# Validation of MAMI tool for identification of malnutrition in infants and their mothers in Indian population

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## I.     Introduction: -

Growth Failure is increasingly being recognized in under-6-month infant. As per estimates, approximately 4.7 million U6M infants worldwide are moderately wasted and 3.8 million are severely wasted. In India, secondary data analysis of National Family Health Survey (NFHS-4) has revealed high prevalence of wasting and severe wasting in U6M infants.

The MAMI approach was created in response to the high numbers of infants u6m who fail to survive and thrive due to a lack of nutrition and of health services equipped to support them. These infants are at higher risk of sickness, death, and poor development. Despite their vulnerability, small and nutritionally at-risk infants u6m are not always identified and/or managed appropriately. The MAMI initiative began in 2007 in response to concerns raised by frontline practitioners encountering challenges identifying and managing small and nutritionally at-risk infants u6m. The aim of the MAMI Care Pathway Package is to help put the latest WHO technical guidance into practice. It was developed as a first step to help fill a gap in programming guidance. The MAMI Care Pathway draws upon and complements existing national and international guidance and protocols. It is modelled on the Integrated Management of Childhood Illness (IMCI) approach.

Version 1.0 of the C-MAMI Tool was produced in 2015 and updated to Version 2.0 in 2018. Version 3 is now available 2021. It has been updated from the 2018 version through stakeholder consultation, literature reviews, and based on learning's of previous implementation experiences.

## II.     Methodology: -

Objective: To study validity of MAMI tool in identification of at nutritional risk infants and mothers in Indian population.

Study design: -  Pilot study conducted in tertiary care hospital in New Delhi India.

Study population: Patients attending OPD in the hospital.

Sample size: -In India, secondary data analysis of National Family Health Survey (NFHS-4) has revealed prevalence of wasting and severe wasting in U6M infants as 46.8%. Taking this value as reference, the minimum required sample size with 5% margin of error and 5% level of significance is 383 patients. Taking lost to follow up as 20%, total sample size taken is **479**.

Sample taken for pilot study was 10% of total sample size.

**Ethical Consideration**

Approval of the study protocol was taken from the Institutional Ethical Committee of the institution (LHMC/IEC/2022/03/75). Written informed consent was taken from the parents/guardian of the study subjects.

**Data collection: -**Data was collected with the MAMI assessment tools given by MAMI care pathway package developed by ENN group and London school of hygiene & tropical medicine LSHTM. Parameters was taken:Infant MUAC, WAZ of infant, WLZ of infant, Feeding risk ,Infant feeding problem, Mother feeding problem, Maternal health risk, Maternal nutrition status and Maternal mental health.

## III.     Result: -

**Table 1:-Distribution of clinical signs and symptoms (infant) of study subjects.**

| Basic information of study population | Frequency | Percentage |
|---|---|---|
| Female | 18 | 36.00% |
| male | 32 | 64.00% |
| Outpatients clinic | 23 | 46.00% |

| | | |
|---|---|---|
| Immunization clinic | 6 | 12.00% |
| Inpatient care s | 13 | 26.00% |
| Self-referral | 8 | 16.00% |
| **Danger signs** | | |
| Unable to breastfeed/ Drink | 4 | 8.00% |
| Vomit everything | 16 | 32.00% |
| Bilateral pitting oedema | 0 | 0.00% |
| Visible Physical neglect( mother or infant) | 2 | 4.00% |
| **Clinical signs and symptoms (infant)** | | |
| Diarrhoea | 28 | 56.00% |
| Fever | 20 | 40.00% |
| Cough | 12 | 24.00% |
| Severe pallor | 12 | 24.00% |
| Any other illness | 11 | 22.00% |
| Congenital condition/disability causing feeding difficulty | 0 | 0.00% |
| **Various other illness** | | |
| Neonatal jaundice | 1 | 14.29% |
| Pneumonia | 3 | 42.86% |
| Seizure | 1 | 14.29% |
| Severe dehydration | 2 | 28.57% |
| **Key risk factors** | | |
| Mother absent or dead | 2 | 4.00% |
| Low birth weight(2500g or less) | 21 | 44.68% |
| Born preterm | 8 | 16.00% |
| Multiple birth | 4 | 8.00% |
| Adolescent mother | 1 | 2.00% |
| Low mother BMI | 7 | 14.58% |
| Mother MUAC <23cm | 19 | 38.00% |

As shown in the table 1 32(64.00%) patients were males and 18(36.00%) patients were females. In majority (23(46.00%)) of patients, source of referral was outpatient clinic followed by inpatients care (13(26.00%)) and self referral (8(16.00%)). Source of referral was immunization clinic in only 6 out of 50 patients (12.00%).Mean value of infant's age(weeks) of study subjects was 10.62 ± 5.3 with median(25th-75th percentile) of 10.5(6-14.75).

