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Review Article

Outcome evaluation of a pilot CSAM program in Central India: a prospective cohort study.

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Abstract

Background: Severe Acute Malnutrition (SAM) remains a major public health challenge in India, particularly in Madhya Pradesh, where a significant proportion of under-five children are affected. The Community-Based Management of Acute Malnutrition (CSAM) approach offers a decentralized, cost-effective solution for treating uncomplicated cases through frontline workers and community infrastructure. This study evaluates the outcomes of a pilot CSAM program in a high-burden district in Central India, assesses its effectiveness against international Sphere standards, and identifies key implementation challenges.

Methods: A prospective cohort study was conducted among 108 children aged 6-59 months with uncomplicated SAM, enrolled from 25 Anganwadi Centers in Babai Block, Madhya Pradesh. The children were followed for a 12-week treatment period. Data on anthropometry, treatment adherence, and program outcomes (recovery, default, non-response rates) were collected from program records and field observations. The program's effectiveness was compared against Sphere Standard benchmarks.

Results: Out of 108 SAM children enrolled, 32 (29.6%) achieved recovery by the end of 12 weeks. The average weight gain among recovered children was 5.7 g/kg/day, while the mean length of stay was 75 days. The default rate was 18.5% and the non-response rate was 51.9%. Key implementation gaps were identified, including inconsistent use of Take-Home Ration (THR) within households, poor documentation of key clinical metrics (24% of records incomplete), and a low referral rate (7.4%) for non-responsive cases to higher facilities.

Conclusion: The pilot CSAM program demonstrated operational feasibility but achieved recovery and non-response rates that were below international standards. The high rate of weight gain among the children who did recover suggests the therapeutic protocol is effective when adhered to. Critical implementation gaps in nutritional support adherence, documentation, and referral pathways were primary contributors to the suboptimal outcomes. Strengthening these areas is essential to realize the full potential of community-based management for SAM in India.

Keywords: Severe Acute Malnutrition; Community-Based Management of Acute Malnutrition (CSAM); Nutrition Program Evaluation; Implementation Science; Recovery Rate; Under-Five Children; Madhya Pradesh; India.

BACKGROUND

Undernutrition is a significant contributor to child morbidity and mortality globally, with Severe Acute Malnutrition (SAM) representing the most life-threatening form. Children suffering from SAM are at a nine-fold increased risk of death compared to their well-nourished peers. In India, the burden of SAM remains alarmingly high, with NFHS-5 reporting a prevalence of 19.3% wasting among under-five children. The state of Madhya Pradesh consistently ranks among the highest in terms of malnutrition indicators, with over 7.8 lakh SAM children, necessitating urgent intervention[1].

Traditionally, SAM management has relied heavily on facility-based treatment through Nutrition Rehabilitation Centres (NRCs). However, this approach is resource-intensive and often inaccessible for rural populations due to geographic, financial, and social barriers. Consequently, there has been a paradigm shift toward Community-Based Management of Acute Malnutrition (CMAM/CSAM), which aims to treat uncomplicated SAM cases at the community level, reserving facility-based care for complicated cases[2]. The CSAM strategy, endorsed by the Government of Madhya Pradesh under the Atal Bihari Vajpayee Bal Arogya Evam Poshan Mission, integrates Anganwadi Workers (AWWs) and Auxiliary Nurse Midwives (ANMs) to screen, treat, and monitor SAM children using locally available resources and Take Home Ration (THR). Evidence from global studies suggests that community-based programs can be both effective and scalable, provided there

