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Diagnostic, Management Capacity and Outcomes for Neonates with Sepsis in Rural Health Facilities of Northern Ghana: A Mixed Method

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ABSTRACT

Aim: The study assessed diagnostic and management competences of rural healthcare providers for neonatal sepsis and related system challenges in health facilities of Gushegu and Nkwanta South districts of Ghana.

Methodology: A convergent mixed-methods design, inspired by the Health Systems Framework and Three Delays Model, was employed. Ten facilities each in Gushegu and Nkwanta South, were selected by stratified sampling. Quantitative data came from 322 neonatal registers, while qualitative data were from health staff and caregiver interviews. Data reliability was ensured through standardization of tools, training, and triangulation. SPSS and NVivo were used to analyze the data by combining descriptive statistics, logistic regression and thematic coding which revealed systemic delays and care deficiencies.

Findings: Most of 322 neonates studied were female(58%), with 70% of caregivers on >GHS 500 monthly income. In Gushegu, only 43% had formal education, and used travel times longer than two hours. The facilities had no CRP and blood culture testing. In Gushegu, recovery rates were 52% and 64% in Nkwanta South; mortality rates were 20% and 14%, respectively. Late presentation (>48 hours) tripled adverse outcomes (OR = 2.8); delayed antibiotics (>6 hours) quadrupled mortality risk (OR = 3.9); delayed referrals (>12 hours) doubled it (OR = 2.1). Only 31% of health workers had recent training.

Conclusions: The study established clinical, and infrastructural, as systemic challenges for the care of neontates with sepsis. Tiered multi-faceted interventions—community education, standardisation of protocols, training, diagnostics, and referral upgrades—are recommended to reduce mortality and improve neonatal health outcomes in rural areas.

Keywords: Neonatal sepsis, Rural healthcare, Northern Ghana, Clinical outcomes, and Diagnostic capabilities.

INTRODUCTION

Neonatal sepsis remains a global health crisis, responsible for approximately one-third of the 2.3 million infant deaths globally each year; 1.3 million of these deaths cause significant morbidity and mortality. Low- and middle-income countries experience a disproportionate burden of these neonatal deaths (UNICEF, 2023). In Ghana, it is one of the leading causes of newborn deaths. It is a crisis that is even more serious in the rural parts of the country, such as Northern Ghana, where there are limited healthcare centers, putting further burdens on the prevention and treatment of infections (Ghana Health Service, 2022). While nationwide, there

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have been considerable progress, there remain deficiencies in the assessment, referral and clinical management of newborns.

As these routine diagnostic instruments — including blood cultures and C-reactive protein (CRP) tests — are scarce, health workers in many rural communities generally make do with clinical judgment alone. The shortcomings in these resources can result in delayed treatment and misdiagnosis, which is particularly harmful to newborns. These barriers — from poorly trained birth attendants, to poor infection control, lack of skills, challenging referral systems, barriers to transportation, to lack of caregiver know-how — cumulatively drive down neonatal survival ratios. However, literature has predominantly been concentrated on clinical and facility audit practice within urban settings with little attention to the operational and systemic obstacles faced in rural settings of Ghana.

The current study assessed the diagnostic capacity and clinical outcomes related to neonatal sepsis in Gushegu and Nkwanta South—two under-resourced districts in rural Ghana. The results will facilitate focused interventions and inform public health policy recommendations to improve neonatal care. By filling systemic and clinical gaps, this research serves the wider goal of eliminating preventable neonatal mortality by 2030 in Ghana, which responds to national and global health priorities. Neonatal sepsis continues its status as the leading cause of preventable neonatal deaths in Ghana, accounting for up to 59% of neonatal admissions in tertiary healthcare institutions (Craymah et al., 2024).

