



WFP/Rein Skallerud

# Meeting Report

Management of At risk Mothers and Infants under six months (MAMI) Special Interest Group (SIG) meeting

17 January 2018



LONDON SCHOOL of  
HYGIENE & TROPICAL  
MEDICINE



A one-day meeting of the Management of At risk Mothers and Infants under six months (MAMI)<sup>1</sup> Special Interest Group (SIG) was hosted by ENN in collaboration with the London School of Hygiene and Tropical Medicine (LSHTM) and Save the Children.

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# 1 Meeting overview

## 1.1 Objectives

The aim of the meeting was to identify synergies, opportunities, priorities and steps to help develop the evidence base on MAMI. It built on the 2016 meeting of the MAMI SIG and was guided by the WHO 2013 Update on severe acute malnutrition (SAM) treatment<sup>2</sup> and the research prioritisation on MAMI published in 2015<sup>3</sup>. The meeting was also informed by the proceedings of a one-day shared meeting with the ENN-led Wasting & Stunting Technical Interest Group (WaSt TIG) that immediately preceded the MAMI gathering (16 January 2018)<sup>4</sup>.

The objectives of the MAMI meeting were to:

- 1) Share progress (evidence, policy, programming) on key MAMI areas;
- 2) Identify barriers to progress and actions to address them; and

- 3) Provide an opportunity for participants to network to identify synergies and potential collaboration.

The agenda is included in Annex 1. The morning session comprised a series of presentations that directly informed four pre-assigned working groups. Prioritised actions emerging from the working groups were identified in plenary. Pre-meeting reading was circulated in advance<sup>5</sup>.

In addition to MAMI SIG members, other participants were invited who had direct experience of and a keen interest in collaborating on MAMI. The meeting was attended by 35 delegates; up to 11 participants attended various sessions remotely (see Annex 2).

## 1.2 Setting the scene Marie McGrath, ENN

Marie introduced the aims of the meeting and reminded the group of the priority actions identified at the 2016 MAMI meeting, including the recommendations to:

- Build evidence and explore the use of weight-for-age z-score (WAZ) and mid-upper arm circumference

(MUAC) to identify at-risk infants under six months of age.

- Pilot breastfeeding interventions, with specific reference to the 'Optimising breastfeeding for undernourished infants under 6 months (IBAMI)' study and the

<sup>1</sup> Formerly 'management of acute malnutrition in infants under 6 months', the term has been updated to reflect evolution in thinking and scope of the initiative.

<sup>2</sup> WHO, 2013. Updates on the management of severe acute malnutrition in infants and children. Guideline.

<sup>3</sup> Angood C, McGrath M, Mehta S, Mwangome M, Lung'aho M, Roberfroid D, et al. (2015) Research Priorities to Improve the Management of Acute Malnutrition in Infants Aged Less Than Six Months (MAMI). *PLoS Med* 12(4): e1001812. doi:10.1371/journal.pmed.1001812

<sup>4</sup> ENN, 2018. Making connections: A joint meeting of the WaSt Technical

Interest Group and MAMI Special Interest Group. Emergency Nutrition Network. 16 January 2018. Meeting Report. [www.ennonline.net/mamiwastmeetingjanuary2018](http://www.ennonline.net/mamiwastmeetingjanuary2018)

<sup>5</sup> Lelijveld N, Kerac M, McGrath M, Mwangome M, Berkley J. (2017) A review of methods to detect cases of severely malnourished infants less than 6 months for their admission into therapeutic care. *Campion-Smith T, Kerac M, McGrath M, Berkley, JA. (2017). A call for evidence: micronutrient supplementation and other non-feeding interventions for the management of acute malnutrition in infants under 6 months of age. Draft report. C-MAMI tool and C-MAMI checklist. www.ennonline.net/c-mami*

community-based management of uncomplicated cases of acute malnutrition in infants under six months of age (C-MAMI) tool<sup>6</sup>.

These areas for action informed the meeting agenda. The 2016 recommendation to engage with No Wasted Lives (NWL) has been achieved; MAMI is one of the priority research areas identified in the NWL research agenda<sup>7</sup> launched in January 2018.

## MAMI highlights from the joint WaSt TIG and MAMI SIG of 16 January

Details of MAMI presentations to the joint meeting are included in Annex 3. The MAMI SIG articulated its call for action, which was well received by the meeting:

- A call to instigate a **Global MAMI Network**, a coordinated network for capture and learning (research and operational experience); a vision was outlined which requires financing<sup>8</sup>.
- **Robust evidence** (in the form of randomised controlled trials (RCTs)) is now needed to complement the strong operational research that is ongoing.
- The need to **scale up**. Lessons can be learnt from the CMAM scale-up process; pilots are critical, informed by country agendas.
- A greater MAMI voice (advocacy) is needed – some participants had not heard about the work of the group, but affirmed its importance.

There was much discussion in the shared meeting on the value but limitations of anthropometric recovery as an outcome, especially in infants under six months old (infants < 6m). Commonalities of findings between the WaSt and MAMI groups included WAZ and MUAC identifying high-risk children, and children stunted by 20-24 months having distinct weight-for-height z-score (WHZ) trajectories of growth under six months of age. This highlighted the need to catch these children early. Medical Research Council (MRC) analysis on wasting and stunting concurrence showed a heightened vulnerability among infants less than six months old who were born in the lean season; seasonal recovery from wasting during the dry season was not sustained and repeated wasting was seen in the subsequent wet season.

Policy priorities identified during the meeting (bold highlights top priorities) were:

1. **To develop a narrative that reflects MAMI and WaSt findings, with discussion on where it might be located and the process to take this forward.**
2. To include MAMI in the policy discourse.

Discussion of outcomes concluded that survival is important in the short term, but there are additional outcomes of interest in the medium term, including early child development (ECD), which offers a policy 'hook' for

nutrition as it is currently high on the global agenda. Programming priorities identified were:

- **A need to simplify the C-MAMI model, acknowledging that this requires resources.**
- **Examination of the continuum of care (across age, across sectors, mother/infant, access by mothers to services).**
  - **Connect with child, maternal and neonatal health to optimise survive and thrive.**
  - **Improve quality of monitoring.**
- To move to using MUAC and WAZ in infants < 6m; discussion revolved around how much evidence on MUAC is enough before we take this step with confidence.
- Targeting breastfeeding support to early intervention (first few weeks of life) and to high-risk infants.

MAMI priority research suggestions identified were:

- **What works to boost longer-term functional outcomes (including cognition)?**
  - Are there risks/benefits of birth size? Do these require specific interventions (i.e. separating low birth weight (LBW) and normal birth weight infants)?
  - Are there long-term, sustained benefits of community-based management of acute malnutrition (CMAM) interventions?
  - What are the benefits of implementing current nutrition elements of routine infant and child health programmes (such as Integrated Management of Childhood Illness (IMCI)? Is scalability one?
- **Interventions for mothers (centred on adolescents)**
  - What interventions work for adolescent girls to impact infant nutrition?
  - How can we engage and maintain engagement with adolescent girls?
  - How can we delay pregnancy in adolescent girls?
- Interventions for infants with growth faltering.
- Testing what works to boost growth.

It was acknowledged that the MAMI SIG has inadequately invested in outward-facing communication and advocacy (limited by capacity/funding) and it needs to do that now to create demand for scale-up. At the same time, there is an interest and drive for scale-up and a risk of our not meeting this demand that the collective has had a hand in creating unless resourcing increases significantly to support the collective effort.

We also need robust evidence development to support the operational research already undertaken around the CHNRI top-five priority research questions. This will enable greater clarity on where the risk/benefit lies. Agencies are starting to use MUAC in their programmes in infants < 6m and we need to provide clear recommendations.

