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Effect of Audio Recordings of CMAM Key Messages on Treatment Outcome

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Abstract

Severe acute malnutrition (SAM) poses a significant threat to child health in Nigeria. The CMAM program provides essential treatment for children with SAM, and treatment quality is influenced by how well caregivers understand key CMAM messages. This study evaluates the effect of audio messages on treatment outcomes in SAM cases compared to traditional health talks. An interventional study design was used, involving 80 SAM children in Adamawa State. Participants were divided into two groups: the experimental group received weekly audio messages in Hausa, while the control group received traditional health talks from health workers. Treatment outcomes were measured based on weight gain and mid-upper arm circumference. Data were collected via the mHealth platform and analysed on SPSS 16 using t-tests to determine statistical significance. The mean age of the respondents was 28 years with an age range of 16.0 – 50.0 years, while the mean age of the index children was 15 months with a range of 6.0 – 48.0 months. The number of successful treatments was higher in the Experimental group than in the Control group. The t-test for equality of means for treatment outcomes across the two groups was, however not significant (P> 0.005) at a 95% Confidence Interval. Conclusively, we accept the null hypothesis. Audio recordings of CMAM key messages were equally effective as traditional health talks in influencing treatment outcomes in CMAM interventions. The use of audio messages has the potential to ease the burden of health workers while ensuring consistency in message delivery without reducing the efficacy of treatment.

Keywords: *Adamawa State, Audio Messages, Community Management of Acute Malnutrition (CMAM), Health Talks, Severe Acute Malnutrition (SAM), Treatment Outcomes.*

Background

Undernutrition has been a major public health problem across the countries in the developing world and is an underlying cause of death among children under 5 years who die each year of preventable causes, it can present in acute or chronic forms. According to the 2022 Global Nutrition Report [1], Africa still experiences a malnutrition burden among children aged under 5 years, the prevalence of stunting is 30.7%, which is higher than the global average of 22.0%. While prevalence of wasting is 6.0%, which is lower than the global average of 6.7%. According to the latest NDHS report, the nutritional status of children underage in Nigeria 5 has not greatly improved in the past 5 years, this report in 2018 reported that 37% of children under age 5 were stunted, 7% were wasted, 22% were underweight, and 2% were overweight, these figures has increased to 40%, 8%, 27%, and 1%, respectively, in 2023–24 survey report.[2] Adamawa State reported 48.6% stunting, 7.0% wasting and 32.5% underweight which were at best the same as the national average and at worst much greater.

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Severe Acute Malnutrition (SAM) is the most serious form of childhood acute malnutrition and is associated with very high rates of morbidity and mortality. Although rarely documented as a direct cause, more than 50% of all childhood deaths are attributable to undernutrition [3]. Globally, approximately 19 million children under 5 years are affected by SAM [4]. According to the 2017 Global Nutrition Report [5] 52 million children are wasted (SAM) and it is the main challenge to achieving sustainable development goals. Moreover, it is a risk factor for more than 50% of 11 million deaths annually and the number one driver of the global burden of disease [6].

Within Nigeria, the under-five mortality rates range from as low as 48 and 43 reported deaths per 1000 live births in the south-east and south-west zones, respectively to 80 and 73 reported deaths per 1000 births in the north-west and north-east zones, respectively [7] Severe Acute Malnutrition (SAM) is a global public health issue that affects children and is associated with annual deaths among children under five. Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) are global public health issues that affect children and are associated with annual deaths among children under five, the consequences are dire: a child with (SAM) is 11.6 times more likely to die, and a child with MAM is 3 times more likely to die than a well-nourished child [8].

To solve the problem of increasing rates of acute malnutrition, community-based management of acute malnutrition (CMAM), which evolved from the Community-Based Therapeutic Care (CTC) approach, was developed in 2001 from the Community Based Therapeutic Care CTC approach [9]. The first pilot project tested the CMAM approach in 2000 during humanitarian emergencies [10], it was found to be so effective that it was endorsed by United Nations (U.N.) agencies in 2007 [11] and is now considered the standard of care for managing acute malnutrition in emergency and development contexts.

The Community-based Management of Acute Malnutrition (CMAM) program provides an essential framework for addressing this issue, offering treatment through outpatient therapeutic programs (OTPs) and the use of Ready-to-Use Therapeutic Foods (RUTF). Community Management of Acute Malnutrition (CMAM) is a proven approach to manage SAM and MAM in children under 5; and is currently being implemented in more than 70 countries [12]. The integration of CMAM with infant and young child feeding (IYCF) counselling ensures that mothers and caregivers receive adequate knowledge to manage their children's nutrition during and after treatment. A critical component of CMAM is the education of caregivers on key health messages, such as proper feeding practices, hygiene, and the importance of treatment adherence.

