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Health service delivery factors influencing neonatal mortality in health facilities in the bono region of Ghana

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Abstract

Background: The neonatal period is the transitional time from intrauterine to independent existence. Deaths within this period can be further categorized as early neonatal deaths between 0 and 7 completed days of birth. Moreover, late neonatal deaths; are deaths after seven days to 28 completed days of delivery.

The Bono Region of Ghana was selected as one of the only eight Regions to benefit from the MEBCI program (Making Every Child Count Initiative). Under the program, all regional districts received staff training, and various stakeholders were contacted for support. This was to reverse the trend of neonatal mortality, which is increasing annually. Identifying the factors that drive this unusual shift will help in targeted intervention. This study, therefore, seeks to establish health service delivery factors influencing neonatal mortality in the region as a lesson learned for the country.

Method: The study used a mixed-method approach involving quantitative and qualitative studies. The quantitative study administered structured questionnaires to 187 health workers. The data were analyzed using STATA 14.0. Univariate and multivariate analyses were performed to establish human Resource information factors influencing neonatal mortality. Also, Chi-square analyses were performed to establish an association between referral protocols, partograph protocols and neonatal mortality. The qualitative data were obtained using a semi-structured interview guide from 16 in-charges and unit heads of newborn intensive care units in the various hospitals. The data were analyzed thematically, facilitated by manual analysis.

Results: The human resource factors such as participants' district were more likely to influence neonatal mortalities in the Sunyani Municipal (AOR= 2.719, 95% CI = 0.373 – 19.845) and Berekum Municipal (AOR= 0.132, 95% CI = 0.022 – 0.782). Majority of the respondents adhered to the GHS referral guidelines, such as the availability of copies of the referral guidelines (84.0%), familiarity with referral policy (71.7%), documentation and keeping of duplicates (85.0%), booking (83.4%), a feedback mechanism (69.5%) and emergency transport system (83.4%). Also, the majority of the respondents adhered to the WHO partograph protocols such as placing guidelines on the desk (86.1%), assessing and recording moulding caput formation (88.8%), recording contraction per 10min and30mins (84.4%), recording the administration of oxytocin (84.0%), recording of drugs given (85.0%), recording of IV fluids given (85.0%), recording the temperature of mothers (87.7%) and recording the pulse of the mother (85.6%). Finally, participants mentioned

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leadership challenges, inadequate supervision and monitoring activities, challenges with essential resources, and non-involvement of in-charges during management meetings as institutional challenges for neonatal care.

Conclusions: Adherence to referral and partograph protocols using MOH/GHS and WHO/GHS guidelines was high, respectively. However, institutional challenges such as leadership style were identified as the primary factor contributing to Neonatal Mortality. Therefore, the Ghana Health Service and its partners should change the current Leadership practices through capacity building with a focus on rural districts.

Keywords: Neonatal mortality; Stillbirth; Newborns; Postnatal period; ultrasound monitoring; Partograph

1. Introduction

Neonatal death refers to the death of a newborn baby within the first 28 days of life. This is a critical time for newborns as they adjust to the outside world and are particularly vulnerable to illness and complications [1], [2]. The condition represents almost 40% of all childhood deaths and is the most hazardous period of life because of the various diseases the neonate faces [1]. The neonatal period is the transitional time from intrauterine to independent existence. Deaths that occur within this period can be further categorized as early neonatal deaths: deaths between 0 and 7 completed days of birth).

Moreover, late neonatal deaths occur after seven days to 28 completed days of birth [3]. Most maternal and neonatal deaths happen during childbirth and the early postnatal period. Ensuring effective and appropriate interventions before, during pregnancy, and after delivery can preserve the lives of mothers and babies. Safe motherhood measures and interventions in the first month of life can also decrease long-term disability and encourage behaviours such as breastfeeding, with vast benefits for the health of children, families, and communities.

Improving neonatal mortality is, by far extent, an essential element of reducing under-5 mortality. To do this, the UN Secretary-General Ban Ki-moon set in motion global strategies in 2012. The "Every Newborn Action Plan" enhanced the global strategy in 2014 [4]. Every Newborn Action Plan sets specific goals to reduce under-5 and neonatal mortality; these targets were subsequently reflected in the Sustainable Development Goals (SDGs), with the idea of ending preventable deaths of newborn babies and children under five years by 2023. To achieve this, all countries are putting sufficient effort and public health interventions into reducing the neonatal mortality rate (NMR) to 12 deaths per 1000 live births or less than five deaths [4].

In addition to being a serious public health problem, neonatal mortality is a real threat to global development because almost 3 million neonates die annually. Half these deaths occur within the first 24 hours of birth [5]. Among globally reported neonatal deaths, 99% are from low-income or developing countries and are primarily preventable [6]. The three major causes of neonatal mortality (NMR) are related to preterm birth (28%), severe infections (26%), and asphyxia (23%) [7]. The health sector has a role towards humanity from conception to death. In doing that, a specific effort such as regular check-ups, ultrasound monitoring, and other diagnostic tests must be performed throughout a woman's pregnancy and birth to help prevent neonatal mortality. According to the World Bank (2016), Ghana reports over 30000 neonatal deaths annually, and four (4) neonates die every hour. The numbers are shocking compared to other West African countries, such as Liberia and deserve attention as a country [2], [8]. The Liberia government, UNICEF, and partners are implementing low-tech, low-cost, effective health interventions that improve neonates' lives.

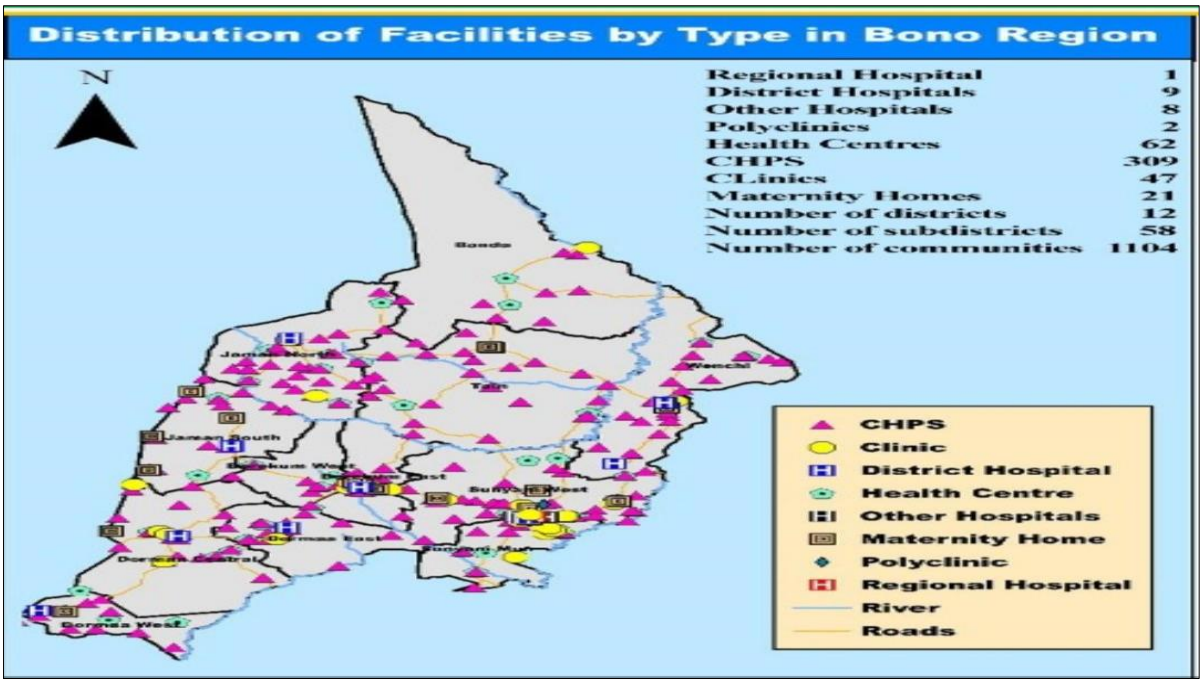
The objective of this study was to explore the health service delivery factors that influence neonatal mortality in health facilities in the Bono region of Ghana.