<sup>6</sup> [www.ennonline.net/c-mami](http://www.ennonline.net/c-mami)

<sup>7</sup> [www.nowastedlives.org/researchagenda/](http://www.nowastedlives.org/researchagenda/)

<sup>8</sup> See footnote 2 and Annex 3.

# 2 Sharing experiences and research

## 2.1 Anthropometric indicators evidence review

**Natasha Lelijveld, ENN consultant/ACF/LSHTM**

This was a review<sup>9</sup> by ENN/LSHTM/CHAIN of methods for detecting severe acute malnutrition (SAM) in infants < 6m in either community or healthcare settings and assessment of their appropriateness for admitting infants for care.

A systematic literature review was undertaken to identify indicators that had been used previously for identifying SAM in infants < 6m and their appropriateness was assessed using a framework of 11 properties, used by Myatt et al<sup>10</sup> in a 2006 review of indicators for SAM in children aged 6-59 months.

The indicators assessed were WAZ, length-for-age z-score (LAZ), WLZ, MUAC, MUAC-for-age, clinical (infant), which included 'too weak to suckle' or 'recent weight loss', and clinical (mother), which included actual/perceived maternal milk insufficiency. The 11 properties of the framework were: simplicity, acceptability, cost, objectivity, quantitateness, independence of age, precision (reliability), accuracy, sensitivity (for mortality),

specificity (for mortality) and predictive value for mortality.

The review concluded with a proposal for use of MUAC and WAZ, alongside simple clinical indicators and identification of kwashiorkor, as the standard indicators for acute malnutrition in infants < 6m. It also suggested that infants born small or preterm should have the same anthropometric indicators for admission due to their heightened risk of mortality.

Discussing the presentation, participants noted that anthropometry is a marker of risk, but it cannot tell you what the problem is. In younger age groups, the range of potential causes becomes broader. A LBW or preterm baby may need a different intervention, but the anthropometric marker cannot guide that decision.

The question was raised: why not just look at weight? Babies are all about the same age when you screen them. (This is examined later in the Burkina Faso data presentation (2.3 below)).

## 2.2 Non-feeding interventions review

**Tim Champion-Smith, ENN consultant, University of Oxford/KEMRI-Wellcome, Kenya**

Tim presented key findings and questions from a review of non-feeding interventions (micronutrient supplementation, deworming, antibiotics, maternal supplementation) undertaken by ENN, LSHTM and KEMRI-Wellcome to try to answer programmers' questions regarding case management. A draft report was circulated for review by the MAMI SIG in December 2017.

The WHO Pocket Book suggests infants < 6m with SAM should receive the same clinical care as those over six months; similar advice is provided by the WHO 2013 updated SAM guideline. However, protocols are lacking for some micronutrients in infants < 6m. This review drew on available direct and indirect evidence of interventions with the aim of informing guidance for providers of care for infants < 6m.

The WHO recommendations for micronutrient supplementation in LBW and malnutrition differ. Often, we don't know whether an infant was born too small (LBW) or too early or what the aetiology of malnutrition is in these cases. Would the likely aetiology push us towards one or the other recommendation? How might interventions be delivered to infants?

While there is an absence of specific evidence, there is much that can be drawn from guidance developed for

<sup>9</sup> Lelijveld N, Kerac M, McGrath M, Mwangome M, Berkley JA (2017). A review of methods to detect cases of severely malnourished infants less than 6 months for their admission into therapeutic care. ENN. May 2017. [www.ennonline.net/mamicasedetectionreview](http://www.ennonline.net/mamicasedetectionreview)

<sup>10</sup> Myatt M, Khara T, Collins S. A review of methods to detect cases of severely malnourished children in the community for their admission into community-based therapeutic care programs. Food and nutrition bulletin 2006;27:S7-S23

infants close in age (LBW/premature) or nutrition status (older malnourished children). Given this, the review examined the evidence base for current WHO feeding recommendations in LBW infants and children over the age of six months with acute malnutrition on which preliminary recommendations could be based.

This review of the evidence base (RCTs and meta-analyses) aimed to draw out trends in interventions that might be efficacious and safe across the following population groups:

- LBW/pre-terms.
- Infants  $\pm$  malnutrition.
- Children  $\pm$  malnutrition.
- Post-natal maternal supplementation.

Interventions reviewed were: antibiotics, deworming, vitamin A, vitamin D, zinc, iron, folic acid and maternal supplementation. Outcomes of interest were safety and efficacy (mortality, morbidity, growth and neurodevelopment).

Ninety-one articles were included, comprising 58 RCTs, 29 meta-analyses and four systematic reviews. Eight articles included malnourished infants <6m, though none presented sub-group analyses of them; only 67% reported on adverse events.

The study experienced significant limitations. It was not a formal systematic review and few studies were found that were conducted in malnourished populations. There was a lack of good global epidemiological data on micronutrient status and programming information was beyond the scope of the review. It was also unclear whether interventions studied were supplementing a nutritionally replete or deficient population, with the result that most studies are likely underpowered if supplementing replete populations.

The review revealed much heterogeneity in dose, age of children admitted, delivery mechanisms, duration of treatment and outcome measures. Its key finding was that the available evidence is not adequate to make clear recommendations for non-feeding interventions in the < 6m age group.

The review raised several questions:

1. Can we extrapolate findings from LBW/pre-terms and children older than six months to the infants < 6m population?
2. What is current practice in the field?
3. What is an adequate threshold for safety?
4. What criteria should we be using to make policy decisions?
5. What impacts would infant interventions have on relactation/exclusive breastfeeding (EBF)-based interventions?
6. What are the next steps to undertake?

Identifying the way forward was the focus of an afternoon working group.

## Discussion

### Other evidence and considerations

Studies<sup>11</sup> in the Gambia in the 1980s showed that supplementing mothers to improve breastmilk quality did not work; he used heavy water to measure breastmilk output.

A multiple micronutrients supplementation trial was reported last year by ER Smith in *The Lancet* ([www.ncbi.nlm.nih.gov/pubmed/29025632](http://www.ncbi.nlm.nih.gov/pubmed/29025632)), which found birth-outcome benefits (reduction in preterm births and LBW) for infants born to supplemented undernourished and anaemic pregnant women.

Maternal mental health and psychosocial aspects are also important. A systematic review published in November 2017 on psychosocial stimulation and SAM treatment found only two studies. The evidence is lacking, but there is general agreement that it should be included in interventions for malnutrition in any age group.

In a ward set-up, maternal supplementation often has a psychological effect; it gives mothers confidence. Encouraging mothers to drink water has also helped to increase breastmilk volumes and confidence.

### How can this work be taken forward?

Most antibiotic data are for older children, so there are implications for application to the < 6m age group, in which there has not been a study, despite high bacteraemia. WHO therefore cautions against calling this data 'high quality'. In Malawi, with a high background of HIV, antibiotics don't have the same effects. Much higher-quality evidence across contexts is needed, including data from south Asia: one good RCT without confounders would suffice.

Gates Foundation plans to conduct some studies to generate evidence. It currently has a dataset of 10 million individual data points on children. People have shared datasets for analysis and others are welcome to share more.

There are things that can be done to move the field forward more quickly; agreeing on one or two anthropometric measures will speed things up. We may not get a perfect definition for infants at risk, but we need a working one.

The WHO guidelines related to MAMI are due for review soon. However, the inclusion of definitions can only reflect the evidence and it was noted that there is no new evidence from the last six years. Studies need to be done well; small, interesting ones do not inform the guidelines. A coordinated approach is needed: agreeing the questions and having studies from different regions is critical to moving forward with guidance.

<sup>11</sup> Prentice A et al. *Dietary supplementation of lactating Gambian women. I. Effect on breast-milk volume and quality.* *Hum Nutr Clin Nutr.* 1983 Jan;37(1):53-64.

