PREVALENCE AND DETERMINANTS OF STUNTING AMONG UNDER-FIVE-YEAR-OLD CHILDREN IN THE NGORORERO DISTRICT, RWANDA

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ABSTRACT

Introduction: Stunting affects 148.1 million children under five globally, with the highest burden in low- and middle-income countries. In Rwanda, stunting remains a significant public health concern, affecting 33% of children under five, with the burden rising to 50.5% in rural areas such as Ngororero District. This study aimed to determine the prevalence and key determinants of stunting among children under five in Ngororero District, Rwanda. **Method:** A descriptive cross-sectional survey was conducted among 384 children, selected using a multistage sampling approach. Data were collected using structured questionnaires and anthropometric measurements. Analysis was performed using SPSS Version 30, WHO Anthro Survey Analyser, and Excel. Pearson chi-square tests and logistic regression were applied to identify a significant association of stunting at $p < 0.05$. **Result:** The prevalence of stunting was 36%, with 12.9% of children severely stunted. Maternal alcohol consumption was strongly associated (OR = 5.2, $\chi^2 = 21.1$, $p = 0.001$), followed by lack of formal maternal education (OR = 3.6, $\chi^2 = 12.9$, $p = 0.012$), and inadequate antenatal care (0–2 visits) (OR = 2.7, $\chi^2 = 10.8$, $p = 0.002$). Other significant factors included untreated drinking water, food shortages, absence of exclusive breastfeeding, and large household size. **Conclusion:** The findings underscore the multifaceted nature of stunting, which is shaped by maternal practices, socioeconomic conditions, and access to healthcare. Reducing childhood stunting in Ngororero District and similar rural settings in Rwanda requires targeted nutrition-specific and nutrition-sensitive interventions alongside improved maternal education. Further studies, including longitudinal research, are recommended.

Keywords: Anthropometric, child nutrition, determinants, maternal education, Stunting

INTRODUCTION

Stunting is defined as impaired linear growth in children, resulting from chronic undernutrition and recurrent infections, typically during the first 1,000 days of life from conception to age two (WHO, 2006). A child is classified as stunted when their height-for-age z-score (HAZ) is less than -2 standard deviations (SD) from the median of the WHO Child Growth Standards, while severe stunting is defined as HAZ less than -3 SD (WHO, 2006). Childhood stunting remains a persistent challenge in low- and middle-income countries, with approximately 148.1 million children affected globally (UNICEF, WHO & World Bank, 2023). Africa bears a disproportionately high burden, with a stunting prevalence of 30%, exceeding the global average of 22.3%. Sub-Saharan Africa, including Rwanda, continues to experience elevated rates, mainly due to poverty, food insecurity, inadequate maternal nutrition, and limited access to healthcare (FAO, 2023). In Rwanda, 33% of children under five are stunted, with rates soaring to 40% in the Western Province and 50.5% in Ngororero District (NISR, 2020). Despite national initiatives to combat undernutrition, rural areas remain disproportionately affected. Socioeconomic disparities, environmental conditions, and maternal health behaviours continue to hinder progress in reducing stunting at the district level.

Stunting is influenced by multifaceted determinants, including maternal health, household conditions, feeding practices, and environmental risk factors. Socioeconomic status plays a critical role, with lower household income, maternal education, and food insecurity strongly associated with stunting (Baye et al., 2020; Sayeed et al., 2023). Additionally, inadequate antenatal care attendance, maternal alcohol consumption, and suboptimal breastfeeding practices have been identified as significant factors associated with child growth faltering (Nshimyiryo et al., 2019; Bhutta et al., 2013). Environmental determinants also contribute to the prevalence of stunting. Poor sanitation, untreated drinking water, and exposure to infectious diseases increase the risk of childhood malnutrition (Vilcins et al., 2018a; WHO, 2015). The absence of kitchen gardens and limited household dietary diversity further exacerbate food insecurity, reducing nutrient intake and impairing child development (Kalinda et al., 2024).

While national strategies such as Rwanda's National Nutrition Policy (2014) and the National Strategy for Transformation 2 (NST2) aim to reduce childhood stunting, localised interventions tailored to district-specific challenges remain insufficient. National statistics provide a broad overview of stunting prevalence but often fail to capture localised risk factors that influence child nutrition outcomes. Previous studies have primarily focused on national or regional trends (NISR, 2015; NISR, 2020; Alphonse-Nshimyiryo et al., 2019). Overlooking district-specific determinants is essential for designing effective, context-specific interventions. Understanding the interplay between maternal knowledge, health

behaviours, dietary practices, and environmental conditions at the district level is crucial for addressing stunting where it is most severe.