2. Methodology

2.1. Profile of Bono Region

The Brong Ahafo Region became functional on the 4th of April 1959 (Act No. 18 of 1959, Constitution of Ghana) and was administratively divided into three, namely Bono, Bono East, and Ahafo Region, in 2018. Bono region covers an area of 39,557 square kilometres; it is the second-largest region in the Brong Ahafo Region (16.6%) and shares boundaries with Bono East, Ahafo, Ashanti, and Western Regions. The region's eastern part connects to Volta Region and La Cote d'Ivoire to the west. The region falls within the forest zone and is a major cocoa and timber-producing area. Some areas in the savanna zone produce grains. The Black Volta is located in the Northern parts of the region. Rivers like the Tain, Bia, Pru, and Tano form the main drainage basins in the south.

However, there are 12 administrative health districts and municipalities. Sunyani is the regional capital. The various districts and municipalities in the region have been demarcated into three zones. There are `communities with health facilities comprising District Hospital, Community Health Planning and Services (CHPS), Clinics, Health Centres, Private Hospitals, Christian Health Association Ghana (CHAG), QUASI, and a Regional Hospital.



Source: Bono Regional Health Directorate, 2019.

Figure 1 Distribution of Facilities for Facility type in the Bono Region of Ghana

2.2. Study type and design

The study is a missed design which deploys both quantitative and qualitative approaches. A descriptive and analytical cross-sectional study design was adopted for the qualitative approach. A cross-sectional study examines exposure and outcome at the same point in time (Pandis, 2014)[9]. The design was adopted for this study because it is relatively quick, easy to conduct, with no long follow-up periods, and cheap. The study was conducted in the selected health facilities within the Bono Region of Ghana between March 2019 to September 2020

2.3. Study Population

The study's population was the staff directly involved in neonatal care in various health facilities in the three selected districts and municipalities in the Bono Region of Ghana.

Due to the study's missed nature, this section is divided into two sections.

2.3.1. Inclusion criteria (quantitative)

- 53 private and public health facilities in Jaman North District, Berekum Municipal, and Sunyani Municipal in the Bono Region of Ghana
- All midwives, medical officers, physician assistants, and health care assistants working at the mother and Baby care Unit.

2.3.2. Exclusion criteria (quantitative)

- Midwives, physicians, physician assistants, and health care assistants who do not work at the mother and Baby Unit at 53 private and public health facilities in Jaman North District, Berekum Municipal, and Sunyani Municipal, the Bono Region of Ghana.

2.3.3. Sample size (quantitative)

The sample size was calculated using Epi info StatCalc (Version (7.2.3.1) based on a population of 481, an expected frequency of 50%, a 5% margin of error, 95% confidence level. Based on this, the sample size was calculated as 214. Therefore, providing a non-response rate of 10% (22), the total sample size was estimated as 236.

2.4. Sampling method

A stratified sampling technique proportionate to size was used in selecting health staff to participate in the study. The number of staff for each cadre relative to the total staff was applied as a sample fraction, thereby getting a proportionate representative in the sample.

A simple Random sampling method was applied to select the sample for each cadre. In this case, a list of all health staff working in the 53 health facilities in the Bono Region who met the inclusion criteria was obtained from the heads of the various Human Resource Department or units in the 53 health facilities. Surnames sorted the names of the 481-health staff, and sequential serial numbers were assigned (one serial number for each) according to their cadre. A random list of serial numbers was generated using Research Randomizer online [10]

In this case, putting the calculated sample size of 236 and the total of 481 health staff (representing midwives, medical officers, and ward Assistants) into the software, a random list of serial numbers totalling 236 was automatically created and generated. Names of midwives, medical officers, and ward Assistants with serial numbers corresponding to the generated random list of serial numbers were then contacted to respond to the instruments.

2.5. Data collection technique and tools

Two types of data were collected: secondary and primary data. The secondary data were collected from the District Health Management Information System (DHIMS) to assess the trend of neonatal death over 5yrs (2015-2019). The primary data were collected by adopting the Ghana Health Service referral protocol and the World Health Organization (WHO) standard Partograph guidelines to assess adherence to referral and partograph protocol. The adopted Ghana Health Service referral protocol and WHO standard Partograph guidelines were administered to respondents by six trained research assistants. The data collected using the Ghana Health Service referral protocol includes; the availability of referral books, the documentation in the referral book, the availability of the transportation system, the existence of a feedback mechanism, and a follow-up system. Also, data that were collected using WHO standard Partograph guidelines include; availability of the partograph protocols, knowledge and documentation process**.**

2.6. Data Analysis

The data captured via the Open Data Kit (ODK) was exported to STATA 14.0 for statistical analysis after cleaning. Descriptive statistics were presented using percentages, frequencies, and tables. Chi-square was performed to establish any association between adherence to referral protocols, adherence to partograph protocols and neonatal mortalities. Also, univariate and multivariate analyses were performed to establish human resource factors influencing neonatal mortalities. Statistical significance for all testing was set at 0.05.

2.6.1. Study type and design (qualitative)

The study adopted an exploratory cross-sectional study design. This design explores healthcare providers' knowledge, attitudes, and practices involved in the topic under study [11]. This design was adopted to explore in-depth knowledge of the themes under consideration. The study was conducted in the selected health facilities within the Bono Region of Ghana between March 2020 to May 2020

2.6.2. Study Population (qualitative)

Nurse Managers, midwives, and the NICU in charge of the health facilities were interviewed.

2.6.3. Inclusion Criteria (qualitative)

All nurse managers or facility in-charges and nurses in charge at New-born Intensive Care Unit (NICU) in the various eight(8) hospitals, namely Sunyani Municipal Hospital, Bono Ahafo Regional Hospital, Sunyani SDA hospital, Owusu Memory Hospital, Berekum Holy Family Hospital, Fountain care hospital, Sampa Government hospital, and Happy Hospital LTD who were directly involved with new-born care in the various hospitals within Jaman North district, Berekum Municipal and Sunyani municipal were included in the study.

2.6.4. Exclusion Criteria (qualitative)

All nurse managers or facility in-charges and nurses in charge of NICU who were not directly involved with new-born care services in the various hospitals within the selected districts and those who find themselves outside the selected districts**.**

2.6.5. Sample Size and Sampling Method (qualitative)

Sixteen (16) hospital in-charges were interviewed from eight hospitals from the selected district and municipals. These involved nurse managers or facility in-charges and nurses in charge of the neonatal unit; however, it was based on the point of saturation. The Point of Saturation is when the researcher is reasonably assured that further data collection would yield similar results and serve to confirm emerging themes and conclusions (Faulkner & Trotter, 2017). All respondents visited their hospitals in the selected district in the Bono Region of Ghana.

2.7. Data collection technique and tools

The interviews were conducted by the researcher using a semi-structured interview guide. The interviews were recorded by a research assistant trained by the researcher using an audio recorder. The interviews were conducted using the English language. Each interview session lasted between twenty (20) to forty-five (45) minutes. Data collected include leadership challenges, availability and unavailability of essential resources, capacity-building programs, and monitoring & evaluation systems within the facilities.

2.8. Data Analysis

The recorded interviews were transcribed verbatim. The data were analyzed thematically, facilitated by manual analysis. Initial codes were applied and sorted into potential themes. The themes generated include leadership challenges, availability of resources, capacity-building programs, monitoring, and evaluation systems

2.9. Ethical Consideration

Ethical clearance was obtained from the Committee for Human Research, Publications, and Ethics of the Kwame Nkrumah University of Science and Technology. Before conducting the research, permission was sought from the District Assembly and the Regional and District Health Administration. The researcher prepared an information sheet detailing the study purpose, benefits, and absence of possible risks to the respondents. Participants agreeing to participate in the study were made to sign a consent form. Study participants were assured of absolute confidentiality and anonymity.

