

Impact of Malnutrition Therapy Programme: A Comparison of Treatment Indicators in Two Local Government Areas of a Northern State in Nigeria

Anuoluwapo Adebomi Babatunde¹, Ebenezer Obi. Daniel², Oladapo Michael Olagbegi³, Paul Olaiya Abiodun¹, Ahmed Mamuda Bello¹, Israel Olukayode Popoola⁴, Michael Avwerhota⁵, Christiana Asibi-Ogben Inegbebon¹, Michael Olabode Tomori¹, Friday Iyobosa Igbिनovia¹

¹Department of Public Health, Texila American University, Georgetown, Guyana

²Department of Public Health, Swansea University, Swansea, United Kingdom

³South African National Bioinformatics Institute, University of the Western Cape, Western Cape, South Africa

⁴Department of Epidemiology and Community Health, University of Ilorin, Ilorin, Nigeria

⁵Department of Public Health, Atlantic International University, Hawaii, United States of American

Email address:

anubabatunde@gmail.com (Anuoluwapo Adebomi Babatunde)

To cite this article:

Anuoluwapo Adebomi Babatunde, Ebenezer Obi. Daniel, Oladapo Michael Olagbegi, Paul Olaiya Abiodun, Ahmed Mamuda Bello, Israel Olukayode Popoola, Michael Avwerhota, Christiana Asibi-Ogben Inegbebon, Michael Olabode Tomori, Friday Iyobosa Igbिनovia. Impact of Malnutrition Therapy Programme: A Comparison of Treatment Indicators in Two Local Government Areas of a Northern State in Nigeria. *Central African Journal of Public Health*. Vol. 8, No. 6, 2022, pp. 233-238. doi: 10.11648/j.cajph.20220806.14

Received: November 26, 2022; **Accepted:** December 12, 2022; **Published:** December 27, 2022

Abstract: The latest estimates of child malnutrition produced by the United Nations agencies show that globally 6.9% or 47.0 million children under 5 years of age suffered from wasting in 2019, including 14.3 million with severe wasting. Nigeria has the second highest burden of stunted children in the world, with a national prevalence rate of 32 percent of children under five. An estimated 2 million children in Nigeria suffer from severe acute malnutrition (SAM), but only two out of every 10 children affected are currently reached with treatment as a result of multiple factors. The North - East of Nigeria where Yobe state belongs has been affected by a violent insurgency for over 10 years which has become a protracted crisis that plunged the region into a humanitarian crisis that is “still far from over” with millions of people affected including women and children – the most vulnerable population. The heightened humanitarian crisis further amplified the prevalence rate of malnutrition in the Northeastern region of Nigeria to which United Nation Organizations and International Non-Governmental Organizations joined the government to deliver life-saving assistance to the most vulnerable persons and households. Efforts to drastically improve the growth trajectories of young children in northern Nigeria are being made by government agencies at the Federal, State, and Local Government levels, working and partnering with Local and International non-governmental Organizations. A retrospective study was conducted by collecting thirty-six (36) months of reported data of SAM and MAM of under-five children, from District Health Information System (DHIS2)-the standard source of health information in Yobe state across three years; 2017, 2018 and 2019 for 2 LGAs- Fika and Nangere. Data was analyzed using SPSS. Findings revealed a statistical significant differences in Malnutrition outcomes across the years and when compared to each LGA. There was also statistical significant differences in the change of different outcomes. It was suggested that Effective monitoring of the program quality and adherence to treatment protocols from the beginning and intermittently conducting evaluation or studies, implementing agencies and the government to conduct pre and post-intervention surveys or systematically review CMAM outcome data periodically to identify patterns and barriers to consistency in results from the program amongst under 5 children in Fika and Nangere Local Government Areas in Yobe state.

Keywords: Impact, CMAM Outcomes, Comparison, Yobe State, SAM, MAM

1. Introduction

Under nutrition is one of the leading causes of morbidity and mortality in under-five children in developing countries. Nearly 20 million children below 5 years of age suffer from wasting and are at risk of death or severe impairment of growth and psychological development (2015). Of these, over 90% are found in South and Southeast Asia and sub-Saharan Africa [1].

