, quelques analyses secondaires ont été menées pour déterminer l'incidence de SAM. Une méta-analyse a montré que le facteur de correction d'incidence variait de trois pays d'Afrique de l'Ouest; ainsi l'incidence facteur de correction recommandée de 1,6 ne pouvait pas être généralisée à tous les contextes. Le contexte estimation spécifique de la charge de SAM est nécessaire pour répondre aux besoins opérationnels. La relation entre le gaspillage et le retard de croissance, et le risque indicatif de NCD, sont une grande préoccupation qui ont besoin de nouvelles enquêtes.

Mots clés: facteur de correction d'incidence, la rechute, les facteurs de risque, la malnutrition aiguë sévère

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Background

Children aged 6-59 months who have low weight for height and/ or mid-upper arm circumference (MUAC) less than 115 mm and or bilateral pitting oedema are classified as severely malnourished (Garenne *et al*., 2009). About 19 million of children aged 6-59 months are said to be severely malnourished worldwide (Black *et al.*, 2013), and about 9% of Sub-Saharan Africa's children younger than five years are wasted, of which 3.5% are severely wasted (Black *et al.*, 2008; Black *et al.*, 2013; World Health Organization, 2015). In Uganda, 5% of children younger than 5 years are wasted and 2% of these children severely wasted (UBOS and ICF International Inc., 2012).

Severe Acute Malnutrition (SAM) is a health outcome as well as the risk factor for infections; the risk of morbidity and mortality increases by SAM (Scrimshaw and SanGiovanni, 1997; Black *et al.*, 2008). SAM is implicated for about half of all death in young children (Caulfield *et al.*, 2004). Children with SAM have 9 folds risk of death compared with normal children (Black *et al*., 2008).

Risk factors for SAM are multiple, complex and connected at different levels. However, poor dietary intake and infections are the immediate or individual level risk factors for SAM. Infection reduces food intake, and inadequate food intake increases susceptibility to infections (UNICEF, 1998). Frequent bout of infections is a high risk of SAM. Studies in Uganda shows fever episode in the previous two weeks increases the odds of SAM (4.4, 95% CI= 1.5; 13) (Wamani *et al.*, 2006). Diarrhoea in previous two weeks is a risk factor for SAM (OR = 2.16, 95% CI = 1.02; 6.6) (Engebretsen *et al.*, 2008). Poor treatment seeking behaviour for ill children, poor breastfeeding practices, household food insecurity and use of unprotected water source were some of the risk factors for SAM identified in a study in Chad (Ratnayake *et al.*, 2013).

The UN jointly endorsed Community-Based Management of SAM as public health approach to treat SAM in non-emergency settings in 2006 (UNICEF, 2013). Currently, millions of children in developing countries are treated for SAM with nutrient dense, lipid-based Ready to Use Therapeutic Food (RUTF) (Bhutta *et al.*, 2013). The current programme performance indicators and targets are exclusively treatment outcomes and health facilities related, risk

factors for SAM relapses and other post-treatment outcomes are not addressed (Kerac *et al.*, 2014; Somasse *et al.*, 2015). Moreover, there is paucity of knowledge on the post SAM treatment outcome of these children.

Some studies suggest that children who are previously cured of SAM remain at risk of relapse of SAM, morbidity, mortality and growth faltering (Paluku Bahwere *et al.*, 2012; Kerac *et al.*, 2014; Somasse, *et al.*, 2015). The current programme performance indicators and targets are exclusively treatment outcomes and health facilities related, risk factors for SAM relapses and other post-treatment outcomes are not addressed (Kerac *et al.*, 2014, Somasse *et al.*, 2015).

The shift from hospital to community based treatment of SAM requires knowledge on SAM burden for programme planning, implementation, and evaluation. However studies on SAM Incidence require longitudinal data, which are rarely conducted and so an incidence correction factor is applied instead (Hure *et al.*, 2016; Isanaka *et al.*, 2016). It is assumed that the incidence correction factor of 1.6 is constant in every setting; but this may not be true since the occurrence of SAM is influenced by several context specific risk factors. So estimation of SAM burden using this factor may be misleading.