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is adequate training, support, and adherence to treatment protocols3. The Sphere Standards offer internationally recognized benchmarks for program effectiveness, recommending a >75% recovery rate, <15% default rate, and <10% non-response rate4. Despite the increasing adoption of CSAM in India, limited evidence exists on its real-world effectiveness in rural program settings, especially in central Indian states. This study addresses this gap by evaluating the effectiveness of the CSAM program implemented in Babai Block of Hoshangabad District, a rural area of Madhya Pradesh, over a 12-week period. By assessing key indicators such as recovery rate, default rate, weight gain, and average length of stay, this evaluation provides valuable insights into the feasibility and performance of decentralized SAM treatment models.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective cohort study conducted as part of a process evaluation of the Community-Based Management of Severe Acute Malnutrition (CSAM) program in Babai Block, Hoshangabad District, Madhya Pradesh. Babai Block comprises 125 villages and 217 functional Anganwadi Centres (AWCs), and has a predominantly rural population of approximately 1.3 lakh. The block was selected for the pilot implementation of the CSAM strategy under the Atal Bihari Vajpayee Bal Arogya Evam Poshan Mission[5].

Characteristics of Participants

The study population included children aged 6–59 months diagnosed with uncomplicated SAM, identified through regular screening at selected AWCs using the criteria laid out in the CSAM operational guidelines. SAM was defined based on WHO criteria: Weight-for-Height/Length (WFH) < −3 standard deviations (SD), MUAC < 11.5 cm, and/or presence of bilateral pitting oedema6. A total of 108 SAM children enrolled in the CSAM program across 25 purposively selected AWCs were followed for 12 weeks. Selection of AWCs was based on operational feasibility and presence of enrolled SAM cases. Children with medical complications or severe oedema at baseline were excluded and referred to NRCs as per protocol.

Program Description and Interventions

Enrolled children were managed at the community level with weekly follow-ups by AWWs and ANMs. Follow-ups included anthropometric assessment, nutritional counselling, and provision of THR and essential medications (Amoxicillin, Albendazole, Iron-Folic Acid syrup, Multivitamins), and weekly review of appetite and progress5. Follow-ups were conducted for 12 weeks, with documentation of weight gain, medication compliance, referral to NRC (if needed), and status at discharge. Program effectiveness was assessed using key indicators compared against Sphere Standard benchmarks benchmarks[7] (**Table 1**)

Table 1. Outcome indicators to assess the effectiveness of CSAM programme.

Indicator	CSAM Program Goal	Sphere Standard
Recovery Rate	>50%	>75%
Default Rate	<15%	<15%
Non-response Rate	<25%	<10%
Mean Weight Gain	>4 g/kg/day	>5 g/kg/day
Average Length of Stay	6–12 weeks	<60 days (ideal)

Data Collection and Statistical Analysis

Data were collected using structured checklists, review of AWW/ANM registers, and direct field observations of program activities. Recovery was defined as WFH ≥ -2 SD or MUAC ≥ 12.5 cm without oedema by the end of 12 weeks. Default was defined as absence from follow-up for ≥2 consecutive weeks. Non-response was defined as failure to meet recovery criteria after 12 weeks of treatment. Data were entered into Microsoft Excel and analysed using R statistical software R 4.5.0 version. Descriptive statistics such as mean and standard deviation were calculated for continuous variables. Categorical variables were presented as proportions. Recovery, default, and non-response rates were compared with Sphere Standards.

RESULTS

A total of 108 uncomplicated SAM children (54 boys and 54 girls) were enrolled in the CSAM program from 25 AWCs in Babai Block. The majority (48%) were between 12–24 months of age. At baseline, all children fulfilled anthropometric criteria for SAM as per CSAM guidelines. The mean weight at enrolment was 6.8 ± 1.2 kg, and mean MUAC was 10.7 ± 0.9 cm. The program's performance was substantially below international benchmarks (**Table 2**). The recovery rate was only 29.6%, while the non-response rate was an exceptionally high 51.9%, indicating that over half the children who completed the program failed to recover.

Table 2. Program Effectiveness Indicators.

Indicator	Observed Value (%)	Sphere Standard (%)
Recovery rate	29.60%	>75%
Default rate	18.50%	<15%
Non-response rate	51.90%	<10%

Observed values from the CSAM program in Babai Block (N=108) compared against international Sphere Standards for program effectiveness.