The latest estimates of child malnutrition produced by the United Nations agencies show that globally 6.9% or 47.0 million children under 5 years of age suffered from wasting in 2019, including 14.3 million with severe wasting [2]. A child who is moderately or severely wasted has an increased risk of death. Wasting is responsible for approximately one-half to 1 million deaths of children under 5 worldwide each year.

Poor early nutrition leads to poor school readiness and performance, resulting in fewer years of schooling, reduced productivity, and earlier childbearing in females. As such, poverty, undernutrition, and ill-health are passed on from generation to generation (cycle) [3].

According to WHO guidelines, children with severe acute malnutrition (SAM) should be actively detected through screening and urgently referred to specific therapeutic feeding programs (TFP) that provide intensive nutritional and medical support. Children suffering from moderate wasting, or moderate acute malnutrition (MAM), should also be detected and referred to appropriate care [2, 4, 5]. The WHO recommendations for MAM management focus on growth monitoring, nutritional advice, and medical care, whereas the use of supplementary foods is only recommended in settings where the prevalence of wasting, or food insecurity is high.

Nigeria has the second highest burden of stunted children in the world, with a national prevalence rate of 32 percent of children under five. An estimated 2 million children in Nigeria suffer from severe acute malnutrition (SAM), but only two out of every 10 children affected is currently reached with treatment [6-9]. Currently, Nigeria ranks 159th out of 162 countries in progress toward meeting the Sustainable Development Goals (SDGs) [10]. According to the most recent Demographic and Health Survey in Nigeria [11, 12], the lifetime risk of maternal death related to pregnancy or childbearing is 1 in 30 women. The number of infants who die between 28 days and one year of age is 28 per 1,000 live births in Nigeria, and one child in every eight will not survive until their fifth birthday [13-15].

The North East of Nigeria where Yobe state belongs has been affected by a violent insurgency for over 10 years which has become a protracted crisis that plunged the region into a humanitarian crisis that is “still far from over” with millions of people affected including children [16]. The heightened humanitarian crisis further amplified the prevalence rate of malnutrition in the region to which United Nation Organizations and International Non-Governmental Organizations joined the government to deliver life-saving assistance to the most vulnerable persons and households.

Pregnant and Lactating women and children under 5 receive nutrition services and treatment for severe malnutrition. Irrespective of this, about 800,000 people are displaced in areas where humanitarian aid cannot reach because of ongoing hostilities and violent attacks. Additionally, a challenging physical environment (during the rainy season, in particular) and bureaucratic impediments are preventing the reach of aid to these populations [17, 18]. These and other factors have possible effect on the outcomes of humanitarian services being provided. With the crisis and constrained access is increased hunger that contributes to Malnutrition which is a combination of Sever Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM). The country nutrition profile in the 2021 annual report recommended the assessment of progress against 10 of the global nutrition targets, using projected data and average annual rates of reduction (AARR) [19].

In spite of the huge investment on the provision of food supplements and other costs involved in this humanitarian service of nutrition therapy programme, the feeding practice of the mothers/caregivers, ranging from issues regarding hygiene to the possibility of sharing the foods among other non-malnourished children, and their perception regarding the whole programme are possible determining factors towards the achievement of the set goals in reducing the acute malnutrition among under 5 children [20, 21].

MAM and SAM make up GAM which as at March 2021, Relief Web [22, 23] reported that Prevalence of GAM in Nigerian North Eastern states mostly affected by the crisis was 12.3% in Yobe, 10.0% in Borno, and 6.2% in Adamawa. Prevalence of GAM was highest in Northern Yobe when assessed by weight-for-height and/or odema and has exceeded WHO [4, 5] Crisis Classification threshold for “Very High” (15.8%). Efforts to drastically improve the growth trajectories of young children in northern Nigeria are being made by government agencies at the Federal, State, and Local Government levels, working and partnering with Local and International non-governmental Organizations. This study was focused on assessing the impact of CMAM treatment programs while comparing the treatment indicators in Fika and Nangere LGAs, Yobe State, Nigeria.

2. Methods

2.1. Study Setting

The study was conducted in 2 Local government Areas in Yobe State namely Fika and Nangere where Nutrition therapy services are being carried out.

