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Addressing contemporary public health challenges in Ghana for improved outcomes: getting to SDG 3

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Addressing contemporary public health challenges in Ghana for improved outcomes: getting to SDG 3

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Editorial: Addressing contemporary public health challenges in Ghana for improved outcomes: getting to SDG 3

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Editorial on the Research Topic
Addressing contemporary public health challenges in Ghana for improved outcomes: getting to SDG 3

Introduction

As the world moves forward in its efforts toward the Sustainable Development Goals (SDG) targets in 2030, decision making and implementation for public health programs to promote, restore, maintain, and improve health outcomes needs to be informed by research evidence generated at local as well as international levels. The need is imperative as the low- and middle-income countries (LIMC) disease burdens evolve from the traditional recognized patterns of mainly communicable diseases and maternal and child health problems to an increasingly sophisticated triple burden incorporating non-communicable diseases (1–4). This supplement's topic therefore aimed to attract a collection of articles mainly but not exclusively related to learning from Ghana, an LMIC in Sub-Saharan Africa's, research experience; to draw lessons for Ghana as well as the wider global community and especially for similarly placed countries in terms of contemporary health challenges and dilemmas as to how to best address them. The focus on an LMIC also had the dual aim of encouraging and promoting LMIC led research and innovation as part of strengthening LMIC capacity and leadership for research to respond to contemporary health challenges. Though the call and focus of this special supplement was on Ghana, two papers are included in the supplement from research in China and Taiwan in East Asia, given the relevance of the themes to contemporary public health in Ghana.

Conceptual/theoretical framework

The conceptual/theoretical framework within which the papers in this supplement are categorized draws on the concepts of health systems and the core functions of public health. Public health deals with the concern of societies to ensure the conditions in which people can be healthy. The UN's Sustainable Development Goal 3, "ensure healthy lives and promote wellbeing for all at all ages" depends on the effective execution of the core

functions of public health for its success. Drawing on the 1988 IOM report (5), we used the concept of assessment (gathering the evidence about the state of health of the population, how and why and the conditions in which populations can stay healthy), assurance (putting in place the service, programs, and interventions to promote, restore and maintain health), and policy development (making of decisions that become authoritative for communities and societies to ensure the promotion, restoration, and maintenance of health) as the three core functions of public health; to categorize the papers in this supplement.

We additionally drew on the WHO definition of the health system as referring to all institutions, actors, processes, and actions whose primary intent is to promote, restore and maintain health and contemporary constructs of the health system that go beyond the traditional WHO building blocks and take a social constructivist perspective that recognizes that health systems are social and complex adaptive systems. How the building blocks are structured and function and how the core functions of public health are executed; and the resulting outcomes are influenced by people, their values, interests, ideologies, power, and use of power to influence processes (Figure 1).

Within each category of the categories related to the core functions of public health, we explore whether there is an underlying focus related to the increasingly triple burden faced by LMIC of maternal and child health, communicable, and non-communicable disease.

Assessment

Of the five papers in the assessment category, all the three papers from West Africa are related to maternal and child health. Salifu et al. (6) evaluate the change in two survey periods of anemia and predictors and contributors to observed trends in Ghana, Sierra Leone, Mali, and Benin. Afagbedzi, Alhassan, Alangea et al. assess maternal factors and child health conditions associated with preterm births. Owusu et al. conduct a district level analysis of the relationship between socio-demographic factors and the COVID-19 pandemic in two regions of Ghana. one paper and another explore maternal factors and child health conditions at birth that are associated with preterm deaths in a tertiary health facility in Ghana. He et al. present findings from an exploration of factors influencing works stress of medical workers in clinical laboratories in China during the COVID-19 pandemic. Their findings confirm the high levels of stress that health workers in the front line of management of a pandemic face and the need to pay attention to reducing the stress on frontline health workers in a health security crisis. Guo et al. present the development of an estimation method for distance cost to access medical services and the policy and patient privacy implications in Taiwan.

Policy development

The two papers in the supplement are related to the policy development function of public health. Both papers explore the issues in relation to maternal and child health. Agblevor et al. present the results of an exploratory and explanatory study of gaps in implementation of the Ghana Adolescent Health Service Policy and Strategy (2016–2020) and how and why context influenced the observed gaps. Ayim et al. explored local government policy and resource disbursements to support health in the context of decentralization in two districts in the Volta Region of Ghana.

Assurance

The largest number (7) of the papers are related to the assurance function of public health, and involve evaluation of services, programs and interventions in place to promote, restore and maintain health. Karamagi et al. explore lessons from Ghana on how to assure that districts are functional for UHC attainment. Koduah examines factors that enabled the prioritization and implementation of selected pharmaceutical reform items and how these contributed to improving equitable access to medicines and universal health coverage in Ghana. Elsey et al. in a historical and systematic review of the Community-based Health Planning and Services [CHPS] program in rural and urban Ghana, explore what works for whom and why, observing that despite renewed

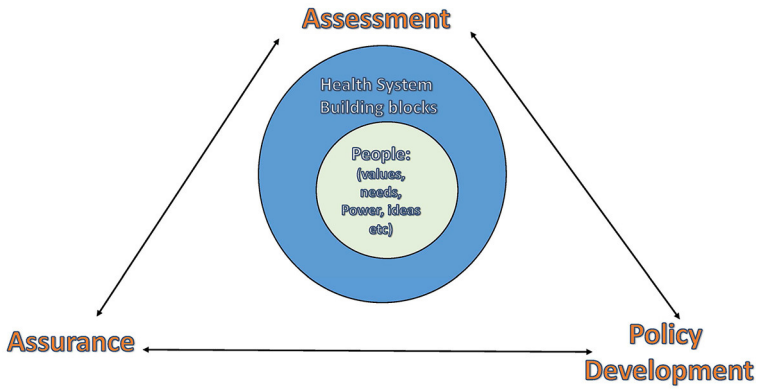

FIGURE 1
Framework for organizing the papers in the supplement.

emphasis on strengthening primary health care globally, it remains under-resourced across sub-Saharan Africa. Awumee and Dery study continuity of care among diabetic patients in Accra, Ghana and it is one of the few papers that looks at a non-communicable disease issue. The use of Long-Lasting Insecticide Nets (LLINs) has been recognized and prioritized as a major intervention for malaria prevention in Ghana. Afagbedzi, Alhassan, Kenu et al. explore the factors influencing the universal coverage and utilization of LLINs in Ghana drawing on data from a cross-sectional survey. The disease focus is thus communicable diseases. Aberese-Ako et al. explore the role of community engagement in COVID-19 management in two Ghanaian municipalities.

Taken together, the collection of articles in this special supplement, bring out the importance of focusing on the increasingly multi-dimensional nature of evolving disease burdens and therefore policy and program priorities in LMIC like Ghana. Without neglecting the traditional priorities of maternal and child health and communicable disease such as malaria in research, policy and program agendas; disease of epidemic potential as well as non-communicable diseases increasingly need more attention.

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Estimation method for distance cost to access medical services: Policy and patient privacy implications in Taiwan

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Introduction: Indicators of healthcare access with high reliability, validity, timeliness, and easy application can aid in an understanding of the supply and demand of a region's medical resources and assist governments in allocating resources more effectively. However, a key concern when developing indicators is the protection of private information, such as patients' residential addresses.

Objectives: We develop an estimation method for distance cost using official public information, including a region's disease prevalence rates and population.

Materials and methods: The method accounts for patients' privacy and addresses limitations associated with using the National Health Insurance Database. This cross-sectional study conducts a secondary data analysis using SPSS and QGIS. The data were divided into a validation group and an index development group with the medical distance calculated for each group. Data for the validation group were sourced from the medical records of patients with diabetes ($n = 108–164$) and hypertension ($n = 243–348$) in Yuli documented by a medical center in 2017–2019, and the data for the novel index development group included diabetes and hypertension prevalence sourced from national official public data. The study compared the consistency of the two groups' medical treatment distances to verify the accuracy of the estimation method.

Results: The estimated distances for the index development group showed a high consistency (ICC > 0.9). Further, the index development group had an excellent R-square after adjusting for age (98.1%) and gender (92.7%).

Conclusions: The proposed method to estimate healthcare on the basis of disease prevalence and population protects patient privacy and can be implemented by local governments.

Trial registration: This study was approved by the Research Ethics Committee of the Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (IRB109-239-B).

KEYWORDS

distance cost, medical service access, patient privacy, QGIS resource allocation distance cost, QGIS resource allocation

Introduction

Taiwan's National Health Insurance system, implemented in 1995, has not only eased financial and economic barriers impeding healthcare access but has also contributed toward alleviating poverty resulting from illness. However, numerous studies have highlighted inadequate or unequal medical resources in Taiwan's remote areas despite the health insurance system (1–3). The Taiwanese government has been making efforts to gradually improve the uneven distribution and inconsistent quality of medical care through the regionalization of healthcare since 1985. Yet, there are still serious concerns about the insufficient and unequal distribution of medical care resources in rural areas and the long distance between doctors and those seeking medical care.

Decision makers for healthcare policies largely adopt the number of specialist medical personnel, the number of hospital beds and the ratio of medical services to a region's population as indicators of medical care access, none of which require geographical information (4–9). Other accessibility indicators include the distribution density of medical resources, distance to medical institutions, travel duration and individual medical care needs. These indicators require patients to provide geographical and private information, which are used for parametric inferential statistics. These indicators relate to the more critical issue of the justice and equity of resource allocation (3, 10, 11).

Studies have shown that distance impacts the utilization and demand for medical services, as when the distance between consumers and medical providers or the time required to access medical care are greater, medical utilization and demand are lower (12, 13). Therefore, the accurate measurement and appropriate configuration of regional medical care services are necessary to effectively improve healthcare services.

Actual medical distance can be measured on the basis of patients' residence and terrain or transportation route from residential location to a medical institution. In addition, it is necessary to account for other factors influencing access to medical resources in a region such as time taken to receive treatment, particularly during rush hour.

The indicators of the two-step floating catchment area (2SFCA) and enhanced 2SFCA (E2SFCA), developed between 2005 and 2016, require spatial information as well as patients' personal data such as age, gender, race, income, occupation and urban development information of patients' residence, thus rendering them tedious to implement (14–17). Lin et al. (2) and Yen and Lin (3) introduced significantly simplified indicators, although they also used the distance between the patient residence and healthcare provider. Overall, 2SFCA and E2SFCA were developed by many variables which are usually privacy information. They are non-accessible and have no immediacy for health policy. The indexes developed by Yen and Lin et al. are briefer, but still, need the address of the patient which is also private data. So in the decision maker's view, streamlined, instant, and accurate distance cost metrics are very important. In sum, where the patient lives is critical for accurately estimating the distance cost (2, 3).

Developed democracies have implemented privacy laws to protect personal information as a fundamental human right. Taiwan's National Health Insurance Database has a 99% coverage rate and contains medical records and conditions, thus making it an important resource when estimating the utilization of and demand for healthcare services. Taiwan's Personal Data Protection Act (18) applies across both the public and private sectors. The National Health Insurance Database lacks social factors and documents a patient's address only at the regional level. In the past, the database was used to estimate the medical distance between hospitals and administrative regions, such as towns. However, for Hualian County, the estimation of distance between users and a medical caregiver is limited to the county's 13 towns. Such over-simplified and biased information impacts the accurate estimation of distance cost for medical care, especially for remote areas where residents are highly dispersed. Hualien county, surrounded by mountains terrain and only 10% narrow range plain, with a total area of 4,628 square kilometers is the largest county in Taiwan. Compare to the capital in Taipei city has 9 medical centers, Hualien county has only one (Hualien Tzu Chi Hospital). According to the Central Health Insurance Agency of the Ministry of Health and Welfare, 7 towns out of 13 in Hualien County are included in the "77 Areas Lacking Medical Resources of the National Health Insurance in 2022" (19). Distance barriers are one of the factors contributing to health inequalities, and accurate and immediate calculation of distance costs will better reflect government subsidy needs than population numbers.

Thus, there is a need to develop a method that accurately estimates the cost of the distance between users and medical care providers and that uses more valid indicators than a patient's Insured unit registered by health insurance at the administrative or "township" level and that does not require the patient's exact address. Given that the population is not uniform within a township, but rather is clustered and randomly distributed, using a weighted center of population, which combines populations and geographical centers, allows for a more accurate calculation of travel distance (20), especially in remote regions with uneven population density. The proposed method will also protect patient privacy and address the limitations of various databases that use location variables at the townships level.

Diabetes and hypertension are highly prevalent chronic diseases in eastern Taiwan. This study focuses on patients with diabetes and hypertension, as these conditions have high rates of serious complications, including cardiovascular disease, stroke, skin ulceration, retinopathy, neuropathy, kidney failure and amputation (21). In 2019, diabetes was the fifth leading cause of

death in eastern Taiwan, and about 50% of all diabetic patients die from heart disease and stroke. Referencing official data on the prevalence of the diseases and area populations as an index development group, we used the number of cases and their distance to medical treatment as key variables when developing the estimation method and used real outpatient data from a medical center to calculate the actual medical distance for a verification group and compared the two methods. We apply the proposed method to demonstrate its accuracy in estimating distance cost. In the future, this new method can be used in further surveys to provide a highly precise distance cost index. In this study, we choose Yuli as our target area is because of we found that the prevalence of diabetes and hypertension increased at a significantly higher rate in Yuli Township than in Hualien from 2017 to 2019.

In conclusion, this study was conducted because of the increasing importance of human rights and national privacy in countries around the world. In particular, personal medical records and residential addresses are highly personalized, so obtaining legal use must go through very complicated administrative procedures or obtain national consent. In Taiwan, there is Taiwan's Personal Data Protection Act to regulate the use of data, and local governments have to spend a lot of time and money to obtain the data, which is often not available in time to meet the reference for decision making in resource allocation. Therefore, we hope to develop a in time method in the present study that is derived from publicly available data, and to confirm its reliability.

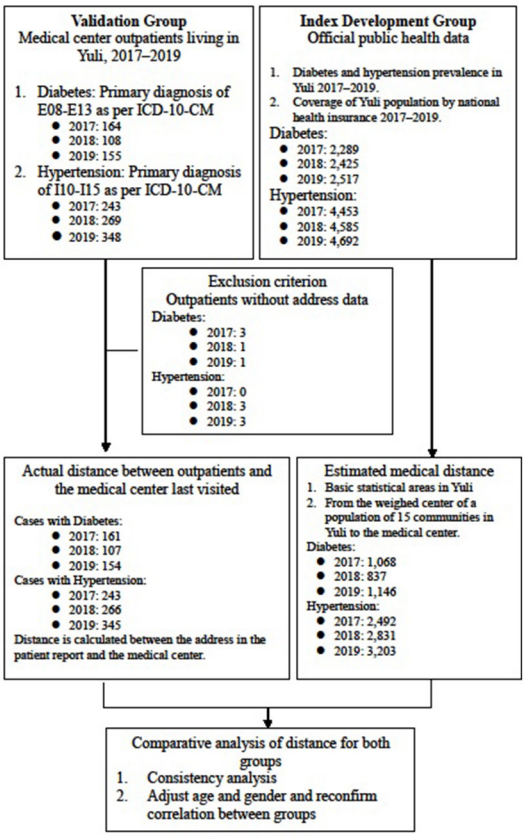

FIGURE 1
Study framework.

Materials and methods

Figure 1 illustrates the framework of this cross-sectional study. We compared the medical distances recorded by the novel index development group and a validation group. For the index development group, we estimated the distance cost using 2017–2019 data on diabetes and hypertension prevalence in Hualien County and the number of patients in the county's Yuli Township. In addition, we use official public data from Taiwan's National Statistics. For the validation group, we obtained the 2017–2019 data for patients with diabetes and hypertension from one medical center in Hualien City and used the real data to calculate the average medical distance.

We conducted a multiple regression analysis and used intra-group correlation coefficients (ICC) to compare the average distance from the weighted center of the population in every statistical area to Tzu Chi Hospital in Hualien. Hualien Tzu Chi Hospital is the only medical center in Hualien County, also in eastern Taiwan which is located in north Hualien city and is responsible for many critical care tasks in eastern Taiwan. Trial registration: This study was approved by the Research Ethics Committee of the Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (IRB109-239-B).

Methods, participant characteristics and variable/concept definitions

Specific nominal definitions

1. As per the ICD-10-CM, we defined diabetes mellitus as categories E08–E13 specified in the first three codes as a primary diagnosis in the outpatient prescription and treatment details.
2. As per the ICD-10-CM, we defined hypertension as categories I10–I15 in the first three codes of the outpatient prescription and treatment details.
3. The Statistical Office of the Ministry of the Interior builds different release area concepts based on cumulative synthesis, the minimum statistical area is the basic spatial unit for data collection, factors such as area, house number, and population (150 to 450 people) are used as the standard for measuring the level of detail, which is much more detailed than the data in the past that used townships and urban areas as the statistical unit. Figure 2 shows the various levels of spatial units. Basic statistical areas include communities, villages, and other smaller spaces. Towns

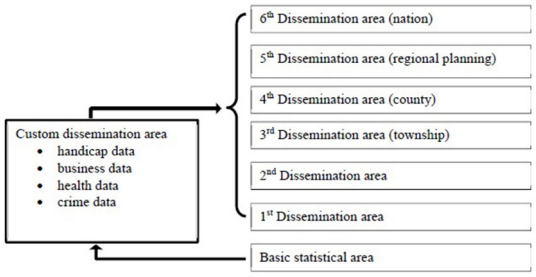

FIGURE 2
Geographical statistical classification of spatial units as per [20].

are generally considered the first level of dissemination area. Cities, counties, and other administrative areas are categorized as second or higher levels of dissemination areas. This study focuses on communities as a spatial unit and accordingly, estimates the number of basic statistical areas in a community using data from the National Development Council (NDC) (22).

Patient and public involvement: Patient and public involvement. The secondly data was used in this study

Index development group

For this group, we used official public data published 2017–2019 by the National Health Insurance Administration, Ministry of Health and Welfare and National Development Council. The data include population numbers and the prevalence of diabetes and hypertension in Yuli. There are "insurance population," "Living population" and "Prevalence" of diabetes and hypertensive that information are from Publicly Available Government Demographics and National Health Insurance Administration Ministry of Health and Welfare in Table 1. We used Living population * Diabetes and Hypertension Prevalence (official public data from National Health Insurance Administration Ministry of Health and Welfare) to get Estimated patient. Because the above 95% Living population is Insurance population that is high coverage, so we used it as insurance population to estimate the patients.

We estimated the number of persons with diabetes as 2,289, 2,425 and 2,517 and that of persons with hypertension as 4,453, 4,585, and 4,692 in 2017, 2018 and 2019, respectively (Table 1).

The disease prevalence is in order to estimate the patient number. We assume the total cost is the sum of the ***patient's number (n)* visit times * and the distance from their home to the hospital***. So in the further, when we can't get the real numbers of patients and their real addresses due to patient privacy, we can use the disease prevalence and total population to estimate the possible patient group in the area from public data.

Validation group

We obtained data on patients with diabetes and hypertension from outpatient records gathered 2017–2019 at the only medical center in Hualien County. We estimated the number of patients with diabetes as 4,294, 4,397 and 4,994 for each year, respectively. Patients who lived outside of Yuli or who did not have their address recorded were excluded. The final sample comprised 161, 107 and 154 patients. For hypertension, we estimated 10,141, 10,521 and 10,786 persons in 2017, 2018 and 2019, respectively. After excluding cases outside of Yuli and with missing address data, the final sample consisted of 243, 266 and 345 patients with hypertension (Table 2).

Data analysis

This study performed data collation and statistical analyses using QGIS 3.6, SAS statistical software 9.4 and SPSS Statistics 21.0. Statistical significance was considered at 0.05 for all tests. ArcGIS was used to visualize the data.

Spatial analysis

We conducted a spatial analysis to estimate and compare medical distance for the two groups:

1. For the index development group, we used official data on the populations in the basic statistical areas published by National Internal Affairs, Ministry of the Interior, to estimate the number of diabetes and hypertension cases in Yuli. Next, we calculated medical distance by measuring the actual distance from the center for each statistical area according to the road network. Finally, we used QGIS to establish an origin-destination matrix to analyze the distance cost of medical care from each statistical area to the hospital.
2. For the validation group, we calculated medical distance based on the outpatient addresses cited in medical records with focus on those living in Yuli's basic statistical areas. D is total distance is estimated as $D = \sum_{ij=1}^{n} dij$, where n is the patients' number, ij is means location, d_{ij} is the distance between those living in ij location and the medical center (Tzu Chi hospital).

We attempted to prove $D = \sum_{ij=1}^{ij=n} dij = \sum_{C=1}^{c=n'} n' * D'_c$, where d_{ij} is the distance between those living in ij location and the medical center (Tzu Chi hospital) (validation group) and D'_c is the distance between the center of the population and the medical center (Tzu Chi hospital) (index development group) (Figure 3).

Symbolic interpretation:

- D: is total distance is estimated
- N: is the patients' number,
- *ij:* patients' real live location

TABLE 1 The prevalence of diabetes and hypertensive from official public data in Yuli.

Years	Diabetes				Hypertensive			
	Insurance population	Living population[1]	Prevalence[2] (%)	Estimated patient[3]	Insurance population	Living population[1]	Prevalence [2] (%)	Estimated patient[3]
2017	23,643	23,725	9.65	2,289	23,643	23,725	18.77	4,453
2018	23,244	23,725	10.22	2,425	23,244	23,725	19.33	4,585
2019	23,008	23,725	10.61	2,517	23,008	23,725	19.78	4,692

3 = 1*2: "Living population * Diabetes and Hypertension Prevalence (official public data from National Health Insurance Administration Ministry of Health and Welfare) = Estimated patient.
Because the above 95% Living population is Insurance population that is high coverage, so we used it to estimate the patients.

TABLE 2 Characteristics of actual cases of medical center in our study: Verification group.

Year	Diabetes				Hypertensive			
	N	Age	Gender		*N*	Age	Gender	
		Mean ± SD	Male (%)	Female (%)		Mean ± SD	Male (%)	Female (%)
2017	161	64.16 ± 12.61	79 (48.17)	85 (51.83)	243	65.75 ± 14.84	104 (42.80)	139 (57.20)
2018	107	66.79 ± 11.41	58 (54.21)	49 (45.79)	266	67.00 ± 13.38	136 (51.12)	130 (48.88)
2019	154	64.54 ± 12.02	77 (50.00)	77 (50.00)	345	66.06 ± 13.87	168 (48.7)	177 (52.3)

- d_{ij}: is the distance between those living in *ij* location and the medical center (Tzu Chi hospital).
- c : the population center location
- D'_c : The distance between the center of the population and the medical center (Tzu Chi hospital).

Statistical methods

Percentage, mean and standard deviation were used to describe the data. We conducted a consistency analysis and used ICC to compare the distance cost between the two groups. Finally, we performed a multiple regression analysis while adjusting for age and gender to reconfirm the correlation between the two groups.

Results

Participant characteristics and potential population with diabetes and hypertension

Table 1 shows that the number of residents, obtained from demographic data by the Ministry of the Interior, was higher than the number of insured individuals. We used the resident population and the prevalence of diabetes and hypertension to estimate the potential patients in Yuli. The results revealed 2,289, 2,425 and 2,517 potential patients with diabetes and 4,453, 4,585 and 4,692 potential patients with hypertension in 2017, 2018 and 2019, respectively. Age and gender data for the population with diabetes, hypertension or any other disease are not publicly available.

Table 2 presents the age and gender for outpatients of the medical center for 2017–2019. The average age of patients with diabetes was between 64.16 and 66.79 years and the gender ratio was about 1. For patients with hypertension, the mean age was 65.75–67.0 years and the rates of female outpatients were 57.2, 48.88, and 52.3% in 2017, 2018 and 2019, respectively.

Table 3 presents data obtained from the Nutrition and Health Survey in Taiwan (23). We found that the prevalence of diabetes and hypertension increased at a significantly higher rate in Yuli Township than in Hualien from 2017 to 2019. The Nutrition and Health Survey shows that the prevalence of diabetes and hypertension during 2015–2018 in Taiwan overall was higher than the numbers recorded in Hualien and Yuli because the survey only included adults over 18 years old.

Medical distance cost for both groups

Yuli Township has a total of 15 communities. For each community, Tables 4, 5 show the number of basic statistical areas, medical distance and number of diabetes

and hypertension cases for both the validation and index development groups. We list the distance calculated by the real address of the same community (The validation group), and the results calculated by the estimation method developed in this study (The index development group), a comparison of these 3 years. The National Internal Affairs' open data platform lists 512 basic statistical areas. Among these, we found that potential patients with diabetes in both groups lived in 109, 84 and 110 areas in 2017, 2018 and 2019, respectively. The basic statistical areas in this study account for 21.3, 16.4, and 21.5% of the total number of areas. The average distance is estimated as the medical distance between the weighted center of population in each basic statistical area (our communities) and the medical center (Tzu Chi Hospital). The concept of basic statistical area have mentioned in Method Section.

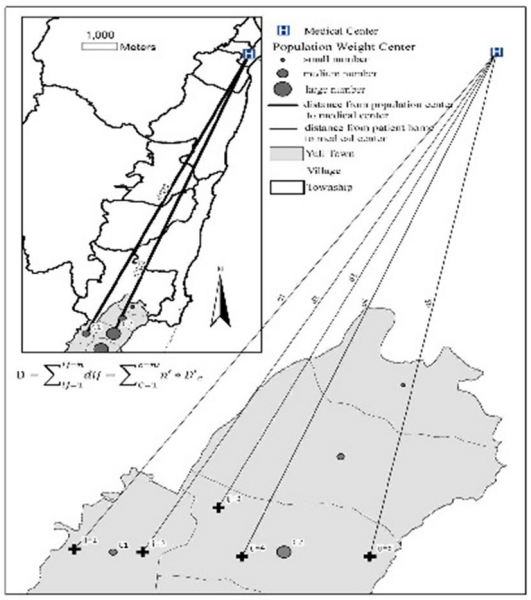

FIGURE 3
Graphical representation of the spatial analysis. D: is total distance is estimated; N: is the patient's number; *ij*: patients' real live location; d_{ij}: is the distance between those living in *ij* location and the medical center (Tzu Chi hospital). c: the population center location; D'c: the distance between the center of the population and the medical center (Tzu Chi hospital).

For the validation group, the Changliang community reported the longest medical distance to the medical center (92,068.66, 92,289.67, and 92,548.62 m), while the Dewu community showed the shortest distance (68,741.32, 68,728.55, and 70,798.78 m). Similarly, for the index development group, the Changliang (91,973.45, 92,863.08, and 92,548.62 m) and Dewu communities (68,752.27, 68,749.14, and 71,949.99 m) reported the longest and shortest distance.

The findings were similar for potential patients with hypertension. For the validation group, the Changliang and Dewu communities reported the longest and shortest medical distances. The longest distances were 91,050.87, 92,076.47, and 92,194.01 m and the shortest were 68,805.85, 68,482.54, and 68,607.77 m in 2017, 2018, and 2019, respectively. For the index development group, Changliang showed the longest distance (91,116.34, 92,101.98, and 92,162.57 m), while we observed the shortest distance for the Dewu community in 2017 (69,216.56 m) and 2019 (68,607.77 m) and for Chunri Vil in 2018 (70,894.40 m). The basic statistical areas chosen for this study account for 28.1, 30.7, and 36.1% of the 512 basic statistical areas during the three-year research period.

Accuracy of estimated medical distance

We used ICC to evaluate the accuracy of the estimated medical distance for the index development group. Table 6 shows the correlation of medical distance between the validation and index development groups for the cases of diabetes. Further, irrespective of whether we used the basic statistical areas or the 15 communities as the weighted center of population, we found high correlations between the two groups for all 3 years. ICC was >0.98 ($p < 0.001$) for the diabetes cases. Similarly, for

TABLE 3 Descriptive statistics of the prevalence rates of diabetes and hypertension in Hualian and Yuli 2017–2019.

Year	County	Hualien		Yuli		Taiwan[a]	
	Disease	Diabetes	Hypertensive	Diabetes	Hypertensive	Diabetes	Hypertensive
2017	N	318,449	318,449	23,643	23,643	9–11%	25.06%
	Prevalence (%)	7.07%	11.70%	9.65%	18.77		
2018	N	317,646	317,646	23,244	23,244		
	Prevalence (%)	7.02%	12.00%	10.22%	19.33		
2019	N	316,559	316,559	23,008	23,008		
	Prevalence (%)	7.29%	12.20%	10.61	19.78		

[a]The diabetes and hypertension prevalence of adults (≥18 years old) in Taiwan during 2015-2018 in NAHSIT (23).

TABLE 4 The actual and estimated distances between living in 15 communities of Yuli and medical center among patients with diabetes.

15 Communities	The total basic statistical area in the community (*n*)	Estimated case with Diabetes			2017				2018				2019			
					The basic statistical area (*n*) (%)	The validation group		The index development group		The basic statistical area (*n*) (%)	The validation group		The index development group		The basic statistical area (*n*) (%)	The validation group		The index development group	
		2017	2018	2019		Case (*n*)	Average distance (m)	Case (*n*)	Average distance (m)		Case (*n*)	Average distance (m)	Case (*n*)	Average distance (m)		Case (*n*)	Average distance (m)	Case (*n*)	Average distance (m)
Sanmin	51	94	99	103	4 (7.8)	4	76,359.57	24	76,281.24	3 (5.9)	3	77,238.89	14	77,091.61	4 (7.8)	4	75,866.52	23	75,866.52
Dayu	45	115	121	126	7 (15.6)	7	80,707.09	54	81,043.37	3 (6.7)	3	80,762.11	36	81,327.22	7 (15.6)	11	80,733.18	51	80,679.82
Zhongcheng.	76	598	634	658	32 (42.1)	54	85,647.58	346	85,679.41	25 (32.9)	39	85,619.84	279	85,648.10	30 (39.5)	47	85,692.95	367	85,702.83
Yongchang	19	141	150	156	9 (47.4)	17	84,182.87	93	84,181.27	4 (21.1)	4	83,984.65	38	84,077.72	4 (21.1)	6	84,191.34	45	84,171.59
Dongfeng	21	59	63	65	1 (4.8)	1	84,135.73	9	83,903.11	2 (9.5)	2	84,239.83	26	84,460.00	2 (9.5)	2	82,824.57	15	82,824.58
Songpu	35	168	178	185	7 (20.0)	9	74,186.73	64	74,900.54	6 (17.1)	7	75,237.49	52	75,512.68	8 (22.9)	9	73,998.18	81	74,006.44
Changliang	50	74	78	81	2 (4.0)	2	92,068.66	21	91,973.45	3 (6.0)	3	92,289.67	24	92,863.08	1 (2.0)	2	92,548.62	17	92,548.62
Chunri.	29	95	101	105	4 (13.8)	5	70,932.30	37	71,291.21	3 (10.3)	3	71,243.48	16	71,586.14	6 (20.7)	7	70,542.99	32	70,617.02
Taichang.	19	151	160	166	3 (15.8)	3	85,147.54	52	85,025.07	5 (26.3)	5	85,134.77	43	85,167.23	9 (47.4)	11	85,041.03	116	85,013.49
Qimo	26	181	192	199	9 (34.6)	15	84,557.03	97	84,564.63	6 23.1)	7	84,579.00	75	84,584.97	6 (23.1)	8	84,526.16	75	84,519.2
Guowu.	18	137	145	150	11 (61.1)	16	84,994.45	113	85,029.53	5 (27.8)	10	85,081.22	50	85,047.53	10 (55.6)	18	85,030.38	111	85,027.91
Yuancheng	49	128	135	140	9 (18.4)	12	87,436.29	78	87,400.96	5 (10.2)	5	87,484.84	59	87,724.74	4 (8.2)	5	87,593.85	39	87,654.48
Dewu	19	84	89	92	4 (21.1)	8	68,741.32	36	68,752.27	4 (21.1)	5	68,728.55	47	68,749.14	5 (26.3)	8	70,798.78	44	71,949.99
Lehe	24	104	110	114	5 (20.8)	5	89,740.39	34	89,510.18	2 (8.3)	2	92,705.79	21	91,939.76	6 (25.0)	8	89,385.27	59	89,671.42
Guanyin	31	160	169	175	2 (6.5)	3	78,639.23	11	83,401.98	8 (25.8)	9	79,372.56	57	80,302.28	8 (25.8)	8	79,372.00	70	79,372.00
Total	512	2289	2425	2517	109 (21.3)	161	83,134.01	1,068	83,271.32	84 (16.4)	107	83,030.16	837	83,178.27	110 (21.5)	154	82,671.46	1,146	82,325.78

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TABLE 5 The actual and estimated distances between living in 15 communities of Yuli and medical center among patients with hypertensive.

15 Communities	The total basic statistical area in the community (*n*)	Estimated case with hypertension			2017				2018				2019			
					The basic statistical area (*n*) (%)	The validation group		The index development group		The basic statistical area (*n*) (%)	The validation group		The index development group		The basic statistical area (*n*) (%)	The validation group		The index development group	
		2017	2018	2019		Case (*n*)	Average distance (m)	Case (*n*)	Average distance (m)		Case (*n*)	Average distance (m)	Case (*n*)	Average distance (m)		Case (*n*)	Average distance (m)	Case (*n*)	Average distance (m)
Sanmin Vil.	51	183	188	192	10 (19.6)	13	75,336.14	99	75,778.59	8 (15.7)	12	75,881.81	96	75,827.93	15 (29.4)	28	75,377.10	147	75,567.42
Dayu Vil.	45	223	230	235	6 (13.3)	11	80,921.94	112	80,796.46	4 (8.9)	10	80,857.65	112	81,012.95	11 (24.4)	24	81,200.83	169	81,088.30
Zhongcheng Vil.	76	1,164	1,198	1,226	39 (51.3)	76	85,571.86	734	85,615.90	43 (56.6)	75	85,636.27	805	85,642.58	45 (59.2)	93	85,631.25	887	85,672.39
Yongchang Vil.	19	275	283	290	7 (36.8)	12	84,159.11	147	84,167.87	9 (47.4)	15	84,041.04	188	84,060.80	12 (63.2)	29	84,106.45	238	84,137.03
Dongfeng Vil.	21	115	119	121	2 (9.5)	2	84,778.18	23	84,438.98	3 (14.3)	4	85,233.40	70	84,790.41	5 (23.8)	7	84,256.75	97	84,174.53
Songpu Vil.	35	328	337	345	13 (37.1)	19	74,201.09	210	74,507.30	12 (34.3)	24	74,330.53	214	74,563.56	17 (48.6)	28	74,506.62	275	74,582.81
Changliang Vil.	50	144	148	152	3 (6.0)	4	91,050.87	15	91,116.34	5 (10.0)	6	92,076.47	56	92,101.98	6 (12.0)	8	92,194.01	81	92,162.57
Chunri Vil.	29	186	191	196	5 (17.2)	8	70,670.29	58	70,813.51	6 (20.7)	8	70,958.69	59	70,894.40	8 (27.6)	8	70,504.19	89	70,774.91
Taichang Vil.	19	294	303	310	12 (63.2)	18	84,947.77	262	84,986.77	9 (47.4)	17	85,028.50	213	85,053.52	8 (42.1)	20	85,167.30	204	85,101.73
Qimo Vil.	26	352	363	371	11 (42.3)	16	84,530.86	214	84,509.53	12 (46.2)	19	84,518.85	221	84,559.36	14 (53.8)	18	84,554.44	273	84,560.39
Guowu Vil.	18	266	274	281	10 (55.6)	23	85,094.05	185	85,219.37	12 (66.7)	25	85,016.98	233	85,014.42	12 (66.7)	28	84,994.38	227	85,013.08
Yuancheng Vil.	49	249	256	262	5 (10.2)	10	86,871.67	118	87,274.66	9 (18.4)	18	87,035.71	174	87,355.51	10 (20.4)	19	86,979.71	159	87,531.92
Dewu Vil.	19	163	168	171	6 (31.6)	6	68,805.85	87	69,216.56	7 (36.8)	8	68,482.54	116	71,887.97	7 (36.8)	11	68,607.77	119	71,887.97
Lehe Vil.	24	202	208	213	8 (33.3)	11	88,726.06	114	90,036.39	9 (37.5)	16	89,262.79	129	90,282.04	9 (37.5)	15	90,485.56	149	90,744.42
Guanyin Vil.	31	310	320	327	7 (22.6)	14	79,127.97	114	79,647.87	9 (29.0)	9	79,519.14	144	79,848.78	6 (19.4)	9	79,446.87	91	80,445.28
Total	512	4,453	4,585	4,692	144 (28.1)	243	82,699.06	2492	82,408.25	157 (30.7)	266	83,017.43	2,831	82,967.03	185 (36.1)	345	82,679.75	3,203	82,492.23

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TABLE 6 Predictive accuracy of diabetes (ICC).

Years	Group*	Patient	The basic statistical area (512 area)							Community (15 communities)						
			The basic statistical area (n)	Patient	Average distance (m)	ICC	95% Confidence interval		*p*-value	The basic statistical area	Patient	Average distance (m)	ICC	95% Confidence interval		*p*-value
							Upper	Lower						Upper	Lower	
2017	Group 1	161	109	161	83,134.01	0.992	0.994	0.989	<0.001	15	161	83,134.01	0.987	0.996	0.963	<0.001
	Group 2	2,289	109	1,068	83,271.32					15	1,068	83,235.39				
2018	Group 1	107	84	107	83,030.16	0.988	0.992	0.983	<0.001	15	107	83,030.16	0.983	0.994	0.951	<0.001
	Group 2	2,425	84	837	83,178.27					15	837	83,178.27				
2019	Group 1	154	110	154	82,671.46	0.984	0.988	0.978	<0.001	15	154	82,671.46	0.989	0.996	0.966	<0.001
	Group 2	2,517	110	1,146	82,325.78					15	1,146	82,624.01				

*Group 1: Verification group; group 2: Index development group.

TABLE 7 Predictive accuracy of hypertensive (ICC).

Years	Group*	Patient	The basic statistical area (512 Area)							Community (15 communities)						
			The basic statistical area (n)	Patient	Average distance (m)	ICC	95% Confidence interval		*p*-value	The basic statistical area (n)	Patient	Average distance (m)	ICC	95% Confidence interval		*p*-value
							Upper	Lower						Upper	Lower	
2017	Group 1	243	144	243	82,699.06	0.997	0.998	0.996	<0.001	15	243	82,699.06	0.994	0.998	0.983	<0.001
	Group 2	4,453	144	2,492	82,408.25					15	2,492	82,408.25				
2018	Group 1	266	157	266	83,017.43	0.959	0.968	0.948	<0.001	15	266	83,017.43	0.993	0.998	0.980	<0.001
	Group2	4,585	157	2,831	82,967.03					15	2,831	82,967.03				
2019	Group 1	345	185	345	82,679.75	0.966	0.973	0.959	<0.001	15	345	82,679.75	0.997	0.999	0.992	<0.001
	Group 2	4,692	185	3,203	82,492.23					15	3,203	82,492.23				

*Group 1: Verification group; group 2: Index development group.

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the hypertension cases (Table 7), we observed a high correlation between the two groups (ICC: 0.96–0.99, $p < 0.001$).

We also performed a multiple regression analysis on the validation groups for diabetes and hypertension (Tables 8, 9). After adjusting for age and gender, the medical distance for the validation group continued to report a significant correlation with that for the index development groups ($p < 0.001$). The adjusted β were all >0.95 for 2017, 2018, and 2019 (adjusted $R^2 = 0.95$). All regression analysis outcomes were obtained using the following formula:

Diabetes cases in 2017 (Table 8).

Estimated medical distance = 0.994 * medical distance of validation group + 0.015 * gender + 0.005 * age (year)

Gender: male = 1, female = 0

Gender and age are not statistically significant ($p > 0.05$)

Adjusted $R^2 = 0.984$

As shown visually in Figure 3, we established the following on the basis of ICC and the regression analysis results:

$D = \sum_{ij=1}^{ij=n} dij = \sum_{C=1}^{c=n'} n' * D'_c$

- D: is total distance is estimated
- N: is the patients' number,
- *ij:* patients' real live location
- d_{ij}: is the distance between those living in *ij* location and the medical center (Tzu Chi hospital).
- c : the population center location
- D'_c : The distance between the center of the population and the medical center (Tzu Chi hospital).

Discussion

The key contribution of this study is a high-precision approach for estimating the distance cost for medical services using population and disease prevalence data without revealing patients' real locations. More specifically, we developed an equation to calculate the distance cost that can be applied to cases of chronic disease. Our method can be used to predict medical distance cost using data on the frequency of patient visits. However, researchers must account for certain conditions and assumptions prior to applying this method to other situations.

Types of disease applications

This study focused on diabetes mellitus and hypertension to estimate the medical distance in consideration of the prolonged nature of chronic disease. The number of chronically ill patients who are cured is lower than patients who experience acute and non-chronic diseases, trauma and accidents. Moreover, the frequency of medical treatment for patients with chronic diseases is more stable, and such patients tend to make repeated visits to a physician or hospital (24, 25). Importantly, accounting for patients with chronic diseases will help local governments estimate long-term medical costs. When the central government's budget for health care or long term care is based on morbidity and the number of elderly people, it is very unfair to the remote villages, which are usually also aging cities with few health care institutions, and the cost of distance can be used as an important factor to negotiate with the central government for an increase in subsidies or budget. An objective of Taiwan's Long-term Care Services Act is to set up long-term care services in residential areas of older adults and individuals with diabetes and hypertension to allow them to "age in place" in familiar locations (26). In order to achieve the goal of aging in place, it is important to have a more accurate and immediate estimate of the distance of access to care or services.

In addition, many studies have shown that spatial interactions between those in need of medical attention and hospitals are influenced by residential location and social demographics, including gender, race and socioeconomic factors. Age and gender are better available from government open data, other economic income remains private, and age and gender are also important risk factors for chronic diseases; for Hualien County, it consists mainly of rural townships, with elderly and aboriginal communities making up the majority of the population, so ethnicity variables would be not confounders. Therefore, we adjusted for age and gender in our regression analysis to more accurately examine the relationship between medical distance between the two groups (Tables 8, 9) (27–29).

In addition to chronic diseases, our estimator can be used to account for the distance cost in treating certain rare diseases, such as chromosomal abnormalities and autoimmune diseases including lupus erythematosus, and inhabitants with special needs who require rehabilitation medicine and early treatment.

Compared with chronic diseases and long-term care needs, non-communicable diseases also can be used to estimate the cost. But it is important to note that this estimation in the present study is due to the consideration of patient privacy, and the actual address cannot be obtained. So, we use the disease prevalence to estimate the number of patients with a specific region and use the distance from each statistical area to the hospital in this region, it should be more accurate to use a fixed area and stable diseases for application.

Medical treatment selection and residents' healthcare seeking behaviors

Residents' healthcare seeking behaviors are an important factor influencing the proposed method of medical costs estimation. In this case, residents' behavior is dependent on the type of disease, their gender, their income and the medical

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TABLE 8 Predictive accuracy of diabetes (multiple regression analysis).

Years	Variables	The basic statistical area				
		β	Adjusted β	95% Confidence interval		*p*-value
				Upper	Lower	
2017	Constant	2,074.109		3,807.569	340.649	0.019
	The distance of the group[a]	0.974	0.994	0.994	0.954	0.000
	Gender[b]	151.870	0.015	362.044	−58.305	0.155
	Age	1.867	0.005	10.111	−6.377	0.655
	Adjusted $R^2 = 0.984$					
2018	Constant	2,595.541		5,359.866	−168.784	0.065
	The distance of the group[a]	0.972	0.988	1.002	0.943	0.000
	Gender[b]	195.622	0.018	522.617	−131.374	0.238
	Age	−3.651	−0.008	10.793	−18.095	0.617
	Adjusted $R^2 = 0.977$					
2019	Constant	2,773.522		5,329.766	217.279	0.034
	The distance of the group[a]	0.968	0.985	0.996	0.939	0.000
	Gender[b]	65.022	0.006	383.084	−253.039	0.687
	Age	1.275	0.003	14.393	−11.843	0.848
	Adjusted $R^2 = 0.968$					

The dependent variable: the medical distance of Index development group.
[a]Verification group.
[b]Gender: male:1, female: 0.

TABLE 9 Predictive accuracy of hypertension (multiple regression analysis).

Years	Variables	The basic statistical area				
		β	Adjusted β	95% Confidence interval		*p*-value
				Upper	Lower	
2017	Constant	1,049.248		1,894.287	204.209	0.015
	The distance of the group[a]	0.988	0.996	0.998	0.979	0.000
	Gender[b]	67.061	0.006	169.947	−35.824	0.200
	Age	0.143	0.000	3.539	−3.252	0.934
	Adjusted R^2 =0.994					
2018	Constant	4,573.560		7,623.760	1,523.359	0.003
	The distance of the group[a]	0.941	0.958	0.975	0.907	0.000
	Gender[b]	273.044	0.025	657.046	−110.959	0.163
	Age	5.390	0.013	19.740	−8.960	0.460
	Adjusted $R^2 = 0.92$					
2019	Constant	3,850.174		6,218.332	1,482.015	0.002
	The distance of the group[a]	0.954	0.966	0.981	0.927	0.000
	Gender[b]	196.362	0.018	495.525	−102.801	0.198
	Age	0.745	0.002	11.538	−10.047	0.892
	Adjusted $R^2 = 0.92$					

The dependent variable: the medical distance of Index development group.
[a]Verification group.
[b]Gender: male:1, female: 0.

resources available to residents (24, 25, 30, 31). Frequency of medical utilization, which is the number of times an individual uses a medical service at a target hospital, and medical distance, which is the distance between a patient's location and a target hospital, can be used to estimate medical costs for small regions or for one medical institution. However,

if a region has multiple medical resources or if the target diseases are of a specific type, such as early stage cancer, then the estimation of medical distance may require data on the utilization of multiple medical services since patients tend to engage in "shopping" behavior to compare medical services (32). Thus, medical utilization behavior is necessary to include when attempting to accurately estimate the cost of medical distance. This study uses diabetes and hypertension to estimate the distance cost because they are chronic diseases and most of the patients tend to be treated at same hospitals, so this method can estimate the distance cost more accurately. The multiple medical utilization behavior would be not as our limitation.

Travel time and distance

Approaches to calculate travel distance between medical service consumers and providers that use relatively linear distance as a basis overlook not only differences between travel distance and medical resource selection but also road network and obstacles present in challenging terrain, such as rivers and mountains. Therefore, it is more appropriate to calculate travel distance on the basis of the actual road network. Hualien County has two main traffic routes between Yuli and the medical center, of which one runs along a coastline and is generally used for sightseeing, while the other is a mountain road for local residents and the shortest straight-line distance. In this case, using a relatively linear distance does not affect our study results and reflects the actual conditions of Hualien. Thus, convenient transportation and multiple travel paths in a county or city are important factors to consider.

Potential benefits of application in medical resource allocation policy

A medical resource allocation policy is critical in a country with a national health insurance system to ensure distributive justice. Taiwan's central government has traditionally depended on population rate or the ratio of the population to physicians, nurses and hospital beds to prioritize medical resource allocation and to determine resource deficiencies. There are special medical support programs for those with specific diseases or living in remote areas or outlying islands. However, these programs are supplementary and focus on sub-groups or low development areas. Some studies highlight that allocation policies should refer to a population's health needs, and these health needs are generally are based on medical utilization, outpatient and inpatient services, medication requirements, and the incidence and prevalence of diseases (15, 33). At present, local governments focus on the shortest travel time and the ratio of medical services to the population to understand medical needs. They must additionally consider medical distance and spatial distribution (34, 35). Determining the shortest path or travel time requires knowledge of the patients' addresses, which are becoming increasingly difficult to obtain from the National Health Insurance Database or other medical records.

The method developed in this study to estimate medical distance requires only official public information. Thus, it not only protects patient data but also is time efficient. Further, the central government can use the proposed method to determine more effective and reasonable resource allocation strategies.

Conclusions

This study developed a cost indicator for medical distance using data from the National Health Insurance Database. The approach addresses limitations associated with various databases and the issue of patient privacy protection. In addition, it is not restricted to administrative regions but delves deeper into townships to avoid oversimplification of distance measurement. We also used data on the incidence of chronic diseases or the distribution of disease prevalence to estimate medical distance and found a high correlation with the actual distance patients traveled. This study has key implications for health policy planning and healthcare promotion and can be applied to enhance medical resource allocation as well as to improve the quality of regional medical care and preventive healthcare.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This study was approved by the Research Ethics Committee of the Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (IRB109-239-B). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

C-FY was responsible for article conception, design, drafting, and data interpretation. S-JG analyzed the data and drafted the Methods Section. C-FY and H-CC contributed to the writing of the article. All authors contributed to the concept and design, data analysis and interpretation, manuscript drafting or

revision, and have read and agree to the published version of the manuscript. The submitted manuscript has been approved by all authors.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Influencing factors of work stress of medical workers in clinical laboratory during COVID-19 pandemic: Working hours, compensatory leave, job satisfaction

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Background: The COVID-19 pandemic continues to pose unprecedented threats and challenges to global public health. Hospital Clinical Laboratory and public health institutions have been playing an important role in case detection, epidemic research and decision-making, and epidemic prevention and control.

Objective: To explore the current situation and influencing factors of work stress of medical workers in hospital clinical laboratory in fighting against COVID-19.

Methods: A cluster random sampling method was used to select seven hospitals from 14 tertiary hospitals in Xiamen, and medical workers in the selected hospitals were investigated by self-administered questionnaire. A total of 150 medical workers inclinical laboratory participated in this survey, 138 valid questionnaires were collected, with a response rate of 92%.

Results: The work stress scores of the medical workers in the clinical laboratory of hospital in the COVID-19 epidemic were collected (55.22 ± 11.48); The top three dimensions of work stress score were work stress (work load), external environment and doctor-patient relationship. The results of multiple stepwise regression analysis showed that the working hours per day, whether overtime and night shift can get compensatory leave and Job satisfaction with the work of the clinical laboratory were the main factors affecting the work stress level of medical workers in the clinical laboratory of hospital during COVID-19 epidemic.

Conclusion: The COVID-19 has caused great harm to the physical and mental health of the public. Medical staff are in the front line of prevention and control of the epidemic, so medical workers in hospital clinical laboratory exposed to a high level of stress at work. Laboratory leaders and hospital managers should take active and effective measures to reduce the working hours of the medical staff in clinical laboratory, optimize the arrangement of night shift and overtime working, strengthen the training of group and individual pressure management, reduce the work stress of the medical staff, improve the overall happiness of the medical staff in clinical laboratory, and stabilize the clinical laboratory team, improve the physical and mental health of medical workers in clinical laboratory.

KEYWORDS

clinical laboratory, COVID-19, epidemic, work stress, medical workers

Introduction

According to the information provided by the World Health Organization, globally, as of June 16, 2022, there have been 535,248,141 confirmed cases of COVID-19, including 6,313,229 deaths, and more than 600,000 new confirmed cases were added every day (1). On January 20, 2020, the National Health Commission of the People's Republic of China incorporated the new coronavirus infection into the Class B infectious diseases stipulated in the "Prevention and Control Law of the People's Republic of China," and adopted the prevention and control measures of class A infectious diseases (2). There is no doubt that COVID-19 pandemic is a multifaceted macroeconomic shock, which may have a negative long-term impact on the economy in recent years (3). The atmosphere of job insecurity and economic turbulence caused by the COVID-19 are also spreading, which also seriously affects the mental health of citizens (4). Because of the role of work in supporting one's physical and mental health and self-esteem, job insecurity can seriously affect one's self-efficacy, confidence, and social support system (5). The phenomenon of elevated work stress and job insecurity is even more obvious among medical workers, as hospitals have been in the front line of prevention and control since the outbreak of COVID-19. Under the background of China's normalized epidemic prevention and control, the hospital's laboratory has to undertake the work of nucleic acid sample testing from a large number of people in the hospital and the local area while carrying out its daily tasks. Due to the lack of sufficient human resources. Due to the lack of sufficient human resources, It is unavoidable to take more workloads for the hospital's laboratory of the COVID-19. In addition, the infectious disease report, the entry of test results and other operations of the COVID-19 require the hospital to allocate special personnel to be responsible, which makes human resources particularly scarce (6).Moreover, because of the huge risks in the biological safety management of the laboratory, it also puts medical workers in the laboratory department under even greater work pressure (7). The clinical laboratory is also a wind vane for epidemic prevention and control, and the medical staff in the laboratory are an important and special force for the normalization of epidemic prevention and control. If the medical workers of the laboratory work under excessive pressure without corresponding measures to alleviate and improve it, it will not only be detrimental to the work and development of the hospital, but also bring adverse effects to the epidemic prevention and control.