Limitation

12.6% were non-respondents due to the non-availability of respondents during the time of data collection. Also, a recall bias was encountered since participants had to remember most of the questions administered to them.

3. Results

3.1. General Information on Health Facilities

A total of 187 participants were recruited for the study. This comprises 146 (78.1%) from the Sunyani Municipality, followed by Jaman North district, 22 (11.8%), and the least from Berekum Municipality, 19 (10.2%).

Most participants were recruited from Government Health Facilities 144 (78.7%). The majority of the participant's level of Health care were Hospitals 153 (81.8%), as indicated in Table 1.

Figure 2 below shows the trends in neonatal deaths over five years. Neonatal deaths had the highest cases in 2017 but declined in 2018; neonatal deaths were the lowest in 2015. Sunyani Municipal reported the highest number of neonatal deaths. See figure 2 for details.

Table 1 General information on Health Facility

Variable	Categories	Frequency	Percent
District	Jaman North	22	11.80%
	Berekum Municipal	19	10.20%
	Sunyani Municipal	146	78.10%
	Total	187	100.00%
Type of health facility	Government	144	77.01%
	Private	43	23.01%
Level of care	CHPS	13	7.0%
	Health Center	21	11.2%
	Hospital	153	81.8%

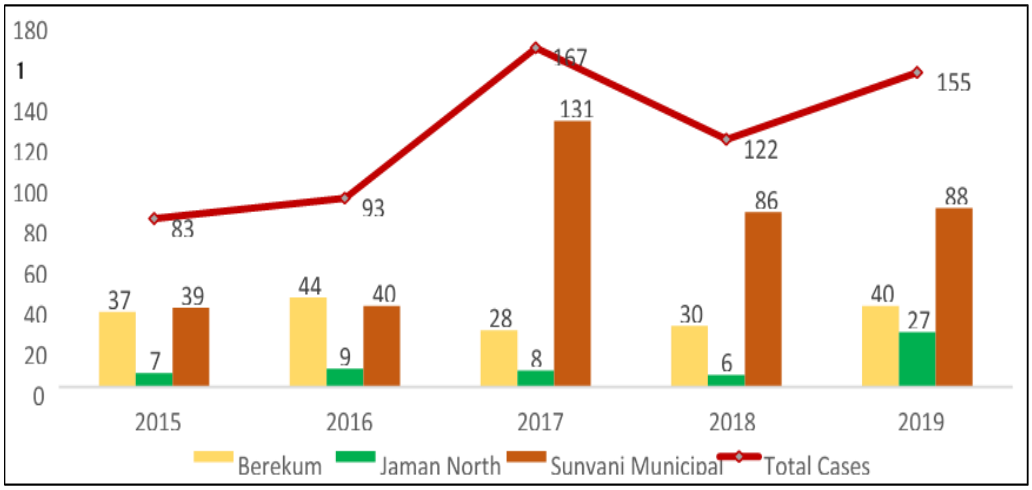


Figure 2 Trends of Neonatal deaths over five years (2015-2019)

Figure 3 shows the distribution of institutional neonatal mortalities (1000 live births) by the level of health care recorded from 2015 to 2019. The results show that all the neonatal mortalities were recorded at the various municipal/district Hospitals (100%) as compared to the other levels of health care (CHPS and Health Centers) (0%).

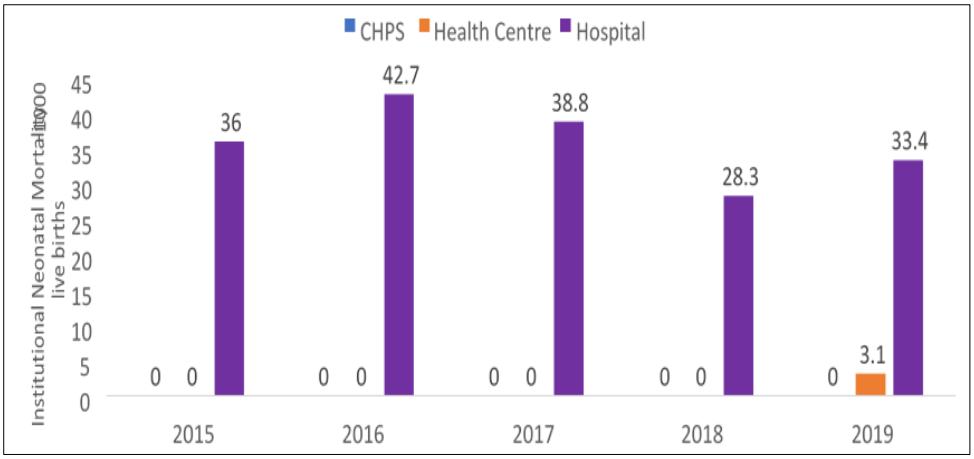


Figure 3 Neonatal Mortalities (per 1000 live births) by Level of Health Care

Figure 4 shows the distribution of neonatal deaths by some selected health facilities in the Berekum Municipality (2018 – 2019). Holy Family Hospital recorded the highest number of neonatal deaths (0 – 7 days) in the year 2018 (29.0%) and 2019 (14.0%).

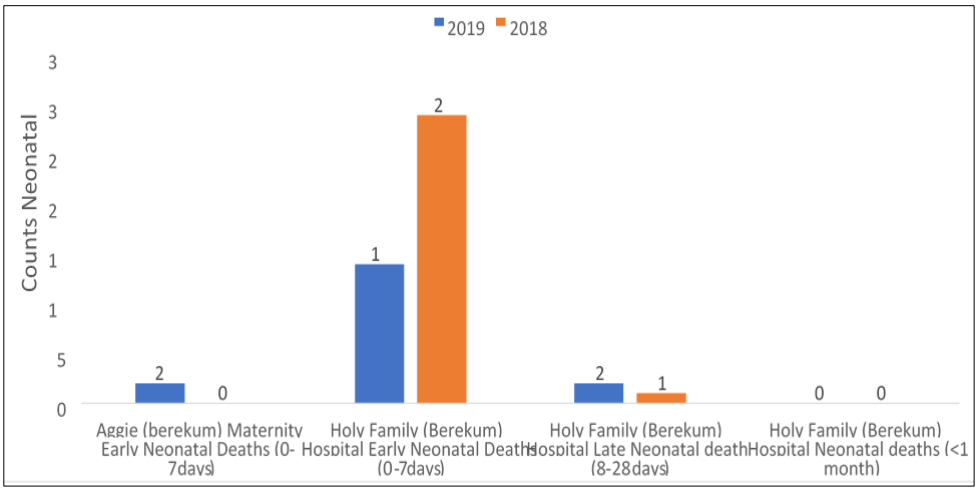


Figure 4 Neonatal Deaths in Berekum Municipality by Health Facilities

Figure 5 shows the percentage distribution of neonatal deaths by health facilities in the Jaman North District (2018 – 2019). Fountain Care Hospital recorded the highest number of Neonatal deaths (0 – 7 days) in the year 2019 (19.01%) and 2018 Sampa Government Hospital (5.00 %).