This aim of this literature review is to highlight the challenges of the current estimation guidelines of SAM incidence and SAM burden and their implications for programming. This review elucidates the post-treatment outcomes among children aged 6-59 months and the long term effects of SAM treatment on children in developing countries. This review also highlights programmatic and research gaps if addressed will enhance the operational response to SAM in developing countries.

Severe acute malnutrition severity patterns

Research has shown that 25% children die after 90 days of successful cure and discharge from SAM treatment. This pattern brings to the forefront the fact that the long term public health benefit of SAM treatment may not be realized by many children (Kerac *et al.*, 2014). Infections such as HIV increase risk of post SAM treatment mortality. Children less than 12 months old have high post SAM treatment mortality risk (Kerac *et al.*, 2014). Discharge from treatment when not fully recovered, not fully vaccinated for age, low dietary intake of oil, seasonality of food insecurity and severity of SAM at admission increase risk of relapse, death and morbidity (Kerac *et al.*, 2014; Burza *et al.*, 2015; Somasse *et al.*, 2015). A study in Burkina Faso showed that 15.4% children relapsed to SAM within 1-year follow-up post SAM treatment (Somasse *et al.*, 2015). Similarly, about 9% of children relapsed 90 days after being successfully cured and discharged from SAM treatment in an Indian study (Burza *et al.*, 2015).

Some studies have been shown that children who were successfully cured of SAM have linear growth deficits post treatment (Kerac *et al.*, 2014; Lelijveld *et al.*, 2016). Post treatment follow up at 12 months revealed that children remained stunted (height-for-age of mean -2.97 z-scores; SD 1.3) in a Malawian study (Kerac *et al.*, 2014). A follow up study of the

cohort of children cured from SAM, seven years later in Malawi, indicated that compared with controls, children with history of SAM treatment had lower height-for-age *Z* scores (0·4, 95% CI 0·6 to 0·2, p=0·001) (Lelijveld *et al.*, 2016). Children with history of SAM treatment had functional deficit of weaker hand grip and less able to perform an exercise test compared with their control (Lelijveld *et al.*, 2016). According to the study, growth faltering among these children could be indicative of risk of cardiovascular diseases and other communicable diseases in future (Briend and Berkley, 2016; Lelijveld *et al.*, 2016).

Wasting causes depressed immunity and reduced linear growth in children (Briend *et al.*, 2015). Wasting and stunting or reduced linear growth co-exist; this is because the risk factors for both conditions are often seen in the same child (Briend *et al.*, 2015). Wasting negatively affects linear growth, and recovery from wasting enhances linear growth. However, long periods of wasting may slow or stall linear growth (Picot *et al.*, 2012). Stunting reduces the intellectual capability of children (Martins *et al.*, 2011). Children with wasting have deficit on cognitive score by -0.63 (Sudfeld *et al.*, 2015). Long term consequence of stunting is low work or physical capacity; and therefore low income and poverty (Martins *et al.*, 2011). Effect of stunting may be intergenerational; a stunted woman gives birth to a stunted baby with a low birth weight (Martins *et al.*, 2011).

Information on the incidence SAM rate among children aged 6-59 month is critical for estimating SAM burden for programme planning purposes. Incidence correction factor (K) of 1.6 is the current guideline for estimation of SAM incidence. This is based on the epidemiological principle that in a steady setting, with rare cases, there is equilibrium between the inception of new cases and termination of prevalent cases, prevalence is a function of incidence and the inverse of the average duration of an episode (Miettinen, 1976). Termination density in the prevalence pool is the number of cured and death divided by the case-time of experience (Miettinen 1976). An average duration of SAM episode of 7.5 months over a year is used to estimate the incidence correction factor of 1.6 (i.e., 12 months divided by 7.5 months) (Garenne *et al.*, 2009; Isanaka *et al.*, 2011; UNICEF, 2013; Guerrero, 2014). SAM incidence is estimated by multiplying prevalence rate by the incidence correction factor (K). The estimated incidence is then used to determined the SAM burden in the population.