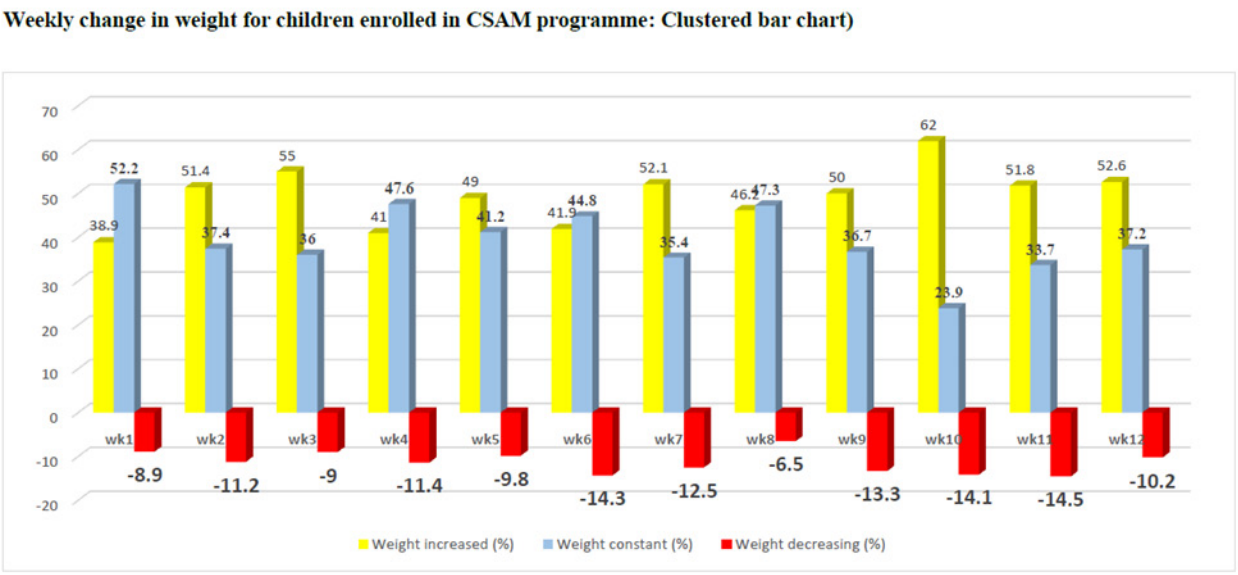
Despite poor overall recovery, the children who did recover showed excellent progress. The mean weight gain among

recovered children (n=32) was 5.7 g/kg/day, exceeding the Sphere benchmark. In contrast, non-recovered children (n=72) gained only 2.3 g/kg/day, indicating a stark difference in treatment response. Weekly anthropometric assessments showed a gradual but inconsistent weight gain. The largest improvements were seen between weeks 4 to 8. A plateau in weight gain was observed thereafter in a substantial number of non-recovered children.

The average length of stay among recovered children was 75 days (SD ± 9.8), aligning with the intended duration of the CSAM cycle but exceeding the ideal Sphere benchmark of <60 days. The delay in weight gain and clinical improvement contributed to longer duration of treatment. In terms of medication and nutritional support, all children received standard CSAM medications during the first week. Adherence to Albendazole, Amoxicillin, and multivitamin syrup was high, with 82% of recovered children adhering to the regimen; however, adherence dropped to 65% in the non-recovered group by week 6. Take Home Ration (THR) was distributed weekly, but field observations revealed inconsistent preparation and sharing of the THR within households, which may have impacted recovery outcomes. Regarding referral and documentation, 8 children (7.4%) were referred to Nutritional Rehabilitation Centers (NRCs) due to weight stagnation or complications. However, documentation of key metrics such as target weight, appetite test results, and complication screening was incomplete in 24% of follow-up records, indicating gaps in monitoring and reporting.