2.2. Data Collection Methods

CMAM data was collected form District Health Information System (DHIS2) of Yobe state where retrospective data was collected from reported CMAM outcomes in Fika and Nangere LGAs. The period of the data collected was for Thirty-six (36) months (January 2017 – December 2019) for each LGA.

2.3. Study Participant

The study populations were under-five children with either Severe Acute Malnutrition (SAM) or Moderate Acute Malnutrition (MAM), diagnosed by measuring Middle Upper Arm Circumference (MUAC) using MUAC tape.

2.4. Ethical Considerations

Approval to conduct the study was obtained from the research and ethics committee at the state ministry of health, Damaturu, Yobe state. Participants were made to give their consent or otherwise to the study. Only participants who consented were involved in this study and their anonymity, privacy and confidentiality was respected.

2.5. Data Analysis

The yearly and average prevalence of SAM was compared between Fika and Nangere Local Government Areas using the independence t-test. Furthermore, the Mann Whitney U test was used to compare malnutrition variables between Fika and Nangere Local Government Areas. The Friedman ANOVA was used to analyze the malnutrition indices' trend during the intervention's three years (2017, 2018 and 2019). To compare the impact of CMAM treatment, changes in malnutrition variables (number of children treated for SAM, number of children admitted into the CMAM program, number of children defaulting from the program, and number of children discharged healthy after nutritional treatment) were calculated between 2017 and 2019, and then the changes were compared using the Mann Whitney U test. The

level of significance was set at $p < 0.05$.

3. Results

A total of 36 months data for SAM and MAM prevalence were extracted from District Health Information System (DHIS) for Fika and Nangere from January 2017 – December 2019.

Table 1 below shows the trend of malnutrition treatment indices across years of intervention in Fika and Nangere Local Government Areas. The results of Friedman ANOVA test show that the median number of children in Fika LGA placed on treatment for SAM significantly from 104.50 in 2017 to 427.50 in 2019 while the median value in Nangere LGA significantly increased from 225.00 in 2017 to 294.00 in 2019. The median number of children admitted into the CMAM programme in Fika LGA significantly increased from 113.50 in 2017 to 378.00 in 2019, The median value for the variable also increased in Nangere LGA from 240.00 in 2017 to 243.00 in 2019 but the increase was not significant. The increase in the median number of children that defaulted from CMAM programme in Fika LGA from 7.00 in 2017 to 10.5 in 2019 was not significant, whereas, the increase in the median value of the variable in Nangere LGA from 5.00 in 2017 to 9.00 in 2019 was significant. In terms of the number children discharged healthy after nutritional treatment, the median number of children in Fika LGA placed on treatment for SAM significantly from 86.00 in 2017 to 304.00 in 2019 while the increase in the median value of the variable in Nangere LGA from 138.00 in 2017 to 186.50 in 2019 was not significant.

Table 1. Trend of malnutrition treatment indices across years of intervention in Fika and Nangere Local Government Area.

FIKA LGA					
	2017	2018	2019	Chi-square	p-value
	Media (IQR)	Median (IQR)	Median (IQR)		
<5 years placed on treatment for SAM	104.50 (81.25, 224.00) ^a	352.50 (193.25, 401.25) ^b	427.50 (241.50, 531.50) ^b	20.583	< 0.001*
Child admitted into CMAM program	113.50 (88.00, 242.25) ^a	239.50 (209.25, 323.00) ^b	378.00 (181.50, 473.75) ^b	17.333	< 0.001*
Child defaulted from CMAM program	7.00 (5.25, 10.75) ^a	20.00 (11.25, 33.75) ^b	10.50 (7.75, 15.00) ^a	17.224	< 0.001*
<5 years discharged healthy after Nutritional Treatment	86.00 (69.00, 102.25) ^a	171.00 (108.50, 233.75) ^b	304.00 (154.00, 382.50) ^c	24.083	<0.001*
NANGERE LGA					
<5 years placed on treatment for SAM	225.00 (145.75, 315.50) ^a	122.50 (95.75, 156.75) ^b	294 (175.00, 362.25) ^a	20.583	< 0.001*
Child admitted into CMAM program	240.00 (172.75, 309.00) ^a	94.00 (80.00, 126.25) ^b	243.00 (134.75, 309.00) ^a	26.800	< 0.001*
Child defaulted from CMAM program	5.00 (2.25, 7.75) ^a	7.50 (5.00, 10.50) ^b	9.00 (4.50, 13.50) ^b	8.024	0.018*
<5 years discharged healthy after Nutritional Treatment	138.00 (117.75, 205.75) ^a	69.00 (52.50, 77.75) ^b	186.50 (116.25, 236.75) ^a	33.083	< 0.001*

