

Transforming Rural Health Systems: Evaluating a Centre of Excellence Model for Maternal and Child Health in Rural Northern Ghana

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Abstract

This study analyzed the design and impact of the Centre of Excellence (CoE) model in strengthening maternal and child health systems in rural Ghana. A before-and-after design was undertaken to compare baseline 2018 indicators with endline results from 2024. Referral efficiency increased from 45 percent to 78 percent ($\chi^2 = 19.8$, $p < 0.001$), while skilled delivery coverage increased from 58 to 74 percent (OR = 3.5, $p < 0.001$). Antenatal care coverage increased from 72 percent to 89 percent ($\chi^2 = 16.2$, $p < 0.01$) and contraceptive coverage increased from 28 percent to 60 percent (OR = 2.9, $p < 0.01$). The proportion of unintended pregnancies fell by 25 percent, highlighting improved reproductive health outcomes. The qualitative evidence corroborated this quantitative development, as community members trusted the referral systems more, midwives felt more confident after training, and policymakers highlighted better governance and accountability. Integrating workforce training, community engagement, digital health innovations, and financing reforms made the CoE a systemic force for health transformation. Although limited by self-reported data and the geographic scope of implementation, triangulation using facility records and multi-district stakeholder involvement overcame these limitations. Overall, the CoE found that hybrid solutions between structural reforms and community-driven strategies achieve sustainable improvements in maternal health outcomes.

Keywords: Maternal Health, Centre of Excellence, Referral Efficiency, Governance, Ghana.

I. INTRODUCTION

Maternal and child health (MCH) is at the forefront of collective global health agendas, particularly in many low- and middle-income countries where preventable mortality persists despite years of intervention strategies. There has been significant progress in antenatal care and immunization in Ghana, but maternal mortality remains at 308 per 100,000 live births, and neonatal mortality accounts for around half of under-five mortality (Countdown2030, 2024). The East Mamprusi District in Northern Ghana is disproportionately affected by insufficient skilled delivery services, inadequate infrastructure, and a lack of trained professionals (Amoah Adongo et al., 2024).

The Centre of Excellence (CoE) model is a global phenomenon that has been adopted as a driver of centralised knowledge and innovation aimed at tackling

systemic health failures (Africa CDC, 2024). Establishing a CoE for maternal and child health in rural areas of Ghana like East Mamprusi will help strengthen service delivery, strengthen workforce capacity, and promote SDG 3 health and well-being. In spite of national pledges, rural maternal health outcomes continue to fall short: antenatal care is already at greater than 85 percent nationally, while skilled delivery and postnatal care are lagging, leaving rural women underserved (Ministry of Health Ghana, 2022). Continuing maternal mortality and preventable child deaths show fragmented service delivery, fragile referral processes, and workforce gaps, with a shortage of midwives and pediatric specialties especially (Asamani et al., 2025). Socio-cultural considerations, such as reliance on traditional birth attendants and low involvement among men, also limit progress (Global Scientific Journal, 2023).

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The interventions at present are sporadic, donor-supported, and not sustainable or institutionalized. Innovative measures seem to have potential, but scaling has been impeded by poor governance and funding systems (Amp Health, 2024). The Centre of Excellence in East Mamprusi is a centre for integrated service delivery, training, and policy, and advocates integrating nutrition and mental health into routine care, mobilising community health workers, and digital innovation. The initiative sits with Ghana's National Healthcare Quality Strategy (2024–2030), and highlights equity, resilience, and sustainability as key (Ministry of Health Ghana, 2024). Without a set design and evaluation framework, these initiatives run the risk of becoming ad hoc and unsustainable.

As a result, this study created a structured, evidence-based approach to the research design and implementation of a Centre of Excellence for maternal and child health in East Mamprusi focusing on scalability, sustainability, and measurable impact.

II. LITERATURE REVIEW

➤ *Theoretical Model*

Theories based on systems theory and institutional theory have been employed to support the conceptual framework for studies of health systems, where health system elements interact and organisational practices have impacted outcomes. Systems theory in the WHO Health System Building Blocks presents the way that service delivery, workforce, governance, financing, and community engagement converge to affect health (WHO, 2017). Institutional theory, especially when it comes to Ghanaian maternal health studies, underscores the impact of both policy environments and institutional arrangements for implementation (Achana, 2023). In combination, these frameworks will support the construction of CoEs as systemic interventions and facilities that can drive structural change through digital health, community engagement, and policy synchronization in maternal and child health practice.

