The cost of implementing the C-MAMI tool to treat nutritionally vulnerable infants in Bangladesh

Monera and her infant Samiba, Barisal, Bangladesh, 2016

Save the Children

By Natasha Lelijveld, Mostofa Sarwar, Golam Mothabbir, Sarah Butler and Nicki Connell

Natasha Lelijveld is a Research Fellow at the Centre for Global Child Health at the Hospital for Sick Kids in Toronto. She has previously worked on acute and chronic malnutrition research at University College London, London School of Hygiene and Tropical Medicine and the No Wasted Lives initiative at Action Against Hunger.

Mostofa Sarwar is a medical doctor with five years' experience in maternal and child health and nutrition in development and emergency contexts with leading non-governmental organisations (NGOs). He is currently the Deputy Manager- Health, Nutrition and HIV/AIDS for Save the Children in Bangladesh.

Golam Mothabbir is the Senior Advisor for Health and Nutrition at Save the Children International, Bangladesh Country Office. He has been providing technical and strategic guidance to the MAMI field research team in Bangladesh since August 2014.

Sarah Butler is the Director of Emergency Nutrition at Save the Children, US. She has more than ten years' experience in nutrition and has been leading the team since Save the Children began implementation research into C-MAMI in 2013.

Nicki Connell is currently the Eleanor Crook Foundation's Nutrition Technical Director. Nicki was previously an Emergency Nutrition Advisor for Save the Children, and served as Project Manager for this work. She has ten years' experience in emergency nutrition, with much experience in the management of at-risk mothers and infants (MAMI).

The authors would like to thank Dr Marko Kerac from London School of Hygiene and Tropical Medicine for his academic support, Save the Children for hosting the fieldwork within their programmes, and the in-kind expertise provided by the No Wasted Lives initiative at Action Against Hunger UK.

Location: *Bangladesh*

What we know: The C-MAMI tool was developed to guide the community-based management of uncomplicated cases of severe acute malnutrition (SAM) in infants under six months, as per the WHO 2013 guideline.

What this article adds: Save the Children carried out a calculation of the cost-efficiency of a protocol based on the C-MAMI tool in Bangladesh, compared to the standard, inpatient-based protocol. Costs were identified for both protocols, including inputs, health system costs, efficiency data (such as number of admissions/month), scale-up costs and costs to caregivers. The cost of C-MAMI to the healthcare provider (per clinic/month) was higher than the standard (USD1,007 vs USD466); however, it was found to be more cost efficient per infant treated (USD289 vs USD685). If fully integrated into the national health system, the cost of C-MAMI would reduce to an estimated USD536 per clinic/month and USD154 per infant treated. The cost for caregivers was found to be lower for C-MAMI compared to the standard (USD53 vs USD74 per caregiver/six months). Overall, the societal costs (healthcare provider + caregiver) were significantly lower in C-MAMI compared to standard (USD342 vs USD759), although both were judged to be cost-efficient.

Background

Current treatment guidelines for severe acute malnutrition (SAM) in infants under six months are based on very weak evidence and focused on inpatient care; WHO guidance recommends community-based management for uncomplicated cases (WHO, 2013). To help a fill a gap in programming guidance, the C-MAMI tool (www.ennonline.net/c-mami) was developed to help catalyse community-based case management. Save the Children (SC) recently tested a protocol based on the C-MAMI tool for the treatment of "nutritional at-risk" infants in Barisal district, Bangladesh, estimating its effectiveness compared to the current standard inpatient protocol (results pending).

A secondary aim of the research was to calculate the cost and cost-efficiency of this new treatment method. This economic sub-study aimed to highlight major considerations in cost differences between standard inpatient protocol and the C-MAMI model from a societal prospective, considering costs to both the healthcare provider and caregivers.

Method

The C-MAMI model (intervention) and standard inpatient protocol (control) were implemented in 24 community clinics in Barisal district within the Ministry of Health (MoH) system, with support from SC staff. All infants receiving C-MAMI support were requested to attend weekly counselling appointments at the clinic and received home visits as necessary.

