



Research Article

Integrated Health and Nutrition Service Delivery Enhances Humanitarian Response in Conflict-Affected Darfur, Sudan

Kamal Eldin Mohammed Fadul^{1,*} , Eltighani Mirghani Elamin² ,
Fadwa Hassan Ibrahim² , Dirdiri Hassan Mahmoud²

¹Department of Silviculture, University of Khartoum, Khartoum, Sudan

²Agricultural Economics & Policy Research Center, Agricultural Research Corporations (ARC), Khartoum, Sudan

Abstract

Displaced and host populations in protracted conflict settings face compounded risks of poor maternal, child and nutritional health, driven by damaged health infrastructure, health worker shortages and disrupted supply chains. This paper examines the health and nutrition component in conflict affected area in South Darfur State, Sudan, targeting South Sudanese refugees, internally displaced persons (IDPs) and host communities around the Bilel primary health care (PHC) clinic and surrounding camps. Using a mixed-methods post intervention evaluation household knowledge-attitudes-practices (KAP) surveys, key informant interviews, focus group discussions, health-facility observation, and a SMART nutrition survey. The study assessed primary health care utilization, maternal health service coverage, referral system performance, and treatment of acute malnutrition. Findings show that 43,883 primary health care consultations were delivered against a target of 46,422, while the proportion of women whose deliveries were attended by skilled staff rose from 60% to 74% and referrals to the regional hospital in Nyala reached 371 against a target of 150. On nutrition, 8,738 children under five were admitted for treatment of severe or moderate acute malnutrition reduced from 2,000. The 2020 SMART survey found global acute malnutrition (GAM) at 11.9% and severe acute malnutrition (SAM) at 0.8% in the surveyed locality. Despite these gains, persistent staff shortages at the Bilel PHC clinic (relative to a caseload of up to 200 patients per day), intermittent drug stock-outs, and rainy-season access barriers to therapeutic feeding constrained the consistency of care. The paper argues that integrating health, nutrition and community-based referral systems anchored in trained lay cadres such as traditional birth attendants and lead mothers is a transferable model for sustaining essential services in protracted, access-constrained displacement settings.

Keywords

Primary Health Care, Nutrition, Severe Acute Malnutrition, Internally Displaced Persons, Conflict-Affected Area, Darfur, Sudan, Maternal Health, Humanitarian Evaluation

*Correspondence: Kamal Eldin Mohammed Fadul (kamaleldin2001@gmail.com)

Received: 29 September 2026; Accepted: 13 October 2026; Published: 28 October 2026



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1. Introduction

Conflict-affected settings account for a disproportionate share of the world's poor health outcomes: estimates indicate that 60% of preventable maternal deaths, 53% of deaths in children under five, and 45% of neonatal deaths occur in fragile settings affected by conflict, displacement or natural disasters [17]. In Sudan, humanitarian needs have remained large and protracted; the 2021 Humanitarian Needs Overview estimated 13.4 million people in need nationally, including 2.5 million internally displaced persons (IDPs), 1.1 million refugees and 170,000 returnees [15]. Darfur has remained one of the country's major areas of protracted displacement and humanitarian need [11, 12, 15].

Darfur remains an epicenter of large-scale protracted displacement, where many IDPs are unable to meet their basic needs independently. The scale and long-term nature of displacement, which has not been matched by adequate economic opportunities, has exposed displaced populations to hardship and uncertainty. Protracted displacement has disrupted access to basic public services, including health and WASH services, particularly in IDP camps and resettlements [11, 15].

In 2018, inter-agency assessments across Darfur identified substantial humanitarian needs in health, nutrition, education, shelter, WASH, food and protection, while insecurity and access constraints continued to affect humanitarian operations [12]. These conditions are particularly important for women and children, who face increased risks of communicable disease, malnutrition and other protection concerns during prolonged displacement [1, 12].

South Darfur State is one of the most populous Darfur states and has a large internally displaced population. The state has experienced substantial humanitarian and development needs, while agriculture and livestock remain important components of local livelihoods [6, 10, 11].