*denotes significant difference at $p < 0.05$

Superscripts (a, b, c) represent post-hoc multiple pairwise comparisons. Median scores that are significantly different have the different superscripts while median scores that are statistically comparable have the same superscripts at $p < 0.05$

Table 2. Comparison of Malnutrition variables in Fika and Nangere LGAs at the beginning of programme in 2017.

Variable	Fika LGA	Nangere LGA	z	p-value
	Median (IQR)	Median (IQR)		
Children placed on treatment for SAM	104.50 (81.25, 224.00)	225.00 (145.75, 315.50)	-2.588	0.010*
Children admitted into CMAM program	113.50 (88.00, 242.25)	240.00 (172.75, 309.00)	-2.475	0.013*
Children defaulted from CMAM program	7.50 (5.25, 10.75)	5.00 (2.25, 7.75)	-2.256	0.024*
Children discharged healthy after nutritional treatment	86.00 (69.00, 102.25)	138.00 (117.75, 205.75)	-3.630	< 0.001*

*denotes significant difference at $p < 0.05$

For better understanding of the impact of CMAM treatment programme on malnutrition variables, the malnutrition variables in 2017 at the beginning of the programme were compared and presented in table 2 above. Results showed that Nangere LGA had significantly higher

number of children placed on treatment for SAM ($p = 0.010$), children admitted into CMAM program ($p = 0.013$), children discharged healthy after nutritional treatment ($p < 0.001$) but a significantly lower number of children that defaulted from CMAM program than Fika LGA ($p = 0.024$).

Table 3. Comparison of the impact of CMAM treatment programme in Fika and Nangere LGAs measured by changes in variables between 2017 and 2019.

Variable	Fika LGA	Nangere LGA	z	p-value
	Median (IQR)	Median (IQR)		
Change in number of children placed on treatment for SAM	283.50 (48.75, 369.25)	64.50 (-133.50, 169.25)	-3392	< 0.001*
Change in number of children admitted into CMAM program	143.00 (85.00, 284.00)	-42.00 (-99.25, 114.75)	-3.134	0.002*
Change in number of children defaulted from CMAM program	3.00 (-6.00, 7.50)	3.50 (-0.75, 6.75)	-0.010	0.992
Change in number of children discharged healthy after nutritional treatment	224.00 (51.50, 289.75)	9.00 (-35.00, 120.50)	-3.536	< 0.001*

*denotes significant difference at $p < 0.05$

Change = Number of children in 2019 - Number of children in 2017

The impact of CMAM treatment programme (measured by changes in variables between 2017 and 2019) was compared and presented in Table 3. The results of Mann Whitney U test showed that Fika LGA had significantly higher median changes in the number of children placed on treatment for SAM ($p < 0.001$) and the number of children admitted into the CMAM program ($p = 0.002$) but lower median change in the number of children that were discharged healthy after nutritional treatment ($p < 0.001$) than Nangere LGA. However, no significant difference was observed in terms of changes in the number of children that defaulted from CMAM program both LGAs ($p = 0.992$).