This study aims to fill this gap by investigating the prevalence and key determinants of stunting among children under five in Ngororero District, Rwanda. Specifically, it examines how socioeconomic status, maternal health behaviours, feeding practices, and environmental conditions contribute to stunting within the local context. The study's findings are expected to inform policymakers, healthcare providers, and community stakeholders on targeted strategies to reduce stunting in rural Rwanda. Strengthening maternal education, improving food security, enhancing access to antenatal care, and promoting nutrition-sensitive interventions are vital for mitigating the long-term effects of stunting. Ultimately, addressing this challenge is crucial for enhancing child health, promoting cognitive development, and advancing Rwanda's broader socioeconomic objectives.

METHODS

Study Design and Setting

A descriptive cross-sectional study was conducted from January to May 2025 in Ngororero District, Rwanda, employing a quantitative approach that included structured questionnaires, anthropometric measurements, and focus group discussions to assess the determinants of stunting comprehensively. Ngororero District, situated in Rwanda's Western Province, was selected due to its predominantly rural population, dependence on subsistence farming, and notably high stunting rate of 50.5% among children under five (NISR, 2020).

Study population and sample size

The study focused on all children under five years of age residing in Ngororero District, estimated at approximately 28,000 (NISR, 2022). This population was chosen because children in this age group are particularly vulnerable to stunting and its associated health consequences. The study also involved their households and mothers or primary caregivers to capture the broader determinants influencing child growth. To ensure representativeness, a multistage sampling technique was applied. First, the district was divided into four clusters, from which one sector was randomly selected in each cluster. In each selected sector, four cells were chosen through simple random sampling. Finally, households with under-five children were identified using computer-based random sampling.

The required sample size of 384 participants was calculated using Fisher's formula for prevalence studies (1998), based on a stunting prevalence of 50.5% from the Rwanda Demographic and Health Survey 2019–2020, a 95% confidence level, and a 5% margin of error.

The formula used was:

Sample size calculation. $n = \frac{z^2(1-p)}{d^2}$

Where:

n = sample size

Z = Z-value (1.96 for 95% confidence level)

p = 0.505 (stunting prevalence)

d = margin of error (5% or 0.05)

Substituting the values into the formula:

$n = \frac{1.96^2 \times 0.505(1-0.505)}{0.05^2} = 384.12 = 384$

Eligibility criteria included children aged 0–59 months, with priority given to the youngest child in households having multiple under-five children. Children with congenital growth disorders were excluded to avoid bias, as such conditions could independently influence growth patterns and nutritional status, unrelated to environmental or dietary determinants under study.

Data Collection Tools and Procedures

Data were collected using a structured questionnaire, and anthropometric measurements were taken to assess stunting and its associated factors. The questionnaire was adapted from the World Bank Microdata and other relevant literature, covering key domains such as household water, sanitation, and hygiene (WASH) conditions, child feeding practices, dietary diversity, maternal health and nutrition, and socio-demographic characteristics. It was translated into Kinyarwanda and pre-tested in a population similar to the study area to ensure clarity, cultural relevance, and reliability.

Anthropometric measurements included height/length, taken with a calibrated stadiometer and length board, following WHO standardised procedures to determine height-for-age Z-scores. Enumerators, who were nutritionists at health centres, underwent WHO-based standardised training on anthropometric measurement techniques and interview protocols. Inter-observer agreement and tool calibration were assessed during training to ensure measurement consistency and accuracy.

Trained enumerators visited selected households after obtaining ethical clearance and local administrative approval. Informed consent was obtained from caregivers before conducting face-to-face interviews and taking child measurements. Measurements were taken twice, with the average used if a difference greater than 0.5 cm occurred. The child's age was confirmed using vaccination cards.