Research has documented that health workers are part of the implementation challenges being experienced in the CMAM program in Nigeria. Government officials and health workers (HWs) have shown concerns about the insufficient number of trained HWs in CMAM health facilities [13]. According to a report by ORIE [14] in 2015, health workers are part of the implementation challenges being experienced in the CMAM program in Nigeria. The study reported that government officials and health workers (HWs) in the two States where the research was conducted were concerned about the insufficient number of trained HWs in CMAM health facilities.

According to the National guideline for CMAM, it is important to develop messages and materials to facilitate communication in CMAM implementation. The guideline recommends the use of simple, standardized messages to explain CMAM (Why, how, to whom and when it is offered,) will help to replace rumours with accurate information. These messages, which should be translated to local languages and adapted for different audiences are expected to be informative but

concise. They should be designed if necessary to be read aloud to an illiterate audience [15]. Currently, there is no compilation of audio forms of these key messages as recommended by the national guidelines in Nigeria. This study would develop a standardized audio message material and test its efficacy in improving effective communication and, consequently, better treatment outcomes

Research has shown that in several countries, CMAM cures high numbers of malnourished children and reduces the frequency of poor outcomes [16, 17]. It has successfully improved the survival and recovery rates of children with SAM by enabling early detection and treatment at decentralized locations, and empowering caregivers with knowledge of appropriate feeding practices. The proposed use of audio-taped key messages in local languages represents a significant innovation that could standardize communication, reduce the workload of health workers, and improve treatment outcomes

Methodology

The study was conducted in Adamawa State, located in the northeastern part of Nigeria. Adamawa is known for its rural communities, with a projected population of over 4.4 million inhabitants. The state has 21 Local Government Areas (LGAs) with a predominantly farming population, producing both cash and food crops. The study focused on two LGAs, Girei and Yola South, which were purposively selected due to their high incidence of Severe Acute Malnutrition (SAM). These locations were safe and had established CMAM (Community Management of Acute Malnutrition) programs, making them ideal for the intervention.

The study employed a quasi-experimental design to assess the effectiveness of audio messages in delivering CMAM key messages. Participants were randomly assigned to either the experimental group, which received audio messages, or the control group, which received standard health talks from health workers. The experiment involved 80 children with SAM, divided equally between the two groups. Over 8-12 weeks, the experimental group listened to prerecorded audio messages in the Hausa language. The control group received the traditional verbal health education provided by healthcare workers.

In this study, laboratory methods were minimal as the focus was primarily on field-based data collection. However, standard protocols were followed to measure anthropometric indices, including weight and Mid-Upper Arm Circumference (MUAC), for the enrolled children. These measurements were taken weekly to monitor the progress of SAM treatment. Additional tests, such as malaria screening, were performed as needed based on the national guidelines for CMAM. All data were collected using the mHealth platform (ODK Collect) to ensure accuracy and real-time data entry. Anthropometric data (MUAC and weight) were collected at baseline and weekly during the intervention period. Treatment outcomes were measured by the percentage of children achieving a MUAC >12.5 cm at discharge.

The study employed a combination of descriptive and inferential statistical methods. Data were analysed using SPSS (version 25), with paired t-tests used to compare pre-and post-intervention outcomes within groups, and independent t-tests to compare outcomes between the two groups. Descriptive statistics, such as frequency distributions and cross-tabulations, were used to summarize participant characteristics and treatment outcomes. Independent and paired samples t-tests were applied to compare the means between the control and experimental groups, evaluating differences in knowledge of CMAM key messages and treatment outcomes. The analysis tested for statistical significance, focusing on p-values to determine if there were any significant differences between the groups.

Ethical Considerations

Ethical considerations were crucial in the study. Approval was secured from the Adamawa State Ministry of Health's Ethical Review Committee in Jimeta, Nigeria. Informed consent was obtained from participants, who were fully briefed in Hausa and participated voluntarily. Participants could withdraw at any time. To protect privacy, questionnaires used serial numbers instead of names. The study involved minimal risk. While there were no direct benefits, participants received free routine drugs on the treatment protocol that they were supposed to procure themselves or receive from the state government. In addition to this, they got information that could help them make informed childcare decisions.

Results

The socio-demographic distribution of respondents included 80 mothers of children suffering from Severe Acute Malnutrition (SAM) who accessed CMAM sites in Girei and Yola South LGAs of Adamawa State. The mean age of the mothers was 28 years, ranging from 16 to 50 years, while the mean age of their children was 15 months, with an age range of 6 to 48 months. The children were evenly distributed by gender, with 50% males and 50% females. Age-wise, 41.2% were 12 months or younger, 47.5% were aged 13–24 months, 10.0% were 25–36 months, and 1.2% were 37–48 months. Most mothers (87.5%) were married, while smaller proportions were divorced (5.0%), separated (2.5%), single (3.7%), or widowed (1.2%). Ethnically, the majority identified as Fulani (67.5%), followed by Hausa (25.0%), and 7.5% from other ethnic groups. Religiously, 91.2% were Muslims, while 8.8% identified as Christians.