4. Discussions

The aim of this study is to assess the Impact of CMAM treatment programs through a comparison of treatment indicators in Fika and Nangere LGAs, Yobe State Nigeria. The result of the study shows significance across the years with various treatment outcomes which can be explained by findings from an evaluation of CMAM in Pakistan [24] where it was mentioned that CMAM outcomes are hampered also by inefficient usage and lack of compliance to prescribed intake of RUTF, sharing of products with siblings, sale of the products, and supply shortages in some centres within the same program. Similarly, Azeez Afebu Oseni et al conducted a study on the impact of CMAM interventions On Demand for other Primary Health Care Services in Katsina State, Nigeria [25] and found that Integrating vertical donor-funded programs into existing primary health systems can be both challenging and rewarding because nutrition is probably the most important component of primary health care, donor-funded nutrition programs, therefore, represent a promising opportunity to boost coverage and reach of PHC programs through improving service delivery quality. Daniel Obi et al in studying the Pattern of Prevalence of Severe and Moderate Acute Malnutrition among Under-Five Children of Three Counties in War-Torn Lakes States, South Sudan [21] highlighted that results may be due to variations in diagnosis according to standards by the Community Nutrition

Volunteers (CNVs) and Community Health Workers (CHWs) in each county using MUAC tapes, and political sentiments in screening exercise, which may be twisted, in collaborations with health workers in order to attract more nutrition intervention funds which in turn would exaggerate the number of Under 5 children discharged as cured.

The change between 2019 and 2019 for CMAM outcomes were compared between the LGAs which showed significance was concluded by a study with similar findings on the Effectiveness of community-based treatment programs for the treatment of uncomplicated severe acute malnourished children aged 6–59 months using locally produced nutrient-dense foods: protocol for a multicentric longitudinal quasi-experimental study [26] that working strategies in one location can be scaled up to all or parts of the high- burden districts because they found the collaboration between the frontline workers and community level structure effective agreeing with World Vision's impact of Community Management of Acute Malnutrition [27] that the program's impact may be attributable to existing community structures such as home-based caregivers and village health workers to implement CMAM because of some local beliefs that may affect caregivers' practices, use of RUTF which is widely accepted by the local community and integration of IYCF messaging in treatment and concluding also that CMAM needs to be an integral part of the national primary health care system [28-32].

5. Conclusion

Overall, this study has shown that there are significant differences in the CMAM indices among under-five children under, within 2 LGAs of Yobe state- Fika and Nangere, across three years being studied likewise in the change in outcome across the years. Hence it is a pointer to the fact that there is a need for a careful determination of the clear enablers for CMAM outcomes in each LGA in the 3 years.

There is need for implementing agencies and the government to conduct pre and post intervention surveys or systematically review CMAM outcome data periodically to

identify patterns and barriers to consistency in results from the program amongst under 5 children.

6. Limitations of the Study

The study was limited to only data that was available on DHIS 2 for the study period. Therefore, other variables that may have enriched the study were not available.

7. Recommendations

From the study, the following are recommended for a steady positive CMAM outcome:

- 1) A reliable supply chain for medicine and therapy feeding is essential to the program's success.
- 2) Community health workers need sufficient training and supervision of CMAM implementation by LGA and state health personnel to ensure children receive adequate follow-up during the referral process.
- 3) Data management was a major challenge as data was incomplete and not of good quality.
- 4) Effective monitoring of the program quality and adherence to treatment protocols from the beginning and intermittently conducting evaluation or studies.

Acknowledgements

Special thanks to the Yobe State Research and Ethics Committee, and the Ministry of Health for the approval and support in the data collections and to others who contributed to the success of this research.

