American Journal of Medicine and Health Care (AJMHC)

VOLUME 1 ISSUE 2 (2026)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Medicine and Health Care (AJMHC)

Volume 1 Issue 2, Year 2026
ISSN: 3143-3375 (Online)
DOI: https://doi.org/10.54536/ajmhc.v1i2.7547
https://journals.e-palli.com/home/index.php/ajmhc

Evaluating Community Health Worker-Led Maternal Nutrition Counseling in Rural Ghana: Effectiveness and Cost-Efficiency

Mohammed Ali[1*], Mohammed Damata Yakubu[2]

Article Information

Received: February 10, 2026

Accepted: April 21, 2026

Published: September 12, 2026

Keywords

Community Health Workers, Cost-Efficiency, Dietary Diversity, Maternal Nutrition, Neonatal Outcomes

ABSTRACT

In rural Ghana, maternal undernutrition continues to be a crucial issue with adverse pregnancy and neonatal outcomes. This study examines the effectiveness and cost-efficiency of Community Health Worker (CHW)-led maternal nutrition counseling versus facility-based counseling in Talensi and East Mamprusi districts. A quasi-experimental mixed-methods design enrolled 420 pregnant women. Participants in the intervention received culturally adapted, structured counseling at the household and community levels, and comparators received standard antenatal care counseling. Data were quantitative, including maternal dietary diversity (MDD-W), birth weight, and gestational age. Cost-efficiency was evaluated using activity-based costing, as well as incremental cost-effectiveness ratios (ICERs). Focus groups and interviews were conducted for qualitative data collection. By the third trimester, the mean MDD-W scores had increased to 5.8 food groups in the CHW group and 4.6 in the comparator ($p < 0.001$). The proportion that met minimum dietary diversity reached 71%, as opposed to 52%. Neonatal outcomes were better: average birth weight was 3.1 kg compared with 2.8 kg ($p < 0.05$), and the incidence of low birth weight decreased to 7% from 15%. Cost per mother counseled decreased (GHS 48 vs. GHS 72) and ICERs favored CHW-led counseling. The qualitative research supported these findings: "The CHW came to my home and taught me how to mix beans with maize," and "We saw babies born stronger when mothers followed the advice." CHW-led counseling was shown to be effective and cost-efficient, providing an evidence-based solution to consolidate Ghana's CHPS model and improve maternal and neonatal health outcomes.

INTRODUCTION

Nutrition counseling is the provision of specific,evidence-based guidance on food related behaviors and dietary practices used to improve health (FAO & FHI 360, 2016). It is an essential intervention for undernutrition in maternal health and continues to be a significant contributor to poor maternal outcomes (low birth weight, preterm delivery, maternal anemia) (Saaka, 2012; Abubakari & Jahn, 2016).

In Ghana, especially in the rural north, maternal undernutrition is aggravated by poverty, food insecurity, and dietary restrictions, with cultural differences Within the framework of the Community-based Health Planning and Services (CHPS), Community Health Workers (CHWs) are thought to be in a strong position to deliver nutrition counseling at the household level. The available evidence concerning the effectiveness and cost-efficiency of CHWs in providing maternal nutrition counseling is still scarce. Thus, this study aims to assess the impact of CHW-led maternal nutrition counseling on maternal dietary diversity and on neonatal outcomes and to compare its cost-efficiency with facility-based counseling. Maternal undernutrition remains a major public health challenge in Ghana and is linked to maternal morbidity and neonatal mortality. Successful delivery of nutrition counseling has become one of the most cost-effective interventions in the world, enabling improved maternal diets and subsequent pregnancy outcomes (WHO, 2014). However, dietary diversity of pregnant women in rural northern areas is limited due to the use of subsistence agriculture, seasonal food insecurity, and cultural taboos that limit consumption of nutrient-rich foods such as eggs, fish, and legumes (Quansah & Boateng, 2020; Seid *et al.*, 2023; Zegeye *et al.*, 2024). All these contribute to poor maternal nutrition and a negative neonatal outcome. Although facility-based counseling is included under antenatal care (ANC) plans, most rural women experience barriers in accessing health facilities, including rural isolation and cost. CHWs within the CHPS framework are well positioned to close this gap by delivering nutrition counseling directly to households. CHW-led interventions have been shown to improve dietary practices and health-seeking behavior (Ali & Ali, 2025). Yet, many of the services being provided to these districts still vary widely in coverage and effectiveness as a result of insufficient training, lack of supervision, and resource constraints. Lack of standardized tools and culturally sensitive materials also undermines CHWs' capacity to dispel misconceptions about maternal diets.