In majority (16(32.00%)) of patients, danger sign was vomits everything followed by unable to breastfeed/drink (4(8.00%)) and visible physical neglect (mother or infant) (2(4.00%)). In majority (28(56.00%)) of patients, clinical signs and symptoms (infant) was diarrhoea followed by fever (20(40.00%)), cough (12(24.00%)), severe pallor (12(24.00%)) and any other illness (11(22.00%)).

In majority (3(42.86%)) of patients, various other illness was pneumonia followed by severe dehydration (2(28.57%)). In majority (21(44.68%)) of patients, key risk factors was low birth weight(2500g or less) followed by mother MUAC<23cm (19(38.00%)), born preterm (8(16.00%)), low mother BMI (7(14.58%)), multiple birth (4(8.00%)), mother absent or dead (2(4.00%)) and adolescent mother (1(2.00%)).

**Table 2:-Distribution of MAMI feeding assessment form of study subjects.**

| MAMI feeding assessment form | Frequency | Percentage |
|---|---|---|
| **What and how do you feed infants** | | |
| Mother breast milk {directly at breast} | 35 | 70.00% |
| Mother expressed breastmilk | 1 | 2.00% |
| Donor human milk | 0 | 0.00% |
| Wet nursing | 0 | 0.00% |
| Breastmilk substitute | 7 | 14.00% |
| Otherwhat and how do you feed the infant | 27 | 54.00% |
| Any difficulties with breastfeeding | 38 | 76.00% |
| Night feeds given | 24 | 68.57% |
| Any breast conditions | 5 | 15.15% |
| is formula fed with a feeding bottle | 25 | 73.53% |
| Any difficulties with feeding | 12 | 35.29% |
| **Any difficulties with breastfeeding** | | |
| Not breastfeed | 4 | 8.00% |
| **How many times is the infant breastfed or given breastmilk in 24 hour** | | |
| 8+feeds in 24 hours | 21 | 60.00% |
| Less than 8 feeds in 24 hours | 14 | 40.00% |
| **Infant well attached to breast** | | |
| Well attached | 19 | 54.29% |
| Not well attached | 16 | 45.71% |
| **Infant suckling effectively** | | |

| | | |
|---|---|---|
| Suckling effectively | 28 | 80.00% |
| Not suckling effectively | 7 | 20.00% |
| **Any other** | | |
| Abscess in breast | 1 | 33.33% |
| Mastitis | 1 | 33.33% |
| Pain | 1 | 33.33% |
| **Other foods or drinks does the infant receive** | | |
| None | 16 | 32.00% |
| Water or other liquids ( e.g. tea , juice) | 32 | 64.00% |
| Potential feeding risk : infant formula | 2 | 4.00% |
| **Type of formula does the infant receive** | | |
| Appropriate formula | 12 | 35.29% |
| Inappropriate formula | 22 | 64.71% |
| **Source of water used in powdered formula** | | |
| Safe water | 11 | 32.35% |
| Unsafe water | 23 | 67.65% |
| **How is infant formula prepared** | | |
| Correctly | 7 | 20.59% |
| Incorrectly | 27 | 79.41% |
| **How much formula does the infant consume at each feed** | | |
| Sufficient infant formula for age | 11 | 32.35% |
| Insufficient infant formula for age | 23 | 67.65% |
| **Feeding risk based on assessment** | | |
| Low feeding risk | 3 | 8.82% |
| Moderate feeding risk | 31 | 91.18% |

As shown in table 2 38(76.00%) mothers faced difficulties with breastfeeding, 35(70.00%) mothers feed breast milk directly at breast followed by feed the infant with other food(27(54.00%)), formula was fed with a feeding bottle (25(73.53%)), night feeds were given (24(68.57%)), faced difficulties with feeding (12(35.29%)), breastmilk substitute was given (7(14.00%)), any breast conditions exist (5(15.15%)) and mother expressed breastmilk (1(2.00%)).21(60.00%) of infants weregiven 8+ breastfed or breastmilk in 24 hours. Only 14 out of 35 infantswere given less than 8 breastfed or breastmilk in 24 hour.