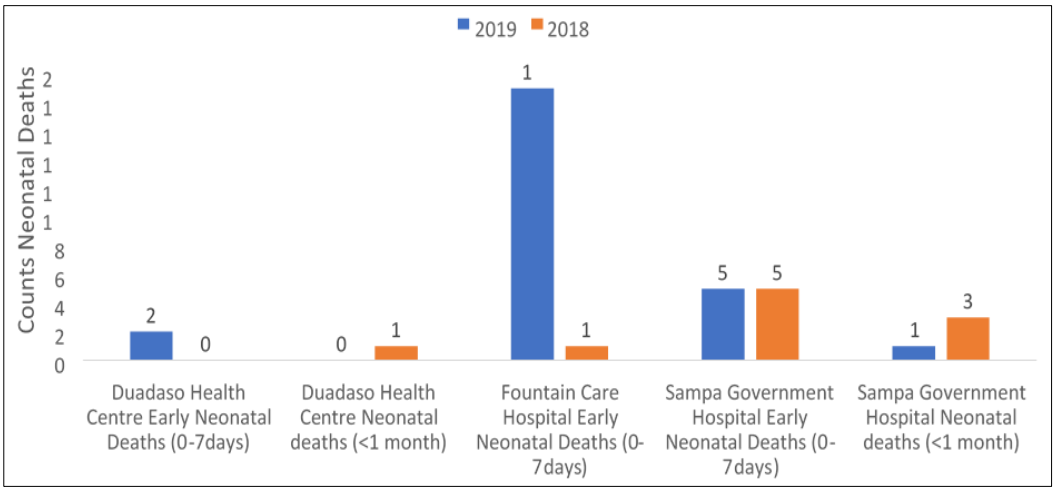


Figure 5 Neonatal Deaths in the Jaman North District by Health Facilities

Figure 6 shows the distribution of neonatal deaths by some selected health facilities in the Sunyani Municipality (2018 – 2019). Sunyani Municipal Hospital recorded the highest number of neonatal deaths (0 – 7 days) in the year 2019 (76 deaths) and 2018 (71 deaths), followed by Brong Ahafo Regional Hospital 2019 (70 deaths) and 2018 (67 deaths), respectively.

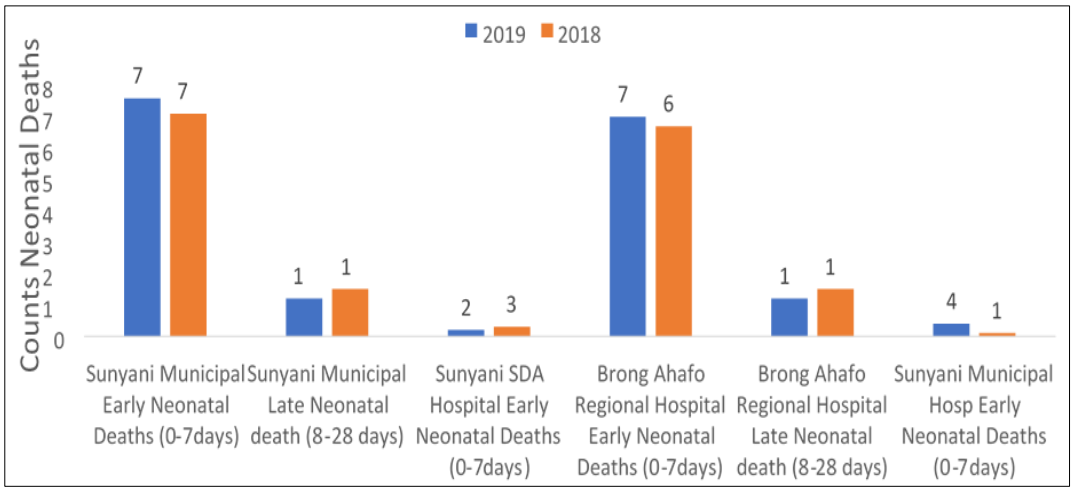


Figure 6 Neonatal deaths in Sunyani Municipality by Health Facilities

Figure 7 shows the impact of MEBCI on the documentation of Neonatal Mortality. Tremendous progress regarding documentation of neonatal mortality after the training and implementation of MEBCI (2015 -2020), as detailed in figure 7.

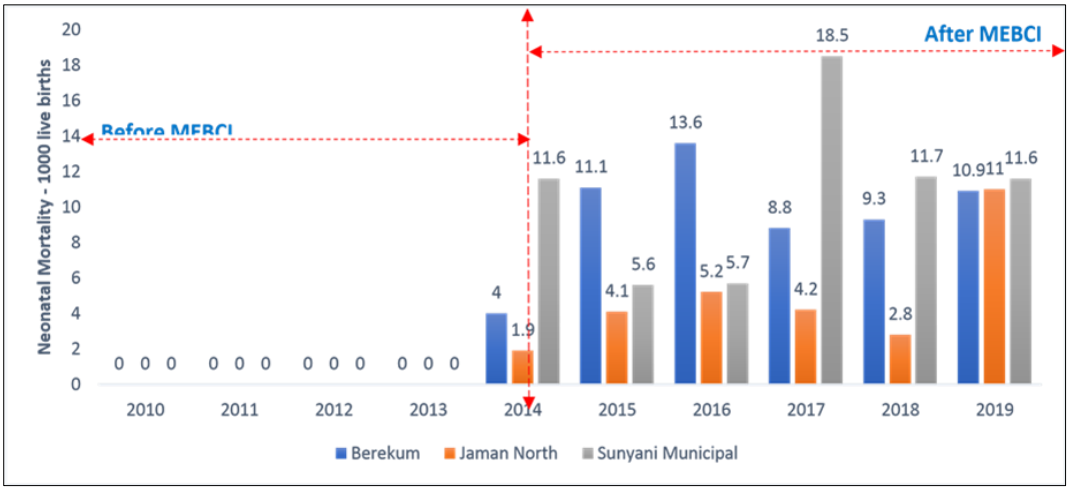


Figure 7 Neonatal Mortality by District before and After MEBCI

3.2. Human Resource Factors influencing Neonatal Mortality

Table 2 describes the human resource characteristics of respondents. A total of one hundred and eighty-seven (187) respondents were recruited, made up of 117 participants for females (95.2%) and nine males (4.8%). The mean age of the study participants was 27.83 ± 10.46 years, having many identified in the 26 – 35 years age category (52.4%). Most study participants were single (49.70%), followed by married ones (46.0%). Most of the participants were midwives (48.1%), followed by medical officers (31.0%) and ward assistants (20.9%). Also, most participants were Senior staff (41.2%) and Principal staff (34.8%). About 43.9% of the participants had 4 – 7 years of working experience. Also, the majority of the respondents (84.5%) were Christians. Some of the respondents interviewed had no position (70.6%), and others (24.6%) were, however, unit and facility (4.8%) in charge. The results showed that about 20.9% of facilities had no incubators to manage neonatal cases. However, 79.1% of the facilities indicated they had more than two functional incubators. On capacity building training programmes, more than half of the participants (59.5%) have been trained on the Making Every Baby Count Initiative (MEBCI), trained on Partograph (83.2%) and had received other capacity training (38.3%) as seen in table 2

Table 2 Human Resource Characteristics of Respondents

Variable	Categories	Frequency	Percent
Age group	20 - 25	35	18.70%
	26 - 35	98	52.40%
	36 - 45	47	25.10%
	46 and above	7	3.70%
Sex	Male	9	4.80%
	Female	178	95.20%
Marital Status	Married	86	46.00%
	Single	93	49.70%
	Separated	4	2.10%
	Divorce	1	0.50%
	Widow	3	1.60%
Cadre/specialization	Midwife	90	48.10%
	Medical officers	58	31.00%
	Ward Assistant	39	20.90%
Rank	Senior	77	41.20%
	Principal	65	34.80%
	Others	45	24.10%
Level of education	Certificate	34	18.20%
	Diploma	122	65.20%
	Degree	31	16.60%
	8 - 11 years	30	16.00%
	11 years and above	20	10.70%
Religious Affiliation	Christian	158	84.50%
	Moslem	29	15.50%
	Traditionalist	0	0.00%
	Other Faith	0	0.00%
Position	Facility in charge	9	4.80%
	Unit in charge	46	24.60%
	No position	132	70.60%
Number of functioning incubators	None	39	20.90%
	One	28	15.00%
	Two	67	35.80%
	Three	32	17.10%
	More than three	21	11.20%

Training Capacity			
Making Every Baby Count Initiative (MEBCI) Trained	Yes	110	59.50%
	No	75	40.50%
Partograph capacity trained	Yes	154	83.20%
	No	31	16.80%
Other capacity training	Yes	70	38.30%
	No	113	61.70%

In univariate and multivariate regression analysis, the results depict that Human resources factors such as participant's district were more likely to influence neonatal mortality, as detailed in table 4.5. For instance, neonatal mortality cases were 2.7 times more likely to be reported in Berekum (AOR= 2.719, 95% CI = 0.373 – 19.845) and 0.13 less likely in Sunyani Municipality (AOR= 0.132, 95% CI = 0.022 – 0.782) compared with Jaman North district. (see table 3 below).