## 2.3 Burkina Faso birth cohort analysis

Jay Berkley, KEMRI-Wellcome, Kenya

Building on his joint presentation of the previous shared day (see Annex 3), Jay presented key findings of a secondary data analysis in progress by ENN, LSHTM, KEMRI-Wellcome and others which has sought to answer three key questions:

1. Which anthropometry best identifies infants at highest risk of death?
2. Could MUAC measured at birth be used as a marker of risk, like LBW? (For example, in home delivery where birth weight may be more difficult to obtain.)
3. Does LBW influence interpretation of anthropometry? A cohort of 1,103 (48% female) infants from birth to 12 months old from four health facilities was recruited in 2003 in Burkina Faso. Monthly follow-up of growth and survival was conducted.

Twenty-one percent of babies were LBW. Babies were born more wasted than stunted (30% wasted; 10% stunted; 17% underweight; mean MUAC 10.2cm). The MUAC cut-off that most closely approximated with LBW was 9.7cm. LBW is very good at predicting mortality risk over the subsequent six to 12 months; MUAC 9.7cm does not perform as well. Modelling for the best MUAC predictor at birth shows 9cm works very well and better than LBW. In settings where you cannot measure weight, MUAC may be useful.

### Should LBW babies be classified and treated as SAM infants?

ROC curves show that none of the anthropometric indices are great predictors of mortality, but WAZ is significantly better than WLZ.

Many LBW infants are wasted at one month, but the majority are not. At two months, 40% of wasted babies were LBW, but the effect is diluted by mortality; by six months several will have died. The data could be corrected for this.

Less than half of the infants stunted at six months were LBW, although stunting is higher among LBW babies than those with normal birth weight.

Mothers continuing agricultural work was associated with LBW; as well as not visiting for antenatal care (ANC), preterm births could be a confounder as mothers have less opportunity to visit ANC.

Measuring MUAC at one month of age shows good predictability for mortality, as does severe underweight (WAZ <-3). In the relationship between underweight and

mortality, rather than reducing the risk of mortality, LBW adds to it. Low weight preterm babies are often considered OK if following a low growth curve (tracking along the z score); this analysis shows they are at elevated risk of being underweight.

No relationship was found between maternal height and LAZ, WAZ or WLZ at six months.

### Discussion

With modelling, if you keep reducing the MUAC cut-off, after a while all infants will die, but absolute numbers will be very small.

In the case of healthy preterm babies, they did not join up to the growth trajectory of the other children until six months old. Should malnourished infants be speeding up growth to catch up with the others? Would interventions put them at risk of non-communicable disease (NCD) or obesity?

Low WAZ and MUAC babies never caught up; they tracked along the z-score. In a population where things are going well, it is expected that babies will catch up by six months. Where they don't catch up is in a non-thrive environment.

Using the ROC curve is appropriate if you give the same value to specificity and sensitivity, but this will depend on the intervention/aim of the programme. If the aim is to encourage breastfeeding, specificity is less important; whereas a food supplementation intervention might lead to a different cut-off focus. We could use graded interventions; for example, use 11cm MUAC to promote breastfeeding and a 9cm cut-off for more aggressive intervention. It is not possible to simply use the statistics to decide on an intervention.

These findings need to be replicated elsewhere to test their validity. However, many datasets do not record MUAC. Kenya data is also available, but it is a nearby country. Data from south Asia is needed, with contexts of high HIV, etc. The important thing is to ensure systematic data collection; if there is more than 2% loss to follow-up, datasets cannot really be analysed.

## 2.4 MAMI tool evaluation

Mary Lung'aho and Louise Day, Save the Children consultants/  
Nutrition, Policy, Practice

### Overview of C-MAMI tool

The aim of the C-MAMI tool is to fill a programming gap in management of uncomplicated malnutrition in infants < 6m in both emergency and non-emergency contexts. The tool complements international and national guidance and recognises that MAMI support must include more than breastfeeding. It is modelled on the IMCI framework<sup>12</sup> and provides guidance to identify and analyse at-risk infants. The language and approach speak of 'enrolment' rather than 'admission'.

Assessment of infants < 6m includes:

1. TRIAGE: check for general clinical danger signs or signs of very severe disease.
2. (A)nthropometric/nutritional assessment.
3. (B)reastfeeding assessment.
4. (C)linical assessment.

And for their mothers:

1. (A)nthropometric/nutritional assessment.
2. (B)reastfeeding assessment.
3. (C)linical assessment.
4. (D)epression/anxiety/distress.

The health worker is asked to Assess, Classify, Act/Manage using the support actions:

1. First Line Breastfeeding Counselling and Support Actions.
2. Second Line Breastfeeding Counselling and Support Actions (common difficulties).
3. Counselling and Support Actions for Mother's own Nutrition and Health.
4. Supplementary Suckling Support (information for the Community Worker).
5. Family and Community Counselling and Support Actions for Mother.
6. Appendix 1: Non-breastfeeding Assessment, Counselling and Support Actions.

Pictorial aids are provided with clear advice for implementers and a quick C-MAMI checklist tool is incorporated.

### Headlines from evaluation

Save the Children is leading on the evaluation of the C-MAMI tool implementation. Evaluation of piloting the tool in the Save the Children-supported government community clinics in Barisal, Bangladesh and the Goal Ireland Gambella refugee camp in Ethiopia programmes seeks to learn lessons for a second version of the tool.

This presentation was of early findings as the analysis is not yet complete.

The team interviewed beneficiaries enrolled and discharged from C-MAMI, wider community members, trained C-MAMI tool users, supervisors and managers as well as contextual experts (local and policy) during November and December 2017.

The evaluators found enthusiasm from users and beneficiaries of the tool. They shared several quotes from interviews with community members, such as: *"Before, the people would buy milk but not come to this clinic. They said, 'What is the point of going to the clinic – will I get milk just from talking?' But now many say it is helpful and everyone goes to the clinic now. They say, 'They must have a tank of breast milk in that clinic from the progress we have seen'"*.

*"In the past we just told them to breastfeed, but with C-MAMI tool we practically help them ... and can solve the problems."* C-MAMI tool user.

*"C-MAMI tool is too complicated ... too big ... too long ... too repetitive. Content is ok but need to rethink the organisation"*. Programme managers.

Many practical suggestions were given to simplify and condense the tool and improve its practicability as a resource. Testament was provided to the quick recovery made by many infants through use of the tool, although less recovery was noted in mothers.

Implementers advocated for inclusion of the tool within infant and young child feeding (IYCF), rather than as standalone, and requested in-depth training as well as implementation plans to facilitate its rollout. Findings of the evaluation will be used to update the C-MAMI tool; version 2 will be available mid-2018.

<sup>12</sup> [www.who.int/maternal\\_child\\_adolescent/documents/IMCI\\_chartbooklet/en/](http://www.who.int/maternal_child_adolescent/documents/IMCI_chartbooklet/en/)

## 2.5 Identifying and managing high-risk infants in Rwanda

### The Paediatric Development Clinic, Katie Beck, Partners in Health

A study to examine outcomes of preterm and LBW infants discharged between 2011 and 2013 from neonatal units in the absence of structured follow-up<sup>13</sup> found that, one to three years later, of 86 children with median age 22.5 months, 47% of children had feeding difficulties and 40% reported signs of anaemia; 79% were stunted, 9% wasted and 38% underweight.

This prompted the Rwanda Ministry of Health to establish paediatric development clinics (PDCs) in 2014, with support from Partners in Health and UNICEF, to provide integrated clinical, nutritional, social and developmental services to infants born with perinatal complications. PDCs are staffed by nurses and social workers, with oversight from a general practitioner. Early intervention is embedded in a medical home model.

Between April 2014 to March 2017, 777 children were enrolled. Prematurity (60.49%) was the main referral reason.