Statement of the Problem

Neonatal sepsis also remains a major cause of preventable neonatal death in Ghana, largely due to lack of diagnostic capacity and proper facilities in some rural districts. In these rural districts, the prevalence of sepsis has been largely been to a shortage of resources—blood culture systems, antibiotics, training—and essential equipment (Konlan et al., 2024). Conversely, urban areas are reporting fewer admissions for hospitalizations related to neonates with sepsis because they have more resources and personnel. Earlier research works such as those at Ho Teaching Hospital have associated early neonatal deaths with a delay in diagnosis and inefficient referral systems (Afeke et al., 2021). Systemic barriers in the Northern and Oti Regions—such as poor documentation, inadequate referral coordination, and the lack of standardized protocols—also inhibit clinical progress in these areas (Konlan et al., 2024; GHS, 2023). At the district level, due to the problem of lacking capacity to confirm sepsis diagnoses, many local clinics have turned to empirical treatments, which also devalues quality despite the efforts on a national level to improve neonatal health.

Objectives

This study examined diagnostic capacity and clinical outcomes of neonatal sepsis in rural Northern Ghana, focusing on tool availability, management practices, referral pathways, and systemic barriers. It aimed to generate evidence to improve care, reduce mortality, and inform policy reforms that strengthen health systems and scale up neonatal sepsis interventions. The aim is to create data informing quality improvement, reducing Neonatal Intensive Care Unit mortality, and informing health system and policy reforms for neonatal sepsis management.

Review of Literature

Theoretical Framework

This research is based on two related theoretical models which help to explain the systemic and clinical issues in neonatal sepsis of rural Ghana. The first is the Health Systems Framework formulated by the World Health Organization (WHO, 2007) that encompasses six basic elements for a working health system: service delivery, health workforce, health information systems, access to essential medicines, financing and leadership/governance. These factors present a systematic perspective on systemic disruptions, especially those of infrastructure and human resources, elements that are essential for neonatal survival. The second model is the Three Delays Model by Thaddeus and Maine (1994) that

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assigns delays to a mother and baby, in a patient's treatment, according to three stages—delays in recognizing illness, delays in reaching appropriate care, and delays in receiving adequate treatment. Such delays are often magnified by low caregiver readiness, lack of transport, and inadequately equipped health facilities. By linking them together, the study highlights how systemic weaknesses, such as service delivery and workforce shortages, access to medicines, and governance challenges, are causative of delays in the diagnosis and treatment of neonatal sepsis. Not only does this dual-framework analysis offer an explanation for consistently poor outcomes, it identifies essential leverage points to reform health systems. However, a wide gap remains in the use of these concepts in rural Ghanaian settings. Although the Health Systems Framework and the Three Delays Model are prominent models in global health research, the impact of them jointly on the explanation of neonatal sepsis outcomes in poorly resourced rural contexts remains relatively under-studied. In particular, there is a lack of evidence on how these systemic delays are experienced at the point of contact when making clinical decisions as well as diagnosing patients in the north of Ghana.

Conceptual Framework

The conceptual framework we have generated in this study relates systemic health system challenges to clinical outcomes in neonatal sepsis. At the core of this framework is the function of diagnostic capacity, the presence and use of laboratory testing (including blood cultures) and C-reactive protein (CRP) analyses. The lack of laboratory infrastructure in rural Ghana frequently necessitates the use of clinical guidelines by healthcare providers, which are applied inconsistently owing to differences in training, experience and resource availability. These constraints direct provider behaviours that lead to differences in disease recognition and treatment implementation. As a result, delays in diagnosis and treatment are not simply pragmatic but entrenched in more systemic impediments. With that being said, the framework does highlight the importance of timely, standardized, and well-supported clinical interventions to improve neonatal outcomes. A significant research gap is the absence of data on how diagnostic limitations impact clinical decision-making and outcomes. We have limited knowledge of how clinical experts overcome these limitations, especially in situations where laboratory support is limited or non-existent.,