Conflict has a serious impact on children and their communities, including through displacement, disruption of services and increased vulnerability among female-headed households [1]. South Sudanese refugees and other displaced populations have also been hosted in South Darfur, adding pressure to already constrained services [6, 11].

In South Darfur, South Sudanese refugees have been hosted in several localities, including Bilel, while refugees from the Central African Republic have also crossed into the southern part of the state [6]. Central Darfur has faced similar pressures. The state has a population of slightly more than 1.6 million, almost one-fifth of whom were classified as IDPs in the UNICEF state profile; it contains nine localities and includes the Jebel Marra massif, with Zalingei as its capital [18]. Prolonged conflict, population movement, environmental pressures and limited basic services have created particularly difficult conditions for women, children and other vulnerable groups in Central Darfur [18].

Sudan continues to face a severe acute malnutrition burden.

More recent humanitarian reporting has documented very high GAM levels in several Darfur localities, while the nutrition situation has continued to deteriorate because of conflict-driven food insecurity, displacement and disruption of essential services [13, 14]. These developments provide an important contemporary context for interpreting the earlier intervention evaluated in this study.

The nutrition situation in Sudan has been further affected by conflict-driven food insecurity, mass displacement, disease outbreaks and flooding [13, 14]. Recent evidence from South and East Darfur also indicates persistent gaps in access to health and nutrition services and a high burden of acute malnutrition, reinforcing the importance of integrated, community-linked service delivery in Darfur [2].

This paper examines improved access to and utilization of health services and reduced morbidity/mortality associated with illness" and Reduce malnutrition cases among children under five, and pregnant and lactating women in IDPs, refugees and host communities in a conflict-affected area.

The objectives of this paper are to: (i) assess the extent to which the health and nutrition intervention met identified needs (ii) quantify progress against primary health care utilization, maternal health and malnutrition-treatment indicators; (iii) identify the human-resource and referral system features associated with continuity of care in this setting; and (iv) derive lessons for future integrated health and nutrition programming fragile and conflict-affected areas.

2. Materials and Methods

South Darfur is situated in the southwest of Sudan and has 21 localities. It borders the states of Central, East and North Darfur, as well as South Sudan and the Central African Republic (CAR). South Darfur covers approximately 81,000 square kilometers. The landscape ranges from lowlands in the south to the Jebel Marra highlands in the north, and numerous seasonal wadis can make road travel difficult during the rainy season. The economy is largely based on rain-fed agriculture and livestock, with sorghum, millet, groundnuts, sesame and other crops providing important livelihoods [5, 6, 18]. The study was conducted in July 2021 at Bilel locality (South Darfur State).

2.1. Study Design and Setting

The study used mixed methods, pre-post evaluation design aligned with the OECD-DAC evaluation criteria and the Core Humanitarian Standard [3]. The evaluation was conducted in July 2021 [6], on Bilel PHC clinic (South Darfur State).

2.2. Data Sources and Sampling

Primary data were collected through: *Household KAP survey*: 320 households drawn from participating beneficiary strata (IDP, refugee, host community), stratified and weighted by camp population, plus a 40-household non-participating comparison group. *Key informant interviews (KIIs)*: with NCA health and nutrition officers, Bilel PHC clinic staff (medical assistants, midwives, the clinic statistics officer), and State Ministry of Health (SMoH) counterparts. *Focus group discussions (FGDs)*: with mothers, Bilel PHC midwives, and community health committee members. *Health-facility survey and observation*: structured assessment of staffing levels, drug and therapeutic-food stock status, and WASH conditions at the Bilel PHC clinic. *SMART nutrition survey*: a Standardized Monitoring and Assessment of Relief and Transitions (SMART) survey conducted 23-29 December 2020 in Bilel locality in collaboration with SMoH, covering 30 clusters (30-33 households each), with anthropometric data analyzed for 603 children aged 6-59 months (296 boys, 307 girls) and a household questionnaire administered in 698 households.

2.3. Data Analysis

Quantitative survey and SMART anthropometric data were analyzed using standard cross-tabulation, frequency distribution (Excel/SPSS and ENA for SMART software conventions). Qualitative data from KIIs and FGDs were thematically coded and triangulated against quantitative findings and clinic records. Achievement against each outcome indicator was rated on the programme's five-point scale Highly Achieved (HA), Achieved (A), Achieved with Minor shortcomings (AM), Moderately Achieved (MA), Below Average (BA), Not Achieved (NA).