Educationally, 62.5% of the respondents had no formal education, 22.5% had completed secondary education, and the remainder had attained primary education or were uneducated. These educational levels likely influenced their economic activities, with the majority (51.2%) engaged in petty trading and 31.2% as full housewives. Other occupations included artisans (7.5%), farmers (6.2%), and apprentices (2.5%). The respondents' varied educational backgrounds underscore the link between education and occupational engagement, highlighting the economic challenges faced by many in this group.

Water sources were diverse among respondents, with the majority (61.2%) relying on boreholes for drinking water. Additionally, 16.2% used pipe-borne water, while 11.2% each depended on rivers/streams or wells. These findings reflect varying levels of access to clean water, potentially impacting the health and nutrition of their households. Overall, the socio-demographic profile of the respondents reflects a predominantly rural, Muslim, Fulani, and economically diverse population, with significant disparities in education and water access.

Table 1. Socio-Demographic Characteristics of the Respondents

Variable	**%**
Gender of Child	
Male	50
Female	50
Total	100
Age of Index Child	
<or = 12 months	41.2
13 to 24 months	47.5
25 to 36 months	10.0
37 to 48 months	1.2

Total	100
Marital Status	
Divorced	5.0
Married	87.5
Other	1.2
Separated	2.5
Single (Never married)	2.5
Widowed	1.2
Total	100.0
Ethnicity of respondents	
Fulani	67.5
Hausa	25.0
Other	7.5
Total	100.0
Religion of respondents	
Christianity	8.8
Islam	91.2
Total	100.0
Highest level of education completed.	
No formal education	62.5
Primary	15.0
Secondary	22.5
Total	100.0
A major source of drinking water	
Borehole	61.2
Pipe borne	16.2
River/stream	11.2
Well	11.2
Total	100.0
Occupation of respondent	
Apprentice	2.5
Artisan	7.5
Farmer	6.2
Full housewife	31.2
House help	1.2
Petty Trading	51.2
Total	100.0

At baseline, there were no significant differences in MUAC or weight between the experimental and control groups. The mean baseline MUAC was 10.9 cm for the experimental group and 10.8 cm for the control group, with a mean baseline weight of 6.5 kg in both groups.

After 8 weeks of intervention, the mean MUAC increased to 12.7 cm in the experimental group and 12.3 cm in the control group. Although the difference was not statistically significant ($p=0.07$), the experimental group had a higher rate of successful recovery (67.5%) compared to the

control group (50%). The mean weight gain in the experimental group was 1.8 kg, compared to 1.5 kg in the control group (p=0.09). The default rate was lower in the experimental group (5%) compared to the control group (12.5%), and caregivers in the experimental group attended more follow-up visits (average of 7.5 visits out of 8) compared to the control group (6.8 visits). Categorizing the treatment outcomes into "Successful Treatment" and "Not Successful Treatment" as shown in Fig 1 below, 20 children achieved successful treatment outcomes in the control group, while 20 experienced unsuccessful treatment outcomes. In contrast, the experimental group exhibited a higher number of successful treatments, with 27 children treated successfully, while 13 did not. This comparison highlights a better treatment success rate in the experimental group when compared with the control group, suggesting potential differences in intervention effectiveness between the two groups.

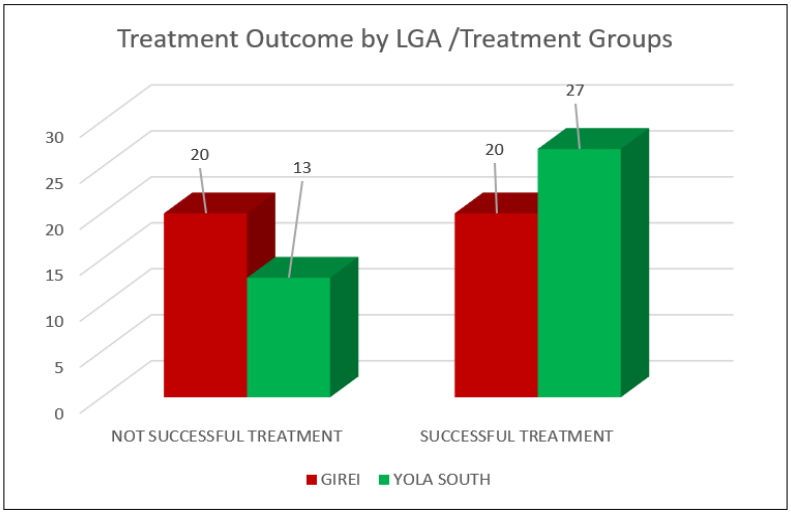

Figure 1. Bar Chart Representation of Treatment Outcome

Table 2 below shows the t-test for equality of means, with a t-statistic of 0.762 and a p-value of 0.449, however shows no statistically significant difference between the means of Mid Upper Arm Circumference for the two groups. The 95% confidence interval for the mean difference includes zero (-114.44683 to 256.29683), further supporting the conclusion that there is no significant difference between the groups.