Fig. 1 Conceptual Framework Diagram

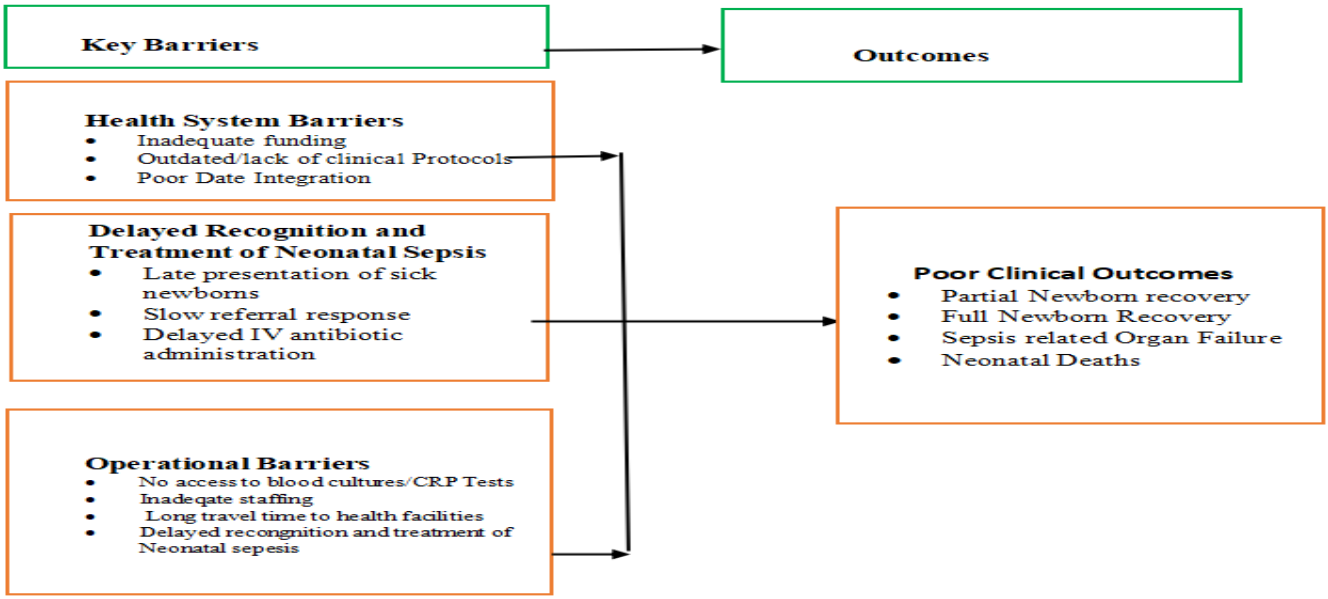

Figure 1 presents the causal pathway from failures in the health system to poor clinical outcomes in neonatal sepsis care, pointing out the operational obstacles that mediate this relationship.