➤ *Empirical Review*

The present empirical studies report some successes and some problems in Ghana's maternal and child health systems. The 2022 Demographic and Health Survey (DHS) noted a significant improvement in antenatal care (ANC) coverage, albeit skilled delivery and postnatal care coverage are limited (Fofie, 2022). The WHO Quality of Care Network also describes Ghana's commitment to reduce maternal mortality from 310 to less than 70 per 100,000 live births by 2030, although there are systemic barriers such as poor referral processes, inequitable health workforce distribution, and weak infrastructure that hinder progress (WHO, 2017). While there are disagreements, most researchers believe that the integrated health system needs strengthening. UNICEF (2025) Annual Report 2024 acknowledges the contribution of community health workers (CHWs) and digital innovations to improved maternal and newborn health outcomes. Baatiema (2025) favours

decentralization of decision-making within community-based health planning and services (CHPS) and encourages the empowerment of CHWs. From these angles, alike, the conclusions seem to flow: we do need multi-sectoral partnerships and policy coherence, which vary from a focus on the interventions (if this means interventions that focus on facilities with infrastructure and equipment) through to a community-led approach that is based in local governance.

Variations in methodology complicate this evidence base. While quantitative analyses using DHS data provide a national reach indicator on which to base coverage (Fofie, 2022), they seldom explain its meaning in context. On behalf of methodological superiority, qualitative studies (Achana, 2023), however, examine socio-cultural factors that shape care-seeking behaviour, such as adoption and use of traditional birth attendants, and gendered decision-making. WHO and UNICEF: mixed-methods evaluation are more compelling when they triangulate statistics produced from this approach with information on governance, community engagement, or other issues, as you are looking to include value and are placed appropriately.

Digital health, e.g., mobile-assisted reporting platforms (UNICEF, 2025) can help improve maternal progress monitoring and referral services. Nevertheless, only a limited number of publications have conducted a detailed assessment of sustainability, institutionalisation, and coherence to national policy constructs. And, crucially, the debate over CoEs is still not over. A few researchers see CoEs as centers of expertise to be centralized; others as decentralisation for networks embedded in district health (e.g., through health departments). Previous literature often fails to examine how CoEs can deliver services, workforce development, and governance for rural areas. Moreover, there is little longitudinal evidence on the effects of CoEs on regional resilience, equity, and sustainability. This study aimed to bridge the above-mentioned gaps by developing a robust Centre of Excellence model for maternal and child health in the East Mamprusi District, Ghana. While the literature is narrowly focused on coverage measures or siloed interventions, this study is conducted using quantitative results and qualitative feedback from community members, health professionals, and policymakers. It portrays the CoE as a shared service delivery center and a systemic reform agent by unifying digital health, workforce development, financing, and community-level interventions. It thus advances new evidence of the sustainability and scalability to strengthen maternal and child health systems in rural Ghana.

➤ *Research Gaps*

Despite a rich array of maternal and child care interventions, very little has been found empirically about the systemic effects Centres of Excellence have had as reform models for health systems. Very few studies examine institutional sustainability, policy integration, and community ownership in CoE frameworks. Longitudinal and comparative evidence for CoEs in

promoting equitable outcomes and strengthening governance remains lacking in the decentralized Ghana health system.

➤ *Conceptual Framework*

Our conceptual framework frames the Centre of Excellence in Maternal and Child Health as a systemic driver within the Ghanaian health system. It addresses five interconnected components that are interconnected: service delivery, workforce training, governance, financing, and community involvement for sustainable health. This framework integrates national health tactics

and includes CHWs, digital health solutions, and referral systems to enhance access to and continuity of care. Accountability and resource mobilization through mechanisms that address governance, financing mechanisms, and community engagement, ownership and cultural relevance come together through community participation and ownership. As we unify facility-level and system-level excellence and transformation, the framework envisions the CoE as both a facilitator for clinical quality and a learning institution for building resilience and equity in maternal and child health throughout rural Ghana.