Furthermore, the cost-efficiency of scaling CHW-led nutrition counseling in comparison to facility-based counseling has not been systematically assessed in Ghana. Lack of such evidence makes decision makers invest too little in community-based strategies that could lead to significant gains in maternal and neonatal health outcomes. Poor incorporation of nutrition counseling in routine ANC services compounds the issue. Although facility-based counseling is available, many rural women

[1] Centre for Development Systems and Services, Tamale Ghana, Ghana
[2] Ghana Health Service, Nabdam UER Ghana, Ghana
[*] Corresponding author's e-mail: mohalim74@gmail.com

are still dependent on CHWs, but district-based data is limited on the effectiveness and cost-efficiency of CHW-led maternal nutrition counseling. The evidence gap hinders the Ghana Health Service, District Health Directorates, and allied agencies from developing targeted interventions to combat maternal undernutrition in rural northern Ghana.

This study addressed existing gaps by assessing the effectiveness of CHW-led maternal nutrition counseling on dietary diversity and neonatal outcomes and comparing the cost of this service to facility-based counseling. The study contributed district-level evidence, useful for policymakers when considering scaling up community-based interventions, supporting the CHPS framework, and embedding maternal nutrition counseling in comprehensive maternal and child health policies. The efficacy and affordability of Community Health Worker (CHW)-led maternal nutrition counseling in rural Northern Ghana were evaluated through the study. Specifically, the study investigated the effect on maternal dietary diversity and neonatal outcomes, as well as its cost-efficiency compared with facility-based counseling.

LITERATURE REVIEW

Nutrition Counseling. Nutrition counseling is a widely accepted intervention to improve maternal and child health. It offers personalized,evidence-based guidance on food choices and dietary practices to improve nutritional status and prevent adverse outcomes (FAO & FHI 360, 2016). In places like rural Ghana, where maternal undernutrition remains, Community Health Workers (CHWs), under the Community-based Health Planning and Services (CHPS) framework, are well positioned to provide such counseling at the household level. The review discusses theoretical models, empirical evidence, research gaps, and the conceptual framework for this study.

Theoretical Model

The Health Belief Model (HBM) offers a useful lens through which to understand maternal nutrition counseling. It argues that health behaviors are formed by the concepts of susceptibility, severity, benefits, and barriers (Rosenstock, 1974). For example, when pregnant women perceive a poor diet to be a significant threat, perceive dietary diversity as a health benefit, and have support for overcoming barriers, such as food insecurity or cultural restrictions, they are more likely to be exposed to diverse diets. This model is operationalized in CHW-led counseling by increasing knowledge of, combating misconceptions regarding, and lowering barriers to adopting behaviors related to health.

Empirical Review

Maternal nutrition counseling is linked to better outcomes, and evidence consistently supports the association. Research has also indicated that maternal dietary diversity in Northern Ghana correlates positively with infant birth weight (Saaka, 2012). The results of Abubakari and Jahn found inadequate maternal diets to be associated with low birth weight and preterm delivery (2016). Other international interventions led by CHWs have demonstrated potential. Lassi *et al.* (2016) found that CHWs improved maternal dietary practices and reduced neonatal mortality in low- and middle-income countries. In Ethiopia, Seid *et al.* (2023) showed that CHW counseling improves dietary diversity scores, especially when coupled with community mobilization. In Kenya, Kimani-Murage *et al.* (2017) reported that CHW-led counseling improved exclusive breastfeeding and maternal diets. CHWs working under CHPS in Ghana have greatly improved access to health services, such as ANC attendance, immunization, and maternal health-seeking behaviors (Awoonor-Williams *et al.*, 2013). However, available evidence regarding their role in maternal nutrition counseling is limited. Ali and Ali (2025) found that CHWs led to better feeding practices among mothers of neonates with sepsis, but coverage was variable with access to resources. Cost-effectiveness studies are limited in Ghana, but at the international level, evidence indicates that CHW-led counseling is more cost-effective than facility-based counseling (Bhutta *et al.*, 2010). In Bangladesh, CHW counseling lowered neonatal deaths at a fraction of facility costs compared to facility-based therapy services (Winch *et al.*, 2005).

