

MAKING CONNECTIONS

Joint meeting of WaSt Technical Interest
Group and MAMI Special Interest Group
16 January 2018



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Context and overview

Emergency Nutrition Network (ENN) coordinates two key international technical groups set up to bring together experts around critical questions for nutrition policy, guidance, research and related programming (see Box 1). Both groups comprise experienced and engaged experts in nutrition, child growth, medicine, epidemiology, nutrition policy and programming. Each group has conducted several research and programme-oriented activities and periodically meets to discuss new findings and set priorities.

To coincide with meetings of both groups, ENN organised an additional day on 16 January 2018, funded by Irish Aid, to bring both parties together with a selection of key donors and implementing agencies working in international nutrition. The meeting was held at Trinity College, Oxford, UK.

Our aim was to share headlines from the work undertaken by both groups, to encourage synergies and to collectively begin to answer the question: What do these findings mean for programmes, policy and research, and what needs to happen now?

The meeting began with a history of both groups and an overview of key work and latest research findings. Following plenary discussion, working groups explored policy, programme and research implications. The agenda is included in Annex 1. A total of 66 participants (54 present and eight remote) participated (see Annex 2).

Box 1: Interest Groups

Management of At risk Mothers and Infants under six months¹ Special Interest Group (MAMI SIG) was set up in 2010 to address critical gaps in policy, research and programming aimed at identifying and managing malnourished infants under six months of age. The group identifies constraints in programming, supports evidence development (through informed research agendas, research and reviews) and helps fill gaps in policy and guidance.

Wasting and Stunting Technical Interest Group (WaSt TIG) was set up to explore the disconnect between wasting and stunting. The group aims to bring together existing knowledge and support evidence development (identifying and prioritising gaps and conducting research) to better understand the linkages between wasting and stunting and to consider these in relation to nutrition policies, programmes and future research.

¹ Formerly called 'Management of Acute Malnutrition in Infants under six months', the group was renamed to reflect its scope more accurately.



Welcome

Carmel Dolan, ENN, welcomed everyone and described the aims of the meeting:

- To share the work of the WaSt TIG and MAMI SIG in order to expose each other to key developments and explore synergies; and
- To hear the reactions and insights of a broader group of donors, research bodies and implementing agencies in order to strengthen collaborative reach and jointly explore the implications for future policy, programme and research priorities.

The WaSt TIG, initiated in 2014, has been discussing how the nutrition sector has developed an unhelpful separation between those focusing on wasting treatment and those focusing on prevention of stunting. The group proposes a different way of thinking and an approach to address undernutrition in all its forms.

The MAMI SIG, formed in 2010, has focused on the particular needs of infants under months of age and their mothers and is currently examining how to identify at-risk infants (beyond a narrow definition of acute malnutrition); how their care can be better integrated with existing services across sectors, especially health; and how to establish a continuum of care for both mother and infant.

The meeting is intended as a first step in greater interaction between the two groups and with the wider nutrition community.

Ben Siddle, Irish Aid, described how Ireland has supported ENN for several years, more recently from its policy budget lines, which provide support for global public goods and knowledge management products. Irish Aid currently provides core support for the ENN products *Nutrition Exchange*, *Field Exchange* and *en-net*², which together constitute a 'critical glue' in the nutrition space.

Irish Aid has supported the WaSt and MAMI groups to reinforce ENN's role in plugging gaps and moving forward on key technical issues. This use of funding is particularly relevant to Ireland's position as a UN member state and to its role in developing countries; it reflects a need to think longer-term about humanitarian response and protracted crises and about actions across the humanitarian/development divide. This complements Irish Aid's role as co-facilitator of the Scaling Up Nutrition (SUN) Donor Network.

² www.enonline.net/nex/ / www.enonline.net/fex/ / www.en-net.org/

THE STORY SO FAR AND KEY RESEARCH FINDINGS

WaSt



WFP/Inger Marie Vennize

The WaSt story so far – Tanya Khara, ENN

ENN undertook a financing review of community-based management of acute malnutrition (CMAM) in 2013 which highlighted the separation of financing focused on wasting (predominantly humanitarian-funded) and funds focused on stunting (mostly development funds). Several papers suggested a stronger link between the two forms of undernutrition than is commonly discussed.

The WaSt TIG was formed with approximately 30 people in 2014. Since then its membership has evolved to encompass a variety of interested agencies and individuals. A 'light touch' literature review on the relationship between wasting and stunting formed the background paper of the group's first meeting in early 2014.

Phase 1 (2014–2016) focused largely on review of the evidence and production of papers:

- A technical review of the literature on the relationship between wasting and stunting (Khara & Dolan, 2014³);
- A Food and Nutrition Bulletin paper on the similarities and differences between wasting and stunting (Briend et al, 2015⁴);
- A research prioritization on the relationship between wasting and stunting published in PLoSOne (Angood et al, 2016⁵);
- A Lancet viewpoint on the issue of WaSt was rejected in 2016. Despite the topic being of interest, further evidence was requested to support the arguments presented.