In majority (22(64.71%)) of infants, type of formula given was inappropriate formula. Type of formula given was appropriate formula in only 12 out of 34 infants (35.29%).23(67.65%)) of infants, source of water used in powdered formula was unsafe water. (27(79.41%)) of infants, formula was prepared incorrectly. 23(67.65%)) of infants consumed insufficient infant formula for age.

31(91.18%)) of infants, feeding risk based on assessment was moderate feeding risk. Feeding risk based on assessment was low feeding risk in only 3 out of 34 infants (8.82%).
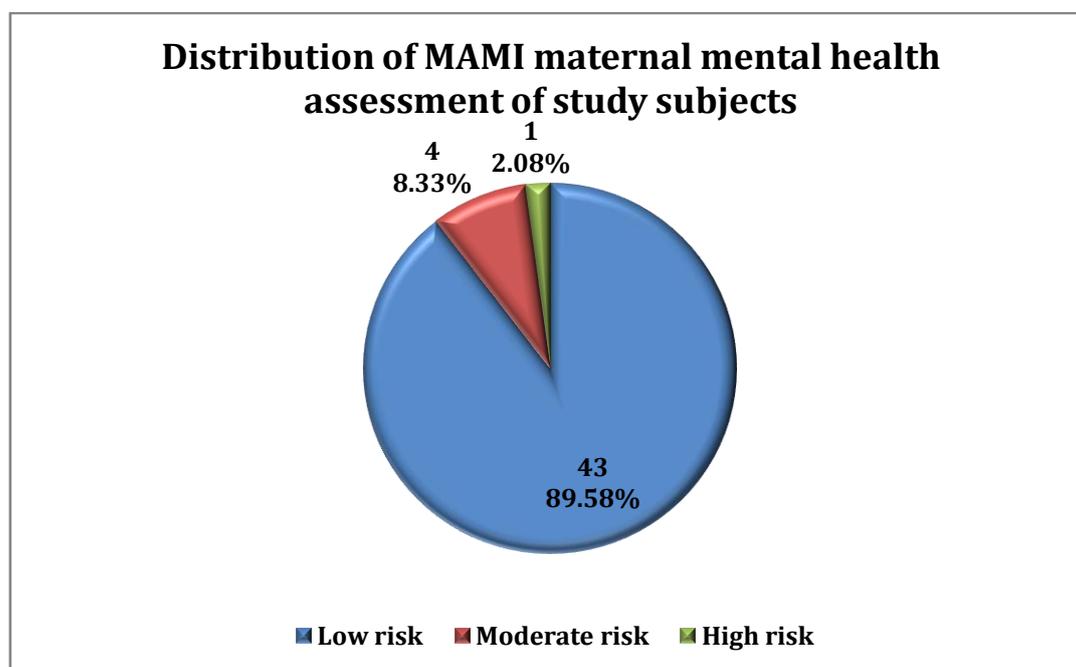


**Figure 1:-Distribution of MAMI maternal mental health assessment of study subjects.**

In majority (43(89.58%)) of patients, MAMI maternal mental health assessment was low risk followed by moderate risk (4(8.33%)). MAMI maternal mental health assessment was high risk in only 1 out of 48 patients (2.08%)
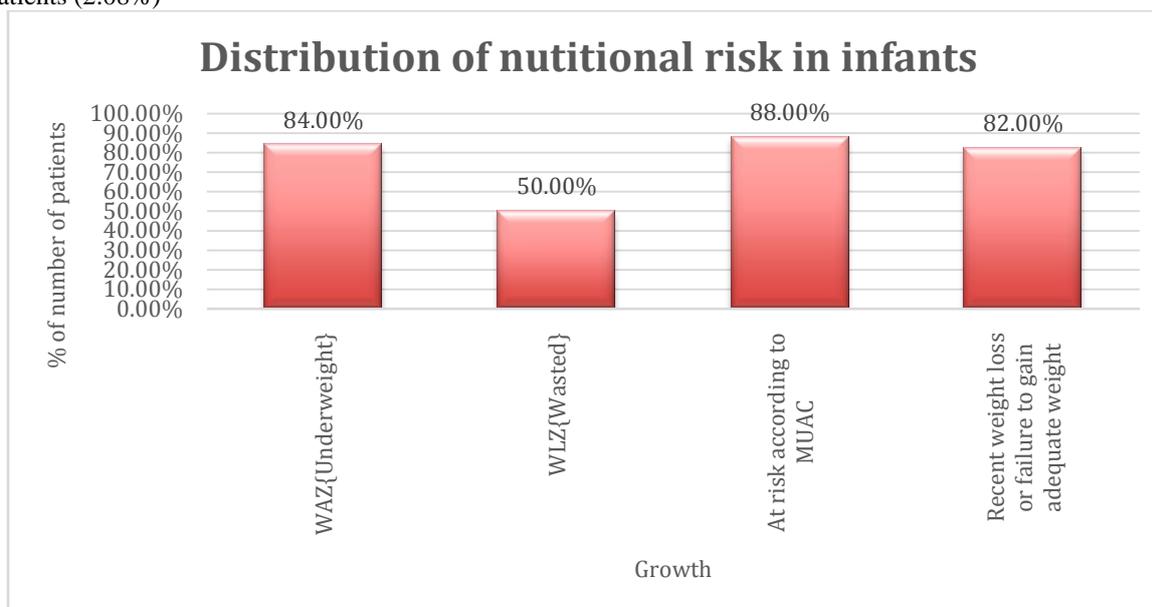