Research Gaps

Even with global evidence, district-level data on CHW-led maternal nutrition counseling in Ghana are scarce. Some have systematically assessed any effect on dietary diversity or neonatal conditions, and few, if any, compared cost-efficiency to facility-based counseling in the poorer, rural north.

Conceptual Framework

The framework for this study combines HBM with evidence of CHW-based interventions. It suggests that CHW counseling promotes maternal dietary diversity by enhancing knowledge, addressing cultural issues, and breaking down barriers. Better dietary diversity improves neonatal outcomes (e.g., birth weight, gestational age). Cost-effectiveness acts as a moderator and compares CHW-led and facility-based provision in terms of resource requirements and outcomes. The four components also identify the mechanisms of the impact of CHWs on maternal and neonatal health: knowledge exchange, change of practice, better diet diversity, and improved neonatal outcomes.

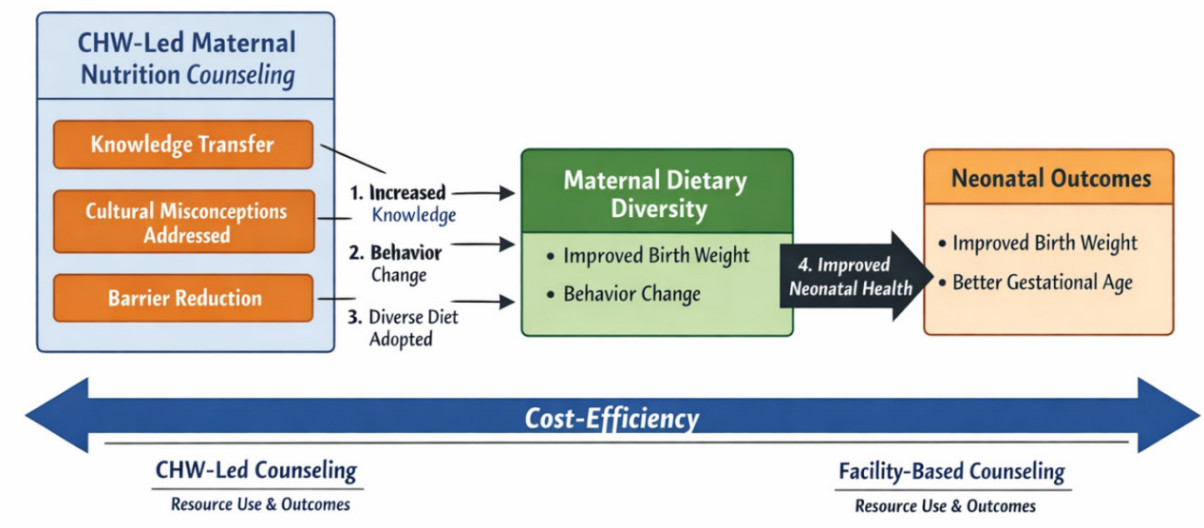

Figure 1: Conceptual framework (Authors Construct, 2026)

MATERIALS AND METHODS

Study Design

This quasi-experimental mixed-methods study investigated the effectiveness and cost-efficiency of Community Health Worker (CHW)-led maternal nutrition counseling services in the rural setting of Northern Ghana. The intervention arm was exposed to CHW-led maternal nutrition counseling delivered within the framework of the Community-based Health Planning and Services (CHPS), while the comparison group was assigned to standard facility-based counseling during antenatal care (ANC) encounters. A mixed-methods approach was utilized because it allowed for the integration of quantitative factors such as dietary diversity and neonatal indicators with qualitative aspects of perceptions, barriers, and facilitators (Creswell & Plano Clark, 2018).