Figure 1 shows weekly weight changes among SAM children enrolled in the CSAM program, with the majority consistently gaining weight each week—peaking at 62% in week 10. A smaller proportion of children experienced weight loss throughout, with the highest observed in weeks 10 and 11 (over 14%), indicating overall positive but varied weight progression. The chart shows the percentage of children whose weight increased (blue), remained constant (orange), or decreased (red) each week compared to the previous week's measurement. Percentages are noted on the bars. The analysis includes all children remaining in the program at each weekly follow-up.

Figure 1. Weekly weight change status of enrolled children.



The weekly progression of Weight-for-Height Z-scores (**Figure 2**) shows a gradual median improvement for both boys and girls, but also illustrates that the majority of children remained well below the recovery threshold (Z-score ≥ -2) throughout the 12 weeks. To understand the reasons for these suboptimal outcomes, field observations and program records were analysed to identify key implementation challenges. These are summarized in **Table 3**. Gaps were evident across all domains, from nutritional support to clinical monitoring and referral.

Figure 2. Progression of Weight-for-Height Z-scores by gender.

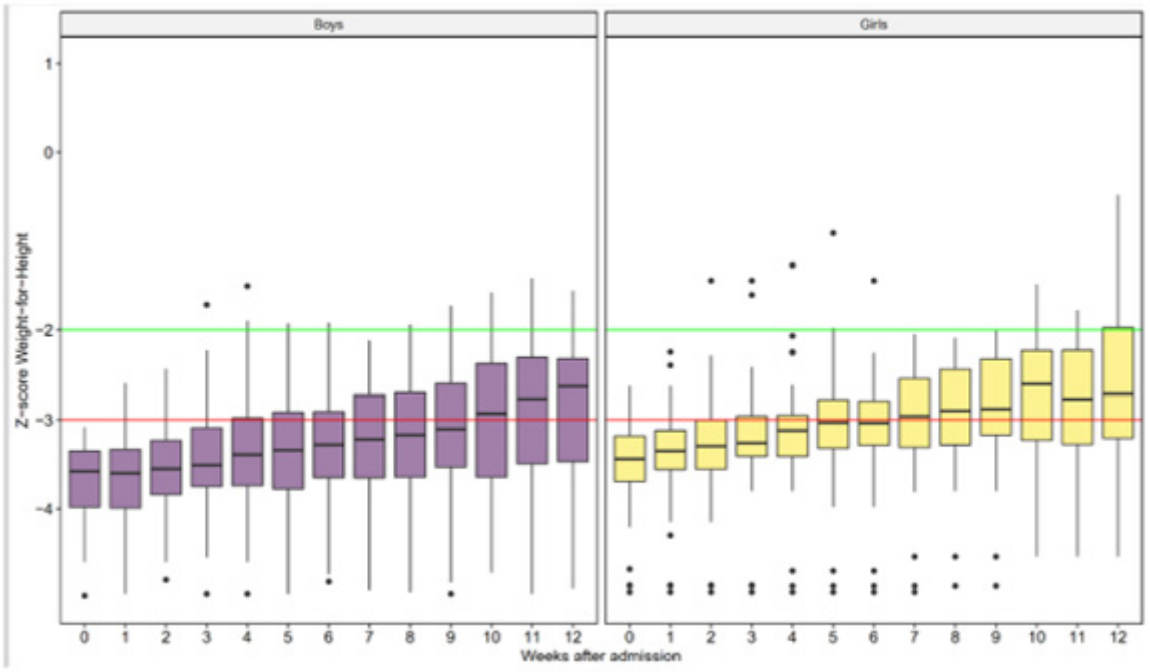


Table 3. Key Observed Implementation Challenges and Gaps.