Data analysis

Data were entered into Microsoft Excel and then exported to the WHO Anthro Survey Analyser to assess stunting prevalence, and subsequently to SPSS Version 30 for detailed analysis. Descriptive statistics (averages, frequencies, and percentages) described the sample characteristics. Pearson chi-square tests identified associations, while logistic regression was used to determine the significant association of stunting. A p-value of 0.05 was used to assess statistical significance. Crude and adjusted odds ratios, along with 95% confidence intervals, were used to measure the strength of the associations. Results were presented using tables, charts, and graphs.

Ethical considerations

Ethical clearance was obtained from the School of Postgraduate Studies at Mount Kenya University Review Board, and the Ngororero District granted permission. During the survey, the purpose of the study was explained, and data were collected anonymously after participants provided informed consent. All data and consent forms were securely stored and were accessible only to the research team.

RESULTS

Participant Characteristics

The study included 384 children and their caregivers. The mean child age was 24.8 ± 16.1 months, with most aged between 6 and 23 months. The child's Age was categorised into six groups (0–5, 6–11, 12–23, 24–35, 36–47, and 48–60 months) based on the WHO growth monitoring intervals. Females comprised two-thirds of the sample, and over half did not live with both parents. Maternal Education was classified into no formal education, primary, secondary, Technical and Vocational Education and Training (TVET), and university. Maternal education varied, but a substantial proportion had no formal education or only primary schooling. About half of the mothers reported smoking or alcohol consumption. Fathers were slightly more likely than mothers to be household heads, with trading and formal employment as the most common occupations. Most households lacked health insurance, reported low monthly incomes, and had large family sizes, typically consisting of six or more members. Detailed socio-demographic characteristics are provided in Table 1.

Table 1: Socio-demographic Characteristics of Participants

Variable	Category	Frequency	Percent
Child's age in Months	0–5 months	17	4.4
	6–11 months	113	29.4
	12–23 months	89	23.2
	24–35 months	65	16.9
	36–47 months	51	13.3
	48–60 months	49	12.8
	Total	384	100
Child Sex	Male	129	33.6
	Female	255	66.4
	Total	384	100
Mother's Education Level	No formal education	75	19.53
	Primary education	106	27.6
	Secondary education	94	24.48
	TVET	101	26.3
	University	8	2.08
	Total	384	100
Mother's Smoking Status	Yes	196	51
	No	188	49
	Total	384	100
Mother's Alcohol Use	Yes	213	55.5
	No	171	44.5
	Total	384	100
Household Head	Father	202	52.6
	Mother	182	47.4
	Total	384	100
Occupation of Household Head	Unemployed	62	16.1
	Farmer	68	17.7
	Trader	122	31.8
	Formal employment	93	24.2
	Other	39	10.2
	Total	384	100
Family Health Insurance	Yes	122	31.8
	No	262	68.2
	Total	384	100
Monthly Household Income (RWF)	< 10,000	162	42.2
	10,000–50,000	138	35.9
	50,001–100,000 and above	84	21.9
	Total	384	100
Number of Household Members	2–5	23	6
	6–9	251	65.4
	10 and Above	110	28.6
	Total	384	100

Prevalence and Socio-Demographic Determinants of Stunting

The prevalence of stunting was 36.0% (95% CI: 31.2–40.9), and severe stunting was 12.9% (95% CI: 9.6–16.7). Stunting prevalence was significantly higher among children whose mothers had no formal or only primary education, and among those whose mothers consumed alcohol. Larger households (with 10 or more members) were also associated with higher stunting rates. In contrast, no significant associations were found between the child's age, gender, maternal smoking, the gender of the household head, health insurance status, or household income. Detailed statistical results are provided in Table 2**.**

Table 2: Socio-Demographic Determinants of Stunting

Independent Variable	**Category**	**Stunting**		**Total**	**Chi-square (χ^2)**	**p-value**
		Yes	No			
Child's age in months	0-5	9	8	17	3.002	0.70
	6-11	43	70	113		
	12-23	31	58	89		
	24-35	23	42	65		
	36-47	18	33	51		
	48-60	15	34	49		
Gender of the child	Male	52	77	129	1.422	0.233
	Female	87	168	255		
Mother's Education Level	No education	41	34	75	12.7	0.005*
	Primary education	63	43	106		
	Secondary education	25	69	94		
	TVET	9	92	101		
	University	1	7	8		
Mother's Smoking Status	Yes	75	121	196	0.741	0.389
	No	64	124	188		
Mother's Alcohol Consumption	Yes	120	93	213	72.9	0.001*
	No	19	152	171		
The household head (Gender)	Father	77	125	202	0.681	0.409
	Mother	62	120	182		
Family Health Insurance	Yes	49	73	122	1.218	0.27
	No	90	172	262		
Monthly Household Income (RWF)	Less than 10,000 RWF	63	99	162	1.135	0.567
	10,000-50,000 RWF	49	89	138		
	50,001-100,000 RWF	27	57	84		
Household Size (Members)	10 and above	47	63	110	6.0	0.049*
	3-5	4	19	23		
	6-9	88	163	251		