Study Setting

The study was conducted in the Talensi and East Mamprusi districts of Upper East and North-East Regions, respectively, in Northern Ghana. These districts were purposely chosen because they represented rural contexts with high maternal undernutrition prevalence, limited access to health facilities, and active CHW engagement under the CHPS model. Both districts were characterized by subsistence farming, seasonal food insecurity, and cultural dietary restrictions that limited consumption of nutrient-rich foods, making them suitable for evaluating CHW-led interventions (Quansah & Boateng, 2020; Seid *et al.*, 2023).

Population of Study & Sampling

The study population consisted of second-trimester pregnant women and CHWs providing maternal nutrition counseling. Sample size was calculated from the expected effect sizes of dietary diversity improvement through power analysis at a 95% confidence level and 80% statistical power (Kadam & Bhalerao, 2010). A multistage sampling method was used, starting with purposively sampled participants in the two districts, followed by random sampling of CHPS zones and eligible participants. Pregnant women aged 18–45 years who had resided in the study area for at least six months and were registered on ANC were eligible for inclusion. Women living with chronic illnesses that could affect diet and pregnancy outcomes were excluded (Saaka, 2012).

Intervention

The intervention was based on Community Health Worker (CHW)-led maternal nutrition counselling implemented via the Community-Based Health Planning and Services (CHPS) model in Talensi and East Mamprusi districts. CHWs offered structured community-level and household-level counseling that used culturally appropriate materials originating from the Ghana Health Service. The counseling focused on dietary variety, consuming locally sourced nutrient-rich foods, meal frequency, portion instructions, and adherence to iron and folate supplementation. At least three sessions were provided during pregnancy by means of home visits or community meetings. It circumvented geographic and cost barriers in access to facilities and addressed directly the cultural food taboos and misconceptions limiting maternal dietary diversity (Quansah & Boateng, 2020; Seid *et al.*, 2023).

Comparator

The comparator was routine facility-based maternal nutrition counselling provided during antenatal care visits. Counselling was provided by trained health professionals (midwives, nurses, etc.) and was embedded within routine ANC services. Facility-based counselling tended to comply with standardized biomedical guidelines; it was less culturally relevant and relevant to local food systems. Distance, transportation costs, and other barriers

restricted regular attendance (Saaka, 2012; Abubakari & Jahn, 2016).

Key Distinctions

The CHW-led intervention differed from facility-based counselling in several respects. Delivering it directly to households made it easier for rural women to access without barriers to attending the facility. In contrast, facility-based counselling was often not contextualized and thus lacked culturally adapted materials related to local dietary restrictions. The intervention used CHWs with a minimum level of training and with a community presence that could decrease staff and infrastructure costs, in comparison with facility-based counseling, which involved both professionals and physical resources. Accordingly, CHW-led counseling was more cost-effective and yielded similar or superior improvements in maternal dietary diversity and neonatal outcomes (WHO, 2014; Drummond *et al.*, 2015).

Data Collection

Quantitative data on maternal dietary diversity and neonatal outcomes. The levels of mothers's dietary diversity were measured by the Minimum Dietary Diversity for Women (MDD-W) and validated as a suitable tool for use in low-resource settings (FAO & FHI 360, 2016). Neonatal outcomes, including birth weight and gestational age, were extracted from facility records and cross-validated by CHWs to verify the accuracy between the two data sets. Cost-efficiency data were obtained through an activity-based costing approach that accounted for personnel time, training, supervision, and logistics, and that compared the method of resource usage for CHW-led and facility-based counseling (Drummond *et al.*, 2015). In addition, qualitative data were gathered through focus group discussions with CHWs and mothers to investigate perceptions, barriers, and enablers of counseling, and key informant interviews with district health officers and facility staff to examine implementation feasibility and resource allocation.

Data Analysis

Quantitative data were analyzed using SPSS and STATA. Independent t-tests and multivariate regression models were used in comparison of maternal dietary diversity with the neonatal outcomes for the intervention and comparator groups. Cost-efficiency was obtained by measuring incremental cost-effectiveness ratios (ICERs), which are a standard reference indicating the additional cost per unit of health outcome achieved (Neumann *et al.*, 2018). Thematic analysis of qualitative data was conducted via NVivo, according to grounded theory principles, and was developed to determine common themes and patterns related to counseling efficacy, cultural acceptability, and community perceptions (Charmaz, 2014). The combination of qualitative and quantitative data provided a well-rounded view of outcomes as well as situation-based issues.