Domain	Challenge/Gap	Observed Metric/Finding
Nutritional Support	Inconsistent household use of THR	Field observations revealed frequent sharing of THR among family members.
Medication Adherence	Lower adherence in non-recovered group	Adherence dropped to 65% in the non-recovered group by week 6.
Monitoring & Reporting	Incomplete documentation	Key metrics (appetite test, target weight) were missing in 24% of records.
Referral Pathway	Potential under-referral of non-responders	Only 8 children (7.4%) were referred to NRCs, despite 56 (51.9%) being non-responders.
Program Fidelity	Limited appetite testing	Appetite tests, crucial for identifying complications, were not systematically documented.

DISCUSSION

The present study assessed the effectiveness of a community-based management model for uncomplicated SAM children under the CSAM program in Babai Block of Madhya Pradesh, over a 12-week intervention. Despite its decentralized approach and integration with the existing ICDS infrastructure, the program fell short of key benchmarks as defined by Sphere standards, particularly in recovery and default rates with a particularly alarming non-response rate of over 50%.

The recovery rate of 29.6% in this study was substantially lower than the internationally accepted minimum threshold of >75%[7]. This is consistent with earlier findings from the Shivpuri district CSAM pilot, which reported moderate recovery rates and emphasized the need for programmatic strengthening[8]. Moreover, the non-response rate of 51.9% significantly exceeded the acceptable limit of 10%, indicating that more than half of the enrolled children did not achieve clinical or anthropometric recovery despite completing the treatment cycle. These figures reflect both operational and contextual barriers in the field-level implementation of CSAM. The default rate (18.5%), though marginally above the Sphere threshold of 15%, represents a critical challenge. It is worth noting that logistical constraints such as caregiver migration, intra-household food sharing, and poor awareness have been consistently identified as contributors to dropout in CMAM/CSAM programs across India and Sub-Saharan Africa[9,10]. A similar observation was made in the Bihar CMAM pilot, where defaulterratesreached21%duetosocialandeconomicfactors[11]. A central paradox emerged from the data: the average weight gain in the small subgroup of recovered children (5.7 g/kg/day) was excellent, suggesting the therapeutic components of the program are potent. It was above the CSAM program's goal of 4 g/kg/day and approaching Sphere standards (>5 g/kg/day), suggesting that the therapeutic approach was effective for those who adhered. This aligns with findings from Michael Ciliberto's trial in Malawi, where children managed

at home with nutritional support gained 3.5 g/kg/day, and those who recovered showed sustained anthropometric improvement[12]. The average length of stay in this study was 75 days, aligning with the 12-week duration of CSAM. However, Sphere recommends a recovery within 60 days, underscoring delays possibly due to nutritional inadequacy or inconsistent medication adherence. Field observations highlighted frequent sharing of THR within households, which has been cited in multiple evaluations (e.g., Odisha and Maharashtra) as a major barrier to achieving expected nutritional outcomes[13].

Another potential explanation for poor recovery is the limited appetite testing and inaccurate anthropometric documentation, both of which are essential for accurate classification and timely referral. Similar gaps were noted in studies from Burkina Faso and Zambia, which emphasized the role of frontline worker training and monitoring systems in maintaining program fidelity[14,15].The referral rate to NRCs was only 7.4%, which may suggest under-referral of complicated or non-responsive cases. In contrast, the standard CSAM algorithm recommends timely referral when children fail to gain weight over two consecutive follow-ups. This operational shortcoming may have further contributed to poor recovery and increased the burden of non-responders. An evaluation in Indore and Ujjain NRCs showed that children who received facility-based care demonstrated significant anthropometric recovery, emphasizing the need for better triage at the community level[16]. There is a need for strengthening capacity-building of AWWs and ANMs, as knowledge and skill gaps can directly impact implementation quality. As Ashworth (2006) reported, community-based recovery is feasible only when workers are well-trained and adequately supervised[17].