Table 3 Human Resource factors influencing Neonatal Mortality

Variables	**Crude Odd Ratio**	**95% Confidence Interval**		**p-value**	**Adjusted Odd Ratio**	**95% Confidence Interval**		**p-value**
District				0.037				
Jaman North	Ref				Ref			
Berekum	1	0.288	3.476	1	2.719	0.373	19.845	0.324
Sunyani Municipal	0.39	0.157	0.97	0.043*	0.132	0.022	0.782	0.026*
Type of health facility								
Government	Ref			Ref				
Private	1.252	0.574	2.73	0.572	0.253	0.038	1.694	0.157
Level of Care				0.009*				
CHPS	Ref				Ref			
Health Center	0.6	0.034	10.51	0.727	2.804	0.061	128.89	0.598
Hospital	7.613	0.965	60.09	0.054	29.571	0.47	1860.1	0.109
Number of functioning incubators				0.012*				0.887
None	Ref				Ref			
One	10.096	2.826	36.08	0.001*	3.773	0.218	65.4	0.362
Two	4.68	1.479	14.81	0.009*	4.027	0.252	64.278	0.324
Three	4.583	1.293	16.25	0.018*	4.578	0.274	76.627	0.29
More than three	5.385	1.384	20.95	0.015*	4.241	0.243	74.136	0.322
Age				0.71				0.079
20 - 25	Ref	Ref						
26 - 35	0.661	0.296	1.478	0.313	0.449	0.142	1.416	0.172
36 - 45	0.606	0.24	1.53	0.289	0.257	0.055	1.208	0.085
46 and above	0.571	0.097	3.376	0.537	5.429	0.206	143.4	0.311
Sex				0.972				

Male	Ref				Ref			
Female	0.975	0.235	4.037	0.972	0.668	0.668	6.556	0.729
Marital Status								
Married	Ref				Ref			
Single	1.018	0.545	1.901	0.956	0.688	0.274	1.727	0.426
Separated	2.036	0.272	15.22	0.489	5.503	0.422	71.789	0.193
Divorce	0	0	.	1	0	0	.	1
Widow	0	0	.	0.999	0	0	.	0.999
Cadre/specialization								
Midwife	Ref				Ref			
Enrolled Nurse	0.741	0.368	1.494	0.402	0.698	0.263	1.853	0.47
Ward Assistant	0.511	0.216	1.209	0.126	0.545	0.151	1.965	0.353
Rank				0.226				0.595
Senior	Ref							
Principal	0.846	0.409	1.749	0.651	0.885	0.336	2.332	0.806
Staff	1.678	0.779	3.61 4	0.186	1.905	0.465	7.804	0.371
Level of education				0.739				0.506
Certificate	Ref				Ref			
Diploma	1.4	0.597	3.283	0.439	1.988	0.408	9.694	0.395
Degree	1.27	0.434	3.718	0.663	3.071	0.457	20.626	0.248
Working experience				0.435				0.969
1 - 3 years								
4 - 7 years	0.689	0.335	1.418	0.312	0.761	0.257	2.252	0.622
8 - 11 years	0.91	0.362	2.288	0.841	0.8	0.17	3.761	0.778
12 years and above	0.393	0.115	1.337	0.135	0.815	0.106	6.261	0.844
Religious Affiliation								
Christian	Ref				Ref			
Moslem	1.308	0.575	2.975	0.522	1.555	0.551	4.389	0.405
Position				0.231				0.26
Facility in charge	1							
Unit in charge	1.1	0.199	6.09	0.913	0.174	0.008	3.588	0.258
No position	2.024	0.404	10.14	0.391	0.361	0.018	7.342	0.507
Capacity Building Training								
Making Every Baby Count Initiative (MEBCI) Trained								
No	Ref				Ref			
Yes	1.077	0.577	2.01	0.816	1.446	0.502	4.169	0.495
Partograph capacity trained								
No	Ref				Ref			

Yes	0.635	0.267	1.511	0.305	1.428	0.275	7.407	0.671
Other capacity training								
No	Ref				Ref			
Yes	1.235	0.659	2.312	0.51	0.874	0.368	2.076	0.761

*p < 0.05; OR significant at 95% CI; OR (95% CI), unadjusted odds ratio from simple logistic regression with accompanying 95% confidence interval; aOR adjusted odds ratio determined using multiple regression. –2 log likelihood = 156.11; Cox & Snell R^2 = 0.347; Nagelkerke R^2 = 0.483.

3.3. Adherence to Referral Protocols using MOH/GHS GUIDELINES

Table 4 shows adherence to referral protocols using the WHO/GHS guidelines. The findings revealed that 84.0% of the participants had copies of the referral policy guidelines. However, copies of the referral guidelines were unavailable to some Berekum Municipal participants (36.8%) during data collection. More than half of the participants (71.7%) admitted to being familiar with the GHS referral policy or guidelines. Referral logbooks/registers were seen on the desk of most participants (86.1%). The study found that most participants (85.0%) documented and kept duplicated copies of the referrals in the logbook/register. Also, most participants (83.4%) did practice advanced booking at the receiving health facility for the referred case. Most participants did acknowledge the availability of feedback mechanisms (69.5%) and emergency transportation systems (83.4%), as detailed in Table 4.

Table 4 Adherence to Referral Protocols

Variables		**Jaman North**	**Berekum Municipal**	**Sunyani Municipal**	**Total%**
Availability of referral Policy guidelines of Ghana/GHS	Yes	16 (72.7)	12 (63.2)	129 (88.4)	157 (84.0)
	No	6 (27.3)	7 (36.8)	17 (11.6)	30 (16.0)
Are you familiar with the GHS referral policy or guidelines?	Yes	14 (63.6)	8 (42.1)	112 (76.7)	134 (71.7)
	No	8 (36.4)	11 (57.9)	34 (23.3)	53 (28.3)
Availability of a referral log book/register	Yes	16 (72.7)	16 (84.2)	129 (88.4)	161 (86.1)
	No	6 (27.3)	3 (15.8)	17 (11.6)	26 (13.9)
Documentation of referrals in the log book/register is done correctly, and copies kept	Yes	18 (81.8)	16 (84.2)	125 (85.6)	159 (85.0)
	No	4 (18.2)	3 (15.8)	21 (14.4)	28 (15.0)
Any advanced booking to the receiving health facility for the referred case	Yes	17 (77.3)	13 (68.4)	126 (86.3)	156 (83.4)
	No	5 (22.7)	6 (31.6)	20 (13.7)	31 (16.6)
Availability of feedback mechanism on referral cases	Yes	15 (68.2)	15 (78.9)	100 (68.5)	130 (69.5)
	No	7 (31.8)	4 (21.1)	46 (31.5)	57 (30.5)
Availability of emergency transportation system	Yes	13 (59.1)	16 (84.2)	127 (87.0)	156 (83.4)
	No	9 (40.9)	3 (15.8)	19 (13.0)	31 (16.6)

Chi-square was therefore performed to establish any association between adherence to referral protocols and neonatal mortality, as shown in Table 5 Adherence to referral Protocols such as availability of referral Policy guidelines of Ghana/GHS (p-value=0.006), Familiar with GHS referral policy or guidelines (p-value=0.005), and availability of emergency transportation system (p-value=0.005) were found to be significantly associated with neonatal mortality as detailed in table 5.