3. Results and Discussion

3.1. Primary Health Care Utilization

A total of 43,883 primary health care consultations were delivered (24,287 female, 19,596 male; 19,142 children under five and 24,741 over five) against a target of 46,422 a shortfall rated Achieved with minor shortcomings (Figure 1). The Bilel PHC clinic was staffed by personnel seconded from the State Ministry of Health (2 medical officers, 3 medical assistants, 4 nurses, 4 midwives, 3 vaccinators and 8 nutritionists), treating an average of 130-150 patients daily, rising to a reported 200 patients on peak days during the August-October rainy season. Household survey data corroborate consistent, if partial, utilization: 30.5% of surveyed beneficiaries reported visiting a health facility in the preceding six months.

The shortfall against target, and the qualitative evidence of a clinic “unable to meet the demands” of peak caseloads (in the words of the clinic’s statistics officer, quoted in the underlying evaluation), together indicate that staffing despite government remained the binding constraint on consultation volume rather than clinic capacity or community demand. This is consistent with broader evidence from a systematic review of 48 studies on primary health care delivery models in conflict-affected Africa, which found that staff shortages and disease/logistics constraints, rather than demand-side barriers, were the most commonly reported challenges to service delivery in these settings [8]. The review’s finding that community health workers and lay cadres are a low-cost strategy for extending primary care capacity through task-shifting is directly reflected in this programme’s reliance on trained traditional birth attendants (TBAs) and community health volunteers to extend the clinic’s effective reach.

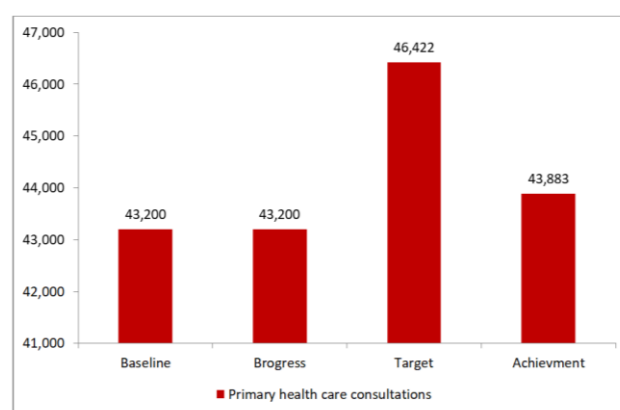


Figure 1. Primary health care consultations.

3.2. Maternal Health and Referral

The results showed that, 74% of women delivering in the catchment area were attended by skilled staff at a health facility, home, or via hospital referral exceeding the 70% target and up from a 60% baseline (Figure 2). Reproductive health services at Bilel operated on a 24-hour basis with four trained midwives, handling 50-80 births per month with 5-6 complicated cases referred monthly to Nyala hospital. Attendance at antenatal care (ANC) and receipt of a second tetanus toxoid (TT2) dose reached 85% (up from an 80% baseline), and 371 patients were referred to and followed up at Nyala regional hospital more than double the target of 150 reflecting both a functioning referral pathway and, plausibly, a genuine level of medical complexity in the caseload that a single PHC clinic could not resolve locally (Figure 3).

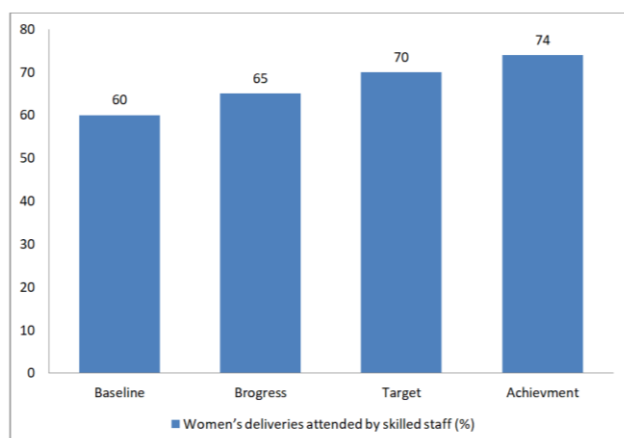


Figure 2. Women's deliveries attended by skilled staff (%).