Work stress refers to the tension or threat that the staff feels in the process of engaging in a certain occupation (8). In addition, during the outbreak of COVID-19, health care workers (HCWs) experience significantly higher work stress than the general population, and the increase in work stress was associated with job burnout (9, 10). Kuo et al. (11) conducted a study on the perceived work stress and its influencing factors among hospital staff during the COVID-19 pandemic in Taiwan, China. The research results showed that the reported stress level of hospital staff was medium. The discomfort caused by protective equipment is the main stressor for participants, and the burden of caring for patients is the second job stressor. According to the survey results, the persistence of the COVID-19 epidemic has led to increasing work pressure faced by doctors. In the context of the normalization of epidemic prevention and control, the doctors' job stressors are mainly from the external environment, workload and career development (12).

On the one hand, the indirect impact of COVID-19 related work stress on anxiety and depression through flexibility is far greater than other indirect effects, and the COVID-19 pandemic has a significant psychological effect on Italian general practitioners and health care workers (HCWs) (13, 14). Zhang et al. (15) conducted a cross-sectional survey of frontline medical workers fighting against COVID-19 in Wuhan, Harbin and Shenzhen, and showed that burnout was common among frontline medical personnel, and that work stress and inadequate protection affected frontline medical personnel's burnout symptoms. Na and Tao et al. (16, 17) found that mental health problems and burnout were prevalent among medical workers in the clinical laboratory, and psychological state and burnout were correlated, and that promoting a reduction in burnout could improve the psychological state of medical workers. On the other hand, in the face of the accelerated pace of life and work, as well as the intensification of social competition, the majority of professional groups are under pressure from different aspects. Although the increase of work stress can improve work efficiency to a certain extent, the increase of work stress will lead to more boredom and physical fatigue to work, and then develop to absenteeism and resignation, the increase of work stress seriously affected physical and mental health, which has become an important public health issue (18). A study found that all HCWs will encounter stress and are frequently exposed to unfavorable conditions in their work and life. The study assessed the relationship between burnout, insomnia, and anxiety severity. The study have found that a bilateral association between insomnia and burnout, so further meaningful intervention measures should be promoted to improve shift work in HCWs (19).

At present, most of the research on staff related to the COVID-19 have focused on front-line nurses, emergency department doctors, primary medical workers and so on. Few studies have paid attention to the work stress situation of medical workers in hospital clinical laboratory under the background of normalized epidemic prevention and control. Our study had two primary objectives. First of all, to provide a reference for hospital managers or health policy makers in order to take practical and feasible measures to ensure the physical and mental health of clinical laboratory medical workers, stabilize the working status of the hospital's clinical laboratory; Secondly, in order to stabilize the laboratory team of the hospital, successfully fight against the epidemic, and steadily promote the epidemic prevention and control work, corresponding countermeasures and suggestions are provided for the medical staff in the laboratory.

Theory: Job demand resource (JDR) model

The selection of key variables in this study is based on the Job Demand Resource (JDR) model, which was originally developed to better understand the effects of job stress, initially focusing on the effects of job engagement (20) and job burnout (21). This model proposes that specific physical, psychological, social or organizational factors are related to work stress (21). The JDR model divides job characteristics into job demands and job resources. Job demands are the "negative factors" that consume an individual's energy at work and are defined as the physical, psychological, social, or

organizational demands of the job that require cost or effort on the part of the individual (employee) to complete the work, including work overload, time pressure, job insecurity, etc. Job resources are "positive factors" at work, defined as factors at work that facilitate the achievement of job goals and promote personal learning and development, including social support, job satisfaction, self-efficacy, and general wellbeing, etc.

Job demands and resources directly affect burnout or work engagement, respectively, while the imbalance between job demands and job resources may be a factor contributing to increased work stress. Job resources have a buffering effect to mitigate the adverse effects of job demands on the development of work stress (22). Therefore, we included "working hours per day" and "the availability of compensatory time off for overtime and night shifts" as representative factors of job demands in the questionnaire, and "the job satisfaction" as a representative factor of job resources (23) into the basic information options of the questionnaire. Based on the JDR model and the actual situation, we made a simple descriptive analysis of the work stress of medical workers in clinical laboratory.

Methods

Participants and sampling

A cross-sectional survey

Using the cluster sampling method, from July 15 to August 1, 2022, seven hospitals were randomly selected from 14 hospitals in Xiamen, and medical workers were selected from clinical laboratories of selected hospitals to carry out the survey. The inclusion criteria were as follows: Inclusion criteria of survey objects: Formal staff in clinical laboratory; Participated in the fight against the COVID-19 epidemic; Volunteer to participate in this research. As of August 1, 2022, the medical workers from hospital clinical laboratory in Xiamen (∼150) were invited to participate in this study, with a response rate of 92%, which resulted in a sample of 138 medical workers.

Measurement

Basic situation survey form

Based on the literature review and expert consultation (24–30), a self- administered general information and demographic questionnaire was developed, including age, gender, marital status, level of academic qualification, professional qualification, Service years, monthly income, working hours per day, whether the overtime working or night shifts can get compensated leave, and job satisfaction with the work of the clinical laboratory.

Stressor scale for medical workers in hospital clinical laboratory

Since there is no relatively mature questionnaire on job stressors for medical workers in the clinical laboratory in China, and considering that it is not appropriate to use a questionnaire with too many questions, we finally used Professor Cooper's job stressors scale (31) and the job stressors scale for doctors produced by Chen (32) in China as a model to prepare a work stress questionnaire for medical staff in the hospital clinical laboratory, which was divided into two parts: basic information, work stress status survey.

The scale has good reliability and validity, with a Cronbach's alpha value of 0.86. There are 19 entries divided into seven dimensions: organizational management, vocational interest, workload, career development, doctor-patient relationship, interpersonal relationship, and external environment. Each item was assessed on the Likert 5-point rating scale, ranging from "No stress" to "Tremendous stress," with a total score of 1–5 for each item, with higher scores indicating greater stress. In our study, scores of 19–38 were classified as mild stress, 39–57 as moderate stress, and 58–95 as severe stress.

Survey method and data collection

An online survey link or quick response code (by way of the questionnaire website platform) was sent to the relevant heads of the selected hospital's clinical laboratory and they were invited to send it to the medical workers within the department. Participants could complete the questionnaire *via* a computer or smartphone that could open the website link or scan the QR code. The researchers initially explained in detail the purpose and significance of the study, how to ensure participant anonymity and confidentiality, and other relevant information. Participants agreed if they connected to the website link and completed the questionnaire.

Statistical methods

Statistical data were represented by frequencies and percentages, and measurements were expressed as $x \pm s$. Two independent sample *t*-tests were used for the comparison between the two groups, The comparison between multiple groups adopts one-way ANOVA, and then the multi-linear regression analysis is performed for multi-factor analysis. All statistical analyses were performed with SPSS for Windows 26.0, and a two-sided $p < 0.05$ was considered statistically significant.

Results

Basic information

The distribution of demographic data of 138 medical workers in the clinical laboratory of hospital during the COVID-19 pandemic is shown in Table 1.

Work stress of medical workers in the clinical laboratory

Under the background of COVID-19, the average work stress score of 138 medical staff in the clinical laboratory of major hospitals in Xiamen is 55.22 ± 11.48, which is a medium stress level. The specific scores of each dimension are shown in Table 2.

TABLE 1 Demographic characteristics of study participants ($n = 138$).

Variable		Numbers (*n*)	Percentage (%)
Gender	Male	48	34.78
	Female	90	65.22
Age	<30	41	29.71
	31–40	55	39.86
	41–50	28	20.29
	>50	14	10.14
Marital status	Unmarried	44	31.88
	Married	92	66.67
	Divorced or widowed	2	1.45
Level of academic qualification	Junior college or below	21	15.22
	Undergraduate	84	60.87
	Master	30	21.74
	Doctor	3	2.17
Professional qualification	No qualification yet	10	7.25
	Primary	42	30.43
	Intermediate	52	37.68
	Senior	34	24.64
Service years	<3 years	26	18.84
	3–5 years	23	16.67
	5–10 years	25	18.12
	>10 years	64	46.38
Monthly income (yuan)	<6,000	13	9.42
	6,000–10,000	47	34.06
	10,001–15,000	51	36.96
	>15,000	27	19.57
Working hours per day	6–8 h	31	22.46
	8–10 h	64	46.38
	10–12 h	43	31.16
Whether the overtime working or night shifts can get compensated leave	Yes	33	23.91
	No	105	76.09
Job satisfaction with the work of the clinical laboratory	Very satisfied	5	3.62
	Relatively satisfied	31	22.46
	Basically satisfied	59	42.75
	Relatively dissatisfied	39	28.26
	Very unsatisfied	4	2.90

TABLE 2 Work stress scores of medical workers in combating the COVID-19 epidemic ($\chi \pm s$, $n = 138$).

Dimension	Score		Rank
	Dimension	Entry	
Organizational management	7.99 ± 2.64	2.66 ± 0.88	5
vocational interest	4.65 ± 1.79	2.33 ± 0.90	6
Work stress and workload	11.36 ± 2.88	3.79 ± 0.96	1
Career development	8.36 ± 2.44	2.79 ± 0.81	4
Interpersonal relationship	6.37 ± 2.09	2.12 ± 0.70	7
Doctor patient relationship	9.96 ± 2.56	3.32 ± 0.85	2
External environment	6.53 ± 1.78	3.26 ± 0.89	3
Total score	55.22 ± 11.48	2.91 ± 0.60	

Single-factor analysis of work stress of medical workers in clinical laboratory

The results showed that Whether the overtime working or night shifts can get compensated leave and Job satisfaction with the work of the clinical laboratory affect the work stress scores of medical staff in clinical laboratory ($p < 0.05$), as shown in Table 3.

Multi-factor analysis of work stress among medical workers in the laboratory department

The work stress scores of medical staff in hospital clinical laboratory were the dependent variable, with the single-factor analysis of their stress load, and the titles of basic information were used as independent variables for stepwise multiple linear regression analysis. The results showed that working hours per day, whether the overtime working or night shifts can get compensated leave and Job satisfaction with the work of the clinical laboratory were the main factors influencing the job stress levels of nurses assisting in the fight against COVID-19, which explains 49% of the total variance, as shown in Table 4.

Discussion

In past few years many medical advancements have been made in theoretical epidemiology (33) and practical medicine (34–37) that contribute to innovation and development of medical science (38). After the outbreak of COVID-19 epidemic, the majority of clinical laboratory workers worked day and night in the front line of clinical work to complete the detection of SARS-CoV-2 specific nucleic acids and antibodies, and the medical staff was already close to overload due to the increasingly heavy workload, tedious and repetitive work tasks, isolation periods of varying lengths, and various pressures brought about by the work-family conflict (39). According to the on-site survey, the medical staff of the clinical laboratory doctors work intensely, there is no concept of holidays. On average, each

TABLE 3 Single-factor analysis of the job stress of medical staff working in the clinical laboratory ($\chi \pm s$, $n = 138$).

Variable		Total points	Statistics	*p*-value
Gender	Male	53.69 ± 10.56	$t = -1.145$	0.283
	Female	56.03 ± 11.91		
Age	<30	56.66 ± 11.83	$F = 1.175$	0.256
	30–39	56.25 ± 11.02		
	40–50	52.61 ± 12.12		
	>50	55.07 ± 10.36		
Marital Status	Unmarried	58.52 ± 10.33	$F = 1.226$	0.205
	Married	53.93 ± 11.69		
	Divorced or widowed	45.50 ± 0.71		
Level of academic qualification	Junior college or below	58.14 ± 11.36	$F = 0.670$	0.929
	Undergraduate	54.27 ± 11.80		
	Master	56.69 ± 10.67		
	Doctor	49.00 ± 8.91		
Professional qualification	No qualification yet	54.00 ± 12.85	$F = 1.239$	0.193
	Primary	56.71 ± 11.77		
	Intermediate	57.69 ± 10.73		
	Senior	49.94 ± 10.49		
Service years	<3 years	59.58 ± 8.22	$F = 1.218$	0.212
	3–5 years	56.43 ± 13.23		
	6–10 years	54.12 ± 9.19		
	>10 years	53.44 ± 12.42		
Monthly income	<6,000	55.15 ± 10.91	$F = 0.852$	0.719
	6,000–10,000	54.68 ± 12.23		
	10001–15000	56.31 ± 11.47		
	>15000	54.11 ± 10.83		
Working hours per day	6–8 h	48.32 ± 13.99	$F = 1.263$	0.173
	8–10 h	54.52 ± 9.50		
	10–12 h	55.22 ± 11.48		
Whether the overtime working or night shifts can get compensated leave	Yes	45.73 ± 12.33	$t = -2.538$	0.003
	No	58.20 ± 9.44		
Job satisfaction with the work of the clinical laboratory	Very satisfied	41.20 ± 20.01	$F = 2.308$	0.000
	Relatively satisfied	49.16 ± 11.16		
	Basically satisfied	54.15 ± 10.23		
	Relatively dissatisfied	62.33 ± 7.18		
	Very unsatisfied	66.00 ± 4.24		

medical personnel have a night shift as well as many overtime shifts; More than 90% of the medical staff of the clinical laboratory feel psychological pressure and high work stress. The main stress comes from the working duration, the amount of work tasks, because the working hours per day and per week had an impact on work stress (40, 41). The results of our study found that the work stress of 138 medical workers participating in the survey had a single mean score of 2.91 ± 0.60 for work stress, which was generally moderate. The three dimensions with the highest scores in each dimension are work stress and workload, doctor-patient relationship and external environment, which is consistent with the survey results of Mo et al. (40). The research shows that work stress is negatively related to work capacity, work stress and presenteeism have a significantly adverse impact on task performance of medical staff, and health status has a enormous positive impact on task performance (42, 43). COVID-19 pandemic has not only led to a series of changes

TABLE 4 Multiple-factor analysis of the job stress of Medical staff working in the clinical laboratory.

Dependent variable	Regression coefficient	SE	Standardized regression coefficient	*t*-value	*p*-value
Constant	22.034	5.895		3.681	0.000
Working hours per day	3.205	1.089	0.192	2.778	0.006
Whether the overtime working or night shifts can get compensated leave	9.147	1.913	0.341	4.782	0.000
Job satisfaction with the work of the clinical laboratory	4.704	0.895	0.360	5.253	0.000

$R = 0.700$, $R^2 = 0.490$, $F = 12.203$, $P < 0.01$.

in working methods, but also had a great impact on individual psychological wellbeing (44). When dealing with the challenges of panic and fear caused by the COVID-19, psychosocial support and effective organizational support systems are crucial, an open working environment, stress management training and strong social ties can help employees effectively cope with the crisis and reduce work stress (45). COVID-19 has caused serious economic uncertainty and potential economic pressure, factors related to work stress will have a negative impact on the working environment, employee performance and work efficiency will also be reduced. However, managers can take measures to actively respond, improve the safety awareness of employees during the epidemic, ensure business continuity to reduce job insecurity, improve the job satisfaction of employee, and reduce the pressure and anxiety of employee (46, 47). Therefore, we suggest that hospital managers should pay more attention to the work stress of medical workers in clinical laboratory of the hospital, and take positive and effective measures to improve the working environment of the clinical laboratory, optimize the work content of the department staff, reasonably adjust the working hours, and ensure the physical and mental health of medical workers.

Factors influencing the work stress of medical staff in the laboratory of hospitals in fighting against COVID-19

The results showed that the working hours per day, whether the overtime working or night shifts can get compensated leave and Job satisfaction with the work of the clinical laboratory were the main factors affecting work stress of medical staff in clinical laboratory of the hospital in fighting COVID-19.

Daily working hours

This study found that daily working hours were positively related to work pressure. the longer the working hours, the more stressful the work of medical staff was. Since the global outbreak of COVID-19 at the end of December 2019, Xiamen has experienced several epidemic crises. As the front-line staff for epidemic prevention and control, the medical staff in clinical laboratory are required to wear protective clothing, N95 masks, goggles, rubber gloves and other protective props due to the particularity of the work content, which increases the inconvenience of daily work. Working in a closed environment for a long time will lead to an increase in the working stress level (40).The data showed that working 40–50 h per week were positively associated with the work efficiency (48) without considering the work input. The work environment was significantly associated with self-rated health status and working hours. The risk of poor health status was greater for staff who had longer working hours and with higher education (49). Under the background of the COVID-19 epidemic, the working environment of the hospital's clinical laboratory is relatively closed, the atmosphere is slightly suppressed, the medical workers have long working time, and the work stress and physical and mental pressure are tremendous.

Whether the overtime working or night shifts can get compensated leave: our results show that if the overtime working or night shifts can get compensated leave, and the work stress of medical workers in the hospital clinical laboratory will be reduced accordingly. Research shows that there is an association between a high proportion of night shift work and long-term chronic diseases that can cause health problems. Higher rates of sick leave associated with long night shifts may result in additional costs or lost productivity for hospitals (50). Working long hours does not directly affect mental health; However, it will indirectly affect psychosomatic stress reaction and depressive symptoms through factors such as shortened sleep time and irregular meal time (51). Working hours are significantly related to psychological stress response. Workers are prone to show higher psychological stress response when working overtime on weekdays and holidays. Regardless of the type of work, reducing overtime is very important for reducing the psychological stress reaction (52). The workers who worked overtime for a long time showed significantly higher "irritability," "fatigue," "anxiety," "depression" and "somatic reaction" in both genders. The overtime was linearly related to various stress reactions. There was a linear relationship between the length of overtime and various psychosomatic stress responses (53). At the same time, medical workers' alertness and work performance remain the worst during night shifts because of the difficulty of adapting to circadian rhythms (54). Clinical laboratory medical workers are also required to respond to public health emergencies or unexpected medical events during the night shift, which will lead to greater work pressure on medical staff in the clinical laboratory.

Job satisfaction with the work of the clinical laboratory

Our findings showed that medical workers who are less satisfied with clinical laboratory work also have a higher level of work stress. Data research showed that occupational burnout, anxiety, and depression are common among medical workers. When facing work stress, it is more likely to lead to job burnout and work satisfaction of medical workers (55). In addition, an analysis of data

has shown that job dissatisfaction is positively related to depression, anxiety and work stress (56, 57). Staffing, work environment, and working hours are significantly associated with nurse burnout and job dissatisfaction (58). Also, social support is positively associated with job satisfaction (59). Social support and work stress were negatively correlated, and the reinforcement of social support can reduce the work stress of medical workers (60). The job satisfaction of medical staff not only has a direct negative impact on turnover intention, but also has an indirect impact on turnover intention through work engagement (61). Stabilizing the work team, building a favorable working environment, and making rational work arrangements are crucial for the development of departments and even hospitals.

Implications for hospital administrators as well as clinical laboratory leaders

The leaders of the clinical laboratory leaders and hospital administrators should pay attention to the impact of work stress on medical workers in the laboratory department, take active and effective measures to eliminate hospital laboratory staff stressors, unite the medical staff team, and steadily solid the work of epidemic prevention and control. Research shows that adequate sleep, the company of family and pets, and good communication between teams are effective coping styles for job stressors (62). Psychological training and group consultation can effectively reduce job stress, improve self-efficacy and staff confidence (63). Work life balance is of great significance to job satisfaction. Providing a good working environment and facilities, implementing a fair salary and remuneration system and establishing a good communication system in the department can well-improve the work enthusiasm of employees and reduce the work stress of staff (64, 65). The organization can reduce the workload of staff and reduce role conflict and role ambiguity by rationalizing shifts and working hours and optimizing shift arrangements, thus reducing the stress of staff. In addition, the organization should also introduce employee assistance programs and stress management technologies, provide consulting services for employees, help employees learn stress management skills, and conduct stress management, so as to improve their work enthusiasm and productivity (47). Therefore, the hospital can create a harmonious and appropriate working environment through the salary and bonus incentive system, reasonable arrangement of working hours, optimization of shift arrangement, employee assistance plan, group and individual stress management training, optimization of the layout of department work areas, and improvement of department communication system, which will help alleviate the working stress of medical staff in front-line laboratory under the background of normalized epidemic prevention and control, Improve the work quality and efficiency of the hospital laboratory. Hospitals should create a harmonious and appropriate working environment through salary and bonus incentive system, reasonable arrangement of working hours and shifts, group and individual training, and optimization of department work area layout, which will help relieve the working stress of medical workers in front-line clinical laboratory under the background of normalized epidemic prevention and control.

Strengths and limitations

We are the first known study conducted in a municipal administrative region of China on the work stress of a specific group of medical workers in hospital clinical laboratories, which makes our research valuable. In addition, the survey we conducted adopts cluster random sampling method. Compared with ordinary convenient sampling, our research samples are more random and more representative of the research population. And it should be noted that the study has the following limitations. First, due to human, financial and time constraints, this survey was conducted by selecting only a special group of medical workers in the clinical laboratory of hospitals that experienced COVID-19 pandemic, which also resulted in an insufficient number of samples that could be collected by the questionnaire. Therefore, the results of our study data are not particularly satisfactory. Secondly, because this study is a cross-sectional design, we only evaluated the working pressure at a specific time without longitudinal observation, and some potential influencing factors of working stress may not be taken into account. Therefore, it is necessary to expand the research scope and include more potential factors affecting work stress in future research.

Conclusion

COVID-19 pandemic has caused an unprecedented huge impact on all countries in the world. The clinical laboratory plays a particularly important role in the disease management of the COVID-19. The clinical laboratory is crucial to early detection of cases and prevention of disease transmission (66). During the epidemic of COVID-19, the laboratory of domestic hospitals made great contributions to the prevention and control of the epidemic in china, and the work stress of the laboratory of Chinese hospitals deserves attention. In our study, the medical staff in the hospital laboratory are generally under high working stress. The main factors affecting the working stress of the medical staff in the hospital clinical laboratory are working hours per day, whether overtime and night shift can get compensatory leave and Job satisfaction with the work of the clinical laboratory. At the same time, we put forward some countermeasures and suggestions to alleviate the work stress, which also provides reference for other countries to adjust the work stress, maintain physical and mental health of the corresponding medical staff, and improve public health.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Medical Ethics Committee of Xiang'an Hospital, Xiamen University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

GH and YC conceived the study, designed and collected questionnaires, and performed the statistic analysis. GH created and performed the literature search strategy and wrote the original draft. YC and DW guided GH to revise the manuscript. YC, DW, and HW reviewed the manuscript and supervised the process. All authors have read and approved the final manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Maternal factors and child health conditions at birth associated with preterm deaths in a tertiary health facility in Ghana: A retrospective analysis

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Background: Preterm birth continues to be a leading cause of death for children under the age of 5 globally. This issue carries significant economic, psychological, and social costs for the families affected. Therefore, it is important to utilize available data to further research and understand the risk factors for preterm death.

Objective: The objective of this study was to determine maternal and infant complications that influence preterm deaths in a tertiary health facility in Ghana.

Methods: A retrospective analysis of data on preterm newborns was conducted at the neonatal intensive care unit of Korle Bu Teaching Hospital (KBTH NICU) in Ghana, covering the period January 2017 to May 2019. Pearson's Chi-square test of association was used to identify factors that were significantly associated with preterm death after admission at the NICU. The Poisson regression model was used to determine the risk factors of preterm death before discharge after admission to the NICU.

Results: Of the 1,203 preterm newborns admitted to the NICU in about two and half years, 355 (29.5%) died before discharge, 7.0% ($n = 84$) had normal birth weight (>2.5 kg), 3.3% ($n = 40$) had congenital anomalies and 30.5% ($n = 367$) were born between 34 and 37 gestational week. All 29 preterm newborns between the 18–25 gestational week died. None of the maternal conditions were significant risk factors of preterm death in the multivariable analysis. The risk of death at discharge was higher among preterm newborns with complications including hemorrhagic/hematological disorders of fetus (aRRR: 4.20, 95% CI: [1.70–10.35], $p = 0.002$), fetus/newborn infections (aRRR: 3.04, 95% CI: [1.02–9.04], $p = 0.046$), respiratory disorders (aRRR: 13.08, 95% CI: [5.50–31.10], $p < 0.001$), fetal growth disorders/restrictons (aRRR: 8.62, 95% CI: [3.64–20.43], $p < 0.001$) and other complications (aRRR: 14.57, 95% CI: [5.93–35.77], $p < 0.001$).

Conclusion: This study demonstrate that maternal factors are not significant risk factors of preterm deaths. Gestational age, birth weight, presence of complications and congenital anomalies at birth are significantly associated with preterm deaths. Interventions should focus more on child health conditions at birth to reduce the death of preterm newborns.

KEYWORDS

preterm birth, maternal factors, child health conditions at birth, preterm death, newborn, Ghana

Introduction

Preterm birth, since 2016, has been identified as the leading cause of under 5 mortality globally (1, 2). Previously, pneumonia was the leading cause of death with more than half of deaths before age 5 years, but the main cause of death has now shifted to prematurity (3). This shift in epidemiology of infant mortality from pneumonia to preterm birth, should increase concern for and investment into addressing prematurity (1). As at 2010, more than 60% of preterm births occurred in south Asia and Sub-Sahara Africa (SSA) (4), which increased to 81.1% in 2016 (5). Moreover, the highest rates of preterm deaths have been recorded in West Africa at ∼16 per 1,000 live births (1).

Prematurity not only contributes directly to neonatal deaths globally but also increases the risk of death from other causes (6). These causes are multifactorial, including infant biological and medical conditions, such as birthweight, gestational age, (7–10), congenital anomalies, birth complications (2, 3), respiratory problems, jaundice, sepsis, necrotizing enterocolitis, intrapartum asphyxia, seizures, bleeding disorders among others (11, 12). Preterm babies are more affected by these factors because they are physiologically and metabolically less mature than term infants (13). Maternal factors such as age, hypertensive disorders, height, pre-gestational diabetes and pre-eclampsia also increase the risk of preterm deaths (12, 14, 15). Preterm births are not only associated with deaths but also with high economic, psychological, and social costs incurred by affected families (16, 17).

Risk factors of preterm births, which also contribute to a large proportion of preterm deaths (18), have been less explored in low-to-middle-income (LMIC) settings compared to high income countries (HIC). Thus, they are poorly understood and may be totally different in the former (1). It has been projected that if current trends continue in preterm births among other causes of death, SSA will record about 60% of the under-five deaths even in 2030 (3). Prematurity has also been found as one of the top five causes of neonatal deaths in Ghana (19, 20). As at 2010, the estimated preterm birth rate for the country was 14.5 per 100 live births, which reduced to 12 per 100 live births in 2019 with over 8,000 deaths per year (21, 22). It is obvious Ghana has fallen short of its target to reduce the NMR to 21 per 1,000 live births in 2018. This is indicated in an estimated rate of 24 deaths per 1,000 live births in the Ghana National Newborn Health Strategy and Action Plan for 2014–2018 (20). Addressing the national burden of preterm-related neonatal and child mortality is crucial to achieve the SDG 3.2. This study seeks to explore maternal and infant factors influencing preterm births and deaths in the nation's largest tertiary referral hospital. The current analysis offers the opportunity to utilise routine data which is readily available to answer pertinent questions on preterm birth and death with relatively less resources.

Methods

Data source

A retrospective analysis of secondary data on preterm infants was conducted at the neonatal intensive care unit of the Korle Bu Teaching Hospital (KBTH NICU) in Ghana. Data extraction forms were used to collect data from folders from the pediatric department, the admission and discharge book at the nurse's desk, including copies of death certificates covering the period January 2017 to May 2019. All medical records of preterm infants pronounced dead on arrival at KBTH NICU, and those on preterm infants with incomplete data were excluded. Korle Bu Teaching Hospital NICU is a tertiary referral centre that is equipped with 20 incubators, 20 cots, and 10 radiant warmers. The unit manages ∼2,500 newborns annually with about 10 new admissions each day. Preterm babies account for 50–60% of all new admissions. About 80% of the newborns admitted at the unit are referred from the KBTH labor wards and obstetric theatre. The rest are referred from peripheral hospitals. Data extraction span over 5 weeks with the support of five research assistants.

Outcome measure

The primary dependent variable for this study was the discharge outcome at NICU among preterm births, that is whether the preterm infant was dead or alive before discharge from NICU. Preterm infant deaths before discharge were confirmed from the duplicates of death certificates kept at NICU.

Exposure variables

Exposure variables were subdivided into maternal, delivery-related, and infant factors. Maternal factors included sociodemographic characteristics of the preterm infant's mother such as age, occupation, marital status, educational status, religion, parity, and HIV status of mother as well as maternal medical conditions. The place of delivery (whether at KBTH or other facilities), mode of delivery (either by caesarian section or vaginal delivery), and whether any resuscitation was done in an attempt to stabilize the newly delivered preterm infant, constituted delivery-related factors. Infant factors including sex of infant, gestational age in weeks at birth, birth weight, as well as the presence or absence of congenital anomalies and complications were also assessed.

Birth complications in the preterm newborns were categorized using the WHO's International Classification of Diseases (ICD-11) for Mortality and Morbidity Statistics (Version: 04 / 2019) (23). The categories included hemorrhagic/hematological disorders of the fetus, fetus/newborn infections [this is based on clinical evaluation and lab tests (cultures, CRP)], respiratory disorders, fetal growth disorders, and others (digestive system disorders, transitory endocrine/metabolic disorders, disturbances of temperature regulation, neurological disorders and, genitourinary system disorders). Gestational age at delivery were categorized as extreme preterm (<28 weeks), very preterm (28 to < 32 weeks), moderate preterm (32 to < 34 weeks), and late preterm (34 to < 37 weeks). Also, the infant's birth weight in kilograms (kg) was categorized as normal (>2.5 kg), low birth weight (< 2.5–1.5 kg), very low birth weight (< 1.5–1.0 kg), and extremely low birth weight (< 1.0 kg).

Data analysis

The data extracted from the medical records were cleaned, coded, and entered into a Microsoft excel 2016 spreadsheet and exported into Stata IC version 16 (Stata Corp, College Station, TX, US) for final

analysis. Descriptive statistics including frequencies, proportions, mean, and standard deviation were were used to describe the maternal and child characteristics by gestational age at bith. The line plot was also used to describe the preterm outcome after admission at NICU by the completed gestational age at birth in weeks.

Pearson's Chi-square test of association was used to identify factors that were significantly associated with preterm outcomes after admission at the NICU. The Poisson regression model was used to determine the risk factors of preterm death before discharge after admission to the NICU. The variance inflation factor (VIF) was used to assess multicollinearity. The final multivariable model had a average VIF of 2.66 (range: 1.07–7.08) below the threshold of 10. The deviance and Pearson's goodness of fit test were both non-significant with p-values of 1.000 indicating the model is appropriate. The statistical significance for the study was set at a p-value of 0.05.

Missingness and completeness of data used for analysis

Medical records of a total of 1,274 preterm newborns admitted into the NICU of Korle-Bu Teaching Hospital during the years 2017 (n = 387, 30.4%), 2018 (n = 618, 48.5%), and 2019 (n = 269, 21.1%) were reviewed. Due to missingness on some very important variables in the study, a total of 1,203 observations with complete information were used for the analysis of this study, 359 (29.8%) from 2017, 577 (48.0%) from 2018, and 267 (22.2%) from 2019 records (Figure 1).

Results

Descriptive characteristics of study participants

The average age of the 1,203 mothers whose newborns were admitted to the NICU was 30.0 (±6.4) years with most (n = 568, 47.2%) of them in the age range 30–39 years. A few 3.9% (n = 47) had no formal education whilst 18.7% (n = 225) of them had a tertiary level of education. One thousand and six (83.6%) were married and 54.0% (n = 650) of them had given birth to only one child. Fifteen (1.25%) of the mothers were HIV positive. The majority (n = 1,057, 87.9%) of the preterm newborns were delivered at Korle-Bu Teaching Hospital, with over a third (n = 323, 37.3%) of the births through cesarean section. About half (n = 583, 48.5%) of the mothers had no maternal medical conditions. Among the 38 with maternal infectious diseases, hepatitis B was the common with 17, followed by syphilis with 12, urinary tract infection with 5 and 4 with candidiasis. About 50.5% of the preterm infants were males. Of the 1,207 preterm newborns admitted to the NICU, 15.9% (n = 192) of them had no complications and 42.8% of them required resuscitation. Less than a tenth (n = 84, 7.0%) were born with normal birth weight (>2.5 kg), 3.3% had congenital anomalies and about a third (n = 367, 30.5%) were born at 34 to 37 weeks (Table 1).

Table 1 also shows the descriptive characteristics of the participants by the gestational age at birth. The gestational

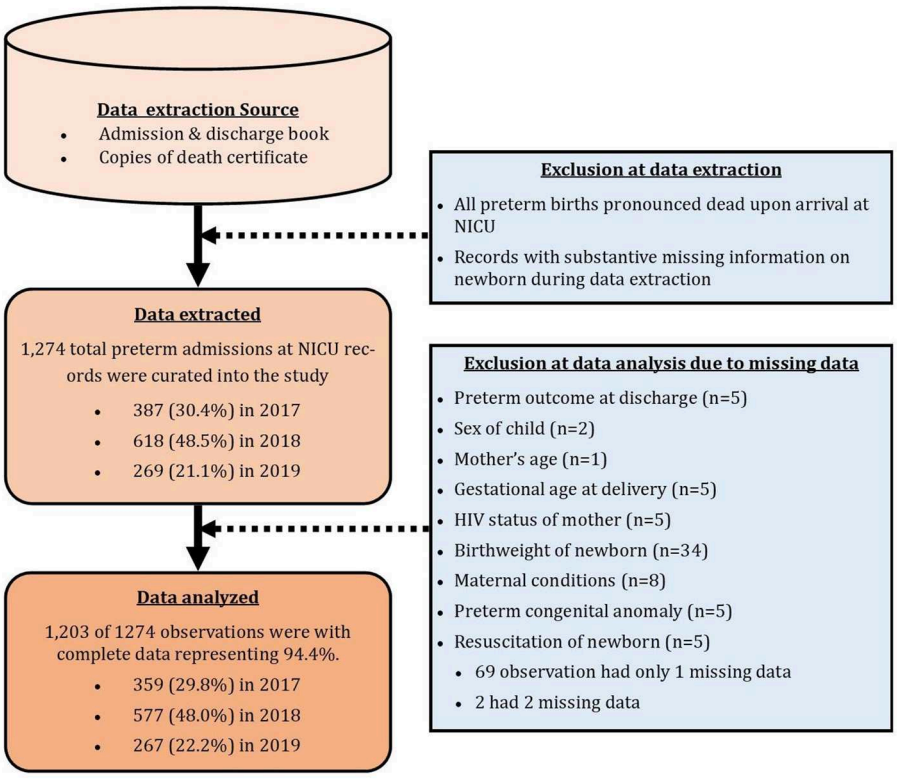

FIGURE 1
Flow chart of data extraction, showing missingness and final data used for analysis.

TABLE 1 Descriptive characteristics of child, maternal and delivery-related factors by gestational age at birth.

Characteristics	Total	Gestational week at birth of preterm newborns				Chi-square (DF)	*P*-value
		Late (34 to <37)	Moderate (32 to <34)	Very (28 to <32)	Extreme (<28)		
	N = 1,203	*N* = 367	*N* = 346	*N* = 320	*N* = 170		
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)		
Maternal							
Mother's age in years: Mean [±SD]	30.0 [±6.3]	30.1 [±6.4]	30.4 [±6.3]	29.8 [±6.3]	29.4 [±6.5]		
Mother's age in years						12.47 (9)	0.190
<20	66 (5.5)	14 (3.8)	16 (4.6)	22 (6.9)	14 (8.2)		
20–29	490 (40.7)	155 (42.2)	138 (39.9)	124 (38.8)	73 (42.9)		
30–39	568 (47.2)	176 (48.0)	164 (47.4)	159 (49.7)	69 (40.6)		
40–49	79 (6.6)	22 (6.0)	28 (8.1)	15 (4.7)	14 (8.2)		
Mother's education						18.20 (12)	0.110
None	47 (3.9)	20 (5.4)	11 (3.2)	11 (3.4)	5 (2.9)		
Primary	247 (20.5)	65 (17.7)	83 (24.0)	57 (17.8)	42 (24.7)		
Junior high school	469 (39.0)	154 (42.0)	137 (39.6)	126 (39.4)	52 (30.6)		
Senior high school	215 (17.9)	59 (16.1)	61 (17.6)	63 (19.7)	32 (18.8)		
Tertiary	225 (18.7)	69 (18.8)	54 (15.6)	63 (19.7)	39 (22.9)		
Marital status						10.08 (6)	0.120
Single	84 (7.0)	19 (5.2)	24 (6.9)	22 (6.9)	19 (11.2)		
Co-habiting	113 (9.4)	33 (9.0)	27 (7.8)	32 (10.0)	21 (12.4)		
Married	1,006 (83.6)	315 (85.8)	295 (85.3)	266 (83.1)	130 (76.5)		
Religion						6.57 (3)	0.087
Non-Christians	138 (11.5)	55 (15.0)	36 (10.4)	31 (9.7)	16 (9.4)		
Christians	1,065 (88.5)	312 (85.0)	310 (89.6)	289 (90.3)	154 (90.6)		
Parity						4.50 (6)	0.610
One	650 (54.0)	191 (52.0)	184 (53.2)	174 (54.4)	101 (59.4)		
Two	272 (22.6)	88 (24.0)	80 (23.1)	66 (20.6)	38 (22.4)		
Three or more	281 (23.4)	88 (24.0)	82 (23.7)	80 (25.0)	31 (18.2)		
Mother's occupation						19.78 (6)	0.003
Unemployed	591 (49.1)	194 (52.9)	169 (48.8)	159 (49.7)	69 (40.6)		
Informal sector	380 (31.6)	103 (28.1)	128 (37.0)	95 (29.7)	54 (31.8)		
Formal sector	232 (19.3)	70 (19.1)	49 (14.2)	66 (20.6)	47 (27.6)		
HIV status						7.22 (3)	0.065
Negative	1,188 (98.8)	358 (97.5)	342 (98.8)	319 (99.7)	169 (99.4)		
Positive	15 (1.2)	9 (2.5)	4 (1.2)	1 (0.3)	1 (0.6)		
Delivery related							
Place of delivery						6.92 (3)	0.074
Korle-Bu	1,057 (87.9)	324 (88.3)	314 (90.8)	278 (86.9)	141 (82.9)		
Other	146 (12.1)	43 (11.7)	32 (9.2)	42 (13.1)	29 (17.1)		
Mode delivery						55.87 (3)	<0.001
Caesarean section	656 (54.5)	215 (58.6)	199 (57.5)	194 (60.6)	48 (28.2)		
Vaginal delivery	547 (45.5)	152 (41.4)	147 (42.5)	126 (39.4)	122 (71.8)		

(Continued)

TABLE 1 (Continued)

Characteristics	Total	Gestational week at birth of preterm newborns				Chi-square (DF)	*P*-value
		Late (34 to <37)	Moderate (32 to <34)	Very (28 to <32)	Extreme (<28)		
	N = 1,203	*N* = 367	*N* = 346	*N* = 320	*N* = 170		
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)		
Maternal conditions						48.62 (18)	<0.001
None	583 (48.5)	168 (45.8)	167 (48.3)	138 (43.1)	110 (64.7)		
Disorders in pregnancy	371 (30.8)	110 (30.0)	111 (32.1)	123 (38.4)	27 (15.9)		
Obstetric hemorrhage	19 (1.6)	6 (1.6)	3 (0.9)	4 (1.3)	6 (3.5)		
Maternal disorders	49 (4.1)	18 (4.9)	17 (4.9)	9 (2.8)	5 (2.9)		
Fetus/amniotic/delivery related conditions	126 (10.5)	41 (11.2)	34 (9.8)	36 (11.3)	15 (8.8)		
Maternal infectious diseases (Hep. B, syphilis, etc.)	38 (3.2)	18 (4.9)	10 (2.9)	4 (1.3)	6 (3.5)		
Unspecified conditions	17 (1.4)	6 (1.6)	4 (1.2)	6 (1.9)	1 (0.6)		
Child							
Sex						3.70 (3)	0.300
Female	608 (50.5)	172 (46.9)	174 (50.3)	172 (53.8)	90 (52.9)		
Male	595 (49.5)	195 (53.1)	172 (49.7)	148 (46.3)	80 (47.1)		
Complications on admission						111.12 (15)	<0.001
None	192 (16.0)	78 (21.3)	61 (17.6)	44 (13.8)	9 (5.3)		
Hemorrhagic/hematological disorders of fetus	250 (20.8)	89 (24.3)	92 (26.6)	56 (17.5)	13 (7.6)		
Fetus/newborn infections	83 (6.9)	33 (9.0)	25 (7.2)	17 (5.3)	8 (4.7)		
Respiratory disorders	349 (29.0)	72 (19.6)	78 (22.5)	107 (33.4)	92 (54.1)		
Fetal growth disorders/restrictions	285 (23.7)	76 (20.7)	83 (24.0)	83 (25.9)	43 (25.3)		
Others	44 (3.7)	19 (5.2)	7 (2.0)	13 (4.1)	5 (2.9)		
Resuscitation						16.89 (3)	<0.001
No	688 (57.2)	221 (60.2)	216 (62.4)	175 (54.7)	76 (44.7)		
Yes	515 (42.8)	146 (39.8)	130 (37.6)	145 (45.3)	94 (55.3)		
Birth weight						616.34 (9)	<0.001
Normal (≥2.5 kg)	84 (7.0)	62 (16.9)	17 (4.9)	1 (0.3)	4 (2.4)		
Low birth weight (1.5 to <2.5 kg)	621 (51.6)	255 (69.5)	243 (70.2)	114 (35.6)	9 (5.3)		
Very low birth weight (1.0 to <1.5 kg)	358 (29.8)	47 (12.8)	83 (24.0)	160 (50.0)	68 (40.0)		
Extremely low birth weight (<1.0 kg)	140 (11.6)	3 (0.8)	3 (0.9)	45 (14.1)	89 (52.4)		
Congenital anomalies						9.48 (3)	<0.001
No	1,163 (96.7)	349 (95.1)	331 (95.7)	315 (98.4)	168 (98.8)		
Yes	40 (3.3)	18 (4.9)	15 (4.3)	5 (1.6)	2 (1.2)		

N (%), Frequency (Column percentage); DF, Degree of freedom; SD, Standard deviation.

age at birth of the newborns varied significantly across some of the characteristics including mode of delivery, maternal condition, complication of child at NICU admission, resusicitation, birthweight and presence of congenital anormaly (Table 1).

Outcome of care among preterm newborns admitted at the NICU

Of the 1,203 preterm newborns admitted at the NICU, 29.5% (n = 355) died before discharge. Marital status [$\chi^2(2) = 7.2$, p-

value = 0.028] was significantly associated with outcome at discharge with higher mortality among single mothers (40.5%) compared to co-habiting (23.0%) and married mothers (29.3%). Also, place of delivery [$\chi^2(1) = 10.72$, p-value = 0.001] was a significant factor with higher mortality among mothers who delivered elsewhere (41.1%) compared to those who delivered in Korle-Bu (27.9%). Mode of delivery [$\chi^2(1) = 3.9$, p-value = 0.048] was associated with outcome at discharge with higher mortality among vaginal delivery (32.4%) compared to caesarean section delivery (27.1%). Death at discharge from NICU was also higher among preterm newborns who were resuscitated (38.8%) compared to the non-resuscitated (22.5%) [$\chi^2(1) = 37.7$, p-value < 0.001]. Mortality at discharge from NICU was higher among preterm births newborns with lower birthweight [$\chi^2(3) = 314.2$, p-value <0.001]. Also, mortality at discharge from NICU was higher among newborns with congenital anomaly [$\chi^2(1) = 10.5$, p-value = 0.001]. Gestational weeks at birth was also associated with moratlity at NICU discharge [$\chi^2(3) = 245.6$, p-value < 0.001] were the factors that significantly influenced the outcome of preterm infants at the KBTH NICU (Table 2).

Completed gestational age in weeks at birth and Preterm outcome after admission at NICU

Figure 2 shows the oucomes dead and alive outcomes before the discharge of preterm newborns admitted to the NICUby their completed gestational age in weeks at birth. All 29 preterm newborns with gestational age <26 weeks died. Only 2 (7.7%) of the 26 newborns during the 26th gestational week survived whilst 43.0% (n = 34/79) of the newborns during the 28th gestational week survived. On the other hand, mortality were 17.1% and 15.9% among the newborns on the 35 and 36th week, respectively. The proportion of preterm newborns surviving at each gestational age increased steeply between 27 and 28th gestational weeks (from 14.7 to 43%) then increased steadily to 32nd gestational weeks before levelling from 34 to 36th gestational weeks. Proportionately more preterm before the 29th gestational weeks died than survive (57% of preterm die at 28 weeks). Half of the preterm newborns born between the 29 and 30th gestational week survived.

Risk factors of death before discharge among preterm newborns admitted at the NICU

Table 3 shows the unadjusted and adjusted Poisson regression model of risk factors of death outcome among NICU admitted preterm newborns. From the adjusted Poisson model, maternal conditions were not significant risk factors of preterm death. The risk of death at discharge was significantly higher among new borns with with complications including hemorrhagic/hematological disorders of the fetus (aRRR: 4.20, 95% CI: [1.70–10.35], p = 0.002), fetus/newborn infections (aRRR: 3.04, 95% CI: [1.02–9.04], p = 0.046), respiratory disorders (aRRR: 13.08, 95% CI: [5.50–31.10], p < 0.001), fetal growth disorders (aRRR: 8.62, 95% CI: [3.64–20.43], p < 0.001) and other complications (aRRR: 14.57, 95% CI: [5.93–35.77], p < 0.001).

Compared to those with normal weight at birth, the risk of death at discharge was significantly higher among those with very low birth weight (aRRR: 2.27, 95% CI: [1.22–4.23], p = 0.010) and those with extreme low birth weight (aRRR: 3.15, 95% CI: 1.68–5.88], p < 0.001).

The risk of death at discharge in admitted preterm newborns with congenital anomalies was over twice the risk in preterm with no congenital anomaly (aRR: 2.18, 95% CI: [1.52–3.12], p < 0.001). Compared to late/moderate preterm newborns, the adjusted risk of death was significantly higher among the very preterm newborns (aRR: 1.41, 95% CI: [1.11–1.79], p = 0.005) and the extreme preterm newborns (aRR: 1.87, 95% CI: [1.43–2.46], p < 0.001) (Table 3).

Discussion

Three out of every ten preterm newborns (29.5%) admitted to the NICU died before discharge. The risk of death among these preterm newborns decreases as their gestational age increases. Those who were born extremely preterm (<32 weeks gestation), had a higher risk of death compared to those born late preterm. Risk of mortality was higher among preterm new-borns with birth weight below 1.5 kg. The risk of death before discharge among preterm babies admitted at NICU was higher for babies with neonatal co-morbidities such as Haemorrhagic /haematological disorders of foetus, foetus/new-born infections, Respiratory disorders, Fetal growth disorders. The existence of complications and congenital anomalies at birth among preterm newborns increased the risk of death. The study, however, found that maternal conditions were not significant risk factors of death at the NICU.

Preterm birth remains a major cause of perinatal, neonatal, and infant mortality (3, 18, 24). The current study found that preterm birth accounted for about one-third of the deaths recorded over a two and quarter year period (January, 2017–April, 2019) at just one facility. A similar prevalence (26%) was reported by an earlier study that assessed neonatal deaths from 2003 to 2009 in northern Ghana (25). Even higher prevalence rates were recorded in South-East Nigeria (46.1%) for the period 2009 to 2013 (8) and 67.7% in South Africa (26). While significant progress has been made in reducing infection-related deaths among children generally, successes have been slow among neonates and more especially among preterms (4). In 2017, Ghana the Maternal Health Survey using a nationally representative sample, estimated neonatal mortality for the 5-year period preceding the survey as 25 deaths per 1,000 live births. The report indicated a very high uptake (98%) of antenatal care (ANC) from a skilled provider among pregnant women with about four out of five of them having four or more ANC visits (27). However, the uptake of ANC must be complemented with quality of care to mitigate neonatal deaths. Adu-Bonsaffoh et al. (14), recently reported that poor antenatal care among other factors predicted the incidence of preterm delivery in the same facility used for this study (28). Moreover, factors that predict preterm birth evidently account for a large proportion of preterm mortality (18). Also a cause for concern, is the preterm births that could have been avoided in low and middle-income countries (LMIC) as it has been found that about 14.2% of provider-initiated preterm birth in LIMC were not medically indicated (15).

TABLE 2 Prevalence and association between death before discharge and demographic characteristics among preterm newborns admitted at the NICU.

Characteristics	Total	Outcone at discharge		Chi-square (DF)	*P*-value
		Alive	Died		
		n (%)	*n* (%)		
Overall	**1,203**	**848 (70.5)**	**355 (29.5)**		
MATERNAL					
Mother's age in years				1.37 (3)	0.713
<20	66	47 (71.2)	19 (28.8)		
20-29	490	337 (68.8)	153 (31.2)		
30-39	568	409 (72.0)	159 (28.0)		
40-49	79	55 (69.6)	24 (30.4)		
Mother's education				7.47 (4)	0.113
None	47	40 (85.1)	7 (14.9)		
Primary	247	176 (71.3)	71 (28.7)		
Junior high school	469	336 (71.6)	133 (28.4)		
Senior high school	215	146 (67.9)	69 (32.1)		
Tertiary	225	150 (66.7)	75 (33.3)		
Marital status				7.17 (2)	0.028
Single	84	50 (59.5)	34 (40.5)		
Co-habiting	113	87 (77.0)	26 (23.0)		
Married	1,006	711 (70.7)	295 (29.3)		
Religion				0.55 (1)	0.460
Non-Christians	138	101 (73.2)	37 (26.8)		
Christians	1,065	747 (70.1)	318 (29.9)		
Parity				2.73 (2)	0.255
One	650	461 (70.9)	189 (29.1)		
Two	272	199 (73.2)	73 (26.8)		
Three or more	281	188 (66.9)	93 (33.1)		
Mother's occupation				4.72 (2)	0.094
Unemployed	591	424 (71.7)	167 (28.3)		
Informal sector	380	274 (72.1)	106 (27.9)		
Formal sector	232	150 (64.7)	82 (35.3)		
HIV status				0.66 (1)	0.416
Negative	1,188	836 (70.4)	352 (29.6)		
Positive	15	12 (80.0)	3 (20.0)		
Delivery-related					
Place of delivery				10.72 (1)	0.001
Korle-Bu	1,057	762 (72.1)	295 (27.9)		
Other	146	86 (58.9)	60 (41.1)		
Mode delivery				3.91 (1)	0.048
Caesarean section	656	478 (72.9)	178 (27.1)		
Vaginal delivery	547	370 (67.6)	177 (32.4)		
Maternal medical conditions				12.41 (6)	0.053
None	583	403 (69.1)	180 (30.9)		

(Continued)

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TABLE 2 (Continued)

Characteristics	Total	Outcone at discharge		Chi-square (DF)	*P*-value
		Alive	Died		
		n (%)	*n* (%)		
Disorders in pregnancy	371	258 (69.5)	113 (30.5)		
Obstetric hemorrhage	19	11 (57.9)	8 (42.1)		
Maternal disorders	49	41 (83.7)	8 (16.3)		
Fetus, amniotic and delivery related conditions	126	98 (77.8)	28 (22.2)		
Maternal infectious diseases (Hep. B, syphilis, etc.)	38	23 (60.5)	15 (39.5)		
Unspecified conditions	17	14 (82.4)	3 (17.6)		
Child					
Sex of child				0.01 (1)	0.941
Female	608	428 (70.4)	180 (29.6)		
Male	595	420 (70.6)	175 (29.4)		
Complications on admission				272.08 (1)	<0.001
None	192	187 (97.4)	5 (2.6)		
Hemorrhagic/hematological disorders of fetus	250	222 (88.8)	28 (11.2)		
Fetus/newborn infections	83	76 (91.6)	7 (8.4)		
Respiratory disorders	349	146 (41.8)	203 (58.2)		
Fetal growth disorders/restrictions	285	195 (68.4)	90 (31.6)		
Others	44	22 (50.0)	22 (50.0)		
Resuscitation				37.65 (1)	<0.001
No	688	533 (77.5)	155 (22.5)		
Yes	515	315 (61.2)	200 (38.8)		
Birth weight				314.20 (3)	<0.001
Normal (≥2.5 kg)	84	76 (90.5)	8 (9.5)		
Low birth weight (1.5 to <2.5 kg)	621	529 (85.2)	92 (14.8)		
Very low birth weight (1.0 to <1.5 kg)	358	225 (62.8)	133 (37.2)		
Extremely low birth weight (<1.0 kg)	140	18 (12.9)	122 (87.1)		
Completed gestational week at birth				245.56 (3)	<0.001
Late (34 to <37 weeks)	367	305 (83.1)	62 (16.9)		
Moderate preterm (32 to <34 weeks)	346	297 (85.8)	49 (14.2)		
Very preterm (28 to <32 weeks)	320	204 (63.7)	116 (36.3)		
Extreme preterm (<28 weeks)	170	42 (24.7)	128 (75.3)		
Congenital anomalies				10.51 (1)	0.001
No	1,163	829 (71.3)	334 (28.7)		
Yes	40	19 (47.5)	21 (52.5)		

N (%), Frequency (Row percentage); DF, Degree of freedom.