Table 5 Association between Neonatal Mortality and Adherence to Referral Protocols

Adherence to Referral Protocols	Chi-square	df	p-value
Availability of referral Policy guidelines of Ghana/GHS	10.26	2	0.006
Familiar with GHS referral policy or guidelines	10.704	2	0.005
Availability of a referral log book/register	3.964	2	0.138
Documentation of referrals in the log book/register is done correctly, and copies kept	0.228	2	0.892
Any advanced booking to the receiving health facility for the referred case	4.568	2	0.102
Availability of feedback mechanism on referral cases	0.888	2	0.641
Availability of emergency transportation system	10.767	2	0.005

3.4. Adherence to Partograph Protocols using WHO/GHS guidelines

Table 6 shows participants' adherence to Partograph using WHO/GHS guidelines. The study revealed that most respondents (86.1%) pasted or placed the partograph protocol on the desk and tables. However, more of the participants in Jaman North district (27.3%) did not paste or had non-availability of partograph on their walls or table compared to those in Berekum (21.1%) and Sunyani Municipality (11.6%).On assessing and recording moulding caput formation, 88.8% indicated yes, while recording contractions per 10 minutes and every 30 minutes accounted for 84%, recording the administration of oxytocin and amount during labour was 85%, recording of drugs and IV fluids given recorded 85%, recording the temperature of a mother (87.7%), and recording the mother's pulse (85.6%) as detailed in table 6

Table 6 Adherence to Partograph using WHO/GHS guidelines

Assessing Adherence to Partograph	Response	Jaman North	Berekum Municipal	Sunyani Municipal	Total
partograph protocol (Posted on the wall or table)	Yes	16(72.7)	15 (78.9)	130 (89.0)	161 (86.1)
	No	6 (27.3)	4 (21.1)	16 (11.0)	26 (13.9)
Assessing and recording moulding cat put the formation	Yes	19(86.4)	15 (78.9)	132 (90.4)	166 (88.8)
	No	3 (13.6)	4 (21.1)	14 (9.6)	21 (11.2)
Recording contractions per 10 minutes and every 30 minutes	Yes	18(81.8)	12 (63.2)	127 (87.0)	157 (84.0)
	No	4 (18.2)	7 (36.8)	19 (13.0)	30 (16.0)
Recording the administration of oxytocin and amount during labour	Yes	18(81.8)	12 (63.2)	129 (88.4)	159 (85.0)
	No	4 (18.2)	7 (36.8)	17 (11.6)	28 (15.0)
Recording of drugs and IV fluids given	Yes	18(81.8)	12 (63.2)	129 (88.4)	159 .(85.0)
	No	4 (18.2)	7 (36.8)	17 (11.6)	28 (15.0)
Recording the temperature of the mother	Yes	16(72.7)	14 (73.7)	134 (91.8)	164 (87.7)
	No	6 (27.3)	5 (26.3)	12 (8.2)	23 (12.3)
Recording the mother's pulse	Yes	16(72.7)	14 (73.7)	130 (89.0)	160 (85.6)
	No	6 (27.3)	5 (26.3)	16 (11.0)	27 (14.4)
Recording Cervical dilatation every 4 hours	Yes	17(77.3)	11 (57.9)	128 (87.7)	156 (83.4)
	No	5 (22.7)	8 (42.1)	18 (12.3)	31 (16.6)

Recording the position of the fetus every four hours	Yes	18 81.8)	14 (73.7)	135 (92.5)	167 (89.3)
	No	4 (18.2)	5 (26.3)	11 (7.5)	20 (10.7)
Recording the presence or absence of cervical oedema every 4 hours	Yes	18(81.8)	13 (68.4)	125 (85.6)	156 (83.4)
	No	4 (18.2)	6 (31.6)	21 (14.4)	31 (16.6)
Recording fetal head descent every 4 hours	Yes	18(81.8)	12 (63.2)	127 (87.0)	157 (84.0)
	No	4 (18.2)	7 (36.8)	19 (13.0)	30 (16.0)

Chi-square was performed to establish any relationship between the level of adherence to partograph protocols and neonatal mortality, as shown in Table 7. Level of adherence to partograph protocols such as Recording contractions per 10 minutes and every 30 minutes (p-value=0.028), Recording the administration of oxytocin and amount during labour (p-value=0.014), recording of drugs and IV fluids given (p-value=0.014), the Recording temperature of the mother (p-value=0.006), Recording the mother's pulse (p-value=0.038), Recording Cervical dilatation every 4 hours (p-value=0.003), Recording position of a foetus every four hours (p-value=0.022) and Recording fetal head descent every 4 hours (p-value=0.028) were significantly associated with neonatal mortality as detailed in table 7.

Table 7 Association between Neonatal Deaths and Adherence to Partograph

Adherence to Partograph	**Pearson Chi-Square**	**df**	**p-value**
Availability of partograph protocol (Posted on the wall or table)	5.154	2	0.076
Assessing and recording moulding caput formation	2.361	2	0.307
Recording contractions per 10 minutes and every 30 minutes	7.172	2	0.028
Recording the administration of oxytocin and amount during labour	8.586	2	0.014
Recording of drugs and IV fluids given	8.586	2	0.014
Recording the temperature of the mother	10.287	2	0.006
Recording the mother's pulse	6.534	2	0.038
Recording Cervical dilatation every 4 hours	11.461	2	0.003
Recording the position of the fetus every four hours	7.672	2	0.022
Recording the presence or absence of cervical oedema every 4 hours	3.641	2	0.162
Recording fetal head descent every 4 hours	7.172	2	0.028

3.5. Institutional challenges confronting neonatal care in health facilities

More than half of the respondents indicated that they experience leadership challenges such as improper communication, non-involvement of unit heads in decision-making, poor leadership style, role conflicts, poor weak supervision, inadequate provision of essential resources needed, and inadequate monitoring in charge of neonatal care. Many points out the issue of prioritization of interest by some health practitioners and managers:

We do not experience leadership challenges in this hospital; we are always one, there is good teamwork, and we support each other; we have a sound system of supervision and monitoring of all cases. The only issue is the interest of other health providers who are not midwives **(IDI – 43-year-old female respondent, In-charge).**

Yes, we have some leadership challenges in this facility, which is very key in every institution; for example, we have communication and role conflicts issues, are not involved in decision-making, and sometimes make work difficult. Managers do not consider the needs of the unit as a priority. When addressed, such challenges can go a long way to save a baby. **(IDI – 38-year-old female respondent, Senior Midwife)**

On how these challenges can be addressed, most of the participants suggested frequent engagement with leadership in their facilities, conducting a general meeting with leaders, and addressing prevailing issues concerning the unit. Also, management or leadership should consider the availability of essential resources as a priority:

Yes, it is so important; we normally conduct weekly meetings with management and discuss all issues, even bad leadership styles, which may affect my unit in delivering safe and effective health care for neonatal. Most of us, my colleagues, know our job role because of experience, but sometimes the approach of leadership makes us look like interns; we must be regarded as Senior Member

(IDI – 53 -year-old female respondent, In-Charge)

Also, respondents indicated that the unavailability of essential resources is a major factor contributing to neonatal mortality. Lack of logistics such as medical laboratory services, drugs, ambulance, and available incubators was mentioned as essential resources contributing to neonatal mortality. Also, lack of dedicated staff, unavailability of follow-up teams, staff motivation, Poor skills and low competency of service providers were identified as factors contributing to neonatal mortality:

I wish I could take you around; not necessary; however, we used to have essential resources such as incubators and drugs. Some essential drugs, with chlorhexidine as an example, are mostly unavailable. We have, on countless occasions, written and requested such items but, unfortunately yet to receive a favourable response. I believe we could save many lives if these resources are in place and functioning. Again, most of our lab requests, like TPHA (syphilis), G6PD and serum bilirubin (neonatal jaundice), are sent to private labs since the facility lab does not have the logistics to run such tests.