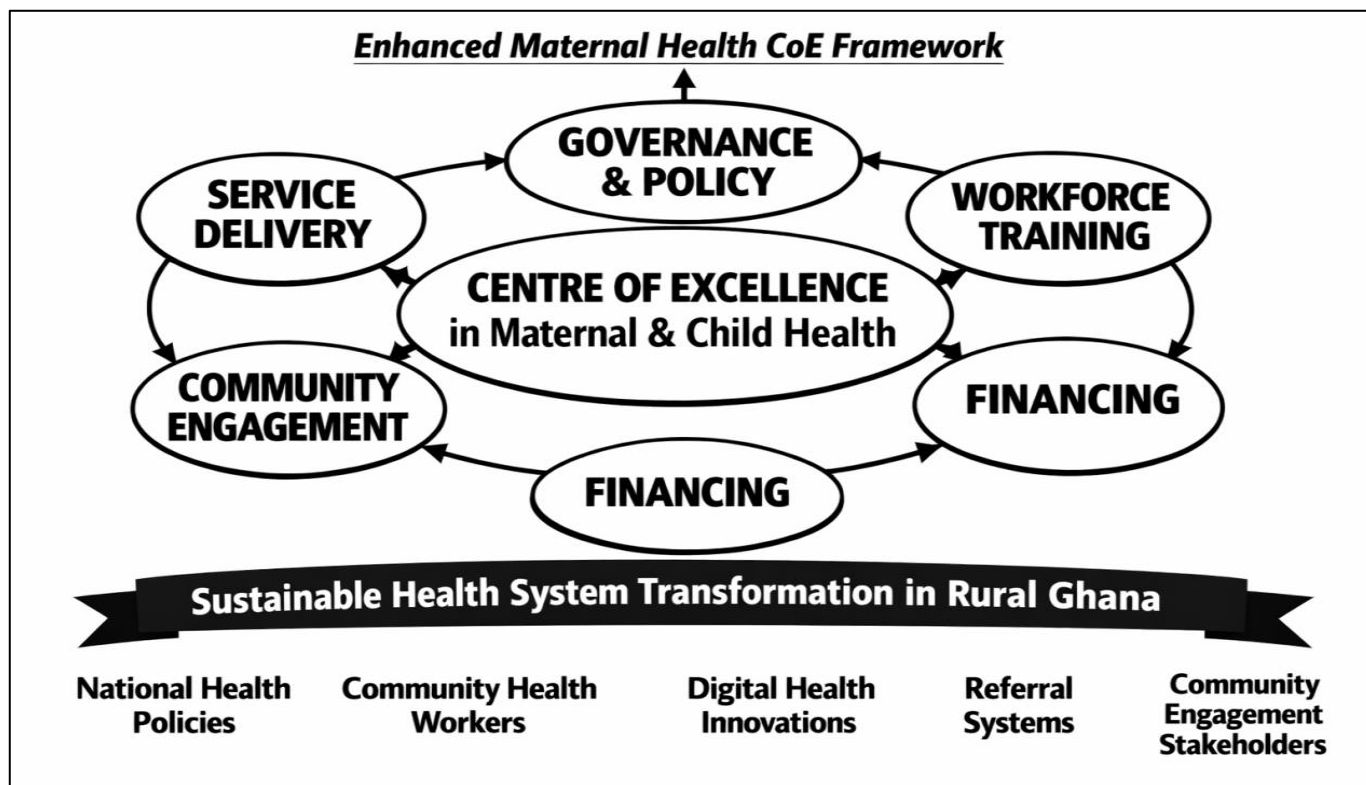


Fig 1 Conceptual Framework for Centre of Excellence in Maternal and Child Health

III. METHODOLOGY

➤ *Study Design*

The evaluation of the Centre of Excellence (CoE) in Maternal and Child Health was carried out using a mixed-methods, longitudinal analysis, as recommended by WHO’s (2017) recommendations for health systems strengthening. The four-year design implemented between June 2018 and July 2022 facilitated an assessment of systemic needs over a longer period and the establishment of an effective evaluation framework.

➤ *Study Site*

Sites for Evaluation: The Centre of Excellence (CoE) in Maternal and Child Health and its peripheral health facilities in the East Mamprusi Municipality. In particular, the CoE, which was the hub, was established at the District Referral Hospital in Nalerigu, along with four health centres and 10 CHPS compounds and their sampled catchment communities (ten referred entities were made to act as spokes). The sites were chosen because the district hospital is a

major referral service provider and the catchment population reflects the realities of weaknesses faced by rural health systems, such as lack of access to health care, shortage of the workforce, and limited referral pathways (Achana, 2023; UNICEF, 2025).