Table 2. Independent Sample t-test for Treatment Outcome Mid-Upper Arm Circumference

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Treatment Outcome MUAC	Equal variances assumed	2.310	.133	.762	78	.449	70.92500	93.11204	-114.44683	256.29683
	Equal variances are not assumed.			.762	77.166	.449	70.92500	93.11204	-114.47838	256.32838

In practical terms, the p-value of 0.449 is much larger than the typical significance level of 0.05, meaning we do not have enough evidence to reject the null hypothesis. This suggests that any observed difference in means between the groups could be due to random variation rather than a true effect. Consequently, the data implies that the health education provided by health workers and audio tapes have a similar impact on treatment outcomes, despite better outcomes observed in the experimental group. Therefore, **we fail to reject the null hypothesis** that there is no significant difference between the means of the treatment outcome of the two treatment groups based on the available data.

The t-test results shown in Table 3 below show a t-statistic of 0.727, with 78 degrees of freedom, and a p-value of 0.469, which is also greater than 0.05. This means there is no statistically significant difference in the weight outcomes between the two groups. The mean difference between the weight outcome of the two groups is 68.49000, but the 95% confidence interval for the difference in means ranges from -118.98063 to 255.96063, which includes zero.

Table 3. Independent Sample T-Test for Treatment Outcome Weight

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Treatment Outcome Weight	Equal variances assumed	2.017	.160	.727	78	.469	68.49000	94.16626	-118.98063	255.96063
	Equal variances are not assumed.			.727	77.360	.469	68.49000	94.16626	-119.00505	255.98505

This further supports the conclusion that there is no significant difference between the groups in terms of weight outcomes. Overall, the p-value and confidence interval indicate that any observed differences in weight outcomes between the groups are likely due to random variation rather than a true difference between the treatments. Therefore, **we fail to reject the null hypothesis**, suggesting that the two groups have similar weight outcomes and that the observed differences are not statistically significant.

Discussion

The results align with the study's objectives, particularly in assessing the impact of audio-taped CMAM messages on treatment outcomes. One of the primary objectives was to evaluate whether audio recordings had a significant impact on treatment outcomes compared to traditional health worker-led counselling. The results demonstrated that while there was no statistically significant difference between the experimental (audio-taped messages) and control groups in terms of treatment outcomes, the audio-message group showed a slightly higher trend of successful treatments. This supports the objective of exploring alternative communication strategies for effective treatment. This aligns with the findings of several studies in high-income countries that reported encouraging results in

using mobile platforms to improve health outcomes [18, 19, 20]. These findings however negate the findings of Amsalu et al, which showed that mobile-based health communication can improve treatment adherence and health outcomes, particularly in rural and resource-limited settings [21].

Further research could involve a larger sample size to ensure broader generalizability of the findings. Additionally, the integration of multimedia (audio-visual content) could be explored to assess whether visual reinforcement further enhances treatment outcomes and caregiver knowledge retention. Expanding the research to other regions with varying socio-economic backgrounds might also help in understanding the adaptability of audio-based interventions in diverse contexts.

The lower default rate in the experimental group is particularly significant, as defaulting from treatment is a major challenge in CMAM programs. Defaulting compromises the ability to monitor a child's recovery and increases the risk of relapse. Audio messages, which can be replayed and accessed at the caregiver's convenience, likely reinforced the importance of attending follow-up visits and completing the treatment regimen.

However, the lack of statistically significant differences in MUAC and weight gain between the two groups suggests that audio messages alone may not be sufficient to achieve significant improvements in anthropometric outcomes. Other factors, such as the quality of care at CMAM centres and the caregiver's overall understanding of child nutrition, may also play a role in influencing treatment outcomes.

Limitations

This study was limited by its small sample size, which may have reduced the statistical power to detect significant differences in treatment outcomes. The study was also conducted in a specific cultural context, which may limit the generalizability of the findings to other regions.

Conclusion

Audio messages have the potential to improve treatment adherence and reduce default rates in CMAM programs, providing a scalable and cost-effective method for delivering health messages to caregivers. While the impact on anthropometric outcomes was not statistically significant, the findings suggest that audio messages can enhance caregiver engagement and treatment compliance. Future studies should explore the use of audio messages in combination with other communication strategies, such as visual aids or group discussions, to further optimize treatment outcomes in CMAM programs.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the conduct of this research.

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