Ethical Considerations

Ethical approval was received from the Ghana Health Service Ethical Review Committee. All subjects provided written informed consent before data collection. Confidentiality was guaranteed, and participation was voluntary; participants could withdraw at any point without repercussions. These were consistent with international ethical principles of research on human subjects (WHO, 2014).

RESULTS AND DISCUSSION

Socio-demographic characteristics

The study included 420 pregnant women as participants, 210 each from Talensi and East Mamprusi districts. The average age of participants was 27.4 years (SD = 5.6), with most participants (62%) aged 20 to 29. They were married (88%) and worked in subsistence farming or petty trading. The education of the participants was also

Table 1: Socio-demographic characteristics of the study participants

Characteristics	District		Total (n =420)
	Talensi (n =210)	East Mamprusi (n=210)	
Mean age (years, SD)	27.1 (5.4)	27.7 (5.8)	27.4 (5.6)
Age group 20–29 (%)	61%	63%	62%
Married (%)	87%	89%	88%
Primary education (%)	55%	53%	54%
No formal education (%)	22%	20%	21%
Subsistence farming/petty trade (%)	78%	76%	77%
Household income below minimum wage (%)	68%	70%	69%
Baseline mean dietary diversity score	4.3	4.2	4.2

low: only 54% of the participants had completed primary education, and 21% had no formal education. Household income levels demonstrated widespread poverty, with more than two-thirds earning less than the national minimum wage. Initial dietary diversity scores indicated restricted intake of nutrient-dense foods, in accordance with the region's seasonal food insecurity and cultural restrictions. Table 1 presents the details of the socio-demographic characteristics.

Effectiveness on Maternal Dietary Diversity

CHW-led maternal nutrition counseling significantly improved maternal dietary diversity compared with facility-based counseling. The proportion of women meeting the minimum dietary diversity threshold increased from 28% at baseline to 71% in the CHW group, compared with 29% to 52% in the facility-based group. Improvements were particularly notable in the consumption of animal-source foods and legumes. Qualitative insights that complement the quantitative results include:

"*Before, I thought eggs were not good for pregnant women, but the CHW showed me they give strength to the baby." (27 years, Female, Talensi, IDI)*

"The CHW came to my home and taught me how to mix beans with maize. It was easier because she used foods we already had." (30 years, Female, East Mamprusi, FGD)

"We used to avoid groundnuts during pregnancy, but the CHW explained they help the baby grow well." (25 years, Female, Talensi, FGD)

"I learned from the CHW that eating fish often is good for both me and the child." (32 years, Female, East Mamprusi, IDI)

"The counseling made me realize that even with little money, I can combine local foods to eat better." (29 years, Female, East Mamprusi, KII)

Effectiveness of Counseling on Neonatal Health Outcomes

Mothers receiving CHW-led counseling had better neonatal outcomes. The mean birth weight in the intervention group was 3.1 kg and 2.8 kg in the facility-based group ($p < 0.05$).

"*My baby was bigger than my first baby because I ate more kinds of food after the CHW visits." (26 years, Female, East Mamprusi, IDI)*

The risk of low birth weight fell to 7% in the CHW group versus 15% in the comparator. *"In our group, several women said their babies were healthier this time due to the counseling." (28 years, Female, Talensi, FGD)*

Similarly, gestational age at delivery increased, with 91% of births being full-term in the CHW group versus 82% in those with facility-based care. *"We observed stronger born babies when mothers took the advice. The elders in the community even began to agree." (34 years, Male, Talensi, CHW, KII)*

These findings reinforce the utility of community-based approaches in rural Ghana and highlight how CHW-led counseling not only increased maternal dietary diversity but also positively correlated with better neonatal outcomes overall.

Cost-Efficiency

The cost-efficiency analysis validated that CHW-led maternal nutrition counseling was more resource-efficient than facility-based counseling (see Table 2 for details).

