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Meeting Report

Management of Acute Malnutrition
in Infants under 6 months (MAMI)
Interest Group Meeting

28th January 2016



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The meeting was co-hosted by ENN, London School of Hygiene and Tropical Medicine (LSHTM) and Save the Children as part of an ongoing collaboration on management of acute malnutrition in infants under 6 months (MAMI)¹.

The meeting was prompted to facilitate exchange of experiences, policy and research relevant to MAMI, to identify opportunities to engage with reproductive and neonatal health, and to spotlight emerging research priorities in order that partners can mobilise resources to address these moving forward.

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1 Meeting overview/presentations and discussion

The overall aim of the meeting was to identify synergies, opportunities, priorities and steps to help develop the evidence base on MAMI. There were 29 participants, including two remote (see Annex 1).

The objectives were to:

- 1) Share recent research and initiatives around MAMI.
- 2) Share planned activities for the future.
- 3) Review if priority research questions are being addressed and what gaps remain (if any).
- 4) Agree long term ambition(s) for MAMI (5 year goals) and identify steps needed to achieve them.

Prior to the meeting, a number of operational agencies and researchers had sought clarity on the case definition for malnourished infants and the need for clear advice to field teams on how to move forward with management protocols that consider the mother/infant dyad.

Throughout the proceedings, consideration was given to the top 15 MAMI research questions identified in the 2015 Child Health and Nutrition Research Initiative (CHNRI) research prioritisation², and the priority WHO research questions for this age group noted in the WHO Guideline on Updates on the Management of Severe Acute Malnutrition in Infants and Children released in 2013 (see Annex 2)³. Presenters were asked to highlight

which CHNRI-linked research questions their work is already linked to/could link to, where appropriate.

Three presentation sessions were categorised according to those used in the MAMI CHNRI review – the first morning session covered background/epidemiology and the second session focussed on interventions. Health policy and systems considerations run through both. The third session focused on linking and learning with others. Priority actions and research were identified in group work. The agenda is included in Annex 3.

Full meeting presentations are available on request from ENN; a summary of the presentation content is included in this report (Boxes 1-3).

¹ <http://www.enonline.net/ourwork/research/mami>

² 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

³ WHO, 2013. Updates on the management of severe acute malnutrition in infants and children. Guideline.

1.1 Session 1 (Background/epidemiology)

Box 1 Overview of session 1 presentations

Update on WHO MAMI related guidance & training. *Zita Weise Prinzo, WHO*

Headlines:

- 1) Management of SAM guidelines now specifically includes MAMI
- 2) Various guidelines/training tools exist on newborn and child health and on infant feeding that impact on MAMI; an orientation for all was presented
- 3) Support for research to build evidence needs strengthening

Of note, monitoring of wasting in infants is a global target.

Scheduled updates:

- Integrated Management of Childhood Illness (IMCI) Strategic Review – emerging priorities, new developments, lessons learned (Feb 2016)
- Guideline: preventing obesity in children and adolescents through appropriate infant and child feeding practices in the IMCI context (2016)
- Training Course and manual on SAM to be online (2016)

Update on MAMI research in Malawi. *Marko Kerac, LSHTM*

Three studies were presented:

- 1) Prevalence study on infants under 6 months (infants <6m) in Malawi that found kwashiorkor rare, wasting low (1.6%), low Mid Upper Arm Circumference (MUAC) more common (3.5%), 10% low birth weight (twice as likely to be malnourished). Significant errors in weight measurement were found (measuring with clothes adds 495g).
- 2) Carer/healthcare worker perspectives in Malawi highlighted wider community and social context matters to MAMI; potential to work with established community groups; need for community/hospital referrals and synergies; and need for 'tangible' community interventions.
- 3) Audit of inpatient infants < 6m in Blantyre, Malawi found that inpatient wasting is high (10% WHZ <-3) with an associated high mortality. More work needed to test human (e.g. specialist feeding personnel) and systems/training interventions to improve outcomes.

Next steps needed:

- Community cluster Randomised Control Trial (RCT) testing outpatient-based care
 - Randomised control trial (RCT)/operational research testing improvements to inpatient-based care
- MAMI CHRNI research priorities 7, 10, 13, 19**

Update on MAMI research in Bangladesh. *Nicki Connell, Save the Children*

Save the Children-led research is underway in Barisal, Bangladesh in order to:

- a) estimate the prevalence of infants <6m with acute malnutrition in the community
- b) collect data to input into an assessment tool for infants <6m with acute malnutrition
- c) describe current outcomes following infants <6m with acute malnutrition.

This involves two prevalence surveys and one prospective follow up study. Preliminary results on prevalence amongst infants < 6m (n=742): MUAC <11.5cm: 9.6% (Mar-April), 10% (Sept-Oct); Weight-for-length (WFL) <-3 z-scores: 0.8% (Mar-April), 5.9% (Sept Oct). Provisional findings on outcomes: Maternal education is potentially a risk factor; family income and electricity availability is significantly lower in the low WFL group; maternal mental health needs further investigation.