To estimate costs, programme inputs ("ingredients") were identified and quantified and costs were assigned against these, informed by the study protocol, accounting data and expert observation. A simple decision tree was built to map the various treatment pathways in each study arm and guide the mapping of major resources for

Table 1 Summary of cost to the health provider for the intervention and the control models

	Cost per clinic per month USD		Cost per infant screening USD		Cost per infant treated USD	
	C-MAMI N=12	Standard N=12	C-MAMI N=630	Standard N=595	C-MAMI N=251	Standard N=49
Staff at clinic	778.13	306.06	14.82	6.17	223.21	449.72
Hospital admission	80.88	102.8	1.54	2.07	23.20	151.09
Supplies	26.58	22.06	0.51	0.44	7.62	32.41
Buildings and equipment	80.86	35.07	1.54	0.71	23.20	51.53
Specialist Training	40.45	0.00	0.77	0.00	11.60	0.00
Total	**1006.91**	**466.02**	**19.18**	**9.40**	**288.83**	**684.76**

Table 2 Estimated cost of a fully integrated MoH C-MAMI intervention model

	Cost per clinic per month USD	Cost per infant screening USD	Cost per infant treated USD
Staff at clinic	347.56	6.62	99.70
Hospital admission	40.08	0.76	11.50
Supplies	26.58	0.51	7.62
Buildings and equipment	80.86	1.54	23.20
Training	40.45	0.77	11.60
Total	**535.53**	**10.20**	**153.62**

* Assumes that the same level of screening and treatment rates are achieved as in the current SC-supported intervention.

Table 3 Cost to caregivers of the intervention vs control treatment protocols

Activities	Cost to Caregivers from 0-6 months USD			
	C-MAMI protocol		Standard protocol	
	Maximum*	Average per child treated	Maximum*	Average per child treated
Transport to clinic	6.51	5.41	3.77	3.16
Cost of time spent at clinics	8.03	3.01	3.57	1.33
Cost of admission for SAM	119.28	3.94	119.28	9.82
Cost of other health seeking	13.97	2.80	26.02	5.08
Cost of BMS	159.03	38.17	159.03	54.07
Total	**306.82**	**53.33**	**311.67**	**73.95**
Total (excluding BMS)	147.79	15.17	152.63	19.88

* Maximum describes the scenario for a mother who is not exclusively breastfeeding and is admitted for inpatient SAM treatment. The "averaged" costs cannot be applied to individual cases as they represent the average across the whole group of mothers, including those with healthier infants who required limited intervention.

inclusion in cost calculations (Figure 1). Due to the integrated nature of the programmes, other health system costs were estimated through key informant interviews and published WHO-CHOICE values (www.who.int/choice/costs/en/)[1]. Efficiency data, such as the number of admissions per month, were calculated from interim values at the time of costing data collection.

Using information from the FANTA II Profiles results for Bangladesh, we also present the estimated cost for scaling up the implementation of the tool within an integrated health system, and this cost in relation to published government spending (Howlader, 2012).

Costs to caregivers, including direct costs and indirect time costs, were estimated through informal, anonymous interviews with a range of caregivers; programme defaulters are likely underrepresented.

Results

There are several key differences between the C-MAMI model and the standard protocol which need to be considered from a cost perspective. The C-MAMI model has a wider range of admission criteria, including maternal health indicators, and the treatment consists largely of weekly counselling and specialised lactation advice, compared to inpatient-feeding based on infant anthropometry only in the standard protocol.

Cost to healthcare providers

For the healthcare provider, the cost of the C-MAMI intervention was higher than the standard intervention (USD1007 vs USD466 per clinic per month), due to additional staff, staff training, tablet computers (for the MAMI app which accompanied the protocol), and capital costs of creating breastfeeding corners (Table 1). However, when this cost is applied to the number of children treated by each clinic each month (3.5 vs 0.7), the C-MAMI intervention becomes more cost-efficient than the standard model (USD289 vs USD685 per child treated).