Qualitative evidence attributes this improvement in skilled-attendance coverage substantially to the role of trained TBAs, who unlike a facility based midwife are resident within the community and were repositioned under the programme as referral agents rather than sole birth attendants, encouraging women toward facility-based delivery while retaining their trusted community role. This task-shifted, hybrid model (formal midwifery plus community-embedded TBA referral) reflects a broader pattern identified in the conflict-health literature: health facility based and community based models are consistently the two leading approaches to care delivery in conflict-affected settings, and their combination rather than reliance on either alone appears best suited to settings where formal health-worker density remains structurally constrained [8]. A residual gap remains, however: the Bilel PHC clinic had stopped providing clean-delivery materials (soap, mosquito nets) alongside its ANC/PNC services, a supply gap the evaluation's qualitative data flags as a specific loss relative to earlier programme phases.

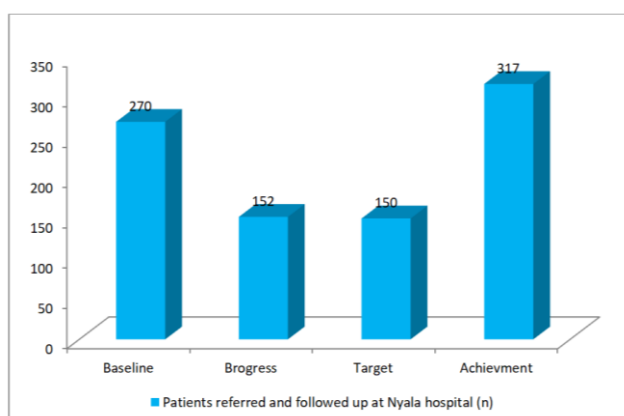


Figure 3. Patients referred and followed up at Nyala hospital.

Factors impacting health facilities' ability to provide services include lack of trained, available, gender-balanced staffing; stock outs of medical and pharmaceutical supplies and vaccines; attacks and looting of health facilities; insecurity of staff reaching or providing services at health facilities; and damage to infrastructure [7, 9]. Since the resurgence of armed conflict across Greater Darfur in April 2023, access to essential health services has been severely hindered across the assessed localities in Central and West Darfur. Malaria, diarrhea, and ARI are among the most reported health issues, with poor WASH conditions cited as contributing factors to the reported increase in diarrheal diseases and malnutrition [1, 4].

3.3. Drug and Commodity Availability

There was no day within the reporting period on which the clinic's ten tracer drugs including malaria rapid diagnostic tests were out of stock, an improvement from a two-day average stock-out at baseline (Table 1), achieved through NCA's drug pre-positioning and its collaboration with WHO and the Ministry of Health on outbreak-preparedness stocking. Timeliness and completeness of reporting to the Early Warning, Alert and Response System (EWARS) was maintained at 100% throughout. Despite this system-level achievement, community-level testimony in FGDs pointed to a persistent perception of medicine insufficiency ("the medicines are not sufficient, and there is no laboratory for testing in the health centre," one Bilel IDP camp respondent reported), suggesting that aggregate tracer-drug stock adequacy did not fully translate into a felt sense of medicine security at the household level a reminder that programme-level supply indicators and beneficiary-perceived adequacy are not interchangeable measures and should be reported alongside one another.

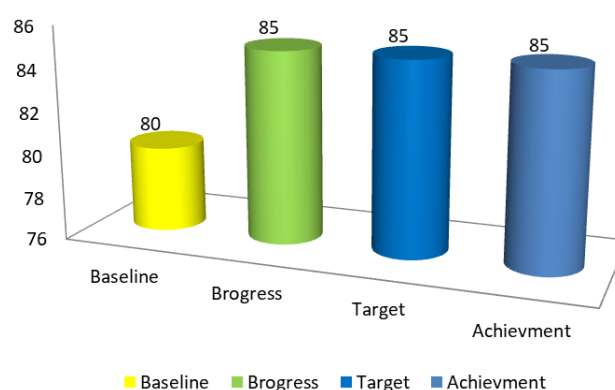


Figure 4. Women attending ANC and receiving TT2 (%).