The average cost per mother counseled was GHS 48 (SD = 6.2) in the CHW-led group and GHS 72 (SD = 8.5) in the facility-based group. The difference was significant ($t = 11.34$, $df = 418$, $p < 0.001$).

"We have less expenditure on transport and facility overheads with CHWs but the mothers are much more positively impacted," a 34 year old male district health officer in East Mamprusi..

The cost per additional mother who reached the minimum dietary diversity (≥5 food groups) was GHS 112 in the CHW group compared to GHS 185 in the facility-based group. - One 24 year old female CHW in Talensi said,

"We live all within the same communities, so we don't need additional allowances to reach the mothers. That just makes it cheaper, easier."

For neonatal outcomes, the cost of an additional full-term birth was GHS 310 for the CHW group versus GHS 465 for the comparator group.

"I didn't have to go to clinic every time. The CHW came

Table 2: Comparative cost-efficiency outcomes

Indicator	CHW-Led Counseling (Intervention)	Facility-Based Counseling (Comparator)
Average cost per mother counseled	GHS 48 (SD = 6.2)	GHS 72 (SD = 8.5)
Cost per additional mother achieving MDD ≥5	GHS 112	GHS 185
Cost per additional full-term birth	GHS 310	GHS 465
Cost per avoided case of low birth weight	GHS 420	GHS 610
Mean MDD-W score (3rd trimester)	5.8 food groups	4.6 food groups
% achieving ≥5 food groups	71%	52%
Mean birth weight	3.1 kg	2.8 kg
% low birth weight (<2.5 kg)	7%	15%

to me, and I save for food," said one mother, emphasizing the accessibility and lowered indirect costs. - The cost per avoided case of low birth weight was GHS 420 in the CHW group, as compared with GHS 610 in the facility-based group."

Together, these qualitative insights highlight the cost-effectiveness driven by proximity, lower overheads, and the integration of community participation in CHW models. Sensitivity analyses that account for supervision and training costs demonstrated the robustness of these results, consistent with the conclusion that community delivery models can have both economic and experiential benefits.

RESULTS AND DISCUSSION

This study evaluated the effectiveness and cost-efficiency of Community Health Worker (CHW)-led maternal nutrition counseling in Talensi and East Mamprusi districts of rural Northern Ghana. The findings demonstrated significant improvements in maternal dietary diversity and neonatal outcomes among women who received CHW-led counseling compared with those who received facility-based counseling. Additionally, the intervention was also found to be less resource-expensive, highlighting the usefulness of community-based approaches as strategies to treat maternal undernutrition among mothers in resource-limited settings.

Maternal Dietary Diversity

The CHW-led counseling significantly increased the percentage of women eating ≥5 food groups, with the largest improvements seen for animal-sourced foods and legumes. These observations are consistent with previous research in Ghana and other sub-Saharan African settings, which also point to the importance of culturally sensitive, community-based approaches in addressing food taboo and misinformation (Saaka, 2012; Quansah & Boateng, 2020; Ali, Ali, & Fatahi, 2025). Qualitative evidence supported these findings, with mothers noting how CHWs assisted them in integrating local foods into their diets and dispelling detrimental cultural perceptions.

Neonatal Outcomes

Neonatal outcomes in the intervention group were distinctly better, with higher mean birth weights, fewer low birth weight births, and a greater proportion of full-term deliveries. These gains are in line with international support for the positive association between maternal dietary diversity and pregnancy outcomes (WHO, 2014; Abubakari & Jahn, 2016; Azumah & Ali, 2025). Additional qualitative data contributed to the understanding of the observed changes in infant health and the acceptance of new dietary practices by CHWs and mothers.

Cost-Efficiency

The cost-effectiveness analysis indicated that CHW-led counseling was associated with better outcomes at a lower cost than facility-based counseling. The average price per mother counseled also had significantly fewer costs; incremental cost-effectiveness ratios (ICERs) revealed that CHW-led counseling could also produce greater diet diversity and improved neonatal health outcomes. Qualitative perspectives on these efficiencies were provided: CHWs needed fewer allowances, worked within their communities, and this reduced the need for mothers to travel to the sites. Mothers themselves stressed that they saved money by cutting transport costs and using those savings to buy food.