Neonatal mortality has long been known to be associated with gestational age, with decreasing mortality in infants as gestational weeks approach full-term (10, 13, 29–31). Findings from this study corroborate these earlier reports because the risk of death among the preterm newborns decreased with increasing gestational age, with those extremely preterm having a higher risk of death compared to those born late preterm. D'Onofrio et al. (28), reported similar findings in their study that extreme preterm birth with a gestational period of 23–27 weeks was a predictor of infant mortalityClick or tap here to enter text.. Jacob et al. (2015), also found that mortality at lower gestational ages was most commonly attributed to extreme preterm birth with the attendant complications (32). About three out of four babies born at 24 weeks of gestation do not survive, one out of three babies die at 25 weeks of gestation and one out of four babies dies at 26 weeks of gestation before discharge from the hospital (33). The risk of death among these preterm newborns

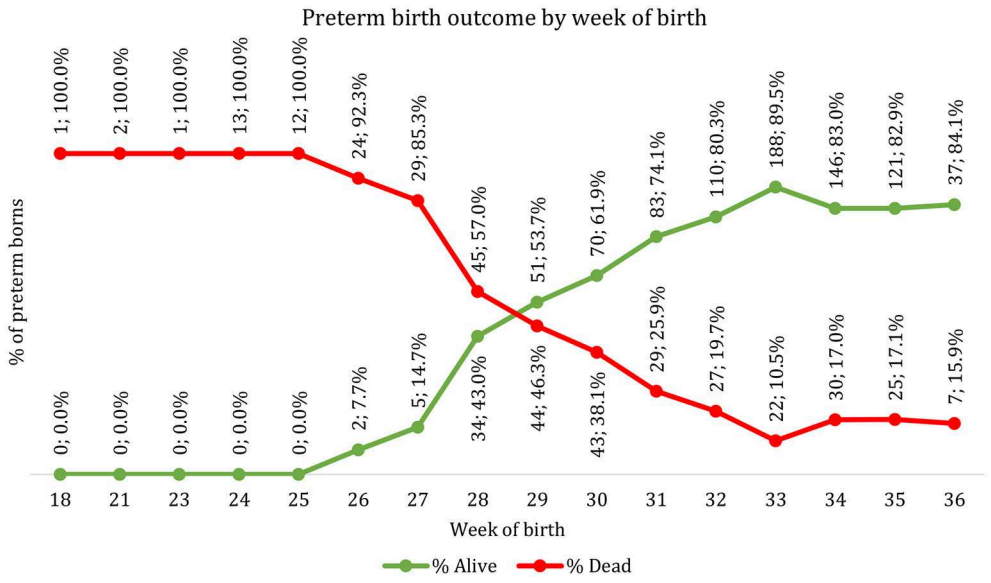

FIGURE 2
Preterm outcome by the week of birth.

significantly increased with the presence of congenital anomalies and complications including hemorrhagic/hematological disorders of the fetus, respiratory disorders, and fetal growth disorders. Preterm birth complications is one of the three leading causes of death worldwide (3). Hyperglycemia occurring on the first day of life in extremely preterm infants (34), increased severity of respiratory failure (35), necrotizing enterocolitis, intraventricular hemorrhage in extreme to very preterm population (32, 36, 37), and birth asphyxia (25) have also been implicated as predictors of preterm deaths. Fetal and newborn infections however, did not siginificantly increase the risk of mortality. This supports earlier observations of significant reductions in infection-related deaths among children (4). These findings do not however, eliminate infection from the causes of preterm deaths as some studies have found its association with the latter (19, 36, 37).

Birth weight was also negatively associated with death in NICU. A very low birth weight (1.0 to <1.5 kg) and extremely low birth weight (<1.0 kg) significantly increased the risk of preterm death. Earlier findings have also indicated low birth weight (LBW) as a predictor of death in the first 24 hours after birth (38). Extremely low birth weight is significantly associated with death in the first 6 days after birth (7) and neonatal death before discharge from the health facility (26). A meta analysis of empirical data from 12 randomized controlled trials conducted in 10 low-to-middle-income countries revealed that maternal supplementation with multiple micronutrients (a minimum of 1 recommended dietary allowance of multiple micronutrients), compared to iron–folic acid (IFA) supplementation alone during pregnancy, increased birthweight thereby, protecting one in ten infants from LBW (39). Maternal micronutrient supplementation (MMS) also reduces fetal growth restriction, prematurity, and neonatal mortality (40, 41). In Ghana, it has also been found that MMS reduces the risk of LBW compared to IFA supplementation alone (42). Moreover, the WHO has also indicated that there is high-certainty evidence that MMS reduces the risk of having LBW neonates compared with IFA supplements only, which is the standard care. However, MMS barely improved other fetal and neonatal outcomes including preterm birth rates. Hence, WHO has not yet recommended MMS for pregnant women. More research is required to ascertain if MMS will improve other neonatal outcomes, and how the micronutirents can be best combined into a single supplement (43). Furthermore, careful consideration must be given to the cultural setting as the economic situation, cultural representations of motherhood, and the unpredictable demands of the pregnant body could influence pregnancy food practices (44).

While birth weight is highly correlated with gestational age, studies that controlled for body size have reported a consistent relationship between prematurity and increased risk of morbidity and mortality (45). More robust survival predictive models based on a combination of gestational age and birth weight still predicts poorer outcomes for preterms classified as small for gestational age (SGA) compared to normal weight or term births (46).

Kangaroo mother care (KMC) is another intervention is being explored to improve the survival of low birthweight and preterm infants though the uptake is slow in low-to-middle-income countries (47–49). There is evidence of its integration into healthcare facilities providing newborn care for LBW in Ghana with designated wards in some hospitals (50, 51). This intervention is increasingly being implemented/scaled-up in different parts of the country.

Maternal factors and delivery conditions were not significant risk factors of preterm death before discharge from NICU in the current study. This supports the earlier findings of Iyoke et al. that survival was not dependent on maternal risk factors in a retrospective review of singleton preterm and term births from 2009 to 2013 in a teaching hospital in Nigeria (52). Contrary findings have also been reported by Bayou and Berhan, who found that obstructed labor, malpresentation, antepartum hemmorrhage and hypertensive disorders of pregnancy were significant predictors of high perinatal mortality (53). Additionally, Adu-Bonsaffoh et al., indicated that maternal age, hypertensive disorders and preterm rupture of membranes were associated with preterm birth in the same facility the current study was conducted (14). The limited

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TABLE 3 Risk factors of death before discharge among preterm newborns admitted at the NICU.

Characteristics	Poisson regression model of risk factor of death at discharge			
	Unadjusted model		Adjusted model	
	uRRR [95% CI]	*P*-value	aRRR [95% CI]	*P*-value
MATERNAL				
Mother's education				
None	1.00 [reference]		1.00 [reference]	
Primary	1.93 [0.89–4.20]	0.097	1.20 [0.67, 2.15]	0.532
Junior high school	1.90 [0.89–4.07]	0.097	1.31 [0.74, 2.32]	0.362
Senior high school	2.15 [0.99–4.69]	0.053	1.25 [0.69, 2.27]	0.452
Tertiary	2.24 [1.03–4.86]	0.042	1.17 [0.61, 2.26]	0.635
Marital status				
Single	1.38 [0.97, 1.97]	0.075	1.25 [0.99, 1.58]	0.066
Co-habiting	0.78 [0.53, 1.17]	0.236	0.85 [0.64, 1.12]	0.247
Married	1.00 [reference]		1.00 [reference]	
Religion				
Non-Christians	1.00 [reference]		1.00 [reference]	
Christians	1.11 [0.79–1.57]	0.535	0.99 [0.79, 1.25]	0.941
Parity	1.05 [0.93–1.19]	0.407	1.11 [1.01, 1.21]	0.029
Mother's occupation				
Unemployed	1.00 [reference]		1.00 [reference]	
Informal sector	0.99 [0.77–1.26]	0.917	0.98 [0.82, 1.16]	0.810
Formal sector	1.25 [0.96–1.63]	0.097	1.13 [0.82, 1.57]	0.455
HIV status				
Negative	1.00 [reference]		1.00 [reference]	
Positive	0.68 [0.22–2.10]	0.498	1.11 [0.43, 2.82]	0.833
Delivery-related				
Place of delivery				
Korle-Bu	1.00 [reference]		1.00 [reference]	
Other	1.47 [1.12–1.94]	0.006	1.14 [0.95, 1.38]	0.166
Mode delivery				
Caesarean section	1.00 [reference]		1.00 [reference]	
Vaginal delivery	1.19 [0.97–1.47]	0.097	1.00 [0.83, 1.21]	0.997
Maternal medical conditions				
None	1.00 [reference]		1.00 [reference]	
Disorders in pregnancy	0.99 [0.78–1.25]	0.910	1.21 [0.99, 1.48]	0.058
Obstetric hemorrhage	1.36 [0.67–2.77]	0.391	1.17 [0.76, 1.79]	0.479
Maternal disorders	0.53 [0.26–1.07]	0.078	0.87 [0.49, 1.54]	0.629
Fetus, amniotic and delivery related conditions	0.72 [0.48–1.07]	0.106	0.98 [0.74, 1.31]	0.917
Maternal infectious diseases (Hep. B, syphilis, etc.)	1.28 [0.76–2.16]	0.361	1.36 [0.89, 2.06]	0.155
Unspecified conditions	0.57 [0.18–1.79]	0.337	0.83 [0.38, 1.84]	0.655
Child				
Sex of child				
Female	1.00 [reference]		1.00 [reference]	

(Continued)

TABLE 3 (Continued)

Characteristics	Poisson regression model of risk factor of death at discharge			
	Unadjusted model		Adjusted model	
	uRRR [95% CI]	*P*-value	aRRR [95% CI]	*P*-value
Male	0.99 [0.81–1.22]	0.951	1.11 [0.97, 1.28]	0.137
Complications on admission				
None	1.00 [reference]		1.00 [reference]	
Hemorrhagic/hematological disorders of fetus	4.30 [1.66–11.14]	0.003	4.20 [1.70, 10.35]	0.002
Fetus/newborn infections	3.24 [1.03–10.20]	0.045	3.04 [1.02, 9.04]	0.046
Respiratory disorders	22.34 [9.20–54.24]	<0.001	13.08 [5.50, 31.10]	<0.001
Fetal growth disorders/restrictions	12.13 [4.93–29.84]	<0.001	8.62 [3.64, 20.43]	<0.001
Others	19.20 [7.27–50.70]	<0.001	14.57 [5.93, 35.77]	<0.001
Resuscitation				
No	1.00 [reference]		1.00 [reference]	
Yes	1.72 [1.40–2.13]	<0.001	1.12 [0.97, 1.30]	0.135
Birth weight				
Normal (≥2.5 kg)	1.00 [reference]		1.00 [reference]	
Low birth weight (1.5 to <2.5 kg)	1.56 [0.76–3.20]	0.231	1.30 [0.71, 2.39]	0.397
Very low birth weight (1.0 to <1.5 kg)	3.90 [1.91–7.96]	<0.001	2.27 [1.22, 4.23]	0.010
Extremely low birth weight (<1.0 kg)	9.15 [4.47–18.71]	<0.001	3.15 [1.68, 5.88]	<0.001
Congenital anomalies				
No	1.00 [reference]		1.00 [reference]	
Yes	1.83 [1.18–2.84]	0.007	2.18 [1.52, 3.12]	<0.001
Completed gestational weeks at birth				
Late/Moderate (32 to <37 weeks)	1.00 [reference]		1.00 [reference]	
Very preterm (28 to <32 weeks)	2.33 [1.79, 3.02]	<0.001	1.41 [1.11, 1.79]	0.005
Extreme preterm (<28 weeks)	4.84 [3.75, 6.24]	<0.001	1.87 [1.43, 2.46]	<0.001

uRRR, Unadjusted relative risk ratio; aRRR, adjusted relative risk ratio, CI; confidence interval.

data from the records reviewed in this study did not allow for the effect of maternal lifestyle factors including smoking and alcohol intake to be assessed although they have been implicated in literature as influencing preterm births and some negative neonatal outcomes (54–56).

There is the need for further research into interventions that are safe, effective, and scalable in limited-resource settings, where most preterm-associated infant mortality occurs (5). It might be useful to focus on hospital care related interventions delivered during labour and birth, which have been found to be most effective in reducing neonatal deaths. The KMC and the use of antenatal corticosteroids can avert about half and one third of preterm-related deaths, respectively (57, 58). Also, low and middle-income countries should improve their availability and quality of data on preterm births as recommended by the WHO in the framework of the Global Strategy for Women's, Children's and Adolescents' Health (59, 60). Currently, most of the data available are from facility-based research studies, which were often conducted in tertiary facilities and are largely not nationally representative (5) as is the case for this study. Efforts in this post-2015 era should advance beyond just promoting child survival to reducing child morbidity and ensuring healthy development. It is crucial that as child survival improves, children are not left with impairments (3).

Study limitations

Although the study design adequately answered the study objective, the retrospective record review employed did not allow for some relevant clinical indicators of preterm birth implicated in literature, such as maternal lifestyle factors including smoking and alcohol intake, medications used by mothers during pregnancy, and record of antenatal care among others to be assessed. For the same reason, a very important predictor of preterm outcome such as single/multiple birth was not extracted. Furthermore, authors are unable to report on other method of determining gestational age and its possible impact on preterm classification.the data used in this study was obtained from just one tertiary facility. Hence the sample is not nationally representative and findings cannot be generalized for the country.Since the data was extracted from hospital records, issues of missingness of information on specific characteristics was common. This was evident from the flow chart in Figure 1 where 71

observation did not have data on key variables. Also, the method of measurement of information such as gestational age at birth may vary from one record to the other. Also, the issue of complete omission of information of some records cannot be ignored given that past records of hard copies spanning over a 3 years were reviewed.

Conclusion

This study demonstrate that maternal factors are not significant risk factors of preterm deaths. Gestational age, birth weight, presence of complications and congenital anomalies at birth are significantly associated with preterm deaths. Interventions delivered during labour and birth including kangaroo mother care and the use of antenatal corticosteroids should be scaled up to ensure nationwide coverage so as to reduce preterm deaths. Additionally, further research involving national level data on preterm deaths and associated causes is recommended.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by Korle Bu Teaching Hospital, Institutional Review Board, IRB No: KBTH-IRB/00010/2019. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

HT conceived the study, prepared the data collection guide, and collected the data. HT and DOA researched the literature. SKA and YA were involved in the data analysis and result interpretations. SKA wrote the first draft of the manuscript. All authors reviewed, proofread, and approved the final version of the manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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District-level analysis of socio-demographic factors and COVID-19 infections in Greater Accra and Ashanti regions, Ghana

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Since December 2019 when COVID-19 was detected, it took the world by surprise in terms of spread and morbidity/mortality. The high rate of spread and casualties recorded from COVID-19 called for research in all directions to find ways to contain and reverse the incidences. It is against this background that this paper sought to measure the association of the socio-demographic factors in the hard-hit districts in Greater Accra and Ashanti to analyze its relationship with the novel COVID-19 virus. Data on COVID-19 cases from 35 Districts in both Greater Accra and Ashanti Regions were collected from the Ghana Health Service and population data from Ghana Statistical Service. Descriptive statistics and regression analysis were generated using R. We found that some socio-demographic variables have an association with COVID-19 infections. For example, age and religion especially Christianity and Islam pose risk to COVID-19. The population aged 15–64 was particularly at high risk of infections due to the high level of movement of this age group. We, therefore, recommend that places of congregation such as Churches and Mosques be targeted for vigorous sensitization on COVID-19 protocols and prevention. Also, districts with a high population between the ages of 15–64 should step sensitization efforts to educate their inhabitants on the need to reduce travel and related activities to curb the spread of the virus.

KEYWORDS

COVID-19 infections, socio-demographic factors, religion, ethnicity, greater

1. Background

It was on the 31st of December 2019 that news of cases of a disease like pneumonia whose antilogy was not known at the time detected in Wuhan city of China emerged (1). The World Health Organization (WHO) announced on January 12, 2020 that a novel coronavirus was the source of respiratory disease in a group of patients in Wuhan City, Hubei Province, China (2, 3). The disease was given the name COVID-19, and the pathogen was identified as SARS-Coronavirus-2 (an RNA virus) (SARS-CoV-2) (4).

The virus is spread mostly by contact with minute droplets produced by an infected person coughing, sneezing, or talking (5, 6). While a large percentage of infected people are asymptomatic, fever, cough, acute respiratory distress, lethargy, and failure to clear after 3 to 5 days of antibiotic treatment are the most prevalent symptoms in clinical cases. Secondary outcomes include the incidence of pneumonia and acute respiratory distress syndrome which

has the resultant effect of organ function damage, including acute kidney injury, cardiac injury, liver dysfunction, and a host of other complications that required patients to be put on mechanical ventilation (3, 7).

Before the confirmation of the epidemic in Ghana, the National Disease Surveillance Department of the Ghana Health Service conducted a readiness assessment and developed a response strategy (1). Furthermore, the country provided orientation at the Kotoka International Airport (KIA) and other ports of entry for effective screening and handling of suspected cases, as well as contact tracing training for Alumni and Residents of the Ghana Field Epidemiology and Laboratory Training Program (GFELTP) and Ghana Health Service staff (GHS).

Ghana's health ministry announced the first two cases of COVID-19 on March 12, 2020 (1). As a first response, all public meetings such as religious gatherings and festivals were prohibited on March 15. On March 16th, a ban on all public gatherings, as well as the closure of schools, churches, mosques, and other places of worship were announced. On March 17, a ban on entry for travelers arriving from a country with more than 200 confirmed COVID-19 cases within the previous 14 days was also announced. The government also announced a mandatory quarantine of all travelers arriving 48 h before the closure of the country's borders. On the 30th of March, a partial lockout was implemented in areas known as "hotspots" for public safety reasons. These "hotspot" areas were in two regions, which are the Greater Accra and the Ashanti region.

On April 20th, the limitations on Accra and Kumasi were eased, and on April 26th, the usage of face masks became necessary. Even though the lockdown was lifted after three weeks, post-lockdown procedures were implemented to keep the illness from spreading. Early in the COVID-19 pandemic, Ghana's response was hailed as one of the best among African countries; its innovative testing approach and science-driven political leadership (8, 9). The country's COVID-19 outbreak response was diverse, contact tracing capacity was strengthened by training several surveillance officers and more treatment centers and Intensive Care Unit beds were established to handle cases (8). There was a provision of psychosocial support and protective gear to several persons. Personal hygiene and self-protection measures were strictly enforced, and these include wearing a nose mask, restriction on social gatherings, social separation, an increase in the number of testing stations, and humanitarian aid for Ghanaians were among them. As the nation continues to increase surveillance and other response actions, this has become the new normal (10).

The impact of the COVID-19 pandemic has been phenomenal. There has been an unprecedented challenge to public health, world of work, and food security (11, 12). The social, demographic, and economic disruption caused by the pandemic is devastating and millions of people worldwide are at risk of falling into extreme poverty, job losses, shuttered businesses, and gaps in schooling, to violence and addiction, among others (13, 14). The consequences of this disease are no different in Ghana, especially in the epicenters such as Greater Accra and Ashanti regions. Because of this, this paper sought to measure the strength of the association between socio-demographic factors and the increase in COVID-19 virus infections in the hard-hit districts in Greater Accra and Ashanti regions, Ghana.

The need for this analysis is to determine the strength of socio-demographic variables in contributing to the increased number of cases in such "hotspot" areas. With such information, the government can easily develop and implement the exact measures to minimize the increased number of cases in these hotspot areas. This can help in the allocation of resources such as the formation of quarantine sites, distributing hand sanitizers and nose masks, and the building of COVID-19 facilities to help stop the spread of the virus.

1.1. Impact of COVID-19

Since the 1918 influenza pandemic, the novel human coronavirus has been responsible for five (5) pandemics, including the COVID-19 outbreak (15). The COVID-19 began in Wuhan, China, and quickly spread throughout the world. On January 2020, the World Health Organization (WHO) named the new virus the 2019 novel coronavirus (2019 nCoV), and on February 12, 2020, it was renamed the infectious coronavirus disease 2019 (COVID-19) (16). On March 11, 2020, the WHO declared COVID-19 to be a pandemic.

From its outbreak in December 2019 up to February 2023, an estimate of about 676,208,868 recorded case, 648,612,009 recoveries and 6,771,722 million deaths have been recorded (17). For the same period in Ghana, 171,112 cases, 14 active, 2 serious, 169,636 recoveries, and 1,462 deaths had been documented (17). COVID-19 Pandemic has had great impact on the worldwide population, including multiple deaths and economic hardship (15). COVID-19 as a pandemic has affected a number of regions globally, apart from China and Thailand who recorded the initial cases (16). Like any other continent, Africa has had its fair share of the infections and continues to spread throughout the continent. In fact, the continent was considered as vulnerable due to the swiftly rate at which the pandemic was spreading (18). On the 14th of February 2020, Egypt confirmed its first case of COVID-19, while the first case from Sub-Saharan Africa was recorded in Nigeria on the 27th of February 2020, (18). After the first cases reported on march 12, MOH, in conjunction with the GHS began tracing the people suspected to have had contact with cases, particularly those returning from outside the country upon their arrival at the entry points and also a contact tracing activity on all those suspected having sufficient with the two suspected cases (19).

Due to the rate at which COVID-19 pandemic spread across the continents, the United Nations Framework (2020) reported COVID-19 pandemic as the worst recorded with the highest historic levels of unemployment, restrictions on people's freedom of movement, and heightened levels of hardship in human history (20).

The COVID-19 pandemic has had severe humanitarian consequences such that an attempt to estimate the overall cost in human life, is considered the unthinkable, although the impacts are still being determined around the world in terms of political, social, economic, and health systems networks and education. Aside the high cost of life and a severe health crisis, the world is experiencing an economic downturn that is having a significant influence on the well-being of huge segments of the world's population (21). According to UNIDO (2020) the most concerning consequences of COVID-19 worldwide pandemic, beyond human life is felt in terms of the economic damage it has caused around the world. Expectations for global economic development were all shattered as a result of investment setbacks (22). All sectors of economics have been devastated resulting in Global Gross Domestic Product fallen by over 78%, and in some regions experiencing negative growth from the 3.2%

before the COVID-19 pandemic to 1.8% during the countries' lockdown limitations (UNIDO, 2020). High levels of supply shortages have disturbed global supply systems, resulting in soaring prices (23). The ILO (24) provides a full assessment of the impact of the pandemic on employment dynamics; the findings show that unemployment and under-employment have skyrocketed. Unemployment has risen by 5.3, 13.0, and 24.7 million, considering low, mild, and high impact scenarios, respectively. The global financial crisis increased unemployment by 22 million, implying that in a high impact scenario, the pandemic has a deeper consequence. Downward wage and working hours' adjustments are worsening the under-employment. The number of hours worked has plummeted even far more than the situation in the 2008 global financial crisis. In Ghana, the COVID-19 mitigation measures have had an unmeasurable impact on Government, business community and individuals well beyond the human life lost. Impacts are seen in terms of strained government budget and liquidity constraints, increased unemployment rate, a decline in income generation, and disruption in transportation, among other essential services (25). Ghana Statistical Service in its industrial survey conducted and published in 2021 attested to the devastating impact of COVID-19 on Ghanaian businesses. They indicated that 35.7% of business establishments had to close during the partial lockdown, 46.1% of business reduced wages for 25.7% of the workforce (about 770,124 workers) (26).

2. Materials and methods

2.1. Study area

The study considered districts from two regions in Ghana that is; Greater Accra and Ashanti region which were the epicenters of COVID-19 during the early stages of the disease in Ghana and districts from the two regions were studied (see Figure 1). The location, socio-demographic, economic, and health profiles of the two regions, Greater Accra and Ashanti regions are discussed below. First the Greater Accra Region. On July 23, 1982, the Greater Accra Region, which was previously joined to the Eastern Region, was geographically and legally separated. It is one of the Ghana's sixteen (22) administrative regions. It is located in the country's southern coast, bounded by Eastern Region located at the north, at the east of Greater Accra is the Volta Region, the Central Region located at its western zone, and the Gulf of Guinea at the south. It covers a land area of 3, 245 km^2, which is 1.4% of the total land area in Ghana.

Greater Accra Region includes Ghana's capital city, Accra, as well as 28 Metropolitan, Municipal and District Assemblies (MMDAs). The region is made up of four district assemblies, 23 municipal assemblies, and two metropolitan assemblies. Each of the MMDAs is led by a Chief Executive.

Despite its small land surface area, the Greater Accra region is the most densely populated. With a population of 5,455,692, the region's female population (2,776,629) outnumbers the male population (2,679,063) (27). More than half of the population, 3,295,777 people, are under the age of 65 and from the working class. The region has become home to a diverse range of groups and ethnicities from across the country, with the Ga-Dangme people serving as the primary indigenous group. The Akan are the largest ethnic group in the Greater Accra Region, followed by Ga–Dangme and the Ewes. Because of in-migration from the country's northern regions, the region has a very high population density and growth rate. Even though international migration is low, migrants from other African countries into the region outnumber those from outside the African continent. The most populous district is the Accra Metropolitan Assembly, followed by the Tema Metropolitan Assembly. Greater Accra Region has the highest literacy rate among the 16 administrative regions, at 87% for both urban and rural male and female populations.

The region's population of 5,455,692 demonstrates that it is economically active. More than half of the economically active populace (51.8%) are self-employed, and 32.6% are employed by someone else. Men are 1.5 times more likely to be employed than women. The region is made up of sales and general workers who are typically concentrated in the two metropolitan areas. Agriculture, hunting, fish farming, and animal husbandry employ roughly half of Greater Accra's population. Salt mining is the region's primary mining activity. On the other hand, approximately 11.3% of the Greater Accra population is unemployed (27). Accra, the country's capital, is home to much of the country's infrastructure and social amenities. With several national highways connecting population areas throughout the country, the city is also home to many corporate headquarters and Ministry offices.

The Ashanti Region is located in Ghana's middle belt, covering a total land surface area of 24,389 km^2. It is situated between longitudes 0.15 W and 2.25 W and latitudes 5.50 N and 7.46 N. It is bordered by five administrative regions: the Eastern Region located to the east, the Western North Region facing the south-west, the Central Region (to the south), the Bono East Region (to the north), Ahafo Region (to the east), and Bono Region located at the North-West. The Ashanti region is divided into 43 sub-divisions, 24 of which are district assemblies, 18 of which are municipal district assemblies, and one metropolitan assembly, the Kumasi Metropolitan Assembly. Kumasi is the regional capital.

After Greater Accra Region, Ashanti Region has the second largest population. The population increased to 5,440,463 people in the year 2021, according to the Ghana Statistical Service. Females represented 50.7% of the populace (2,760,549), while males amounted to 49.3% (2,679,914). Ashanti region, like the Greater Accra region, has a youthful population and many working-class residents. Between 2010 and 2020, the population increased at a rate of 1.2 percent. Over half of the region's populace lives in urban zones, making it the second most densely populated after the Greater Accra Region. The region has a high rate of immigration, while others migrate to Western and African countries. The Ashantis are the main indigenes of the Ashanti Region, but other ethnic groups live there as well, as in other regions. The Asante nation's social administration is led by traditional chiefs and elders, and each division has its chief or paramount chief.

Forestry and agriculture (the production of timber and livestock) are the region's most important economic activities. Cocoa is an important crop in some parts of the region, and the region also has the country's largest mining site. Furthermore, other residents provide other services such as food, lodging, manufacturing, retail, and wholesale. According to the National Population Council's 2018 report, Ashanti Region had the highest employment rate for both males and females, at 19.7% and 18.8%, respectively. Meanwhile, the region had the second-highest unemployment rate (10.3%) (27).

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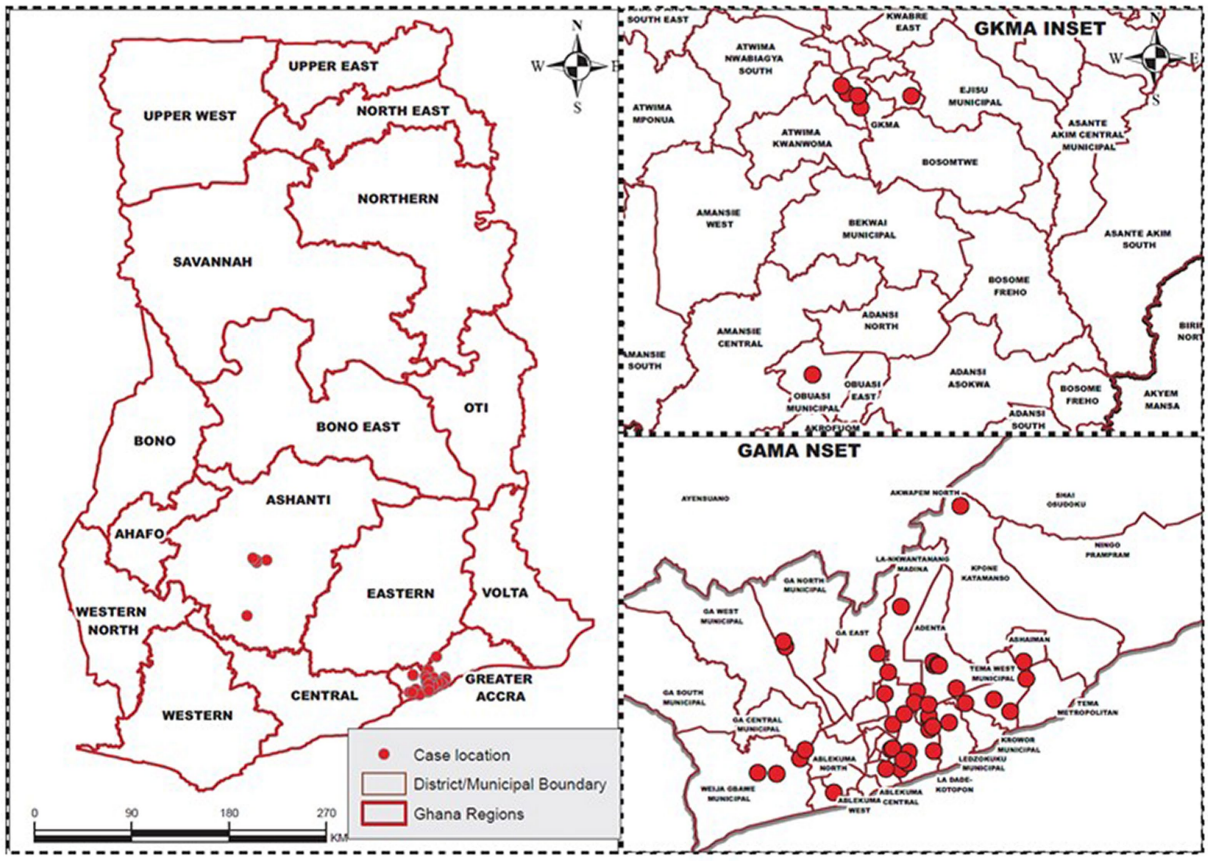

FIGURE 1
Study area.

2.2. Health profile and COVID-19 response

The novel coronavirus was confirmed a worldwide pandemic by The World Health Organization (WHO), on 11th March 2020. With a wide range of mild symptoms to severe illness, the virus could cause fever, shortness of breath, headaches, loss of smell and taste, and sore throat; just to mention a few (Center for Disease Control and Prevention, 2021). The first two confirmed cases of COVID-19 in Ghana were first diagnosed in the Greater Accra Region on 12th March 2020 (28). Since then, the global pandemic had increased gradually in all regions with higher cases in the Greater Accra region and the Ashanti Region.

Between 30th March and 20th April 2020, the strictest lockdowns were witnessed in the most populated cities in the regions, Greater Accra Metropolitan Area (GAMA), Greater Accra Region, and the Greater Kumasi Metropolitan Area and Contiguous Districts (GKMA) in Ashanti region. There was a closure of all activities in these two regions whiles essential services were being provided in Accra and Kumasi. Initiated by the Government of Ghana, the contact tracing system was adopted when the first cases were confirmed. The contact tracing system was a key strategy used to strengthen protection and detect early infections. Within a month, the number of cases recorded increased by more than 50%; 2,655 to 4,131 from 18,000 contacts (10). Initially, only two health facilities were able to test for the virus: the Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR) and the Noguchi Memorial Institute for Medical Research (NMIMR) (29). Drones were also employed by the Ministry of Health to gather COVID-19 samples from over 1,000 health locations. Affected people were isolated and monitored by health workers. According to the government, contact tracing and strict protocols aided in lowering the virus's causality rate. In the Ashanti region, Metropolitan, Municipal, and District assemblies were required to enforce strict safety protocols, and violators were arrested and turned over to authorities.

The COVAX Facility delivered 600,000 AstraZeneca COVID-19 vaccinations to Ghana, making it the first country to do so. The vaccines were distributed to selected health facilities in Greater Accra's 25 districts and Ashanti's 16 districts (30). About 325 vaccination sites were set up in the 25 districts of the Greater Accra Region. By the end of the first week of March 2021, a total of 104,174 people were in Greater Accra and as of 31st March, 555,259 doses of vaccines had been administered nationwide (31).

The rate of increase in infected people has recently slowed. The total number of confirmed cases is 155,665, with Greater Accra leading the way with 86, 732 cases, followed by Ashanti Region with 22, 253 cases (32). The authorities have scheduled the distribution of vaccines for the health facilities in the various districts to ensure equitable distribution. Total vaccine doses administered as of 17th

January 2022 were 9,342,953 (33). The Ghana Health Service continues to schedule vaccination times whiles companies and individuals adhere to safety protocols. In December 2021, a vaccination drive was held and was declared mandatory for all health workers and public servants. Seven million more doses were delivered in the country by the end of December 2021.

In Ghana, one of the most pressing issues is health. Since independence, the country's population growth, particularly in Greater Accra and Ashanti regions, has been viewed as unplanned, with implications on public health. Numerous health centers, led by the Ministry of Health and the Ghana Health Service, have been established in the regions to address the numerous health issues that have arisen. Significant efforts have been made in policy development, guidelines development, and in-service training.

Despite these advancements, the state of health and health care in Ghana varies. While urban areas are well served by health facilities that are available in all areas, rural areas frequently struggle with availability. In the worst-case scenario, modern health care services are unavailable. Although there are over 1,500 health centers, some communities still lack access to health centers and staff. Per the standard of the World Health Organization, doctor to patient ratio is 1:600. Yet, Ghana's status remains 1: 10,000 for a doctor to patients and 1: 9,000 for the nurse to patients. In addition, there is less than one bed per 1,000 people (34). With these findings, the country faces challenges in terms of facilities and workforce; any additional increase in the patient ratio will put a strain on the health sector.

In the early days of COVID-19 (as of July 2020), over 2,000 health workers were infected with COVID-19, with 6 confirmed dead (33). In other news, the Ghana Health Service announced the closure of 99 health facilities in the Ashanti Region in January 2022 due to an increase in the Omicron variant of COVID-19 (35). The Omicron variant of the COVID-19 outbreak overburdened healthcare facilities because staff and healthcare workers became infected with the virus, reducing the limited workforce.

Not only did COVID-19 have a negative impact on healthcare, but it also created opportunities for further improvement in public and individual health. Following the discovery of COVID-19, a lot of focus went to the health industry and individual health. New facilities and health centers were constructed, and others were planned. In the Greater Accra region, extra ICU beds were built, as well as a treatment center in the Ashanti region. Agenda 111 was a government of Ghana program to build 101 health facilities across the country that came forth as a result of the pandemic. In addition, four distinct forms of incentives were given to health personnel to compensate them for their hard work and stressful activities.

Ghanaians, particularly those in Greater Accra and the Ashanti Region, became more aware of personal hygiene, while some thought the whole thing was a "scam." In Greater Accra, audio communication regarding personal hygiene and hand washing was made in some transport stations, and open areas. Even though the number of regular patients in hospitals has decreased due to the fear of being admitted as a COVID-19 patient, residents have made an effort to improve their health by adhering to all protocols and focusing on self-care.

COVID-19 sparked the imagination of the entire human race to respond to disasters. Ghana, as a country, is constantly updating its protocols and combating solutions. On the bright side, new developments in health and human development will continue to emerge.

2.3. Data and method of data analysis

2.3.1. Data

The study made use of District-level COVID-19 secondary data from the Ghana Health Service and population data from the Ghana Statistical Service. The data consist of 35 observations, which are the number of districts in the two regions with recorded COVID-19 cases. Districts with no COVID-19 cases were excluded. The data cleaning and preparations were done using R programming language. Due to the large variability in the independent variable, the log transformation was used to reduce variation in the observations. The multiple linear assumptions were tested for the study. These are:

1. A linear relationship between the dependent variable (the number of COVID-19 cases) and the levels of each independent variable (socio-demographic factors)
2. The independent variables (socio-demographic factors) are not highly correlated with each other
3. The variance of the residual is constant
4. The residuals are normally distributed.

2.3.2. Data analysis

This is a descriptive cross-sectional study using a quantitative approach. The study made use of secondary District-level COVID-19 data from Ghana Health Service from March 2020 to September 2021 and population data from Ghana Statistical Service, compiled from 2010 PHC.

Multiple linear regression was used to examine the relationship between the levels of each socio-demographic factor and COVID-19 infection at the district level at a 5% level of statistical significance. The dependent variable (number of COVID-19 cases) is numerical and the independent - (socio-demographic factors) considered in the study are age with three levels (Under 15, 15–64, 65+), ethnic groups (Akan, Ga-Dangme, and Gurma) and religious groups (Christianity, Islam, and Traditionalist). Due to the high variability in the data obtained, the log transformation was used to reduce variation in the data and to normalize the data. Taking the log of the variable will effectively change the base from a unit change to a percentage change. However, the data had no missing values. (Due to collinearity between the independent variables, an estimate from overall multiple linear regression was not appropriate, we, therefore, analyze the effect of COVID-19 on each of the socio-demographic factors to see the relationship with each of them separately.)

The descriptive analysis and regression analysis was carried out using R. The hypothesis for the multiple linear regression is as follows.

> *H0*: There is no significant relationship between COVID-19 and the levels of each of the socio-demographic factors.

> *H1*: There is a significant relationship between COVID-19 and the levels of each of the socio-demographic factors.

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TABLE 1 Regressing COVID on ln (age).

Age	Coefficient	Std. err.	*t*	*p* >|*t*|	[95% conf. interval]
ln (Under 15)	−4040.80	1669.70	−2.42	0.022	[−7446.19, −635.42]
ln (15–64)	3427.45	996.06	3.44	0.002	[1395.97, 5458.93]
ln (65+)	1956.55	784.33	2.49	0.018	[356.90, 3556.19]
Constant	−10806.80	3411.98	−3.17	0.003	[−17765.58, −3848.02]

TABLE 2 Regressing COVID on ln (ethnicity).

Ethnicity	Coefficient	Std. err.	*t*	*p* >|*t*|	[95% conf. interval]
ln (Akan)	742.52	208.21	3.57	0.001	[317.87, 1167.17]
ln (Ga-Dangme)	323.73	78.58	4.12	0.000	[163.48, 483.99]
ln (Gurma)	435.98	172.78	2.52	0.017	[83.60, 788.37]
Constant	−13551.91	2107.05	−6.43	0.000	[−17849.27, −9254.55]

TABLE 3 Regressing COVID on ln (religion).

Religion	Coefficient	Std. err.	*t*	*p* >|*t*|	[95% conf. interval]
ln (Christian)	1192.63	292.43	4.08	0.000	[596.22, 1789.03]
ln (Islam)	575.07	264.92	2.17	0.038	[34.75, 1115.38]
ln (traditionalist)	−173.05	227.39	−0.76	0.452	[−636.82, 290.71]
Constant	−17355.36	2359.32	−7.36	0.000	[−22167.23, −12543.49]

3. Results

As shown in Table 1, the variable ln (Under 15) possesses a negative coefficient indicating that a 1% increase in the number of Under 15 aged persons is expected to decrease COVID cases by 40.41%. In the case of the variable ln (15–64), the coefficient is positive which indicates that 1% increase in the number of 15–64 aged persons in a district is expected to increase COVID cases by 34.27%. The variable ln (64+) with a positive coefficient indicates that a 1% increase in the number of 64+ aged persons is expected to increase COVID-19 cases by 19.57%. There are statistical significances for all levels of the Age factor at a 95% confidence level, hence the number of cases is associated with the age profile of a district. However, Ethnicity had much lower coefficients as can be seen in Table 2.

In Table 2, the variable ln (Akan) with a positive coefficient of 742.52 indicates that a 1% increase in the number of Akans is expected to increase COVID-19 cases by 7.43. The variable ln (Ga-Dangme) with a positive coefficient indicates that a 1% increase in the number of Ga-Dangme is expected to increase COVID cases by 3.24. The variable ln (Gurma) with a positive coefficient indicates that a 1% increase in the number of Gurma is expected to increase COVID cases by 4.36. However, there are statistical significances for all levels of Ethnicity at a 95% confidence level. According to the GSS (2013), the population of Ghana is youthful, that is, a larger percentage of the population is in the youth category. Thus, age is a strong factor that explains the low cases and fatalities in Ghana and other countries where the majority of the population is young. However, the implication of this is that work and productivity output will be affected as all the people in the working class are in the affected age category. Religion returned slightly higher coefficients compared to ethnicity (Table 3).

The variable In (Christians) with a positive coefficient indicates that a 1% increase in the number of Christians is expected to increase COVID-19 cases by 11.93. The variable In (Islam) with a positive coefficient indicates that a 1% increase in the number of Islam is expected to increase COVID-19 cases by 5.75. The variable ln (Traditionalist) with a negative coefficient indicates that a 1% increase in the number of Traditionalists is expected to decrease COVID-19 cases by 1.73. However, there are statistical significances for Christianity and Islam while Traditionalist is not statistically significant at a 95% confidence level. This means that circular religion had more effect than traditional religion. This is so because these religions (Islam and Christianity) require their believers to gather in large numbers to worship and thus exposing the people to the pandemic. Although religious gatherings were banned (36), people still gathered to pray once they never exceeded 25. Although COVID-19 protocols were strictly enforced within the church auditoriums and mosques, these were not strictly observed after the people were outside. Another observation was that the ban on social gatherings was not obeyed especially during funerals which were largely religious gatherings. These increase the risk of contracting the disease.

4. Discussions and recommendations

This study provides a comprehensive study of the socio-demographic risk factors of COVID-19, using data for the two most populated regions in Ghana. From the analysis, we found out that districts with a high number of Christians and Muslims are likely to record a high number of COVID-19 cases. In an article by Wildman et al. (37) it was found that, as of the end of the first week of March 2020, almost two-thirds of coronavirus infections (nearly 5,000 cases) were traced back to Patient 31, an individual who worshipped at Shincheonji Church of Jesus in Daegu at South Korea. This goes in line with the analysis in this result that Christianity and Islam which have more religious activity are major factors in the spread of the COVID-19 virus.

However, considering the socio-demographic factor such as age, it was found that the adult regressor was statistically significant with a positive coefficient. This is because they form a large part of

the working class and engage in more activities which lead to the spread of the virus. During the period, schools were closed, and children were more at home with fewer outdoor activities, but the adult population had to move from one place to another largely for household shopping, international travel, and a few social gatherings that were permitted (38–40). Thus, the adult population had more chances of coming into contact with the virus than the children. This finding is further strengthened as we found that above 65 years (Table 3), the coefficient decreases to almost half of the age bracket of 15 to 65 indicating fewer infections among people older than 65. This is not surprising as children and adults above 65 are reported to be less susceptible to infectious diseases (40). However, if serious restrictions are to be enforced, it could further worsen the already ailing economies of these poor countries. This is because the working class is within this age group and productivity will be brought to its lowest level and thus unable to sustain the economies. Many studies on the impact of COVID-19 on household livelihoods around the world indicate that the majority of households are not able to recover to pre-COVID levels (32, 38, 41). This, therefore, calls for a balanced approach to dealing with the pandemic.

We conclude that some socio-demographic variables have an association with coronavirus infections. For example, age and religion, especially Christianity and Islam, pose a risk of the coronavirus. We, therefore, recommend that places of the congregation such as Churches and Mosques be targeted for vigorous sensitization on COVID-19 protocols and prevention. Also, districts with a high population of the age of 15–64 should be educated on the spread of the virus and the need to reduce travel and related activities to decrease the number of cases in such districts.

5. Limitation

This study is more ecological and hence comes with the limitation of ecological design. Also, only three demographic characteristics were considered in the study hence the careful interpretation of results from this study should be done.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

SA contributed to the writing and review of the manuscript. AO designed the study and supported the overall research procedure and contributed to the writing of the manuscript. GY contributed to the writing and review of the manuscript. ET conceived collected data, and performed statistical analysis. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

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Making districts functional for universal health coverage attainment: lessons from Ghana

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Ensuring the sub national level in the health system can function effectively is central to attainment of health results in countries. However, the current health agenda has not prioritized how districts can deploy their existing resources effectively, to maximize the efficiency equity and effectiveness in their use. Ghana initiated a self-assessment process to understand the functionality of districts to deliver on health results. The assessment was conducted by health managers in 33 districts during August–October 2022 using tools pre-developed by the World Health Organization. Functionality was explored around service provision, oversight, and management capacities, each with defined dimensions and attributes. The objective of the study was to highlight specific functionality improvements needed by districts in terms of investments and access to service delivery in achieving Universal Health Care. The results showed a lack of correlation between functionality and performance as is currently defined in Ghana; a higher functionality of oversight capacity compared to service provision or management capacities; and specifically low functionality for dimensions relating to capacity to make available quality services, responsiveness to beneficiaries and the systems and three structures for health management. The findings highlight the need to shift from quantitative outcome indicator-based performance approaches to measures of total health and wellbeing of beneficiaries. Specific functionality improvements are needed to improve the engagement and answerability to the beneficiaries, investments in access to services, and in building management architecture.

KEYWORDS

functionality, management, performance, health systems, oversight, service provision assessment, assessment

Introduction

The 2016 Agenda for Sustainable Development adopted the attainment of good health and wellbeing for all at all ages—its third Sustainable <Development Goal (SDG-3)—as the overarching goal of health actions (1). Given the integrated nature of the SDGs, multiple targets across other SDGs have been identified as contributing to SDG 3. In addition to its 9 core targets

and 3 enablers, contributing targets have been identified in other SDGs ranging from 7 to 27 (2–5). The global health community has brought these together under different themes, with the world health organization (WHO) adopting the triple billions approach that structures these into 3 themes relating to attainment of universal health coverage (UHC), health security (HSE) and addressing the determinants of health (DOH) (6). UHC—the umbrella target of the SDG-3 core targets—aims to ensure all persons can access the health and related essential services they need for their health and wellbeing without the risk of financial catastrophe (7, 8). HSE on the other hand brings together all the targets aimed at minimizing negative effects of health shocks while DOH consolidates all the social, economic, environmental, and political targets in other sectors but influencing health and wellbeing.

The global health community has outlined means to translate the SDG-3 goal and targets to implementable actions. A revitalized Primary Health Care approach has been defined as the most effective way to invest in health, for the attainment of UHC, HSE and DOH outcomes (9). This is placing increased emphasis on empowerment of individuals/communities, alignment of stakeholders and integration of services as drivers of how investments need to be made in health (10). Within the WHO Africa Region, a comprehensive menu of actions around which investments need to be made has been elaborated and is guiding country actions (11).

Ghana has been an active contributor to the evolution of this agenda, with the Head of State a co-chair of the UN Secretary Generals (UNSG) eminent group of SDG advocates. The country shared progress towards SDG targets at the 2019 Voluntary National Review process (12), where the slow and uneven progress towards health targets was highlighted. Some targets, such as maternal mortality rate and malaria prevalence were noted to be on the increase. The country defined a UHC roadmap in 2020 (13) that highlighted a number of challenges with moving to UHC. Health service outcomes are only marginally improving, with several gaps seen such as high institutional deaths, inappropriate pediatric HIV response, persisting micro-and under-nutrition deficiencies, increasing noncommunicable diseases all being noted. With the health investments, there is still uneven access to services with low service availability and quality, insufficient staff mix especially in primary care facilities, lack of basic infrastructure in over half of primary care facilities, unstable external financing due to lower middle income country (LMIC) progression, high exposure to out of pocket expenditure and only 20% of insurance expenditures incurred at primary level facilities.

The country has a strong history of health reforms, to align sector focus with expectations. The administration has been decentralized since 1993 with de-concentration of national functions to a current 16 regions, and devolution of responsibilities to a current 261 Metropolitan, Municipal and District Authorities (14). Health services management has been delegated to an autonomous agency of the Ministry of Health, the Ghana Health Service since 1996 (15). Since 2001, there have been formal health sector performance reviews to document progress being made against pre-determined indicators at national and regional levels (16). A National Social Health Insurance Scheme was established in 2003 (17), which was replaced with the National Health Insurance Act in 2012 to better address financial risk protection challenges by eliminating the 'cash and carry' system of paying for healthcare (18). To align with the current health reforms particularly in relation to a revitalized PHC approach to attain UHC and other health goals, the country in 2020 developed a UHC roadmap to channel efforts towards attaining its desired results by 2030 (19). Part of this involves initiation of institutional reforms particularly at the district level, to enhance efficiency and effectiveness in provision of essential services.