The key highlights and resulting research questions from Phase 1 were:

- Wasting and stunting share many risk factors; does this mean they could be tackled jointly?
- Children concurrently wasted and stunted ('concurrence') may be at heightened risk of death; what do we know about these children and how common the condition is?
- There is some evidence that periods of wasting impact linear growth; can we further explore this?
- We are interested in exploring the processes of wasting and stunting, not just the state of being wasted or stunted.

Using the 2016 research prioritisation exercise and working with a small funding base provided by Irish Aid and USAID, the group decided to focus first on evidence gaps that might be explored through existing data during the next Phase.

Phase 2 (2016 to 2017).

The following outputs were realised:

- Panels/analysis on the overlap of wasting and stunting in the 2015 and 2016 [Global Nutrition Reports](#) (IFPRI 2015 and 2016⁶);
- An 84 country meta-analysis of prevalence and burden of children 6–59 months concurrently wasted and stunted (Khara et al 2017⁷);
- SMART and Medical Research Council (MRC) Gambia dataset analyses papers drafted and one submitted (to Archives of Public Health);
- [SMART analysis poster](#)⁸ presented at ACF Research for Nutrition Conference 2017;
- Draft WaSt Policy and Programme Briefing Note.

Key findings of the meta-analysis of 84 countries MICS/DHS datasets included:

- Concurrence ranged from 0–8% in children aged 6–59 months; with 9 countries >5%;
- Pooled prevalence was 3.0% (95% CI 2.97 to 3.06), signifying a burden of approximately six million children aged 6–59 months;
- Concurrence was highest in the 12–24 months age group and more common in boys.

Conclusions from the analysis are that these children are at particularly high risk of death; that concurrence should be reported routinely; and that the question of whether these children are being reached should be investigated.

The work has had influence, with the WHO/UNICEF 2016 Joint Estimates report recognising the issue for the first time and noting that a global estimate for the level of concurrence is not known (UNICEF/WHO/World Bank Group 2016⁹).

³ Khara T and Dolan C. *The relationship between wasting and stunting, policy, programming and research implications* Technical Briefing Paper. ENN July 2014. http://files.ennonline.net/attachments/1862/WAST_140714.pdf

⁴ Briend A, Khara T, Dolan C. *Wasting and Stunting—Similarities and Differences: Policy and Programmatic Implications*. Food and Nutrition Bulletin 36(1 Suppl): S15–23 March 2015 DOI: 10.1177/156482651503615103

⁵ Angood C, Khara T, Dolan C, Berkley JA, WaSt Technical Interest Group. *Research Priorities on the Relationship between Wasting and Stunting*. May 9, 2016. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0153221>

⁶ Global Nutrition Report 2016: From Promise to Impact: Ending Malnutrition by 2030. International Food Policy Research Institute. 2016. Washington, DC. <http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/130354/filename/130565.pdf>

⁷ Khara T, Mwangome M, Ngari M, Dolan C. *Children concurrently wasted and stunted: A meta-analysis of prevalence data of children 6–59 months from 84 countries*. Maternal and Child Nutrition 25 September 2017. <https://doi.org/10.1111/mcn.12516>

⁸ <https://r4nut-conference.mn.co/posts/1347186>

⁹ *Levels and Trends in Child Malnutrition*. UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates – Key findings of the 2016 edition. www.who.int/nutgrowthdb/jme_brochure2016.pdf

Key findings from analysis of SMART and mortality cohort datasets to explore concurrent wasting and stunting – André Briend, University of Tampere

A working group of the WaSt TIG sought to examine two core questions:

- What is the risk associated with being concurrently wasted and stunted?
- How best to detect these children?

McDonald et al (AJCN 2013¹⁰) reported a high risk of death in children with 'multiple anthropometric deficits' (wasting + stunting + underweight) from analysis of 10 prospective community cohort studies. A working group of the TIG examined two datasets; one consisting of 2,426 (SMART) surveys of almost 1.8 million children from 51 countries, which found that all children who were wasted and stunted were also underweight; and a longitudinal dataset from Niakhar, Senegal (used in the original McDonald analysis) which enabled analysis of the relationship between anthropometric deficits and mortality (see below).

These analyses indicate that there is a multiplicative effect of concurrent wasting and stunting on mortality. Despite being reported by Waterlow in 1974¹¹, this has been overlooked in recent years due to the tendency to focus on one or other deficit.

