Analysis of trends in SMART Nutrition Survey data from South Sudan between 2004 and 2016

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Introduction: Emergency levels of Global Acute Malnutrition (GAM) persist in former Northern Bar el Ghazal State in South Sudan despite ongoing interventions. Reasons for long-term trends in GAM in South Sudan have not been explored despite decades of nutrition and health interventions.

Objective: This project aimed to identify and analyse changes in patterns of malnutrition and key factors associated with malnutrition from 2004 to 2016.

Methods: Secondary data analysis was carried out using Standardized Monitoring and Assessment of Relief and Transitions (SMART) nutrition surveys. Anthropometric data collected from children under five years of age from 2004 to 2016 were analysed to estimate seasonal differences in the prevalence of GAM (weight-for-height z-score (WHZ) <-2) and severe acute malnutrition (WHZ <-3). Risk factors for GAM were explored using data collected in 2014 and 2015 and analysed using logistic regression. Adjusted Wald tests investigated which variables were associated with GAM (p<0.05).

Results: In Aweil West and North a reduction in GAM was observed between September 2004 (21.0%, CI 18.2-23.9) and November 2009 (16.2%, CI: 13.7-18.9). However, this apparent decline likely reflects a seasonal difference because the 5-year overall mean GAM was 20.4% (SD: 0.403) and 17.5% (SD: 0.380) in pre- and post-harvest seasons respectively. In multivariable linear regression modelling, not having been sick in the past two weeks (aOR 0.78, 95% CI 0.61, 0.99, p=0.047), and not having consumed juice (aOR 0.67, 95% CI 0.45, 0.99, p=0.045) were protective against GAM after adjusting for all potential confounders.

Conclusion: This study highlights the impact of instability on the nutritional status of a generation, with the high prevalence of GAM and severe acute malnutrition remaining unchanged since 2004. Regular collection of representative nutrition data is useful to inform decision making. The results of this study suggest that a focus on care seeking behaviours and hygiene practices would be beneficial. The persistent prevalence of GAM identifies a need, not just for nutrition programmes but also effective prevention programmes.

Keywords: malnutrition, South Sudan, Aweil, illness, juice, SMART survey

INTRODUCTION

Concern Worldwide has been implementing nutrition programmes in the former Northern Bar el Ghazal (NBeG) State in South Sudan since 1998. NBeG is the most rural state in South Sudan and sits on the present-day border with Sudan. It has faced conflict and war in the past. More recently, it has largely escaped the direct effects of the civil war and its population has freedom to move around the region. Predominately composed of the Dinka ethnic group [1], it has the highest cattle population in the country and some of the most fertile land. Sorghum and cattle rearing are the main agricultural activities. [2]

The two main seasons are the dry season (October to April) and the wet season (May to September); the lean period peaks in June/July. [3] Attendance is typically poor at health facilities and illnesses are common. [4] According to the Food and Agriculture Organization, NBeG faces one of the greatest nutritional needs in the country. [5]

Long-term trends in Global Acute Malnutrition (GAM) have not been explored despite ongoing interventions. The effects of conflict on health cannot be

understated, particularly given their disproportionate effect on children.[6] A rapid assessment in 2010 concluded that insufficient data were collected. Reports were often incomplete and understanding of monitoring and evaluation by health care staff was poor.[7] Without robust analysis of the fluctuations in GAM, changes over time cannot be adequately monitored. It is important to fill this gap and assess the nutrition situation to target nutrition programming. In Aweil West and North counties, a comprehensive historical analysis of nutrition surveys is lacking despite the availability of this type of data.

The objective was to identify and analyse changes in patterns of malnutrition and key factors associated with malnutrition from 2004 to 2016, including seasonal differences where data were available.

The specific objectives are:

1. To describe the seasonal prevalence of GAM from 2004 to 2016 in Aweil West and Aweil North Counties using SMART survey data.

2. To identify risk factors associated with malnutrition across seasons in the same year, and across years from 2004 to 2016.

METHOD

Secondary data analysis was done using cross-sectional SMART nutrition survey data from Aweil West and North Counties. Anthropometric data collected from children under five years of age (n=12,326) from 2004 to 2016 (excluding 2007 and 2012 due to lack of data) were analysed to estimate seasonal differences in the prevalence of GAM (weight-for-height z-score (WHZ) <-2), severe acute malnutrition (WHZ <-3), stunting (height for age z-score (HAZ) <-2) and underweight (weight-for-age z-score (WAZ) <-2). GAM in children aged 6-59 months was defined by a WHZ of less than negative two standard deviations.

Risk factors for GAM were explored using data collected from children under five (n=2,775) in 2014 and 2015 and analysed using STATA-12 and logistic regression analysis adjusted for survey design. Year, county, season, child age and sex were *a priori* control variables. Predictors assessed included history of vitamin A supplementation, illness and treatment seeking behaviour, vaccination status and infant and young child feeding practices. Adjusted Wald tests investigated which variables were associated with GAM (p<0.05).