Empirical Review

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There is strong empirical and clinical evidence that show a critical need to address the burden of neonatal sepsis that currently remains a leading cause of neonatal deaths in Ghana and sub-Saharan Africa. Worldwide, about 30% of neonatal mortality occurs from sepsis according to UNICEF (2023), illustrating its serious impact on child survival. For example, neonatal sepsis has been identified by the Ghana Health Service (GHS, 2022) as one of the most significant contributors to neonatal mortality, especially in rural and underserved areas, in Ghana. Wondifraw et al. conducted a systematic review on this topic (2025) and estimated the pooled prevalence of neonatal sepsis in Africa to be 40.98%, with strong associations with very low birth weight, low APGAR scores, and preterm birth. Similarly, Traoré et al. (2024) performed a meta-analysis in sub-Saharan Africa and indicated that maternal infections, unhygienic delivery practices, and absence of skilled birth attendants were major risks of both maternal and neonatal sepsis. In Ghana, Afeke et al. (2021) reviewed neonatal and young infant sepsis in a regional hospital and found high case fatality rates, particularly among neonates born outside health facilities or treated late for care. It highlighted the impact of late diagnosis, poor laboratory support, and inconsistent clinical protocols on these findings. Enyew et al. (2025) reinforced the systemic issues of weak referral systems, poor infection control, and insufficient staff training as significant contributors to poor neonatal outcomes. These results are consistent with international regional observations indicating infrastructure inadequacies, supply chain disruptions and governance failures as the ongoing barriers to improved neonatal care (Camara et al., 2024; Wudu et al., 2025). For instance, Camara et al. (2024) highlighted inadequate collaboration on infection control policies in rural clinics, and Wudu et al. (2025) noted that frequent stockouts of critical antibiotics and diagnostic reagents are paramount in obstructing patients' access to appropriate treatment in a timely manner. However, much less is known about the way healthcare providers define and treat neonatal sepsis in Northern Ghana. Most studies in the literature concern clinical risk factors, microbiological profiles or facility audits, and often miss out on the behavioral, logistical and regulatory aspects of care. Much of this research focuses on provider decision-making, diagnostic tool functionality, referral timing and frontline staff experiences, particularly in rural districts like Gushegu and Nkwanta South. This study aims to fill this gap by integrating facility audits, clinical outcome measurements, and stakeholder interviews to create data for practice improvement. The aim is to offer insights into health system enhancements and policy-relevant ideas that may improve neonatal sepsis care in emerging geographies.

METHODOLOGY

This study was conducted in rural health facilities in Gushegu (Northern Region) and Nkwanta South (Oti Region), known high neonatal mortality settings due to insufficient diagnostics and delayed care (GHS, 2023). The facility selection was based on geography, level of service delivery and neonatal cases. Gushegu and Nkwanta South were also situated with a projected population of approximately 154,456 and 135,735 (GSS 2021). This registered some 5,390 live births a year in Gushegu and 4,725 live births in Nkwanta South; there was a crude birth rate 35/1,000. (Crude Birth Rate (Per 1,000 People) falls 2.02% to 25.4 births in Ghana in 2024, 2024)

Using a neonatal survival ratio of 0.98, the estimate is 440 neonates at any time in Gushegu and 385 in Nkwanta South (UNICEF, 2021). In Gushegu, suspected neonatal sepsis accounted for 18.6% of neonatal admissions in the year before this study and 15.2% in Nkwanta South. Hence, the corresponding case fatality rates were 20% and 14%, while complication rates were 24% and 18% respectively (GHS, 2023). These findings underscore the influence of delayed disease diagnosis and limited diagnostic quality, as well as erratic referral systems. Most facilities do not have these crucial diagnostic tools — blood culture systems, CRP test kits. For diagnostic capacity and outcomes, a mixed-methods approach was used (Creswell & Plano Clark, 2021). Collecting and analyzing statistical features and interview data were conducted over a period of 9 months to obtain contextual knowledge (Creswell & Hirose, 2023). The participants comprised health facilities, frontline health workers, caregivers and newborn records.

Stratified sampling was utilized to guarantee rigorous methodological rigour and transparency. Stratified sampling was the best response to assess the diversity in facilities, as the sample was recruited using geographic location, service (service level and neonatal case volume) as its criterion, and further credibility

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was also promoted with the implementation of the findings. According to these criteria, ten selected facilities and centers were set forth to be included. Power calculations and access were factored in, accounting for 322 neonatal records. Additionally, 20-25 health workers and 15-20 caregivers completed interviews, which were at saturation, to reflect a range of experiences and insight (Bouncken, Czakon, & Schmitt, 2025). Data collectors were trained for two days on purpose, ethical approach of the study performed and data collection protocol for maintaining quality consistency quality of data collection. The training focused on the significance of neutrality, informed consent and documentation. The tools for data collection were evaluated in a separate institution to confirm clarity and relevancy of method. These methods were used to mitigate bias and improve reliability (Korstjens & Moser, 2022).