While the country is reliant on the regions and districts in coordination and management of the delivery of desired health results, there are no tools or processes to inform how well these are functioning (20). Functionality here is focusing on how well the region/district is deploying its existing resources, to facilitate attainment of its desired results. The existing processes focus on assessing performance—which focuses on comparing a unit of performance against pre-determined norms such as a coverage target. This information, while useful for a high-level decision maker, is of limited utility to a mid—frontline manager who is concerned with whether they are appropriately deploying their available resources. Functionality of the sub national unit in this context is critical as it represents the first point of action that will lead to attainment of the desired health results—it has been documented to strongly correlate with attainment of desired health results (21). The objective of the study was for Ghana to embarked on a process to of determining how well the districts and regions are functioning. The aim was to work with health management teams at the regional and district level to identify areas where they need to place emphasis, to improve the overall functionality of the districts/regions. This it is presumed will facilitate accelerated attainment of UHC, HSE and other health results in Ghana. We present the methods and outputs from this process.

Methodology

Purpose

The overall purpose was to systematically review the functionality of the district system in Ghana. The output would highlight specific areas for a participating district to focus on, while concurrently identify emerging areas for prioritization at the regional and national level.

Site

The assessment was conducted in a sample of districts, focusing on those in six newly established regions of the country by a country team (22). A focus on the districts in newly established regions was to provide these new districts with guidance on where to prioritize their focus to accelerate their contribution to the country's health results.

Process for review

The assessment using the WHO tool for reviewing the functionality was conducted during August–December 2022. A 10-member national planning and implementation team was constituted on 8 August 2022 to review the tool and adapt the tool to reflect the country context The members included health research scientists, district directors of health services, regional directors of health services, regional and district health information officers,

health planners, public health specialists and public health nurses. Review tools were pretested during 23rd August–7th September in the Ga East and Ningo Prampram districts. Following incorporation of lessons from the pre-test, the preparation and review in the review districts was conducted concurrently, between 24th October–end December 2022.

Sample selection

A target of five districts in each of the 6 new regions were identified to participate in the assessment. Based on their high and low performance on their attainment of a basket of health outcomes in the year 2021 (outcomes were coverages for ANC 4+; Penta3; % HIV + ves on treatment; and TB treatment success rate) 18 districts in total were included. Data on the indicators was extracted from DHIMS as of August 12, 2022. Based on the regional average for each indicator, a district is given a score of 1 if it performed above the average, 0 if equal to the average, and-1 if less than the average. The overall performance score for each district was obtained by summing the scores for the four indicators. The overall score ranged from − 4 to + 4.

Review team

In each district, a multidisciplinary team of at least 6 members was formed (see Supplementary Appendix 1 for members and their designation). In each region, a 4-day orientation meeting was organized for all the selected district members, where participants were oriented on the process and tools. Each district team worked as a unit to conduct their own district review, under observation of the national team members present to ensure queries were clarified, and each district team member was actively engaging in the process. Self-assessment was the best methodology in this case because the process aim for both actions to be undertaken by the managers and providing information for cross district comparison. The review tools were designed for this purpose in mind.

Review tool

The tool used in the review were developed by the WHO Regional Office for Africa.[1] It is an attribute-based tool that allows self-review of functionality across oversight, management, and service provision capacities at a specific sub national unit. Several dimensions construct each of the above capacities, against which the attributes are described (see Supplementary Appendix 2 for the working definitions of each dimension and their full set of attributes). Oversight capacity reviews functionality of the decision-making process across 6 dimensions drawn from governance literature (23–25): organizational structure, policy and strategic guidance, technical and social accountability, legal and regulatory frameworks, stakeholders' engagement, and integrity and public confidence. Management capacity reviews functionality of the implementation team across 7 dimensions drawn from management literature (26–28): structure, strategy, systems, managerial style, skills, staff capacities and values. Finally, the service provision capacity reviews functionality of the system investments needed to provide services across 4 dimensions drawn from service delivery functionality literature (21): overcoming access barriers, quality of care, demand for essential services and resilience of the system.

For each dimension above, a set of attributes are defined that describe what the sub national unit is expected to do. The review by the sub national unit is to determine, on a Likert scale, where it lies regarding the description of the attribute. The sub national unit scores the attribute as 1 (fully disagree), 2 (somewhat disagree), 3 (somewhat agree) or 4 (fully agree) depending on its situation as agreed by the review team. A 'not applicable' option also exists in case the sub national unit does not consider the attribute applicable.

Analysis of review information

The review is meant to be of primary use for the sub national unit participating. As such, the sub national unit receives a consolidated list of attributes organized by the score immediately the assessment is completed. This allows the SNU to immediately know and plan action, to enhance its performance as the attributes are described in a manner that necessitates action. For the attributes scoring poorly (score of 1), it suggest actions to implement the attribute, while it needs a plan to sustain attributes where it scores well (score 4). For those where a SNUscores 'NA', the SNU needs to explore why it is not applicable and consider their implementation.

To discern a regional and national picture about functionality in the newly created regions, we conducted several statistical tests on the data from all the districts. Prior to analysis, we first calculated an arithmetic mean for the values of the attributes constructing each dimension by district. The values were then converted from a 0–4 to a 0–100 scale by applying a multiplication factor of 25. We then tested the district data for compliance to assumptions for an analysis of variance using Bartlett's Chi-square test, with the results showing significant homogeneity of variances.

First, we explored variations in findings between the high ($n = 7$) and low ($n = 11$) performing districts. We looked at the mean, standard deviation, and confidence intervals, together with analysis of the between and within group variations using analysis of variance (ANOVA) to determine if there were differences in the two groups. *F*-statistic and associated value of p were used to determine the level of significance.

Second, we explored the variations in findings across the 3 capacities of functionality—service provision, oversight, and management capacities. Each, conducted one way analysis of variance (1-way ANOVA) focusing on the mean, standard deviation, 95% confidence interval for the reporting districts ($n = 33$). We further explored the source of variation both between and within the 3 capacities of functionality to determine the statistical significance, if any, of reported variations. To explore the multiple possible comparisons amongst the 3 different capacities, we applied the Scheffé test (29) to explore the significance of variation between (1) Management and oversight capacity, (2) management and service provision capacity, and (3) oversight and service provision

1 http://bit.ly/3XHFXb4

capacity. A statistically significant value ($p < 0.05$) would be interpreted to mean significance in the difference between these capacities.

Third, we analyzed the variations in findings across the dimensions constructing each of the 3 capacities of functionality. For each capacity, we conduct one way analysis of variance focusing on the mean, standard deviation, 95% confidence interval for the 33 reporting districts. We further explore the source of variation both between and within the dimensions for each capacity to determine the statistical significance if any of the variations reported. We apply the Scheffé test to explore the significance of variations across the different combinations of dimensions making up each capacity—with a statistical significance value suggesting significance between the combinations.

Finally, the mean attribute scores were sorted and ranked according to the scores from the districts, to classify them based on numbers of districts scoring each value. This is to identify the most reported attributes as being (1) not applicable, (2) most functional, and (3) least functional.

The script for the analysis has been uploaded on the github and can be accessed publicly at: https://github.com/DAK-Projects/SNU_Ghana.

Presentation of results

Presented first were the overall findings and followed by presentation of each of the 3 capacities for the districts. After this, we presented results from the statistical analysis of the results at three levels: for different levels of district performance; for the different capacities and for the dimensions constructing each capacity. We lastly presented the five attributes reporting the most and least functionality across the reporting districts.

Results

Overall functionality of districts in Ghana

The overall reported level of functionality by district and for each functionality capacity are displayed in Table 1. We present for each district its performance classification prior to the study, together with the results for its functionality, overall and by each of the capacities that construct it. The functionality by dimension is shared in Supplementary Appendix 3. The reporting districts have a mean was 80.68, with the functionality of the oversight capacity dimensions highest and that of the service provision capacity lowest.

Functionality across different levels of performance

The mean for the high performing districts is lower than that for the low performing districts (74.93 vs. 80.37). The statistical analysis for these districts is shown in Table 2.

The variation in functionality by performance is not statistically significant, with a low value of p for this variance (0.325). We see in Figure 1 below that the confidence limits significantly overlap, with the low performing districts confidence limits within the range of that for the high performing districts.

Functionality of the capacities contributing to the overall picture

Looking at the capacities contributing to this overall functionality summarized in Table 3, oversight capacity is reported to be highest (89.2), while the service provision is lowest (76.42). These variations across the 3 capacities are statistically significant ($p = 0.000115$).

However, the variation between the management (76.42) and service provision (76.40) capacities is not statistically significant; there is considerable overlap between the confidence limits of these two capacities, as shown in Figure 2 below.

Functionality of the dimensions contributing to each capacity

Within the specific capacities, functionality was driven by specific dimensions, as illustrated in Table 3. The variations in the dimensions for all capacities show statistical significance. For service provision, the functionality for different dimensions is, in descending order, (1) demand for services, (2) system resilience, (3) quality of care, and (4) access to essential services. Looking at oversight capacity, the dimension functionality in descending order is (1) technical accountability, (2) stewardship, (3) policy/strategic guidance, (4) authority and mandate, (5) legal/regulatory framework, (6) stakeholder engagement, (7) integrity and public confidence, and (8) social accountability. Finally with the management capacities, the dimensions functionality in descending order is (1) strategy, (2) leadership style, (3) shared values, (4) appropriate staff, (5) required skills, (6) required managerial structure and (7) needed systems (Table 4).

The confidence limits overlap for many of the dimensions, despite the significant differences. From the Scheffé test (see Supplementary Appendix 2), we see significant differences between dimensions that are not sharing the same confidence limits. For the service provision capacity, these are demand for services against all the other dimensions. With the oversight capacity, we see significance in the value of ps for (1) integrity and public confidence versus stewardship and technical accountability, and (2) social accountability versus authority/mandate, policy/strategic guidance, stewardship, and technical accountability. With the management capacity, significance is seen in value of ps for strategy versus skills, structure, and systems.

Attributes of specific mention

Finally, looking at the specific attributes within each dimension, we identified the 5 attributes that were mostly mentioned as available or not available in the districts. For the attributes most captured as not being done were:

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TABLE 1 Overall functionality and by capacity for the 33 reporting districts in Ghana, 2022.

District name	Performance classification	Overall functionality	Service provision capacity	Management capacity	Oversight capacity
Juan	High	73.35	70.57	54.33	95.14
Nkwanta South	High	90.20	83.85	93.00	93.75
Nkwanta North	High	57.39	53.13	42.67	76.39
Tano North	High	91.21	87.24	93.33	93.06
Asutifi South	High	87.58	85.16	88.00	89.58
Nkoranza South	High	77.03	69.27	74.33	87.50
Bunkpurugu Nakpanduri	High	62.56	58.07	64.33	65.28
Krachi West	Low	87.38	86.72	81.67	93.75
Krachi Nchumuru	Low	76.69	78.91	55.33	95.83
Asunafo South	Low	91.03	88.28	89.67	95.14
Tano South	Low	79.25	75.78	79.33	82.64
Asutifi North	Low	83.82	80.47	79.33	91.67
Kintampo North Municipal	Low	89.89	84.90	90.33	94.44
Techiman Municipal	Low	73.10	73.96	70.33	75.00
Pru	Low	84.39	79.95	84.33	88.89
Yunyoo-Nasuan	Low	67.72	61.98	53.67	87.50
Chereponi	Low	91.49	87.24	90.00	97.22
East Mamprusi	Low	77.26	75.26	76.67	79.86
Ga East	NA	70.50	65.36	67.67	78.47
Ningo Prampram	NA	76.29	72.66	75.67	80.56
Bia East	NA	77.13	79.17	63.33	88.89
Bodi	NA	69.18	64.06	48.33	95.14
Mamprugu Moagduri	NA	72.63	58.07	73.00	86.81
Aowin	NA	79.47	72.92	78.00	87.50
West Mamprusi Municipal	NA	95.36	95.31	96.33	94.44
Bole	NA	76.69	71.09	76.33	82.64
North East Gonja	NA	80.80	63.02	86.33	93.06
East Gonja	NA	96.72	95.57	96.67	97.92
Central Gonja	NA	93.32	92.71	89.33	97.92
North Gonja	NA	72.36	66.41	50.67	100.00
Sawla-Tuna-Kalba	NA	93.46	86.20	97.67	96.53
West Gonja	NA	87.14	81.51	82.00	97.92
Sefwi Akontombra	NA	79.88	76.30	80.00	83.33
Total for reporting districts		80.68	76.40	76.42	89.20

TABLE 2 Overall mean functionality score for districts in newly created regions of Ghana in 2022.

Groups	Sample	Sum	Variance	Std Dev	Mean
All districts	*33*			*13.20*	80.68
High performing districts	7	524.52	209.81	14.49	74.93
Low performing districts	11	884.06	70.76	8.41	80.37
Source of Variation	*d.f.*	*SS*	*MS*	*F*	value of *p*
Between groups	1	126.50	126.50	1.029	0.325
Within groups	16	1,966.42	122.90		
Total	17	2,092.92			

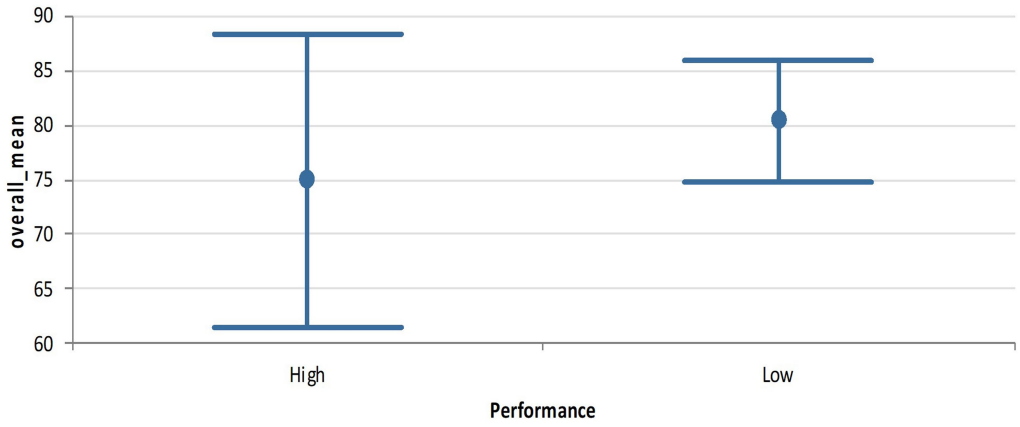

FIGURE 1
Means plot at 95% confidence interval for high and low performing districts in Ghana.

TABLE 3 Mean score for constituent capacities of district functionality in newly created regions of Ghana in 2022.

Capacities	Sample size	Std Dev	Mean	95% confidence interval	
Management capacity	33	15.22	76.42	71.03	81.82
Oversight capacity	33	8.09	89.2	86.34	92.07
Service provision capacity	33	11.13	76.4	72.45	80.34
Source of Variation	*d.f.*	*SS*	*MS*	*F*	*Value of p*
Between capacities	2	3,601.133	1,800.567	12.829	0.000
Within capacities	96	13,473.826	140.352		
Total	98	17,074.959			
Scheffe group vs. Group (Contrast)	*Difference*	*95% confidence interval*	*Test statistic*	*Value of p*	
Management vs. oversight capacities	(12.780)	(20.032)	(5.529)	4.382	0.000
Management vs. service provision capacities	0.027	(7.224)	7.279	0.009	1.000
Oversight vs. service provision capacities	12.808	5.556	20.060	4.391	0.000

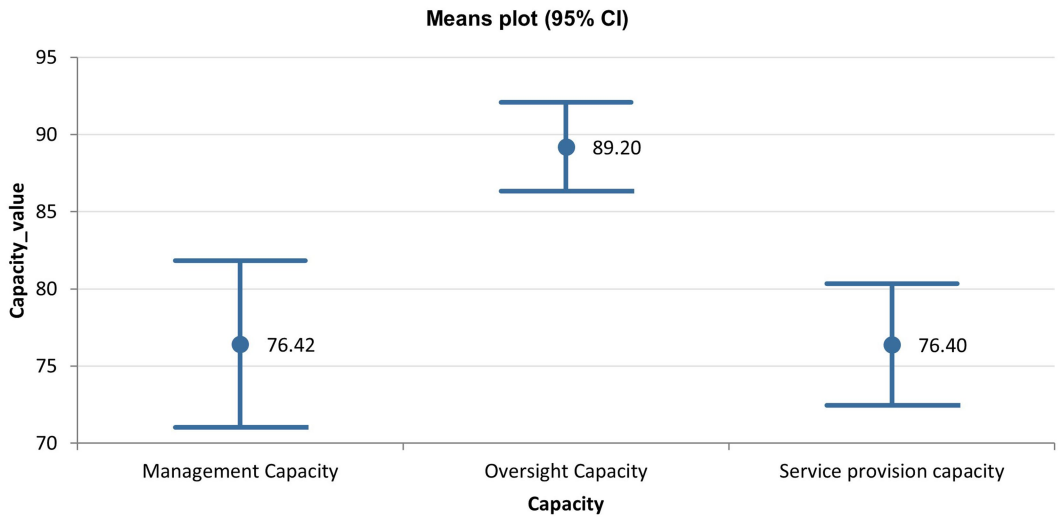

FIGURE 2
Means plot at 95% confidence interval for the 3 functionality capacities in Ghana.

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TABLE 4 Mean scores for constituent dimensions for functionality capacities in newly created regions of Ghana in 2022.

Capacity	Feature of analysis	Outputs				
Service provision	*Dimension*	*Sample size*	*Std Dev*	*Mean*	*95% confidence interval*	
	access	33	17.88	68.89	62.55	75.23
	demand	33	11.75	89.77	85.60	93.94
	quality	33	13.69	76.85	71.99	81.70
	resilience	33	12.57	77.46	73.00	81.92
	Source of variation	*d.f.*	*SS*	*MS*	*F*	Value of *p*
	Between groups	3	7,361.02	2,453.67	12.22	0.0000
	Within groups	128	25,701.76	200.79		
Oversight capacity	*Dimension*	*Sample size*	*Std Dev*	*Mean*	*95% confidence interval*	
	Authority	33	8.90	91.41	88.26	94.57
	Engagement	33	14.55	86.74	81.58	91.90
	Integrity	33	15.35	82.39	76.95	87.83
	Legal	33	13.17	90.34	85.67	95.01
	Policy	33	11.91	91.82	87.59	96.04
	Social	33	18.45	79.36	72.81	85.90
	Stewardship	33	9.39	94.09	90.76	97.42
	Tech	33	7.12	94.51	91.98	97.03
	Source of variation	*d.f.*	*SS*	*MS*	*F*	Value of *p*
	Between groups	7	7,043.38	1,006.20	6.09	0.0000
	Within groups	256	42,282.62	165.17		
Management capacity	*Dimensions*	*Sample size*	*Std Dev*	*Mean*	*95% confidence interval*	
	skills	33	20.81	74.65	67.27	82.03
	staff	33	18.02	78.79	72.40	85.18
	strategy	33	10.56	90.78	87.04	94.53
	structure	33	16.97	72.58	66.56	78.59
	style	33	13.26	81.25	76.55	85.95
	systems	33	19.26	68.09	61.26	74.92
	values	33	19.81	81.06	74.04	88.08
	Source of variation	*d.f.*	*SS*	*MS*	*F*	Value of *p*
	Between groups	6	10,647.62	1,774.60	5.93	0.0000
	Within groups	224	67,080.29	299.47		

- Presence of health equipment (blood pressure apparatus, stethoscope, adult and infant scale, thermometer) in 80% of primary care units,
- Presence of health facilities as per norms,
- Outreach and mobile services conducted into the hard-to-reach regions from hospitals,
- Monitoring, management and reporting of radiation emergencies, and
- Presence of clinical support staff in hospitals.

On the other hand, the five attributes most reported as being there but inadequate were:

- Presence of primary care staff with technical skills to treat, rehabilitate and provide palliative care for users with cancer,
- Use of online consultations by hospitals to improve capacity and access for beneficiaries,
- Conduct of emergency simulation exercises to assess capacity to respond to potential shock events,
- Monitoring, management and reporting of radiation emergencies, and
- Presence of hospital staff with technical skills to treat, rehabilitate and provide palliative care for users with cancer.

Finally, the five attributes most reported as being there and adequate were:

- Primary care facilities have the expected service provision areas.
- Mechanisms for health leadership to answer/report on their progress, e.g., through performance monitoring.

- Presence of community level service delivery modalities (home visits, community outreaches, community events, etc.).
- Outreach and mobile services conducted into the hard-to-reach regions from primary care facilities.
- Availability of programs for promoting health and wellbeing for under 5 s.

Discussion

The results highlight the importance of having a clear distinction between functionality—how well resources are being deployed for attainment of desired results, and performance—what results are being attained. It is common to presume they are synonyms and correlated in practice, but this is not so. It is common to perceive performance in line with coverages achieved for selected indicators—in this case antenatal care, immunization, HIV and TB care being the selected ones. Significant investments have been focused on refining and improving health system performance frameworks that focus on identifying indicators that better reflect dimensions relating to effectiveness, equity, quality of care, and/or efficiency (20, 30–31). The use of performance measures based on selected outcome indicators may not be adequate for informing progress at the district level for two reasons: (1) it under-estimates the range of outcomes actually achieved from a functional system, and (2) it largely focuses on the quantitative and easy to get indicators, skewing the perception of performance. The current health results such as UHC define desired outcomes not on how many program outputs are delivered, but rather by their impact on the beneficiary—ensuring everyone, everywhere is getting services they need for their health and wellbeing while avoiding financial catastrophe. A functionality review such as the one reported here is a better pointer to whether a system will attain UHC and other person-focused health results that are currently desired, as they present a picture of the status of the range of needed actions for health managers to focus on to attain the results. The absence of correlation between functionality and the way performance is currently measured is therefore expected. An interpretation of performance based on consolidating vertical programmes outcomes is at best an incomplete view of performance arising from investment made in the health sector. The current health sector performance approaches that are based on selected programmes outcomes—usually child and maternal health outcomes—grossly under-represent the wide range of outcomes that arise from investment in health. When we look at the capacities constructing functionality, we see the managers view a higher level of oversight capacity compared to service provision and management. Oversight is concerned with the capacity of the district to engage with, show direction and respond to the expectations of its beneficiaries and stakeholders. This higher capacity may reflect the emphasis that has been placed on the oversight functions vis-à-vis the service provision and management. It is common for support programs—whether public or donor—to have significant budgets for different oversight functions compared to the other capacities. If health results are to be attained, it is important for more focus and investment to be placed on management and service provision capacity at the district level.

A further analysis of the oversight dimensions show there is a higher perception of functionality for those focusing on ensuring clear direction such as technical accountability, stewardship, policy/strategic guidance with less emphasis on those dimensions relating to beneficiaries such as ensuring stakeholder engagement, integrity and public confidence plus social accountability. Managers appear to ensure functionality in being seen to be 'doing the right thing' in the eyes of whoever is watching, compared to 'doing things right' in the eyes of the beneficiaries. As such even though oversight capacity appears to be most functional, there is still immense scope for improvement particularly in relation to how the beneficiaries engage with and contribute to the direction being taken.

When we look at service provision capacity, it is concerned with the capacity to ensure the population in the district is, during both routine and emergency situations, accessing quality essential services they are demanding for their health and wellbeing. The functionality of this capacity is intuitively the most central as it represents the ability to deliver the needed services to the population. We however see the dimension of demand as being the most functional, while access to essential services is least functional. This presents an interesting dichotomy in engagement with beneficiaries—while at the service provision (facility/community) level services are being tailored to the demands from the beneficiaries, we noted at the oversight level that there is limited functionality of initiatives to 'do things right' in the eyes of the beneficiaries. The means of engaging with beneficiaries at the governance level are not linked to the service provision level. This may contribute in practice to the limited interest of beneficiaries in engaging with oversight and governance institutional arrangements, even where these exist—with many institutional arrangements resorting to coercive approaches to be able to function (32). On the other hand, the low functionality of access to essential services mirrors the current evidence, where physical, financial and sociocultural gaps are documented as being the rate limiting step in accelerating movement towards desired health results (21, 33). Interestingly, the capacity attributes relating to system resilience are viewed higher than access or quality of care. This is primarily due to the higher assessed levels of inherent system resilience within the Ghana districts—that aspect of resilience to do with the inherent nature of the system to anticipate, absorb, adapt to and transform when faced with unplanned shock events (34–36). Investments in targeted resilience—focused on known shock events—are still quite low in the districts. Finally with the service provision capacities, the quality-of-care attributes are only better than access to essential services. The importance of quality of care cannot be under-estimated, as it addresses crucial areas relating to the process of care provision (37).

Finally, when we explore the results relating to the management capacity, we again see some interesting trends. The dimensions relating to the 'architecture of management'—such as the needed systems and structures are least functional, relative to those relating to the software subjective management dimensions such as strategy, leadership styles and shared values. Many of the existing management programs focus on these subjective management dimensions particularly on planning, change management methods and leadership skills, with little emphasis on ensuring the needed architecture of management exists and is functional (38, 39).

Limitations of the analysis

The results and discussion represent findings from self-assessments carried out by health managers in 33 districts. The

implications of the study need to be interpreted with this in mind. Self-assessments are prone to assessor bias. However, we feel the impact of this on the results is reduced by the expensive training done prior to the assessment, large number of different officers involved in the assessment in each district and the emphasis during entry of data on the fact that the results were primarily for local use—and not a traditional data collection exercise.

Additionally, the number of districts (32) involved in the sample were few compared to the current 261 Metropolitan, Municipal and District Authorities in Ghana. The districts were purposively selected—as these were newly created districts and were not aimed at being representative for the whole country. Again, the results need to be looked at in this perspective.

Implications and conclusion

The functionality of districts does provide unique information not only for the district as it self-assesses itself, but also at the management level to know where to channel support if the district is going to meaningfully contribute to the health results the country is aspiring to. From this analysis, we have identified some critical areas of emphasis needed to make the districts better functioning for the delivery of UHC and other related health results.

First, we see a need to rethink the way we are measuring performance particularly at the district level. We need to shift from quantitative outcome indicator-based measures, towards those that measure the total health and wellbeing of beneficiaries as this is the best way to capture the wide range of outcomes achieved from functional systems.

Second, we need to focus on enhancing specific aspects of oversight, management, and service provision capacities at the district level. With oversight capacity, focus is needed on improving engagement and answerability to the beneficiaries. With service provision capacity, access to services remains a major bottleneck to functionality with more investments needed in ensuring the staff, medicines/supplies and infrastructure exists for beneficiaries to reach services they need. The management on the other hand need to invest in building the management architecture and not only focus on the software.

At present, the country is expanding the use of the functionality tools to all districts as they have found it a useful tool for determining attributes on which to focus actions during their planning process. The same process is being conducted in other countries, which should facilitate alignments of the way districts are organized and managed with their current expected results particularly in relation to attainment of UHC, health security and improvements in the determinants of health.

It is our opinion that further research would help to better understand the patterns being seen in functionality and how to link this to a broader view of performance of health systems using appropriate indicators that cover the breadth of areas impacted by actions in health.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

HuK, AO, and FK share senior authorship. CD, AO, and FK share last authorship. HuK, SS, and SK led the design of the study. SK, DA, and CD coordinated the fieldwork and district engagements. SS, HiK, and BK led the analysis of the data. DA, CD, AO, and FK led the review and contextualization of the work within Ghana. HiK, AO, and FK led the interpretation of findings and discussion. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1159362/full#supplementary-material

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Continuity of care among diabetic patients in Accra, Ghana

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Introduction: Diabetes mellitus is a fast-rising non-contagious disease of global importance that remains a leading cause of indisposition and death. Evidence shows that effective management of diabetes has a close link with continuity of care which is known to be the integral pillar of quality care. This study, therefore, sought to determine the extent of continuity of care between diabetic patients and their care providers as well as factors associated with relational continuity of care.

Methodology: This cross-sectional, facility-based study was conducted among diabetics in Accra, Ghana. We sampled 401 diabetic patients from three diabetic clinics in the region using a stratified and systematic random sampling technique. Data were collected using a structured questionnaire containing information on socio-demographic characteristics, the four dimensions of continuity of care, and patients' satisfaction. A 5-point Likert scale was used to measure patient's perception of relational, flexible, and team continuity, while most frequent provider continuity was used to measure longitudinal continuity of care. Scores were added for each person and divided by the highest possible score for each domain to estimate the continuity of care index. Data were collected and exported to Stata 15 for analysis.

Results: The results show that team continuity was the highest (0.9), followed by relational and flexibility continuity of care (0.8), and longitudinal continuity of care was the least (0.5). Majority of patients experienced high team (97.3%), relational (68.1%), and flexible (65.3%) continuity of care. Most patients (98.3%) were satisfied with the diabetes care they received from healthcare providers. Female subjects had higher odds of experiencing relational continuity of care as compared to male subjects. Furthermore, participants with higher educational levels were five times more likely to experience relational continuity of care than those with lower educational background.

Conclusion: The study demonstrated that the majority of diabetics had team continuity of care being the highest experienced among the four domains, followed by flexible and longitudinal being the least experienced. Notably, team and flexible continuity of care had a positive association with relational continuity of care. Higher educational level and being female were associated with relational continuity of care. There is therefore the need for policy action on the adoption of multidisciplinary team-based care.

KEYWORDS

diabetes mellitus, continuity of care, longitudinal continuity, relational continuity, Ghana, Accra

Introduction

Diabetes mellitus (DM) remains a major public health burden in Ghana. The occurrence of diabetes in Ghana is increasing rapidly, coupled with high complications, admission, and fatalities. For instance, the prevalence of type 2 diabetes mellitus (T2DM) among urban men and women stands at 10.3 and 9.2%, respectively (1). This is coupled with the prevalence of high chronic complications including glycemic complications (79%), cerebrovascular conditions (10.5%), renal impairment/nephropathies (18.3%), cardiovascular condition (21%), peripheral neuropathy (60.4%), diabetic foot disease (4.9%), eye disease (58.6%), and erectile dysfunction (31.0%). Consequently, diabetes admission rates has seen increase of more than 6-folds and inpatient fatality from 7.6 per 1,000 deaths in 1983 to 30 per 1,000 deaths in 2012, with an average 28-day mortality rate of 18.5% (2, 3). Moreover, the prevalence of hypertension either as a comorbid or complication in diabetics remains astronomically high, 97.2% (2).

The term "continuity of care" evolved in the 1960s and the concept is still evolving. In the healthcare literature, the term has been used to describe several relationships between patients and providers in the delivery of care services. These definitions have evolved and overlap with concepts such as coordination, integration, and patient-centered care. Even though there is no universally accepted definition of continuity of care, there is general acceptance that, it is a multi-dimensional concept and as a result, several authors have proposed several terms to describe the various dimensions involved (4–6). It can best be described as a "hierarchical concept ranging from the basic availability of information about the patient's past to a complex interpersonal relationship between physician and patient characterized by trust and a sense of responsibility" (6). Table 1 summarizes the key dimensions that have been proposed.

Diabetes mellitus is a long-term condition, and its management requires regular interaction between the patient and the care provider. There is evidence that increasing patients–clinicians interaction results in better treatment outcomes (6, 15), and that increased continuity of care leads to a lower mortality rate (16). Relational continuity of care is characterized by an ongoing personal relationship between the patient and care provider guided by personal trust and a sense of responsibility (6). This interpersonal relationship has been shown to improve patients' adherence to treatment and cooperation with care providers (17). The development of this interpersonal relationship requires frequent and repeated visits of patients to their usual care providers (longitudinal continuity), responsive care in the face of changing needs of the patient (flexible continuity), and well-coordinated care (team continuity) (18–20). Similar evidence by Gulliford et al. (21) shows that to achieve optimal treatment objectives for diabetes, there must be an existing bond between diabetes patients and their care givers for the entire treatment process. However, there is a lack of comprehensive evidence to establish the extent of the four dimensions of continuity of care experienced and the factors influencing relation continuity of care between diabetics and their care providers in Ghana. A clear understanding of the effect of longitudinal continuity of care on relational continuity (and vis visa) among diabetes mellitus patients and their health providers in Ghana will help inform and reshape policy regarding treatment and management of the condition. This study, therefore, sought to determine the extent of continuity (relational, longitudinal, flexible, and team) of care and factors associated with relational continuity of care among diabetics and their care providers in three health facilities in the Greater Accra Region of Ghana.

Methods

Study design

The study employed a cross-sectional, health facility-based design using a quantitative data collection approach to collect data. This study involved a survey with a sample size of 401 diabetic patients from three health facilities (La-General hospital in the La-Dadekotopon Municipality, Pentecost hospital in the

TABLE 1 Dimensions of continuity of care.

Dimension	Description
Longitudinal/chronological continuity	Care from a regular site of care (5–11)
Relational/interpersonal continuity	Ongoing relationship between a patient and the healthcare providers (6–9)
Information continuity	Availability of and shared information between healthcare professionals (5–12)
Team continuity	Good communication across a team of professionals or services (13)
Management continuity	A consistent approach to the management of a patient from all those involved (4)
Geographic continuity	Care that is given or received in person on one site (office, home, hospital, etc.) (6)
Site continuity/clinician continuity	Care from multiple but related physicians such as those practicing as a group (9, 12)
Referral continuity	Care linked by a referral (9)
Flexible continuity	Services that are flexible and adjusted to the needs of the individual over time (13).
Cross-boundary continuity	Care that follows the patient across settings (e.g., from primary care to hospital or vice versa) (13)
Structural continuity	"Site of medical encounter and the way in which the delivery of services is organized" Nassif et al. (14)
Process continuity	"The coordinated delivery of care over a period of time or throughout an illness episode" Nassif et al. (14)

La-Nkwantanang Municipality and the Cocoa clinic in the Accra Metropolis) in the Greater Accra region of Ghana in 2019. Diabetic patients attending the outpatient department (OPD) of the selected facilities and on medication for at least 12 months preceding the study were included.

Measurement of continuity of care

In this study, continuity of care was measured using composite indices which were generated from questions that measured each of the four dimensions of continuity. A 5-point Likert scale was used to measure patients' perception of relational, flexible, and team continuity of care. Four sets of variables ("there exist a strong interpersonal relationship between me and my doctor," "my doctor knows my familial circumstances very well," "my doctor is concerned about me," and "my doctor knows my daily activities very well") were used to measure relational COC. Three variables were used to measure flexible COC ("it is easy to communicate with my health provider about my diabetes," "I must wait for a long period of time before I speak with a doctor or nurse at the hospital for my diabetes care," and "it does not take long to obtain an advice urgently from a doctor or nurse"). For team COC, seven sets of variables ("in general, my diabetes care is well-coordinated," "these health providers transfer information very well to each other," "these health providers work together very well," "they share an agreed plan of treatment for my diabetes care," "the care of these health providers is very well-connected," "the health providers know very well from each other what they do," and "I feel the healthcare providers communicate well with each other whenever I visit the hospital") were used. To estimate the scores for flexible, relational, and team continuity, items under these three dimensions were rated from 1 to 5 points (from strongly disagree to strongly agree). Scores of the responses were added for each person and divided by the highest possible score for each dimension to estimate the continuity index (22). These continuity indices were also categorized into low (<0.75) and high (≥0.75) for each dimension (23).

Similarly, longitudinal continuity of care was measured using the most frequent provider continuity of care (MFPC) index. This is a measure of the extent of concentration or spread of the patient's visits among different physicians. This was computed by determining the proportion of visits to the regular provider out of all visits to the healthcare physician for the past 12 months.

$$MFPC = \frac{\max\left(n1,\ n2,\ n3 \ldots\ldots nk\right) - 1}{N - 1}$$

where max (n1, n2, n3,…., nk) is the number of visits to the most frequently visited provider and N is the total number of visits (6).

The values for this index range from 0 (no visit to the regular provider) to 1 (all visits made to the regular provider). The values were transformed into categorical variables and further categorized into two sub-sections based on the distribution of the scores low (<0.75) and high (≥0.75) (19).

TABLE 2 Demographic characteristics of respondents.

Variable	Frequency	Percentage
Age (years)		
Mean (SD)	**61.6 (11.1)**	
<40	10	2.5
40–49	46	11.5
50–59	116	28.9
60–69	133	33.2
70+	96	23.9
Sex		
Male	108	26.9
Female	293	73.1
Level of education		
None	83	20.7
Primary	40	10.0
JSS/JHS/middle school	144	35.9
SSS/SHS/O and A "level"	60	15.0
Technical/vocational	54	13.4
Tertiary	20	5.0
Occupation		
Unemployed	13	3.2
Formal sector worker	22	5.5
Informal sector worker	287	71.6
Retired	79	19.7
Marital status		
Single	7	1.7
Currently married	311	77.6
Currently not married	83	20.7
Religion		
Christianity	308	76.8
Islam	93	23.2
Family history of diabetes		
Yes	265	66.1
No	136	33.9
Health insurance		
Yes	399	99.5
No	2	0.5
Type of insurance		
NHIS	388	97.2
Private insurance	11	2.8

Mean (SD): mean (standard deviation).

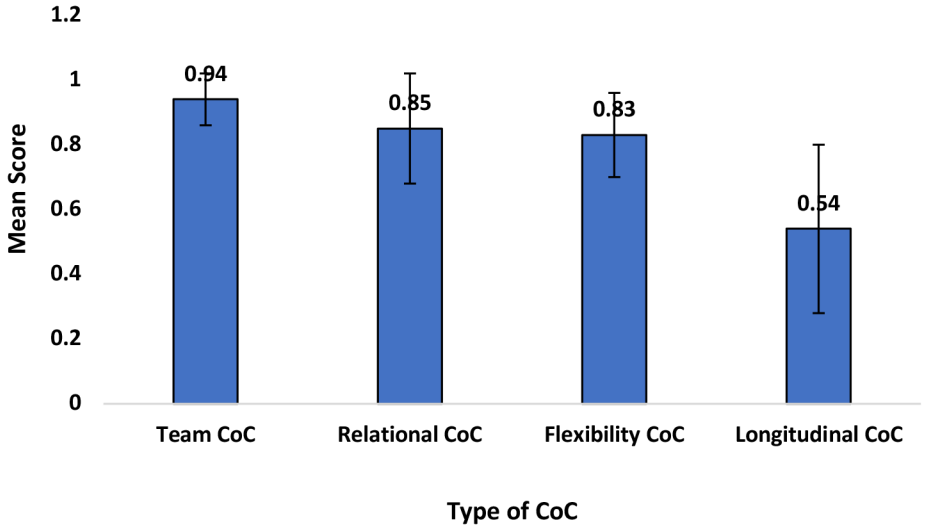

FIGURE 1
Extent of continuity of care.

Data collection and analysis

A structured questionnaire was used to collect data on socio-demographics, patients' experience with longitudinal, flexible, relational, team continuity of care, and patients' satisfaction with diabetes care. The completed questionnaires were captured and cleaned using Microsoft Excel. Descriptive statistics such as frequency distribution, proportions, and charts were used for the categorical variables, while mean scores and their respective standard deviations were computed for continuous variables. Multiple logistic regression analysis was used to measure the strength of the association between relational continuity and other independent variables. This was done by first running a bivariate analysis between all the domains of continuity (longitudinal, relational, flexible, and team continuity and patient satisfaction) and all other independent variables. Independent variables with a p-value of ≤ 0.05 in bivariate analysis were fitted in the final multiple logistic regression model to assess the strength of association using the adjusted odds ratio (AOR) with a 95% confidence interval (CI).

Results

Demographic characteristics

Four hundred and one (401) participants took part in the study with the mean (±SD) age of all participants being 61.6 ± 11. The majority of patients were female subjects (73.1%), one-third had some formal education, and 20.7% had no formal education. Regarding employment, more than half (71.6%) were employed in the informal sector, while 5.5% were employed in the formal sector and 20% were retired. Most participants were currently married (77.6%), and the majority were Christians (76.8%). In addition, 66.1% indicated they had a family history of diabetes, while almost all (99.5%) stated they had health insurance as shown in Table 2.

The extent of continuity of care

The extent of COC is summarized in Figure 1. The highest extent of continuity of care was team continuity of care, while longitudinal continuity of care was the least experienced by patients (0.5).

Figure 2 below summarized the proportion of respondents and the extent of continuity in each of the four dimensions of COC. The majority (97.3%) of the respondents had high team continuity, while 68.1% had high relational continuity. Furthermore, 65.3% of respondents had high flexible with only 20% with high longitudinal continuity.

Factors associated with relational continuity of care

Binary logistic regression was performed to determine factors associated with relational continuity of care. Patients' adherence to management, and flexible and longitudinal continuity of care were factors associated with high relational continuity of care. The logistic regression model showed that patients with good adherence to the management of diabetes were two times more likely to experience high relational continuity of care (AOR = 2.10; 95% CI: 1.02–4.34; $p = 0.045$) compared to those with poor adherence. The model also revealed that diabetics with high flexible continuity of care were also more likely to have high relational continuity of care (AOR = 5.10; 95% CI: 3.10–8.38; $p < 0.001$) compared to those with low flexible continuity. However, patients with high longitudinal continuity of care were 71% less likely to experience high relational continuity of care (AOR = 0.29; 95% CI: 0.16–0.52; $p < 0.001$). Though not statistically significant, patients who were satisfied with diabetes care were 21% more likely to have high relational continuity of care (AOR = 1.21; 95% CI: 0.06–26.18; $p = 0.901$) as shown in Table 3.

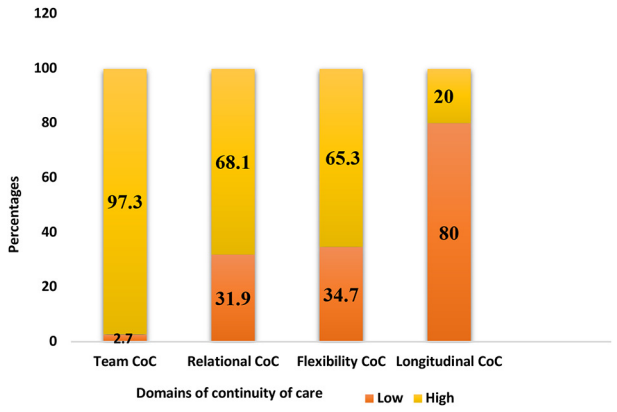

FIGURE 2
Proportion of respondents by continuity of care dimension.

Discussion

This study sought to determine the extent of continuity of care between diabetic patients and their care providers as well as factors associated with relational continuity of care. The study found high continuity for all dimensions except longitudinal continuity. In addition, team continuity, flexible continuity, higher educational level and being female were associated with relational continuity of care.

It is worth noting that, a substantially high number of diabetics have their care well-coordinated among various teams of health professionals as well as experience a strong sense of harmonization among their health providers with regard to their diabetes management. This is very needful in current times of multiple conditions. Coordination of shared care among different health experts could result in positive health outcomes such as good diabetic control and reduced risk of admission suicide (24). Team continuity of care performs one of the core functions of quality healthcare and is known to be an integral part of the continuity of care (24). High team continuity experience by diabetics is an indication of high quality and satisfaction of care among patients whereas for doctors it creates a platform to increase knowledge, confidence, and skills (25). Our findings showed high experience of team continuity of care. This is a desirable attribute of continuity of care because of the many benefits of having a well-coordinated health care among health professionals. However, healthcare providers must make it a conscious effort to establish coordination by accepting the responsibility for effective communication. Furthermore, team continuity of care if not managed well can lead to undesirable outcomes. For instance, inter team conflict or conflict between a team member and a patient may break the confidence of the patient and this may lead to negative health outcomes. Similarly, diabetics having multiple health professionals attending to their health needs may sometimes be confused due to conflicting prescriptions by their care givers or other inconsistent service rendered by team members. Other factors may be inefficient sharing of patients' health history, duplication, and poor reconciliation of patients' information. These may lead to less quality of care (24, 25).

TABLE 3 Factors associated with relational continuity of care.

Variable	COR (95% CI) *p*-value	AOR (95% CI) *p*-value
Age (years)		
<40	Ref	
40–49	0.87 (0.21–3.39) 0.840	
50–59	2.19 (0.58–8.36) 0.248	
60–69	1.39 (0.37–5.20) 0.620	
70+	1.21 (0.32–4.61) 0.774	
Sex		
Male	Ref	Ref
Female	2.13 (1.34–3.37) 0.001	1.91 (1.06–3.45) 0.031*
Level of education		
No formal education	Ref	Ref
Primary	1.25 (0.59–2.67) 0.561	1.87 (0.77–4.56) 0.170
JSS/JHS/middle school	3.19 (1.79–5.67) <0.0001	3.08 (1.57–6.02) 0.001
SSS/SHS/O and A "level"	1.90 (0.96–3.77) 0.065	2.35 (1.04–5.33) 0.041
Technical/vocational	6.88 (2.79–16.97) <0.0001	4.62 (1.73–12.35) 0.002
Tertiary	3.07 (1.02–9.23) 0.045	5.41 (1.28–22.82) 0.020
Occupation		
Unemployed	Ref	
Formal sector worker	2.13 (0.47–9.50) 0.324	
Informal sector worker	1.17 (0.37–3.67) 0.789	
Retired	2.12 (0.62–7.28) 0.234	
Marital status		
Single	Ref	
Currently married	0.92 (0.18–4.84) 0.925	
Currently not married	0.64 (0.12–3.48) 0.603	
Religion		
Christianity	Ref	
Islam	0.53 (0.33–0.85) 0.009	
Health insurance		
Yes	Ref	
No	2.37 (0.12–49.65) 0.579	
Type of insurance		
NHIS	Ref	
Private insurance	0.39 (0.12–1.23) 0.109	
Patients' satisfaction		
Not satisfied	Ref	
Partially satisfied	0.07 (0.01–2.33) 0.135	
Satisfied	0.43 (0.03–9.11) 0.591	

(Continued)

TABLE 3 (Continued)

Variable	COR OR (95% CI) *p*-value	AOR OR (95% CI) *p*-value
Patients' adherence to management of diabetes		
Poor adherence	Ref	Ref
Good adherence	1.92 (1.05–3.48) 0.033	2.35 (1.11–4.96) 0.025*
Flexible continuity of care		
Low	Ref	Ref
High	7.57 (4.73–12.10) <0.001	4.62 (2.78–7.68) <0.001*
Team continuity of care		
Low	Ref	Ref
High	5.35 (3.12–9.16) 0.006	17.95 (0.94–34.22) 0.055
Longitudinal continuity of care		
Low	Ref	Ref
High	0.18 (0.11–0.30) <0.001	0.35 (0.19–0.64) 0.001*
High		0.29 (0.16–0.52) <0.001*

*Statistically significant.

Notably, both relational and flexible continuity recorded 68.1 and 65.3% high continuity of care, respectively. This means that over 65% of diabetic patients get appropriate and consistent health support anytime it is required and more also have a high sense of affiliation with their health providers. Diabetics in this study had an appreciable number of experiencing high relational continuity. This outcome is highly appreciable since findings from other researchers project relational continuity as the most valued in primary healthcare and mental health (26). This finding connotes a well-established strong relationship between diabetics and with care providers. This level of patient–doctor friendship contributes to trust, decreases the cost of healthcare as well as increases satisfaction with health service leading to a high experience of quality care (6, 23). In addition, a study conducted in Israel reveals that patients with high relational continuity of care are more likely to achieve clinical targets. It is important to note that same study shows patients with high relational continuity had lower odds of mortality and low admission rates (23, 27). In addition, attributes of relational continuity of care such as trust, good rapport, effective communication, and confidence are known to boost the adherence to the medication of diabetics resulting in good health outcomes (24). Although most patients prefer an existing and strong affiliation with their doctors, relational continuity was not the highest in terms of all the domains of continuity. This finding agrees with a study conducted by some renowned researchers (28). It is worth to note this study shows a considerable number of diabetics in Ghana being offered services that are flexible and adjusted to their personal needs overtime. Our findings reflect the fact that most diabetes specialists adapt to care protocols to provide suitable care to the changing needs of their patients, resulting in the satisfaction of care received as well as other better health outcomes (24, 25).

Although longitudinal continuity (LCOC) of care recorded the lowest score in this study, it is consistent with other studies that have recorded LCOC score to be the lowest of all the dimensions of continuity of care (21, 29). Similarly, a study conducted in the US by Baker et al. (30) recorded a mean score of 0.61 for LCOC which is close to the average LCOC mean score of 0.5 derived from this study. This reflects the fact that only few diabetics experience an ongoing health pattern of care with the same physician at the same facility over time (31). This could also mean that high proportions of diabetic patients are seeing multiple physicians, making healthcare fragmented. This is typically experienced in Ghana since most health facilities in Ghana do group practice which makes it difficult for a patient to see the same physician continuously. Low experience of longitudinal continuity may affect the quality of care received leading to negative health outcomes. Patients who visits other physicians other than their usual physician are likely to experience the duplication of medical tests resulting to high medical cost as well as other negative consequences that stem from consulting different specialists (20). In the same sense, low experience of longitudinal continuity of care could lead to high costs for the prescription. This is proven by a study conducted in the US which demonstrated that people who experienced high longitudinal continuity for a period of 10 years had lower prescription costs as compared to those with low LCOC (17).

Most patients with low experience of LCOC from this study complained they do not get reminders for appointments with their usual providers and hence making them forget the appointment schedule. This makes them miss out on some scheduled meetings with usual health providers. In view of this, the record units of facilities should take up the responsibility of coordinating diabetes care such that regular reminders are sent to patients on their appointment days.

Factors associated with relational continuity of care

Considerable studies have proven relational continuity of care being critical for positive recovery outcomes. Similarly, this type of continuity of care birth trust between patients and their care givers. This strong bond boost compliance with patients' medication leading to positive health outcomes (23). It is evident from the result that female subjects have higher odds of experiencing relational continuity of care than men. Many studies have shown women having higher odds of visiting health facilities than men. This trend is fueled by many natural variables such as pregnancy and its related issues, childbirth, and other gynecological and obstetrics problems thus to mention

few (32). In addition, a study done in Uganda showed that healthcare was sought more by diabetic women as compared to men (33). These may possibly account for the trend observed in our studies. In addition, our results demonstrate that participant who attained the tertiary level of education is five times more likely to experience relational continuity of care as compared to those with no formal education. This may be due to the fact that people with higher educational levels are more likely to visit health facilities more and can communicate better with their care givers leading to a stronger bond (34, 35). Good communication is a good indicator of a strong relationship (23). Furthermore, people with no formal education may not have smooth communication with their clinicians due to the language barrier and other cofounders. Furthermore, our findings reveal that diabetics with higher flexible and team continuity of care are four times and 17 times more likely to experience a good relationship with their care givers. Patients who are empowered to access their doctors anytime anywhere as well as well-coordinated care given will surely have a strong existing and ongoing therapeutic relationship with their doctors (23, 25). Accounting for all other factors, it is evident from this study that high relational continuity of care of diabetics did not translate into high longitudinal continuity of care. This possibly could be that patients who have experienced low longitudinal continuity of care are more likely to experience high relational continuity of care as compared to those with high longitudinal continuity. Relational continuity is vital in ensuring that, patients develop an interpersonal relationship with their clinician on regular basis. This happens when physician–patient relationship transcends the usual contact exchange to the physician being made aware of the patient's familial circumstances. This is important in managing complications and at the same time ensuring the wellbeing of patients with diabetes. Indeed, relational continuity is beneficial in reducing hospitalization duration and reducing the use of emergency departments and also improves patient outcomes (23). This study identified a strong relationship between diabetes adherence and relational continuity among patients with diabetes. There are several possible reasons contributing to why longitudinal continuity of care has decreased the odds of relational continuity of care. Multiple referrals during health service delivery may also be a contributing factor. A well-established interpersonal relationship can make a physician in charge of a patient refer the patient when necessary since the doctor knows the familial circumstances of the patient. In this case, fragmented care received by the patient may be due to the strong interpersonal bond that exists between a patient and the physician. This could account for the low longitudinal continuity of patients with high relational continuity. Another contributing factor is the group practicing the culture of doctors. The emerging numbers of part time and salaried doctors in general practice results in seasonal rotation of practicing physicians which distorts the order of repeated visits to a particular physician over time. This finding is similar to a study conducted by Aboulghate et al. (28). Hitherto, this finding reflects the fact that most diabetics in Ghana are most likely to experience low longitudinal continuity of care.