(IDI – 48 -year-old female respondent, Midwife)

On the concept of capacity-building programs, many respondents indicated that frequent participation and exposure to capacity-building programmes would help sharpen health providers' skills in neonatal cases and reduce neonatal mortality. Frequent involvement and participatory programmes such as; the Making every baby Count Initiative (MEBCI), Helping Babies Breath (HBC), Kangaroo Mother Care (KMC), Emergency Obstetric and Neonatal Care and Essential New-born care were indicated as good measures in reducing neonatal mortality:

Weekly and monthly capacity-building programs are good, and we must do more. I believe this is an effective tool to sharpen the skills of midwives. Training on the best practices, such as KMC, and MEBCI techniques, will help reduce neonatal mortality. Again, leaders who join training should do their best to disseminate the information acquired to other staff.

(IDI – 53 -year-old female respondent, In-Charge)

We often do drills and clinical presentations and challenge ourselves with new techniques. The failure of information dissemination by our superiors after they have attended workshops is also a challenge since new ideas/techniques do not get to us.

(IDI – 32 -year-old female respondent, Midwife)

Those of us in the rural areas hardly get involved in capacity-building programs; it must be brought to the rural areas for us to benefit; everything is done in Sunyani, the regional capital, which is bad!

(IDI – 41 -year-old female respondent, Midwife)

I have benefited greatly from capacity-building programs such as the Safe Motherhood Program and Helping Babies Breath. I have learnt and gained much experience. More of this will help reduce neonatal mortality. Similar programmes must be initiated by the

Regional Health Directorate to aid sustain the newborn care programmes

(IDI – 39 -year-old female respondent, Midwife)

On the monitoring and evaluation systems needed to reduce neonatal mortality, the study found an absence or weak supervision, mentoring, and monitoring systems in most of the facilities. The study further explored that effective monitoring and evaluation systems were practised more at private Hospitals as compared to the government hospitals:

We do not even have laptops and computers to document issues relating to neonatal mortality. With proper monitoring and evaluation systems, neonatal cases can be well documented and followed up. In this facility, we do manual reporting of cases and hardly will you see a dedicated staff following up. Also, senior managers only come here to check on us when they need reports, but I think they should regularly visit to check on how we manage the various neonatal cases to give their input rather than just coming in for reports.

(IDI – 39 -year-old female respondent, NICU In-Charge)

For my hospital, the doctor in charge and matron pay us periodic visits and responds to our calls and needs as soon as possible. We do not have challenges when it comes to supervision and monitoring**.** Their presence alone serves as a source of motivation to us.

(IDI – 36 -year-old female respondent, NICU In-Charge)

Also, poor quality of data collations, thus data either incomplete or inaccurate on neonatal mortality by health providers, were factors identified to affect monitoring and evaluation systems:

The facility normally relies on little experience to enter and analyze data. You may witness all sorts of papers pasted on the walls, making it difficult to retrieve documents when needed. Me, I think we need training and support in generating good quality data as far as neonatal mortality is concerned. The workload also makes it very difficult to complete most of our reports.

(IDI – 51 -year-old female respondent, Midwife)

Respondents, therefore, suggested the need to strengthen integrated supportive supervision and reinforce maternal and perinatal death audits and mentorship at all levels:

It is teamwork; there is a need to support each other. We need to strengthen the supportive supervision system and conduct several maternal and perinatal death audits to help us know the causes of such unfortunate incidents and address them. Mentorship is key and must strengthen at all levels of care.

(IDI – 35 -year-old female respondent, In-Charge)

4. Discussion

4.1. Human Resource factors influencing neonatal mortality

The first objective was to establish human resource factors associated with neonatal mortality. The field data revealed that most health workers were females with a mean age of 28 years (in the 26-35 age category). Most health workers were single and principals, with seniors and others with more than four years of working experience following closely. Christians dominated among the health workers. Some of the respondents had no position. Others were, however, unit and facility in charge.

Most of the participants were midwives (48.6%), followed by medical officers (31.4%) and ward assistants (20.0%). This is in line with the finding of Galal and Al-Gamal (2014)[12], which states that the presence of health workers with midwifery skills during childbirth and critical emergencies that demand referral is an advantage in reducing neonatal mortality.

About 43.5% of the participants had 4-7 years of working experience. Regarding the availability of functional incubators, the results showed that 20.90% of facilities had no incubators to manage neonatal cases. However, 79. 1.1% indicated that they had more than two functional incubators. On capacity building training programs, close to half of the participants (40.5%) indicated that they had not had any form of training on the "Making Every Baby Count Initiative (MEBCI)," Moreover, this was found to be significant among the assessed districts. Most participants (77.3%) recruited from the Jaman North district had not been trained on MEBCI as compared to that of the Berekum (63.2%) and Sunyani

Municipality (40.5%). On the training of Partograph Capacity, the majority (83.2%) stated that they had already been trained in using partograph similar to Opiah, Bola, Ekere and Monjok (2012). A cross-sectional study to assess the awareness and usage of partograph among midwives in the Niger Delta region of Nigeria. The findings revealed that 86.2% of respondents had some partograph training while in midwifery schools, but 13% said they had not been trained. About 38% of the participants suggested they have had other capacity training such as Helping Babies Breath (HBB), Kangaroo Mother Care (KMC), Emergency Obstetric and Neonatal Care hygiene, and Essential Newborn care.

In univariate and multivariate regression analysis, the results depict that Human resources variables such as age, a cadre of staff, working experience, presence of functional incubators, and capacity-building training were more likely to be determinants influencing neonatal mortality cases among the selected health facilities in the Bono Region. Interestingly, hospitals in the region were 29.57 times more likely to identify and report neonatal mortality cases than CHPS compounds (Adjusted OR= 29.517, 95% CI = 0.47 - 1860.096). Neonatal mortality cases were 2.7 times more likely to be reported in Berekum and 0.13 less likely in the Sunyani Municipality as compared to Jaman North district (Adjusted OR= 2.719, 95% CI = 0.373 – 19.845) and (Adjusted OR= 0.132, 95% CI = 0.022 – 0.782). Private health facilities were also 1.25 times more likely to identify and report neonatal cases than government health facilities (Crude OR= 1.252, 95% CI = 0.574 – 2.73). The results showed that health facilities with one functional incubator were ten times more likely to identify and report neonatal mortality than those without one (Crude OR= 10.096, 95% CI = 2.83 – 36.08). On capacity training, the results showed that MEBCI-trained participants were 1.08 times more likely to report neonatal mortality than untrained ones (Crude OR= 1.077, 95% CI = 0.577 – 2.01). Partograph capacity trained were also 1.43 times more likely to report neonatal mortality than those without training (Adjusted OR= 1.428, 95% CI = 0.275 – 7.407), and those with other capacity training were 1.24 times more likely to report neonatal mortality. (Crude OR= 1.235, 95% CI = 0.659 – 2.312).