Standardized procedures, consistent training, and diverse data sources also increased internal validity of the study, as well as stratified sampling across facility types and location, increasing the ability to generalize findings to other similar rural settings (Bengtsson, 2022; Creswell & Hirose, 2023). For qualitative data, double-encoding was used to mitigate bias as two researchers coded transcription with one another independently and talked about and resolved any differences. In order to enhance the credibility of interviews, triangulation was employed by synthesizing qualitative interviews along with quantitative data. And continuously monitor and debrief the data collection team on the training, identify and address potential biases that were surfacing. Yet there were also some limits. Bias within interviewers and self-report, which affected accuracy, were concerns with the design. The district-specific findings were context-specific and the findings may not be transferable to all districts. Additionally, some studies were constrained through data restrictions, and helped identify where further research was required.

Quantitative analysis used SPSS (version 29) and STATA (version 18) and detailed a descriptive statistics, cross-tabulation, and multivariate logistic regression approach to examine whether there was a causal association between diagnostic delay, timing of treatment, and neonatal outcome. These results were visually presented in tables and graphs able to show trends in admissions and rates of mortality, as well as referral timelines by district. Qualitative data were collected using semi-structured interviews, which were complete and verbatim transcribed in local languages (Braun & Clarke, 2021). Interview themes revolved around neonatal care experiences, diagnostic problems, and referral processes. These qualitative and inferential insights, merged with the statistical, offered a broader picture of the neonatal setting. This enabled triangulation of results, which enhanced validity and provided a more profound grounding. Transcripts were analyzed using NVivo (version 14) and Braun and Clarke's (2022) method of thematic analysis. Coding was conducted in stages in which a theme evolved from participants' stories that were cross-checked to quantitative data related to neonatal outcomes. Key themes were described; supported with illustrative quotes anonymised to highlight gaps in the system, caregiver perspectives, and staff adaptations. Quotations were selected to reflect both district-by-district variation that lent credibility and depth to our results, but also to overlap. Ethical approval was obtained from the Institutional Review Board of Ghana Health Service (GHS-ERC 008/03/20).

RESULTS / FINDINGS

This study compared the neonatal sepsis care outcomes of two rural districts of Ghana, Gushegu and Nkwanta South, and identified pivotal differences in sociodemographic status, diagnostics, clinical management and systemic barriers. These findings are consistent with emerging problems in sub-Saharan Africa and highlight the need for focused health system reform.

Access Barriers and the Sociodemographic Context

From the 322 study participants, 58% were female and the biggest category of caregivers were mothers aged from 18–35—65% in Gushegu and 59% in Nkwanta South. As evidenced in Table 1, more than 88% of the caregivers were women on average, while informal education levels were significantly low, with 43% of the respondents in Gushegu, and 39% in Nkwanta South, not having formal education. Moreover, over 70% of respondents from both districts had an income less than GHS 500 per month, which suggests

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a general financial insecurity. Travel time to health facilities was also much longer in Gushegu at an average of 2.1 hours, as opposed with 1.6 hours in Nkwanta South.

Table 1 Socio-demographic Profile of Study Participants (n = 322; Field Data).

Variable	**District**	**District**
Variable	**Gushegu (n =156)**	**Nkwanta South (n =164)**
Caregivers	102 (64.9%)	96(58.5%)
Health workers	46(29.1%)	52(31.7%)
Facility Managers	10 (6.3%)	61(6.3%)
Caregivers age	78%	81%
No formal education	43%	39%
Monthly income < GHS500	76%	71%
Average travel time to facility	2.1hours	1.6 hours

Diagnostic Capacity Clinical Readiness. What the diagnostic infrastructure was fundamentally missing. Although basic tools including thermometers and malaria rapid diagnostic tests were available, no facilities provided essential instruments for neonatal sepsis–blood culture systems, CRP system and procalcitonin tests. Pulse oximeters were functional only in 35% of Gushegu and 48% of Nkwanta South facilities. Sepsis-specific protocols were used in 28% and 41% of facilities. *"There's a lot of improvisation involved," one midwife in Gushegu said*."*We adapt based on what's on the market — in some cases we use adult IV kits for babies.".*