Study limitations

The following are some limitations of this study that should be considered when interpreting the results:

- First, the study used a cross-sectional design, which means that causal relationships cannot be established. For example, while the study found that good adherence to diabetes management was associated with high relational continuity of care, it is possible that patients who experienced high relational continuity of care were more likely to adhere to management in the first place.
- Second, the study was conducted in only three diabetic clinics in Accra, Ghana, which may limit the generalizability of the findings to other settings.
- Third, the study relied on self-reported measures of continuity of care, which may be subject to recall bias and social desirability bias.
- Fourth, the study did not assess the quality of diabetes care received by participants, which may have an impact on their perception of continuity of care.
- Finally, the study did not assess the perspectives of healthcare providers, which could provide additional insight into the factors that contribute to the continuity of care.

Conclusion

The majority of diabetics in this study experienced high continuity of care in three of the domains of continuity. Most diabetics had their care well-coordinated among multiple health providers, were more likely to experience responsive and timely care from their health providers, and had strong interpersonal bond with their health providers. This means most health providers in the diabetic clinics used for this study have flexible plans in the management of the changing needs of patients and are able to adapt to care protocol to suit peculiar cases of patients when it faces up. Notably, patients with a high team and flexible continuity of care are 17 and four times more likely to experience relational continuity of care. Furthermore, female subjects in this study have higher odds of experiencing a continuity of care as compared to male subjects. However, the majority of diabetics in Accra experienced low longitudinal continuity of care. Considering the importance of CoC in improving quality care, there is a need for policy action on the adoption, of multidisciplinary team-based care, optimization of information technology (electronic records/data and electronic information management systems), and advocacy for family medicine. Overall, while this study provides important insights into the extent of continuity of care experienced by diabetic patients in Accra, Ghana, further research is needed to confirm these findings and identify strategies to improve longitudinal continuity of care.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Ghana Health Service Ethics Review Committee. The patients/participants provided their written informed consent to participate in this study.

Author contributions

VA and SKKD conceived the idea and made intellectual contributions to the conception and design. VA analyzed the data and drafted the manuscript, and it was reviewed by SKKD. Both authors read and approved the final manuscript.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Universal coverage and utilization of free long-lasting insecticidal nets for malaria prevention in Ghana: a cross-sectional study

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Background: Malaria continues to be one of the leading causes of mortality and morbidity, especially among children and pregnant women. The use of Long-Lasting Insecticide Nets (LLINs) has been recognized and prioritized as a major intervention for malaria prevention in Ghana. This study aims to establish the factors influencing the universal coverage and utilization of LLINs in Ghana.

Methods: The data used for this study was from a cross-sectional survey carried out to assess LLINs ownership and use in 9 out of the 10 old regions of Ghana from October 2018 to February 2019 where free LLIN distribution interventions were implemented. The EPI "30 × 7" cluster sampling method (three-stage sampling design) was modified to "15 × 14" and used for the study. A total of 9,977 households were interviewed from 42 districts. Descriptive statistics using percentages as well as tests of associations such as Pearson Chi-square and the magnitude of the associations using simple and multivariable logistic regression were implemented.

Results: Of the 9,977 households in the study, 88.0% of them owned at least one LLIN, universal coverage was 75.6%, while utilization was 65.6% among households with at least one LLIN. In the rural and urban areas, 90.8% and 83.2% of households, respectively, owned at least one LLIN. The was a 44% increase in universal coverage of LLINs in rural areas compared to urban areas (AOR: 1.44, 95% CI: 1.02–2.02). There were 29 higher odds of households being universally covered if they received LLIN from the PMD (AOR: 29.43, 95% CI: 24.21–35.79). Households with under-five children were 40% more likely to utilize LLIN (AOR: 1.40, 95% CI: 1.26–1.56). Respondents with universal coverage of LLIN had 25% increased odds of using nets (AOR: 1.25 95% CI: 1.06–1.48). Rural dwelling influences LLIN utilization, thus there was about 4-fold increase in household utilization of LLINs in rural areas compared to urban areas (AOR: 3.78, 95% CI: 2.73–5.24). Household size of more than 2 has high odds of LLINs utilization and awareness of the benefit of LLINs (AOR: 1.42, 95% CI: 1.18–1.71).

Conclusion: About nine in 10 households in Ghana have access at least to one LLIN, three-quarters had universal coverage, and over two-thirds of households with access used LLIN. The predictors of universal coverage included region of residence, rural dwellers, and PMD campaign, while households with child under-five, in rural areas, and with universal coverage were positively associated with utilization.

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KEYWORDS

universal coverage, utilization of insecticidal nets, long-lasting insecticide nets, mosquito nets, point mass distribution, malaria prevention

Introduction

The estimated number of malaria cases recorded worldwide in 2021 was estimated to be 247 million, which was 2 and 15 million cases more than 2020 and 2019 figures, respectively. The total number of deaths from malaria globally in 2021 was estimated at 619,000 compared to 625,000 deaths in 2020 and 568,000 deaths in 2019 (1–3). World Health Organization African region accounted for 95% of the global malaria cases in 2021. The percentage of global malaria deaths accounted for by African regions alone in 2021 is estimated at 96% (1–3).

Long-lasting insecticide net (LLIN) is one of the core interventions recommended by the WHO for malaria vector control in SSA and has been responsible for an estimated two-thirds of the reduction in the global burden of malaria in recent years (4). In 2021, 47% of the world population slept under an LLIN, an increase from 3% in 2000 (3). The percentage of the sub-Saharan Africa population with at least one ITN increased from 5% in 2000 to 68% in 2021. During the same period, the percentage of the population with access to an ITN within their household increased from 3 to 54% (3).

Malaria is endemic in Ghana, which means that about 31 million residents are susceptible to malaria infection (4–6). Ghana contributed 2% of the global malaria morbidity and mortality in 2021 (3). Incidence of malaria accounted for 20.3% of causes of outpatient morbidity with pregnant women, children under 5 years, and immuno-compromised being the most vulnerable group (5, 7, 8). The Ghana Health Service through its agency, National Malaria Control Programme, over the years adopted a number of strategic plans to combat malaria, some of which include Roll Back Malaria (RBM) initiative in 1999 that emphasized the strengthening of health services through multi-and inter-sectoral partnerships and making treatment and prevention strategies more widely available; in the year 2000, the first National Malaria Strategic Plan (2000–2010) was developed with the goal to reduce malaria specific morbidity and mortality by 50% by the year 2010; and most recently the 2015–2020 Ghana Malaria Strategic Plan which aimed to reduce malaria burden in the country by 75% (6, 8).

The use of Long-Lasting Insecticide Nets (LLINs) has been recognized and prioritized as a major intervention for malaria prevention by the various strategies adopted in Ghana. The President Malaria Initiative (PMI) continues to support Ghana's LLINs strategy aimed at achieving universal coverage of LLINs through complementary distribution channels: mass campaign distribution and continuous distribution. In line with the Ghana Malaria Strategic plan (2014–2020), the goal of the mass LLIN distribution campaign is to protect at least 80% of the population at risk with effective malaria prevention interventions. The GHS through National Malaria Control Programme (NMCP) implements Point Mass Distribution (PMD) of LLINs campaigns as one of its strategies. NMCP has implemented three rounds of mass LLIN distribution campaigns since 2010 and the last round was completed in December 2018. With support from partners such as United Nations International Children's Emergency Fund (UNICEF), Department for International Development (DFID), Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) and others between December 2010 and October 2012. National Malaria Control Programme has distributed nearly 12.5 million free LLINs through the PMD campaign in all the then 10 regions of Ghana (9). The second round of PMD LLINs campaign, which ended in the year 2016, saw the distribution of a total of 4,888 LLINs in Greater Accra, Northern, Upper East, Upper West, and Eastern Regions. During the first half of 2016, the PMD of LLIN was conducted in Upper West and Northern regions and a total of 2,457,872 LLINs were distributed (10). The third round of mass distribution of LLINs ended in 2018, with about 15.5 million LLINs (11) distributed in 194 districts in nine of the country's 10 regions.

Ghana's 2010–2012 mass LLIN distribution campaign saw the distribution of approximately 12.8 million LLINs (9). Thereafter, the country has been struggling to reach and sustain universal coverage and continuous use of LLINs despite so much commitment by the Ghana Health Service (GHS) and its agency NMCP, implementing different strategies (12). The RBM Partnership's scaling-up for impact strategy was implemented in Ghana to reduce malaria-related mortality by about 75% from the year 2000 (base) by 2015. This therefore pushed Ghana to set specific targets to achieve this level of impact, which included 100% of households owning at least one LLIN, one LLIN available per two persons, 80% of the general population sleeping under an LLIN and 85% of children under 5 years and pregnant women sleeping under LLIN (4, 12). Ghana as a malaria-endemic country, subscribed to the WHO Global Technical Strategy for Malaria 2016–2030 (WHO-GTS) which has one of its goals, universal access to malaria prevention with the recommendation of universal coverage of the population at risk with LLINs (10). Alongside the continuous distribution of LLINs to pregnant women and children under-5 in schools and health facilities, Ghana is also implementing a mass distribution of free LLINs every 3 years since 2012, with the latest conducted in 2018.

Despite the progress made in the last decade to increase the coverage of LLINs distribution, Ghana has not been able to achieve the target of 100% LLINs ownership and usage of 80% in the general population. Literature has shown that LLINs ownership is usually higher than usage. A study conducted in the Hohoe Municipality among mothers with children under five showed that LLINs ownership was 81.3%, and usage was 66.4% (13). Another study conducted among 300 pregnant women seeking antenatal care in an urban hospital in the Ashanti region, reported a net ownership of 78 and 61% usage (14). This study was undertaken to determine the factors that influence the universal coverage and utilization of LLINs following the recent PMD distribution campaign in 2018, which covered nine out of the old 10 regions in Ghana.

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Methods

Study design and setting

The study was a cross-sectional survey to assess LLINs ownership and use in Ghana. The survey employed a stratified three-stage sample design with the aim of estimating key malaria indicators at the national level. The first stage involved the selection of districts followed by clusters made up of enumeration areas, which was drawn from the 2010 census data. At the third stage, a sampling frame made up of all households to allow for equal chances of selection and to make the data obtained nationally representative was adopted. Households to be included in the survey were randomly selected from the sampling frame. Quantitative data was collected from October 2018 to February 2019.

Study population and sampling methods

The study population was head of households, pregnant women, mothers, and caretakers of children less than 5 years. The study was conducted in nine (9) out of the 10 traditional regions in Ghana (before the creation of the new regions) where interventions (PMD) were implemented, these including Ashanti, Brong Ahafo, Central, Eastern, Greater Accra, Northern, Upper East, Volta, and Western Regions. Upper West region was excluded from the sampling frame because interventions were not implemented there.

The sampling frame was the entire eligible 205 districts in the 9 regions of Ghana. The sampling frame excluded the population living in collective housing units such as hotels, hospitals, work camps, prisons, or boarding schools. The sample was stratified to provide adequate representation of urban and rural areas, as well as all eligible regions and districts.

The first stage of the sampling was to select districts from each region randomly proportionate to the number of districts in the region. A total of 42 districts were selected from 205 districts in the 9 regions of Ghana, representing 20.5% of the eligible districts. In effect, six (7) districts were selected from the Ashanti region, six (6) from Brong Ahafo, and five (5) each from Eastern, Volta, and Western Regions, respectively. Four (4) districts each were also selected from Central, Northern Regions and Greater Accra region, and two (2) from Upper East. The second stage was the selection of primary sampling units (PSUs), which are also called clusters based on the list of enumeration areas (EAs) created in the 2010 Population and Housing Census. The third stage of selection was at the household level in each cluster. Figure 1A shows the location of Ghana on Africa map, Figure 1B shows the implementing regions on the map of Ghana and Figure 1C shows the locations of the implementing districts in the country.

Selection of communities, houses, and households

The EPI "30 × 7" cluster sampling method was modified to "15 × 14" and used for the quantitative study. Thus, 15 clusters from each identified district were selected. In each cluster, 14 heads of households were randomly selected and interviewed. This gave a total of 210 households interviewed for each district and 8,820 households for the entire study. The modification allowed more samples to be collected within cluster especially when the homogeneity within cluster is likely to be high. Logistics was also a factor to this modification as it was relatively more expensive to reach a high number of clusters with smaller number of households than to reach a smaller number of clusters with high number of household, especially when similarities across districts within region is high.

In each EA, the base was identified. Field workers spanned a pencil at the EA base and followed where the tip of the pencil pointed, and the clockwise direction followed for the selection of households from the various houses in that direction till all 14 households were selected. At the household level, the head of the household was interviewed. In the absence of the household head, all eligible representatives of the household head were listed alphabetically by their given first names. The first person on the ordered list was interviewed in that household. For this study, a household was defined as a group of people who live together and eat from the same pot. Polygamous families were considered as one unit if they have one household head.

Training

A three (3) day training on how to administer the questionnaires for the quantitative aspect of the study with a mobile application software known as Research Electronic Data Capture (REDCap) was organized for 30 research assistants from 22nd to 24th October 2018. Pre-testing of the questionnaires was done in Kimbu, a community in Greater Accra region. A total of 12 research assistants, comprising two (2) supervisors and 10 data collectors were assigned for data collection in each region. Research assistances were taken through both the English version of the questionnaire and the local dialect.

Data collection and management

Structured questionnaire with both closed and opened ended questions was used for this study. In each EA, community entry was done with appropriate authorities. Data collectors established a rapport with household heads and administered informed consent before interviews were conducted. A questionnaire which covered the entire point mass distribution (PMD) process (registration and code card distribution, net redemption, and Social and Behavioral Change Communication, SBCC) was administered in each household. Hanged nets and any evidence of nets used during the previous night and unused nets from the PMD available in the household were observed during the interview. Data collection was done with an online data collection management system called Research Electronic Data Capture System (REDCap). Therefore, data collection, tracking, and management were done in real time. At the close of each day, the data collected was synced into the REDCap server. Daily, the uploaded data was cleaned, reconciled with data collected from the field. A back-up copy of the data was saved each day in another cloud to prevent data loss.

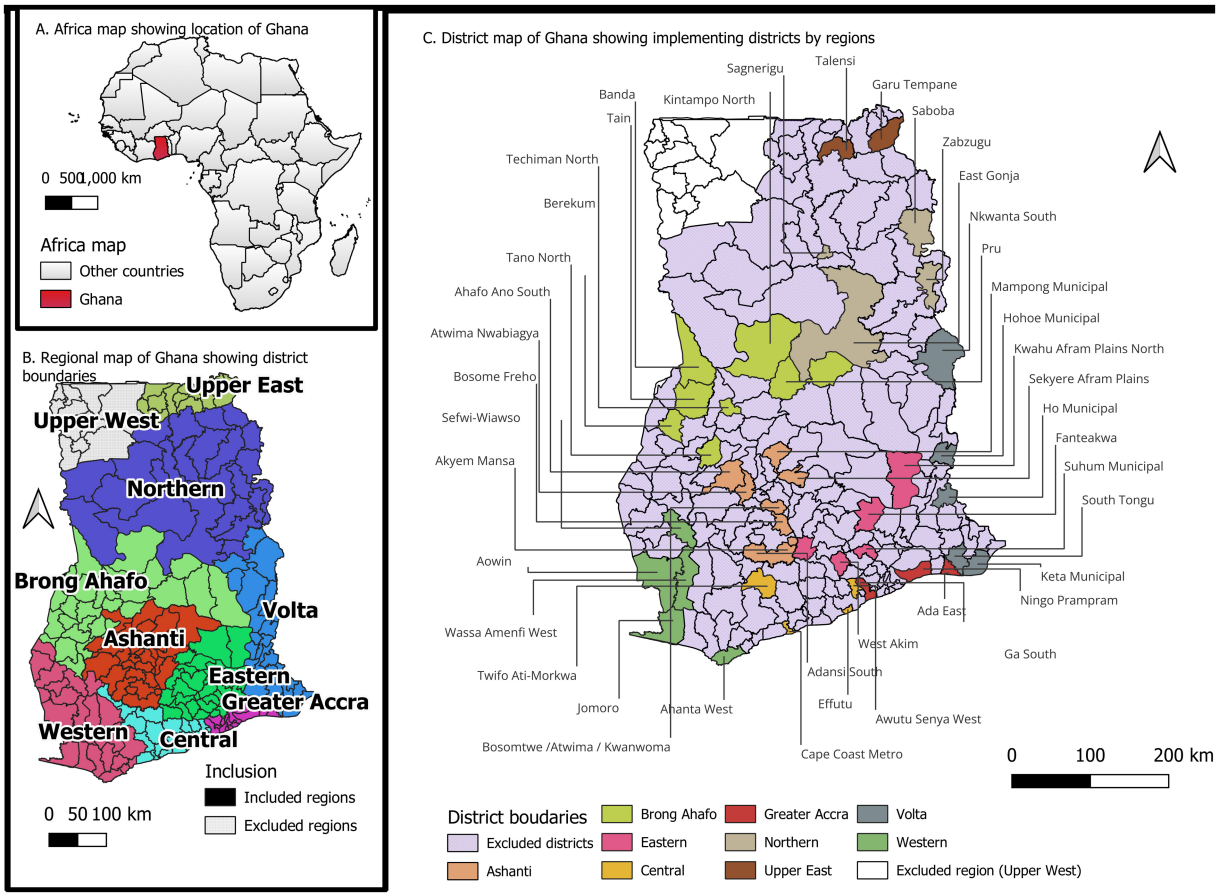

FIGURE 1
Map of Africa showing the location of Ghana **(A)**, Map of Ghana showing the implementing regions **(B)** and the implementing districts **(C)**.

Ethics approval

This was a secondary data obtained from the National Malaria Control Programme. The survey was a subsection (implementation research findings of the malaria program) of the main Point Mass Distribution exercise, and it was approved by the Ghana Health Service.

Study variables

Outcomes

There are two main outcome variables for this study, these are, *Universal Coverage* defined as households with at least one LLIN per every two household members and the other outcome is *LLIN utilization,* defined as the use of at least one LLIN by a household the night prior to the survey among households with at least one LLIN.

Predictors

Important predictors of the outcome variables were categorized into household characteristics (Region, Residence, Household size, Household has, child under-5, Household has a pregnant woman, received, net from PMD campaign, Number of nets in household) and respondent characteristics (Household respondents, Respondent's age, Marital status, Highest education, Religion, Employment status, Aware of benefits of LLINs, Aware of key facts of LLINs, Aware of continuous use and care for LLINs).

Data analysis

Analyses of the data were done using both descriptive and inferential statistics. In the descriptive part, frequencies, proportions, or percentages and charts were employed. These were carried out and presented according to the outcomes and further delineated into the levels of each of the predictors. A continuous variable such as age of the respondent was categorized into two (18–49 and >49 years) levels for ease of the analysis and interpretation. The Choropleth map was used to display access to, universal coverage and utilization of LLINs by region and further by rural and urban areas within regions.

Further analyses were done using the simple logistic regression model and Pearson Chi-square test to establish associations or relationships between the two main outcomes (universal coverage and utilization) of interest with each of the predictor variables. Multivariable logistic regression was then implemented after variables were selected from the bivariate analysis due to their significance with a type-I error of 5%. Variables such as respondents' age, employment status, and religion were included due to their relevance as observed

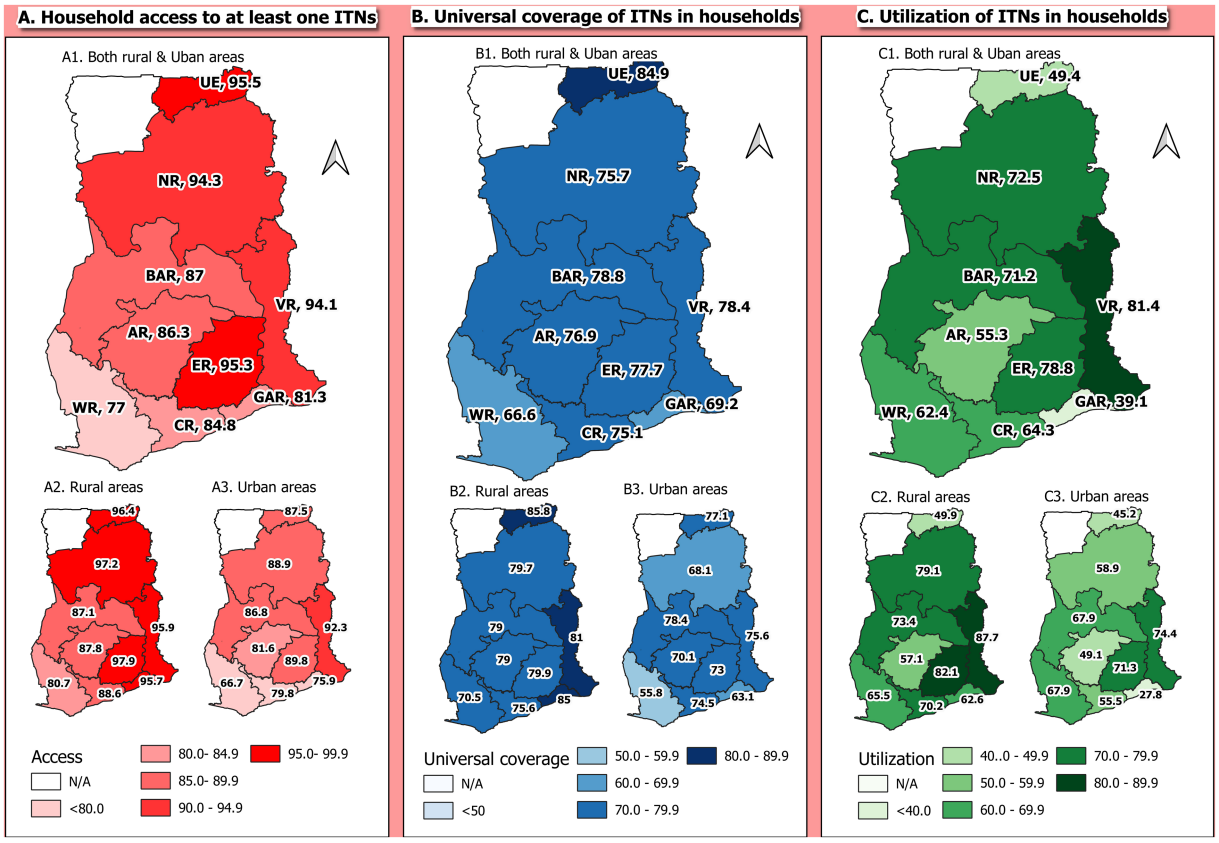

FIGURE 2
Maps of the regional and rural–urban distribution of access **(A)**, universal coverage **(B)**, and utilization **(C)** of LLINs by households.

from literature. In addition, two variable interaction effects were examined for combinations of the predictors and none except residence and region interaction was significant. This was therefore included in the final multivariable logistic regression model to obtain adjusted odds ratios.

Analysis was conducted using Stata IC version 16 (Stata Corp., College Station, TX, United States). All statistical analyses were considered significant at a predefined alpha value of 0.05.

Results

Descriptive characteristics of households in the study

A total of 9,977 households were interviewed. The Ashanti region (16.6%) was the most represented while the Upper East region (4.7%) was least represented. About two-thirds (62.6%) of the households interviewed were in rural areas. The median household size was 5 members (IQR: 3 to 6 members) with approximately half (51.3%) of the households having a child below 5 years and while 6.9% had a pregnant woman. Majority (86.2%) of the households had received LLINs from the PMD campaign (Table 1).

Less than half (44.9%) of the respondents were the household head. The median age of the respondents was 41.5 years (IQR: 38 to 52 years). Majority (73.4%) of the respondents were females. Majority (64.1%) were also married. About a third had no formal education (31.4%) While 4.3% had tertiary education. Majority (79.2%) were Christians (79.2%) or were employed (87.1%). Majority were also aware of the benefits of LLINs (63.1%), the key facts of LLINs (62.6%), while less than half (40.7%) were aware of the continuous use and care of LLINs (Table 1).

LLINs ownership among households interviewed

Of the 9,977 households in the study, 88.0% (8,777/9,977) of the households owned at least one LLIN. 95.5% (449/470), 95.3% (1,168/1,226), and 94.3% (932/988) of households from the Upper East, Eastern, and Northern regions, respectively, owned at least one net, the highest. About 77.0% (881/1,144) of the households in the Western region owned at least one LLIN being the least. In rural areas, 90.8% (5,675/6,248) of the households owned at least one LLIN, while 83.2% (3,102/3,729) of households in the urban areas also owned at least one LLIN. Household access to at least one LLIN was higher in the rural areas than the urban areas for each of the 9 regions. Figure 1A shows the distribution of access to LLINs among households across regions and also rural–urban distributions (Figure 1).

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TABLE 1 Descriptive characteristics of households and household respondents.

Variables and categories	Frequency (%) N =9,977
Region	
Greater Accra	960 (9.6)
Ashanti	1,661 (16.6)
Eastern	1,226 (12.3)
Central	937 (9.4)
Volta	1,193 (12.0)
Brong Ahafo	1,398 (14.0)
Western	1,144 (11.5)
Northern	988 (9.9)
Upper East	470 (4.7)
Residence	
Rural	6,248 (62.6)
Urban	3,729 (37.4)
Household size, median (IQR)	5 (3, 6)
Household size	
1–2 members	1,677 (16.8)
3–5 members	4,726 (47.4)
6–7 members	2,183 (21.9)
8 or more	1,382 (13.9)
Household has child under-5[M]	
No	4,824 (48.7)
Yes	5,073 (51.3)
Household has a pregnant woman	
No	9,285 (93.1)
Yes	692 (6.9)
Received net from PMD campaign	
No	1,379 (13.8)
Yes	8,598 (86.2)
Respondents' characteristics	
Respondent household	
Household head	4,484 (44.9)
Others	5,493 (55.1)
Respondent's age, median (IQR)	41.5 (38.0, 52.0)
Respondent's age[M]	
18-49 years	7,045 (71.0)
>49 years	2,883 (29.0)
Sex	
Male	2,657 (26.6)
Female	7,320 (73.4)
Marital status[M]	
Single	1,559 (15.7)
Divorced/separated	708 (7.1)
Cohabiting	315 (3.2)
Widowed	988 (9.9)
Married	6,376 (64.1)
Highest education[M]	
No formal education	3,110 (31.4)
Primary	1,518 (15.3)
JHS/JSS/Middle	3,697 (37.3)
SHS/SSS/VOC/TECH	1,157 (11.7)
Tertiary	423 (4.3)
Religion[M]	
None	271 (2.7)
Christian	7,888 (79.2)
Muslim	1,411 (14.2)
Traditional	389 (3.9)
Employment status[M]	
Unemployed	1,283 (12.9)
Employed	8,687 (87.1)
Aware of benefits of LLINs	
Yes	6,299 (63.1)
No	3,678 (36.9)
Aware of key facts of LLINs	
Yes	6,241 (62.6)
No	3,736 (37.4)
Aware of continuous use and care for LLINs	
Yes	4,056 (40.7)
No	5,921 (59.3)

M, Variable has missing observations.

Universal coverage of LLINs among households

Out of the 9,977 total households interviewed, about three-quarters (75.6%, n = 7542/9977) had universal coverage of LLINs. Among the nine regions, the universal coverage of LLINs was highest in the Upper East region (84.9%) and lowest in the western region (66.6%). Households in rural areas (78.7%) had a higher percentage of universal coverage of LLINs compared to households in urban areas (70.4%). Universal coverage of LLINs was highest in the rural areas than the urban areas in all 9 regions. Figure 1B shows the distribution of the universal coverage of LLINs among households across regions and also rural–urban distributions (Figure 1).

Utilization of LLINs among households with access to at least one LLINs

About 8,777 households have access to at least one LLINs, out of which two-thirds (65.6%) had at least one member of the household sleeping under LLINs the night before the survey. Among the nine

regions, household utilization of LLINs was highest in the Volta region (81.4%) and lowest in the Greater Accra region (39.1%). Utilization of LLINs was higher among households in rural areas (70.2%) compared to households in urban areas (57.1%). Utilization of LLIN was also higher in rural areas compared to the urban areas in each of the 9 regions. Figure 1C shows the distribution of the utilization of LLINs among households across regions and also rural–urban distributions (Figure 1).

Bivariate analysis of factors associated with universal coverage of LLINs

The Pearson's Chi-square test showed that region of residence ($\chi^2 = 110.6$, $p < 0.001$), area of residence ($\chi^2 = 86.4$, $p < 0.001$), household size ($\chi^2 = 160.7$, $p < 0.001$), children under-5 years in household ($\chi^2 = 11.4$, $p < 0.01$), and household receiving LLINs from recent PMD campaign ($\chi^2 = 2{,}700$, $p < 0.001$) were household characteristics that were significantly associated with universal coverage of LLINs. The statistically significant respondents' characteristics associated with universal coverage of LLINs were household head ($\chi^2 = 3.9$, $p < 0.05$), the age of the respondent ($\chi^2 = 5.3$, $p < 0.05$), marital status of the respondent ($\chi^2 = 23.2$, $p < 0.001$), and the highest education of the respondent ($\chi^2 = 13.3$, $p < 0.05$). The awareness of respondents on the benefits of LLINs ($\chi^2 = 838.5$, $p < 0.001$), key facts about LLINs ($\chi^2 = 874.9$, $p < 0.001$), and the continuous use and care for LLINs ($\chi^2 = 177.7$, $p < 0.001$) were also significantly associated with universal coverage of LLINs in households (Table 2).

Bivariate analysis of factors associated with household utilization of LLINs

Pearson's Chi-square test showed that region of residence ($\chi^2 = 617.4$, $p < 0.001$), area of residence ($\chi^2 = 152.0$, $p < 0.001$), household size ($\chi^2 = 43.7$, $p < 0.001$), household with children under-5 years ($\chi^2 = 105.5$, $p < 0.001$), household receiving LLINs from PMD's distribution campaign ($\chi^2 = 48.6$, $p < 0.001$), number of LLINs in household ($\chi^2 = 61.9$, $p < 0.001$), and household having at least 1 net per every 2 persons ($\chi^2 = 10.8$, $p < 0.01$) were household characteristics significantly associated with utilization of LLINs. The marital status of the respondent ($\chi^2 = 57.2$, $p < 0.001$), the highest education of the respondent ($\chi^2 = 18.1$, $p < 0.05$), religion of the respondent ($\chi^2 = 23.0$, $p < 0.001$), and employment status ($\chi^2 = 11.1$, $p < 0.01$) were respondents characteristics significantly associated with utilization of LLINs. The awareness of respondents on the benefits of LLINs ($\chi^2 = 181.8$, $p < 0.001$), key facts about LLINs ($\chi^2 = 149.8$, $p < 0.001$) and the continuous use and care for LLINs ($\chi^2 = 200.0$, $p < 0.001$) were also significantly associated with universal coverage of LLINs in households (Table 2).

Multivariable analysis of factors associated with universal coverage of LLINs

The binary logistic regression model was used to estimate both the crude and adjusted odds ratio of factors associated with universal coverage of LLINs among the households. From the adjusted model, the odds of universal coverage of LLINs among households in the Greater Accra (AOR: 2.86, 95% CI: 1.99–4.12), Ashanti (AOR: 2.03, 95% CI: 1.36–3.02), Eastern (AOR: 2.24, 95% CI: 1.50–3.36), Central (AOR: 2.24, 95% CI: 1.49–3.35), Volta (AOR: 3.02, 95% CI: 2.07–4.40), Brong Ahafo (AOR: 2.99, 95% CI: 2.03–4.40), and Northern (AOR: 1.93, 95% CI: 1.29–2.90) regions were significantly higher compared to households from the Western region. There was a 44% increase in universal coverage of LLINs in rural areas compared to urban areas (AOR: 1.44, 95% CI: 1.02–2.02).

An interaction effect between residence (rural) and region of residence showed increased universal coverage in the rural parts across all 9 regions; Greater Accra (AOR: 3.00, 95% CI: 2.14–4.21), Ashanti (AOR: 2.14, 95% CI: 1.51–3.03), Eastern (AOR: 2.19, 95% CI: 1.50–3.19), Central (AOR: 3.39, 95% CI: 2.32–4.97), Volta (AOR: 2.39, 95% CI: 1.69–3.40), Brong Ahafo (AOR: 1.44, 95% CI: 1.02–2.02), Western (AOR: 2.85, 95% CI: 1.97–4.12), Northern (AOR: 3.44, 95% CI: 2.24–5.29), and Upper East (3.00, 95% CI: 2.14–4.21; Table 3).

Universal coverage of LLINs was over 11 folds higher in households with 1–2 members (AOR: 11.46, 95% CI: 8.89–14.79), 3 folds higher in households with 3–5 members (AOR: 3.31, 95% CI: 2.83–3.87), and 2-folds higher in a 6–7members (AOR: 2.15, 95% CI: 1.81–2.54) as against households with 8 or more members. Those who received LLINs from PMD's had a higher Universal coverage, about 30-fold higher as against those from different sources (AOR: 29.43, 95% CI: 24.21–35.79; Table 3).

Compared to respondents who were single, there was 23% increased odds of universal coverage of LLINs among respondents who were married (AOR: 1.23, 95% CI: 1.03–1.46). Universal coverage of LLINs was high among households whose representative was aware of the key facts of LLINs (AOR: 1.38, 95% CI: 1.11–1.72; Table 3).

Multivariable analysis of factors associated with utilization of LLINs

From the adjusted logistic regression model, the odds of utilization of LLINs was higher among households in the Western (AOR: 2.59, 95% CI: 1.82–3.68), Ashanti (AOR: 2.19, 95% CI: 1.63–2.94), Eastern (AOR: 5.02, 95% CI: 3.68–6.86), Central (AOR: 2.90, 95% CI: 2.13–3.93), Volta (AOR: 6.49, 95% CI: 4.90–8.60), Brong Ahafo (AOR: 5.01, 95% CI: 3.79–6.63), and Northern (AOR: 3.52, 95% CI: 2.53–4.88) regions compared to households from the Greater Accra region. There was about 4-fold increase in household utilization of LLINs in rural areas compared to urban areas (AOR: 3.78, 95% CI: 2.73–5.24).

An interaction effect between residence (rural) and region of residence also showed increased utilization in the rural parts across all 9 regions: Greater Accra (AOR: 3.78, 95% CI: 2.73–5.24), Ashanti (AOR: 2.93, 95% CI: 2.32–3.70), Eastern (AOR: 8.96, 95% CI: 6.80–11.80), Central (AOR: 4.67, 95% CI: 3.51–6.23), Volta (AOR: 15.99, 95% CI: 11.48–22.25), Brong Ahafo (AOR: 5.97, 95% CI: 4.59–7.75), Western (AOR: 4.49, 95% CI: 3.46–5.82), Northern (AOR: 8.13, 95% CI: 6.05–10.92), and Upper East (2.15, 95% CI: 1.61–2.86; Table 3).

Utilization of LLINs was 40% higher in households with at least one child aged below 5 years (AOR: 1.40, 95% CI: 1.26–1.56) and 25% higher in households with universal access to LLINs (AOR: 1.25, 95% CI: 1.06–1.48; Table 3).

TABLE 2 Bivariate analysis of factors associated with universal coverage of LLINs and utilization of LLINs.

Variables	Universal coverage of LLINs			Household utilization of LLINs		
	Total	Covered	χ^2 value of p	Total	Use	χ^2, value of p
	N	*n* (%)		*N*	*n* (%)	
Total	9,977	7,542(75.6)		8,777	5,756(65.6)	
Household characteristics						
Region			110.6***			617.4***
Greater Accra	960	664(69.2)		780	305(39.1)	
Ashanti	1,661	1,277(76.9)		1,433	792(55.3)	
Eastern	1,226	952(77.7)		1,168	920(78.8)	
Central	937	704(75.1)		795	511(64.3)	
Volta	1,193	935(78.4)		1,123	914(81.4)	
Brong Ahafo	1,398	1,101(78.8)		1,216	866(71.2)	
Western	1,144	762(66.6)		881	550(62.4)	
Northern	988	748(75.7)		932	676(72.5)	
Upper East	470	399(84.9)		449	222(49.4)	
Residence			86.4***			152.0***
Rural	6,248	4,916(78.7)		5,675	3,984(70.2)	
Urban	3,729	2,626(70.4)		3,102	1772(57.1)	
Household size			160.7***			43.7***
1–2 members	1,677	1,380(82.3)		1,353	785(58.0)	
3–5 members	4,726	3,651(77.3)		4,193	2,775(66.2)	
6–7 members	2,183	1,628(74.6)		1964	1,339(68.2)	
8 or more	1,382	876(63.4)		1,260	855(67.9)	
Household has child under-5[M]			11.4**			105.5***
No	4,824	3,717(77.1)		4,075	2,445(60.0)	
Yes	5,073	3,761(74.1)		4,634	3,266(70.5)	
Household has a pregnant woman			1.9			1.2
No	9,285	7,034(75.8)		8,160	5,339(65.4)	
Yes	692	508(73.4)		617	417(67.6)	
Received net from PMD campaign			2700.0***			48.6***
No	1,379	270(19.6)		598	314(52.5)	
Yes	8,598	7,272(84.6)		8,179	5,442(66.5)	
Number of nets in household						61.9***
One	–	–		1,211	680(56.2)	
Two	–	–		2024	1,316(65.0)	
Three	–	–		2,233	1,495(67.0)	
>Three	–	–		3,309	2,265(68.5)	
Universal coverage of LLINs						10.8**
Not covered	–	–		1,446	894(61.8)	
Covered	–	–		7,329	4,860(66.3)	
Respondents' characteristics						
Respondent household			3.9*			1.4
Household head	4,484	3,432(76.5)		3,870	2,564(66.3)	
Others	5,493	4,110(74.8)		4,907	3,192(65.1)	
Respondent's age [M]			5.3*			3.3

(Continued)

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TABLE 2 (Continued)

Variables	Universal coverage of LLINs			Household utilization of LLINs		
	Total	Covered	χ^2 value of p	Total	Use	χ^2, value of p
	N	*n* (%)		*N*	*n* (%)	
18-49 years	7,045	5,283(75.0)		6,187	4,104(66.3)	
>49 years	2,883	2,225(77.2)		2,550	1,640(64.3)	
Sex			1.06			2.2
Male	2,651	1989 (74.9)		2,274	1,520(66.8)	
Female	7,295	5,553 (75.9)		6,503	4,236(65.1)	
Marital status [M]			23.2***			57.2***
Single	1,559	1,111(71.3)		1,225	711(58.0)	
Divorced/separated	708	552(78.0)		616	386(62.7)	
Cohabiting	315	231(73.3)		271	184(67.9)	
Widowed	988	772(78.1)		890	545(61.2)	
Married	6,376	4,852(76.1)		5,749	3,914(68.1)	
Highest education [M]			13.3*			18.1**
No formal education	3,110	2,389(76.8)		2,819	1849(65.6)	
Primary	1,518	1,141(75.2)		1,352	918(67.9)	
JHS/JSS/Middle	3,697	2,806(75.9)		3,219	2,143(66.6)	
SHS/SSS/VOC/TECH	1,157	864(74.7)		999	605(60.6)	
Tertiary	423	292(69.0)		331	204(61.6)	
Religion [M]			4.3			23.0***
None	271	193(71.2)		231	161(69.7)	
Christian	7,888	5,984(75.9)		6,911	4,570(66.1)	
Muslim	1,411	1,051(74.5)		1,261	759(60.2)	
Traditional	389	298(76.6)		358	253(70.7)	
Employment status [M]			0.6			11.1**
Unemployed	1,283	959(74.8)		1,117	683(61.2)	
Employed	8,687	6,579(75.7)		7,656	5,070(66.2)	
Aware of benefits of LLINs			838.5***			181.8***
Yes	6,299	5,361(85.1)		6,008	4,219(70.2)	
No	3,678	2,181(59.3)		2,769	1,537(55.5)	
Aware of key facts of LLINs			874.9***			149.8***
Yes	6,241	5,332(85.4)		5,957	4,161(69.9)	
No	3,736	2,210(59.2)		2,820	1,595(56.6)	
Aware of continuous use and care for LLINs			177.7***			200.0***
Yes	4,056	3,347(82.5)		3,740	2,764(73.9)	
No	5,921	4,195(70.9)		5,037	2,992(59.4)	

M, Variable has missing observations. *p*-value notation: *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Additionally, compared to household representatives who were single, there was 31% increased odds of utilization of LLINs among respondents who were married (AOR: 1.31, 95% CI: 1.13–1.52). There were 35% increased odds of utilization of LLINs among respondents who were Christians (AOR: 1.35, 95% CI: 1.15–1.58) against Muslims (Table 3).

Discussion

The purpose of this study was to evaluate the universal coverage and utilization of long-lasting insecticide nets across nine (9) out of the ten (10) regions of Ghana at the time of the study. Long-lasting insecticide nets are the core malaria prevention methods used across

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TABLE 3 Multivariate analysis of factors associated with universal coverage of LLINs and utilization of LLINs.

Variables	Household coverage of LLINs		Household utilization of LLINs	
	COR [95% CI]	AOR [95% CI]	COR [95% CI]	AOR [95% CI]
Household characteristics				
Region				
Greater Accra	1.12 [0.94–1.35]	2.86 [1.99–4.12]***	1.00 [reference]	1.00 [reference]
Ashanti	1.00 [reference]	1.00 [reference]	2.59 [2.12–3.15]***	2.59 [1.82–3.68]***
Eastern	1.67 [1.41–1.97]***	2.03 [1.36–3.02]**	1.92 [1.61–2.30]***	2.19 [1.63–2.94]***
Central	1.74 [1.45–2.09]***	2.24 [1.50–3.36]***	5.78 [4.73–7.06]***	5.02 [3.68–6.86]***
Volta	1.51 [1.25–1.84]***	2.24 [1.49–3.35]***	2.80 [2.28–3.44]***	2.90 [2.13–3.93]***
Brong Ahafo	1.82 [1.51–2.19]***	3.02 [2.07–4.40]***	6.81 [5.53–8.39]***	6.49 [4.90–8.60]***
Western	1.86 [1.56–2.22]***	2.99 [2.03–4.40]***	3.85 [3.19–4.66]***	5.01 [3.79–6.63]***
Northern	1.56 [1.29–1.89]***	1.93 [1.29–2.90]**	4.11 [3.36–5.04]***	3.52 [2.53–4.88]***
Upper East	2.82 [2.13–3.73]***	2.39 [0.93–6.11]	1.52 [1.20–1.93]***	1.71 [0.89–3.28]
Residence				
Rural	1.55 [1.41–1.70]***	1.44 [1.02–2.02]*	1.77 [1.61–1.94]***	3.78 [2.73–5.24]***
Urban	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Interaction (Region # Residence)				
Greater Accra # Rural	–	3.00 [2.14–4.21]***	–	3.78 [2.73–5.24]***
Ashanti # Rural	–	2.14 [1.51–3.03]***	–	2.93 [2.32–3.70]***
Eastern # Rural	–	2.19 [1.50–3.19]***	–	8.96 [6.80–11.80]***
Central # Rural	–	3.39 [2.32–4.97]***	–	4.67 [3.51–6.23]***
Volta # Rural	–	2.39 [1.69–3.40]***	–	15.99 [11.48–22.25]***
Brong Ahafo # Rural	–	1.44 [1.02–2.02]*	–	5.97 [4.59–7.75]***
Western # Rural	–	2.85 [1.97–4.12]***	–	4.49 [3.46–5.82]***
Northern # Rural	–	3.44 [2.24–5.29]***	–	8.13 [6.05–10.92]***
Upper East # Rural	–	3.00 [2.14–4.21]***	–	2.15 [1.61–2.86]***
Household size				
1–2 members	2.68 [2.27–3.17]***	11.46 [8.89–14.79]***	1.00 [reference]	1.00 [reference]
3–5 members	1.96 [1.72–2.23]***	3.31 [2.83–3.87]***	1.42 [1.25–1.61]***	1.11 [0.93–1.32]
6–7 members	1.69 [1.46–1.96]***	2.15 [1.81–2.54]***	1.55 [1.34–1.79]***	1.09 [0.88–1.36]
8 or more	1.00 [reference]	1.00 [reference]	1.53 [1.30–1.79]***	1.03 [0.79–1.33]
Household has child under-5[M]				
No	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Yes	0.85 [0.78–0.94]**	0.99 [0.87–1.12]	1.59 [1.46–1.74]***	1.40 [1.26–1.56]***
Household has a pregnant woman				
No	1.00 [reference]	–	1.00 [reference]	–
Yes	0.88 [0.74–1.05]	–	1.10 [0.93–1.31]	–
Received net from PMD campaign				
No	1.00[reference]	1.00[reference]	1.00 [reference]	1.00 [reference]
Yes	22.53[19.48–26.05]***	29.43[24.21–35.79]***	1.80 [1.52–2.13]***	1.00 [0.81–1.24]
Number of nets in household				
One	–	–	1.00 [reference]	1.00 [reference]
Two	–	–	1.45 [1.25–1.68]***	1.03 [0.86–1.24]
Three	–	–	1.58 [1.37–1.83]***	1.03 [0.84–1.27]
>Three	–	–	1.69 [1.48–1.94]***	1.00 [0.79–1.25]

(Continued)

TABLE 3 (Continued)

Variables	Household coverage of LLINs		Household utilization of LLINs	
	COR [95% CI]	AOR [95% CI]	COR [95% CI]	AOR [95% CI]
Universal coverage of LLINs				
Not covered	–	–	1.00 [reference]	1.00 [reference]
Covered	–	–	1.22 [1.08–1.37]**	1.25 [1.06–1.48]**
Respondents' characteristics				
Respondent household				
Household head	1.00 [reference]	1.00 [reference]	1.00 [reference]	–
Others	0.91 [0.83–1.00]*	0.98 [0.87–1.12]	0.95 [0.87–1.04]	–
Respondent's age[M]				
18-49 years	1.00 [reference]	1.00 [reference]	1.00 [reference]	–
>49 years	1.13 [1.02–1.25]*	0.95 [0.82–1.10]	0.91 [0.83–1.01]	–
Sex				
Male	1.00 [reference]	-	1.00 [reference]	–
Female	1.06 [0.96–1.18]	-	0.92 [0.84, 1.03]	–
Marital status[M]				
Single	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Divorced/separated	1.43 [1.16–1.76]**	1.27 [0.96–1.68]	1.21 [0.99–1.48]	1.10 [0.88–1.37]
Cohabiting	1.11 [0.84–1.46]	1.03 [0.73–1.46]	1.53 [1.16–2.02]**	1.14 [0.84–1.55]
Widowed	1.44 [1.20–1.74]***	1.00 [0.77–1.30]	1.14 [0.96–1.36]	1.09 [0.89–1.33]
Married	1.28 [1.13–1.45]***	1.23 [1.03–1.46]*	1.54 [1.36–1.75]***	1.31 [1.13–1.52]***
Highest education[M]				
No formal education	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Primary	0.91 [0.79–1.05]	0.98 [0.82–1.17]	1.11 [0.97–1.27]	1.11 [0.95–1.29]
JHS/JSS/Middle	0.95 [0.85–1.06]	1.00 [0.86–1.15]	1.04 [0.94–1.16]	1.02 [0.90–1.16]
SHS/SSS/VOC/TECH	0.89 [0.76–1.04]	1.11 [0.90–1.36]	0.81 [0.69–0.93] **	0.93 [0.78–1.10]
Tertiary	0.67 [0.54–0.84]***	1.03 [0.76–1.41]	0.84 [0.67–1.07]	1.00 [0.77–1.30]
Religion[M]				
None	1.00 [reference]	–	1.52 [1.12–2.06]**	1.29 [0.92–1.79]
Christian	1.27 [0.97–1.66]	–	1.29 [1.14–1.46]***	1.35 [1.15–1.58]***
Muslim	1.18 [0.88–1.58]	–	1.00 [reference]	1.00 [reference]
Traditional	1.32 [0.93–1.88]	–	1.59 [1.24–2.05]***	1.26 [0.94–1.67]
Employment status[M]				
Unemployed	1.00 [reference]	–	1.00 [reference]	1.00 [reference]
Employed	1.05 [0.92–1.21]	–	1.25 [1.09–1.42]**	1.08 [0.93–1.24]
Aware of benefits of LLINs				
No	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Yes	3.92 [3.57–4.32]***	1.09 [0.87–1.37]	1.89 [1.72–2.07]***	1.42 [1.18–1.71]***
Aware of key facts of LLINs				
No	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Yes	4.05 [3.68–4.46]***	1.38 [1.11–1.72]**	1.78 [1.62–1.95]***	1.15 [0.96–1.39]
Aware of continuous use and care for LLINs				
No	1.00 [reference]	1.00 [reference]	1.00 [reference]	1.00 [reference]
Yes	1.94 [1.76–2.14]***	1.03 [0.90–1.19]	1.94 [1.77–2.12]***	1.08 [0.96–1.21]

COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval; *p*-value notation: *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

the globe by people who are at risk of malaria infection. In this study, 88% of households own at least one LLIN which is a higher percentage compared to 74%, 68%, and 48% recorded by the most recent Ghana Malaria Indicator Survey 2019 (15), Ghana Demographic and Health Survey (GDHS) 2014 (16) and Adjei and Gyimah in 2012 (17) respectively. However, there are other studies conducted across the world which recorded LLINs ownership similar to or above the current study (18–22). The high percentage of LLINs ownership could be attributed to the free mass distribution of LLINs programs coupled with the continuous distribution of LLINs in health facilities and schools, being undertaken in malaria endemic countries across the world including Ghana with increasing support from partners such as Global Fund, USAID, World Bank, US President's Malaria Initiative (PMI) (23, 24).

A higher percentage of households living in rural than urban areas own LLINs—91% vs. 83%, which is consistent with the Ghana 2014 DHS findings, 78% vs. 60%, respectively, and the findings of other studies (25, 26). Universal coverage of LLIN differs significantly by geographic location in Ghana with more households in Upper East region owning LLINs. This finding is also consistent with a subnational profiling analysis of LLINs ownership and use conducted in Nigeria which revealed significant variation among ownerships in subnational locations (27). The heterogeneous transmission of malaria across Ghana could explain why the region of location may influence the universal coverage and use of LLINs. This is because of the high endemicity of malaria in the northern parts of Ghana and other areas in the middle belt during the raining season, more NGOs and some malaria research institutions operate in those areas. As a result, more social and behavior change communication messages are being broadcasted in those regions to create awareness about malaria prevention and the benefits of LLINs use.

The 80% universal coverage recommendation from WHO of providing each household with one LLIN for 2 people, was not achieved (28, 29). However, there has been a marked increase in universal coverage of LLINs since GDHS in 2014. This study showed that 76% of households in the study area have at least one LLIN for every two people who stayed in the household the night before the survey compared to 45% reported by the GDHS in 2014 (16) and 52% by the GMIS in 2019 (15). This is partly due to the increased availability of LLINs since 2010–2012 mass campaigns that saw a distribution of over 12 million LLINs (9); it is also due to increased awareness of the benefits of using LLINs (29, 30). Universal coverage was higher among households which received LLINs from the PMD campaign and households whose representatives were aware of the key facts of LLINs. This finding suggested that the goal of universal coverage in terms of the adequate provision of nets can only be achieved through sustained mass and continuous distribution systems and education activities. A similar conclusion was drawn in a study that evaluated a universal coverage campaign in Tanzania (31). Therefore, we recommend that the distribution exercise continue unabated.