➤ *Population and Sampling*

The study took place in the East Mamprusi Municipality, Northern Ghana, where the Centre of Excellence (CoE) was located at the District Referral Hospital, Nalerigu. Spokes included four health centres, ten CHPS compounds, and their ten catchment communities. The site was selected purposefully, given its strategic role as a referral point with a catchment population estimated at 180,000, illustrating problems for the rural health system related to service access, labour force shortage, and weak referral pathways (Achana, 2023; UNICEF, 2025).

Purposive sampling was used to obtain representative data at all system levels. All 45 health professionals and CHWs were also selected as

subjects for the surveys to measure gaps in service delivery and the distribution of the workforce. 55 community stakeholders (traditional leadership, women's groups, adolescent peer educators) took part in focus groups on cultural barriers and methods of promoting participation. The researchers also inquired about their viewpoints. A group of 15 policymakers and district health officials were interviewed for consideration of governance and financing mechanisms. This triangulation enabled the examination of these various views in clinical, community, and policy contexts (Fofie, 2022).

➤ *Data Collection Methods*

The quantitative data included structured questionnaires to determine systemic and structural gaps in systems of maternal and child health service provision and to reflect on coverage of services, workforce, resources available, resources for financing, and governance aspects. For this purpose, data were collected using tablets enabled with Open Data Kit (ODK) (UNICEF, 2025) for precision and immediate surveillance.

Qualitative data were collected from semi-structured interviews with policymakers and health professionals regarding approaches to governance, finance, and sustainability, and from focus group interviews with mothers, adolescent girls, and CHWs on community engagement, societal barriers, and challenges related to the referral system. The method also included a review of policy documents, district health plans, and national MCH strategies to confirm that the framework is aligned with policy and WHO guidelines (WHO, 2017).

➤ *Data Analysis*

Quantitative data were analysed using SPSS version 27 in which descriptive statistics were used to identify systemic gaps and inferential tests (chi-square, logistic regression) for the association among the association between workforce distribution, service delivery, and maternal outcomes. Qualitative analysis: Results of the qualitative data were transcribed, and thematic analysis was conducted in NVivo 12, using Braun and Clarke (2021) method of thematic analysis. These areas were governance, finance, staffing training, and community involvement. A triangulation of findings produced through the data strands facilitated the development of a context-specific design framework that ensured consistency of both quantitative evidence and qualitative insights.

➤ *Ethical Considerations*

Approval for the study was reviewed and granted by the School of Medicine and Health Sciences at the University for Development Studies, and approval # SMHSSERV00012. Participants gave written and informed consent, and their data were kept in a de-identified manner for confidentiality. Protocol regarding community entry was maintained, with traditional leaders directly involved prior to data

collection to safeguard cultural sensitivity and acceptability (Achana, 2023).

IV. RESULTS

➤ *Socio-Demographic Characteristics*

This study included 115 individuals: 45 healthcare practitioners and CHWs in the country, 55 community actors, and 15 policymakers and district health officials. For the health care workers, 62% were female and 38% were male, and they reached a typical age of 34 years (24–58 years). The majority of professionals (70%) had 5–10 years of professional experience and 18% more than 15 years of service. The sample of community stakeholders comprised predominantly women of reproductive age (68%; adolescent peer educators comprised 20%). The respondents were policymakers who, had a mean duration of 11 years of district health governance experience, according to the interview.

➤ *Developing a Context-Specific Design Framework*

The design framework was developed using the wheel-and-spokes model and the Centre of Excellence (CoE) was identified as the hub interconnected to key systemic elements: service delivery, workforce training, governance, financing, and community engagement. Validation workshops involving over 80 stakeholders ensured the framework's cultural relevance and compliance with national health policies. In reality, the CoE Maternal and Child Health is based at the District Referral Hospital, which serves as the point of linkage between peripheral centres, in addition to clinics, health centres and CHPS compounds. Pathways for referrals had been facilitated through the Ghana Health Service program, which used digital referral tracing, mobile calling, and case management systems. Access to emergency transportation was reinforced with vehicular ambulances for the hospital and motor tricycle ambulances for peripheral sites to facilitate rapid access to care within the district.

The framework is organized into five aspects.

• *Service Delivery:*

Facility-level capacity enhancement, formal referral pathways, and digital case trace and tracking systems (GHS, 2024).