As it is complicated to assess both stunting and wasting in a child in order to identify those with concurrent WaSt, the group looked at whether existing measures used at community and facility level might be used. It found that weight-for-age z scores (WAZ) have a high specificity and

sensitivity at detecting concurrent WaSt and MUAC scores slightly lower. Further analysis was undertaken to investigate how to detect children who are concurrently wasted and stunted and at the most risk of death. For this, the Niakhar dataset (which is a community-based study of ~ 5000 children measured every six months for two years with exhaustive recording of deaths) was used.

The analysis revealed that all anthropometric indices were highly correlated with mortality; however, multivariate analysis showed that only WAZ <-3 and MUAC <115 mm were independently associated with mortality within six months.

These results suggest that WAZ could be considered as an additional criterion for identifying high-risk children not identified by MUAC for admission into CMAM programmes. Most immediately, testing of these findings on other datasets and further modelling of caseload and programmatic implications is needed.

Pending research questions

- What is the optimal WAZ cut-off avoiding overloading programmes but detecting high-risk children missed by MUAC <115 mm?
- How to adjust WAZ in programmes using a higher MUAC cut-off?
- Are the same findings repeated when other mortality cohorts are analysed?



Conclusions

- All children who are wasted and stunted are also underweight; multiple anthropometric deficit is not an independent category and this term should be abandoned.
- When a child experiences both wasting and stunting concurrently there is a strong multiplicative effect on mortality risk.
- WAZ and MUAC detect WaSt.
- MUAC and WAZ are both independently associated with risk of death; but not WHZ, HAZ or WaSt.
- WAZ <-2.8 detects a group of high-risk children not detected by MUAC.

¹⁰ McDonald CM, Olofin I, Flaxman S, Fawzi WW, Spiegelman D, Caulfield LE et al. The effect of multiple anthropometric deficits on child mortality: meta-analysis of individual data in 10 prospective studies from developing countries. *American Journal of Clinical Nutrition* Volume 97, Issue 4, 1 April 2013, Pages 896–901. <https://doi.org/10.3945/ajcn.112.047639>

¹¹ Waterlow JC. Some aspects of childhood malnutrition as a public health problem. *Br Med J*. 1974 Oct 12; 4(5936): 88–90. www.ncbi.nlm.nih.gov/pmc/articles/PMC1612178/

MRC data analysis. The relationship between wasting and stunting: A retrospective cohort analysis of longitudinal data in Gambian children from 1976-2016

– Sophie Moore (Kings College, London)

An MRC retrospective cohort study of children aged 0-24 months of age from three villages of Keneba, Gambia, revealed a secular decrease in stunting between 1976-2012. However, rates of stunting have remained high despite impressive healthcare access in this remote rural area and rates of wasting have not changed in over 10 years.

Data from scheduled health checks of all infants aged 0-24 months in the MRC Keneba clinic were used to examine the relationship between wasting and stunting. This dataset comprised 64,342 observations on 5,160 subjects (2,499 female, 2,661 male), with a median of 12 observations per individual between May 1976 and September 2016.

Key findings included:

- In the wet/hungry season there is high infection and poor infant growth;
- Pregnant women follow an annual cyclical trend of weight loss and gain;
- Rates of stunting increased with age, up to 39% at ~24 months;
- Prevalence of wasting and of concurrence peaked at ~12 months in both boys and girls; at peak, 10% of boys were WaSt, compared to 5% of girls;
- Wasting is more common if a child is stunted; stunting is more common if a child is wasted. This generates the hypothesis that children recover from wasting by stunting.
- Children who are wasted in the wet season, even if they recover in the interim, are more likely to be wasted again in the following wet season.
- Season of birth is a predictor of growth patterns: children who are born at the start of the annual lean season fail to thrive in the early post-natal months.
- Children stunted at 20-24 months have distinct weight-for-length z-score trajectories (experience of wasting) from approximately six months of age.

Conclusions

- **Wasting and stunting are closely linked; in particular, being wasted increases the likelihood of a child becoming stunted.**
- **Increased susceptibility to wasting continues in a child even after they have recovered from a prior episode, indicating profound metabolic disturbances and/or environmental factors at play.**
- **The season in which a child is born strongly predicts their subsequent linear growth and weight gain.**
- **Boys are more wasted, stunted and concurrently wasted and stunted than girls.**

- Current wasted status increases a child's odds of being stunted in three months' time by a factor of 3.2; current stunted status increases the odds of the child being wasted in three months' time by a factor of 1.5.

Key points from plenary discussion

Potential for further analysis of the data presented

Attributable risk for concurrent wasting and stunting (i.e. what proportion of mortality is attributable to concurrent WaSt) was not examined from the SMART and Niakhar analysis. To do this requires prevalence data which differs by country and would require data on incidence to get an accurate estimate.

McDonald et al only examined the mortality of wasted-only children (weight for height z score (WHZ) <-2); a comparison with wasting cut-off of WHZ<-3 would be interesting to see whether concurrent WaSt is the same as severe wasting only in terms of mortality risk.