At each visit nurses:

- Measure weight, length and head circumference.
- Calculate interval growth for patients less than six months old: adequate for infants < 3 months is minimum weight gain of 20 g/day; the target for infants aged 3-6 months is  $\geq 15$  g/day.
- Calculate current age and adjusted age (corrected for the number of weeks of prematurity).
- Plot on WHO growth charts using adjusted age starting from age adjusted to 40 weeks gestational age (GA); record Z-scores.

An examination of nutritional monitoring data of 316 patients (51.9% female) assessed from 1 January 2015 to 31 December 2016 (2,117 visits) revealed that higher rates of severe stunting ( $HAZ < -3$ ) and severe underweight ( $WAZ < -3$ ) were recorded in the group of children whose GA was unknown compared with the group for whom the GA was known. This finding suggests that without a known GA we potentially overestimate severe stunting and severe underweight.

Further findings included a significant association of stunting at six months with child's sex (male 54.9%,  $p$ -value  $< 0.01$ ); and a strong case for underlying developmental/neurological status in hypoxic ischemic encephalopathy and prematurity that limits adequate feeding behaviour.

A revision of the PDC protocol was completed in August 2017, one objective of which was to address the challenge of many patients ending up on infant formula. It now includes a higher level of nutrition counselling and interventions, including an adapted C-MAMI tool.

The revised protocol has shifted treatment of uncomplicated acute malnutrition  $< 6m$  to PDC instead of referral to district hospital and includes an algorithm to guide nurses and social workers in growth failure and malnutrition management.

The C-MAMI counselling tool has been translated into Kinyarwanda and training on new tools was provided in September 2017, with continued follow-up mentorship at the clinics.

Adaptation of C-MAMI in PDC has included the creation of a one-page algorithm for nutrition assessment and integrated parts of C-MAMI documentation into pre-existing visit forms. Interval growth is included as part of the classification of malnutrition.

Partners in Health is conducting additional research on children's nutritional status after six months of age. It believes there is a strong need for advocacy for better feeding guidelines for high risk infants.

### Discussion

Discussion revolved around whether knowledge of GA is important if a baby presents as wasted or stunted, noting that it is essential to keep identification and management as simple as possible. Kenya data implies there is no less risk because an infant is preterm; what would we do differently if a baby is preterm? The frequency of follow-up and measurement to check a child is growing is important.

The question was also raised of the degree of importance of precision of measurement. In many settings, people only have access to salter scales (calibrated to 100g). Data could be examined to see what happens when you round off to 100g. In Malawi, LSHTM conducted a study to measure children as they arrived and compared the measurement with their weight after they had undressed; 10% of their weight was clothes. A related question was whether we need different MUAC cut-offs for different ages (e.g. 0-2 months, 2-4 months).

The LBW data was strongly associated with stunting in this study, which is different to the Burkina Faso data (see above). This is a reminder of the need to gather data from different places/studies. Nobody mentioned oedema in their presentations.

<sup>13</sup> Kirk et al. (2017). *Health, nutrition and development of children born preterm and low birth weight in rural Rwanda: a cross-sectional study*. *BMC Pediatrics*.

## 2.6 Opportunities and challenges on MAMI in the Rohingya response

**Nicki Connell, Save the Children**

A conclusion from Phase 1 of MAMI research in Bangladesh was that SAM in infants < 6m is a complex marker of socioeconomic factors, maternal health and women's empowerment; therefore, a package of evidence-based interventions is needed to treat them successfully.

Save the Children is currently piloting the C-MAMI tool in Barisal, Bangladesh until November 2018. Intervention and control clusters (two distinct sub-districts in Bangladesh) have been established using the tool in intervention clusters and existing MoH protocols in controls. The aim is to conduct a costing analysis (of the cost to service provider and caregiver) and ensure that a rigorously evaluated tool is updated and finalised, with the long-term objective of contributing to rolling out a package of outpatient care for nutritionally vulnerable infants globally.

In Bangladesh, a large proportion of women and a high number of infants were arriving in a poor state with high prevalence of trauma after several weeks in transit. Women were not confident to leave their homes to travel to health facilities.

Piloting in the camps (funded by UNICEF, supported by UNHCR) involved active case-finding of IYCF cases, referral to directly implemented health and nutrition centres (health services, outpatient therapeutic programmes (OTPs), mother-baby areas (MBAs)) and incorporation of C-MAMI services in MBAs, comprising:

- IYCF counselling in MBA for all (IYCF counsellors).
- Systematic follow-up for nutritionally vulnerable (MAMI counsellors).

Community Health and Nutrition Volunteers (CHNVs) cover 300-400 households each. They follow-up the target population and assess and record needs/progress in registers. Maternal Child Health Nutrition Promoters supervise five to 10 CHNVs. Two MAMI counsellors work in each MBA with a catchment of ~4,000 households, providing systematic counselling sessions regularly in MBAs and at household level to support appropriate nutrition practices.

Current discharge criterion is growth (MUAC, WLZ), plus a minimum stay of six weeks.

A broad, multi-sector approach has been established between sectors which includes:

*Food Security:* Targeted food security projects to include

families with a child who is enrolled in the C-MAMI programme.

*Nutrition:* Malnutrition prevention activities are linked to C-MAMI by ensuring caregivers enrolled in C-MAMI are participating in local nutrition-related projects (e.g. blanket supplementary feeding programme (BSFP) or IYCF).

*Water, sanitation and hygiene:* Link to projects focused on access to appropriate latrine and water facilities within the community and hygiene-promotion activities.

*Health:* Ensure that mother and infant have access to clinical services as needed, including mental health and reproductive health support.

Outstanding questions and challenges

- In which platform to include services – MBAs/baby-friendly spaces (BFS), CMAM or other?
- Discharge criteria not identified globally.
- Capacity-building for all on C-MAMI is needed.
- Need for C-MAMI Toolkit (implementation package).
- Quick tablet computer purchase is a challenge in emergencies, affecting M&E.
- Support groups are beneficial but not recommended/agreed in this context.
- Approval is required to try an innovative approach (despite national buy-in).
- Mental health services are not widely available.

### Discussion

There is a need to support general government mental health systems and ensure health staff have training and capacity to identify women in need of support, such as those depressed or rejecting their infants. The challenge is to design an intervention that is deliverable, makes sense locally and is effective. Effective cognitive behavioural therapy (CBT)-type treatments for maternal depression have recently been reported in Pakistan (by Rahman). Treatment had an impact on reducing diarrhoea in children, but non-significant impact on infant growth.

WHO has five ongoing intervention studies with adolescents to relieve stress and anxiety in humanitarian settings in four countries. WHO puts through ethics proposals prior to the location of an emergency being identified so that, when something arises, there is a pre-approved proposal which simply requires the addition of local details prior to taking it to the government for approval. This approach could be used to design further studies.

## 2.7 Optimising breastfeeding for undernourished infants < 6m (IBAMI)

Martha Mwangome, KEMRI-Wellcome, Kenya

A clinical trial showed that infants < 6m treated for SAM have a growth trajectory that tracks along -3 z-scores rather than catching up 12 months after discharge. However, the trial did not provide intensive lactation support for infants. This study, funded by Global Health Trials and CHAIN (Gates Foundation), sought to explore the role of breastfeeding support in recovery of malnourished infants < 6m as sub-optimal breastfeeding was reported in 90% of the infants.

The objective was to apply the WHO guidelines on nutritional rehabilitation of malnourished infants < 6m, alongside clinical treatment and collect pilot data on breastfeeding, growth, morbidity and mortality. The study was to include 90 infants but preliminary data was presented for 45 infants aged 4-16 weeks with low MUAC/WLZ/WAZ, no congenital abnormality and the possibility to breastfeed.