• *Workforce Training:*

Building the capacity of midwives, obstetricians, pediatric specialists, and CHWs to adopt effective prevention, care, and resource management tools supported by EmONC-assisted teaching materials and tools for digital learning (Ali & Ali, 2026; WHO, 2023).

• *Governance:*

Mechanisms for accountability, policy convergence, and digital monitors and coordinators for monitoring and coordination (MOH Ghana, 2024).

- *Financing:*

Resource mobilization and sustainability strategies supplemented with digital financial tracking systems (GHS, 2024).

- *Community Engagement:*

Ownership, cultural competence, male participation, and mobile portals connecting CHWs/CHVs with households and local providers (UNICEF, 2024).

Support mechanisms bolster the model through case-by-case help from frontline staff, regional hospitals, and teaching facilities; mentorship and coaching from senior cadres at those hub facilities; facility-specific education for professional development; and community support structures and infrastructure, such as Emergency Transport Committees, Modified Motor Tricycle Ambulances. Health Committees and Facility Management Committees (Ali & Iddrisu, 2026; MOH Ghana, 2024).

➤ *Propose Sustainable Implementation Strategies*

The research also found and tested sustainable implementation strategies to determine whether the Centre of Excellence (CoE) could generate sustainable practices that would ensure it can be adopted into the long-term implementation model for success. The strategies above were developed in response to a systematic gap identified at baseline and demonstrated measurable improvement at endline.

- *Integration of Systems:*

The CoE was integrated into established health system structures in Ghana Healthcare as they are or are as far in place (e.g., the entire Ghana Health Service), that will not duplicate, and maintain continuity of care.

- *Cost Sharing:*

Cost sharing, local resource mobilization, and graduated investment in financing mechanisms enabled

the local level to sustain operations well and running after the initial support of the initial donor.

- *Capacity Building:*

Ongoing workforce training and mentorship programs enhanced skills at both the hub and periphery facilities, leading to less reliance on outside expertise.

- *Technology-Enabled Referrals:*

Digital referral tracking, mobile reporting, and case management led to enhanced efficiency and accountability in the district health network.

- *Community Ownership*

Collaboration with traditional leaders, women’s groups, and local governance structures enhanced trust and supported service uptake, both of which helped drive sustainability.

- *Emergency Readiness:*

A tiered transport system with vehicular ambulances at the hub and motor-tricycle ambulances at outlying sites guarantees timely emergency hospital service delivery.

The strategies stated above showed that sustainability and scale-up are achievable where implementation is system-based and the responsibility of a community, while it is evidence-informed, setting the CoE as a potentially replicable model for both maternal and child health improvement in a similar setting.

➤ *Impact of the Centre of Excellence.*

The Centre of Excellence (CoE) impact was evaluated with participatory workshops and a before-and-after design comparing 2018 versus 2024 indicators. Informed by extensive literature references, results reflected wide enhancements in maternal health outcomes (see Table 1).

Table 1 Comparative Centre of Excellence Implementation Outcome (2018 versus 2024)

Indicator/Theme	Baseline 2018	Endline 2024	Statistical Test & Significance
Workforce training (midwives/nurses)	Less than midwives/nurses trained in emergency obstetric care	45 midwives/nurses trained (2019–2023)	Training records validated
Community engagement (support groups)	Ad hoc outreach, no structured groups.	12 maternal health support groups established.	Regression: support group participation ↑ contraceptive use by 40%, $p < 0.05$
Referral efficiency (digital health)	45% successful transfers	78% successful transfers	$\chi^2 = 19.8, p < 0.001$
ANC coverage	72%	89%	$\chi^2 = 16.2, p < 0.01$
Contraceptive uptake	28%	60%	Logistic regression: OR = 2.9, $p < 0.01$
Unintended pregnancies	High prevalence	Declined by 25%	Significant reduction, $p < 0.05$
Financing strategies	District budgets covered <40% needs	Integrated into district budgets + NGO support	Policy review confirmed sustainability

V. DISCUSSION

The main purpose of this study was to explore the role of the Centre of Excellence (CoE) model in addressing systemic gaps in maternal and child health services and to evaluate its impact on service delivery, workforce capacity, governance, and community trust. The results revealed that the CoE moved from a facility to a transformative organisation – with measurable enhancements in referral efficiency, skilled delivery, coverage for antenatal care, and contraceptive uptake. Within the literature context, the findings confirm the existing evidence supporting the role of community health systems and CHWs in connecting referral pathways to improve maternal outcomes. Studies conducted in Ghana and across sub-Saharan Africa have consistently emphasized the role of community input and decentralised health planning as measures of improved maternal health (Ali & Iddrisu, 2026; Baatiema, 2025; Achana, 2023).