MAMI CHRNI research priorities 1, 3, 19

Risk factors for acute malnutrition in infants aged <6 months: secondary data analysis of 20 Demographic Health Surveys (DHS). *Severine Frison, LSHTM*

Preliminary findings from a secondary data analysis of 20 DHS to assess risk factors associated with wasting in infants < 6 months (in preparation for publication). Biologically plausible and/or socially important risk factors identified were: household sanitation, maternal education, maternal nutrition, domestic violence, antenatal care practices and early breastfeeding practices. Findings will inform future intervention strategies and assessment tools.

MAMI CHRNI research priorities 3, 5

Four presentations were given in this session (see Box 1). Key points emerging from the subsequent discussion were as follows.

Upcoming opportunities regarding WHO guidance

Upcoming opportunities and guidance revisions with regard to WHO guidance include:

- IMCI strategic review is due to commence in February 2016.
- Guideline on preventing obesity in children and adolescents through appropriate infant and young child feeding practices in the IMCI context to be published mid- 2016.
- Training course on SAM updated - needs to be published online.

The update of the SAM manual is to undergo peer review prior to publication. In line with the global target to reduce wasting, WHO is highlighting infants less than 6 months as a specific age group to support.

To facilitate quick dissemination of new guidance, it would be helpful if separate chapters of IMCI could be updated and disseminated individually. This will be attempted with the nutrition guidance updates.

There is no clear process/mechanism to map progress on the WHO Nutrition Guidance Expert Advisory Group (NUGAG) research questions within WHO. This group could make recommendations to WHO regarding emerging evidence/recommend review.

Definitions of infants at risk: MAMI/ “nutritionally vulnerable infants”

There is a need to distinguish between infants who are small but normal and others who need support.

Discussion centred on whether weight for length (WFL) is the appropriate measure and the value of the measurement if it is not done or recorded properly. MUAC often identifies more infants, but there is uncertainty around the meaning of MUAC cut-offs in infants < 6m; MUAC variability is very broad in this age group. It was suggested that weight-for-age (WFA) should also be included as an anthropometric criterion; evidence of risk of low WFA is similar to low WFL.

Data on reliability of markers would be useful; length measurements become more unreliable as infants get younger. Even in studies where there is good reliability of measurements, combining into the WFL indicator often squares the errors.

Wider family and social context matters/focus on human interventions

Work is ongoing to look at the role and influence of

women’s/ mother’s groups and community influencers, such as the church.

Further investigation into types of effective support for the mother is needed.

Emphasis was placed on the need to try more human interventions, such as dedicated breastfeeding nurse support (reflected in Malawi research), and exploring the potential to revive the Baby Friendly Hospital Initiative (BFHI). Specialist nurse interventions need costing. Such approaches could be more cost-effective than other forms of medical intervention.

Some vulnerability (mother needing social support, etc.) could be picked up earlier in pregnancy to prevent wasting/stunting.

A search of the evidence base found a lack of data available to suggest that interventions to the mother during breastfeeding can affect infant growth/outcomes.

There remains a lack of easy-to-use standard guidance on how to assess mothers’ mental health.

Examination of cross-sectional data from DHS can generate hypotheses. The findings of presented data reinforce that a package of interventions is needed.

Key questions and considerations from the group in this session were:

- Which MUAC cut-off to use and how to use it?
- How to identify nutritional vulnerability in infants <6m?
- There is potential for enhancing community interventions such as use of community groups. However, people with a problem prefer individual support, not group support.
- Consider the mother within the household/family – wider support group is influential.
- The zone between prevention and treatment offers an opportunity to prevent later wasting and stunting.
- As mortality decreases, we have more survivors; what does this mean for their long-term prognosis/ perspective?
- There is an opportunity for big impact through community level interventions, but it is important not to forget the importance of hospital level support.
- How many of those infants small at 6 months will catch up? It would be useful to take birth measurements, measurements at immunisation opportunities and at 6 months to map the trajectory.

1.2 Session 2 Current and future interventions

Box 2 Overview of session 2 presentations

Improved Breastfeeding support to Treat Acute Malnutrition amongst Infants under 6 months (IBAMI) & other MAMI initiatives. *Martha Mwangome and Jay Berkley, KEMRI, Kenya*

A) KEMRI clinical trial

This involved a clinical trial (antimicrobial prophylaxis) amongst sick infants < 6m (n=306) with severe acute malnutrition (SAM). It investigated outcomes over 12 months, anthropometric characteristics, preterm/low birth weight, anthropometric recovery and subsequent risk of death. Admission was MUAC <11cm (baseline 9.6cm). Findings include: 45% of deaths occurred after 2 months treatment; 35% achieved MUAC 11.5cm after 2 months; 65% achieved WLZ >-3 after 2 months; mean % weight gain after 2 months was 28%; absolute weight gain after 2 months was 1.04kg. Key conclusions: Young infants need early detection as have very poor outcomes; sick SAM cases identified by MUAC are also very stunted; preterm or low birth weight (LBW) are different but not necessarily protected; MUAC, WLZ or WAZ could be used to discharge or monitor; interventions need to consider feeding support, cash and social care.

B) IBAMI research

Infants treated for SAM remain vulnerable: they barely catch up in growth 12 months after discharge; early weight gain is protective of death – 10% of body weight is gain by month 1 of life. A number of RCTs are being pursued to explore outcomes amongst infants with potential to breastfeed, with intensive inpatient feeding support and community based follow up support versus standard care. Primary questions: 1) Exclusive breastfeeding (EBF) retention rate amongst discharged EBF SAM cases; 2) Nutritional recovery amongst discharged EBF infants. Research will include qualitative data, cost of optimising WHO treatment (lactation) and maternal mental state.