Influence of Maternal Care, Childcare, and Feeding Practices on Stunting

Significant associations with stunting were observed for food insecurity, feeding a child only once per day, and mothers having fewer than three Antenatal Care (ANC) visits. Lack of exclusive breastfeeding, absence of nutritional supplements, non-participation in Monthly Kitchen Village sessions, and poor caregiver knowledge of balanced diets also showed significant associations with higher stunting rates (Table 3.

Table 3: Maternal, Child-care, and Feeding Practices and Stunting

Independent Variable	Categories	Stunting		Total	Chi-Square	p-value
		Yes	No			
Food shortage (last 3 months)	No	20	122	142	10.74	0.001*
	Yes	119	123	242		
Meals per day (child)	Three & above	4	23	27	7.91	0.019*
	Two	61	160	221		
	One	74	62	136		
Number of ANC visits	0–2 times	51	46	97	19.35	0.002*
	3–4 times	35	42	77		
	More than 4 times	24	157	181		
Place of delivery	Health facility	36	44	80	3.428	0.18
	At home	88	170	258		
	Other	15	31	46		
Exclusive breastfeeding	No	110	91	201	16.52	0.032*
	Yes	29	154	183		
Child fully vaccinated	Yes	58	93	151	0.528	0.468
	No	81	152	233		
Nutritional supplements (Iron Multiple Micronutrient Powder (MNP), and Vitamin A).	Yes	82	150	232	5.34	0.021*
	No	73	79	152		
Monthly Kitchen Village	Yes	39	125	164	8.29	0.038*
	No	100	120	220		
Caregiver's knowledge of a balanced diet	Yes	45	132	177	13.26	0.003*
	No	94	113	207		
Enrolment in nutrition programmes	Yes	41	53	94	2.967	0.085
	No	98	192	290		

Environmental and Sanitation Determinants of Stunting Among Children Under Five Years

Untreated drinking water, absence of toilet facilities, and lack of kitchen gardens showed significant associations with higher stunting prevalence. In contrast, the type of toilet, water source, handwashing facilities, and small livestock ownership demonstrated no significant associations. The lack of significance for some expected Determinants may be explained by the relatively homogeneous socio-economic and environmental conditions in the study area, which could limit variability in exposure, or by potential underreporting of certain behaviours, such as handwashing facilities, due to social desirability bias. Full statistical details are provided in Table 4**.**

Table 4: Environmental and Sanitation Determinants of Stunting Among Under-Five Children

Independent Variable	Category	Stunting		Total	Chi-square (χ^2)	p-value
		Yes	No			
Source of water	Piped water	62	98	160	1.178	0.555
	Borehole	50	89	139		
	River/stream	27	58	85		
Water treatment	Yes	48	160	208	14.6	0.004*
	No	91	85	176		
Toilet facilities	Yes	64	182	246	16.08	0.027*
	No	75	63	138		
Type of toilet facility	Flush toilet	22	23	45	3.599	0.165
	Pit latrine	52	96	148		
	Improved pit latrine	65	126	191		
Handwashing facilities	Yes	83	135	218	0.768	0.381
	No	56	110	166		
Kitchen garden	Yes	41	150	191	22.18	0.004*
	No	98	95	193		
Small livestock	Yes	85	137	222	0.996	0.318
	No	54	108	162		

Logistic Regression Analysis

This analysis identifies factors significantly associated with child stunting using logistic regression. Logistic regression identified maternal alcohol consumption as the strongly association of stunting (OR = 5.2, 95% CI: 2.9–9.4, p = 0.001), followed by no formal maternal education (OR = 3.6, p = 0.012), 0–2 ANC visits (OR = 2.7, p = 0.002), untreated water (OR = 2.6, p = 0.004), and lack of exclusive breastfeeding (OR = 2.5, p = 0.032). Other significant factors included food shortage (OR = 2.4), one meal per day (OR = 2.3), no toilet (OR = 2.2), poor dietary knowledge (OR = 2.1), no kitchen garden (OR = 1.9), large household size ≥10 (OR = 1.8), lack of supplements (OR = 1.6), and no Monthly Kitchen Village participation (OR = 1.8).