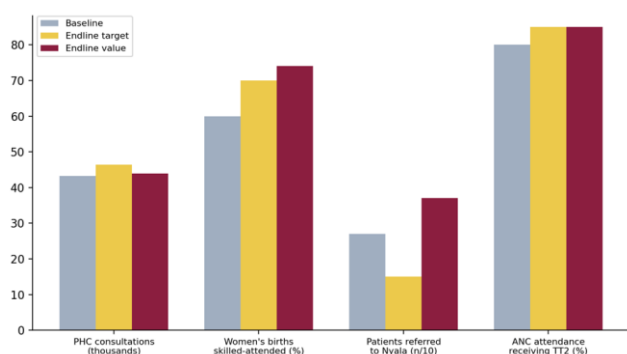


Figure 5. Health indicator performance.

3.4. Acute Malnutrition: Treatment Volume and Burden

A total of 8,738 children under five were admitted for treatment of severe or moderate acute malnutrition (SAM/MAM),

more than four times the endline target of 2,167 and the 2,000 baseline (Table 1). This scale of admissions reflects both an expanded community-based screening effort 15,526 children and pregnant/lactating women screened routinely at nutrition centers, plus a further 8,087 children and 2,087 pregnant/lactating women reached through home-to-home outreach by community nutrition volunteers and, plausibly, a genuinely high underlying burden of acute malnutrition in the catchment population. The independent SMART survey conducted in December 2020 corroborates the latter: global acute malnutrition (GAM) among children 6-59 months stood at 11.9%, moderate acute malnutrition (MAM) at 11.1%, and severe acute malnutrition (SAM) at 0.8%, with prevalence broadly similar between boys and girls (Table 2). A GAM prevalence above 10% is classified by WHO thresholds as indicating a serious nutritional situation [10, 16], underscoring that the scale of programme admissions was a response to genuine need rather than an artifact of expanded case-finding alone.

Table 1. Nutrition indicator performance.

Indicator	Baseline	Progress	Endline target	Endline value	Rating
Children <5 admitted for SAM/MAM treatment (n)	2,000	1,034	2,167	8,738	HA
Days Bilel PHC clinic out of RUTF stock	2	0	0	0	A
Overall rating					Achieved
Key:	HA: Highly Achieved			A: Achieved	

Table 2. Prevalence of SAM, MAM and SAM malnutrition at Bilel locality.

Malnutrition status	All n = 603	Boys n = 296	Girls n=307
Prevalence of global malnutrition GAM	(35) 11.9%	(35) 11.8%	(37) 12.1%
Prevalence of moderate malnutrition MAM	(67) 11.1%	(32) 10.8%	(35) 11.4%
Prevalence of severe malnutrition SAM	(5) 0.8%	(3) 1.0%	(2) 0.7%

Recovery outcomes among children admitted to the supplementary feeding programme remained strong and stable: 97% cured, 0% defaulted, 0% deaths at endline, against 99% cured, 1% defaulted, 0% deaths at baseline (Figure 7) both comfortably within accepted Sphere performance thresholds for community management of acute malnutrition [6]. There was no day on which the Bilel PHC clinic was out of stock of ready-to-use therapeutic food (RUTF), achieved through close coordination with UNICEF (RUTF/RUSF supply) and WFP (targeted supplementary feeding commodities). Qualitative evidence nonetheless identifies a structural vulnerability in this otherwise strong performance: families living far from the

Bilel PHC clinic reported difficulty maintaining the monthly RUTF/RUSF collection cycle during the rainy season, and because therapeutic food rations are calibrated to roughly one month's supply, an interruption of more than around two months was reported to compromise treatment completion for affected children. This access-driven attrition risk is not captured by facility-level stock-out indicators, which measure supply-side availability rather than demand-side accessibility, and is consistent with recent Darfur-specific evidence that transportation barriers and low facility-utilization reflect systemic weaknesses in health and nutrition access independent of commodity availability [7]. KIIs with protection specialists

also noted that community structures trained by UNFPA and other NGOs play a key role in raising awareness about protection issues in the community, reducing stigma around seeking services and referring survivors to services. However, KIIs also indicated very limited protection services are currently available in south and Central Darfur due to conflict and displacement.