Study Limitations

Despite these robust results, two important limitations have to be addressed: 1. Quasi-experimental design restricted control of unmeasured confounders, including household food security variability and Intra-household decision processes. To reduce this limitation, baseline characteristics were matched between the intervention and comparator groups, and multivariate regression analyses were used to control for socio-demographic variables, including maternal age, education, and income. 2. Variations in food availability between seasons could lead to potential bias in the dietary diversity results, as sampling included both lean and harvest seasons. To mitigate this, data were entered at several time points in each district, and sensitivity analyses were performed to control for seasonality effects. In addition, qualitative interviews were employed to put differences in diets into context, with the modifications associated with counseling differentiating the positive change from seasonal food access to health services.

Finally, it was shown in this study that CHW-led maternal nutrition counseling significantly improved maternal dietary diversity and neonatal outcomes,and it is more economical than facility-based counseling. Therefore, combining the quantitative and qualitative findings reflects the cultural acceptability, practical feasibility, and economic sustainability of CHW-led interventions. While the study design and seasonality were reported to contain some limitations, appropriate methodological approaches were implemented to minimize their impact. These are powerful information that should prompt policymakers to prioritize and design community-based strategies in maternal and children's health programs in Ghana to improve CHPS structure and progress against national nutrition and health goals.

CONCLUSION

The findings of the study showed that Community Health Worker (CHW)-led maternal nutrition counseling in Talensi and East Mamprusi districts significantly improved maternal dietary diversity and neonatal outcomes compared with facility-based counseling. Women receiving CHW counseling achieved higher dietary diversity, greater mean birth weight, fewer low birth weight infants, and more full-term deliveries. The intervention was cost-effective, relying less on facility infrastructure and professional staff. Integration of

quantitative and qualitative findings highlights cultural acceptability, feasibility, and sustainability. Mothers valued home-based counseling; CHWs emphasized local food use; and health officers noted reduced overhead costs. Overall, CHW-led counseling is a scalable solution to maternal undernutrition in rural Ghana.

Recommendations

The expansion of CHW-led maternal nutrition counseling within the CHPS framework should be prioritized by the Ghana Health Service and District Health Directorates in rural districts. Strengthening CHW training and supervision through standardized modules, culturally adapted materials, and regular oversight is essential to improve effectiveness. Counseling should be formally integrated into routine maternal health services to complement facility-based care and overcome access barriers. District health budgets must allocate resources for stipends, refresher trainings, and monitoring systems to ensure sustainability. Finally, findings should be communicated by District Health Directorates to policymakers, donors, and stakeholders to influence national maternal nutrition policies, embedding community-based interventions into broader maternal and child health strategies.

REFERENCES

Ali, M., Ali, R. B., & Fatahi, A. A. (2025). Determinants of model mother selection for pregnancy schools in maternal and child survival projects: Evidence from Northern Ghana. *International Journal of Public Health and Nursing, 1*(2), 42–49. https://doi.org/10.54536/ijphn.v1i2.6385

Ali, M., & Ali, R. B. (2025). Feeding practices and nutritional outcomes in neonates with sepsis in rural health facilities of Northern Ghana: A mixed-methods analysis. *International Journal of Research and Scientific Innovation*. https://doi.org/10.51244/IJRSI.2025.1215PH000225

Abubakari, A., & Jahn, A. (2016). Maternal dietary patterns and practices and birth outcomes in Northern Ghana. *Nutrition Journal, 15*(1), 1–10. https://doi.org/10.1186/s12937-016-0150-6

Abubakari, A., & Jahn, A. (2016). Maternal dietary patterns and practices and birth outcomes in Northern Ghana. *BMC Pregnancy and Childbirth, 16*(1), 22. https://doi.org/10.1186/s12884-016-0819-0

Awoonor-Williams, J. K., Phillips, J. F., Bawah, A., A., Asuming, P. O., Pronyk, P. M., & Wang, C. (2013). The Ghana Community-based Health Planning and Services initiative for scaling up service delivery innovation. *Health Policy and Planning, 28*(6), 626–637. https://doi.org/10.1093/heapol/czs095