Table 5: Factors Significantly Associated with Stunting

Variable	Odds Ratio (OR)	95% CI (Lower–Upper)	P-value
Alcohol consumption during pregnancy	5.2	2.9 – 9.4	0.001*
Food shortage in the household	2.4	1.5 – 3.7	0.001*
ANC visits (0–2 times)	2.7	1.4 – 5.1	0.002*
Not enough knowledge of a balanced diet	2.1	1.3 – 3.4	0.003*
Water not treated before drinking	2.6	1.5 – 4.3	0.004*
No Toilet facility	2.2	1.2 – 4.0	0.027*
No Kitchen garden	1.9	1.3 – 3.0	0.004*
No Exclusive breastfeeding	2.5	1.3 – 4.6	0.032*
One meal per day	2.3	1.1 – 4.7	0.019*
Large household size (≥10)	1.8	1.01 – 3.2	0.049*
No nutritional supplements	1.6	1.1 – 2.3	0.021*
No participation in the monthly kitchen village	1.8	1.0 – 3.3	0.038*
No formal education (mother)	3.6	1.3 – 9.9	0.012*

* Significant at $p<0.05$

DISCUSSION

This study examined the prevalence and key determinants of stunting among children under five years old in Ngororero District, Rwanda. The study found that the prevalence of stunting was 36%, with 12.9% being severely stunted. Although this represents a reduction from the previously reported district prevalence of 50.5% (NISR, 2020), it remains higher than the national average of 33%. This persistent high burden, particularly in rural settings, aligns with national patterns and underscores the need for targeted interventions (Kalinda et al., 2024). Several socio-economic, maternal behaviours, feeding practices and childcare factors were found to be significantly associated with stunting. Maternal alcohol consumption showed the strongest association with stunting, where children of mothers who consumed alcohol were 5.2 times more likely to be stunted (OR = 5.2, p = 0.001). This supports findings by Modjadji & Pitso (2021) and le Roux et al. (2020), who noted that alcohol use disrupts caregiving and feeding practices.

The study also found that the level of education was significantly associated with stunting; children of mothers without formal education were 3.6 times more likely to be stunted (OR = 3.6, p = 0.012). This study aligns with studies conducted by Habiryayo et al. (2025) and Alphonse-Nshimyiryo et al. (2019), which highlight the role of education in informed feeding and healthcare-seeking behaviour. This study confirms that investing in education is a good choice to combat the public health issue of stunting among children under five.

Antenatal care (ANC) attendance was also significantly associated with stunting. Children whose mothers attended fewer than two ANC visits were 2.7 times more likely to be stunted (p = 0.002), reaffirming ANC's role in maternal counselling and nutritional intervention (Bhutta et al., 2013). Exclusive breastfeeding for six months showed a protective effect, with non-exclusively breastfed children being 2.5 times more likely to be stunted (p = 0.032), supporting global evidence (Rahayu et al., 2023). Inadequate dietary intake was another major factor associated with stunting, as children consuming only one meal per day had more than double the odds of stunting (OR = 2.3, p = 0.019), which aligns with the findings of Addae et al. (2024). Household food insecurity (OR = 2.4, p = 0.001) and caregivers' lack of knowledge about balanced diets (OR = 2.1, p = 0.003) further emphasised the role of both food access and maternal nutrition literacy as factors contributing to stunting (Darojat et al., 2023; Sayeed et al., 2023).

Larger household size (≥10 members) was associated with stunting (OR = 1.8, p = 0.049), likely due to increased competition for limited resources and reduced caregiver attention (Tafese et al., 2020). This finding supports the importance of family planning to ensure families have a manageable number of children, enabling them to meet each child's nutritional, health, and developmental needs. Similarly, the lack of micronutrient supplementation and non-participation in Monthly Kitchen Village sessions were significantly associated with stunting, with p-values of 0.021 and 0.038, respectively. These findings support the promotion of the Multiple Micronutrient Supplementation (MMS) programme as a key strategy

to reduce Rwanda's high rates of stunting and break the intergenerational cycle of malnutrition (UNICEF, 2024). Both factors may limit access to essential micronutrients and dietary diversity necessary for healthy child growth.