Clinical Management and Referral pathways

Empirical antibiotic use was significant in both districts as 89% of neonatal sepsis cases in Gushegu and 93% of cases in Nkwanta South were managed with a similar regimen of ampicillin and gentamicin. Intravenous access limitations were more common in Gushegu (42%) than Nkwanta South (35%), delaying management efforts. The completion rate for suspected sepsis for referrals was 58% in Gushegu and 66% in Nkwanta South, but the median time for the referral was more pronounced at 21 hours in Gushegu, where the median duration was 15 hours in Nkwanta South. Feedback from referral centers had remained scant in Gushegu, 9%, and Nkwanta South, 15%. These results (summarized in Table 2) demonstrate notable deficiencies in clinical care and referral pathways that correspond to high regional variability.

Table 2: Clinical Management Practices and referral pathways (n=100; field-based data).

Indicator	**District**	
	Gushegu (n=100)	**Nkwanta South (n =100)**
Empirical antibiotic use	89% of cases	93% of cases
Common regimen	Ampicillin & Gentamicin	Ampicillin & Gentamicin
IV access challenges	42% of facilities	42% of facilities
Referral rat for suspected sepsis	58%	66%
Median rferral delay	21 hours	15 hours
Feedback from referral centers	9% of referring facilities	15% of referring facilities

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Problem: Outdated clinical guidance – a response from a community health nurse from Nkwanta South *"We have old protocols. "No one thing is a neonatal sepsis, and we haven't had refresher training in years."* It also found that only 31% of health workers recently received training, and sepsis markers were not integrated within the District Health Information Management System 2 (DHIMS2) and therefore data-informed planning and monitoring limited access.

Clinical Outcomes and Timing of Care.

Results differed by the district: Gushegu had 52% recovery, 24% complications, and 20% mortality. On the other hand, Nkwanta South had 64% recovery, 18% complications, and 14% mortality. Delays in seeking care (>48 hours after onset of symptoms) were three times the odds for bad outcomes, OR = 2.8 and delays at intravenous antibiotics (> 6 hours) increased the chance with complication risk threefold, OR = 3.2. The chances for adverse outcomes increased twice when the waiting time for referral exceeded 12 hours (OR = 2.1). One caretaker in Gushegu recounted her experience: "*Our parent borrowed us money to go to the hospital to get to the hospital and when we got there, they said we were totally late and the nurses didn't even look at the baby,"* she said. Another first-time mother in Nkwanta South confessed: *"I had no idea the signs mattered. The baby was breathing fast but, I thought was fine till it was getting worse."* These quotes illustrate a wider issue of low awareness of neonatal danger signs and delayed recognition however 72% of caregivers showed awareness of neonatal danger signs in care.

Policy levels and systemic gaps.

Health workers reported the use improvisation due to tool shortages and outdated protocols. Caregivers cited cost, transport, and poor staff interactions as barriers. Awareness of danger signs was low (72%), and many felt dismissed—49% in Gushegu, 38% in Nkwanta South. Only 31% of health workers had recent training. DHIMS2 lacked sepsis indicators, limiting planning. Some health workers described frequent improvisation due to shortages of neonatal-specific equipment. Below presents some of the quotes: "We often have to improvise with what's available—sometimes even using adult IV kits for newborns." (Midwife, Gushegu District Hospital). Others expressed concern about outdated clinical guidelines and limited training opportunities: "The protocols we have are outdated. There's nothing specific for neonatal sepsis, and we haven't had refresher training in years." (Community Health Nurse, Nkwanta South Health Centre)