Maternal height was not controlled for in the MRC analyses. The data is available for the children born from the 1990s onwards and could be examined. A further valid analysis would be stratification according to severity of stunting and risk of wasting. This could be considered in Phase 3.

Implications for treatment

In terms of treatment for low WAZ, a graded approach would be required in line with the severity of the risk of death. Research being undertaken by the NGO ALIMA and also by the ComPAS study¹² is looking at different doses of ready-to-use therapeutic food (RUTF) for different severities of malnutrition; a similar model using WAZ could be looked at.

Risk factors and potential associated causes

Season of birth also reflects the season of conception; the conditions of the mother at the time of conception and her health and wellbeing through pregnancy may be relevant. With the MRC data it is not possible to pinpoint the timing of the insult that is responsible for the relationship between season of birth and subsequent linear growth and weight gain. The post-natal period is of interest as it's a time when women are engaged in hard work in the fields and mother's physiology/energy status may play a role.

The risk for children born in the wet season might reflect the ability of households to respond to stresses; it might be biological or might be linked to household resilience to respond. Some other studies have examined this; e.g. a Gates study of pre-conception mothers and their children up to two years of age is collecting household data to try to understand behaviours, access, food security, etc.

¹² <https://www.ennonline.net/fex/53/thecompassstudy>

THE STORY SO FAR AND KEY RESEARCH FINDINGS

MAMI



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 (infants < 6m) at a time when protocols were lacking. These reports sparked a two-year MAMI project by ENN in collaboration with University College London (UCL), Action Against Hunger, and an advisory group of programmers, experts and academics funded by the Global Nutrition Cluster. [The MAMI project](#)¹³ investigated the global burden, guidance available and case management using secondary data analysis and qualitative research of acutely malnourished infants <6m with humanitarian agencies. Key findings included:

- Extrapolating [DHS data analysis](#)¹⁴ to an estimated 55.8 million infants < 6m in developing countries, an estimated 3.8 million infants < 6m 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. Admissions criteria varied widely, including anthropometric, clinical and feeding criteria. Nutrition treatment centred around supplementary suckling.
- Published [analysis](#)¹⁵ by Kerac et al 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 or 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](#)¹⁶ 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 together 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. vaccination contact points, 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](#)¹⁷ to improve the management of acute malnutrition in infants < 6m (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?

¹³ MAMI Report 2010. www.enonline.net/ourwork/research/mamireport2010

¹⁴ Kerac M, Blencowe H, Grijalva-Eternod C et al (2011). Prevalence of wasting among under 6-month-old infants in developing countries and implications of new case definitions using WHO growth standards: a secondary data analysis. *Archives of Disease in Childhood* 2011;96:1008-1013. <http://dx.doi.org/10.1136/adc.2010.191882>

¹⁵ Grijalva-Eternod, C.S., Kerac, M., McGrath, M., Wilkinson, C., Hirsch, J.C., Delchevalerie, P., Seal, A.J. (2017). Admission profile and discharge outcomes for infants aged less than 6 months admitted to inpatient therapeutic care in 10 countries. A secondary data analysis. *Maternal and Child Nutrition*, 13(3). <https://doi.org/10.1371/journal.pmed.1001812>

¹⁶ www.enonline.net/ourwork/research/mami

¹⁷ Angood C, McGrath M, Mehta S, Mwangome Z, Lung'aho M, Roberfroid D, Perry A, Wilkinson C, Israel AD, Bizouerne C, Haider R, Seal A, Berkley JA, Kerac M; MAMI Working Group Collaborators. Research priorities to improve the management of acute malnutrition in infants aged less than six months (MAMI). *PLoS Med*. 2015 Apr 21;12(4):e1001812. doi: 10.1371/journal.pmed.1001812. <https://doi.org/10.1371/journal.pmed.1001812>

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 less than six months' to 'Management of **At risk Mothers and Infants** under six months', 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 Management of At risk Mothers and Infants under six months identified with SAM around birth, 66%, with little intervention, no longer had SAM. However, infants who had 'recovered' were significantly more underweight and stunted than infants who had not been malnourished.

Infant and young child feeding (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**¹⁸, 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, support collaboration on research, ensure identification and tracking 'potentially better practices' to fill immediate gaps and document 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 collection 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 among 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 al¹⁹ examined programme datasets from 2004-2008 in 12 countries comprising admission profiles of infants < 6m. 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.

¹⁸ www.ennonline.net/c-mami

¹⁹ Grijalva-Eternod, C.S., Kerac, M., McGrath, M., Wilkinson, C., Hirsch, J.C., Delchevalerie, P. and Seal, A.J. (2016) Admission profile and discharge outcomes for infants aged less than 6 months admitted to inpatient therapeutic care in 10 countries. A secondary data analysis. *Matern Child Nutr.* 2016 Jul 25, doi: 10.1111/mcn.12345.