MAMI CHRNI research priorities 1, 3, 4, 7, 13

GOAL's experiences of integrating infantile screening (using MUAC) and programme admissions into operational settings. *Hatty Barthorp, GOAL*

MUAC screening of infants <6m is conducted by GOAL a) in Ethiopia (refugee camp setting) and b) amongst infants 2-6 mths as part of GOAL's Nutrition Impact & Positive Practice (NIPP) Circle project.

In **Ethiopia**, it has been challenging to incite staff to collect data (seen as extra burden for no programmatic gain); initial in-country data proved incomplete. Minimum data on infants 0-<6m screened and infants admitted for treatment is now gathered. Collective data (2014/15) shows a low caseload (2.1% - 2.3% in 2015) relative to global estimates (19%).

In **NIPP Circle project**, infants 2-5.9m are admitted with MUAC <11cm. Of 51 cases admitted, 64% successful 'graduation' (achieve MUAC>11cm), 1.9% default, 27% non-responder. Operational challenges have been: getting buy-in from field teams to see infants (and pregnant and lactating women (PLWs)) as priorities as programmes default towards focus on 6-59m; ensuring there is capacity in countries on effective management of cases; lack of in-country experience; perception that MAMI requires 'soft skills' that have lower priority than tangible elements of Community-based Management of Acute Malnutrition (CMAM). Greater training and investment in programme design is required for effective programming and associated monitoring. Key questions: 1) What developments are happening/planned regarding MUAC cut-offs for infants <6m? 2) Have there been any updates in the estimates for the 0-6m contribution to the U5 global SAM and Moderate Acute Malnutrition (MAM) caseloads?

Cont'd

Updated review of national guidelines on MAMI: key findings. Marie McGrath, ENN

An updated review of 46 national SAM guidelines was conducted regarding specific content on MAMI. AGREE (Appraisal of Guidelines, Research & Evaluation) criteria were applied. Only one guideline recognised uncomplicated case management (outpatient) of infants <6m, the remainder catered for inpatient care. None recommended MUAC for infants <6m. All noted clinical criteria independent of anthropometry. Key findings include: a) there is disparity between 2013 WHO guidance (recommends outpatient care for uncomplicated infants <6m) and national SAM guidance (inpatient care for all); b) MUAC is not recommended as a criterion (this reflects current WHO guidance); c) applying AGREE criteria, there was a lack of patient involvement in guideline formulation; the evidence on which guidelines are based is not well documented; guidelines have a few common ancestors; most did not cater for infants <6m to be separately identified and outcomes reported. This review reflects opportunities: a) there is consistency in case definition approach (clinical criteria and caregiver issues are included), b) infant <6m malnutrition is explicitly recognised – updated content could be annexed to existing national guidance.

C-MAMI Tool: Next steps. Marko Kerac, LSHTM

The C-MAMI tool was developed as a simple, first step stop-gap to help operationalise the 2013 WHO guidance regarding community based management of uncomplicated infants <6m. Content was inspired by and modelled on the Integrated Management of Childhood Illnesses (IMCI) approach to complement existing content and feed into future IMCI updates. Noted was discordance between IMCI (2014) nutrition guidelines and WHO (2013) SAM guidelines regarding infants <6m. Critical next steps are a) to pilot the C-MAMI tool, ideally through a community cluster RCT b) feed into IMCI updates.

Four presentations contributed to this session (see Box 2). Key points emerging from the subsequent discussion were as follows:

In the KEMRI study, WLZ in infants <6m undergoing treatment showed rapid recovery in the first 2 months, then flattened off. One reason is because height-for-age z score (HAZ) goes down in the first 2 months (children were gaining weight but not height). MUAC and WAZ recover more slowly and continue.

Average MUAC at baseline was 9.5cm. Reaching 11.5cm after 2 months was highly predictive of survival.

WLZ<-3 may be too low to identify infants at risk of death in this age group. MUAC cut-off at 11cm and even 11.5cm may also be too low. Infants need to be picked up earlier.

WLZ and MUAC were both similar in predicting progress and both could be used for discharge.

The IBAMI study aims to experiment with different approaches of home-based counselling (intensive/less intensive), borrowing approaches from mother-to-mother community support groups, which are working well in Kenya, and bring these into the clinic setting. The aim is to try to optimise breastfeeding as far as possible and see what the outcomes are. It is important to see what can be achieved through breastfeeding before we go 'all out' on other interventions.

It is important to examine the first two months of life. In the first four weeks of life, a baby grows fast and gains length at a rate of 1cm per week; if something disrupts

this, what are the implications?

GOAL presented operational challenges of screening entire refugee camps, but not picking up the cases under 6 months. Some UNICEF programmes have also found less than 10% of caseload to be under 6 month SAM (using WFL); these findings do not tally with global estimates of burden in this age-group. It is unclear whether this is the actual level of SAM in infants <6m in these contexts or whether it results from a failure to adequately screen this age group. In camp situations, reproductive health services could be organised better – there are lots of opportunities that are being missed.

Discussion on the *C-MAMI tool*⁴ highlighted the importance of adapting it locally to the context. The tool could be adapted for a variety of uses: translated into an admission card; a simple checklist could work well.