On Caregivers' experiences, some of them cited financial and logistical barriers to timely care: "I had to borrow money for transport, and when we arrived, the nurse said we were late and didn't even look at the baby."(Mother of four, Gushegu District)

Also, someone opined that low awareness of neonatal danger signs contributed to delays in seeking care: "I didn't know the signs were serious. The baby was breathing fast, but I thought it was normal until it got worse." (First-time Mother, Nkwanta South District)

DISCUSSION

The results show major disparities in neonatal sepsis care between Gushegu and Nkwanta South are consistent with but markedly different from recent trends in sub-Saharan Africa. The high prevalence of young, low income, less educated mothers is consistent with caregiver profiles identified in recent regional reports that have shown a similar association between sociodemographic factors on a delay in recognition and response to neonatal illness (Traoré, Mensah, & Oketch, 2024). Gushegu's travel time of 2.1 hours (compared to 1.6 hours in Nkwanta South) indicates geographical barriers, and there is the importance of district-specific interventions. The diagnostic readiness of both districts was substantially lower than expected, consistent with findings from a multicountry survey of neonatal clinicians in 25 sub-Saharan African countries indicating limited access to blood cultures, CRP testing and infection control protocols (Rosa-Mangeret et al., 2024).

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The lack of sophisticated diagnostics in Gushegu and Nkwanta South mirrors WHO's worry that many primary facilities in low- and middle-income countries do not have the basic tools needed for early identifying sepsis (WHO, 2022). While Nkwanta South had somewhat higher availability of functional pulse oximeters and sepsis protocols, this indicates a small edge in preparedness. These results are in line with those of many others in low resource settings, particularly in Malawi and Tanzania (Molyneux et al., 2016; Mboya et al., 2021) and recognized by WHO (2020).

Clinical management was in line with that identified in the 2025 meta-analysis by Wondifraw et al., and there

was an extensive dependence on empirical antibiotic use in African settings. Gushegu's heightened challenges with IV access and longer duration of referral may differ from improvements noted in those facilities with more efficient transport coordination and supply chains (Wondifraw et al., 2025). The poor level of referral center feedback in the two districts suggests a continuation of breakdown in continuity of care, similar to feedback reported in recent reviews of neonatal care systems throughout the region (Traoré et al., 2024). Multivariate analyses showed that delay of presentation (> 48 hours) was associated with 3 times risk of poor outcome (OR = 2.8) and that delayed IV antibiotics and referral delays also significantly increased risk (OR = 3.2 and OR = 2.1, respectively). These corroborated that delayed presentation and treatment drastically increased the odds of poor outcomes, consistent with pooled data that delay in care-seeking and initiation of antibiotics is strongly associated with neonatal mortality (Wondifraw et al., 2025). Corresponding with the recent reports in Nigeria and Bangladesh, neonatal sepsis continues to have a high burden of disease, especially for resource poor settings with diagnostic and referral gaps (Mustapha et al., 2024; Wondifraw et al., 2025). Gushegu had higher mortality (20% vs. 14%) and complication rates (24% vs. 18%), reflecting district-level inequities in clinical management and access to timely care. Qualitative results showed barriers similar to those identified in recent surveys, like outdated protocols, caregiver neglect, and little awareness of danger signs (Rosa-Mangeret et al., 2024). Such findings are in accordance with the trends observed in Sierra Leone and Liberia (Baldeh et al., 2022; Perry et al., 2017).

There were systemic problems in the form of lack of surveillance, lack of training, and in missing DHIMS2 integration (MOH Ghana, 2021). Interventions proposed range from standardisation to DHIMS2 integration, emergency transport vouchers, diagnostic, and training investment, with Gushegu quickly receiving a prioritized priority (WHO, 2020). Systemic gaps revealed in Ghana's health system reviews (GHS, 2022) are shown in the lack of neonatal sepsis surveillance and integration with DHIMS2. These comparisons highlight the need for careful, district-based reforms.