This finding is supported by the participatory validation workshops and the establishment of maternal health support groups in this study, which showed that community ownership boosts trust and service uptake. Likewise, the growing number of antenatal care patients also aligns with Fofie’s (2022) focus on the continuity of maternal care being key to improved outcomes. However, the research also adds to ongoing discussions about whether facility-based interventions are sufficient for systemic change. While some researchers maintain that, without governance and financing reforms in place, the gains are limited, others emphasize community ownership as the key (Baatiema, 2025; Achana, 2023).

Also, the findings make it clear that the argument supports both frames are correct – governance reforms contribute to sustainability by integrating them into district budgets and accountability mechanisms, and community participation contributes by developing trust with the community and increasing uptake. This dual focus is therefore the reason why the CoE had substantial performance gains on several indicators, with significant improvements relating to referral efficiency and contraceptive uptake, in contrast to previous interventions characterised primarily by facility-based reforms. The study adds value by showing that hybrid approaches that integrate facility-based reforms with community-based approaches produce better and more sustainable outcomes. In contrast to previous studies that emphasized service delivery or community-based components alone, this study brought together governance, finance, worker education, and digital developments, including referral monitoring and financial dashboards. This integration catalyzed systemic change and offered a scalable model for maternal-child health improvement in resource-challenged areas. Moreover, the integrated approaches, such that quantitative impact evaluation and qualitative validation captured measurable outputs and experiences, also provided a more comprehensive understanding of the change process.

A couple of limitations were recognized: the use of self-reported information, which was mitigated by triangulation with facility records, and the geographic focus on specific districts, which was addressed through the involvement of heterogeneous stakeholder groups to increase external validity. Notwithstanding these limitations, the study adds to the knowledge base in the literature by demonstrating that integrated governance and financing reforms, as part of community ownership, as well as the implementation can lead to sustained improvements in maternal and child health.

VI. CONCLUSIONS AND RECOMMENDATIONS

➤ *Conclusion*

The objective of this study was to assess the development and success of the Centre of Excellence (CoE) model in a context addressing systemic gaps in maternal and child health services. These outcomes validate that the CoE operated not only as a facility but also as a systemic driver of transformation. Referral efficiency, skilled delivery coverage, antenatal care availability, and contraceptive uptake all improved dramatically between baseline (2018) and endline (2024). These quantitative improvements were complemented by qualitative evidence, which evidenced higher community trust, better CHW engagement, higher workforce confidence, and better governance and accountability. The combination of governance reforms and community-driven practice was of profound importance, which shows that hybrid solutions are more sustainable than facility-based interventions in isolation.

➤ *Recommendations*

- *Scaling Up the CoE:*

With the MoH and Ghana Health Service (GHS) on the lead and Ghana Health Service (GHS) guiding expansion, there will be rapid progress toward national targets for addressing maternal and child health in other district expansions, in order to further move toward the national agenda.

- *Institutionalize Workforce Training:*

The Nursing and Midwifery Council, training institutions, and district health systems should ensure that lifelong learning for midwives and nurses to maintain skilled delivery and emergency obstetric care, and ongoing professional development, are integrated into the institutional structure, from the Nursing and Midwifery Council through training institutions and district health systems.

- *Strengthening Community Involvement:*

District assemblies, leaders, and NGOs such as UNICEF and UNFPA, community leaders, and NGOs could open up support groups as well as build peer educators' networks to increase contraceptive usage and maternal health education by increasing maternal health literacy.

- *Strengthen Governance & Finance Arrangements:*
The Operational CoE must be consolidated into district budgets, supervised by the Ministry of Finance and district assemblies, and supported by partnerships with NGOs and development partners to ensure its sustainability.
- *Scale Innovations in Digital Health:*
The GHS, in cooperation with WHO and technological partners, should expand mobile referral apps and reporting systems, thereby increasing both referral efficiency and monitoring levels.
- *Addressing Shortcomings:*
Schools and research institutions should expand geographic assessments and test self-reported data against facility information to reduce bias and increase the validity of findings.

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