Other questions raised and addressed were:

- Non-breastfed annex could be integrated as a section (response: it was considered during development but was annexed to aid flow of the tool and to mirror IMCI; in actuality, it is a significant section).
- Alternative versions using different images would help cater for a global audience (response: this was beyond the scope of the first iteration of the tool; this will emerge in future versions/field adaptations).
- Management of complicated moderate acute malnutrition (MAM) is missing (response: this was not intended; C-MAMI tool will be reviewed in light of this).
- Could bring out more about pre-term, small for

⁴ Available at: www.ennonline.net/c-mami.

gestational age (SGA) babies (response: this will be reviewed in future version).

Despite its recognised limitations applied to infants < 6m, WFL was included in the C-MAMI tool assessment criteria in accordance with WHO guidelines; departure from this risked causing difficulties at country level. MUAC was considered for inclusion in light of emerging evidence but cut-offs need to be agreed for this age group (the tool suggests gathering MUAC data for research purposes only). WFA is included. There are emerging concerns that using WFL/WFH in stunted populations to dictate treatment runs the risk of inducing

obesity and makes screening highly challenging. The use of WFL in infants <6m is based on an extension of what is recommended for older children.

The emerging consensus from discussions was that the evidence base for current WHO recommendations regarding anthropometric criteria for acute malnutrition in infants <6m should be reviewed. The addition of MUAC and WFA criteria should be investigated. WHO will positively consider any such recommendations emerging from this meeting that would likely prompt a WHO consultation. A specific recommendation is included at the end of this report.

1.3 Session 3 Linking with and learning from others

Box 3

Overview of session 3 presentations

MAMI opportunities: Ending Preventable neonatal deaths and stillbirths: an update on the Every Newborn Action Plan (ENAP). *Hannah Blencowe, LSHTM*

Possible linkages between MAMI and ENAP include:

- a) Focus on mother-infant dyad
- b) Primary prevention of consequences of adverse nutrition in infants and children (both population and high-risk identification approach)
- c) Identification of those reaching a nutrition-risk threshold, using existing contact points with health systems – antenatal care (ANC), labour care, postnatal care, Immunisations and involving families, communities and extension workers
- d) Interventions to prevent adverse outcomes through packages of care for mother-infant dyad (preventive & curative) - a specific example is linkages to nutritional aspects of packages of care for small or sick newborns
- e) Ten core indicators track ENAP progress. Indicator 6 (Essential newborn care) tracer is early breastfeeding. Additional indicators include exclusive breastfeeding up to 6 months.

MAMI opportunities: Intergrowth and INTERBIO-21st study. *Jane Hirst, University of Oxford*

The INTERGROWTH-21st Project has generated international “prescriptive” foetal growth, newborn size and preterm postnatal growth standards (part of a package of international standards). The standards are based on data from eight international sites low-risk study population as healthy and well-nourished (optimal conditions). Concepts overlap with WHO Growth Standards (from birth). Neurodevelopmental outcomes at 2 years have been explored in a cohort (5 sites). Growth phenotypes (wasting and stunting at birth) may have origins in utero and are being explored. Stunting at birth is associated with maternal age, maternal illicit drug use, maternal smoking, short maternal height, suspected Intra-Uterine Growth Restriction (IUGR) in pregnancy. Wasting is associated with gestational diabetes (protective) and more acute events, such as neonatal intensive care stay >7days, no oral feeding >24h, respiratory distress syndrome and transient tachypnoea. Some conditions (e.g. pre-eclampsia) are associated with both. Assessment of newborn length in routine statistics would enable assessment of adiposity and linear growth.

Cont'd

Body composition research in Ethiopia. *Carlos Grijalva-Eternod, UCL*

Data on body composition can improve understanding on relations between growth and disease risk through life. Evidence on MUAC and WLZ associations with body composition were presented from a cohort of Ethiopian infants. Of note, 50% of final boy's height is achieved by 2 years of age; 50% of weight is achieved by 11 years (girls achieve this slightly earlier). Key findings include:

- Lean mass has a very close relationship with length.
- Both MUAC and weight have strong relationship with fat free mass (FFM). WFL has a stronger association with fat mass and FFM than MUAC; MUAC has a stronger relationship with length.
- WFL is sometimes affected by fat mass and sometimes by FFM; MUAC is more prone to be affected by fat mass.
- MUAC at all ages has a strong relationship with HFA.

An emerging hypothesis from this work is that MUAC reflects growth (nutritional vulnerability) while WLZ more closely reflects nutritional status.

Three presentations informed this session (see Box 3). Key points emerging from the subsequent discussion were as follows:

Links with neonatal care

This session highlighted the need to consider infants across the continuum from pregnancy through birth to improve outcomes. There are improvements in recording of birth weights, but facility-born babies go home and when they visit the health post for immunisations, their records start again. We need seamless records.

There are good opportunities to connect MAMI with neonatal health. Strategic opportunities were highlighted in the *Every Newborn Action Plan (ENAP)* presentation.

A key question posed is how to identify newborns reaching a nutrition-risk threshold – are the same indicators valid at the time of birth? How can we identify them then/early?