The team developed a standard operating procedure (SOP) on breastfeeding support and monitoring, which is applied to each mother by peer supporters in a hospital set-up. Growth is monitored using weight velocity as recommended by WHO guidelines. Tools used for breastfeeding support in the ward include breastfeeding simulators, manual breast pumps and counselling cards.

A large percentage of infants (44%) have a history of LBW and normally present with respiratory problems. Their mothers are not malnourished but are largely illiterate.

A large proportion of infants with low anthropometry have some form of congenital malformation (35/106 screened) and need specialised feeding care. Mothers have multiple breastfeeding challenges, including those relating to technique, delayed start and perceived milk insufficiency. The SOP recommending active relactation for 14 days has managed to increase the proportion of infants exclusively breastfeeding from 53% at admission to 73% at discharge (results so far for 45 infants). However, just 64% of infants discharged on exclusive breastfeeding reached the WHO breastfeeding discharge criteria of sufficient weight gain on breastmilk alone for three consecutive days (>5g/kg/day).

The pilot data on growth indicates that Infants discharged having met the WHO breastfeeding discharge criteria may have higher average MUAC, WLZ and WAZ than those who did not meet the criteria. However, there was no statistical difference between the two groups. Notably,

both groups were still nutritionally deficient two months after discharge. These results indicate that meeting the WHO discharge criteria may not by itself lead to catch-up growth after discharge.

*Key messages emerging from the research include:*

- Strategy to use peer supporters to support breastfeeding in an inpatient setting is **acceptable and effective to re-establish exclusive breastfeeding** in a large percentage of infants admitted with acute malnutrition.
- On average, infants receiving breastfeeding support **gained weight and MUAC after discharge but this was not sufficient to improve WAZ and WLZ scores**
- Infants discharged after meeting WHO exclusive breastfeeding discharge criteria may have improved growth after discharge.

*Some challenges identified include:*

- How to define “cure” during hospitalisation? How to use and interpret weight velocity? There is a need to integrate clinical and nutritional care into a single set of guidelines.
- Who bears the “additional” cost of extended length of stay? Hospital-acquired infection risk is high, but what service can infants be discharged to?
- Tools are lacking to monitor the quality of breastfeeding post-discharge.

### Discussion

It was suggested that much of this support could be carried out in the community or sub-contracted out, but it would be very difficult to measure the 5g/kg/day weight gain recommendation using salter scales. In a small baby this amounts to just 20g/d; several factors can affect this, including volume of medication and a full bladder.

UNHCR experience in Congo was that mothers did not feel confident themselves as the weight gain is small and barely visible, so support was extended to between five to seven days or until the mother was confident. In this study, the first three days are usually spent stabilising the infant prior to fully engaging the mother.

Challenges were noted in managing the health or wellbeing of mothers while keeping them with their sick infants during admission to the neonatal unit; protocols dictate that sick mothers should be referred to the women’s ward and ways to manage this need to be found.

# 3 Collective thinking

The meeting divided into four working groups to examine policy, programming and research and agree on priority next steps for MAMI. Discussions and recommendations are summarised below. The groups then reconvened in plenary to share their conclusions, discuss each area and agree on priorities and next steps.

## **Group 1 examined what anthropometric indicators should be used in programming and research to identify nutritionally vulnerable infants.**

Ideally an indicator can be used in all settings; e.g. household, community, primary care, secondary care, tertiary care. MUAC and WAZ were agreed as anthropometric indicators of choice; however, MUAC and WAZ should be considered as measures of risk and not a diagnosis. Any contact point with an infant < 6m should be used as an opportunity to measure MUAC, and weight if possible.

The barrier to making a specific recommendation on MUAC is what threshold/cut-off to use: for 0-2 months there is not enough evidence; for 2-4 months, there is good evidence for <11cm; for infants >4 months, there is strong evidence for 11.5cm.

There is good potential to build the evidence gap on thresholds and caseload through analysis of existing data sets. This should include analysis of datasets with mortality and MUAC from a variety of contexts, especially for infants 0-2 months; determine whether adjustment for GA is necessary; and evaluate weight and MUAC thresholds at common age-specific contact points (e.g. vaccination) or within a narrow age range.

All surveys should include infants <6m, including MUAC to help build the evidence base.

Further primary research should test non-anthropometric discharge criteria; in infants <6m, health and feeding criteria are key determinants rather than anthropometric status. Research should include follow up of discharged infants <6m.

Evidence underlying recommendations should be published.

## **Group 2 examined how to address gaps around MAMI programming faced by implementing agencies in the immediate and longer term.**

To address immediate gaps, the group proposed:

- A global joint statement should be issued by UN

agencies and clusters on the importance of MAMI including a recommendation to include infants < 6m in assessments. Current data and experience could be used to inform the statement, with later buy-in from other stakeholders.

- Develop a forum for agencies implementing C-MAMI to share resources and experiences, collaborate on tool development and overview operational research.
- Use the No Wasted Lives initiative as leverage (as MAMI is an identified research priority) and target for funding.
- Use opportunities to share data and MAMI experiences at country level and exchange learning between operations (e.g. exchange visits).

Longer term, we need buy-in from wider coordination structures (e.g. government, Nutrition Cluster, agencies) to include infants <6m in assessments and to recognise C-MAMI as an essential emergency intervention. External advocacy is needed targeting larger organisations, coordination structures, donors.

The group also recommended review of inpatient guidelines to incorporate C-MAMI; building links with and empowering health providers on MAMI; a shift away from a narrow focus on acute malnutrition (to at risk); ensure enforcement of the International Code of Marketing of Breastmilk Substitutes; research that includes country stakeholders from the outset; and accelerated research to continuously inform guidance.

Key support sought from the MAMI SIG is development and endorsement of an actionable MAMI roadmap and agreement on key MAMI messaging for all to use in external advocacy. Key advocacy messages could include:

- C-MAMI prevents further malnutrition and saves resources in the short and long term.
- Advocate that key contact points (vaccination campaigns, expanded programme on immunisation (EPI)) include screening infants <6m.

We should take advantage of the interest in key crises (e.g. Rohingya) to push advocacy messages (e.g. joint interagency statements including MAMI).

Data on burden can be used to evidence advocacy; e.g. ACF has age-disaggregated data on age of all children admitted to programmes; 20% were aged 6-9 months in one location, which is an indirect indicator of < 6m caseload.

**Group 3 examined what is the key question to answer, what is the intervention package to be tested and what outcomes should be measured?**

The group identified the need to define the problem in each population (e.g. prevalence of LBW, identified co-morbidities, breastfeeding practices, maternal health) and discussed the potential to use existing datasets to analyse risk groups, explore interventions by risk group and context, and estimate proportion of infants unable to breastfeed. One opportunity identified was analysis scheduled by Gates Foundation (epidemiological analysis for wasting) that could add MAMI-relevant questions (e.g. on WAZ) and potentially include more datasets.

A MAMI package of interventions that requires testing should include: C-MAMI refined tool; antibiotics; maternal mental health; feeding protocols (breastfeeding quantity (duration) and quality, alternatives in cases of breastfeeding issues); ready-to-use therapeutic food (RUTF) as an adjuvant to treatment; and additional interventions where evidence is poor (e.g. as identified in the non-feeding review).

The key research questions to answer are: where does a MAMI intervention 'sit' (e.g. health, CMAM programme), and how does the delivery platform of a MAMI package vary by context?

Research should:

- Test the broader package of intervention to examine what is the effectiveness/added value of each component for specific target groups.
- Test refinements to the C-MAMI tool, building on previous work.
- Test discharge criteria.
- Demonstrate effectiveness and cost-effectiveness.
- Examine the sequence of delivery, delivery mechanisms (e.g. contact points, healthcare worker burden) and continuum of care (e.g. access of infants discharged from inpatient care to community-based support).

In terms of key outcomes, mortality would be ideal, but likely not feasible. The primary outcome should be growth.