References

- [1] Seid Legesse Hassen, Ayalew Astatkie, Tefera Chanie Mekonnen and Getahun Gebre Bogale (2019) Survival Status and Its Determinants among Under-Five Children with Severe Acute Malnutrition Admitted to Inpatient Therapeutic Feeding Centers in South Wollo Zone, Amhara Region, Ethiopia. *Journal of Nutrition and Metabolism* Volume 2019, Article ID 2643531, <https://doi.org/10.1155/2019/2643531>. Pg1, 7-9.
- [2] World Health Organisation (2019) Therapeutic feeding of children 6–59 months of age with severe acute malnutrition and acute or persistent diarrhea. <https://www.who.int/elena/titles/diarrhoea>
- [3] Laura E. Caulfield, Stephanie A. Richard, Juan A. Rivera, Philip Musgrove, and Robert E. Black (2006). *Disease Control Priorities in Developing Countries*. 2nd edition. Chapter 28 Stunting, Wasting, and Micronutrient Deficiency Disorders. <https://www.ncbi.nlm.nih.gov/books/NBK11761/>
- [4] WHO. Guideline: Updates on the management of severe acute malnutrition in infants and children. Geneva, World Health Organization; 2013.
- [5] World Health Organization, Malnutrition, April 2020. <https://www.who.int/news-room/q-a-detail/malnutrition>
- [6] UNICEF (2015) Maternal and child health. <https://data.unicef.org/topic/maternal-health/maternal-mortality/>
- [7] United Nations Children's Fund (UNICEF), Management of Severe Acute Malnutrition in Children: Working Towards Results at Scale, United Nations Children's Fund (UNICEF), New York, NY, USA, 2015.
- [8] UNICEF (2012) Nigeria battles worsening nutritional crises. <https://reliefweb.int/report/nigeria/nigeria-battles-worsening-malnutrition-crisis>
- [9] United Nations Children's Fund (UNICEF) (2013). Ready-To-Use Therapeutic Food For Children With Severe Acute Malnutrition. UNICEF Current Issues.
- [10] Jeffrey Sachs, Guido Schmidt-Traub, Christian Kroll, Guillaume Lafortune and Grayson Fuller (2019). Sustainable Development Report 2019. Transformations to Achieve the Sustainable Development Goals. <https://www.sdgindex.org/reports/sustainable-development-report-2019/>
- [11] Nigeria Demographic and Health Survey, 2018. (May 2019). Key Indicators Report.
- [12] Nigeria: Acute Malnutrition Situation in North East Nigeria September - December 2019 and Projection for January - April 2020 (April 2020). https://knowledge4policy.ec.europa.eu/publication/nigeria-acute-malnutrition-situation-north-east-nigeria-september-december-2019_en
- [13] IPC Acute Malnutrition Analysis September 2019 – April 2020 (February 2020). http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IP C_Nigeria_AcuteMalnutrition_2019Sept2020April.pdf
- [14] Malnutrition and Food Insecurity in Borno and Yobe States (2020). <https://www.acaps.org/special-report/malnutrition-and-food-insecurity-borno-and-yobe-states>
- [15] IPC Acute Malnutrition Analysis September 2020 – August 2021 (March 2021). http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Nigeria_Acute_Malnutrition_2020Sept2021Aug_Report.pdf
- [16] United Nations News (August 2019). <https://news.un.org/en/story/2019/08/1043581>
- [17] ACF International External Evaluation (June, 2013). Sustainable CMAM implementation in Northern Nigeria.
- [18] The 2020 Global Nutrition Report (2021) <https://globalnutritionreport.org/reports/2020-global-nutrition-report/>
- [19] Country Nutrition Profiles (2021). <https://globalnutritionreport.org/resources/nutrition-profiles/africa/western-africa/nigeria>
- [20] Ebenezer O. Daniel, Ademola M. Amosu, Gabriel O. Ayeni, Oladapo M. Olagbegi. 2017. Child Feeding Practice and Perception of Mothers/Caregivers on Nutrition Therapy Programme in Three Counties of Lakes State South Sudan. *Texila International Journal of Public Health* Volume 5, Issue 4, Dec 2017.
- [21] Ebenezer O. Daniel, Ademola M. Amosu, Gabriel O. Ayeni, Oladapo M. Olagbegi (2019). The Pattern of Prevalence of Severe and Moderate Acute Malnutrition among Under-Five Children of Three Counties in a War-Torn Lakes State, South Sudan. *Texila International Journal of Public Health* Volume 5, Issue 4, Dec 2017.