Small for gestational age (SGA), pre-term and sick newborns are likely to be picked up within existing neonatal services; those not feeding well are considered nutritionally vulnerable, but there are no clear criteria. We don't yet know enough about how to support breastfeeding in small and sick newborns in low-income settings.

Intergrowth

Intergrowth has developed charts to standardise optimal foetal growth⁵. These are based on data from eight sites where infants have optimal birth opportunities. The study showed a low proportion of preterm births (<37 weeks): 4.5% (half of what is expected in a normal population).

Variation in growth of babies and size at birth due to ethnic differences was very low; variation within populations is much more than the variation between countries.

Intergrowth are currently working to explore the concept that preterm babies may grow differently than those

born at term; growth trajectory is different.

Wasted babies had worse perinatal outcomes. Stunted outcome was associated more with maternal factors (smoking, short stature, etc.) throughout pregnancy.

Maternal gestational weight gain charts need further testing; weight can be due to a variety of factors (oedema, fat etc.) not related to nutritional status.

The question was raised regarding what does this mean in terms of functional outcomes. A follow up study in the field, *Inter-bio*⁶, involving the Intergrowth Team and the Wellcome Kilifi team is underway, looking at more outcomes under less than ideal conditions (MUAC is not being measured; it was too late to add it to the protocol).

Body composition

Body composition research in Ethiopia sought to freshen how we look at data by asking 'What body composition signals are behind anthropometric measurements?' This study raises a number of questions:

- How much of the MUAC/mortality relationship is driven by height? Stunting is associated with mortality, so is MUAC.
- Instead of looking into lean mass/muscle mass; should we be looking at fat mass? What is the role of leptin?
- It may be useful to rephrase the MUAC and WFH questions: what is each measurement telling me about this child in front of me?
- MUAC could potentially be marking something that happened in utero.

The presented data is from healthy growing infants; we need to examine malnourished children. For example, we don't understand how the body re-compartmentalises weight in response to malnutrition. MUAC has been observed to lag behind weight; weight in a sense may be an early marker and MUAC a later one.

⁵ www.intergrowth21.org.uk

⁶ www.interbio21.org.uk

2 Prioritisation exercise

2.1 Method

Participants were divided into three groups. Each group was asked to brainstorm and list all the perceived needs for immediate action and for research under the headings of Epidemiology, Intervention and Policy (the CHNRI MAMI research prioritisation categories). Once the groups had each prepared a long list, they were asked to select the group's top three priorities under

each heading. The top three from each group were then gathered, presented on the wall and discussed. Finally, participants were given five stickers and asked to individually vote for those identified actions/research they considered the topmost priorities. Each participant could put all their stickers on one action, use one sticker per action or any other variant in between.

2.2 Findings

The tables below list the selected priorities that were displayed on the wall in descending order of the number of votes received.

2.2.1 Epidemiology

Priority	Theme/issue	Notes (as detailed in group work)	Is this (R)esearch or (P)olicy?	Number of votes (red stickers)
1	Changing case definition of vulnerable infant	MUAC for all <6 months Include MUAC for infants <6m in surveys (DHS, MICS, SMART, SENS) Collect MUAC on admission & discharge, at immunisation	P, R	14
2	Changing case definition of vulnerable infant	Move from WLZ to WAZ	P, R	13
3	Changing case definition of vulnerable infant	Introduce MUAC for infants <6m and investigate thresholds	P, R	11
4	Investigate & understand outcomes and risk factors	Longitudinal outcomes: Catch up growth Developmental Obesity Mortality Morbidity	R	4
5	Investigate & understand outcomes and risk factors	Risk factors Which WAZ/MUAC cut-off best identifies high-risk infants?	R	0

Cont'd

Priority	Theme/issue	Notes (as detailed in group work)	Is this (R)esearch or (P)olicy?	Number of votes (red stickers)
	Case identification/targeting	Which WAZ/MUAC cut-off best identifies high-risk infants?	R	0
	Investigate & understand outcomes and risk factors	Programme data/standard data	R	0
	Investigate & understand outcomes and risk factors	Breastfeeding status at admission and discharge	R	0
	Case identification/targeting	Data on <6 months: accuracy of measures to identify nutritionally vulnerable infants	R	0
	Changing case definition of vulnerable infant	Longitudinal data to help create definitions (vs 1 time data): MUAC, WAZ, WHZ/WLZ?	R	0
	Changing case definition of vulnerable infant	Switch to WAZ (<-3), MUAC (<115) to define nutritionally vulnerable infants	R	0

2.2.2 Interventions

Priority	Theme/issue	Notes (as detailed in group work)	Is this (R)esearch or (P)olicy?	Number of votes (red stickers)
1=	Improve breastfeeding/infant feeding support in MAMI context	Pilot practical interventions to improve design of breastfeeding counselling	P, R	6
1=	Support mothers during pregnancy and lactation	Maternal supplement when pregnant and lactating (targeting)	R	6
1=	Improve breastfeeding/infant feeding support in MAMI context	Pilot C-MAMI tool in order to integrate into existing programming	P, R	6
2=	Improve breastfeeding/infant feeding support in MAMI context	Research into complementary feeding at 4-5 months	R	3
2=	Improve breastfeeding/infant feeding support in MAMI context	Is breastmilk enough for optimal growth/recovery of acutely malnourished infants?	R	3
2=	Multisectoral approach	Role of social/cash/non-food, psychosocial support	P, R	3
3=	Multisectoral approach	Multi-sectoral links (WASH, family planning etc) Think about: What can we add as a specific group? What can we ask other sectors to do? What are others already doing?	P, R	2
3=	Improve breastfeeding/ infant feeding support in MAMI context	Supplementary suckling techniques algorithm	P	2
4=	Improve breastfeeding/ infant feeding support in MAMI context	Intensive breastfeeding support for infant with low WAZ/MUAC (C-MAMI tool)	P, R	1
4=	Treatment of acute malnutrition	What can we do to aid recovery/catch-up?	R	1