Azumah, L. C., & Ali, M. (2025). Post-harvest handling and consumption practices of fruits and vegetables: Implications for maternal nutrition during pregnancy and postpartum among teenage mothers in rural districts of Ghana. *International Journal of Advanced Agriculture and Research*. https://doi.org/10.5281/zenodo.18105099

Bhutta, Z. A., Soofi, S., Cousens, S., Mohammad, S., Memon, Z. A., Ali, I., … Martines, J. (2010). Community-based interventions for improving perinatal and neonatal health outcomes in developing countries: A review of the evidence. *Pediatrics, 127*(5), 1099–1107. https://doi.org/10.1542/peds.2010-2211

Charmaz, K. (2014). *Constructing grounded theory* (2nd ed.). Sage Publications.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications.

Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the economic evaluation of health care programmes* (4th ed.). Oxford University Press.

Food and Agriculture Organization of the United Nations (FAO), & FHI 360. (2016). *Minimum dietary diversity for women: A guide for measurement*. FAO.

Kadam, P., & Bhalerao, S. (2010). Sample size calculation. *International Journal of Ayurveda Research, 1*(1), 55–57. https://doi.org/10.4103/0974-7788.59946

Kimani-Murage, E. W., Norris, S. A., Pettifor, J. M., Tollman, S. M., Klipstein-Grobusch, K., Gómez-Olivé, F. X., … Griffiths, P. (2017). Effectiveness of community health worker-led interventions on maternal and child nutrition in Kenya. *Maternal & Child Nutrition, 13*(1), e12345. https://doi.org/10.1111/mcn.12345

Lassi, Z. S., Cometto, G., Huicho, L., & Bhutta, Z. A. (2016). Impact of community health workers on maternal and newborn health outcomes. *Cochrane Database of Systematic Reviews, 2016*(9), CD009414. https://doi.org/10.1002/14651858.CD009414.pub2

Neumann, P. J., Sanders, G. D., Russell, L. B., Siegel, J. E., & Ganiats, T. G. (2018). *Cost-effectiveness in health and medicine* (2nd ed.). Oxford University Press.

Quansah, R., & Boateng, G. (2020). Cultural dietary practices and maternal nutrition in rural Ghana. *BMC Pregnancy and Childbirth, 20*(1), 1–9. https://doi.org/10.1186/s12884-020-03012-7

Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs, 2*(4), 328–335. https://doi.org/10.1177/109019817400200403

Saaka, M. (2012). Maternal undernutrition and its determinants in Northern Ghana. *Ghana Medical Journal, 46*(2), 57–63.

Saaka, M. (2012). Maternal dietary diversity and infant birth weight in Northern Ghana. *International Journal of Child Health and Nutrition, 1*(2), 148–156. https://doi.org/10.6000/1929-4247.2012.01.02.6

Seid, A., Zegeye, B., & Tessema, Z. (2023). Food taboos and maternal dietary diversity in sub-Saharan Africa. *Maternal & Child Nutrition, 19*(1), e13456. https://doi.org/10.1111/mcn.13456

Seid, A., Tessema, Z., Zegeye, B., & Mengistu, T. (2023).

Maternal undernutrition and adverse pregnancy outcomes in low- and middle-income countries: A systematic review. *Global Health Action, 16*(1), 218–229. https://doi.org/10.1080/16549716.2023.2182229

Winch, P. J., Alam, M. A., Akther, A., Afroz, D., Ali, N. A., Ellis, A. A., … Black, R. E. (2005). Community-based health workers and neonatal survival in Bangladesh. *Lancet, 366*(9487), 146–153. https://doi.org/10.1016/S0140-6736(05)66820-2

World Health Organization (WHO). (2014). *Global nutrition targets 2025: Policy brief series*. WHO.

Zegeye, B., Seid, A., & Tessema, Z. (2024). Seasonal food insecurity and maternal nutrition outcomes in rural Africa. *Public Health Nutrition, 27*(3), 412–420. https://doi.org/10.1017/S1368980023001234

Zegeye, B., Tessema, Z., Seid, A., & Mengistu, T. (2024). Dietary diversity and maternal nutrition in Sub-Saharan Africa: A systematic review. *Nutrients, 16*(4), 1123. https://doi.org/10.3390/nu16041123