- [22] Relief Web (June 2018) what you should know about the Humanitarian crisis in North East, Nigeria. <https://reliefweb.int/report/nigeria/what-you-should-know-about-humanitarian-crisis-north-east-nigeria>.
- [23] Relief Web, (March 2021) <https://www.google.com/search?q=prevalence+of+GAM+in+North+East+Nigeria&oq=prevalence+of+GAM+in+North+East+Nigeria&aqs=chrome.69i57.14873j0j4&sourceid=chrome&ie=UTF-8>
- [24] Global health Learning. <https://www.globalhealthlearning.org/taxonomy/term/1641>
- [25] Azeez Afebu Oseni, Wale Falade (2021). Impact of a CMAM Intervention on Demand for Other Primary Health Care Services in Katsina State, Nigeria. https://www.researchgate.net/publication/355826508_Impact_of_a_CMAM_Intervention_on_Demand_for_Other_Primary_Health_Care_Services_in_Katsina_State
- [26] Praveen Rajesh Kumar Sinha, Abner Daniel, Hemang Shah, Raja Sriswan, Arun Kokane, Aditya Mohapatra, Vivek Kashyap, Anil Kumar Goel, Virendra Kumar, Asha Kiran, N. Arlappa, Ankur Joshi, Rashmi Ranjan Nayak, Manjula Singh, Mihretab Salasibew, Samik Ghosh, Sameer Manikrao Pawar, Preetu Mishra, Khyati Tiwari, Sourav Bhattacharjee, Farhat Saiyed, Tarun Shrikrishna Patel, Pritish Kumar Nayak, Sanjay Kumar Sahoo, Mahendra Prajapati, Shikha Sinha, and Arjan de Wagt (2021) Effectiveness of community-based treatment programs for treatment of uncomplicated severe acute malnourished children aged 6–59 months using locally produced nutrient-dense foods: protocol for a multicentric longitudinal quasi-experimental study. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8672603/>
- [27] Word Vision (2013). CMAM Impact report. <https://www.wvi.org/sites/default/files/CMAM%20Impact%20Report%202013.pdf>
- [28] Zubaida Ladan Farouk, Garba Dayyabu Gwazo, Aisha Zango, Halima Abdu (2016) Improving the outcome of Severe acute malnutrition by community-based management. *Journal of Health Research and Reviews in Developing Countries*. <https://www.jhrr.org/article.asp?issn=2394-2010;year=2016;volume=3;issue=1;spage=20;epage=23;aulast=Farouk>
- [29] Christal Nneka Ozoka (2018) Burden of Malnutrition in Children Under 5 Years in Nigeria: Problem Definition, Ethical Justification and Recommendations. *Journal of tropical Diseases*. <https://www.longdom.org/open-access/burden-of-malnutrition-in-children-under-5-years-in-nigeria-problem-definition-ethical-justification-and-recommendations-2329-891X-1000268.pdf>
- [30] Reinhardt K, Fanzo J (2014) Addressing chronic malnutrition through multi-sectoral, sustainable approaches: a review of the causes and consequences. <https://www.frontiersin.org/articles/10.3389/fnut.2014.00013/full>
- [31] Linking the Community Management of Acute Malnutrition and Integrated Community Case Management in Kenya. 2018. <https://knowledgegainstunger.org/research/treatment/linking-cmam-and-iccm/>
- [32] Cora Mezger, Veronica Tuffery, Charles Umar, Gloria Olisenekwu, Esther Namukasa. Community Management of Acute Malnutrition (CMAM) in Nigeria: Performance assessment of the CMAM information system, 2018. <https://www.opml.co.uk/files/Publications/a1468-nigeria-nutrition/ms2-opm-cmam-data-systems-final-report.pdf?noredirect=1>
- [33] Veronica Tuffrey, Cora Mezger, Simeon Nanama, Assaye Bulti, Gloria Olisenekwu, Charles Umar, Emma Jones and Esther Namukasa. Assessment of monitoring systems in the management of severe acute malnutrition in northern Nigeria 2021. <https://bmcnutr.biomedcentral.com/articles/10.1186/s40795-020-00405-z>
- [34] Banda C, Shaba B, Balemire S, Sogoba M. Simplified lot quality assurance sampling Evaluation of access and coverage (SLEAC) survey of Community Management of Acute Malnutrition program northern states of Nigeria valid international. ACF International, Save the Children International: FMOH/SMOH; 2014. http://www.coverage-monitoring.org/wp-content/uploads/2014/05/Valid_ACF-SLEAC-Nigeria-report.pdf
- [35] Mulubrhan Amare, Todd Benson, Olusegun Fadare, and Motunrayo Oyeyemi (2018) Study of the Determinants of Chronic Malnutrition in Northern Nigeria: Quantitative Evidence from the Nigeria Demographic and Health Surveys International Food Policy Research Institute (IFPRI) Working Paper 45. <https://doi.org/10.1177/0379572118768568> report/