This study was limited by restricted district coverage, cross_sectional design, and absence of detailed neonatal mortality data. Also, patient outcomes were not fully linked with logistics capacity, reducing generalizability, cultural relevance, and policy applicability of findings.

CONCLUSION AND RECOMMENDATIONS

Summary

This research investigated the capability of health care workers and parents to diagnose and treat neonatal sepsis in two rural Ghana regions, Gushegu and Nkwanta South. Using a mixed methods design as primary research methods, the study investigated diagnostic capacity, clinical treatment, referral strategies, and system barriers to effective neonatal medical intervention. Some of the findings highlighted significant discrepancies in care provision between the two districts. These challenges were pronounced in Gushegu where early maternal age, low household income, lack of formal education, long transportation to health facilities, and poor caregiver knowledge on neonatal danger signs were prevalent factors. These conditions helped slow care-seeking and treatment, which directly impacted survival rates. Both districts had a very restricted diagnostic capacity. None of the health facilities had blood culture systems or C-reactive protein (CRP) testing; health workers had to rely on clinical judgment and outdated protocols. Intravenous access was often poor, and referral pathways were often slow and lacked feedback from senior facilities. These clinical limitations posed an elevated risk for neonatal morbidity and

mortality. These issues were further exacerbated by systemic problems. The lack of indicators of sepsis in the District Health Information Management System 2 (DHIMS2), the limited training of staff and the absence of updated clinical guidelines significantly disrupted continuity of care and reduced accessibility to high-quality services. Nevertheless, the study offers important district-level data to connect diagnostic readiness with clinical outcomes and to suggest targeted interventions to provide better neonatal sepsis care.

CONCLUSIONS

The study established that neonatal sepsis care in rural Northern Ghana could be complicated by clinical, infrastructural, and systemic inadequacies. Gushegu, in particular, was worse-affected given longer referral times, a weaker diagnostic apparatus and more severe social and economic impediments. While districts experience similar difficulties, the disparity in outcomes emphasizes the need for localized solutions that are adapted to respective districts' requirements. Shortage of critical health diagnostic tools, reliance on empirical treatment, combined with lack of integrated data and processes including DHIMS2 hinder health workers' opportunities to take timely, effective action. This lack of familiarity among caregivers about neonatal danger signs, in combination with financial or logistical barriers, adds further delay in accessing life-saving interventions. Although the study provides some important insights, the focus is modest. The outcomes may not be comparable outside the two districts in question and the use of self-report data can lead to biases. Still, the evidence provides a strong foundation for policy and research-oriented.

RECOMMENDATIONS

For addressing the issues in this study, a tiered intervention strategy was recommended. Low-cost interventions at the community level must involve training of young mothers via local volunteers, radio programs, brochures, etc. These may be supplemented by design of simplified, illustrated clinical protocols to help frontline health workers identify and manage neonatal sepsis. At the facility level, medium-cost efforts should involve implementing regular training and mentoring programs for health workers, focusing on early identification of sepsis, using intravenous access techniques, and appropriate antibiotic administration. Integrating neonatal sepsis indicators into DHIMS2 will augment our surveillance, planning, and monitoring capabilities. To have a long-lasting impact, high-cost interventions must give a preference for funding CRP and blood culture testing by district hospitals. Lower-tier institutions need point-of-care diagnostic tools to improve early detection. The referral systems need to upgrade, including good transportation and mobile communications while financial incentives will attract and retain experienced pediatric employees in underprivileged areas. Further research is needed that assesses the impact of diagnostic and educational interventions on neonatal outcomes and investigates scalable models for a surveillance approach to sepsis and investment in child health. Health workers should be empowered to lead quality improvement efforts, overseeing their key performance indicators. Public awareness and policy change need to be the goal and findings need to be transmitted through stakeholder workshops, policy briefs and media partnership. These suggestions can help Ghana move toward reduction of neonatal mortality and strengthening of its rural health systems to effectively cater for its most vulnerable populations.

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