**Figure 2:-Distribution of nutritional risk in infants.**

Majority (44(88.00%)) of patients was at risk according to MUAC followed by WAZ{Underweight} (42(84.00%)) and recent weight loss or failure to gain adequate weight (41(82.00%)). Only 25 out of 50 patients (50.00%) were WLZ{Wasted}.

**Table 3:-Distribution of assessment summary of study subjects.**

| Assessment summary | Frequency | Percentage |
|---|---|---|
| **Step 1 : Any clinical sign requiring referral to hospital or specialized services** | | |
| Low nutritional risk{No} | 3 | 6.00% |
| High nutritional risk{Yes} | 47 | 94.00% |
| **Step 2 : Any sign of infant growth failure** | | |
| Low nutritional risk | 7 | 14.00% |
| Moderate nutritional  risk | 43 | 86.00% |
| | | |
| **Step 3 : Any other risk factors** | | |
| Not at risk | 12 | 24.00% |
| At risk | 38 | 76.00% |
| **Step 4 : Any sign of moderate feeding risk** | | |
| Not at risk | 16 | 32.00% |
| At risk | 34 | 68.00% |
| **Step 5 : Maternal mental health assessment score** | | |
| Low nutritional risk{0-9} | 45 | 90.00% |
| Moderate nutritional risk{10-14} | 5 | 10.00% |

In majority (47(94.00%)) of patients, any clinical sign requiring referral to hospital or specialized services was high risk. Any clinical sign requiring referral to hospital or specialized services was low risk in only 3 out of 50 patients (6.00%). (43(86.00%)) of patients, any sign of infant growth failure was moderate risk followed by low risk (7(14.00%)). In 38(76.00%), 34(68.00%) patients, any other risk factors and any sign of moderate feeding risk was present respectively. 45(90.00%)) of patients, maternal mental health assessment score was low risk{0-9}. Maternal mental health assessment score was moderate risk {10-14} in only 5 out of 50 patients (10.00%).

## IV.    Discussion
GOAL integrated the MAMI approach into its ongoing nutrition programs in two refugee camps in Gambella, Ethiopia using a locally adapted version of the C MAMI tool (Sonja 2017)[4]. Community screening was undertaken by the local community agent involved in the other nutrition activities.  The study shows mixed response from the agents for the C MAMI tool. General impression of tool is good for half participants and others find it difficult. Many difficulties were reported by Sonja et al in the implementation of MAMI tool 2.0

version e.g. anthropometric / nutritional assessment and identification in moderate and severe risk, need of training.

A study was carried out of a GOAL pilot C-MAMI project in two refugee camps in Ethiopia and a Save the Children Pilot C-MAMI project in Bangladesh to test the C-MAMI approach and C-MAMI tool in 2017 -2018 (Butler 2018)[3]. An inter-agency evaluation team conducted key informant interviews and focus group discussions and employed questionnaires, observations of assessment and management, case scenarios and a quiz for tool users. Finding of study were positive. Respondent reported that infant's identification and management were better than previous standard care. Respondents were found that C-MAMI tool providenecessary, comprehensive framework; areas for improvement, such as admission and discharge criteria and have informed Version 2.