The absence of a kitchen garden in the household was significantly associated with stunting, likely due to limited access to diverse, home-grown vegetables that are essential for micronutrient intake. Kitchen gardening is known to increase vegetable consumption, enhance dietary diversity, and improve overall food intake. It also contributes to global food security, with greater benefits observed when both garden size and crop diversity are prioritised (Habimana & Muhawenayo, 2023). Environmental health factors further contributed to risk: untreated drinking water increased the odds of stunting (OR = 2.6, p = 0.004), in line with Vilcins et al. (2018), who noted that waterborne infections impair nutrient absorption. A lack of toilet facilities (OR = 2.2, p = 0.027) was also significantly associated with stunting, consistent with findings in Ethiopia and Uganda (Woldesenbet et al., 2023**;** Kasajja et al., 2022)**.** This reinforces the importance of sanitation in child health.

Although the sample had a higher proportion of female children (66.4%), child sex was not significantly associated with stunting. The gender imbalance may be due to chance in the sampling process or reflect demographic patterns in the study area, such as higher female child survival rates or cultural factors influencing household willingness to present female children for measurement. The absence of a significant association between child sex and stunting aligns with findings from previous studies in sub-Saharan Africa (Akombi et al., 2017; Chirande et al., 2015), which similarly reported that stunting prevalence did not differ significantly between boys and girls. Nevertheless, the overrepresentation of females in the sample should be acknowledged as a limitation, as it may affect the generalizability of the findings.

Certain variables like child's age, maternal smoking, health insurance coverage, and household income, also had no significant association with stunting, but some previous studies have been identified as determinants of stunting (Aheto et al., 2015; Keino et al., 2014). This may reflect the relatively homogeneous socio-economic conditions of the study population, which reduce variability and statistical power to detect differences. It is also possible that the effects of these factors are mediated through other significant determinants identified in our analysis, such as maternal education, feeding practices, and environmental sanitation (Onyango et al., 2019; World Health Organisation, 2020). Additionally, reliance on self-reported behaviours, such as smoking, may have introduced social desirability bias, leading to underreporting and attenuating potential associations (Krumpal, 2013).

Potential reverse causality was considered when interpreting some observed associations. For example, household food insecurity and limited use of health services may not only contribute to child undernutrition but could also result from it, as caring for a malnourished child may impose economic and time burdens that further strain household resources (Victora et al., 2021). Similarly, poor child health could discourage

or limit caregiver participation in health promotion activities, such as Monthly Kitchen Village sessions, thereby reinforcing the cycle of undernutrition. Previous research has noted that undernourished children often require more healthcare, which can exacerbate household poverty and reduce resources available for adequate nutrition (Headey & Hoddinott, 2015). The cross-sectional design of this study limits the ability to disentangle these bidirectional relationships, underscoring the need for longitudinal studies to better clarify temporal pathways between these factors and stunting.

Study limitation

This cross-sectional study cannot establish causality between identified factors and stunting. Additionally, self-reported data, for example, on alcohol and smoking, may be affected by recall and social desirability biases, possibly leading to misreporting despite mitigation through non-judgmental interviewing. Future research, employing longitudinal or qualitative approaches, is recommended to gain a deeper understanding of causal pathways and contextual influences.

CONCLUSION

The study confirms that stunting remains a significant public health concern in Ngororero District, affecting 36% of children under the age of five. Key determinants include maternal behaviours, poor feeding practices, inadequate antenatal care, and unsafe environmental conditions. Addressing this issue requires integrated, multi-sectoral interventions aligned with Rwanda's Vision 2050 and National Strategic Transformation (NST2). Specific actions should include expanding maternal nutrition education campaigns, improving coverage and participation in Monthly Kitchen Village programs, promoting kitchen gardening and local food production to improve dietary diversity, and implementing targeted interventions to reduce alcohol consumption among pregnant women. Strengthening access to safe water, sanitation, and hygiene facilities should also be prioritised to support child growth and development in Ngororero and similar rural settings.

Conflict of interest

The authors declare that they have no conflicts of interest**.**

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