RESULTS

Seasonal Anthropometric Analysis

Aweil West and North Trends: A reduction in GAM was observed between September 2004 (21.0%, CI 18.2-23.9) and November 2009 (16.2%, CI: 13.7-18.9) with little overlap between confidence intervals. SAM prevalence remained unchanged over this time, reducing by 0.9 percentage points from 3.2% (CI: 1.9-4.4) in 2004 to 2.3% (CI: 1.3-3.4) in 2009. The proportion of values flagged with WHO flags (See box on page 127) were higher in 2009 (9.4%) than 2004 (1.4%) however, indicating data quality concerns. The 5-year overall mean GAM was 20.4% (SD: 0.403) and 17.5% (SD:0.380) in pre- and post-harvest seasons respectively. GAM prevalence was highest in April 2011 (24.1%, CI 20.5-27.7) in Aweil North, however in Aweil West in the same year GAM prevalence was close to the lowest recorded (14%, CI 11.0-17.0) with no overlap in CIs.

Risk Factors Identified as associated with GAM

- Females had a significantly higher WAZ (p=0.008) and HAZ (p=0.001) than males. No significant difference in WHZ (p=0.104) or GAM (p=0.089) was found by sex or between age categories.

- No significant difference in weight, WHZ, WAZ, HAZ or GAM was found between surveys in univariate and multivariable associations with GAM.

- Vitamin A supplementation coverage improved from 21.5% in Aweil North in April 2014 to 66.7% and 57.7% in Aweil West and North respectively in November 2015.

- Measles vaccination fluctuated, 51.6% were reported as vaccinated in Aweil North in April 2014, whereas this had fallen to 40.8% in Aweil West and 41.4% in Aweil North in 2015.

- Prevalence of illness in the past two weeks reached almost two thirds of children in Aweil North in November 2015, with a high prevalence of illness overall, however a trend towards increased treatment seeking behaviour was observed. 81% of caregivers whose child was ill in the past two weeks sought treatment in November 2015 compared to 69% in November 2014.

- In multivariable linear regression modelling not having been sick in the past two weeks (aOR 0.78, 95% CI 0.61, 0.99, p=0.047), and not having consumed juice (aOR 0.67, 95% CI 0.45, 0.99, p=0.045) were associated with GAM after adjusting for all potential confounders.

DISCUSSION

Despite the limitations of this study including limited continuity of data, it adds to the literature base. Political instability and poor infrastructure affect a considerable proportion of people in Aweil West and North Counties. This study highlights the impact of this instability with the prevalence of GAM and SAM remaining unchanged since 2004. Recent illness was identified as a risk factor

associated with GAM along with the consumption of juice, which could be an indicator of the consumption of unclean water and unhygienic juice preparation using over-ripe fruits.

It is important to note that any interpretations must be made with caution due to the cross-sectional nature of the data. The multifactorial aetiology of GAM and varying risk factors across settings [8] mean that a single nutritional intervention alone is not likely to reduce the prevalence of GAM to 'Zero Hunger'. The results of this study suggest that a focus on care seeking behaviours and water, sanitation and hygiene practices would be beneficial.

The persistent prevalence of GAM identifies a need, not just for the community management of acute malnutrition programmes, which have been shown to be effective,[9-11] but preferably effective prevention programmes.[12] The prevention of acute malnutrition requires addressing the immediate causes of malnutrition, while also working to address the upstream underlying causes such as the political environment and social protection services. [13]

Regular collection of representative nutrition data is useful as a tool to inform decision making [14] but it can only be informative when it is fully utilised. According to a recently published Scaling Up Nutrition Report, [15] there is a gap between data collection and effective use of the information. Further, this study has high levels of missing and incompatible data. The use of SMART surveys is increasing.[15] It is recommended that SMART surveys are carried out in a consistent manner from year to year with reference to UNICEF indicators to allow fair comparisons and reporting that is compatible with international standards. Without this consistency and quality, it is wasteful of valuable resources to collect data that cannot accurately inform programmes.

Rigorous staff training in anthropometric measurements should also be considered as vast amounts of data were lost to WHO flags in this study (17.5% of data points in regression analysis for example). This may be difficult to sustain however as it is known that building local capacity is a challenge. In a setting where international staff turnover is high[15], strengthening local capacity is essential. Routine nutrition monitoring is essential and must be strengthened if the government and implementing organisations seek to fulfil the Sustainable Development Goal of 'Zero Hunger'. Regular collection of representative nutrition data is useful as a tool to inform decisions, advocate for nutrition sensitive programming and designing interventions that target the underlying causes of malnutrition.

CONCLUSION

The current findings have important implications for future research, policy and programming. It is recommended that the causes of malnutrition in this setting are examined more comprehensively. Analysis and evaluation of malnutrition prevention programmes in this setting are also warranted to assess what works and why. Prevention of malnutrition should be the primary aim, however efforts to treat GAM should be ongoing.

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WHO Flags for SMART Nutrition Surveys

WHO flags are used in assessing SMART nutrition surveys for outliers. Flags are based on a reference population. For weight for height, the range is -5 to +5 standard deviations. If a child is found to be outside of this range the weight for height data is not included in the analysis. When weight for height data is entered into the Data Entry Anthropometry tab in ENA for SMART it is automatically excluded if the z-score is beyond the -5 to +5 range, indicating that a measurement or data entry error has likely occurred. If WHO flags are as high as 9.4%, it is likely that the SMART survey was not carried out to a high standard.

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