In Nov 2017 and July 2018 A pilot program was implemented by Save the Children and UNICEF in the Rohingya response to identify and manage malnourished infants less than 6 months using an adapted C-MAMI Tool ( Kueter 2018) [2]. Seven C-MAMI sites were established, integrated/aligned with existing programs. In the study 1,964 infant-mother pairs were referred to C-MAMI sites, of whom 762 were enrolled in outpatient care and 78 complicated cases referred for inpatient treatment. Programme challenges included lack of baseline caseload data and the recruitment of suitably qualified staff. Experiences have informed the latest C-MAMI Tool (Version 2).

GOAL integrated the MAMI approach into its nutrition program in two refugee camps in Gambella, Ethiopia, using a locally adapted version of the C-MAMI tool (Burrell, Barthoap 2020)[1]. Community screening was done by community outreach agents using simple criteria and thorough monthly screening by counsellors at the nutrition care Centre. Defaulter rate was high due to population mobility; among those who remained in the camp, cure rate was 71%. Qualitative feedback from community members, beneficiary mothers and staff reveals that the programme is highly valued; staff suggested that simplification of the C-MAMI tool would aid implementation. The repose was encouraging.

U6m malnutrition is particularly serious in India, where the prevalence of wasting in this age group is 31.9% and that of severe wasting is 14.9% (IIPS, 2017)[11].In this study we also found very high prevalence of wasting 50 % and underweight 84%. The prevalence of wasting is highest at birth (37%) and declines with age (IIPS, 2017) – a similar pattern to that seen in other South Asian countries, such as Bangladesh, but different to the pattern seen in west and central Africa, where prevalence of wasting is relatively low at birth and increases in infancy, peaking at around 12 months of age (WHO and UNICEF, 2004)[10]. However, the Pattern of Bangladesh and Ethiopia give idea about difficulties and affectivity of tool but their growth pattern and development pattern of infants and maternal metal status are relatively different from Indian scenario. The need of the study is very high in Indian health care setting. The low birth weight and early growth failure problems are found very high in infants less than six months of age in this pilot study.

## V.     Conclusion

The C MAMI tool was developed to help identify, assess and mange malnutrition and at risk infants at community level. It has not been field tested yet in India. As state in these articles, MAMI tool is good for identification of malnutrition and management. We found if effective for facility level management. It cost effective too. There are some hurdles in implementation of MAMI tool. This Pilot study assessed a high burden of undernutrition in infants less than six months and half of the study population was wasted. We will also identify the effect and percentage of infants managed for undernutrition and wasted infants after the main study. Due to less sample size correlation and association could not be drown in the pilot, we will also able to tell about the main risk factors. Preventive interventions must be targeted at reducing low birth weight, promoting exclusive and effective breastfeeding and improved nutrition of mothers. We conclude that infants less than 6 months of age are prone to malnutrition in India large scale study must needed for nutritional care of at risk infants and their mothers.

## References:
[1].    Burrell, Barthorp, 2020 GOAL's experiences of management of at-risk mothers and infants under six months (MAMI) in Ethiopia. Field Exchange - Emergency Nutrition Network ENN
[2].    Kueter, A M Burrell, Butler, Sarwar, 2018 Piloting the C-MAMI approach in the Rohingya response in Bangladesh. Special Section on MAMI: Management of at risk mothers and infants under six months.
[3].    Butler, Connell, N Barthorp, 2018 C-MAMI tool evaluation: learnings from Bangladesh and Ethiopia. Special Section on MAMI: Management of at risk mothers and infants under six months.
[4].    Read, S 2017 Improving community management of uncomplicated acute malnutrition in infants under six months (C-MAMI): developing a checklist version of the C-MAMI tool.
[5].    https://resourcecentre.savethechildren.net/library/mami-care-pathway-package-version-30
[6].    https://resourcecentre.savethechildren.net/spotlight/mami
[7].    C-MAMI Tool, Version 2 (2018) | ENN

[8].    MAMI Care Pathway Package, Version 3 (2021) | ENN
[9].    United Nations Children's Fund (UNICEF), World Health Organization (WHO).
[10].   World Health Organization. Updates on the management of severe acute malnutrition in infants and children. Guideline. 2013.
[11].   International Institute for Population Sciences (IIPS) and Macro International. National Family Health Survey (NFHS-4), 2015-2016; India. Vol. I. Mumbai: IIPS; 2017.

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