From a systems perspective, this study reinforces that CSAM cannot operate in isolation. A functional continuum of care—including proper screening, nutrition education, uninterrupted supply of medications, home visits, and supportive supervision—is essential. Evidence from the SNEHA CMAM model in Mumbai demonstrated improved recovery when these components were implemented holistically[18]. Despite its limitations, the CSAM program offers a viable and scalable alternative to facility-based care, particularly in rural areas with limited healthcare access. However, several areas require improvement for greater effectiveness: regular training and supervision of Anganwadi Workers (AWWs) and Auxiliary Nurse Midwives (ANMs) must be ensured to maintain consistent care quality; the nutritional adequacy of Take-Home Rations (THR) needs to be better monitored to prevent household sharing and improve compliance; referral mechanisms and follow-up protocols should be strengthened to ensure timely interventions; and increased community sensitization is crucial to enhance adherence and reduce program defaulting, ultimately improving health outcomes for children with severe acute malnutrition. To improve program outcomes further, it is recommended that training and supportive supervision of Anganwadi Workers (AWWs) and Auxiliary Nurse Midwives (ANMs) be institutionalized and scaled to ensure consistent skill development and effective service delivery. Household-level counseling should be reinforced to minimize the sharing of Take-Home Rations (THR) and enhance dietary compliance among caregivers. Strengthening appetite testing, anthropometry, and documentation with simplified tools will improve data accuracy and monitoring. The timely referral of non-responders to Nutritional Rehabilitation Centers (NRCs) should be enforced based on weight progression criteria to ensure early intervention[19]. An integrated monitoring and feedback system should be implemented to enable continuous quality improvement and to address any gaps in service delivery.

The findings of this study should be interpreted in light of certain limitations of our study. The evaluation was conducted within a single administrative block (Babai Block) hence the results are context-specific. Also, the selection of Anganwadi Centers was purposive rather than random, driven by operational feasibility. The study depended on anthropometric and follow-up data collected by frontline workers. While essential for evaluating a real-world program, the observed rate of incomplete documentation could have introduced information bias and impacted the accuracy of the reported recovery and default rates. Nevertheless, these findings offer crucial programmatic insights into the field-level implementation of CSAM in a high-burden setting.

CONCLUSION

The study findings suggest that while the community-based approach to managing SAM is operationally feasible and leads to positive weight gain in recovered children, the overall program effectiveness was suboptimal compared to Sphere standards. The program's success is contingent not merely on its design, but on the health system's capacity to support it with high-fidelity monitoring, uninterrupted supply chains, robust referral mechanisms, and continuous supportive supervision. The CSAM model shows promise for addressing Severe Acute Malnutrition (SAM) in rural India, but its full potential can only be realized through strengthened health systems, enhanced capacity building, and increased community engagement.

List of abbreviations

- ANM: Auxiliary Nurse Midwife
- AWC: Anganwadi Center
- AWW: Anganwadi Worker
- CMAM: Community-Based Management of Acute Malnutrition

- CSAM: Community-Based Management of Acute Malnutrition
- ICDS: Integrated Child Development Services
- IHEC: Institutional Human Ethics Committee
- MUAC: Mid-Upper Arm Circumference
- NRC: Nutrition Rehabilitation Centre
- SAM: Severe Acute Malnutrition
- SD: Standard Deviation
- THR: Take Home Ration
- WFH: Weight-for-Height/Length

Declarations

Ethics approval and consent to participate

The study received ethical clearance from the Institutional Human Ethics Committee (IHEC), AIIMS Bhopal (IHEC-LOP/2019/MD0106). Written informed consent was obtained from all mothers or primary caregivers of enrolled children. Confidentiality and anonymity were maintained throughout the study.

Consent for publication

Not applicable

Availability of data and materials

The dataset is available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Author Contributions

AMK, AP, SV conceived and designed the study. SV collected the data. AMK, AP, SV & AM analysed the data. AM wrote the first draft of the manuscript. All authors reviewed, contributed to, and approved the final manuscript.