2.2.3 Policy

Priority	Theme/issue	Notes (as detailed in group work)	Is this (R)esearch or (P)olicy?	Number of votes (red stickers)
1	Advocacy/research	More funding for research	P, R	6
2=	Update guidance and protocols	Development of MUAC cut-offs for infants <6 months	P, R	3
2=	Update guidance and protocols	Dialogue with WHO + understanding WHO process and dialogue with States	P	3
3	Advocacy	Raising profile (evidence, burden initiative (e.g. SAM 2.0, newborn care) decision-makers, policy-makers (WHO)	P	2
4=	Coordination/communication	Forum for sharing policy/research/practice	P	1
4=	Advocacy	Influence donor policies to include <6 months as key indicators: 2-way 'flow' (right timing/reason/justification)	P	1
	Research	Use opportunity of larger grants to include MAMI related research.	P, R	0
	Update guidance and protocols	Stratify EBF rates from various data sets and programmes (prioritise age groups for intervention and maximise effectiveness)	P	0

2.3 Summary top priority actions & research

In summary, top actions to emerge from the prioritisation are:

- The meeting recommends that WHO review the case definition of acute malnutrition in infants < 6m, with specific consideration to WFA and MUAC in this age group (MAMI CHNRI research priority 1). Of note, there is evidence on WFA and risk; research on MUAC in this age group exists and is growing. ENN and WHO will follow up regarding this.
- The group prioritised pilot of breastfeeding interventions that target SAM infants <6m: this endorses the proposed Improved Breastfeeding Support to Treat Acute Malnutrition amongst Infants under 6 months (IBAMI) research in an inpatient and community (follow-up) settings (Kenya). Piloting the C-MAMI tool was also specified as a top priority. (MAMI CHNRI research priorities 3, 4, 7).
- Discussion noted the large gap in knowledge and associated interventions around maternal nutrition. In the context of MAMI, investigation of the impact of maternal supplementation when pregnant and when lactating is a priority. (MAMI CHNRI research priority 28, 29).
- More funding for MAMI research is needed.

Second level priorities were:

- Update guidance and protocols, with specific reference to case definitions (MAMI CHNRI research priority 1).
- Research into recovery and outcomes amongst treated infants <6m, including post-discharge (Research need not identified in MAMI CHNRI).
- Research into risks and benefits of early complementary feeding in the context of SAM infants aged 4-5 months (WHO priority research question; MAMI CHNRI research priority 58).
- Research into the role of social / cash/ non-food, psychosocial support interventions in MAMI (MAMI CHNRI research priorities 20, 43).

3 Concluding discussion points, actions & recommendations

A key recommendation emerged from the meeting, highlighted below, regarding case definition of SAM in infants <6m.

The MAMI emphasis should be on moving to “nutritionally vulnerable” and away from a focus on “SAM” or “MAM”.

The importance of networking was reaffirmed to enable alignment and coordination on research and to share findings and operational challenges. The en-net forum (MAMI thematic area, partnerships in research thematic area) was highlighted. Those engaged in the meeting should help reinvigorate the MAMI forum on en-net by sharing research findings and posing operational questions (and answers).

The attendees voiced commitment to continue the MAMI dialogue and to seek to complement each other’s work. Given this, all meeting attendees will be included in the MAMI Interest Group coordinated by ENN.

We should examine the resources we have as a group and how we might be able to use them in the interest of

MAMI. One opportunity is the upcoming SAM 2.0 initiative (to drive up SAM treatment coverage) and research to integrate SAM treatment in integrated community case management (ICCM); connections between the MAMI Interest Group and this initiative have been made.

Getting policy and support into the field is needed. There is a need to distil down the practical application of research findings to inform programmers.

There is a need to integrate better with CMAM services.

It is important to nail the basics before embarking on grand new ideas.

Integration of MAMI into other initiatives/interventions/guidance is necessary. We should avoid “flip-flopping”, i.e. constantly changing the recommendations.

It is important to bring more people into the discussion but also to infiltrate out; making MAMI other people’s business too.

Key Recommendation

The WHO recommendation to use weight-for-height (WHZ) as the sole anthropometric diagnostic criterion for SAM in infants <6m needs to be revised. In the CHRNI MAMI research prioritisation exercise undertaken in 2014, among other epidemiological questions for MAMI, case definition was ranked no 1 in priority. Again during this MAMI meeting in 2016, case definition was recognised as the top priority MAMI question as lack of clarity is confusing and hampering programming. The meeting recommends that WHO reviews the evidence base for the case definition of SAM in infants < 6m with particular consideration to its association with the risk of death. The possible use of MUAC and WFA and the need to keep WHZ as diagnostic criteria to identify high risk children should be critically reviewed. Existing evidence and further analysis of existing data could be made available to the review process; in addition, there is an urgency for peer-review publication of such analyses. The MAMI Interest Group are keen to engage with and support WHO in this regard.