In most studies including this current one, LLIN use rates fell below the WHO and Roll back malaria Partnership target of 80% (32, 33). With Ghana almost doubling its LLIN's utilization from 2014 (36%) to the current study (66%), still much more improvement is needed. Studies have shown that countries such as Madagascar, Uganda, and Equatorial Guinea are doing better than Ghana in terms of LLIN use (19, 20). Households in rural areas are more likely than urban households to sleep under LLIN (70% vs. 57%) (25). Hence, an urban region like Greater Accra recorded 39% utilization compared to less urban like Volta region with 81% net utilization. This finding is in sync with most studies and therefore ignites the call for more awareness creation on the benefits of LLINs use, especially in peri-urban and urban slums (25, 26). Other studies, Ladi-Akinyemi et al. and Aung et al. have also reported the association of rural dwellers with LLIN ownership and use (25, 26). Perhaps this may be due to poor household structures that exist in rural areas hence the need to use the nets as a more effective extra layer against mosquito bites. In urban areas, household are more likely to have good structures which may prevent mosquitoes from entry. People living in urban areas may be able to use other alternative preventive measures such as mosquito spray and coils. On the contrary, a study found that urban households (72.1%) owned LLINs than rural (64.6%) ones (34). Though there is the perception that people living in urban settings may be able to purchase or use alternative approaches, concerted effort need to be made in other to reach out to people in these areas if the goal is to completely eradicate malaria in Ghana.

Utilization of LLINs was higher among households with children under 5 years. A similar study conducted in Nigeria also revealed that households with children under age 5 were more likely to sleep under an LLIN than other households with older children and adults (25). The finding that a household with at least one child aged below 5 years is more likely to use the LLIN compared to a household without a child under the age of five is very re-assuring. This means that, with the PMD program, vulnerable groups like children are more likely to be protected than older children and adults. Increased odds of households using LLIN was associated with children below age 5 in studies elsewhere in Kenya and Zimbabwe (35, 36). Households with smaller size (<8) were more likely to own bed nets compared to households with larger size. This may be due to an uneven distribution on the part of the field officers, probably as a result of the shortage of nets.

Furthermore, married respondents were 23% more likely to own a net when compared with single respondents. This is consistent with Kimbi et al. (37) who linked the finding to the fact that married women received financial aid from their husbands unlike single women who struggle on their own to take care of all family responsibilities (37). Findings from elsewhere reasoned that a household with both parents living together is more likely to make a better decision in favor of the use of LLINs to prevent malaria infection than others (33, 38).

Findings of the study further showed that the utilization of LLIN in households was directly associated with the household with one or more nets for every 2 persons. Long-lasting insecticide net (LLIN) use is ultimately the most important action needed for malaria control as people cannot use LLINs if they do not have access (39). Studies have shown that most rates of LLIN use among those with access to LLINs are at 80% target or above (40). Thus, increasing LLIN access will lead directly to increases in LLIN use. Awareness of the benefits of LLINs is another predictor of LLIN use found in this study. This finding is in harmony with studies conducted by Aina and Ayeni and Birhanu (33, 40). The 30-folds significance difference in universal coverage between households who received LLINs from PMD campaign and those who did not may be explained by the effectiveness of the PMD program to

achieve sustained universal coverage of LLINs for malaria prevention (28, 29).

Strength and limitations

The research assistants and field supervisors were well trained to carry out and ensure high-quality data collection process. The multistage sampling approach that was adopted ensured an adequate representation of the diverse population across regions and districts as well as urban and rural communities. In terms of limitations, there is the possibility of self-reporting bias as a result of respondents providing socially desirable responses. The second limitation is as a result of recall bias, which also has the potential to affect the results and the conclusions arrived at.

Conclusion

Access, universal coverage, and utilization of LLINs continue to increase in Ghana, especially in the rural areas. The predictors of universal coverage of LLINs are region of residence, rural dwellers, household size of more than 2, receiving LLIN from PMD campaign, married, and awareness of key facts of LLINs. The predictors of utilization of LLINs are region of residence, rural dwellers, households with a child under age 5, households with universal coverage of LLIN, awareness of the benefits of LLINs, married, and Christianity.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: the data has not been made publicly available. Requests to access these datasets should be directed to cbguure@ug.edu.gh.

Ethics statement

The studies involving human participants were reviewed and approved by Ghana health Service Ethics Review Committee. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SA, CG, EK, KM, and NP conceptualized the study. SA, CG, YA, and EK carried out data duration. SA, CG, YA, and EK led the statistical analysis, interpretation, and drafting of the main manuscript with support from KM, DB, NP, and OA. SA, YA, EK, KM, DB, AP, OA, and CG contributed to the design, protocol implementation, manuscript drafting, identification of communities, and preparation of this manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Implementation of the Community-based Health Planning and Services (CHPS) in rural and urban Ghana: a history and systematic review of what works, for whom and why

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Background: Despite renewed emphasis on strengthening primary health care globally, the sector remains under-resourced across sub–Saharan Africa. Community-based Health Planning and Services (CHPS) has been the foundation of Ghana's primary care system for over two decades using a combination of community-based health nurses, volunteers and community engagement to deliver universal access to basic curative care, health promotion and prevention. This review aimed to understand the impacts and implementation lessons of the CHPS programme.

Methods: We conducted a mixed-methods review in line with PRISMA guidance using a results-based convergent design where quantitative and qualitative findings are synthesized separately, then brought together in a final synthesis. Embase, Medline, PsycINFO, Scopus, and Web of Science were searched using pre-defined search terms. We included all primary studies of any design and used the RE-AIM framework to organize and present the findings to understand the different impacts and implementation lessons of the CHPS programme.

Results: $N = 58$ out of $n = 117$ full text studies retrieved met the inclusion criteria, of which $n = 28$ were quantitative, $n = 27$ were qualitative studies and $n = 3$ were mixed methods. The geographical spread of studies highlighted uneven distribution, with the majority conducted in the Upper East Region. The CHPS programme is built on a significant body of evidence and has been found effective in reducing under-5 mortality, particularly for the poorest and least educated, increasing use and acceptance of family planning and reduction in fertility. The presence of a CHPS zone in addition to a health facility resulted in increased odds of skilled birth attendant care by 56%. Factors influencing effective implementation included trust, community engagement and motivation of community nurses

through salaries, career progression, training and respect. Particular challenges to implementation were found in remote rural and urban contexts.

Conclusions: The clear specification of CHPS combined with a conducive national policy environment has aided scale-up. Strengthened health financing strategies, review of service provision to prepare and respond to pandemics, prevalence of non-communicable diseases and adaptation to changing community contexts, particularly urbanization, are required for successful delivery and future scale-up of CHPS.

Systematic review registration: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=214006, identifier: CRD42020214006.

KEYWORDS

Community-based Health Planning and Services (CHPS), health services administration and management, primary care, public health, social medicine, urban health

1. Introduction

Globally there is a renewed interest and emphasis on strengthening primary health care (1, 2). Yet, across sub–Saharan Africa, primary health care is under-resourced, and attention directed to prestigious central referral hospitals and vertical programmes (3). There are few examples of national strategies for delivery of primary and community prevention and care that have developed from context-specific research to identify the most effective approach. The Community-based Health Planning and Services (CHPS), which has been national policy in Ghana since 1999, is one such example (4). CHPS delivers community level health promotion, prevention and primary clinical care in Ghana's multi-tiered primary health care system, to provide the appropriate health services to communities, whilst supported by a system of referrals to higher levels of care when needed (5). The wealth of quantitative and qualitative assessments of CHPS over three decades provide valuable insights into the successes and challenges of the programme (6). Learning and sharing these lessons is important not only for similar resource-constrained countries across sub-Saharan Africa but is vital to inform adaptations to the CHPS programme in Ghana itself, particularly at a time of epidemiological and demographic transition. Ghana, like all countries in sub-Saharan Africa is experiencing rapid urbanization with an urban growth rate of 4.2 and 65% of the population is expected to be urban by 2030 (7). This is coupled with a rising prevalence of non-communicable disease whilst still contending with infectious diseases (8).

While there are still challenges in resourcing primary care within rural Ghana, within-urban analysis highlights the inequities in health outcomes, particularly for children aged under 5 years (9). This highlights the need to improve the accessibility and quality of prevention and primary care services for urban poor communities, the majority of whom are dependent on often unregulated, private providers (10).

The evolution of the CHPS programme in Ghana occurred out of progressive national and health system learning over several decades, with policy makers drawing on lived and research evidence from these processes. Figure 1 shows key health policy development milestones in blue, and the development of CHPS in green. Five years before independence, the Maude Commission of 1952 recommended health service development focusing on hospitals and health centers resulting in an increase from 89 doctors and three health centers in 1952 to 141 doctors and 46 health centers by 1961 (11). The following 10-year health programme (1961–1970) emphasized an efficient rural health service with integration of hospitals and health centers, training of medics and paramedics and intersectoral collaboration to tackle the social determinants of health (12). Concerns however remained over the slow pace of trickle-down of benefits to communities. Initiatives to reach rural communities followed with the 1967 Kintampo Mark I model of "cottage hospitals" and health posts (13) followed by The Danfa Comprehensive Rural Health and Family Planning Project (1972–1977) which developed a new cadre of community-based workers known as Health Education Assistants (HEA) to better reach rural communities. Evaluations showed that the HEA approach improved adoption of family planning but struggled to bring about changes in health practices when other support services were not available (14–16). To address this the 1977/78 primary care policy emphasized community involvement with the selection and training of village health workers, and the introduction of Village Development Committees to stimulate intersectoral collaboration (13, 17). Tiers from national through regional, to district, sub-district and community were developed. Later in 1978, 134 member states approved the WHO declaration of Alma-Ata and the translation of the declaration into action resulted in a plethora of uncoordinated initiatives at community level with much emphasis on volunteerism and local support for community health workers (CHW).

Ghana, like many other countries in sub-Sharan Africa, was in a period of economic decline and stress throughout the 1970 and 1980's, and in 1985 started a World Bank structural adjustment programme that involved significant out-of-pocket user fees at point of service across the health sector. The results were catastrophic for the poorest, many of whom lived in rural areas in a country that though progressively urbanizing, was still predominantly rural (18). Senior policy makers were keen to reduce reliance on user fees and community volunteers and find ways to enable patients'

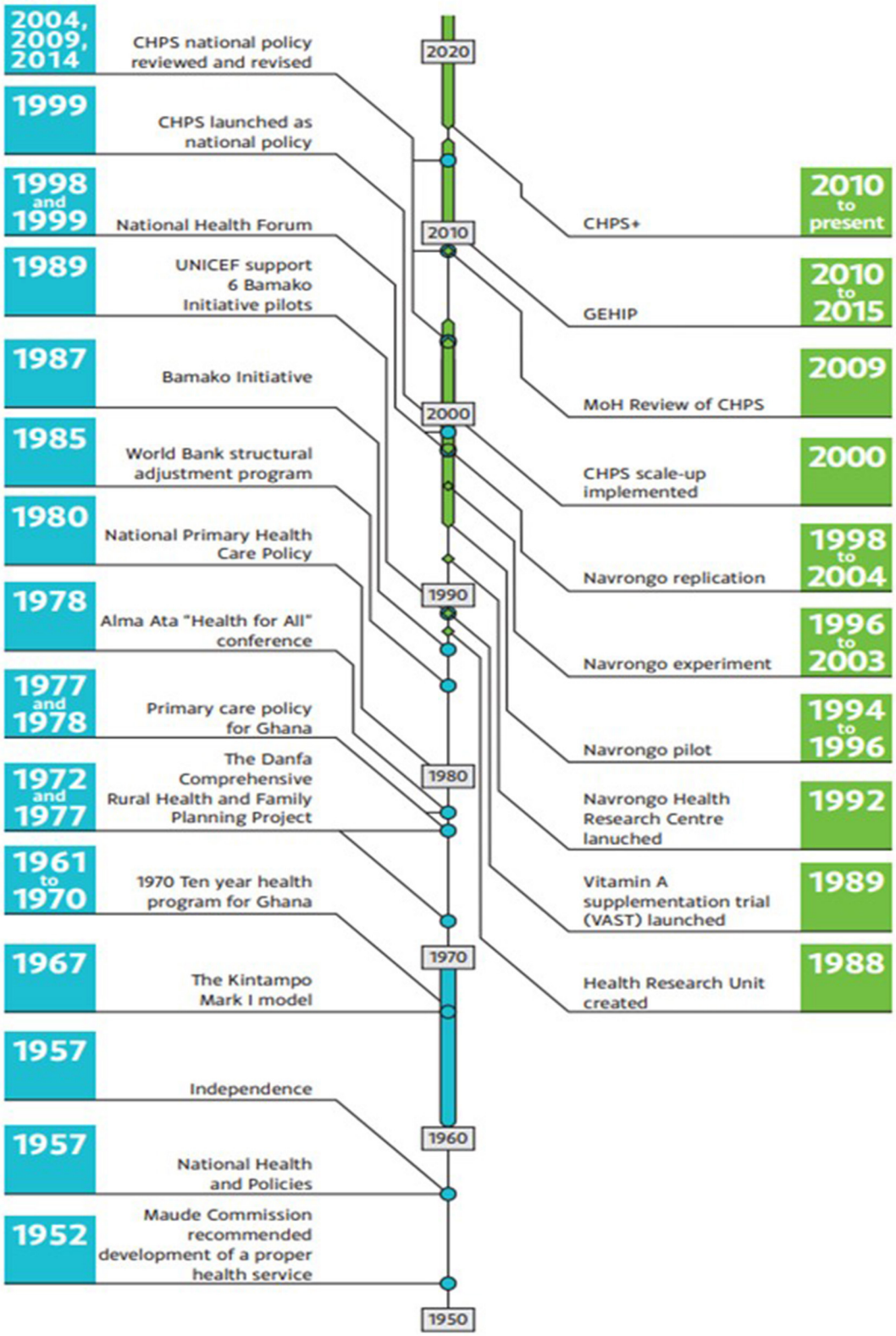

FIGURE 1
The history of CHPS from its inception.

financial protection, address health systems weakness particularly at sub-district and community levels (19) and coordinate donor programmes.

The adoption of the Bamako Initiative under the leadership of UNICEF in 1987 presented an opportunity to address these challenges. The initiative aimed to increase availability

of healthcare services at community level, with essential drugs supplied by donors slightly above cost-price with profits sustaining future provision (20–23). Despite initial skepticism from senior policy makers, the Ministry of Health (MoH) in Ghana began implementation in six pilot districts in 1989. The district health director and team developed a structured programme for selection, training, support, and supervision of volunteer community health workers who would be paid by medicine sales. At this time rural areas were the focus as the most deprivation and need were found here. The internal evaluation in 1992 highlighted the limitations of relying on volunteers with *ad hoc* payment mechanisms based on medicine sales. There was a realization that community-based health workers integrated within the formal health system, receiving a regular salary and with formal community health nurse training were more likely to achieve success. This learning paved the way for the Navrongo Community Health and Family Planning Project (CHFP) where existing cadres of community health nurses were redeployed from health centers and health posts to live and work in the community, with responsibility for a wider catchment population. Senior policy makers, understanding the value of robust evaluation, ensured research became an integral part of the design, implementation and evaluation of CHFP, which became known as the "Navrongo Experiment." Following the initial 1994 pilot, the programme was launched in 1996 with a focus on bringing essential health services closer to the communities, with particular emphasis on hard-to-reach rural areas (5). Initial strategies involved retraining and deploying health staff to communities, utilizing traditional institutions and support structures to organize and mobilize communities, and providing "doorstep" services such as preventive care, family planning, and immunization services (24). This combination of health staff deployment with community volunteer mobilization became the recommended "Navrongo model." Results demonstrated that the strategies were both feasible and improved the primary health care impact, particularly around child mortality and fertility indicators (24–26). Construction of a compound in each community was found to be essential, not only as a base for outreach and provision of primary care services, but to provide accommodation for the community health nurse. Within this rural context, land was abundant and willingly provided by communities. Following a successful replication of the strategies in Nkwanta in 1998, CHPS was declared a national policy in 1999, with roll-out throughout Ghana from 2000 onward, using Navrongo and then Nkwanta as exemplars to inform scale up (5).

1.1. Components of CHPS: 15 steps and milestones

Today, the key characteristics of the early Navrongo and Nkwanta pilots remain, with community-based care provided by a resident professional nurse known as a Community Health Officer (CHO) supported by community volunteers, as opposed to conventional facility-based and "outreach" services. A key strategy for the successful introduction of CHPS in a community is close engagement with the traditional leaders to ensure commitment to the CHPS concept. This aims to trigger further community participation and mobilization of volunteers, first to construct a CHPS compound and then to support implementation of health services. The process has been detailed in a series of 15 steps to guide successful CHPS implementation (6, 27) (see Figure 2). Services provided by the CHOs include household visits for antenatal care, family planning services, and health education; outreach clinics, providing child welfare services; and school health services. In-service training workshops organized for CHOs serve to improve basic clinical and midwifery services and develop diplomacy, communication, and counseling techniques (6).

The careful evidence-based design, clearly specified features of CHPS and national roll-out make it a prime subject for continued evaluation, as can be seen by the many quantitative and qualitative studies conducted since its inception. Learning the lessons from these evaluations is vital if primary health care is to develop and respond to the changing context within Ghana and beyond. In light of this, we aimed to understand the challenges and facilitators to the implementation of the CHPS programme and its impact on health and process outcomes. To do this we conducted a systematic review of published and unpublished empirical studies of the CHPS programme to address the following objectives:

1. To describe the effectiveness of the CHPS programme in improving health and health service outcomes.
2. To identify the extent to which CHPS has been able to reach different population groups and geographical settings, both rural and urban.
3. To describe the facilitators and barriers to implementation of the CHPS programme and the maintenance of this implementation over time.

The systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (28).

2. Methods

2.1. Protocol and registration

The protocol for the review was registered on the PROSPERO International prospective register for systematic reviews (CRD42020214006).

2.2. Review design

We conducted a systematic review of published and unpublished empirical studies on the CHPS programme in both rural and urban areas in Ghana. To understand not only which outcomes CHPS improves, but also for whom, in what context and why, we conducted a mixed-method systematic review using a results-based convergent design where the quantitative and qualitative findings are synthesized separately and then brought together in a final narrative synthesis (29). This allowed us to collate quantitative results on the outcomes of CHPS and qualitative, mixed-methods or quantitative results on the mechanisms (e.g., health system, participant, or contextual factors) that may influence effectiveness.

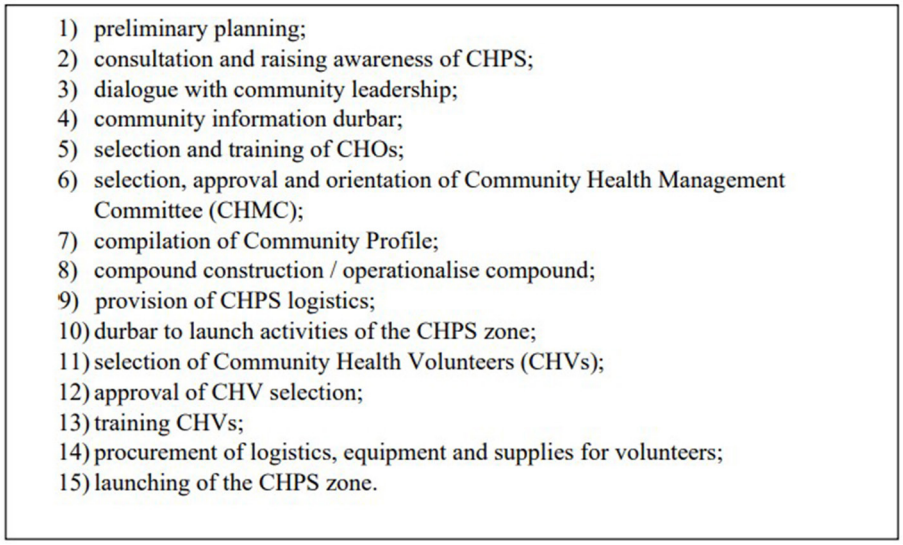

FIGURE 2
The 15 steps to CHPS implementation.

2.3. Inclusion and exclusion criteria

We included all primary studies of any design from both published and unpublished literature that reported CHPS implementation and evaluation in rural and urban Ghana. Quantitative, qualitative and mixed methods studies that evaluated CHPS spanning from 1994 (launch of the Navrongo experiment, forerunner to CHPS) to March 2022 were eligible. See Supplementary Table 2 for detailed description of the inclusion and exclusion criteria.

2.4. Search strategy and terms

An electronic search was planned on EMBASE (Ovid), MEDLINE (Ovid), PsycINFO (Ovid), Web of Science, and Scopus and included studies from database inception up to October 2020, to identify relevant published and gray literature on CHPS implementation in Ghana. An updated search was conducted in March 2022, using variants of the search terms associated with "Community-based health planning and services" and "Ghana" and "CHPS implementation" and "health outcomes" (see Supplementary Table 1). Both index terms and free texts were incorporated into the search strategy to make our search as sensitive as possible. We searched the reference lists of included studies, national CHPS annual reports from Ghana Health Service (GHS), GHS policy, planning monitoring and evaluation reports, and unpublished theses from the School of Public Health of the University of Ghana. We drew heavily on the knowledge of co-authors with long experience of CHPS to develop a list of organizational websites to search for evaluations including: USAID (United States Agency for International Development), UNFPA (United Nations Population Fund), JICA (Japan International Cooperation Agency), DfID now FCDO (Department for International Development), The Doris Duke Charitable Foundation, Columbia University; Royal Netherlands Embassy; GIZ (Deutsche Gesellschaft fur Internationale Zusammenarbeit), KOICA (Korea International Cooperation Agency), KOFIH (Korea Foundation for International Healthcare), WHO (World Health Organization), and CHAG (Christian Health Association of Ghana).

2.5. Data screening and extraction

One reviewer (MA-O) conducted an initial screening of titles and abstracts to remove any studies not conducted in Ghana. The remaining titles and abstracts of all identified studies were screened by two reviewers. Screening was organized using Rayyan software (https://www.rayyan.ai/). Where insufficient information was available in the abstract, full texts of papers were independently assessed by two reviewers and any uncertainty resolved by a third reviewer. Data extraction was performed independently by two reviewers using a standardized proforma, with any discrepancies resolved by a third reviewer. Variables extracted include: Authors/year, Region/District of study (classify as urban or rural), aims/objectives, study design and methods, target population, quantitative results and measures of health outcomes (e.g., child mortality, fertility, and maternal mortality) and any proximal outcomes (e.g., uptake of services, satisfaction, availability of providers, and community involvement). Qualitative themes were also extracted from findings and discussion sections.

2.6. Quality assessment

As this review included all primary studies of any design, a number of quality assessment tools designed for specific

TABLE 1 Included studies with quality score.

References	Focus/research question	Region and urban/rural	Study design and Sample	Quality
Quantitative studies—plausibility trials, chronologically ($n = 8$)				
Debpuur et al. (26)	Impact of the initial 3 years of CHFP on contraception and fertility	Upper East, Rural	8,998 women (15–49 years)	High
Phillips et al. (34)	Demographic and health impact of CHFP with a view to scaling up results	Upper East, Rural	139,000 individuals	High
Binka et al. (35)	Demographic and health impact of CHFP with a view to scaling up results	Upper East, Rural	139,000 individuals	High
Pence et al. (24)	Impact of CHFP on under-5 mortality during 1993–2000	Upper East, Rural	52,801 children and 52,801 mothers	High
Phillips et al. (36)	Long-term impact of CHFP on fertility	Upper East, Rural	47,036 women (15–49 years)	Medium
Bawah et al. (37)	Contribution of CHPS to mitigate effects of poverty on childhood mortality	Upper East, Rural	94,599 under-five children	High
Bawah et al. (37)	Effect of GEHIP on under-5 mortality and associated factors	Upper East, Rural	7,044 under-five children and 5,914 women	High
Asuming et al. (38)	Family planning and unmet need impact of GEHIP	Upper East, Rural	5,914 women (15—49 years)	High
Quantitative studies—other designs, chronologically ($n = 19$)				
Awoonor-Williams et al. (39)	Exposure to CHPS and change in health-seeking behavior and health knowledge	Oti, Rural	Cross-sectional, 831 women (15–49 years)	Low
JICA (40)	Project for the scaling up of CHPS implementation in region	Upper West, Rural	Secondary data/programme evaluation, NA	Low
Naariyong et al. (41)	Comparing technical process quality of ANC between CHPS and non-CHPS areas	Eastern, Rural	Cross-sectional, 600 mothers (15–49 years)	Medium
Aikins et al. (42)	Evaluation of Facilitative Supervision Visits (FSV) component of CHPS	Upper West, Rural	Secondary data analysis, NA	Medium
Wood and Esena (43)	Community utilization of CHPS	Central, Rural	Cross-sectional, 175 heads of households	Medium
Johnson et al. (44)	Impact of CHPS on the uptake of skilled birth care	National, Rural, and Urban	Secondary data analysis, 4,349 births between 2003 and 2008	High
Awoonor-Williams et al. (45)	Monitoring systems to gauge CHPS coverage in all GEHIP districts	Upper East, Rural	Analysis of routine health service data	Low
Ferrer et al. (46)	HBC and CHPS implementation on utilization, treatment and satisfaction	Multiple, Rural	Cross-sectional, 1,356 carers of children under-5	Medium
Ferrer et al. (47)	Effectiveness of iCCM and CHPS on disease knowledge and health behavior	Multiple, Rural	Cross-sectional, 1,356 carers of children under-5	Medium
Ferrer et al. (48)	Cost-effectiveness of iCCM and CHPS on diagnosis and treatment of under-5s	Multiple, Rural	Cross-sectional, 1,356 carers of children under-5	Medium
Wiru et al. (49)	Patronage of CHPS, factors associated with their use and challenges faced	Bono East, Rural	Cross-sectional, 171 community members	Medium
Sakeah et al. (50)	Role of CHPS in women having PNC visits and factors associated	North East, Rural	Cross-sectional, 650 women who had delivered in the past 5 years	Medium
USAID (51)	Quality and relevance of pre-service and in-service education of CHPS workers	Multiple, Rural, and Urban	Cross-sectional, 401 majority CHNs, followed by enrolled nurses, midwives	Low
Braimah et al. (52)	Contribution of CHPS policy to women's access to PHC services	Upper West, Rural	Cross-sectional, 805 women	Medium
GHS (53)	Verification exercise to determine the functionality of all CHPS zones	National, Rural, and Urban	Cross-sectional, NA	High
Maly et al. (54)	Access and quality of CHPS services after 2–4 years of project support	Western, Rural	Post-test, non-equivalent control design, 426 community members	Medium

(Continued)

TABLE 1 (Continued)

References	Focus/research question	Region and urban/rural	Study design and Sample	Quality
Amponsah et al. (55)	Process evaluation on MCHNP and possible barriers to implementation	Eastern, Urban	Cross-sectional, NA	Medium
Kweku et al. (56)	Relevance of community involvement and community perception of CHPS	Volta, Rural	Cross-sectional, 1,008 community members	Medium
Kweku et al. (57)	Community utilization and satisfaction with CHPS services	Volta, Rural	Cross-sectional, 1,008 community members	Medium
Qualitative studies, chronologically ($n = 26$)				
Nyonator et al. (58)	Qualitative Systems Appraisal (QSA) of why CHPS is implemented in some districts, but stalled in others	Volta, Rural	Qualitative diagnostic approach, using focus group (19) with district managers, sub-district health teams, clinic and community-based nurses, community leaders, men and women of reproductive age	High
Binka et al. (59)	Independent, in-depth assessment of CHPS progress	Upper East, Rural	Qualitative, using desk review, in-depth and key informant interview, field visit	High
Ntsua et al. (60)	Diagnostic appraisal of delivering family planning services using CHPS model	National, Rural, and Urban	Qualitative, using desk review, in-depth and key informant interview and focus group with CHOs, women (15–49 years) and men in partnerships	High
Adongo et al. (61)	Male involvement in family planning in communities with and without CHPS	Multiple, Rural	Qualitative descriptive, using in-depth interview (62) with CHOs, CHVs and health managers; focus group (12) with male and female community members	High
Awoonor-Williams et al. (63)	Lessons learned from CHPS scaling up in region where the pace has been much more rapid than other regions	Upper East, Rural	Desk review of reports and qualitative interviews with district and regional directors	Low
Baatiema et al. (64)	Assessing participatory process in CHPS	Upper West, Rural	Spider-gram, using in-depth interview (17), focus group (2) and community conversation with service users, providers, community health committee members	High
Adongo et al. (61)	Implementation challenges and lessons from introducing rural CHPS experiences to an urban environment	Greater Accra, Urban	Analysis of routine health service data (mainly women 15–49 years)	Low
Krumholz et al. (65)	Facilitating and constraining factors in CHPS scaling up	Upper East, Rural	Qualitative, using in-depth interview (12) with key managerial staff current CHPS system managers	High
Sakeah et al. (66)	Extent to which CHO midwifery program is integrated into CHPS	Upper East, Rural	Case study, using in-depth interview (67) with CHO-midwives, supervisors, District Directors, heads of maternity wards, tutors of midwifery schools, health professionals, community leaders and residents	High
Sakeah et al. (68)	Extent of community participation in CHPS skilled delivery program	Upper East, Rural	Case study, using in-depth interview (12) with CHO-midwives	High
Atuoye et al. (69)	Transportation barriers to access maternal and child health services	Upper West, Rural	Qualitative, using focus group (2) with male and female participants, aged 18–70 years	High
Dalaba et al. (70)	Effect of CHPS on reproductive preferences and contraceptive use	Upper East, Rural	Qualitative, using in-depth interview (5) with community chiefs and elders and focus group (8 male and 8 female panels)	High
Bougangue and Ling (62)	Male involvement in various aspects of maternal health care	Central, Rural	Qualitative, using in-depth interview and focus group with married men, CHOs, CHVs, and community leaders	High
Assan et al. (71)	Barriers and facilitators of CHPS through a systems-centric perspective	Multiple, Rural, and Urban	Qualitative, using in-depth interview (41) with national, regional, district, and sub-district/local participants	High

(Continued)

TABLE 1 (Continued)

References	Focus/research question	Region and urban/rural	Study design and Sample	Quality
Atinga et al. (72)	How and why women and children are disadvantaged in CHPS implementation	Upper West, Rural, and Urban	Case study, using focus groups (5) with community informants, in-depth interview with clients (71), and staff (13)	High
Nwameme et al. (73)	Reactions of health care personnel on implementation of CHPS in Accra	Greater Accra, Urban	Qualitative, using in-depth interview (19) with CHPS staff and officials	High
USAID (74)	Formative research to adapt the CHPS model to urban settings	Multiple, Urban	Unclear	Medium
Woods et al. (75)	Contribution of CHPS to community health sustainability	Upper West, Rural	Qualitative, using in-depth interview and focus group	High
Yakubu (76)	Factors (health service delivery, socio-cultural, economic) influencing utilization of CHPS	Northern, Rural	Qualitative, using in-depth (25) and key-informant (5) interview and focus group (12) with community members and key informants	High
Amoah (77)	State and functioning of CHPS from a social capital perspective	Ashanti, Rural	Qualitative, using in-depth interview (11) and focus group (2) with younger and older adults	High
Assan et al. (67)	Challenges to achieving UHC through CHPS	Multiple, Rural and Urban	Qualitative, using in-depth interview (41) with national, regional, district, and sub-district/local participants	High
Kushitor et al. (78)	Community perceptions, involvement and how CHPS could be strengthened	Multiple, Rural	Qualitative, using focus group (20) with mothers and fathers of children under-5, adolescents without children and community leaders	High
Haykin et al. (79)	Perceptions of non-physician health workers on capacity to manage CVD at CHPS facilities	Upper East, Rural	Qualitative, using in-depth interview with 21 nurses and 10 nurse supervisors	High
Kweku et al. (80)	Challenges, capacity development priorities, and stakeholder perspectives on improving CHPS	Volta, Rural	Qualitative, using focus group (4) with health workers and community members	High
Kweku et al. (81)	Responsibilities, motivations, and challenges of CHPS community health management committees	Volta, Rural	Qualitative, using focus group (4) with CHVs	High
Wright et al. (82)	Community perceptions of gaps in CHPS maternal and child health services	Multiple, Rural	Qualitative, using focus group (53) with parents of children under-5, young men and women (15–24 years)	High
Bassoumah et al. (83)	Challenges to implementation and utilization CHPS	Northern, Rural	Qualitative exploratory, using in-depth interview (30) with CHOs, volunteers, and women receiving postnatal care	High
Sakeah et al. (84)	Selection procedures and roles of CHVs and CHMCs in CHPS	Upper East, Rural	Qualitative exploratory, using focus group (33) and in-depth interview (43) with health professionals and community members	High
Mixed-methods studies, chronologically ($n = 3$)				
Sacks et al. (85)	Domains of community health nurse satisfaction and motivation	Multiple, Rural	Cross-sectional, survey of 205 rostered CHNs, qualitative interviews (29) and focus groups (4) with selected CHNs	Medium
Yeboah and Francis (86)	Factors that facilitate or constrain community participation in CHPS	Central, Rural	Case study, using interview and informal discussion with community members, health volunteers, opinion leaders, CHOs, CHPS coordinator and Director of Health in municipality	Medium
Atinga et al. (87)	Community capacity to participate in CHPS implementation	Upper West, Rural and Urban	Exploratory sequential mixed-methods study, using in-depth interview (13), focus group (5) with key stakeholders of CHPS, and cross-sectional survey of 420 households	High

TABLE 2 Reach, adoption, and implementation of CHPS by region*.

Region	References	Population coverage and proportion of functional CHPS# (year reported)	Utilization of CHPS	Trained CHOs at CHPS zones	Other staff and CHVs training	Proportion with CHMC (functioning)
Ashanti	GHS (53)	CHPS zones with >5,000 population = 25.3% With basic equipment = 15.2% Functional CHPS = 7.8% (2018)	N/R	Zones with trained CHOs = 31.4%	Zones with trained CHVs = 75.3%	94%
Bono East	Wiru et al. (49)	12 Functional CHPS compounds sampled	12.3% said CHO absenteeism affected their use of CHPS	N/R	N/R	N/R
Brong Ahafo	GHS (53)	CHPS zones with >5,000 population = 22.8% With basic equipment = 30.7% Functional CHPS = 10% (2018)	N/R	Zones with trained CHOs = 35.4%	Zones with trained CHVs = 79.1%	97.4%
Central	Wood and Esena (43)	N/R	Of 175 respondents, CHPS utilized "Very often" by 2.9%, "Often" by 30.3%, "Not often" by 66.9%	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 population = 22.3% With basic equipment = 33.8% Functional CHPS = 11.1% (2018)	N/R	Zones with trained CHOs = 47.7%	Zones with trained CHVs = 77%	86.1%
Eastern	Naariyong et al. (41)	Within Brim North District: 11/49 areas were CHPS zones	N/R	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 population = 17.2% With basic equipment = 36.5% Functional CHPS = 6.5% (2018)	N/R	Zones with trained CHOs = 50.0%	Zones with trained CHVs = 82.8%	95.7%
	Amponsah et al. (55)	N/A: only areas with functional CHPS sampled	N/R	N/R	N/R	Three of 10 zones had regular VHM
Greater Accra	GHS (53)	CHPS zones with >5,000 population = 48.5% With basic equipment = 36.4% Functional CHPS = 4.7% (2018)	N/R	Zones with trained CHOs = 46.3%	Zones with trained CHVs = 33%	67.7%
Northern	Ferrer et al. (46)	N/R	11.8% (61/671)	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 population = 21.1% With basic equipment = 35.5% Functional CHPS = 10.8% (2018)	N/R	Zones with trained CHOs = 24.9%	Zones with trained CHVs = 93.7%	95.7%
Oti	Awoonor-Williams et al. (39)	By 2004, 30% of population exposed to CHPS	N/R	N/R	N/R	N/R
Upper East	Phillips (36)	By 2008, CHPS (combined) scaled up in all CHFP arms—<50% in cell1 (Zurugelu) areas, <60% in cell4 (comparison) areas, 100% in cell2 (nurse out-reach) and cell3 (combined) areas	N/R	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 = 9.1% With basic equipment = 47.8% Functional CHPS = 45.4% (2018)	N/R	Zones with trained CHOs = 54.3%	Zones with trained CHVs = 96%	97%
	Asuming et al. (38)	GEHIP increased coverage from 20 to 100% in intervention districts	N/R	100% in intervention districts	100% in intervention districts	N/R

(Continued)

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TABLE 2 (Continued)

Region	References	Population coverage and proportion of functional CHPS[#] (year reported)	Utilization of CHPS	Trained CHOs at CHPS zones	Other staff and CHVs training	Proportion with CHMC (functioning)
Upper West	JICA (40)	36% of target number of functional CHPS zones by 2015, increasing from 24 in 2006 to 71 in 2009	N/R	N/R	160 CHOs trained	N/R
	Braimah et al. (52)	256 CHPS zones created as of 2017	N/R	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 = 3.3% With basic equipment = 55.2% Functional CHPS = 55.9% (2018)	N/R	Zones with trained CHOs = 83.2%	Zones with trained CHVs = 97.5%	93.6%
Volta	Ferrer et al. (46)	N/R	31.3% (228/685)	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 = 17.9% With basic equipment = 18.4% Functional CHPS = 6.7% (2018)	N/R	Zones with trained CHOs = 39.2%	Zones with trained CHVs = 73.9%	79.3%
	Kweku et al. (56, 57)	Central Tongu 15/18 demarcated CHPS zones were functional Nkwanta South 21/25 demarcated CHPS zones were functional	Central Tongu 53.8% Nkwanta South 76.6% Both districts 65.2%	N/R	N/R	N/R
Western	GHS (53)	CHPS zones with >5,000 population = 21.0% With basic equipment = 39.1% Functional CHPS = 13.2% (2018)	N/R	Zones with trained CHOs = 45.1%	Zones with trained CHVs = 72.4%	89.2%
	Maly et al. (54)	Only CHPS zones (24) with physical structure were sampled	N/R	Mean 3 CHOs per CHPS zone (range 1–8)	N/R	22/24
National	Johnson et al. (44)	2009–2011 CHPS zones doubled from 868 to 1,675 (functionality not specified)	N/R	N/R	N/R	N/R
	GHS (53)	CHPS zones with >5,000 = 21.9% (national average CHPS zone population = 3,821) Of the 5,918 CHPS zones surveyed, 13% were considered functional, 31.4% had basic equipment	N/R	Zones with trained CHOs = 42.4%	Zones with trained CHVs = 76.2%	89.8%

*Bono, North East, Savannah, Western Northern–no quantitative results relating to adoption or implementation of CHPS from these regions [GHS (53) validation survey report presents results for national-level and by region, but not according to the new list of regions].

[#]Functional CHPS means all steps completed except construction of compound, motorbike training, procure bicycle, procure drug kits and volunteer supplies.

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study types were implored in assessing the quality of included studies. Among them were The Cochrane risk of bias tool (30), used to assess the quality of randomized controlled trials (RCTs); ROBINS-I was used to assess risk of bias in non-randomized intervention studies (31); and the risk of rigor (32) within qualitative studies was assessed using the Critical Appraisal Skills Programme (CASP) Qualitative Research Checklist (33), see Table 1 for included studies and corresponding quality scores.

2.7. Data analysis

In accordance with our results-based convergent design, quantitative and qualitative findings were synthesized separately and then brought together in a final synthesis (29). For quantitative studies, effect sizes (Relative Risk, Odds Ratio, change in means), sample sizes and potential moderators (e.g., population characteristics) were summarized in tabular form. Due to the significant heterogeneity of studies, and with many studies drawing on the same longitudinal data set, we were unable to conduct the planned random-effects meta-analysis to estimate the effect size (and 95% confidence intervals) for each outcome. Instead, the key parameters reported in each study are presented in Tables 2–4.

Data from qualitative studies were extracted and analyzed using the RE-AIM framework. The RE-AIM framework has been used extensively (88) to evaluate public health interventions and aims to understand not only effectiveness (E and our objective 1), but also who is reached (R) by the intervention, how far it has been adopted (A) in different settings and by different health workers (addressing our objective 2), and lessons on implementation (I) and maintenance (M) which refers to the sustainability of the programme (addressing our objective 3, see Figure 3). Segments (commonly sentences) within the qualitative findings were coded against the five RE-AIM domains independently by two reviewers and arbitrated by a third reviewer. Once all findings had been coded, the segments from each study were combined and reorganized under the RE-AIM domains. Segments were then compared and where one segment was clearly articulating the same issue as a segment from another study, these were grouped together and assigned a heading that represented all grouped and single segments. These were color-coded to illustrate issues that occurred frequently and less frequently in the synthesized findings. Issues occurring less frequently should not be seen as less important, merely that they were identified less frequently in published studies (see Figures 5, 6).

Qualitative and quantitative findings from mixed methods studies were included in the respective qualitative and quantitative synthesis. Any meta-inference from mixed methods studies was included in the qualitative synthesis. The final synthesis of quantitative and qualitative data was conducted according to the RE-AIM framework. We identified and confirmed any key lessons, commonalities, and any contradictions by returning where necessary to included studies and quality assessments.

3. Results

3.1. Study selection and characteristics

A total of 8,376 records were initially identified through the electronic searches with an additional 27 papers identified through reference list screening and gray literature sources, of which 2,225 were duplicates and removed. Following screening, 117 full text papers were assessed for eligibility, with 59 excluded with reasons, leaving 58 papers included in the final synthesis and analysis (see the PRISMA flow chart in Figure 4). The final synthesis included 58 studies, 28 of which were qualitative, 27 quantitative, and three mixed methods studies. Details of the quantitative findings are presented in the following tables: Table 2 presents a summary of the quantitative results relating to the domains of Reach, Adoption and Implementation; Table 3 presents quantitative results of effectiveness in improving child mortality and fertility; and Table 4 presents effectiveness of other outcomes measured in the included studies on family planning, maternal and child health. Qualitative findings are integrated with key quantitative results under the RE-AIM domains in the text below.

3.2. Study settings

The geographical spread highlights the uneven distribution of studies assessing CHPS, with the majority conducted in the Upper East Region, where the original Navrongo Experiment was located (see Figure 5). While most studies focused on CHPS in rural settings, some papers have assessed CHPS implementation in urban areas, including three qualitative studies (51, 61, 73), and one quantitative study conducted only in urban areas (55).

3.3. Adoption of CHPS within different settings

3.3.1. Low functionality in remote rural and urban areas

Guided by the RE-AIM framework, "adoption" refers to the places and settings in which the CHPS programme is being delivered and thus highlights geographical regions or types of areas where adoption has been limited. Following the launch of the national policy to scale up CHPS in 1999, there has been a focus in the literature on increasing the coverage of the programme (see Table 2). National level studies identified that between 2009 and 2011, functional CHPS compounds doubled from 868 to 1675 (44).

A process of declassification of "non-functional" CHPS zones took place throughout the country in 2018. CHPS zones were classed as non-functional when CHPS compounds were found to be non-existent or essential staff and equipment were not available (53). This was found to be particularly apparent in remote rural areas, with the North East and Northern regions having only 22. Four percent and 33.8% of CHPS zones functioning effectively (53). Adoption was also challenging in urban areas, for example in the Greater Accra region only 672 of the 834 zones were termed "functional," and only 539 of them had basic equipment to

TABLE 3 Studies of CHPS assessing effectiveness in improving child mortality and fertility.

References	Context Study design Sample	Intervention	Fertility, parity progression and contraceptive prevalence	Under-5 child mortality rate (0–59 months)	Neonatal mortality rate (first 1 month of life)	Infant mortality rate (0–11 months)	Early child mortality rate (0–23 months)	Late child mortality rate (24–59 months)
Debpuur et al. (26)	Kassena-Nankana District Pilot and 4-arm plausibility trial phases (baseline 1993 and plausibility trial 1996–1999) $N = 8,998$ women (15–49 years)	Arm 1: Volunteers and community engagement Arm 2: CHO located in sub district health center <10 km from rural households Arm 3: Both volunteers and CHOs (i.e., CHPS) Arm 4: Neither/Comparison Analysis of Navrongo Demographic Surveillance System (NDSS) data to assess impact on family planning knowledge, use and fertility	Contraceptive prevalence rises from 3.4% in 1993 to 1999: Arm 1 (Vol) = 6.0%; Arm 2 (CHO) = 6.0%; Arm 3 (Vol + CHO, CHPS) = 8.2%; Arm 4 (Comparison) = 6.0% Total fertility rate dropped in all 4 arms OR for parity progression compared to Arm 4 (Comparison) from 1993 to 1999: Arm 1 (Vol) = 0.81, $p < 0.05$; Arm 2 (CHO) = 0.85, $p < 0.05$; Arm 3 (Vol + CHO, CHPS) = 0.77, $p < 0.05$	NA	NA	NA	NA	NA
Phillips et al. (34)	Kassena-Nankana District Plausibility trial with four arms and 9 time points between 1996 and 2003 $N = 139,000$ individuals	Same arms as above	Fertility rate reduced by 15.0% in Arm 3 (Vol + CHO, CHPS) compared to Arm 4 (Comparison).	Arm 3 (Vol + CHO, CHPS) = 224–100 deaths per 1,000 person-years; Arm 4 (Comparison) = 212 to 145 deaths per 1,000 person-years No significant difference between Arm 1 (Vol) or Arm 2 (CHO) and Arm 4 (Comparison); 95% CI or p-value not presented	NA	NA	NA	NA
Pence et al. (24)	Kassena-Nankana District Plausibility trial (1 July 1993−30 April 2000) $N = 52,801$ children and 52,801 mothers	Same arms as above	NA	(0–59 months) Significant positive effect: Arm 2 (CH0) Rate Ratio = 0.86 (95% CI = 0.74, 0.99) No significant difference in before/after analysis: Arm 1 (Vol), Arm 3 (Vol + CHO, CHPS) and Arm 4 (Comparison)	NA	(0–11 months) No significant difference in before/after analysis in any arm. But greater declines seen in Arm 2 (CHO) and Arm 3 (Vol + CHO, CHPS): Arm 1 (Vol) = −11%; Arm 2 (CHO) = −43%; Arm 3 (Vol + CHO, CHPS) = −33%; Arm 4 (Comparison) = −13%	(12–23 months) Significant negative effect: Arm 1 (Vol) Rate Ratio = 2.35 (95% CI = 1.52, 3.63) No significant difference in before/after analysis: Arm 2 (CHO), Arm 3 (Vol + CHO, CHPS) and Arm 4 (Comparison).	(24–59 months) Significant positive effect: Arm 2 (CH0) Rate Ratio = 0.61 (95% CI = 0.42, 0.88)

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TABLE 3 (Continued)

References	Context Study design Sample	Intervention	Fertility, parity progression and contraceptive prevalence	Under-5 child mortality rate (0–59 months)	Neonatal mortality rate (first 1 month of life)	Infant mortality rate (0–11 months)	Early child mortality rate (0–23 months)	Late child mortality rate (24–59 months)
Phillips (36)	Kassena-Nankana District Plausibility trial, assessed the impact period (1995–2001) and CHPS scale-up period (2004–2010) $N = 47{,}036$ women (15–49 years)	Same arms as above; further arms added in scale up: Arm 5 (Comparison for scale-up): Volunteer services added to Arm 4 Arm 6: CHOs added to Arm 4 Arm 7: Volunteers added to Arm 2 (CHO only) Arm 8: CHOs added to Arm 1 (Vol only)	Total fertility rate in impact period (1995–2001): Arm 1 (Vol) = 5.01–4.40; Arm 2 (CHO) = 5.75–5.34; Arm 3 (Vol + CHO, CHPS) = 4.94–4.33 Arm 4 (Comparison) = 5.06–4.89 Significant difference between Arm 3 (Vol + CHO, CHPS) and Arm 4 (Comparison) in 2001: Linearized hazard ratio = 0.85 (95% CI = 0.79, 0.92); non-significant in other arms. In scale-up period (2004–2010): Arm 1 (Vol) = 4.24–3.59; Arm 2 (CHO) = 4.94–4.72; Arm 3 (Vol + CHO, CHPS) = 4.03–3.71; Arm 4 (Comparison) = 4.69–4.07 By 2010, significant difference between Arm 4 (Comparison) and Arm 1 (Vol) = 0.88 (0.81, 0.96); and New Arm 7 (Volunteers added to CHOs) = 1.11 (1.02, 1.21)	NA	NA	NA	NA	NA
Bawah et al. (37)	Kassena-Nankana District Plausibility trial (January 1, 1995 to December 2010) $N = 94{,}599$ under 5 children	As above four arms, analysis of Navrongo Demographic Surveillance System (NDSS) data to identify relationship between wealth/education and child mortality in the 4 arms. Age-conditional proportional hazard analysis	NA	All arms showed improvements, but only Arm 3 (Vol + CHO, CHPS) significantly improved mortality among the poorest and least educated, over all time periods: HR by 2008–2010 Arm 1 (Vol) HR = 0.98, NS; Arm 2 (CHO) HR = 1.11, NS; Arm 3 (Vol + CHO, CHPS) HR = 0.67, $p < 0.01$; Arm 4 (Comparison) HR = 1.00	NA	NA	NA	NA
Awoonor-Williams et al. (39)	Nkwanta District 2002 district level survey $N = 831$ women (15–49 years)	Cross-sectional survey of CHPS and non-CHPS zones, using logistic regression models to assess the effect of CHPS exposure on health indicators	Adjusted risk ratio for CHPS generating knowledge of modern contraception = 1.82, $p < 0.01$ and for use of modern contraceptives among those who reported knowledge = 3.33, $p < 0.01$	NA	NA	NA	NA	NA

(Continued)

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TABLE 3 (Continued)

References	Context Study design Sample	Intervention	Fertility, parity progression and contraceptive prevalence	Under-5 child mortality rate (0–59 months)	Neonatal mortality rate (first 1 month of life)	Infant mortality rate (0–11 months)	Early child mortality rate (0–23 months)	Late child mortality rate (24–59 months)
Bawah et al. (37)	Upper East Region GEHIP (A 5-year trial launched in 2010, to test means of accelerating CHPS) $N = 7{,}044$ under-5 children and 5,914 women	Clusters: four treatment and seven contiguous comparison districts	NA	It is not possible to obtain an overall estimate of mortality for all children under 5 because the mortality hazard ratio varies by age	GEHIP reduced neonatal mortality by approximately one half (HR = 0.52, 95% CI = 0.28, 0.98, $p = 0.045$).	No significant difference between GEHIP and control (HR = 0.72; 95% CI = 0.30, 1.79; $p =$ 0.480)	NA	NA
Asuming et al. (38)	Upper East Region GEHIP (A 5-year trial launched in 2010, to test means of accelerating CHPS) $N = 5{,}914$ women (15–49 years)	Clusters: four treatment and seven contiguous comparison districts	Contraceptive prevalence rises by 64.40% in intervention and 7.60% in comparison districts between baseline and end line (2011–2015) aOR for use of modern contraceptives among currently married women in intervention vs. comparison district = 1.79 (95% CI = 1.32, 2.44), $p < 0.01$	NA	NA	NA	NA	NA

provide services (53). As a result of this declassification, the GHS reported that by September 2019, there were 5,155 functional zones, 2,467 zones with compounds, and 3,160 with basic equipment nationally (53).

3.3.2. Resources and leadership required for adoption

Qualitative studies highlighted the facilitators and barriers to adoption of CHPS within different geographical settings (see Figures 6, 7). For under-served rural areas there were particular challenges due to the uneven distribution of CHOs (67) and inadequate accommodation for CHOs (67, 72, 85), while recruitment of staff from the communities they serve aided adoption of CHPS in these areas (63). The majority of qualitative studies cited limited investment in the development of new CHPS compounds with insufficient supplies, equipment and infrastructure to deliver CHPS services as a major barrier to wide scale adoption. Authors explained this was due to a lack of financial resources within Ghana's health sector (58, 67) which impeded actions to scale up CHPS from sub-district to national level (65). Nyonator et al. (6) found that with some creative mobilization of resources, and particularly with political support, including politicians contributing funds to CHPS, districts were able to establish functioning CHPS zones (58, 63). However, when there was a low level of awareness of the principles of CHPS (including shared ownership between government and communities) (59), and a strong political motivation for building CHPS compounds during local elections without ensuring they were equipped and staffed (67), the zones were not able to function.