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REFERENCES

1. Ulahannan SK, Wilson A, Chhetri D, Soman B, Prashanth NS. Alarming level of severe acute malnutrition in Indian districts. BMJ Glob Health. 2022 Apr;7(4):e007798. doi: 10.1136/bmjgh-2021-007798. PMID: 35450860; PMCID: PMC9024259.

2. Akuu JA, Amagnya MA. Community-based management of acute malnutrition: Implementation quality, and staff and user satisfaction with services. J Taibah Univ Med Sci. 2023 Feb 17;18(5):988-996. doi: 10.1016/j.jtumed.2023.02.002. PMID: 36890797; PMCID: PMC9986645.

3. Lassi ZS, Kumar R, Bhutta ZA. Community-Based Care to Improve Maternal, Newborn, and Child Health. In: Black RE, Laxminarayan R, Temmerman M, et al., editors. Reproductive, Maternal, Newborn, and Child Health: Disease Control Priorities, Third Edition (Volume 2). Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2016 Apr 5. Chapter 14. Available from: https://www.ncbi.nlm.nih.gov/books/NBK361898/ doi: 10.1596/978-1-4648-0348-2_ch14

4. H. Charter Minimum standards in food security and nutrition. In: sphere hand book (2011) Google Scholar

5. Government of Madhya Pradesh. Atal Bihari Vajpayee Bal Arogya Evam Poshan Mission: CSAM Operational Guidelines. Department of Women and Child Development, 2019.

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

7. The Sphere Project. Humanitarian Charter and Minimum Standards in Humanitarian Response. Geneva: The Sphere Project; 2018

8. Aguayo VM et al. Integrated management of severe acute malnutrition in Madhya Pradesh: Lessons from Shivpuri District. 2010.

9. Tembo AN. Performance of the CMAM program in Lilongwe, Malawi. University of the Western Cape, 2015.

10. Somassè YE et al. Challenges in scaling up CMAM in Burkina Faso. Food and Nutrition Bulletin. 2016.

11. Burza S et al. Community-based management of acute malnutrition in Bihar, India: An effectiveness study. PLoS Med. 2015.

12. Ciliberto MA et al. Comparison of home-based therapy using RUTF vs standard therapy. Am J Clin Nutr. 2005;81:864–870.

13. Patil S et al. CMAM implementation in Odisha: Process evaluation. Indian Pediatrics. 2015.

14. Habulembe R. Evaluation of SAMCTC Centres in Zambia. University of Zambia, 2010.

15. Bodson, Oriane & Barro, Ahmed & Turcotte-Tremblay, Anne-Marie & Zanté, Nestor & Somé, Paul & Ridde, Valéry. (2018). A study on the implementation fidelity of the performance-based financing policy in Burkina Faso after 12 months. Archives of Public Health. 76. 10.1186/s13690-017-0250-4.

16. Taneja G et al. Evaluation of NRC-based nutrition rehabilitation in Indore and Ujjain. 2010.

17. Ashworth A. Efficacy and effectiveness of community-based treatment of severe malnutrition. Food and Nutrition Bulletin, 2006.

18. Shah More N, Waingankar A, Ramani S, Chanani S, D'Souza V, Pantvaidya S, Fernandez A, Jayaraman A. Community-Based Management of Acute Malnutrition to Reduce Wasting in Urban Informal Settlements of Mumbai, India: A Mixed-Methods Evaluation. Glob Health Sci Pract. 2018 Mar 30;6(1):103-127. doi: 10.9745/GHSP-D-17-00182. PMID: 29602868; PMCID: PMC5878065.

19. Dasgupta, Rajib & Ahuja, Shalini & Yumnam, Veda. (2014). Can nutrition rehabilitation centers address severe malnutrition in India?. Indian pediatrics. 51. 95-9. 10.1007/s13312-014-0341-z.