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

- Modelled on an approach by Myatt et al in 2006²⁰, an ENN/LSHTM/CHAIN review (ENN 2017²¹) 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.
- *The American Journal of Clinical Nutrition* published a community cohort study (Lelijveld et al, 2017)²² 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 for infants below 45cm in length, 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](#)²³ 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.

- An LSHTM research student investigated mothers' willingness to implement the supplemental suckling technique in Malawi. Interviews with mothers of infants with SAM who were experiencing breastfeeding difficulties found that perinatal depression was notable. This affected the effectiveness of 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 criteria 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 and is proving to have potential for identification of risk in children >6m also.

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.

²⁰ 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 Nutr Bull.* 2006 Sep;27(3 Suppl):S7-23. http://journals.sagepub.com/doi/abs/10.1177/156482650602735302?url_ver=Z39.88-2003&rft_id=ori%3Arid%3Aacrossref.org&rft_dat=cr_pub%3Dpubmed&

²¹ Lelijveld N, Kerac M, McGrath M, Mwangome M, Berkley JA. A review of methods to detect cases of severely malnourished infants less than 6 months for their admission into therapeutic care. *ENN* June 2017. <https://www.ennonline.net/mamicasedetectionreview>

http://s3.ennonline.net/attachments/2615/MAMI-June-2017_Final-SHARE.pdf

²² Mwangome M, Ngari M, Fegan G, Mturi N, Shebe, Bauni, Berkley JA. Diagnostic criteria for severe acute malnutrition among infants aged under 6 mo. *Am J Clin Nutr* Jun;105(6):1415-1423. doi: 10.3945/ajcn.116.149815. Epub 2017 Apr 19. www.ncbi.nlm.nih.gov/pubmed/28424189

²³ Berkley J et al. Daily co-trimoxazole prophylaxis to prevent mortality in children with complicated severe acute malnutrition: a multicentre, double-blind, randomised placebo-controlled trial. *Lancet Glob Health* 2016; 4: e464-73. Published Online June 2, 2016 [http://dx.doi.org/10.1016/S2214-109X\(16\)30096-1](http://dx.doi.org/10.1016/S2214-109X(16)30096-1)

Reflections, observations and synergies

Invited reflections

To begin, four participants were invited to reflect on the morning's presentations.

Elizabeth Bontrager, Nutrition Advisor, Food for Peace/USAID

Within USAID we frequently separate nutrition programmes into those that focus on stunting and those that focus on wasting. In development programmes we see a high level of stunting and some wasting. This coming together is critical for addressing both and preparing policy/thinking for the future.

Guy Holloway, Children's Investment Fund Foundation (CIFF)

We silo wasting and stunting work. We've been discussing with the Power of Nutrition how to support them move from stunting to wasting and to bridge the two. These discussions today are helpful.

We're interested in research; blending programmatic and research input to ensure we take things up faster. We're looking at the 0-6 month period and how it can be a benchmark for what happens later in life. We want to think about this more closely: if you target this period, what are the knock-on effects? If we invest in a small way now, the impact tomorrow may be significant. This is the rationale for our investments.

Laura Lamberti, Gates Foundation

Today's presentations resonate with our new strategy. We've been siloed in nutrition teams, diarrhoea teams, etc. We made the decision to integrate Maternal and Child Health work with nutrition work. As diarrhoea and pneumonia deaths plummet, those remaining are nutrition-related and occur in younger children.

Our current strategies include a focus on the mother-infant dyad (working closely with Jay Berkley through the Childhood Acute Illness and Nutrition Network (CHAIN²⁴), focused on the overlap between acute illness and nutrition); and risk stratification for interventions; when anthropometric markers are the signal of other issues. We're testing interventions in the under-6 months and mother-infant dyad.

Marie Ruel, International Food Policy Research Institute (IFPRI)

It's interesting that WAZ is back! In research we dropped WAZ for a while. It is unspecific, it doesn't differentiate

between wasting and stunting, so we don't know what it means.

These analyses raise questions in terms of the next steps for programming. The old studies relating undernutrition to mortality were based on WAZ because we didn't have WHZ as an indicator. I've spent much of my professional life trying to understand stunting – it is still a mystery why some children stunt, others waste. There have been lots of attempts to add new elements to programmes with no obvious effects. I don't believe the etiology of stunting and wasting is the same; e.g. in south America stunted children are never wasted and there are extremely wasted children in the Horn of Africa who grow tall.

For prevention, we need to address all the determinants of stunting; this should be the same for wasting.