Secondary outcomes are: breastfeeding practices duration and quality; cause-specific morbidity; readmission or 'adverse event'; developmental outcome (though difficult in this age group); maternal mental health; and bonding between mother and child.

Potential geographies were considered for future research. It is important to work across south Asia and Africa. Options based on previous research could include Kenya and Bangladesh. Emergency contexts should be considered. The research package and design would need to be tailored to the context.

**Group 4 discussed the findings of the non-feeding review in more depth and examined means to achieve consensus on recommendations for programmers** (with specific reference to the Delphi process).

A key consideration in discussion was the low level of direct evidence and weak evidence overall on non-feeding interventions. Discussion points included: the importance of context when examining evidence; antibiotics and resistance; community versus inpatient treatment; questions on case fatality in infants < 6m.

The group identified the need for urgent research on prioritised questions and the need for policy (WHO) and political (to influence donors) advocacy on critical gaps that currently 'paralyse' programmers.

We need to identify specific questions with which to examine existing datasets.

A Delphi consultation process could be used to secure consensus, using a selected group for review comprised of clinicians and programmers (rather than researchers) to examine which of these interventions will have the greatest effect and are most practical to implement.

Dissemination of the non-feeding review (informed by the MAMI SIG review) is important for advocacy; peer review publication that highlights the evidence gap is an important next step.

A MAMI SIG working group could lead to further work.

## 4 Reflections and conclusions

The challenge of having several MUAC cut-offs for infants < 6m was further discussed in response to the recommendations around anthropometric measurements. Although it was agreed that, depending on the intervention, a more sensitive, less specific cut-off could

be used (for breastfeeding counselling/support, for example), proposing too many cut-offs could create programming confusion and difficulty.

It was noted that having two sets of guidelines is a big

threat to health; for example, in Kenya, national guidelines, the WHO blue book and a set of malnutrition guidelines are all in use, with some differences in protocols between them. We need one set so that everyone is doing the same thing.

The move to discussion of 'failure to thrive', rather than 'acute malnutrition' was welcomed by the group, noting that WHO should lead in clarifying language/terminology and seek to avoid the confusion and varying use of language that currently exists between nutrition and medical texts.

With regard to the level of research and evidence to influence WHO guidance, it was noted that the guidance is quite flexible already in what it says, so there are several things we can move forward on. However, operational or

'implementation' research needs to be conducted with rigour; to be of use it must be systematic and seek to avoid loss to follow-up. Much of the CMAM protocol was introduced on the basis of expert opinion, without trials. Now it is difficult to do trials. The opportunity exists for MAMI to conduct research within the context of programmes and recruit control populations. We need to seize the opportunity to develop RCT/case-control trials. The window will close in a couple of years; we need to act urgently.

Key research questions have already been asked in WHO 2013 and the CHNRI MAMI review. In the next few months the group will have enough data to start designing the next round of research questions. There is huge potential but a need to proceed with care as there are risks as well as benefits of identifying at-risk infants, depending on what intervention is prompted.

## 5 Next steps

Through plenary discussion, priority next steps were identified – actions the MAMI SIG can undertake; actions that involve collaboration with the WaSt TIG; and actions that are deemed a priority but beyond current capacity of the MAMI SIG to take forward.

### *Further examination of existing datasets to provide more evidence*

- Investigate wasting and stunting concurrence in infants < 6m. MAMI SIG to follow up with WaSt TIG to explore potential.
- Obtain more data and reanalyse existing data to calculate caseloads in the < 6m age group and investigate whether GA needs to be considered for a different approach/indicators. Potential datasets include those from UNHCR, MRC Gambia data, Malawi data. There is potential for follow up on some datasets by MAMI SIG members as an initial step (Jay Berkley). Greater capacity needed for more comprehensive data collation and analyses.
- Drill down on specific questions that existing datasets could be used to answer; Gates Foundation has access to datasets and could think about how these might be used to facilitate answering questions if they are identified. Additional capacity required.

### *Priority areas of action for research*

- Review the list of research priorities for MAMI and agree on core pieces to take to NWL with identified potential partners; deadline of mid-February to submit ideas [www.nowastedlives.org](http://www.nowastedlives.org).

- Examination of discharge criteria is a priority area for research: should criteria include an anthropometric measure or focus on wellness, maternal confidence and ability to breastfeed effectively? Additional capacity required.
- Recommendations need to be tested to provide a more robust evidence base upon which WHO can act. Additional capacity required.
- Guidance and support to operational agencies needs to be provided to ensure robust and 'useful' data collection. A small working group could convene by email to develop guidance on how to collect data, to detail systematic approaches and issues around loss to follow-up and the importance of tracing all children enrolled in a study. ENN will follow up on capacity for 'light' support, additional capacity required.

### *Next steps for the C-MAMI tool*

- Set up a forum to discuss a C-MAMI implementation package. ENN nutrition groups portal is an option for this. ENN to explore.

### *Advocacy*

- Consider perinatal period cut-offs being variable depending on type of intervention: higher cut-offs potentially for less intensive interventions. Further analysis is needed to help determine whether variable cut-offs are practical.
- Follow up with UN agencies and Global Nutrition Cluster regarding drafting of a Global Joint Statement in order to get commitment on MAMI.

- The MAMI SIG can start to prepare key advocacy messages agreed on. ENN will initiate this.
- Develop an actionable roadmap (steps to integrate MAMI into the standard package of support). What steps can be taken now? Additional capacity required.

The group also identified next steps for joint work with the WaSt TIG:

- Work with WaSt TIG on further analysis of infants < 6m

data that they are analysing of WAZ/MUAC/WLZ across contexts.

- Further identify existing data to estimate caseloads (with MUAC and WAZ).
- Consider MUAC and WAZ (not WHZ) for discharge where MUAC cut-offs aren't working across different contexts/age groups (e.g. example of a child hovering at 122mm but clinically well to discharge).

## 6 Final words

ENN currently has limited funds to take MAMI forward; work to date relies heavily on pro bono contributions of members, which is critical but limits scalability and activity scope. ENN made an appeal to donors to step up and support the work further. Gates Foundation has data available to support pieces of research and has been impressed by the work of the group; how much it has managed to achieve to date and how it has moved the thinking forward. Given this, it will examine its role/engagement on MAMI/with the MAMI SIG.

Nicki Connell closed the meeting by reiterating the opportunities to work with the WaSt group and summarised that we now have access to essential pieces of evidence that can influence our programmes for the better and the importance of applying those learnings. The MAMI meetings are always inspiring, as this group

challenges the status quo, brings ideas and is not afraid to discuss and question them.

Nicki thanked ENN, the presenters and the donors, Irish Aid and Margaret A. Cargill through Save the Children, who have supported the MAMI work and meeting.

### Postscript on progress

Informed by the priorities identified at the MAMI SIG meeting, expressions of interest were subsequently submitted by ENN and LSHTM to address areas identified requiring additional capacity to take forward – specifically on indicators and thresholds (including shared analysis with the WaSt TIG), the C-MAMI package of support, and an RCT on C-MAMI. Complementary expressions of interest were also submitted by MAMI SIG members (C-MAMI implementation research).