This level of training in neonatal healthcare-related activities is similar to the observations of Brathwaite et al. (2020), in their work "Evaluation of two new-born resuscitation training strategies in regional hospitals in Ghana." A Tanzanian study conducted by Msemo et al. (2013)[13] revealed that the provision of new-born resuscitation, specifically by skilled birth attendants trained in Helping Babies Breathe (HBB), reduced neonatal mortality by 47 per cent (Msemo et al., 2013). Although numerous concepts (MEBCI, HBB, KMC) are available for capacity building of health workers, the level of training remains inadequate; stakeholders must, therefore, endeavour to acquire the needed resources to train health workers.). The study's findings showed that more than 16% of respondents had no form of training on partograph. It is in line with a finding made in South Africa by MethibeNekeJ.M, Lebeko F.L, and Motupab, which revealed that 38 percent of midwives reported that they had never attended an in-service partograph use education [14] which is uncalled for and unacceptable as it is a recommendation to be used in all labour situations.

4.2. Adherence to referral protocols

Objective two sought to assess the adherence to referral protocols by the district using WHO/GHS guidelines and its association with neonatal mortality. The findings reveal that 84.0% of the participants had copies of the referral policy guidelines. However, copies of the referral guidelines were unavailable to some Berekum Municipal participants (36.8%) during data collection. More than half of the participants (71.7%) admitted to being familiar with GHS referral policy guidelines.

Referral log books/registers were seen on the desk of most participants (86.1%). The study found that most participants (85.0%) documented and kept duplicated copies of the referrals in the logbook/register. The study further found that most participants (83.4%) did practice advanced booking at the receiving health facility for referred cases. Most participants acknowledged the availability of feedback mechanisms (69.5%) and emergency transportation systems (83.4%). The findings further show a significant association between referral protocols, such as the availability of referral policy guidelines of Ghana/GHS, familiarity with GHS referral policy guidelines, availability of emergency transportation system and neonatal mortality in some health facilities in Berekum and the Sunyani Municipal with a (p-value <0.05). This contradicts the findings of "Phiri et al. (2014)" [15], which revealed high non-adherence to referral protocols in Ghana and was attributed to the unavailability of standard referral protocols, lack of feedback and transportation mechanisms, lack of communication from the referral facilities, and health care providers unwillingness to follow patients to the receiving facilities. The finding aligns with Austin et al. (2015)[16] study on assessing barriers to providing quality emergency obstetric care in Addis Ababa, Ethiopia, which did show that health providers were well abreast with the referral guidelines. The documentation was well done, with copies of every process of documenting information well filed. However, communication, limited availability of transportation, and coordination were identified as hindrances.

This means there is an improvement in the adherence to referral protocols in the assessed districts using WHO/GHS guidelines compared to other districts in Ghana and sub-Saharan Africa. This contributes to the achievement of the goals of the Ghana National Newborn Health Strategy and Action Plan (2014 – 2018) [8] that sought to reduce the neonatal mortality rate from 32 per 1000 live births in 2011 to 21 per 1000 live births in 2018, presenting a 5% reduction in neonatal mortality per annum.

4.3. Adherence to partograph protocols

Equipping health workers directly involved with maternal and newborn care to better decipher and act promptly on partograph usage and reinforcing the referral framework is required to guarantee quality care for both mother and baby [17]. Objective three sought to assess the adherence to Partograph (using WHO/GHS guidelines) by health providers directly involved in Newborn care in the districts and Municipals. Adherence, in general, was 86.1%. This is similar to the partograph used in Nigeria, about 86% [18]. The study shows a significant relationship between adherence to partograph and neonatal mortality. Adherence to partograph protocols such as recording contractions per 10 minutes and every 30 minutes, the administration of oxytocin and amount given during labour, drugs and IV fluids given, temperature and the pulse of the mother, cervical dilatation every 4 hours, position of a fetus every four hours and recording fetal head descent every 4 hours were found to be significantly associated with the district of various participants (p-value<0.05). It implies that health workers of hospitals within the district adhere to protocols as compared to those at the health centres and CHPS compounds. This is a good strategy to reduce neonatal mortality in the district. The findings are, therefore, similar to that of Assifua (2018)[19] study on knowledge and utilization of partograph by midwives in public health facilities in the Cape Coast Metropolis. Assifua found that though the health workers feel that completing the partograph is more time-consuming, most (78%) midwives have a fair knowledge of the partograph and its necessity in managing labour. Over 97% of the midwives also reported using the partograph to monitor mothers' progress during labour.

4.4. Institutional challenges confronting Neonatal Mortality

The fourth objective was to examine neonatal care's institutional challenges in health facilities. The qualitative study found out that the majority of the respondents do experience leadership challenges such as improper communication, non-involvement of unit heads in decision making, poor leadership style, role conflicts, poor supervision, inadequate provision of essential resources needed, and inadequate monitoring by the personnel in-charge of neonatal care. Many point out the issue of prioritization of interest by some health practitioners. This confirms the findings of Fotso et al. (2006) [20] that leadership challenges, availability of essential resources, health-strengthening interventions such as capacity building, and monitoring and evaluation were the main institutional challenges confronting neonatal care in health facilities. The study's findings also added role conflicts, improper communication, and non-involvement of unit heads in decision-making as institutional challenges confronting neonatal care in health facilities.

The field data also revealed that the unavailability of essential resources is a major factor influencing neonatal mortality in their facility and district, as indicated by most respondents. The lack of logistics was listed, such as medical laboratory services, drugs, ambulance, and functional incubators. Lack of human resources such as dedicated staff, unavailability of follow-up teams, staff motivation, poor skills, and low competency of service providers influenced neonatal care in the district. On the other hand, inadequate capacity building programs, absence or weak supervisory, mentoring, and monitoring systems in most health facilities and poor quality of data collations affect neonatal mortality in the district.

This was in line with the study of Narang et al. (2015) [21] in Delhi, India, on predictors of mortality among neonates transported to referral centres. They discovered that ambulances carrying patients to referral centres were few, and most patients rely on private vehicles such as hired taxis/tempos and public transport such as trains and buses. Even among those who were transported by ambulances, there was no equipment for resuscitation or warming, while a clinical note did not even accompany others. Similarly, Galal and Al-Gamal (2014)[12] found that the availability of health workers with midwifery skills at childbirth, supported with transport in case of emergency referral, is the most critical health factor associated with neonatal mortality. Esena and Sappor (2013)[22] added that the poor attitude of health workers accounts for neonatal mortality, while Moyer et al. (2012)[23] found in their analysis that an enabling atmosphere at different levels of the healthcare system, sufficient resources, facilities, and an efficient and successful referral network, backed by supportive policy and regulatory framework, affect neonatal death.

5. Conclusion

Human resource factors such as participants' districts influenced neonatal mortalities, and adherence to referral protocols was also associated with neonatal mortalities, particularly with WHO/GHS guidelines. Institutional challenges facing neonatal care include leadership challenges, non-involvement of the unit head in decision-making, poor

leadership style, role conflicts, weak supervision, inadequate provision of resources, lack of logistics, human resources, follow-up teams, staff motivation and poor skills, low competency of service providers, inadequate capacity building programmes, absence or weak supervision, mentoring, and monitoring systems, and poor quality of data collations.

Compliance with ethical standards

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Authors' contributions

This work was carried out in collaboration with all authors. Author RAB carried out protocol design, data collection and analysis. AMK, DPT, PPAB, DDO and DNKBAB participated in data analysis, manuscript editing and proofreading. OV assembled the manuscript and performed corrections. JA conducted proofreading, and DKAM supervised the entire project, from protocol designs, data collection, and data analysis and manuscript submission.

Disclosure of conflict of interest

All authors declared no conflict of interest in this paper.

Statement of ethical approval

Ethical approval was obtained from the Ethics Review Board of CHRPE reference number CHRPE/AP/196/20 to undertake the study. Also**,** administrative permission was sought from the Reginal Health Directorate, Bono and Jaman North District health directorate, Berekum Municipal, and Sunyani Municipal.

Statement of informed consent

All participants were informed of their freedom to freely agree to or deny involvement in the research and their ability to discontinue participation without repercussions. After being briefed on the study's objectives and their respective responsibilities, all participants were treated fairly.

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