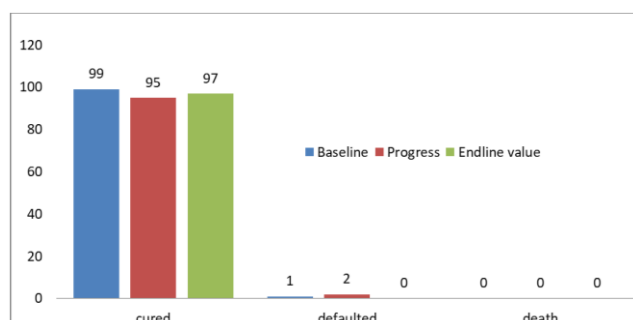


Figure 6. Health indicator performance.

3.5. The Role of Task-shifted, Community-embedded Cadres

Across both the health and nutrition components, the strongest and most consistently cited driver of continuity of care was the deliberate use of trained lay and community-embedded cadres to extend the reach of a small, government-sectored clinical staff: traditional birth attendants for maternal referral, lead mothers and mother groups for infant and young child feeding counseling and mid-upper arm circumference (MUAC) screening, and community nutrition volunteers for home-to-home acute malnutrition case-finding. This pattern is consistent with, and reinforces, the wider evidence base on primary health care delivery in conflict-affected African settings, where community-based models paired with facility-based care are the two dominant and most sustainable modalities of service extension, particularly through task-shifting to lay health workers where formal clinical staff remain structurally scarce [8, 19]. The model's principal vulnerability is durability beyond the funding cycle: as in the WASH component of this same response, community volunteers in health and nutrition roles were not compensated on a comparable basis to salaried government-sectored clinical staff, and the evaluation's qualitative data suggest this asymmetry is a plausible long-term retention risk for the outreach and screening functions that made the programme's population-level nutrition reach possible. Recent evidence also suggests that community health workers can extend essential services to underserved and remote populations when appropriately trained, supported and linked to the formal health system [19].

4. Conclusion

The health and nutrition component of the NCA/DG ECHO response in Darfur achieved most of its targets, with particularly strong performance on maternal health coverage, hospital referral, and treatment of acute malnutrition, against a backdrop of persistent staffing constraints and a genuinely high underlying burden of malnutrition confirmed independently by SMART survey data. The programme's integration of a small, government-sectored clinical workforce with trained community-embedded cadres traditional birth attendants, lead mothers, and nutrition volunteers offers a transferable, low-cost model for sustaining essential health and nutrition service reach in access-constrained, conflict-affected settings. Future programming should address the two structural gaps this evaluation identifies most clearly: incentive parity for unpaid community cadres relative to paid facility staff, and rainy-season-resilient distribution mechanisms for therapeutic and supplementary foods, so that the strong recovery outcomes documented here are not undermined by seasonal access attrition.

Abbreviations

SAM	Severe Acute Malnutrition
MAM	Moderate Acute Malnutrition
GAM	Global Acute Malnutrition
KII	Key Informant Interview
TT2	Second Tetanus Toxoid
SMoH	State Ministry of Health
SDS	South Darfur State
CDS	Central Darfur State
NCA	Norwegian Church Aid
PHCANC	Basic Health Clinic Attendance at Antenatal Care
HIMS	Health Information Management System

Acknowledgments

The authors express their profound appreciation to all who contributed to making this study possible. Special thanks are extended to NCA staff at Nyala and Zalingei. Great thanks to Mr Samson Marufu from Palm Associates Limited & Palm Gesamac Consulting for his comment and support during the study period.

Author Contributions

Kamal Eldin Mohammed Fadul: Conceptualization, Writing – original draft

Eltighani Mirghani Elamin: Conceptualization, Supervision, Validation

Fadwa Hassan Ibrahim: Data curation, Supervision

Dirdiri Hassan Mahmoud: Data curation, Supervision

Conflicts of Interest

The authors declare no conflicts of interest.

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