3.3.3. Socio-economic structures in urban areas challenge adoption of the rural model

Despite the potential strengths of the urban setting, such as better roads and facilities suitable for referral of emergency cases (51, 74) challenges specific to the adoption of the CHPS model in urban areas were found. These included the lack of traditional leadership structures, lack of trust and limited home-visiting and engagement (51). These challenges were exacerbated by the fact that staff often did not come from or live in the communities in which they work (73), due to the difficulty in finding accommodation in the area (51, 61). The need to pay volunteers due to the opportunity cost they face (61), declining shared community values, particularly among socially alienated young people (87), and a preference for private facilities were also reported challenges. In addition, a changing disease burden with increases in non-communicable diseases and subsequent shifting demand for services by urban residents raised further challenges to the adoption of the original model (61), particularly given CHOs do their field training only in rural CHPS zones (73). Nevertheless, attempts to adapt the model to link in with private facilities which could then become CHPS outreach points for urban communities was identified as a potential facilitator to the adoption of the CHPS model within urban areas (51).

TABLE 4 Other outcomes: family planning, maternal, and child health.

References Context Study design Sample	Intervention	ANC	Delivery attended by a medical professional or skilled birth attendant	PNC	Health knowledge (including knowledge of contraception)	Contraception indicators
Debpuur et al. (26) Kassena-Nankana District 4-arm plausibility trial $N = 8,998$ women (15–49 years)	Arm 1: Volunteers and community engagement Arm 2: CHO in health center <10 km from households Arm 3: Both (CHPS) Arm 4: Neither/Comparison Analysis of NDSS data to assess impact	NA	NA	NA	OR for modern contraception knowledge compared to Arm 4 (Comparison) from 1993 to 1999: Arm 1 (Vol) = 0.72, $p <$ 0.05; Arm 2 (CHO) = 0.94, NS; Arm 3 (CHPS) = 1.28, NS	OR for identifying source for contraception compared to Arm 4 (Comparison) from 1993 to 1999: Arm 1 (Vol) = 0.67, $p < 0.05$; Arm 2 (CHO) = 0.60, $p < 0.01$; Arm 3 (CHPS) = 1.19, NS
Awoonor-Williams et al. (39) Nkwanta District 2002 district-level survey $N = 831$ women (15–49 years)	Cross-sectional survey of CHPS and non-CHPS zones, using logistic regression models to assess effect of CHPS exposure on health indicators	Adjusted OR for CHPS exposure and ANC attended by health professional = 1.79, $p < 0.05$	Adjusted OR for CHPS exposure vs. non-exposure = 1.79, $p < 0.05$	Adjusted OR for CHPS exposure and PNC attended by health professional = 3.20, $p < 0.01$	Adjusted OR for CHPS exposure and unprompted knowledge of one or more family planning methods = 2.12, $p < 0.01$	NA
Naariyong et al. (41) Birim North District 2010 survey $N = 600$ mothers (15–49 years)	Cross-sectional survey of CHPS and non-CHPS zones, using logistic regression models to assess effect of CHPS exposure on health indicators	Adjusted OR for CHPS exposure with: Full utilization of ANC services = 2.73 (95% CI 1.68–4.43), $p < 0.001$ Receipt of malaria Prophylaxis = 3.73 (95% CI 1.73–8.04), $p < 0.05$ Tested for HIV Infection = 4.49 (95% CI 2.37–8.51), $p < 0.001$	NA	NA	Adjusted OR for CHPS exposure and index of knowledge about pregnancy danger signs = 1.17 (95% CI 0.69–2.00), NS	NA
Johnson et al. (44) National 2003 and 2008 Ghana Demographic and Health Survey (GDHS) $N = 4,349$ births	Secondary analysis of GDHS data with logistic regression Models to examine the effect of proximity to health facilities and CHPS on use of skilled care at birth	NA	Adjusted OR for uptake of skilled birth care with CHPS-only = 1.40 (95% CI 0.61–3.24), NS For CHPS and health facility within 8 km = 1.56 (95% CI 1.04–2.36), $p < 0.05$	NA	NA	NA
Ferrer et al. (46) Volta and Northern Regions 2014 household survey $N = 1,356$ carers of children under-5	Survey conducted two and eight years after iCCM in Volta and Northern Regions respectively, and more than 10 years of CHPS in both regions	NA	NA	NA	Volta: Adjusted OR for carers to identify at least two signs of severe diarrhea after messages from CHPS = 3.6 (95% CI 1.4–9.0), p 0.02 Northern: receiving messages from CHPS was not associated with knowledge	NA

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TABLE 4 (Continued)

References Context Study design Sample	Intervention	ANC	Delivery attended by a medical professional or skilled birth attendant	PNC	Health knowledge (including knowledge of contraception)	Contraception indicators
Sakeah et al. (50) Builsa and West Mamprusi Districts 2016 household survey $N = 650$ women who had delivered in the past 5 years	Survey conducted at CHPS zones in both districts	87% of the women reported having had at least four ANC attendance (Bulisa = 93.1%, West Mamprusi = 80.8%)	66.3% were supervised by a skilled attendant during child birth (Bulisa = 75.4%, West Mamprusi = 57.2%)	62.3% had attended PNC at least three times (Bulisa = 90.1%, West Mamprusi = 34.5%)	NA	NA
Asuming et al. (38) Upper East Region GEHIP (A 5-year trial launched in 2010, to test means of accelerating CHPS) $N = 5,914$ women (15–49 years)	Clusters: four treatment and seven contiguous comparison districts	NA	NA	NA	NA	Crude OR for unmet need for modern contraceptives among currently married women in intervention vs. comparison district = 0.85 (95% CI 0.64–1.12)

3.4. Reach of CHPS

3.4.1. Variation in reach

Within the RE-AIM framework, "reach" focuses on the absolute number, proportion and representativeness of individuals who participate in or are reached by CHPS. Given the aim of CHPS to increase access for all to health care, many of the quantitative studies assessing CHPS have looked at overall coverage (see Table 2) or utilization across the population through cross-sectional household surveys. Findings varied across regions with rates of utilization of 76.7% in Nkwanta South Municipal (Oti Region) and 53.8% in Central Tongu District (Volta Region) (56), whereas Wood and Esena's earlier study in Central Region found lower rates with 66.9% reporting rare use of CHPS (43). Ferrer found 11.8% in Volta region and 31% of the population in Northern region utilizing CHPS for childhood illnesses (46). Johnson's national analysis using 2003 and 2008 Demographic and Health Survey data found only 9.9% of all births were in communities within 8 km of CHPS (44). Given the different methods, tools, and target populations of these studies, results are not comparable, but do indicate the variability of reach of the CHPS programme across Ghana.

3.4.2. Inequities in reach

Studies identifying *who* in the population CHPS reaches were more limited. While quantitative studies have explored whether there is a social gradient in health improvements in CHPS areas (37), few studies quantified whether particular groups within communities were more or less likely to be "reached" by the programme. In the Upper East Region, ethnic and educational differences were found to undermine equal reach, with women of the Nankana ethnic group significantly disadvantaged in accessing CHPS for delivery compared to those within Kassena communities, possibly due to the former's more traditional beliefs about childbirth (66). Differences in reach to specific ethnic and religious groups were also found in Nkwanta, with Christian and Muslim women more likely to receive safe-motherhood care than women who identified as traditionalists or with no religion (39).

3.4.3. Reaching young people and men

Further insights on "reach" from the qualitative studies include the observation that young people (78, 87) were frequently overlooked by the CHPS programme. There were mixed findings on the ability of CHPS to reach fathers with several studies identifying Father-to-Father Support Groups as a valuable mechanism for increasing male knowledge on health issues (72), and male involvement being evident in family planning activities of CHPS (45, 89). Others found the CHPS programme rarely reached men with many seeing the programme as a "women's thing" (78) and traditional gender norms around pregnancy and childbirth influencing the nature and level of male involvement in maternal health and CHPS more broadly (62), and this was highlighted in family planning programmes in Southern Ghana (90). Reaching particular groups of vulnerable individuals far from the CHPS compound was a common challenge described in a number of

qualitative studies, especially in relation to people with cardiovascular disease (79), and maternal health care where women challenged the accepted notion that 5 km should be considered walking distance when seeking maternal services without access to good roads and any means of transport (69).

3.5. Effectiveness of CHPS

3.5.1. Mortality and family planning

Since the inception of CHPS, effectiveness studies have focused on child mortality and fertility as primary health outcomes. Many studies have also assessed key "process outcomes" such as uptake of antenatal care visits and institutional deliveries, immunizations and child health programmes (44, 46, 47, 55). Studies with a low risk of bias reporting the effectiveness of the CHPS programme in health outcomes are shown in Table 3. These studies all use data from the Navrongo Demographic Surveillance System (NDSS) 1990–2010 and compare four interventions implemented in Kassena-Nankana district, Upper East Region: (1) Volunteers (Zurugelu), (2) Nurse only, (3) Nurse + Volunteers, and (4) "unexposed" areas. Three studies assessed under-5 mortality (24, 34, 37). The most detailed analysis, which analyzed mortality over time and identified interactions with wealth and education found under-5 mortality improved over time in all areas, but Volunteers alone and CHO alone benefitted the better off and educated. Only the combination of CHO and volunteers significantly reduced under-5 mortality in the poorest and least educated (37).

One study (24) assessed infant mortality but found no significant difference between the four interventions from baseline, but greater declines were seen in CHO (243%) and CHO plus Volunteer areas (233%) than in the volunteer only (211%) and comparison areas (213%).

Three studies used the NDSS data and four-arm trial design to assess outcomes of family planning including change in fertility rate (26, 34, 36). Given the context of Kassena-Nankana district where the "fertility transition" had not begun in early 1990's (i.e., 3.4% in 1993), a rise in contraceptive use and drop in fertility rate was found in all four intervention areas, but the odds of parity progression reducing from 1993 to 1999 were highest in the CHO plus Volunteer arm (see Table 3).

3.5.2. Maternal health

The results of studies reporting outcomes associated with improved health are shown in Table 4. In Nkwanta district, the presence of a CHPS zone was identified as increasing the odds for delivery attended by medical professional [OR1 = 1.74 ($p < 0.01$), OR2 = 1.79 ($p < 0.05$)] and for postnatal care from a medical professional [OR1 = 3.09 ($p < 0.01$), OR2 = 3.20 ($p < 0.01$)] (39). Assessment of national DHS data found that the presence of a CHPS zone in addition to a health facility resulted in increased odds of care by a skilled birth attendant by 56% (44). In Brim North, Eastern Region, CHPS exposure was found to be positively associated with receipt of ANC (OR 2.73 (95% CI 1.68–4.43) compared to participants in non-CHPS areas and these improvements in the provision of four ANC visits (75.4% in CHPS compared to 72.3% in non-CHPS) from a trained provider (96.3% in CHPS and 90.3% in non-CHPS) increased the odds of receiving an HIV test and anti-malarial prophylaxis (41).

3.5.3. Child health

In terms of child health programmes, CHPS has been compared with integrated community case management (iCCM) in the Volta and Northern regions of Ghana. Differences in effectiveness between the two interventions were found in each region with health messaging from CHPS found to be associated with identification of severe diarrhea by parents in Volta and prompt care seeking in Northern Region (47). Cost-effectiveness analysis found that appropriate diagnosis and treatment of malaria, diarrhea and pneumonia were more cost-effective under iCCM than CHPS in the Volta Region (48).

3.5.4. Accessibility and acceptance

Qualitative studies frequently highlight positive perceptions of effectiveness of CHPS at community level, with respondents acknowledging the programme's significant role in making basic health services more accessible for women and children, allowing them to benefit from immunization, ante- and postnatal care, health education, family planning, referral of severe disease conditions and school health visits, in addition to improving health outcomes in their respective zones (61, 73, 82).

Participants in several qualitative studies also highlighted the critical role CHPS has played in changing negative perceptions of some health services, particularly family planning, through improved knowledge of the side effects of contraception (45, 60, 61). This increased acceptance of family planning was identified as creating a shift in perceptions of the ideal family size, with spacing births seen as desirable, although some women still reported keeping their use of contraceptive secret from their husbands (70).

3.6. Implementation of CHPS: barriers and facilitators

3.6.1. Trust and engagement

Both quantitative and qualitative studies identified barriers and facilitators to the implementation of the CHPS model as specified at design. Two inter-related themes that consistently emerged across studies and settings was the need for trust between CHPS staff and communities for smooth implementation, and vital to this was strong community engagement (see Figure 6). When CHOs lived within the communities they service, these good relationships could develop (66, 71, 77). Volunteers played a vital bridging role between CHOs and communities, often facilitating implementation with their diplomacy skills, as well as offering practical support by running errands for CHOs and sometimes taking CHOs for home visits on their motorbikes (60).

Community engagement organized through local leaders and women's groups to solicit their support for CHPS was frequently identified as critical for effective implementation in the rural

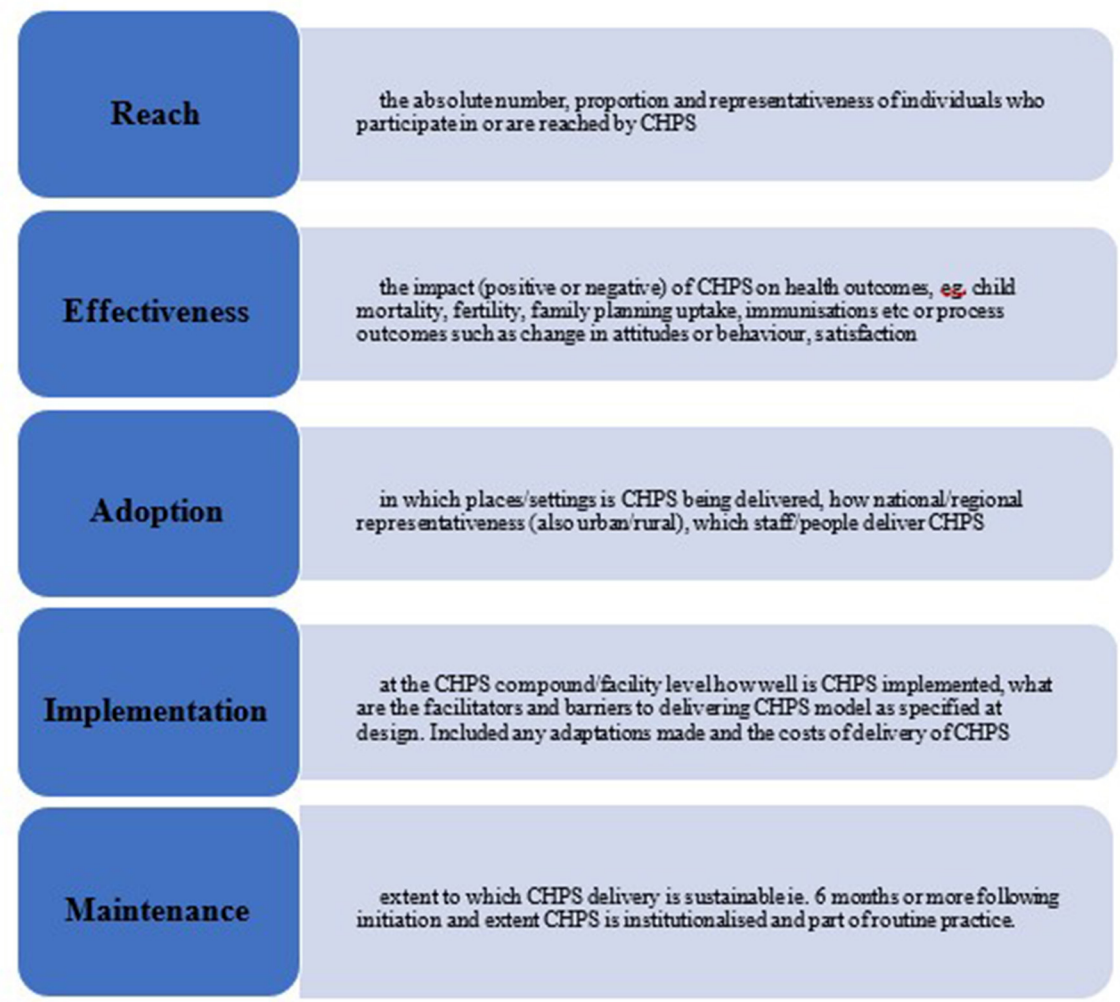

FIGURE 3
RE-AIM categorizations used in the review of CHPS studies.

studies (51, 57, 58, 63, 64, 68, 77, 82, 87). Where the engagement component of CHPS were adapted sensitively to the local context, implementation was more successful. For instance, in Nkwanta, which has a more complex ethnic composition than the original Navrongo communities, the engagement process was adapted so instead of relying on traditional leaders to organize community action in CHPS as had been done in the Navrongo model, leaders were rather identified among elected officials, teachers and clerics (45). A strong CHMC with membership able to resolve any conflicts between health staff and community members has also been identified as important for CHPS implementation in such rural settings (61). One study that quantified community engagement within the CHPSplus (CHPS+) intervention in Volta region found that 48.9% of the 1,000 respondents were actively involved, including through the identification of resources, organizing durbars and preparing sites for outreach services, and that involvement in these activities was associated with positive perceptions of CHPS (80).

There was much consistency in the barriers to implementation identified in the qualitative studies (see Figure 7) and the majority cited limited community engagement as a key underlying cause of poor CHPS implementation (58, 62, 65, 77). Lack of engagement specifically led to CHMCs that were not sufficiently active to provide the support and problem-solving needed for implementation (53). Several studies identified low volunteer motivation, particularly in urban areas, where communities were not sufficiently engaged (73).

3.6.2. Organizational collaboration

Beyond the community level, effective implementation was characterized by careful collaboration with diverse stakeholders but particularly local authorities, religious organizations and professional groups and associations. This helped to facilitate ongoing operations such as establishing referral systems to higher facilities, which promotes the use of CHPS services (66). The importance of outreach services, particularly door to door services has been identified by several studies as key for both delivering services (60, 61), and also in building trust (56, 77).

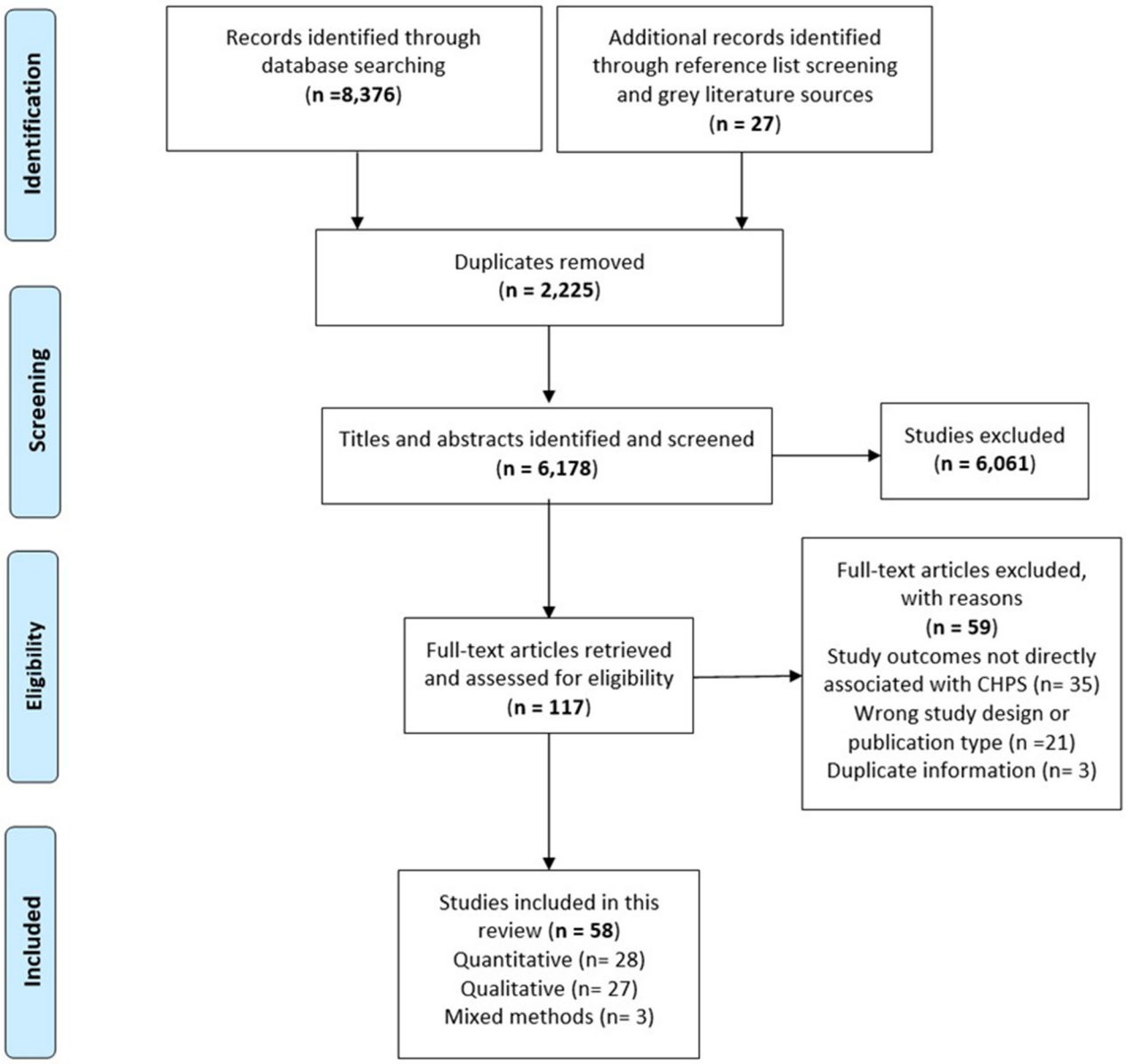

FIGURE 4
PRISMA flow diagram of the CHPS review.

3.6.3. Accommodation and logistics

From the health systems perspective, the most frequently reported barriers to implementation were the lack of provision of accommodation for CHOs, logistics and facilities to ensure a functioning CHPS zone and this was found both in rural and urban areas (51, 57, 65, 71, 73, 78, 82, 87). Lack of accommodation for the CHOS within the community was a particular challenge undermining both service delivery and the level of trust between CHOs and community members (66, 77, 82). Within urban areas, where land is scarce, this was a particular challenge with CHOs having to commute into their areas of work (61, 73). In rural areas, the recruitment of CHOs from outside the communities and who may not therefore share a common language was identified as undermining implementation both by CHOs and by communities (85). The wider implications of limited resources were evident, with the lack of motorbikes and provision of funds for their running and maintenance undermining CHOs' ability to undertake home visits leading to more clinic-based static services and reduced trust and engagement with households (59). Frequent stock-outs of essential medicines including contraceptives was noted by CHOs and women in the communities as a challenge that undermined reliable service delivery (43, 70) with shortages of medicines reported by 41.5% of survey respondents in Bono East Region (49).

3.6.4. Supervision, training, and referrals

Further health systems challenges were noted, particularly the limited supervision from CHPS coordinators at sub-district

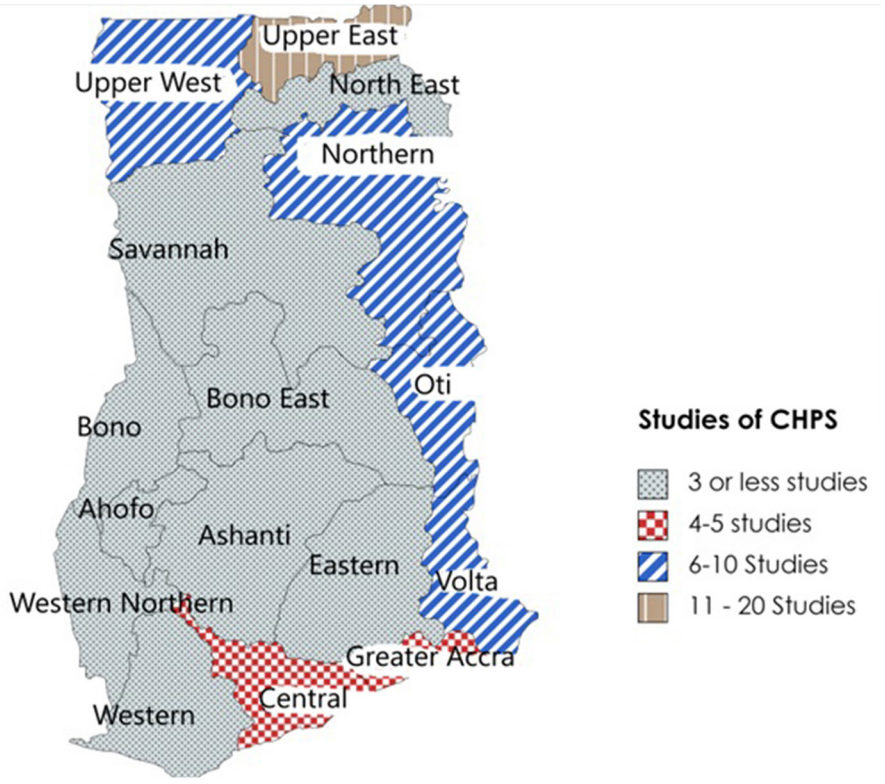

FIGURE 5
Regional distribution of CHPS studies included in the review.

level and from higher levels (73). Cited reasons for this in both rural and urban areas were the lack of available transport and human resources (53, 65, 73). Referral systems were frequently found to be lacking (57) and CHOs expressed a wish for further training (85) not only in clinical skills such as midwifery (59) and childhood illnesses (47), but also to improve support to volunteers, planning and data collection (74). The limitations to facilities, accommodation, resources, support and training were frequently cited as a cause of the low motivation, with just over 50% of CHOs stating they were satisfied with their role (85). Low levels of motivation and negative attitudes among CHOs were identified as a cause of favoritism and unequal treatment of clients, and affected the effective implementation of CHPS (56, 77, 78). Subsequently, a high attrition rate of CHOs was identified in several of the qualitative studies (57, 72–74).

3.7. Maintenance of CHPS

3.7.1. Planning, budgets, and insurance

The RE-AIM framework defines "maintenance" as the extent to which CHPS can be delivered sustainably for at least 6 months or more following initiation. This domain allows exploration of the extent to which CHPS has become institutionalized and part of routine practice. The included studies identified several issues that undermined the sustainability of CHPS services over time. Low motivation and high absenteeism of CHOs, changing disease burden, increasing demands and expectations of communities beyond the prescribed service package of CHPS, linked with the implementation issues identified above have all been identified as a threat to sustainability of CHPS (67, 71, 72, 79, 82, 85). The non-accreditation of elements of the CHPS programme, particularly home-visits under the National Health Insurance Scheme (NHIS) has also been identified as distorting delivery to favor clinic-based services, therefore undermining the outreach and community engagement components of CHPS in the long term (34, 60, 77, 82). Even where NHIS accreditation does exist, the delayed NHIS reimbursement undermines continued delivery of service (53). The changing disease burden has also been identified as a threat to sustainability of CHPS (79, 82) and particularly the increasing demands and expectations of communities beyond the prescribed service package of CHPS (67).

However, more fundamental organizational issues were also highlighted as barriers to CHPS maintenance, including a lack of action planning, and more crucially limited budget, with the Ministry of Health and GHS having no specific budgets to support the CHPS programme (58), reportedly linked to a lack of high-level political will and resource allocation specifically to CHPS (49).

3.7.2. Community collaboration and ownership

Conversely, in areas where CHPS has managed to engage communities, particularly with strong support from traditional leaders (56), integration within existing community structures that

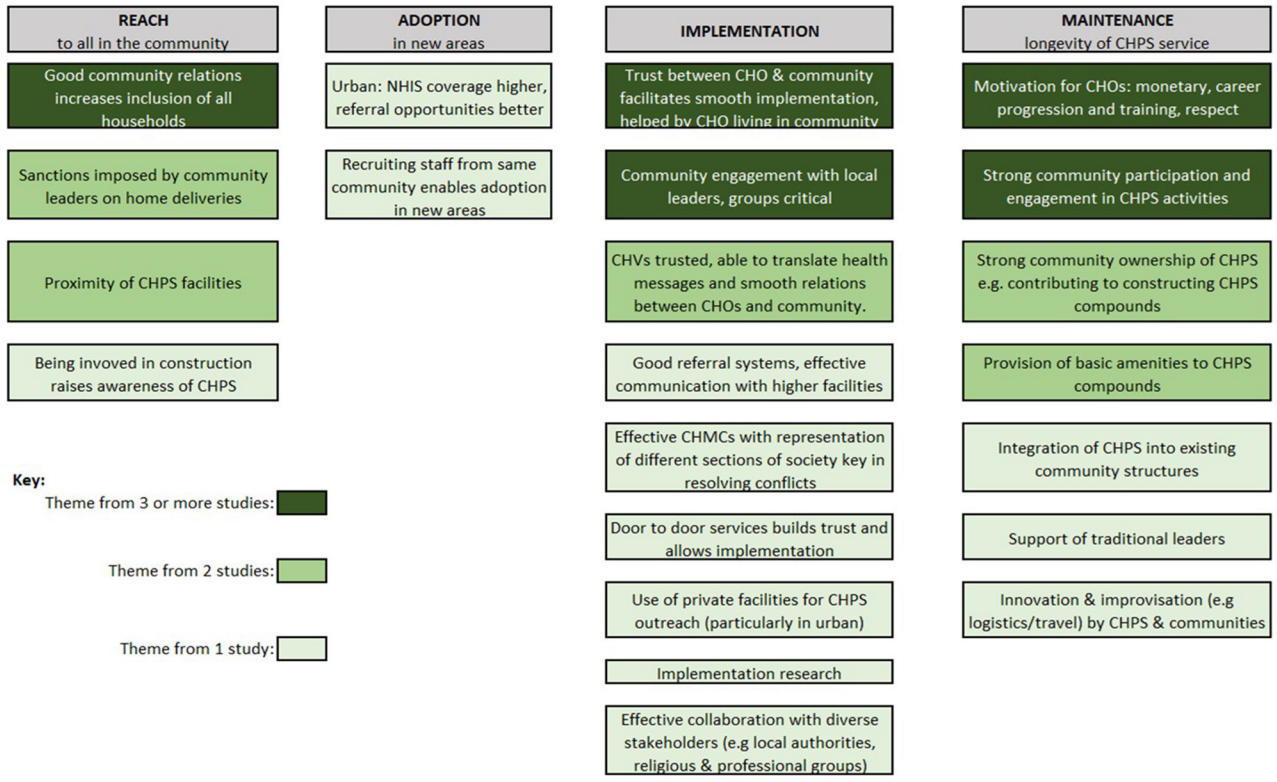

FIGURE 6
Facilitators from qualitative studies.

predated the establishment of CHPS in the community (64), and initial community contributions to constructing CHPS compounds (56, 68), CHPS programmes seemed able to flourish and sustain activities. Similarly, where CHOs reported feeling motivated and respected by communities and supervisors (66, 85), with basic amenities provided in CHPS compounds (57, 66) and adequately trained (53), CHPS services were maintained.

4. Discussion

CHPS is one of the few community-based primary care and prevention programmes in sub-Saharan Africa that has been shaped through pragmatic experimental research conducted within the delivery context. The early studies from the Navrongo Experiment show significant reductions in child mortality and improvements in uptake of family planning. While the studies in our review highlight many of the challenges in the adoption of the approach across all locations and in implementation, where CHPS was implemented according to the "15 steps," delivery was more likely to be successful.

So why is it so challenging to scale-up what is evidently a successful approach? The literature on scale-up highlights the need for both vertical scale-up i.e., institutionalization, and horizontal scale-up i.e., increased coverage (91). Despite the initial skepticism of senior health advisers in the Ministry following the signing of the Bamako Initiative in 1989, the evidence from the Navrongo Experiment convinced health leaders to turn the approach into national policy and so the process of institutionalization, or vertical scale-up began.

Vertical scale-up has been identified as a pre-requisite for increasing horizontal scale-up (92). A review of studies reporting processes of scale-up by Milat et al. (93) has identified a number of factors which are frequently associated with success. Interestingly, many of these appear to have been present within the CHPS scale-up process, including systematic use of relevant evidence, strong leadership within the health sector and a well-defined scale-up strategy. The launch of CHPS as a national policy in 1999, and several subsequent reviews and revisions of the policy and "Implementation Guideline," the most recent of which took place in 2016, make use of monitoring and research to strengthen implementation. The development of CHPS training with the clarity of the 15 steps and the six milestones are in-line with scale-up frameworks which emphasize the importance of simplifying and clarifying the intervention (91).

The use of costing and economic modeling of intervention approaches to inform policy and resource allocation was recommended by Milat et al. (93) as a strategy for successful scale-up. However, it is notable that the evidence base does not tend to take this into consideration. Only one study, Ferrer et al. (48), looked at cost-effectiveness of CHPS compared to integrated community case management (iCCM) to treat three infectious diseases. None of the studies took a broader approach to assessing costs and effectiveness across the range of primary care outcomes that CHPS is designed to address. Several of the qualitative studies highlighted the lack of resources within Ghana's health sector as

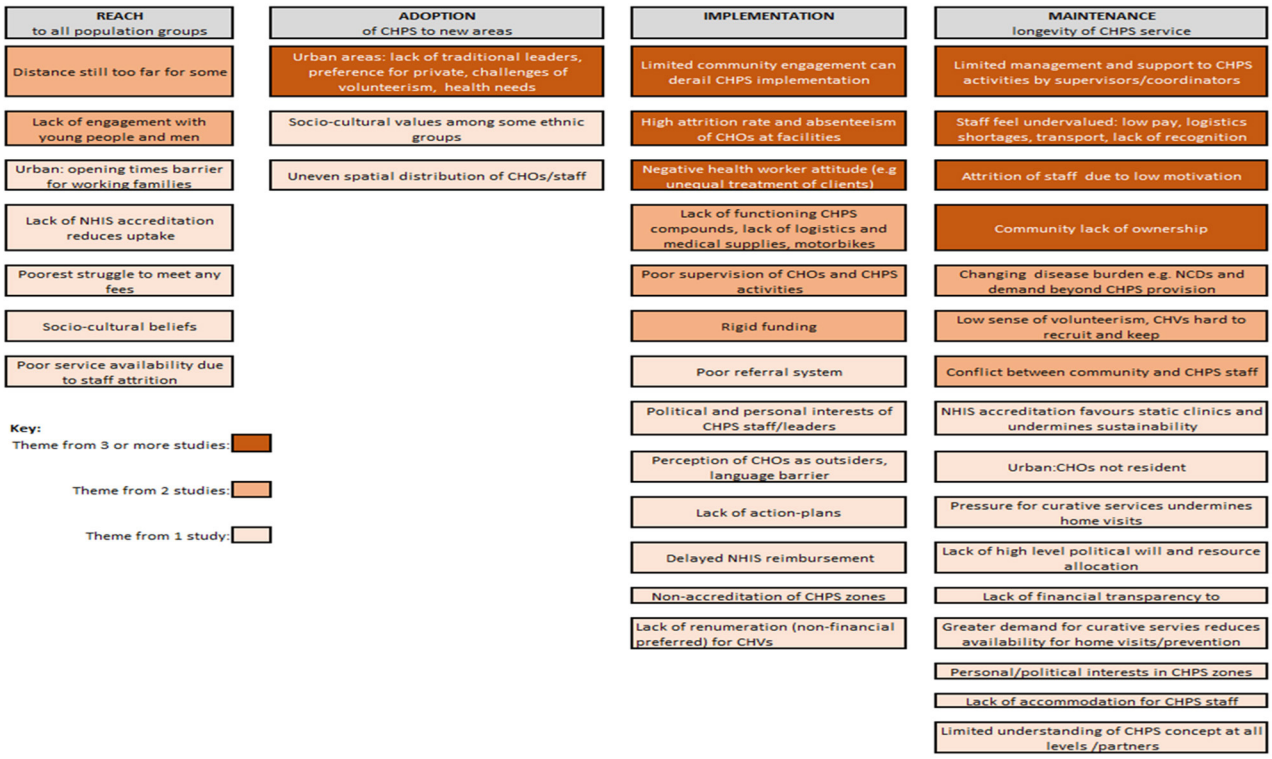

FIGURE 7
Barriers from qualitative studies.

a major limitation to the successful delivery of CHPS (35, 85). The decrease in donor funding due to donor transitions has compounded the funding challenges facing the CHPS programme. Increasingly, this means that budgetary allocations to primary health care and the CHPS programme from the Government of Ghana are insufficient. With few countries on the continent meeting the target of 15% of government expenditure on healthcare as agreed in the Abuja Declaration of 2001 (3), these challenges are common. However, the lack of government funding makes CHPS increasingly reliant on internally generated funds from the NHIS, out-of-pocket expenditure and funds from vertical programs and projects. Each of these sources present significant challenges to a strong health system-led by primary health care, with out-of-pocket expenditure undermining accessibility and vertical programmes leading to a focus on specific diseases rather than the holistic needs of the patient (1).

Our findings highlight challenges with horizontal scale-up, or increased adoption (in the language of RE-AIM), in certain geographical contexts including remote rural areas and urban areas. The challenges of delivering primary health care in remote areas are well-covered in the literature, with poorly maintained infrastructure, and a lack of supervision and managerial leadership cited as leaving those working in primary health care demoralized and suffering from burn-out (3). CHPS research, monitoring and evaluation has traditionally focused on rural areas because of the perception that Ghana's major primary health care challenges were rural. However, Ghana has evolved from a country that was 40% urban when the Navrongo pilot was conducted in 1994-5. Current estimates suggest over 57% of the population are now living in urban areas (94), and with an estimated urban growth rate of 4.2%, the urban population is expected to reach 65% by 2030 (7).

Increasingly questions arise as to how to adapt and deliver primary health care systems developed for rural poor populations to urban poor populations. This has led to increasingly attention to urban primary care in research and policy (95, 96) with findings pointing to the value of exploring different approaches to structuring primary health care, including building linkages between the plethora of private, informal and NGO providers with the more limited public sector primary health care providers (97). Developing strong community engagement and integration of volunteers, which is a key feature of the CHPS model, is a particular challenge in urban contexts. Strategies tried elsewhere include moves to pay CHVs regular stipends, as recently agreed in Kenya (98) and implemented in informal settlements in Bangladesh through the Manoshi programme, where volunteers receive financial incentives for each pregnancy identified or woman that they accompany to a delivery center (99). The need to adapt CHPS to fit the fast-evolving urban setting highlights a tension between clearly specifying the programme—as typified by the 15 Steps—and being able to allow flexibility and adaptability.

4.1. Strengths and limitations

A strength of the review is the wide search strategy used to identify both published and gray literature. However, given the

diverse actors—NGOs, INGOs, donors, and researchers—who have been involved with the CHPS programme since its inception, it is likely that some evaluations will have been missed. Our systematic use of the RE-AIM framework to categorize the qualitative studies and to structure our synthesized findings is a further strength of our review. The review team also acknowledged throughout the review process that the use of the RE-AIM framework was at times challenging as findings did not always fit neatly into the RE-AIM domains. In particular, aspects of the context were hard to capture within the RE-AIM framework and this may have undermined insights in our synthesis.

4.2. Lessons for policy and practice

The review highlights the need to identify the resources required to successfully implement CHPS within the different socio-economic and socio-cultural contexts of Ghana. Clearly, adequate resourcing and strategies to meet the financial requirements of the programme are urgently needed. With reducing donor funds, the role and functionality of NHIS and its contributions to CHPS are of fundamental importance.

While the clarity of the steps needed to establish CHPS has undoubtedly helped with scale up, flexibility and nimble responses are needed in the context of rapid urbanization, health security in the face of pandemics and the changing disease burden exhibited within different contexts. The challenges of chronic diseases such as hypertension and diabetes, poor mental health, tobacco, alcohol and substance abuse are especially rife within urban populations, thus health needs will differ from those in a more traditional CHPS setting, and thus require a different approach. Ensuring that CHPS is not pulled too far from its original focus on promotion and prevention is particularly crucial given the increasing prevalence of non-communicable diseases. The studies included that focus on the urban context highlight the need to challenge assumptions that urban populations are already well-served by primary care. The predominant use of private, often unregulated health services and the lack of prevention highlight the need for an urban-specific CHPS model.

Keeping true to the original focus on community engagement is key, however, creative thinking to respond to the changing types of communities we find in rapidly urbanizing cities is needed. This may involve linking with occupational community structures such as market-traders associations or savings groups that are active in poor urban neighborhoods in addition to engaging with traditional leaders. Careful consideration of how to incentivize engagement is required in the urban context where volunteer time has a high opportunity cost. Given the rich history of evidence-informed programme development that characterizes CHPS, it is hoped that further research focusing on strategies to address the financial, service provision and community engagement challenges will continue to inform and improve CHPS.

5. Conclusions

The CHPS programme is built on a sound body of evidence, and clear specification together with a conducive national policy environment has aided scale-up. The combination of community health nurses and volunteers, with significant community engagement has been found effective in reducing under five mortality, particularly for the poorest and least educated, increasing the use and acceptance of family planning and reducing the fertility rate. While it is clear that the CHPS strategy can work for these rural populations in improving these outcomes, effectiveness in urban contexts is yet to be established. A clear specification of CHPS and a conducive national policy environment has aided scale-up, with strong community engagement, adequate resourcing and motivation for community health workers proving key to successful implementation. However, challenges to implementation and adoption across Ghana remain, particularly in urban and remote rural areas where these aspects are hard to deliver. Strengthened health financing strategies, review of service provision in light of pandemics, prevalence of non-communicable diseases and adaptation to changing community contexts will be required for future successful delivery and scale-up of CHPS.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

HE, MA-O, AG, AA, AA-O, DD, EA, KA-W, and IA developed the protocol and concept of the review. MA-O, HE, AA, AG, AA-O, DD, EA, and KA-W screened and extracted data from the included studies. HE, LW, AN, DA, and AG coded qualitative findings. HE and DA synthesized qualitative findings. AV and HE synthesized quantitative findings and conducted the overall synthesis of results. HE drafted the manuscript with support from NA. All authors read and approved the final manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1105495/full#supplementary-material

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How and why pharmaceutical reforms contribute to universal health coverage through improving equitable access to medicines: a case of Ghana

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Background: Examining how and why a country prioritizes and implements pharmaceutical reforms tends to show complex processes and myriad efforts made toward improving access to medicines. This study examines factors that enabled the prioritization and implementation of selected pharmaceutical reform items and how these factors contributed to improving equitable access to medicines and universal health coverage in Ghana.

Methods: An analytical framework was developed to identify variables to explore in answering the study questions and frame the analysis and presentation of findings. Documents analyzed included the National Medicines Policies, Health Sector Program of Work, and other health policies. Quantitative data were sourced from databases maintained by World Health Organization and the Institute for Health Metrics and Evaluation.

Results: The three main factors, evidence, financial and technical support, and alignment to national and global policies, influenced the prioritization and implementation of access to medicines reforms. The reforms targeted rational selection and use of medicines, medicine pricing, sustainable medicine financing, and regulatory and supply chain systems. Although there were limited quantitative data to quantify access to medicine policies" impact on universal health coverage, it can be reasonably assumed that, in Ghana, access to medicine policies has contributed to financial protection and improved access to quality health services.

Conclusion: Access to medicine policies targeted at promoting rational medicine selection and use, regulating medicine pricing and improving sustainable financing for medicines as well as the regulatory and supply chain systems arguably contributed to the attainment of UHC and must be sustained. Therefore, data collection and reporting indicators for access to medicines must be prioritized.

KEYWORDS

access to medicines, universal health coverage, policy prioritization, reforms, Ghana

Introduction

Access to safe, effective, quality, and affordable essential medicines by the population contributes to universal health coverage (UHC). Essential medicines are those that satisfy the priority health needs of the population (1), and as noted in Sustainable Development Goals (SDGs) 3.8, governments must seek to achieve universal health coverage for their population,

including improving access to essential medicines and vaccines for all (2). Access to essential medicines is a central component of universal health coverage (3). Universal health coverage "*means that all people have access to the full range of quality health services they need, when and where they need them, without financial hardship*". UHC seeks to improve access to quality health services, including essential medicines, by providing financial risk protections and increasing population coverage (4).

The World Health Organization (WHO) proposes four dimensions for improving access to medicines: (1) rational selection and use, (2) affordable prices (3), sustainable financing, and (4) reliable health and supply system (1). The rational selection and use of essential medicines include the development of evidence-based standard treatment guidelines and corresponding essential medicines list (EML) and its use for prescribing, dispensing, procurement, reimbursement, and training across the health sector. The rational selection and use of medicines contribute to improved access to quality health services and population coverage. The affordable price dimension deals with medicine pricing policies, such as promoting the use of generics, local manufacturing of medicines, markup regulations across the supply chain, pooled procurement, and tax exemptions for pharmaceutical products, and these policies contribute to reducing financial risk as medicines are made more affordable. The sustainable financing dimension deals with the reduction of out-of-pocket expenditures, increasing funding for essential medicines, and expanding health insurance, thus providing financial risk protection for the general population, especially the poor, and vulnerable population groups. The reliable health and supply system dimension deals with the regulation of medicines, integrating medicines in health sector developments and plans, and the supply of medicines and aims to ensure the population's essential medicines needs are covered (1, 5).

Improving access to medicines for all is complex and can be challenging. Globally and nationally, there are gains in the development of national treatment guidelines and essential medicine list (6–8); however, there are gaps at the national level in the selection of medicines compared with those recommended by the World Health Organization (7), and there are also reported cases of inappropriate use of medicines (9–12). The prices of medicines are high, making them inaccessible to, especially, the poor and vulnerable population groups (10–13). Effective public procurement systems are critical for ensuring access to medicines, but there are also reported challenges including the operations of many "middlemen" along the pharmaceutical supply chain (14) and shortage of medicines (10–12, 15).

In Ghana, access to essential medicines by the population is uneven (16) and hence uneven universal health coverage. Over the years, the government through the Ministry of Health (MoH) and its agencies prioritized and implemented pharmaceutical reform items to promote rational medicine selection and use, regulate medicine pricing, and improve medicine financing and the regulatory and supply chain systems (10–12). These pharmaceutical reform items were first noted in 1999 in the National Drug Policy, which aims "*to make essential drugs available and accessible to the population and ensure the safety, efficacy and the quality of drugs and their rational use by prescribers, dispensers, and consumers*" (12). It is important to understand factors influencing government prioritization and implementation of pharmaceutical reform items and how these reforms contributed to improving access to medicines and largely to universal health coverage. There is, however, limited literature on this subject. Some studies focused on population coverage toward UHC (17), Ghana's progress toward UHC indicators and health service utilization (18), coverage of health services toward UHC (19), and essential medicines in UHC (20).

Examining how and why a country prioritizes and implements pharmaceutical reforms tends to show complex processes and myriad efforts made toward improving access to medicines. This study examines factors that enabled the prioritization of access to medicines reforms and the implementation approaches and how these reforms contributed to universal health coverage in Ghana. This study, specifically, seeks to answer the following questions: (1) What access to medicines pharmaceutical reform items were prioritized since 1999, when the National Drug Policy was developed, and why? (2) What implementation approaches were employed and sustained and why? (3) How did the reforms influence equitable access to medicines and contributed to universal health coverage?

Methods

A retrospective longitudinal study of pharmaceutical reform items stated in the National Drug/Medicines Policies (10–12) was conducted for the period from 1999 to 2017. The pharmaceutical reform items prioritized over the years were mapped out, and an analysis of the pharmaceutical reforms items and their influence on access to medicines and contributions toward universal health coverage was carried out using three consecutive policies, namely, using the three consecutive policies, namely the National Drugs Policy (1999), National Drug Policy (2004) and National Medicines Policy (2017) (10–12), Health Sector Program of Work (21–25), and National Health Policy (26), Ghana's Roadmap for Attaining Universal Health Coverage (16), National Community-Based Health Planning and Service (CHPS) policy (27), national drug policy implementation evaluation reports, and quantitative data. The gray literature and health sector reports were identified from the Ghana MoH website and Pharmacy directorate office and research articles from Google Scholar. The search terms were "national medicine/drug policy reforms", "pharmaceutical reform", "national access to medicine", "access to medicine agenda", "national medicines laws", "UHC and medicines", "rational selection of medicines", "rational use of medicines", "affordable medicines pricing", "essential medicines list", standard treatment guidelines", "national medicines priority", "sustainable financing for medicines", "supply chain systems", and "medicines regulatory systems". The search year ranged from 1988 when the first essential drug and national formulary with therapeutic guideline was developed in Ghana to 2022. Table 1 summarizes the review guideline. The quantitative data on universal health coverage and access to medicines indicators were sourced from databases maintained by World Health Organization (WHO), the SDG tracker organization, and the Institute for Health Metrics and Evaluation (IHME).

TABLE 1 Literature review guideline.

Objective	To synthesize evidence on access to medicines reforms and its prioritization enabling factors and implementation approaches To synthesize evidence on how the access to medicines reforms contributed to access to medicines and universal health coverage	
Research questions	(1) What access to medicines pharmaceutical reform items were prioritized since 1999, when the National Drug Policy was developed, and why? (2) What implementation approaches were employed and sustained and why? (3) How did the reforms influence equitable access to medicines and contributed to universal health coverage?	
Search strategy	Inclusion	National medicine/drug policy reforms. Health sector policies. National access to medicine. National development policies, health sector policies, and laws aligned to national access to medicines agenda. Gray literature including printed copies of national drug/medicine policies and laws; documents on Ministry of Health and agencies websites; peer-reviewed journals. Language: English
	Exclusion	Exclude countries other than Ghana
	Timeframe	1988–2022
Data source	Institutional website and Office Google Scholar	Ministry of Health (Pharmacy Directorate) National Health Insurance Authority Peer-reviewed literature

Data analysis

Drawing on the WHO's access to medicine dimensions (i.e., rational selection, affordable prices, sustainable financing, and reliable health and supply system) (1) and the universal health coverage dimensions —access to the needed healthcare and financial protection—an analytical framework (Figure 1) was developed to guide the analysis of factors that seem to have played significant roles in the access to medicine policy prioritization, the implementation approaches, and the ways the reforms contributed to universal health coverage. The National Drug/Medicine Policies objectives for 1999, 2004, and 2017, policy items listed, and their alignments to other national policies were mapped for trends. The literature reviewed and the themes based on the analytical framework are summarized in Table 2.

Data on rational selection and use, affordable price, sustainable financing, reliable regulatory and supply system prioritization factors, implementation approaches, and ways these reforms may have contributed to universal health coverage were documented and analyzed. Further analysis involved mapping and categorizing external and internal factors to the identified access to medicine reforms and potential contribution to universal health coverage. The themes in the analytical framework are mapped to the research questions to provide a structure for the presentation of the results. The study reports on access to medicine policies prioritized over time, potential contribution to universal health coverage, and the implementation approaches.

Results

Access to medicine policies prioritized and potential contributions to UHC

Table 3 summarizes the access to medicine policy items, National Drug/Medicines Policy objectives, and alignment with other national policies.