Estimated cost if the C-MAMI intervention was fully integrated with national MoH

The above costs are based on the current system, which is supported by SC staff. If the C-MAMI protocol were to be fully integrated into the national health system, it would streamline and save costs. These hypothetical cost calculations include more Community Health Volunteers (CHVs) in place of Field Officers for screening, training Health Assistants to make referrals and home visits, and utilising Family Welfare Assistants to replace the role of SC Technical Officers as lactation specialists. The tablet computers would still be necessary to use the C-MAMI app. High-level staff training is still required; although associated cost and time is high, it is fundamental to the successful treatment of infants <6m and could be more cost-effectively implemented if conducted on a larger scale. Table 2 presents the summary of costs for this hypothetical "streamlined" and "fully integrated" intervention model.

If considering the scale-up to national level, based on an estimate of 17,700 community clinics in Bangladesh, the cost of implementing C-MAMI for one year at a national level would be USD114 million.

Cost to caregivers

Despite the additional time and money spent on weekly clinic visits, the overall cost is lower for caregivers in the C-MAMI intervention than the standard protocol (average USD53 vs USD74 per caregiver for six months). The C-MAMI programme saved some caregivers the high cost of lengthy inpatient admissions and the need to seek additional private health advice. Successful relactation through the C-MAMI lactation support also saved the cost of breastmilk substitute (BMS) where applicable.

Costs from a societal perspective

The societal cost per child treated (health provider + caregiver) by either the C-MAMI intervention (USD342) or the standard protocol (USD759) was less than the Bangladesh 2016 per capita GDP (USD1,358.8), which suggests that both models are "cost-effective". Based on estimates from a FANTA report, the cost of implementing the "integrated" C-MAMI protocol for one year at a national level (USD114million) is approximately 11% of the Bangladesh 2012 Health Promotion and Nutrition budget, which seems attainable.

This study could not calculate any additional cost-savings of the intervention in potentially preventing infant SAM cases, preventing child stunting, and reducing the burden of severe wasting in children aged 6-59 months; however, these factors should be considered by policy-makers. In addition,

[1] The WHO-CHOICE project (CHOosing Interventions that are Cost-Effective) has a database of region-specific costs for common health interventions to help policy-makers assess cost-effectiveness of health programmes, including for Bangladesh specifically.


Field research officers measure the weight of an infant under six months in Barisal, Bangladesh, 2016

Save the Children

it will be important to calculate the "cost per recovered" once the main study results have been analysed.

Conclusion

The absolute cost per clinic of the C-MAMI intervention is higher from a healthcare provider perspective than the cost of the standard control protocol, but is more cost-efficient per child treated and less costly to caregivers. A national, integrated C-MAMI intervention is potentially viable at scale. It is important to reassess cost-effectiveness of treatment approaches in light of potential SAM cases averted, if data is available. Additional cost-savings in preventing malnutrition and in reducing severe wasting burden in children aged 6-59 months should also be considered when evaluating the cost-effectiveness of the C-MAMI intervention.

For more information please contact Natasha Lelijveld at Natasha.lelijveld.11@ucl.ac.uk or Sarah Butler at sbutler@savechildren.org

References

Islam, M., et al., *Severe malnutrition in infants aged <6months-seasonal prevalence, outcomes and risk factors in Bangladesh: repeat cross sectional surveys and a prospective cohort study.* Under Consideration, 2018.

Islam, M.M., et al., *Risk factors for severe acute malnutrition in infants <6 months old in semi-urban Bangladesh: A prospective cohort study to inform future assessment/ treatment tools, in ACF Research Conference*. 2016, ENN Field Exchange. p. 62.

Read, S., *Improving community management of uncomplicated acute malnutrition in infants under six months (C-MAMI): Developing a checklist version of the C-MAMI tool. Field Exchange*, 2017. 54(February 2017): p. 30.

Howlader, S.R., et al., *Investing in nutrition now: a smart start for our children, our future. Estimates of benefits and costs of a comprehensive program for nutrition in Bangladesh, 2011–2021. PROFILES and Nutrition Costing Technical Report.* Washington DC, USA:

Food and Nutrition Technical Assistance III Project (FANTA), 2012. Food and Nutrition Technical Assistance III Project (FANTA), FHI, 2012. 360.

WHO (2013) *Updates on the management of severe acute malnutrition in infants and children.* Available from: http://www.who.int/nutrition/publications/guidelines/updates_management_SAM_infantandchildren/en/

Figure 1 Decision trees for the control treatment model and the intervention treatment model