WFP, Amadou Baraze

# Annex 1 Agenda

Time	Topic	Presenters
08.30 – 08.45	Arrival, registration and coffee	
08.45 - 09.35	Welcome, Introductions	Lola Gostelow, ENN consultant
09.35 – 09.45	1. Setting the scene	Marie McGrath, ENN
<b>Session 1: Identification of nutritionally vulnerable infants U6m</b>		
09.45 - 10.00	2. Anthropometric indicators evidence review – findings, questions, implications	Natasha Lelijveld, ENN/LSHTM/ACF
10.00 – 10.25	3. Non-feeding interventions review – findings, questions, seeking consensus	Tim Champion-Smith, ENN consultant
10.25 - 10.50	4. Burkina Faso analysis – implications	James Berkley & Martha Mwangome, KEMRI/Wellcome Trust Research Programme
10.50 - 11.15	<i>Coffee Break</i>	
<b>Session 2: Interventions – experiences</b>		
11.15 – 11.45	5. C-MAMI tool: observations from evaluation in Bangladesh & Ethiopia	Louise Day & Mary Lung'aho, Save the Children consultants
11.45- 12.15	6. Identifying & managing high risk infants in Rwanda	Katie Beck, Partners in Health
12.00 – 12.15	7. Opportunities & challenges on MAMI in the Rohingya response	Nicki Connell, Save the Children
12.15 – 12.45	7. Opportunities & challenges on MAMI in the Rohingya response	Nicki Connell, Save the Children
12.15 – 12.45	8. Improved Breastfeeding support to Treat Acute Malnutrition amongst Infants < 6 m (IBAMI)	Martha Mwangome (KEMRI/Wellcome Trust Research Programme)
12.45 – 13.00	9. Introduction to working groups & working group allocation	Lola Gostelow
13.00 – 14.00	<i>Lunch</i>	
<b>Session 3: Working Groups (WG)</b>		
14.00 – 15.00	<b>WG1:</b> Anthropometric indicators to identify high risk infants under 6 months <b>WG2:</b> Package of interventions – taking to next level (programming) <b>WG3:</b> Package of interventions – taking to next level (research) <b>WG4:</b> Non-feeding interventions review: discussion points & process for consensus	All
15.00 – 15.40	WG feedback	WG leads
15.40 - 16.00	<i>Coffee Break</i>	
16.00 – 16.45	Plenary discussion	Lola Gostelow
16.45- 17.15	Next steps	Lola Gostelow
17.15- 17.30	Close	Nicki Connell, Save the Children

## Annex 2 Participants list

Name	Affiliation
Aileen Wynne	GOAL
Alice Burrell	Save the Children
Amber Alayyan	MSF
Amy Mayberry	No Wasted Lives/ACF
André Briend	Independent
Anita Zaidi	Gates Foundation
Carlos Grijalva Eternod	UCL
Caroline Wilkinson	UNHCR
Dolores Rio	UNICEF
Donna Wegner	College of Medicine, Malawi
Elizabeth Bontrager	USAID
Emily Smith	Gates Foundation
Erin Boyd	USAID/OFDA
Hatty Barthorp	GOAL
Himali De Silva	MAITS (International disability charity)
Imara Gluning	LSHTM
Jane Hirst	Intergrowth/Interbio/Interpractice
Jay Berkley	KEMRI-Wellcome Trust
Karine Le Roch	Action Against Hunger
Katie Beck	Partners in Health
Kirrily De Polnay	MSF
Laura Lamberti	Gates Foundation
Louise Day	Save the Children consultant
Marisa Sanchez Peinado	Action Against Hunger
Mark Manary	College of Medicine, Malawi
Marko Kerac	LSHTM

Name	Affiliation
Martha Mwangome	KEMRI-Wellcome Trust
Mary Lung'aho	Save the Children consultant
Miriam Yiannakis	World Vision
Montse Escruela	MSF
Natasha Lelijveld	Action Against Hunger/LSHTM
Nicki Connell	Save the Children
Nigel Rollins	WHO
Severine Frison	Epicentre
Tim Champion-Smith	ENN consultant
Remote	
Natalie Avril	MSF
Kathryn Dewey	UCDavis
Andy Prendergast	QMUL
Sonja Read	LSHTM
Leisel E. Talley	CDC
Mija-Tesse Ververs	Independent
Elhadj Hallarou Mahamad	University of Brussels
Alice Nkoro	FHI360
Maryanne Stone-Jimenez	Independent
Cecile Bizouerne	Action Against Hunger
Rachel Lozano	ICRC
ENN	
Marie McGrath	ENN
Lola Gostelow	ENN consultant
Tamsin Walters	ENN consultant
Rachael Butler	ENN volunteer
Pamela Oloya	ENN volunteer

# Annex 3 MAMI presentations from WaSt TIG and MAMI SIG joint meeting 16 January 2018

## The MAMI story so far

– Marie McGrath, ENN and Marko Kerac, London School of Hygiene and Tropical Medicine (LSHTM)

### Origins

The MAMI project began in 2007, when NGO workers began sharing challenges with ENN around managing acute malnutrition in infants under six months of age, while protocols were lacking. These reports sparked a two-year MAMI project by ENN in collaboration with UCL, ACF and an advisory group of programmers, experts and academics funded by the Global Nutrition Cluster. The **project** investigated the global burden, guidance available and case management using secondary data analysis and qualitative research with humanitarian agencies.

**Key findings** included:

- Extrapolating **DHS data analysis** to an estimated 55.8 million infants < 6m in developing countries; an estimated 3.8 million infants < 6 months are severely wasted; and 4.7 million infants who are moderately wasted (WHO growth standards).
- A review of 37 national and international guidelines for SAM treatment found inpatient care dominated, with no community-based options for this age group. Admission criteria varied widely, including anthropometric, clinical and feeding criteria. Nutrition treatment centred around supplementary suckling.
- Published **analysis** of programme data from 12 countries found higher mortality in infants < 6m (4.6%), compared to 4% in older children in the same programme, with high variability between sites. A third of the countries had mortality rates of 11-20%. No information was available on clinical confounding factors on coverage of community SAM burden.

### MAMI SIG

The project concluded in 2010 with a long list of gaps and recommendations and a vision for a Global MAMI Network (see below) to address these. To make a start on this ambitious agenda, the **MAMI SIG** was born, initially comprising six people and now including around 36 members. A critical function of the group is to network researchers, practitioners and experts and to harmonise and collaborate on policy, research and programming. Members share experiences and undertake pieces of work to fill critical gaps that hamper programming. ENN

coordinates the group, collaborating closely with LSHTM and Save the Children US. The KEMRI-Wellcome Trust Programme in Kenya has driven MAMI research.

One of the key recommendations from the MAMI Project in 2010 was to explicitly recognise infants < 6m in global guidance and to offer community-based care as an option in this age group. This has been achieved through advocacy and direct engagement in the WHO guidance development process: infants < 6m were specifically mentioned for the first time in the WHO SAM guidelines 2013, with the division of “complicated” SAM for inpatient treatment (as before) and “uncomplicated” for outpatient care, which was new.

While international policy for MAMI is now strong, moving forward with programming has been slower, with resistance to policy change at country level fuelled by lack of evidence, lack of simplified protocols and concerns on capacity. The MAMI SIG has been examining experiences from rollout of other initiatives; e.g. CMAM and opportunities for compatibility of MAMI with other approaches/key entry points; e.g. EPI/vaccination contacts, health facilities and community groups. MAMI needs to be simple to make sure it is deliverable at country level.

In April 2015 the group published **research priorities** to improve the management of acute malnutrition in infants aged less than six months (MAMI). The top five research questions have informed the priority activities of the MAMI SIG:

1. How should infants < 6m SAM be defined?
2. What are the key opportunities/timings where infant SAM management can be incorporated with other healthcare programmes?
3. What are the priority components of the package of care for outpatient treatment of infants < 6m SAM?
4. Having detected SAM in the community, what is the efficacy of providing targeted, skilled breastfeeding support to caregivers of stable infants?
5. How can existing tools be adapted and/or linked together to better identify and manage infants < 6m SAM?

## MAMI direction

Over the last 10 years, our understanding of MAMI has evolved. This is reflected in the recent acronym change from 'Management of acute malnutrition in infants' to 'Management of nutritionally **A**t risk **M**others and **I**nfants', noting that the challenge is broader and more encompassing. The term 'acute malnutrition' is off-putting at country level; 'at risk' bridges the gap between treatment, care and prevention.