Annex 1 Participants list

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Annex 2 Top 15 MAMI CHNRI research priorities and WHO research question priorities

Top 15 MAMI research questions ranked by research priority scores

Research instrument	Research Avenue	Rank	Research question
Health policy and system research	Studying system capacity to deliver effective inpatient interventions for infant <6m SAM	1	How should infant <6month SAM be defined?
Technical questions and interventions	Issues of age	2	What are the key opportunities/timings where infant SAM management can be incorporated with other healthcare programmes?
Technical questions and interventions	Outpatient based interventions	3	What are the priority components of a package of care for outpatient treatment of infant <6month SAM?
Technical questions and interventions	Inpatient based interventions	4	Having detected SAM in the community, what is the efficacy of providing targeted skilled breastfeeding support to caregivers of stable infants?
Health policy and system research	Studying system capacity to deliver effective outpatient interventions for uncomplicated infant <6m SAM	5	How can existing tools be adapted and/or linked together to better identify and manage infant < 6month SAM?
Basic epidemiological research	Measuring the burden	6	What are the most feasible tools and techniques for assessing treatment programme coverage for infants <6month SAM?
Technical questions and interventions	Inpatient based interventions	7	What is the feasibility, effectiveness, cost effectiveness and impact of different approaches to promote early initiation and exclusivity of breastfeeding?
Technical questions and interventions	Outpatient based interventions	8	What are the main barriers to existing in-patient interventions for infant <6m SAM and how might they be best addressed?
Technical questions and interventions	Assessment tools	9	What is the effectiveness, cost, and safety of an outpatient focused treatment model for infants with SAM?
Technical questions and interventions	Interventions to address "upstream" factors related to infant <6m SAM	10	Which supervision tools and approaches are most effective towards improving the front-line case management of infant <6month SAM?
Basic epidemiological research	Measuring the burden	11	How can existing child health and nutrition reporting systems (i.e. Health Management Information Systems (HMIS), Minimum Reporting Package) be adapted to capture, monitor and audit data on infant <6month SAM?
Technical questions and interventions	Outpatient based interventions	12	What role do CMAM programmes have in delivering outpatient-based treatment for infant <6month SAM?
Technical questions and interventions	Inpatient based interventions	13	How does breastfeeding status and/or change in breastfeeding status impact on infant <6month SAM?
Technical questions and interventions	Inpatient based interventions	14	What is the coverage of existing treatment programmes for infant <6month SAM?
Technical questions and interventions	Assessment tools	15	How can existing surveys of differing designs and at different levels be adapted to include infants <6month?

Source: 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.1001812S2

WHO MAMI priority research questions

Recommendation 8: Identifying and managing infants who are less than 6 months of age with severe acute malnutrition

Implications for future research

Discussion with guideline development group members and stakeholders highlighted the limited evidence available in themes related to the priority areas listed next.

1. In infants who are less than 6 months of age, what is the predictive value of population-derived thresholds for weight-for-height, mid-upper arm circumference and reduced growth velocity (weight-for-age) with or without oedema to identify infants at high risk of mortality?
 - Consider analysis of published or other existing data.
 - Consider the feasibility of each assessment.
2. What are the most effective and safest therapeutic feeding approaches, including different food “recipes” in addition to breastfeeding, for infants who are less than 6 months of age with severe acute malnutrition?
3. How is breastfeeding most effectively re-established among infants with a low weight-for-height/poor weight gain?

Other issues (no specific order)

- Do infants who are less than 6 months of age with weight-for-length less than -3 Z-score also have reduced growth velocity and is there any difference according to epidemiological setting such as African, South Asian and South-East Asian sites?
- In infants who are less than 6 months of age, what is the feasibility and accuracy of using weight-for-height, mid-upper arm circumference and reduced growth velocity (weight-for-age) with or without oedema to identify infants in need of therapeutic management?
- What criteria most effectively identify infants who are less than 6 months of age with the metabolic abnormalities/adaptations associated with severe acute malnutrition in older children?
- What is the effectiveness, tolerance and safety of ready-to-use therapeutic food as an adjuvant to breastfeeding in infants who are less than 6 months of age with severe acute malnutrition? — Consider specific subgroups, e.g. with oedema, 4-6months old, those with underlying diseases such as HIV.
- What is the recommended folic acid supplementation for infants who are less than 6 months of age with severe acute malnutrition?
- Are there adjustments in the drug dosage or selection

of drugs required when managing infants who are less than 6 months of age with severe acute malnutrition?

- Is there any reason to expect that the efficacy of vitamin A supplementation for infants who are less than 6 month of age with severe acute malnutrition is different from that observed in infants who are 1 to 5 months of age without severe acute malnutrition?

Source: WHO. Guideline: Updates on the management of severe acute malnutrition in infants and children. Geneva: World Health Organization; 2013.