How do we prevent SAM and MAM? We just did a trial in Burkina Faso and Mali with Helen Keller International where we brought prevention to a CMAM programme with the main purpose of increasing the number of children screened. Children who returned healthy from screening without receiving anything didn't go back. We gave lipid-based nutrient supplements (LNS) and behaviour change communication (BCC) to entice mothers back to screening. This reduced stunting but not wasting. However, the CMAM programme was not working properly; people were not attending, there were challenges with compliance and various issues behind this. We can't just assume CMAM is working well everywhere.

The MAMI work is impressive and important and needs to be publicised more. There is an enormous need for prevention; breastfeeding as currently managed isn't working.

Plenary reflections

Participants shared their thoughts on what they had heard, whether the findings and implications as presented resonated with their understanding of these issues and questions and suggestions for the future. Key reflections are summarised below.

²⁴ <http://chainnetwork.org/>

Relationship between wasting and stunting

The WaSt group presented wasting and stunting as two manifestations of the same underlying problems; participants recognised the overlap, but emphasised the different experience of the child who is wasted and the child who is stunted. The example was given that a wasted child in the Syria emergency context with acute food deprivation is very different to a stunted child in Guatemala. Participants questioned whether wasting and stunting can simply be two manifestations of the same factors given that the patho-physiology is different.

The WaSt group has not found any differences in risk factors underpinning stunting and wasting; in emergencies there are more risk factors at play and at more extreme levels. Wasting and stunting have a common component which is the change in body composition, including a deficit in lean tissue; this suggests there may be a common mechanism behind them.

It was also noted that biology and growth are such complex phenomena that it may be unrealistic to be too reductionist in trying to understand the causes and describe these outcomes definitively. Trialling interventions that contribute to saving lives and improving functional outcomes may be the important issue as a means to ‘chip something off the ice block’ and recognise that we may not be able to ‘solve’ this huge issue.

Treatment and intervention

The move to divide wasting and stunting was initiated to facilitate response to treatment, knowing that wasting responds quickly. Previously, there were concerns about giving food to stunted children, even if they were also wasted, in case they become fat. Evidence is mixed. Body-composition studies have showed that even short children deposit lean tissue, not fat, when supplemented, although other studies (in food-secure areas) have shown increased fat deposition with supplements. Much seems to depend on the food/supplement provided and the context.

Other studies have shown a failure to improve linear growth with high-quality food supplements. Malnutrition is more than the diet and there is a need to be careful of knee-jerk responses. Mark Manary recently completed a trial with cowpea supplements in which children grew taller; the intervention prevented some stunting. He hypothesised that it may be linked to the quality of the protein and/or the fibre resulting in increased microbiota and better gut health. Participants noted that the impact of interventions on childhood development and resilience in terms of repeated infections and episodes of wasting has been missing from previous research. It was proposed that there could be some value in looking back into the datasets of the collaborative research support programmes conducted by USAID in the 1980s and early 1990s, which comprise longitudinal data on functional outcomes. This will be considered in Phase 3 of the WaSt TIG portfolio of work.

A new policy narrative

There was a discussion of the need for a new policy narrative, that does justice to all that has been discussed

today, which reframes nutritional vulnerability, spanning types of malnutrition and age groups and encompassing both treatment and prevention. Such a reframing would need to embrace the many different groups having similar conversations. It must be a sufficiently simple narrative for policy-makers but somehow engender the emerging technical work and recognise complexity; a macro-narrative under which the different technical issues can be articulated.

The Lancet spoke of the nutrition sector as a ‘fragmented community’. Participant discussion and agreement are reflected in the following statement:

Fragmentation according to type of malnutrition and age of vulnerability is not a helpful approach; it ensures we only see the problem from the dimension we went in to look at it from. There is high political interest in nutrition right now; this offers an opening to bring wasting back into the conversation by thinking about wasting and stunting together and life stages as a continuum.

Working groups

Following the plenary reflections participants were divided into small groups to explore the implications of the opening ‘stories’ and research findings in three domains: policy, programming and research. WaSt and MAMI group members were not segregated but mixed to encourage crossover.

Each group fed back their views on the implications and priority actions to plenary, which was followed by a dynamic process of voting on the priority themes and actions as presented in bold below, with the additional proposed actions in Annex 3.

Policy suggestion 1: Develop a new narrative on malnutrition to include:

- Human rather than anthropometric outcomes.
- MAMI mainstreamed in discourse.
- Resilience and humanitarian/development nexus helping to bring wasting and stunting into the same space.
- The survive and thrive agenda.
- Complements existing multi-sector approach/stunting agenda (SUN Movement).

Constraints for moving forward with this approach include:

- Inadequacy of the evidence base.
- The need for an investment case.
- An opportune moment may have been missed as the discussion on human capital has recently taken place.
- There is a need to influence and work with many people outside this meeting: get UN agencies on board and ministries of health in various countries to move things forward/develop collective consensus.