The limitation is that the total number of SAM current cases (prevalent cases) increases by the number of new (incident) cases, and decreases as a result of recovery or death. Prevalence rates mostly obtained from cross-sectional surveys are prone to seasonality and nutritional oedema is often neglected. A recent meta-analysis of cohort and survey data confirmed that of the recommended incidence correction factor of 1.6 could not be generalised to every context. Isanaka *et al.* (2016) showed that pooled estimate of the incidence correction factor was 4.82 (3.15, 7.38) for Mali, Burkina Faso and Niger. However incidence correction factor varied across the three countries, thus 2.53 (95% CI: 1.64, 3.89) in Mali, 13.25 (95% CI: 4.34, 40.48) in Burkina Faso and 6.17 (3.86, 9.87) in Niger. Case definition and frequency of follow up varied across the countries making the data heterogeneous (Isanaka *et al.*, 2016). The current incidence correction factor may not be applicable to all contexts and therefore may not give the true picture of the SAM burden at a given point in time. Studies

to estimate context specific incidence correction factor is therefore recommended to inform operational response such as quantities of RUTF, staff and other health communities required (Isanaka *et al.*, 2016).

SAM treatment in Uganda

Despite the overall improvement in lowering of chronic malnutrition over the past five years, the proportion of children who are wasted has remained almost unchanged (6% in 2006 to 5% in 2011) in Uganda (UBOS and ICF, 2012). There are significant disparities in malnutrition between the regions of the country. Karamoja sub-region which is a semi-arid area of northern Uganda that borders Kenya and South Sudan has the highest burden of malnutrition compared with the rest of the country (UBOS and ICF, 2012). About 3.8% (95% CI; 3.2-4.5) of the children younger than five years are severely wasted in Karamoja Region. Stunting and underweight rates amongst children under 5 years stand at 39.5% and 31% respectively (UNICEF *et al.*, 2015). Majority (80%) of Karamojong live below the poverty line (Ministry of Finance, 2014) and nearly half of all households (46%) in Karamoja are said to be food insecure (UNICEF *et al.*, 2015). About 79% of the poor households are less likely to have at least two meals a day than those living above the poverty line (Ministry of Finance, 2014). Less than half of Karamoja's children receive a minimum frequency of meals for their age (UNICEF *et al.*, 2015). Only 3% of children are fed adequately in terms of diet diversity and meal frequency recommended by WHO (UNICEF *et al.*, 2015).

The SAM children are more vulnerable to infections because of the effect of SAM on their body metabolism and require high quality of care to catch up with growth and development (Bizouerne, 2012). A discussion with UNICEF revealed that cases of children exiting the treatment programme after being successfully cured and discharged reappear for re-admission after relapsing to SAM (Birungi, 2015).

The Ugandan Government rolled out Integrated Management of Acute Malnutrition (IMAM) Guidelines for treating children with SAM to facilitate integration of treatment of SAM in the existing health system (Ministry of Health Uganda and UNICEF, 2016). Over 103 SAM treatment centres have been established in Karamoja Region. It is reported that 10,000-11,500 SAM cases are treated annually in the Karamoja Region (Kouam *et al.*, 2014). It has also been reported that only half of SAM children (49.7%) receive treatment in the Karamoja Region.

Dealing with SAM in a developing country context

Public health approach for treatment of SAM requires the knowledge of context specific estimation of SAM burden for effective operational response (Hure *et al.*, 2016; Isanaka *et al.*, 2016). The current guideline for estimation of SAM burden based on prevalence rate and incidence correction factor may not reflect a true SAM burden in developing countries. There is an urgent need for research to determine incidence of SAM in developing countries to address SAM burden estimation issues. The relationship between wasting and stunting and the indicative risk of NCD is a great concern which needs further investigations. Research

is needed to identify risk factors for post SAM treatment outcomes to prevent the consequences of NCDs and poor productivity as a result of stunting and poor cognitive ability. It is important that programme emphasis is placed on interventions to reduce wasting and stunting in an integrated approach. The current programme performance indicators and targets should not be only health facilities related treatment outcomes. Other risk factors for SAM relapses and other post-treatment outcomes should be considered for performance indicators and targets in developing countries.

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