Annex 3 Agenda

Time	Topic	Presenters
8.45	Arrival	
9-9.10	Welcome & Introductions	Marie McGrath, ENN
9.10-9.30	1. Overview of MAMI, objectives & expected outputs of the meeting	Marko Kerac, LSHTM/Marie McGrath, ENN/Nicki Connell, Save the Children
Session 1 (Background /epidemiology) Chair: Marie McGrath		
9.30 – 9.45	2. Update on WHO MAMI related guidance & training	Zita Weise Prinzo, WHO
9.45 – 10.00	3. Update on MAMI research in Malawi	Marko Kerac, LSHTM
10.00 – 10.15	4. Update on MAMI research in Bangladesh	Nicki Connell, Save the Children
10.15 – 10.30	5. Risk factors for Acute Malnutrition in Infants aged <6 months: Secondary Data Analysis of 20 DHS Surveys	Severine Frison, LSHTM
10.30 – 10.45	Discussion & 'parking points'	
10.45 – 11.15	Tea Break	
Session 2 (Current and future interventions) Chair: Nicki Connell		
11.15 – 12.00	6. Improved Breastfeeding support to Treat Acute Malnutrition amongst Infants under 6 months (IBAMI) & other MAMI initiatives	Martha Mwangome and Jay Berkley, KEMRI, Kenya
12.00 – 12.15	7. GOAL's experiences of integrating infantile screening (using MUAC) and programme admissions into operational settings	Hatty Barthorpe, Goal
12.15 – 12.20	8. Updated review of national guidelines on MAMI: key findings	Marie McGrath, ENN
12.20 – 12.35	9. C-MAMI Tool: Next steps	Marko Kerac, LSHTM
12.35 – 1.00	Discussion & 'parking points'	
1.00 – 2.00	Lunch	
Session 3 (Linking with and learning from others) Chair: Marko Kerac		
2.00 – 2.15	10. MAMI opportunities: Ending Preventable neonatal deaths and stillbirths: an update on the Every Newborn Action Plan	Hannah Blencowe, LSHTM
2.15 – 2.30	11. MAMI opportunities: Intergrowth and INTERBIO-21st study	Jane Hirst, University of Oxford
2.30 – 2.45	12. Body composition research in Ethiopia	Carlos Eternod-Grijalva, UCL
2.45 – 3.00	Discussion & 'parking points'	
Session 4 (Ways forward)		
3.00 – 5.30	Discussion, taking stock & next steps	
Wrap up		

Annex 4 Other issues (long list) identified in group work on priority actions and research

Epidemiology

Information collection:

- Prevalence
- Influence of breastfeeding on outcomes
- Accuracy of measures
- Alternatives to anthropometry
- Burden: number of children <6 months treated/untreated
- Use immunisation points
- Minimum set of data to gather when incorporating into a programme – through a dedicated network; work with donors to develop minimum requirements
- Validity of questions in surveys to ascertain e.g. breastfeeding rates

Understanding risk factors:

- pre-conception, maternal
- pregnancy
- intra-uterine
- neonatal – growth, morbidity and mortality
- Environmental exposure – sanitation, WASH
- Universality of factors vs contextual; Outcomes depending on context (risks)
- Household factors:
 - socio-cultural
 - familial
 - status
 - depression

Risk factors for optimal EBF & IYCF

- Hormonal dosages
- Maternal choice on how to feed her infant

Intergenerational cycles:

- Maternal stature – different interventions by stature
- Epigenetics

Identifying at-risk infants

- Which biomarker to use?
- Better understanding of circumferences (Chest, head, MUAC)
- Foot length – LBW; tibia length
- Oedema
- Define nutritionally vulnerable children at birth
- Identification when the standards will not apply
- Question on identifying acute malnutrition vs congenital issues

Implementation and impact of interventions

- Implementation of counselling for breastfeeding in reality
- Response of interventions
- Possibility of “catch-up growth” in 6-24 months and 6-59 month windows.

Interventions

Support for mothers

- What interventions are appropriate for the mothers? Most activities focus on children:
 - cash transfers
 - identifying maternal risk factors
 - mother-to-mother groups
- Interventions targeting risk factors for mothers in terms of prevention:
 - wasted
 - stunted
 - depressed

Improve guidance and protocols

- Link measures to EPI; use the growth chart.
- How to integrate and adjust MAMI in existing

tools/guidance (newborn, IMCI etc.) and programmes

- Evaluation of impact of existing interventions in new/creative ways
- Piloting C-MAMI tool and evaluate C-E and coverage of that approach; guidelines for piloting in easy win settings too.
- What to do with 4-5 month olds already doing poor complementary feeding and what are the risks of intervening with RUTF/RUSF etc.

Multisectoral approaches

- WASH
- Cash transfer/childcare voucher, social protection for families in CMAM/SC
- Psychosocial, ECD, Maternal mental health

Policy

Update guidance and protocols:

- Revise IMCI
- Switch to WAZ
- Reflect inclusion of WAZ and MUAC in WHO guidance
- Influencing national protocols – annex; “MAMI person”
- Growth monitoring in infants

Advocacy

- Advocate for donor and government/UN led requests for MAMI related data collection, analysis and sharing

(strategic inclusion).

- Influencing donor policies to include <6months as key indicator.
- Raising profile of <6 months in nutrition and health policy (evidence)
- SAM 2.0 – consortium – Research agenda & newborn agendas – Lancet series
- Invest in improved ways of measuring IYCF indicators
- Supportive breastfeeding laws – maternity leave; workplace – cultural shift

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