Opportunities:

- Broader and holistic measures of nutrition attract cross-sector engagement.
- The survive and thrive agenda is already there; a ready-made agenda. However, there is pressure to decrease the number of indicators. Early child

development (ECD) is going to be one of the top indicators in survive and thrive (an index is actively being developed at the moment to go out to countries in six to eight months' time). The link between ECD, human and anthropometric outcomes would be a good message to articulate.

Policy suggestion 2: Include MUAC in growth monitoring for detection and referral of at-risk children

Constraints for moving forward include:

- Referral to which services?
- How well is growth monitoring implemented?
- What happens to low WAZ?

Opportunities:

We will take a quantum step forward when mothers become engaged and want to monitor their children (using MUAC). There was a suggestion to introduce 'home-based growth monitoring' using MUAC.

Programming suggestion 1: Simplify C-MAMI protocol (to take it to scale)

Details of how to simplify were not elaborated.

Programming suggestion 2: Promote the continuum of care by connecting management of infants under 6 months with children over 6 months

Perceived obstacles:

- Allegiance of programmers to WHZ may be a barrier to MUAC use in infants < 6m (see opportunities).
- Treatment of infants < 6m requires a different approach and skillset; how to manage this within the continuum of care? Encourage consideration of the mother-child dyad.
- How to manage the non-breastfed infant; much of the policy framework is around breastfeeding.
- Where we house C-MAMI is still a question; e.g. within IYCF, malnutrition treatment services? etc.
- Attending different programmes takes up a lot of time for mothers/communities. There is a need to think from the mother's perspective with the intention for her to access all the services she needs in one place and time.
- Coverage is critical; it is important to be able to deliver high tempo-spatial case-finding.

Opportunities:

- MUAC may have an advantage to encourage continuum of care, as it is already used in older children.
- Pilot in several places and learn before finalising the protocol and scaling up.
- CMAM had the advantage of simplifying a highly efficacious complex intervention. MAMI might need to make an effective complex programme first, then simplify it.

Research suggestion 1: What works in MAMI to boost longer-term positive functional outcomes (including cognition)?

André Briend and Mark Manary are both planning to work on this. There is still a need to find effective interventions that boost anthropometry before we move to functional outcomes.

There may be other existing opportunities to look at wider, longer-term outcomes as well as to consider psychosocial elements.

Research suggestion 2: What interventions work for mothers/adolescent girls to impact infant nutrition? How can we engage and maintain engagement with adolescent girls? How to delay pregnancy in adolescent girls?

There will be a family planning summit in 2019, with a focus on women choosing when they get pregnant, including adolescent girls. This is an opportunity for the group.

A Kilifi project (KEMRI-Wellcome Project, Kenya) is examining how to support optimal adolescent nutrition for pregnant girls who want to go back to school.

World Vision International is working on projects that aim to delay marriage and first pregnancy. Their experience suggests that adolescent girls should be prioritised over other pregnant mothers as they are at higher risk.

We have more evidence around risk factors that exist, rather than clear evidence on interventions for mothers that have an effect on the developing foetus. The evidence is strong for reducing pre-term birth through supplementation of mothers in pregnancy and we should use this evidence to promote intervention.

Concluding remarks on research priorities

There was an identified need to communicate research findings more widely and expand the scope and interrelation between existing platforms to share and learn.

Resources are required to make these platforms effective; much has relied to date on enthusiastic researchers undertaking analyses in addition to their core work. Donors should include research dissemination in research grants to encourage uptake.

Finally, a reminder that it is essential to ensure that country-level priorities inform our global initiatives and research priorities.

Closing remarks

Ben Siddle, Irish Aid, closed the meeting by observing that, while the synergies between WaSt and MAMI may not have been explicit throughout the day, there is great potential to strengthen them, given a very rich and stimulating exchange. He referred to the Lancet critique of the overall nutrition architecture that came up in discussion; it would be useful to find a mechanism to achieve consensus on an end goal to address this.

He reiterated that we should not just focus on donors to secure funding for critical research, but also consider national governments and their contributions. Ben emphasised the importance of the work of ENN and both groups in distilling evidence into policy/programming. The discussion of 'A new narrative' is very interesting and we need to think through the vehicle and process for this.