*The MAMI vision is that every infant under six months, at every community/ health-service contact, is nutritionally assessed and appropriately supported: to survive and thrive*

It is vital to get treatment right for infants at risk: too slow/inadequate response can lead to short-term increased risk of death, whereas a rapid/excessive response can result in a longer-term increased risk of death/non-communicable disease. Anthropometry is a symptom, which should flag the questions: *Why are these infants small? Are they small and growing well or small (or big) and drifting down their growth curves? Is the underlying factor related to disease or breastfeeding failure; is the latter simple or more complex?*

Breastfeeding failure can result from a range of different issues, including maternal depression/mental health. It is vital to consider the infant and mother pair and examine the wider picture of underlying factors.

There is an urgent need to identify and manage at-risk infants < 6m and to broaden our horizons in how we do this. A Save the Children Bangladesh cohort study showed that, at six months of age, of those identified with SAM around birth, 66% no longer had SAM. However, infants who had 'recovered' were significantly more underweight and stunted than infants who had not been malnourished.

IYCF is the bedrock (primary prevention) of the approach; MAMI comes in later (secondary/tertiary):

- **Primary:** health promotion and other activities on the determinants of health to prevent disease occurring. ('Upstream' actions to stop people becoming ill.)
- **Secondary:** early detection of disease, followed by appropriate intervention, such as health promotion or treatment.
- **Tertiary:** reducing the impact of the disease and promoting quality of life through active rehabilitation.

The **C-MAMI tool**, developed by ENN, LSHTM and partners, was a first step to catalyse community management of at-risk infants. Members of the MAMI SIG are currently trialling the C-MAMI tool and have gathered observational reports; however, there is an urgent need for a robust trial to examine effectiveness.

The potential around MAMI is huge. But the needs are outstripping the grassroots, informal initiative of the group. It is time to scale up to achieve a vision of a *Global MAMI Network* to galvanise and support collective, collaborative, harmonised efforts on research and policy informed by, and to inform, practice. Such a coordinated effort would harmonise data, collaboration on research, identification and tracking 'potentially better practices' to fill immediate gaps and documented outcomes. It would work across disciplines and contexts at global and country levels. It would involve multi-centre intervention trials, well designed operational research, and harmonised programme data reflecting national priorities and different contexts. Real-time learning would be a cornerstone. Such an initiative would help bridge divides: sectors, humanitarian/development, prevention/treatment.

## Conclusions

Infants <6m are now on the international policy agenda but **country-level policy and programmes are lacking, fuelled by weak evidence.**

Key issues we need to address include:

- How do we achieve optimal growth amongst nutritionally vulnerable infants?
- How do we deal with complex underlying diagnosis through feasible programming?
- What does the package of care look like? Breastfeeding support is necessary but not sufficient.
- We need to reframe our thinking to see prevention and treatment as one and build bridges between MAMI and IYCF approaches.
- We must embed interventions in wider health programmes, such as integrated management of neonatal and child illness (MNCI).

Our vision is that every infant has an infant Nutrition Action Plan – to get there, we urgently need:

- **STRONG evidence in the form of phase 3 RCTs**, and
- **a ROBUST coordinated network of learning and exchange.**

## Key MAMI research findings

– Martha Mwangome and Jay Berkley, KEMRI-Wellcome, Kenya

The MAMI SIG has pursued the priority questions highlighted in the 2015 CHNRI research prioritisation exercise (see above) through the following key pieces of research:

- Carlos Grijalva-Eternod et al. examined programme datasets from 2004-2008 in 12 countries comprising admission profiles of infants < 6m (see above). This highlighted the challenge of missing anthropometry in many datasets but revealed that infants < 6m made up a significant proportion of children in SAM programmes.

How to define SAM in infants < 6m has been a key question for the group:

- Modelled on an approach by Myatt et al in 2006, an ENN/LSHTM/CHAIN review investigated performance of anthropometric indicators in infants < 6m. MUAC and WAZ came out as the best anthropometric indices.
- Data from Keneba, Gambia was examined to compare MUAC and WLZ as predictors of mortality in infants < 6m since 1974. WLZ identified only three of 40 deaths. A ROC curve showed that WLZ was a poor predictor of mortality; MUAC performed better.
- AJCN 2017 published a [community cohort study](#) of 2,882 infants admitted in Kilifi hospital, Kenya, with remote follow up at three-month visits of 1,455 discharged infants. Inpatient mortality comprised 140 infants. WAZ performed slightly better than MUAC at predicting inpatient mortality. WLZ data is often missing because there is no reference below 45cm, or patients are severely ill and die before length is measured.

Data is required that have been systematically collected with long-term follow-up. This data is rare.

- Data secured by ENN from Burkina Faso has provided one such dataset, which is currently under analysis by the original researcher/ENN/LSHTM/KEMRI-Wellcome. Anthropometric and mortality data of infants were gathered monthly from birth to one year. Analysis is being finalised. Low birth weight (LBW) babies are of particular interest; mortality is significantly higher and their growth curves continue to diverge from normal birth weight (NBW) babies over time. LBW sets a child up for long-term increased mortality risk. Many are in trouble before the 6-14-week check; <115 mm MUAC screening at vaccination time (two months of age) could pick up a hugely at-risk group. WAZ<-2 was not predictive of mortality but WAZ <-3 was.
- Data examined from a clinical trial in Kenya of complicated SAM follow-ups for one year revealed that LBW infants with SAM have the same mortality risk as non-LBW SAM infants.

Breastfeeding in SAM infants < 6m is an important area of investigation.

- A LSHTM research student investigated mothers' willingness to implement the supplemental suckling technique in Malawi. Perinatal depression was notable, affecting the effectiveness of breastfeeding in the following ways: mother likely to report insufficiency of milk; fewer days of exclusive breastfeeding; and early cessation.
- A study exploring the role of breastfeeding in support and recovery of malnourished infants < 6m (Improving Breastfeeding support to treat Acute Malnutrition amongst Infants under 6 months (IBAMI) study, KEMRI-Wellcome) aims to apply WHO treatment guidelines rigorously and evaluate impact on breastfeeding, growth, morbidity and mortality after discharge. Infants discharged on the WHO breastfeeding discharge criteria had subsequent higher average MUAC, WLZ and WFAZ than those who did not meet the criteria, but the differences between the groups were not statistically significant. Both groups were still nutritionally deficient two months after discharge. The results indicate that meeting the WHO discharge criteria may not by itself lead to catch-up growth after discharge.

Outstanding questions include:

- Whether to use MUAC or LBW to define risk at birth.
- Feasibility of introducing screening at every infant contact and link to growth monitoring.
- What package of support is needed for infants after discharge from SAM treatment?
- How to manage infants without a possibility to breastfeed.
- Gaps in guidance regarding non-feeding interventions (e.g. antibiotics, micronutrient supplementation).

### Key points from plenary discussion Implications of the findings and suggestions for further analyses

Attempts to examine what the infants died of in the Kenya studies have been difficult: did they become malnourished again before dying, or did they suddenly die? The group wants to research this more.

The Burkina Faso dataset shows that, at one month of age, the majority of severe WAZ were LBW. Are the origins of SAM in infants < 6m and children > 6m equivalent?

The majority of moderate wasting occurs in the first 24 months of life; can we trace it back to LBW and wasting in the first six months?

After six months it's hard to shift a child's track; even after six weeks it becomes more difficult. The true window of opportunity may be much shorter than 1,000 days.

A stratified approach to monitoring and follow-up of children might be useful to separate those at high risk. WAZ could be good for this as it's already used in growth

monitoring. There is scope for increased collaboration with groups working on neonatal nutrition.

Maternal stunting was strongly associated with LBW, wasting of children and subsequent mortality in Malawi; BMI wasn't. The Burkina Faso dataset has this information and is being examined.

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