Annex 1 Agenda

Time	Topic	Presenters
08.30 – 08.50	Arrival, registration and coffee	
08.50 – 09.15	Welcome, Introductions & Setting the Scene	Carmel Dolan (ENN) & Ben Siddle (Irish Aid)
Session 1: Evidence & Experience		
09.15 - 10.00	WaSt: Where we have come from - the story so far	Tanya Khara (ENN)
	WaSt: Key research findings	André Briend (University of Tampere & University of Copenhagen) & Sophie Moore (MRC Gambia & King's College London)
10.00 - 10.15	WaSt Q&A	Lola Gostelow
10.15 – 10.45Coffee Break		
10.45- 11.30	MAMI: Where we have come from - the story so far	Marie McGrath (ENN) & Marko Kerac (LSHTM)
	MAMI: Key research findings	Martha Mwangome & James Berkley (KEMRI/Wellcome Trust Research Programme)
11.30 – 11.45	MAMI Q&A	Lola Gostelow
11.45 – 13.00Lunch		
Session 2: Implications and Priorities		
13.00 – 13.45	Quick reflections: observations & synergies	Invited contributors, All
13.45 – 14.00	Introduction to Group work on Policy, Programme, Research implications	Lola Gostelow
14.00 - 15.00	Group work	
15.00 - 15.30Tea break		
15.30 – 16.00	Plenary feedback for each theme	Lola Gostelow
16.00 – 17.15	Priorities, opportunities & actions	Lola Gostelow
17.15 – 17.30	Close	Ben Siddle (Irish Aid) & Carmel Dolan (ENN)

Annex 2 Participants list

Name	Affiliation
Abigail Perry	DFID
Amy Mayberry	No Wasted Lives/ACF
Ana Antunes-Martins	MRC
André Briend	University of Copenhagen & University of Tampere
Anita Zaidi	Gates Foundation
Anne Peniston	USAID
Ben Siddle	Irish Aid
Carlos Grijalva Eternod	UCL
Caroline Wilkinson	UNHCR
Dolores Rio	UNICEF
Elizabeth Bontrager	USAID
Emily Smith	Gates Foundation
Erin Boyd	USAID/OFDA
Gaelle Nizery	ECHO
Guy Holloway	CIFF
Hatty Barthorp	Goal
Jack Castle	Power of Nutrition
Jay Berkley	KEMRI-Wellcome Trust
Jeniece Alvey	USAID
Katie Beck	Partners in Health
Kevin Phelan	ALIMA
Laura Lamberti	Gates Foundation
Louise Day	Save the Children consultant
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Mark Manary	College of Medicine, Malawi
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Nancy Aburto	WFP

Name	Affiliation
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Nicki Connell	Save the Children US
Nigel Rollins	WHO
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Sophie Moore	King's College, London
Stephanie Richard	Johns Hopkins University
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William Checkley	Johns Hopkins University
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Marie McGrath	ENN
Carmel Dolan	ENN
Tanya Khara	ENN
Jeremy Shoham	ENN
Tamsin Walters	ENN
Rachael Butler	ENN
Pamela Oloya	ENN

Annex 3 Additional actions proposed by working groups

Policy change

- Closer monitoring and increased outreach to take account of seasonality in wasting and stunting? (Constraints: do what and when?)
- Report on wasting and stunting concurrence in joint estimates (UN and World Bank) (Constraint: unclear what the steps to follow after reporting would be).
- WHA targets in National Nutrition Plans to include wasting and link to preparedness (Constraint: countries may not see wasting as a current priority/issue).

Development for programming

- Causal analysis in a given context should be conducted to take account of both wasting and stunting rather than one or the other.
- More push from donors to support IYCF.
- Funding streams within and across donors need to be more connected.
- Infants: use WAZ and MUAC as anthropometric indices of at-risk; for children >6 months use WAZ and MUAC – but need to consider caseloads, feasibility and appropriate treatment.
- Inclusion of adolescent girls and pregnancy.
- More routine reporting and emphasis (with explanation) on proportion of severe underweight (WAZ <-3).
- Connect with child, maternal and neonatal health to optimise survive and thrive.
- Consider stunting levels in humanitarian response.
- Enhance monitoring and tracking quality to capture infants < 6 months in monitoring and linking in with mothers.
- Target breastfeeding support in programmes more narrowly: pinpoint timings in the early weeks to get a good start and target those at high risk.

Research for MAMI

- Interventions for infants with growth faltering.
- Testing what works to boost growth.
- Are there risks/benefits of birth size? Are specific interventions needed (i.e. separating LBW and normal birth weight)?
- Investigate long-term sustained benefits of CMAM interventions.
- Benefits of implementing current nutrition elements of routine infant and child health programmes (such as Integrated Management of Childhood Illness (IMCI)) and scalability of these.
- Investigate interventions for mothers.

Research on the relationship between wasting and stunting

- Reanalysis of more of the McDonald dataset of cohort studies which cover different contexts.

- Operational research/considerations of treating low WAZ in different contexts/regions.
- Interventions related to growth monitoring as the entry point: What? How to improve quality? How to improve coverage?
- What are the determinants of concurrent WaSt in different contexts?
- Use of biomarkers for stratifying interventions to target the most vulnerable?
- What drives seasonal risks of both wasting and stunting? What to do about it?
- Implications of greater risk of concurrent WaSt in boys: regular monitoring of birth cohort 0-6 months growth (wasting and stunting, growth trajectories) and probably mother/infant issues as per C-MAMI and other tools of the MAMI group if also looking at determinants/interventions).



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