Rational selection and use of medicines

Rational selection and use of medicine policies have been prioritized over the years to improve patient management practices including diagnosis, prescribing, and dispensing because of evidence of irrational use at all levels within the health sectors (10–12). The main policy items prioritized include the following: First, the national standard treatment guideline (STG) with essential medicines list (EML) (28–31). The standard treatment guidelines and the accompanying EML sought to guide healthcare workers at all levels of care in selecting their treatment options for both adults and children, designing institutional medicines lists, and the procurement of medicines, thus informing the availability and use of essential medicines. To promote the use of the STG and EML, the Ministry of Health over the years organized workshops on the use of the STG and EML and the rational use of medicines for healthcare practitioners (12, 32). For example, the MoH pharmacy directorate held 10 training workshops in all regions between 2016 and 2019 on the use of STG and EML. Health professionals spanning from the public-, private-, and faith-based sectors were trained (32). The EML concept was introduced, promoted, and supported by the World Health Organization to improve access to medicines, and this is a global priority (6, 33). The first national treatment guidelines and medicine list was published in 1988 and revised over the years with the seventh edition published in 2017 (8). Accurate diagnosis through the use of standard treatment guidelines, rational prescription, and the use of medicines is an integral part of quality health service provision and aligns with Ghana's Roadmap for Attaining Universal Health Coverage (16). Over the years, there has been reported improvement in the rational use of medicines; in 2004, the MoH reported a reduction in the average number of drugs prescribed per outpatient encounter from 4.6 to 3.7. In addition, the proportion of outpatients receiving antibiotics and injections has reduced from 54 and 38% to 42 and 33%, respectively (11). Second, the medicine advertisement and promotion policy is prioritized to ensure that the advertising and promotion of medicines are of high professional standards and conform with the requirements of the Food and Drugs Law 1992 (PNDCL 305B) and subsequently the Public Health Act 2012 (Act 851). Advertising and promotion of non-over-the-counter medicines are restricted to only professional publications (12). Third, health technology assessment is prioritized and aligned with Ghana's Roadmap for Attaining Universal Health Coverage. As noted in Ghana's Roadmap for Attaining Universal Health Coverage, health technology assessment is to ensure appropriateness and value for money during the medicines selection process (16). Health technology assessment seeks to support evidence-based decisions around the selection of medicines for use and

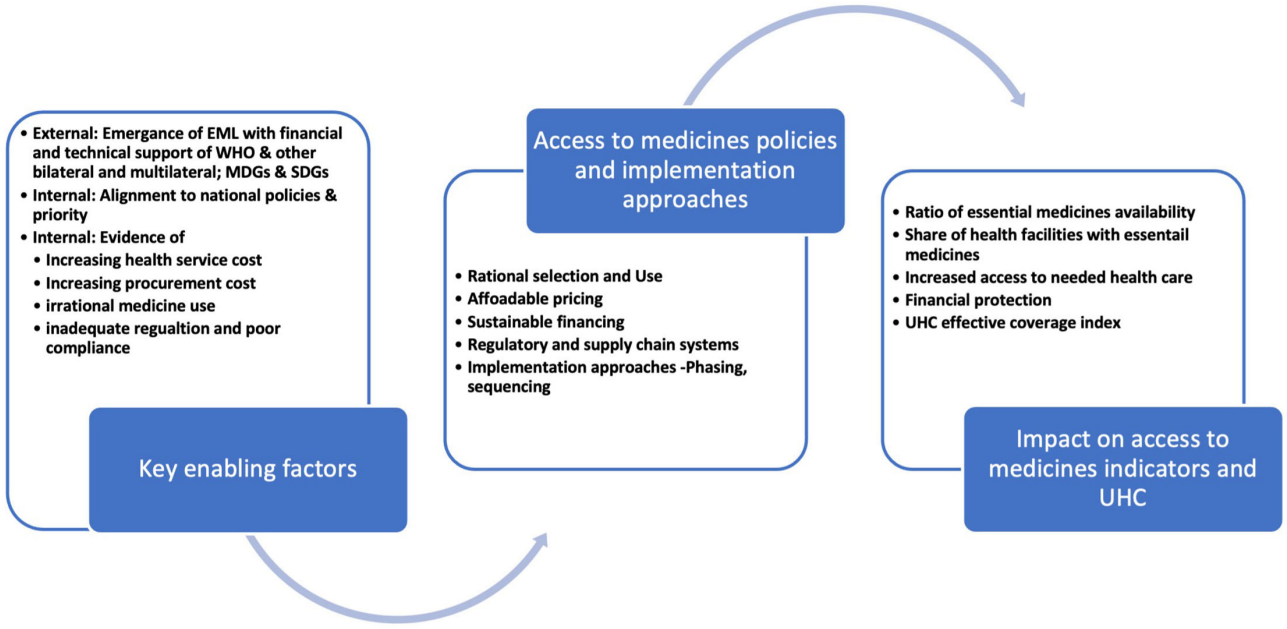

FIGURE 1
Analytical framework.

reimbursement through a process that summarizes the medical, social, economic, and ethical issues related to the use and selection of medicines in a systematic, transparent, and robust manner (10).

Affordable price

Access to medicine policies geared at promoting affordable medicines were prioritized over the years because of the increasing cost of medicines with expanding healthcare provision (10–12). Medicines are estimated to constitute 60–80% cost of healthcare, tax tariffs and duties, and markups along the supply chain significantly contribute to the final prices (11). The main policies were prioritized and targeted at cost buildup along the supply chain to provide financial protection, and these align and contribute to universal health coverage (16). First, tax exemptions for pharmaceuticals, i.e., selected active pharmaceutical ingredients, excipients, packaging materials, and selected imported essential medicines. Second, some essential medicines were "ring-fenced" for only local manufacturing to encourage local manufacturing of essential medicines and guarantee market. Third, bulk procurement of medicines through framework agreements to ensure the best-priced and economies of scale. Medicines with high financial impact and high supply risk such as program medicines are to be aggregated, procured, and managed centrally (10). Fourth, generic policy—to ensure affordability in the public sector, medicines are to be procured and prescribed per the EML and in generic (non-proprietary) names only (12). A 2008 medicine use survey found that 87.5% of public sector prescriptions are based on the EML (34). Additionally, a prescription audit across selected regions conducted by the Ministry of Health showed that 98% of medicines prescribed for uncomplicated hypertension were from the first-line recommended medicines in the STG and EML, and 83% of medicines prescribed for severe malaria were in line with the STG and EML (32).

Sustainable financing

To promote access to medicines, sustainable financing policies that dealt with increasing funding for essential medicines, expanding health insurance, and the reduction of out-of-pocket expenditures were prioritized. These policies aligned with Ghana's Roadmap for Attaining Universal Health Coverage to ensure a constant flow of medicines and prevent stock-outs across all levels within the health sector. Financing options for essential medicines procurement included the following: First, the government-led medicine financing, where the MoH centrally procures essential medicines; second, government and donor partnership financing; the MoH with support from development partners centrally procures antiretroviral, psychotropics, family planning commodities, and vaccines. Most of the antiretroviral and tuberculosis (90%) are donations and/or products received through the voluntary pooled procurement mechanism from Global Fund and the Global Drug Facility, the United States Agency for International Development—President's Emergency Plan for AIDS Relief, and the Global Alliance for Vaccines and Immunizations (10); third, drug revolving funds in health facilities. Internally generated funds from the sales of medicines are deposited in the designated Bank account and used for medicines procurement to ensure a constant supply of medicines (11); and fourth, the National Health Insurance Scheme (NHIS). NHIS was introduced in 2003 to reduce catastrophic expenditure, especially for the poor and vulnerable (35–37), and as reported in 2010, over 62% of

TABLE 2 Summary of literature reviewed and key themes.

Title/year/source/ reference	Theme based on the analytical framework
Access to Essential Medicines in Ghana: A Survey of Availability of Children's Medicines in Medicine Outlets in the Ashanti Region, 2016 (39)	Availability of essential medicines
Annual programme of work, 2004, MoH Website (56)	Internal factors: Alignment to national policies and priority
Annual programme of work, 2005, MoH Website (57)	
Annual programme of work, 2010, MoH Website (25)	
Assessing approaches to improve adherence to Standard Treatment Guidelines by health professionals in selected regions in Ghana. MoH (Pharmacy Directorate) (32)	Alignment to access to medicine policies—Standard Treatment Guidelines
Assessment of the implementation of the Ghana National Drug Policy 2004–2013, and Proposed policy directions for 2014–2020. MoH (Pharmacy Directorate) (58)	Access to medicine policy assessment
Essential Drugs List and National Formulary with Therapeutic Guidelines, (1988, 1993, 1998) MoH. (59–61)	Access to medicine policy: Rational selection and use
Ghana National Drugs Policy, 1999/Pharmacy Directorate (12)	Access to medicine policies • Rational selection and use • Affordable pricing • Sustainable financing • Regulatory and supply chain systems Internal factors: Evidence of • Increasing health service cost • Increasing procurement cost • Irrational medicine use • Inadequate regulation and poor compliance
Ghana National Drugs Policy, 2004/Pharmacy Directorate (11)	
Ghana National Medicines Policy, 2007, MoH Website. (10)	
Ghana's Roadmap for Attaining UHC 2020-2030/MoH (16)	Internal factors: Alignment to national policies and priority
Health Sector 5-Year Programme of Work, 1996/ MoH (62)	Internal factors: Alignment to national policies and priority
Independent review: Health Sector Programme of Work 2007, 2008, MoH (63)	Internal factors: Alignment to national policies and priority
Institute for Health Metrics and Evaluation. (42)	UHC effective coverage index
Medicines Prices in Ghana, 2008./MoH (34)	Access to medicine policy implementation: Affordable pricing. Medicines availability
Mid-Term Review of the Implementation of the Ghana National Medicines Policy 2017. 2021. MoH (Pharmacy Directorate) (64)	Access to medicine policy assessment
National Community-based Health Planning and Service Policy 2010. MoH, (27)	Internal factors: Alignment to national policies and Priority
National Health Policy 2007/MoH (26)	Internal factors: Alignment to national policies and priority
Pharmaceutical Availability across Levels of Care: Evidence from Facility Surveys in Ghana, Kenya, and Uganda, 2012 (40)	Availability of essential medicines
Procurement Reforms in Ghana 2002 (38)	Access to medicine policy: Regulatory and supply chain systems
Public social policy development and Implementation: a case study of the Ghana National Health Insurance Scheme, 2008, (35)	Financial protection
Standard Treatment Guidelines and Essential Medicines List (2000, 2004, 2010, 2017) MoH (28–31)	Access to medicine policy: Rational selection and use
Use of evidence and negotiation in the review of STG. 2019. (8)	Rational selection of medicines
Value Added Tax (VAT) Exemptions (Amendment) 2017	Access to medicine policy: Medicine pricing Alignment to national policies and priority
VAT Exemptions Regulations 2015	Access to medicine policy: Medicine pricing Alignment to national policies and priority
WHO Essential Medicines List 30th Anniversary/WHO (33)	External factors: Emergence of EML with financial and technical support from WHO

the population accessed care and essential medicines through the NHIS (10).

Reliable health and supply system

This dimension focuses on integrating medicines in health sector development and policies, creating an efficient supply chain, and assuring the quality of medicines through regulatory control. Over the years, essential medicines issues are captured in national policies with goals to improve access. For example, the MoH and its stakeholders recognized the importance of procurement in its Medium-Term Health Sector Strategy for Ghana 1997–2001 (38). The supply and management of medicines were rationalized through central and regional medical stores to improve medicine distribution and management at all levels of healthcare delivery (11). This was because of inadequate medicine supply management procedures, and unsuitable and insufficient distribution, and storage facilities, often resulting in increased procurement costs and losses (11). In the public sector, health facilities are necessary to procure the best-priced and quality medicines following procurement laws. Medicines are to be procured centrally, and if the central and regional medical stores are unable to supply them, they can be purchased from the private sector (11). Logistics management information systems are in place to support the quantification and planning, ordering, and tracking of medicines and the availability of medicines at the point of dispensing to the patient (16).

In addition, quality assurance policies were prioritized because of increasing evidence of under-developed machinery to ensure the enforcement of existing laws and regulations resulting in poor compliance (11). The MoH through the Food and Drugs Authority established a National Quality Control Laboratory (NQCL) to test medicines through the supply chain and ensure that only safe and effective medicines are supplied to consumers (11). Also, all medicines for use in Ghana are to be registered by the Food and Drugs Authority. Additionally, a Ghana National Drugs Programme (GNDP) was initiated in 1997 to coordinate the development and implementation of national medicine policies (12). The Ghana National Drugs Programme supported initially by the Dutch government funded activities in both the Food and Drugs Authority and the Pharmacy Council to improve the regulation of medicines and pharmacy practice and promote efficiency in the health sector regulation (11).

Reporting on the access to medicine policies prioritized and their potential contribution to universal health coverage, there were limited quantitative data on the impact of direct improved access to medicines and actual contributions to universal health coverage in Ghana. Some studies focused on the availability of medicines and prescriptions based on the EML and provided information on how accessible medicines were for healthcare services in selected regions and facilities. For example, a 2016 study conducted in 27 districts in the Ashanti region on the availability of 42 children's essential medicine contained in the STG found an overall average availability of 41.3%, while ferrous sulfate syrup (95%), albendazole suspension (90%), and paracetamol syrup (88.8%) had the highest availabilities (39). Another study in 2012 assessed the availability of 50 essential medicines in over 200 facilities in Ghana, Kenya, and Uganda and found that it ranged from 44% in referral hospitals to 16% in community health posts in Ghana. The study further noted that essential medicines availability in Ghana was generally better than that in Uganda and Kenya (40). These studies may not be nationally representative; however, the median availability of selected generic medicine data for Ghana is not available on the WHO Global Health Observatory data repository (41). Nevertheless, we can safely infer that the identified access to medicine policies contributed to the universal health effective coverage index which represents health service coverage across the population. UHC effective coverage index for Ghana has increased from 29.5 in 1990 to 41.6 in 2010 and to 49.1 in 2019 (42).

Implementation approaches of access to medicine policies

Two main implementation approaches were identified: sequencing and phasing. In this study, the sequencing approach refers to policies implemented and sustained in succession and phasing refers to policies implemented in a distinct period to cover a specific population or type of medicine. For example, the rational selection of medicine policies is implemented in a sequencing approach, because as recommended by the World Health Organization, these policies should be regularly reviewed. The first Essential Drugs List and National Formulary with Therapeutic Guidelines designed for use in 1988 has been revised in 1993, 1996, 2000, 2004, 2010, and 2017 and implemented over years in succession. The MoH through the Ghana National Drugs Programme coordinated the design and implementation of the guidelines and medicines list. The MoH usually with financial and technical support from development partners constantly organizes workshops and meetings to promote the rational use of medicines at all levels. Again, the national health insurance scheme reimbursement medicines list which aligns with the national EML is implemented in succession, as the National Health Insurance Authority together with stakeholders regularly review and implement the list. In addition, the Food and Drugs Authority constantly regulates medicine quality through its National Quality Control Lab.

However, some access to medicine policies was phased out to target specific medicines. For example, the bulk procurement through the framework contracting agreement focused on high-volume, high-risk essential medicines and was implemented in 2018, 2019, and 2021. Again, the tax exemptions for pharmaceutical implementation were phased out. Tax exemptions were implemented for active pharmaceutical ingredients, excipients, and packaging materials for some selected essential medicine locally manufactured in 2015 (43). The tax exemption was later implemented for some selected imported medicines in 2018 (44).

Discussion

This study explored access to medicine policies prioritized since 1999 when the first national drug policy was designed, the potential contribution of these policies to universal health coverage, and the implementation approach employed. The study highlights the influence of three main factors: (i) evidence, (ii) financial and technical support, and (iii) national and global policies on the prioritization and implementation of the identified access to medicine policies over time. Evidence of irrational use of medicines, increasing medicines cost, supply chain challenges including increasing procurement cost and losses, and inadequate enforcement of medicine regulatory laws influenced the government's decision to prioritize and sustain access to medicine policies over time. Evidence of challenges within the health sector influencing policy prioritization is not new, and this is documented in the literature (45–47). The availability of financial and technical support either from the government or donors also influenced the prioritization of these policies. Donors and government over the years supported the design, review, and implementation of the standard treatment guidelines and essential medicines list, and as a result, these policy items are sustained and prioritized in the national medicine policy (8). The government of Ghana and donor financial support co-existed and influenced the prioritization and implementation of the access to medicine policies, and this is also noted in a scoping review of the health policymaking process in sub-Saharan Africa (48). The finding of donor influence in national policy prioritization is similar to the study on donor influence on national health policymaking in Cambodia and Pakistan (49). The control of financial resources and provision of technical expertise was the most commonly identified route by which donors influenced policymaking processes (49, 50).

TABLE 3 National medicine policy year and objectives, reforms, and alignment with other national policies.

National drug/medicine policy year and objective	Reform dimension and policy items				Alignment to other national policies and plans
	Rational selection and use	Affordable price	Sustainable financing	Reliable health and supply system	
1999: "*to make essential drugs available and accessible to the population and to ensure the safety, efficacy, and the quality of drugs and their rational use by prescribers, dispensers, and consumers*"	Rational drug use, Drug selection and registration, and Drug advertising and promotion	Local manufacture	Drug financing	Drug storage and distribution	• Essential drug list and formulary with therapeutic guidelines (1988) distributed to health practitioners. • Food and Drugs Law 1992 (PNDCL 305B) and the Pharmacy Act (Act 489) • Ghana National Drugs Programme associated with the development of a National Drug Policy • Vision 2020—growth and development—development of the pharmaceutical sector
2004: "*to improve and sustain the health of the population of Ghana by ensuring the rational use and access to safe, effective, good quality, and affordable pharmaceutical products*"	Drug Selection Rational Drug Use	Local manufacture of pharmaceutical and traditional medical products Generic policy	Drug Financing	Quality Assurance	• Health Sector Programme of Work 2nd • Public Procurement Act of 2003 (Act 663) and (Act 914)
2017: "*to ensure universal, equitable and sustainable access to priority, efficacious, and safe medicines and other health technologies of acceptable quality for all people living in Ghana and promote their responsible use by healthcare providers and consumers*"	Selection of essential medicines and health technologies Rational Medicine Use Health technology assessment	Medicine Pricing VAT exemptions for local manufacturing	Medicine Financing	Quality assurance of pharmaceuticals	• Sustainable Development Goals (SDGs) toward Universal Health Coverage (UHC), SDG 3. • Ghana Shared Growth and Development Agenda 1 and 2 for wealth creation. • National Health Policy, Creating Wealth through Health, 2007. • Ghana Health Sector Medium Term Plan, 2010–2013 and 2014–2017

To fulfill national and global goals, some access to medicine policies was prioritized and sustained. For example, the promotion of local manufacturing of essential medicines aligned with a national goal—Vision 2020, which sought to develop the pharmaceutical sector and affordable medicine pricing and also aligned with the Millennium Development Goal 8E, i.e., "…. *provide access to affordable essential drugs in developing countries*". The alignment of national policies to global goals and target is usually facilitated by international organizations (51). The access to medicine policy implementation approaches reflects the nature of the policies and also the availability of human and financial resources. Some prioritized policies were sustained and constantly revised, while others were only implemented in distinct periods.

Access to medicines policies and contribution to UHC

As noted earlier, there were limited Ghana-specific data on access to medicines indicators and the impact of direct improved access to medicines and actual contributions to universal health coverage. There seems to be less priority for data collection and reporting on access to medicine indicators, and this phenomenon is also reported by others (52, 53). The Millennium Development Goals 2015 report also notes the lack of data for indicators of access to medicines and the limited number of surveys undertaken especially between 2007 and 2014 in low-income and lower-middle-income countries (54). Policies promoting medicine affordability and financing are designed and implemented; however, the intended and unintended effects usually in the form of indicators are not fully documented, and sometimes, there are limited data (20). Additional data on medicine expenditure in many countries are limited and, if available, lack adequate details on the types of medicines procured and the degree of access by the population (3). Notwithstanding, the policies targeting rational selection and use, affordable price, sustainable financing, and reliable regulatory and supply system have arguably contributed to the UHC dimension, i.e., access to the needed quality healthcare and financial protection in Ghana. Rational selection and use of medicines policies through improving prescription and dispensing practices, creating an efficient supply chain, and assuring the quality of medicines through a regulatory control system seem to have contributed to improving the general quality of health services. As noted by Ozawa et al. (55), the medicine quality assurance system contributes to reaching universal health coverage goals by ensuring the quality of essential medicines helps deliver effective and safe treatments. In addition, healthcare savings made when quality medicines are used can be reinvested toward universal health coverage (55). Again, the medicine pricing policies and sustainable

financing initiatives for medicine may have also contributed to financial protections, especially for the poor and vulnerable.

Policy implications

This analysis suggests three policy lessons and implications. First, access to medicine policies targeted at promoting rational medicine selection and use, regulating medicine pricing, improving sustainable medicine financing, and the regulatory and supply chain systems arguably contributed to the attainment of universal health coverage and must be sustained. Second, due to limited data on access to medicines indicators, it is difficult to quantify the policies' impact on universal health coverage and analyze the trend over time. Third, universal health coverage is on both national and global agendas, and therefore, there is a need to constantly galvanize the interest of policy actors toward data collection and reporting indicators for access to medicines.

Limitations

First, secondary data were analyzed, and while this may be extensive, primary data sources may have provided additional information. Second, there were limited quantitative data for indicators of access to medicines and their impact on universal health coverage. Despite these limitations, this analysis provides information on access to medicine policies prioritized and how they potentially contribute to financial protection and access to quality healthcare service in Ghana. Future research is recommended in the following areas: evaluation of access to medicine policy implementation across all levels of care and the roles of pharmaceutical players in the implementation of access to medicine policies in Ghana.

Conclusion

Health sector evidence, financial and technical support, and alignment to national and global policies and goals were the main enablers to prioritization and implementation of access to medicine policies. These policies have been sustained and implemented over time. Although there were limited quantitative data to quantify the effect of the access to medicine policies on universal health coverage, it can be reasonably assumed that, in Ghana, the access to medicine policies has contributed to financial protection and improved access to quality health service.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

AK conceptualized the study, collected and analyzed data, and wrote and reviewed the manuscript.

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Conflict of interest

The reviewers HB and RT declared a shared affiliation with AK to the handling editor at the time of review.

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Why district assemblies disburse resources to district health systems for service delivery at district level in the context of decentralization: a comparative study of two districts in the Volta Region of Ghana

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Objectives: To explore why the District Assembly disburses financial and other resources to the District Health System.

Design: Multiple case study with a single unit of analysis (holistic) using quantitative and qualitative methods of data collection involving a desk review, analysis of routine health management information system data and key informant interviews.

Setting: Two districts in the Volta Region of Ghana.

Participants: Twelve key officials of each district assembly and the district health system (24 total) who had worked in the district at least a year or more.

Interventions: None.

Results: Both District Assemblies had moderate decision space which was influenced by their capacity, power and contextual factors like politics, economics, legal and situational factors. Disbursement of financial and other resources to the District Health Systems was influenced by financial capacity, use of power by stakeholders, context and the decision space of the District Assembly. Political actors appeared to have more power in resource disbursement decision making than community members and technocrats in a context of resource constraints and inadequate funding. The funding available was used predominantly for capital investments, mainly construction of Community Based Health Planning and Services (CHPS) compounds.

Conclusion: It is important to make policies that will regulate the relative power among the political appointees like the District Chief Executives (DCEs), public and civil servants in decentralized departments and agencies and Community members to make resource disbursement more sensitive to communities and decentralized departments.

KEYWORDS

decentralization, devolution, district assemblies, district health systems, financial disbursement

Introduction

Decentralization is a strategy for transferring authority and responsibility from central to sub-national levels of government. Sometimes, governments only adopt the concept in theory and fail to delegate power to the districts and regions (1). Bossert (2) made the argument that decentralization will improve the delivery of services only when an appropriate degree of discretion is combined with adequate institutional capacities to make choices consistent with good health sector performance and accountability of those choices to local health needs and priorities. Literature on accountability argues that actively involving local democratic structures and civil society in decision-making will make public services delivery more responsive to local health needs and reduce the risk of elite capture (3, 4). Work done in Indonesia in 2006 where there had been a radical political, administrative and fiscal decentralization with the delivery of health services becoming the responsibility of district governments revealed that district governments were reliant on the central government for as much as 90% of their revenue even though public funding for health services more than doubled between 2001 and 2006. Key financial decisions were still made by the central government. It was concluded that in contrast to the promise of decentralization there has been little increase in the potential for discretion at the district level in managing public funds for health (5). This findings was in contrast to the belief that allowing local communities and regional entities to manage their own affairs, and through facilitating closer contact between central and local authorities, effective systems of local governance enable responses to people's needs and priorities to be heard, thereby ensuring that government interventions meet a variety of social needs (6). Bossert's work in 2014 on Empirical studies on decentralization investigated how institutional capacity helps to make good decisions and accountability to local elected officers as well as the interaction between decision space, capacity and accountability. He described decentralization as a set of rules about local choice and incentives that the central authorities use to encourage local decision makers to make choices that are likely to achieve the objectives of the central authorities. The approach defined the 'decision space' or local discretion allowed by the central government for functions and sub-functions about financing, service delivery, human resources and governance. It emphasized that decentralization is fundamentally about shifting choice from central authorities to local authorities but the choice allowed is not a single block but rather a range of discretion allowed over different functions. This is a more realistic way of viewing the complexity of real experience than the usual dichotomous descriptions in which systems are defined as decentralized or centralized. In the comparative decision space for Ghana, Zambia, Uganda and Philippines, the study found that Ghana had a moderate range of choice in financing function and Philippines had a wide range of choice (7). In the various areas of finance function, Zambia had a narrow range of choice in the area of sources of Revenue but had moderate choices in the area of expenditure and income from fees. The study realized that the formal legal and regulatory rules about decision space did not really define the actual practice of officials. So, though decentralization offers many opportunities, (8) concludes that to work properly, a decentralized system needs well-defined rules and enforcement. Otherwise, decentralization becomes a risky venture, particularly in poor developing countries, such as most of the African countries, where democratic institutions are fragile, and capacity is weak (8, 9). Concluded in their work that decentralization has not fulfilled its promise. They explained that after over 16 years after the adoption of the constitution, municipal governance in South Africa is in a state of paralysis, service delivery failure, and dysfunction. Hardly a day goes by when the country does not experience a "service delivery" protest somewhere.

A World Bank study in 2012 titled "A Health Sector in Transition to Universal Coverage in Ghana" suggested that there should be a Decentralization Policy and Legal Framework in health, on either moving the agenda to support the devolution and/or to stay with the current modality of decentralization through delegation and deconcentration. The study emphasized that the policy should include what is to be devolved and what is not. Also, Ghana was to develop the legal framework for health systems decentralization. The report stated that it was important for the policy to help enhance greater accountability, by adopting some of the mechanisms already in place, such as the District Assemblies Common Fund (DACF) to consolidate the various funds flows through integrated planning and budgeting processes, integrated M&E, developing equalization/equity formula and the performance-based financing mechanisms. Furthermore, local authorities could be given more control over budget/expenditure as well as the establishment of a clearer staff role and functions, and lines of authority within the District Assemblies and District Health Management Teams (10).

A Study into the Utilization of the District Assemblies' Common Fund (DACF) done in the New Juaben Municipality and published in 2013 revealed that the Assembly does not receive the total amount of Common Fund budgeted for in each year. In 2008, 46.67% of the Common Fund was received. In 2009, 51.33% was received while 40.75% of the Common Fund was received in 2010. They also observed that Education received the highest percentage of the Common Fund allocation of 22.45% whiles Health had 21.40% of the Common Fund allocation being the second highest sector in terms of the allocation of the common fund. Water and sanitation followed as the third sector with 16.75% of the common fund allocation. Agric sector and other departments of the District Assembly received smaller proportions of the DACF allocation (11).

Districts in Ghana are governed by District Assemblies, which are established by the Minister of Local Government, and serve as the highest political authority and decision-making body in each district. The membership of the District Assembly comprises: the District Chief Executive, appointed by the President of the Republic, one person (an Assemblyman or woman) from each electoral area within the district elected by universal adult suffrage, the member or members of Parliament from the constituencies that fall within the area of authority of the District Assembly, and other members that shall not exceed 30% of the total membership of the District Assembly appointed by the President in consultation with the traditional authorities and other interest groups in the district (12).

The District health systems of Ghana consist of networks of primary care health facilities that deliver a comprehensive range of promotive, preventive and curative health care services to a defined population with the active participation of the community and under the supervision of a district hospital and District Health Management Team. District health services are further organized into three levels: CHPS zone (community), subdistrict (health centres, clinics) and district (district hospital and district health directorate) (13).

Both the Local Government Act (462) of 1993 (14) and the Ghana Health Service (GHS) Act 525 of 1996 (15) have implied devolution (or political decentralization) of health at the district level to local government (district assembly). To date, the mode of decentralization for health remains administrative (deconcentration) rather than political (devolution). District Assemblies support for the District Health Systems have not been systematic. Relationships between the District Health Management Team (DHMT) and District Assembly (DA) remain *ad hoc* and personality-dependent (16). The financing pattern for health by local government appears fragmented and confusing (17).

In the current administrative decentralization model, the district health system operates a matrix organizational structure reporting horizontally to the District Assembly and vertically to the Regional Health Directorate (Figure 1). There was delegation from the Ministry of Health to the Ghana Health Service (GHS) by Act 525 in 1996 and deconcentration from the headquarters of GHS to the Regional Health Directorates and District Health Directorates. The Ministry of local Government has deconcentrated to the Regional Coordinating Council and then to the District Assemblies. Greater power and influence appear to dominate the relationship between district and regional levels of the Ghana Health Service, compared to district health teams and local government (16, 18).

Ghana's health sector is mainly financed by the central government, development partners, and private out of pocket payments by individuals and households. Public resources are allocated to the Ministry of Health (MoH) and health facilities through budgetary transfers, while the National Health Insurance Scheme (NHIS) is funded by the National Health Insurance (NHI) levy and by Social Security and National Insurance Trust (SSNIT) deductions (19). The Districts Assemblies financial obligations to the district health system in the context of decentralization is exercised through the District Assembly Common Fund (DACF), Member of Parliament's (MP) Fund and Internally Generated Fund (IGF).

The latest local government law Act 936 (Local Government Act 2016) in its intent suggests devolution in the health sector with the district health system becoming the health department of the District Assembly (section 77 (1) first schedule and section 78 (2) third schedule). Implementation of this law will imply that the department of Health of the District Assembly shall therefore perform the functions assigned to them under the local Government Instrument, 2009 (L.I 1961) and any other enactment in force (Act 936, section 80). Ghana is moving toward implementation of this Local Government Act, 2016 (Act 936) and other policies for the devolution of the district health system. In the past, decisions of District Assemblies to allocate and actual disbursement of financial and other resources to support the District Health System have been erratic and non-systematic (17). In this context it is important to understand the actual patterns of District Assembly financial and other resource support to the district health system, as well as the "why" of these patterns (Figure 2).

Research questions

The research questions were therefore: what are the sources of funding for district assemblies in Ghana; how much of these resources do these assemblies disburse to support the district health system to deliver services. How are disbursement decisions made and what are the lessons for developing and implementing decentralization policies and programs in Ghana to support primary health care and Universal Health Coverage (UHC) attainment?

Conceptual framework

As a framework within which to organize to collect and analyze data to answer the research questions we theorized that the

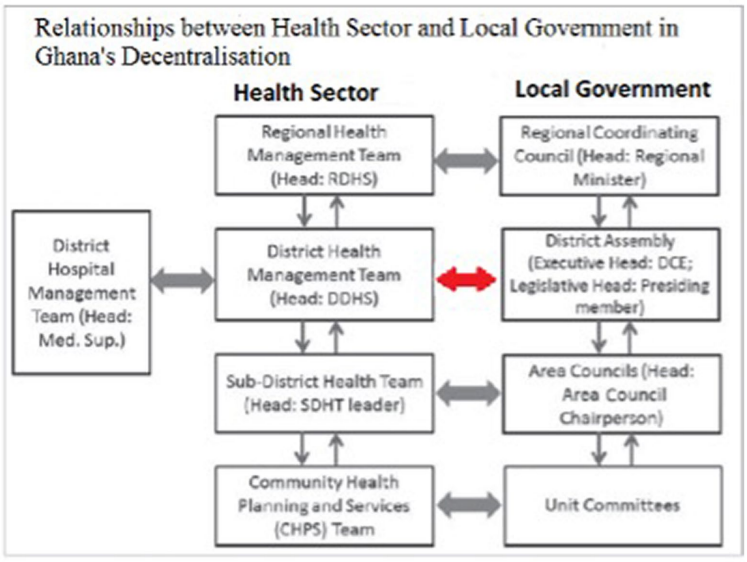

FIGURE 1
Relationship between local government and Ghana health sector in Ghana's decentralization.

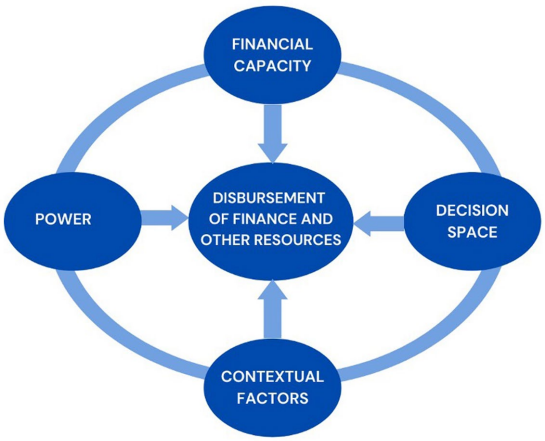

FIGURE 2
Contextual framework of factors influencing the disbursement of financial and other resources by the district assembly to the district health system.

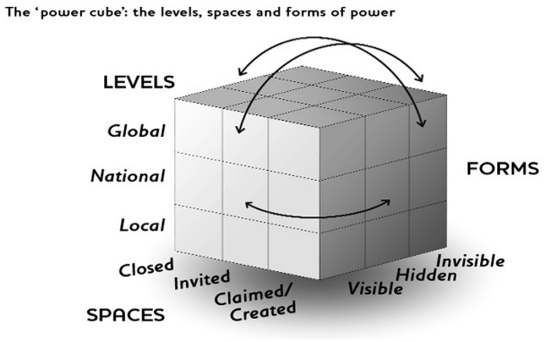

FIGURE 3
The 'power cube'- The levels, spaces and forms of power (Reference: finding the spaces for change: a power analysis. IDS bulletin volume 37 No 6. November 2006. Institute of development studies).

disbursement of financial and other resources by the District Assembly to the District Health System will be influenced by (1) Financial capacity of the district assembly to disburse these resources (including availability of funds), (2) the decision space of the District Assembly under the model of decentralization in implementation (3) the power and use of power by stakeholders and (4) contextual factors.

The above conceptual framework was drawn from aspects of various frameworks. To explore financial capacity, we drew upon Aragon's framework (20). For decision space we drew on Bossert's framework (21), for power we drew on Gaventa's power cube (22) and for contextual factors we drew on Leichter's classification (23).

Aragón (20) has divided organizational capacities into 'hard' capacities such as 'infrastructure, technology, finances and 'soft' capacities, such as the 'human and organizational capacities, or social capital of the organization, including management knowledge and skills, organizational systems and procedures, and procedures for planning and evaluation. The study drew on the organizational systems and procedures to understand the District Assemblies' financial capacity to execute the budget process and the 'soft' capacities that influence the disbursement of funds to the District Health System.

In the Bossert theory, the decision space captures the degree to which local officials make use of decision-making powers and is classified into narrow, moderate and wide in order of freedom to decide. The study drew on the finance component of decision space by officers of the District Assembly in terms of sources of financial resources, allocation from central government as well as their internally generated funds.

As depicted in Figure 3 below, John Gaventa's power framework conceptualizes 'three dimensions' of power as the spaces, levels and forms of power using a cube with each dimension representing one side of the cube (22).

The study drew on the concept of John Gaventa's power framework in terms of how well officers of the district assemblies were able to influence disbursement through the various power structures at national and local levels.

To explore Contextual factors, we drew on the classification by Leichter into Situational factors, Structural factors, Cultural factors and environmental factors (Reference: Howard M. Leichter. A comparative approach to policy analysis. Health Care policy in four nations. Cambridge University Press 1979).

Materials, subjects, and methods

The study design was a multiple (two district) mixed method case study. The comparative study of the two districts was done to enable exploration and understanding of the phenomenon in two different contrasting settings or context.

In the social sciences, the case study design is a common approach to conduct an in-depth investigation of a phenomenon that allows the exploration of the phenomenon of interest in its real-life context. In this case study, the phenomenon of interest was defined as "the why of the disbursement of financial and other (non-financial) resources by local government to the District Health system." The district was considered as the single case or unit of analysis.

Both case study districts are in the Volta Region of Ghana (For the sake of anonymity, the districts are labeled as District A and District B). They were purposively selected to be able to study, compare the phenomenon of interest in a relatively developed and less developed district. The selection was guided by the Ghana District League Table (DLT) Report 2017. The DLT is an index of the developmental status of districts and ranks all the districts in Ghana based on indicators of performance in six key sectors – health, education, sanitation, water, security and governance. These indicators are aggregated into a single index, and districts are ranked from highest to lowest performing. The DLT is a joint Center for Democratic Development (CDD)-Ghana and UNICEF Ghana project, implemented in collaboration with the Ministry of Local Government and Rural Development and the Office of the Head of the Local Government Service. The report ranked District A as low level (less developed) district and District B as middle level (relatively developed).

District A was carved out of a bigger district in 2012 by Legislative Instrument LI.077 and the historic administrative records of that part of the district was assigned to the 'new' district (records before 2012 was retrieved and reviewed for this study). District A is located in the southern part of the Volta Region. The total population as of the 2010

census was 59,411 with a growth rate of 3.5%. The district has a total land area of about 700kmsq and 78.3% of the total households are engaged in agriculture. The major crops cultivated include maize, cassava, rice, pepper and tomatoes. The lower Volta Basin passes through the district and creates the opportunity for fishing. According to the 2019 District development profile document, there is one (1) District Hospital, four (4) Health Centres, one (1) private clinic, fourteen (14) CHPS compounds, one (1) private maternity home and one (1) private clinic. There are 71 basic schools, 50 Junior High Schools and two Senior High schools in the district.

District B is also located in the southern part of the Volta Region with a total land size of 779square kilometers and is a relatively resource-rich district with higher local government revenue generation capacity because it contains a major border crossing point between Ghana and Togo. Thus, goods and passengers traveling use this border crossing. According to the 2010 population and Housing Census, the total population was 160,756 with a growth rate of 2% with a sex ratio of 88.9 males per 100 females. According to the District's 2019 Development profile compiled by the District Planning Committee Unit (DPCU), there are 33 health facilities comprising one (1) Government hospital, three (3) private hospitals, two (2) clinics, nine (9) health centres, two (2) private maternity home and sixteen (16) CHPS compounds. There are 82 public basic schools, 43 recognized private basic schools, 4 public Senior High Schools (SHS), 1 private SHS and one private technical/vocational institute. The population derives its livelihood from agriculture, Salt winning, Trade and commerce. The border market is a commercial distribution centre for agricultural produce from various regions of Ghana. Some of the goods are subsequently exported to Togo.

Data was collected from July 2019 to March 2020 using quantitative and qualitative methods of data collection involving a desk review of administrative documents, secondary data analysis of financial and routine management information system data of the district assembly and the district health system and Key informant in-depth interviews. Routine data compilation forms were designed and used to extract data on budget request, actual receipts, and financial allocations for the District Assembly and District Health system from 2004 to 2018.

Twelve key officials of each district assembly and the district health systems who had worked in the district for at least a year or more were purposively selected for key informant in-depth interviews. These officials were deemed by the District Assembly and District Health Systems to be associated with receipt and disbursement of financial resources by the District Finance officers and District Health Finance officers. District assembly officials interviewed included the District Coordinating Directors, District Finance Officers, Planning Officers, Budget Officers, Internal Auditors, members of the District Planning Committee and Assemblymen who were members of the social services committee. Within the district health system, officials interviewed included the Director of Health Services, District Health Finance Officer, District Public Health Nurse, District Health Service Administrator and Disease Control Officer. Respondents work experience in the District Assembly System in Ghana ranged from 2 years to 26 years (Table 1).

Data analysis and calculations

The transcripts of the key informant in depth interviews were manually analyzed for themes, commonalities, and contrasts drawing on conceptual framework for the study. Additional to the themes from the conceptual framework, the interview transcripts were also analyzed for any new and emergent themes from the data that were not in the framework. The influence of power was analyzed in terms of levels, spaces and forms using data from the in-depth interview and also from the desk review. The decision space for decisions on disbursement of funds was analyzed on a three-point ordinal scale and classified as narrow decision space, moderate decision space and wide decision space. This classification was adapted from Bossert's work (24) on analysis of decision space. In the Bossert's decision space theory, the decision space captures the degree to which local officials make use of decision-making powers. The width of local decision space depends primarily on the degree to which local government decision-makers are permitted to make a variety of financial decisions, as opposed to decisions being handed down. Decision space may be widened or narrowed from below, such as local decision-makers who make decisions regardless of what official rules say or make choices which capitalize to a greater degree on available options (2, 25).

Routine data was entered into an excel spread sheet and analyzed for patterns and trends. We analyzed what percentage of the budgeted total funds the District Assembly received and used it as a proxy of the decision space they were permitted to spend within. The description

TABLE 1 Respondent demographic data.

Variable	District A	District B	Total
Number	12	12	24
Mean age (years)	49 years (Range32-65)	47 years (Range 31–55)	
Mean number of years of work in district assembly/district health system	4.2 years (Range 2–8)	4.2 years (Range 2-7 years)	
Mean number of years of work in the district assembly/district health system of ghana	10.4 years (Range 3–25)	13 years (Range 2–26)	
Male	11	11	22
Female	1	1	2
Groupings			
Officers of the district assembly	5	6	11
Officers of the district health system	4	5	9
Assemblymen	3	1	4

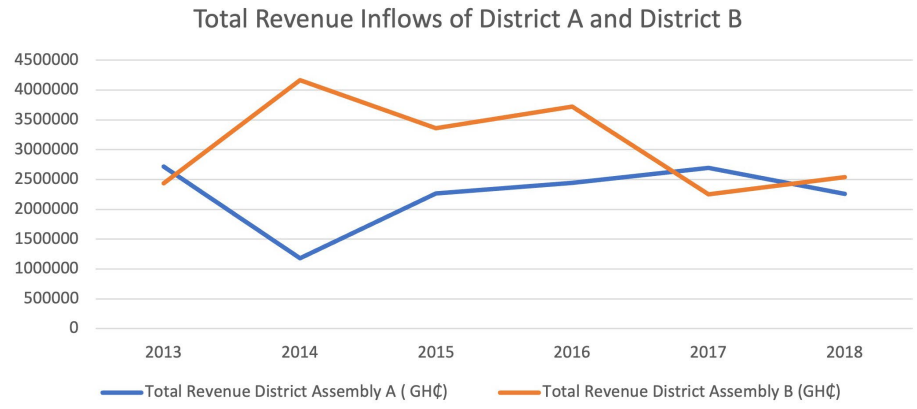

FIGURE 4
Total revenue inflows and the inflows by source for the two districts over the five-year period 2013–2018.

of the sources of financial and other resources of the District Assembly and the proportionate disbursements to decentralized departments in this study was used as a proxy to the financial capacity of the Assemblies to meet their obligations and mandates to support the decentralized departments.

For quality assurance we followed the guidelines on best practices for ensuring rigor in qualitative research (26) and have also referred to the criteria included in the 32-item consolidated criteria for reporting qualitative research (COREQ) checklist to guide our reporting of our study.

Ethical approval was sought from the Ghana Health Service Ethical Review board (GHS-ERC No. 001/04/19) Permission was sought from the District Assembies and District Health Directorate of District A and B, the Volta Regional Coordinating Council and Volta Regional Health Directorate. All primary data was collected with informed consent. Each key informant was given a written study information sheet and a verbal explanation of the consenting process. A written consent form was signed by key informants before they took part in the study.

Results

What are the sources of funding of the district assemblies?

Three sources of financial resources of the two District Assemblies were identified namely: transfers from Central Government that can be from either general tax funding or centrally pooled donor funds; Internally generated funds (IGF) that are mobilized locally by the assemblies from citizens through taxation and other fees and Decentralized development partner funding sent directly to the assemblies with no central government transit.

The two funding pools from which transfers from Central Government are made to district assemblies are the District Assembly Common Fund (DACF) and the District Development Facility (DDF). The District Assemblies' Common Fund (DACF) is a pool of resources from central government tax revenue created under Article 252 of the 1992 constitution of Ghana which requires a minimum of 5% of national revenue to be set aside to be shared among all District Assemblies in Ghana with a formula approved yearly by Parliament. The District Development Facility (DDF) is a donor pooled fund. In 2008, the Government of Ghana (GoG) and the governments of Germany, France, Canada and Denmark joined hands to establish DDF as a central donor pooled fund that is then disbursed by government to the district assemblies. IGF is revenue that is directly generated from citizens by District Assemblies (DAs) within their area of jurisdiction from local government taxes and other fees.

Figure 4 above shows the total financial resources that was received by the two study districts assemblies (A and B) from 2013 to 2018 and displays the irregular financial inflows. District B received more resources than District A from 2014 to 2016. In 2017, District A received more financial resources. District Assembly A experienced a decrease in financial resources from 2017 to 2018 whiles District B had a marked decrease in 2016 to 2017.

Also, analyzing the *per capita* District Assembly financial resource gave another difference between the financial capacity of the DAs. The population of District A in 2018 was 71,331 and the total financial resources was GH¢ 1,929,836.19. Therefore, District A's *per capita* financial resources for disbursement was GH¢ 27.05 whiles District B's *per capita* financial resources was GH¢12.82 because their 2018 population extrapolated from the 2010 census was 198,459 and their total revenue was GH¢ 2,544,864.35.

Figures 5, 6 shows the relative levels of the different sources of financial resources to the district Assemblies. The two districts received financial resources from the three sources. The District Assembly Common Fund (DACF) was the highest financial resource to the two District Assemblies. District B received higher amounts for DDF and IGF from 2013 to 2018. In 2017 and 2018, District B's DACF was generally higher than District A. The trend for sources from central government (DACF and DDF) was irregular from 2013 to 2018. The trend of IGF seemed relatively consistent from 2013 to 2018 in both Districts.

How much of these resources do DA disburse to support the programmes of the DHS?

Tables 2, 3 shows how much of the District Assemblies' financial resources was disbursed to the District Health System. The proportion of the total District Assembly financial resources was irregular for both District Assemblies. The proportion per year was also different in the two

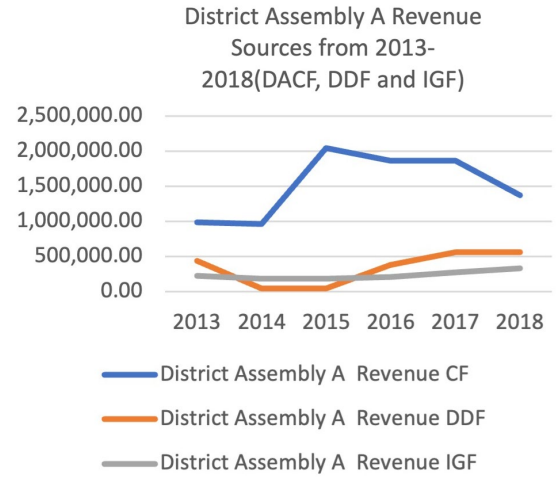

FIGURE 5
Ketu south municipal and central Tongu district revenue sources from 2013 to 2018.

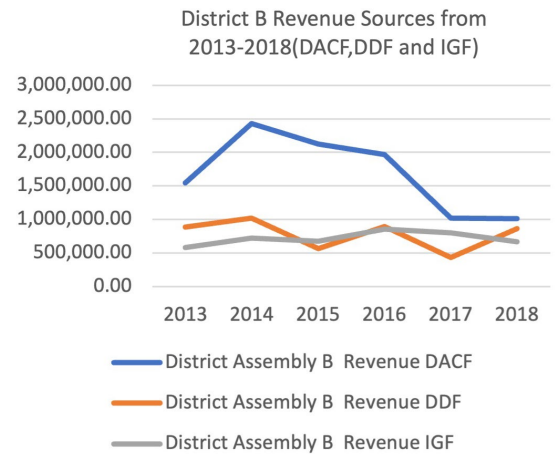

FIGURE 6
Percentage of budget received by district A and district B from 2013 to 2018.

study districts. Funding of programmes of the District Health Systems (DHS) was limited and erratic in both districts (see Tables 4, 5). The better resourced District Assembly B provided more support to the district health system than the deprived District Assembly A. District Assembly A did not fund any programmes of the District Health System, except for HIV activities which was carried out by the Social Welfare department in collaboration with the District Health System. District Assembly B funded several of the programs of their DHS. The financial support ranged from 3 to 16.9% of the total cost of the programs. Majority of the programs funded by District Assembly B from 2004 to 2018 were programs initiated at the national level (e.g., National Immunization Campaigns, National Malaria Long-lasting bed net distribution campaigns).

The issue of District Assemblies disbursing limited and irregular support to the programmes of the DHS was corroborated by the results of the in-depth interviews.

> *"When we requested for money for NID, they ended up giving GHS 500 only. How do we use such a meagre amount to purchase enough fuel for such activity? So, we don't get financial support from the assembly."* (Health Officer, Central Tongu District)

The District Assemblies' main support to the District Health System were in infrastructure as shown in Tables 6, 7 below.

Key informants explained that the community demand for health services were mostly construction of health facilities. It was not always clear to service providers how decisions as to where to site the clinics were finally arrived.

> *"In terms of support, we get infrastructural support like CHPS compounds (which they put up at places which sometimes we don't want). Apart from that, there is no financial support. I don't think health should go under the Assembly."* (Health Officer, District A)

Most infrastructure projects took 2–3 years to complete because of inadequate financial resources and some had to adjust the original cost to accommodate inflation. Others were left uncompleted because other priorities took up the resources of the District Assembly. The DACF and DDF were the main sources of funding for these projects. Participants explained that political gains were what motivated the District Assemblies to initiate more projects than their funding sources can support.

> *"Sometimes, the Assembly is seen doing more projects for political gains but it is not the best. It is better to build 2 CHPS and pay upfront rather than spreading many projects which cannot be paid for, early".* (District Assembly officer, District B)

TABLE 2 District A assembly total revenue and amount disbursed to district health system.

District A assembly revenue (GH¢)					Amount disbursed to district health system health	% disbursed to district health system health ghc
	DACF	DDF	IGF	Total		
2013	2,065,985	433,280	219,836	2,719,101	270,202	10%
2014	957,087.01	42,720	180,000	1,179,807.01	437,667.28	37%
2015	2,046,574.57	42,720	180,000	2,269,294.57	437,667.28	19%
2016	1,861,218.58	378,720	203,241.20	2,443,179.78	258,667	11%
2017	1,865,485.72	555,675	274,642	2,695,802.72	1,128,262	42%
2018	1,373,832.19	555,675	329,670	2,259,177.19	1,053,862	47%

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TABLE 3 District B assembly total revenue and amount disbursed to district health system.

District B assembly revenue (GH¢)					Amount disbursed to district health system health	% disbursed to district health system health
	DACF	DDF	IGF	Total		
2013	1,548,201.71	889,000.90	580.922.15	2,437,202.61	52,164.20	2%
2014	2,428,565	1,020,392.15	719,756.67	4,168,713.82	32,059	1%
2015	2,125,155.92	562,402	672,215.10	3,359,773.02	80,635.60	2%
2016	1,965,522.99	897,200	858,102	3,720,825.23	511,583.27	14%
2017	1,020,400	432,546.36	800,635.60	2,253,581.96	580,191.84	26%
2018	1,010,954.26	865,836.97	668,073.12	2,544,864.35	87,119.05	3%

TABLE 4 District assembly A's disbursement for HIV programme from 2013 to 2018.

Year	District Assembly A Funding Support for HIV Programme from 2013–2018
2013	I,440
2014	1,689.19
2015	706.59
2016	1,302.75
2017	1,313.67
2018	1,348.82

District Assemblies (DA) did not specifically disburse financial resources for Maternal Newborn and Child Health (MNCH) related services which was one of the services the study expected the Assemblies to prioritize in terms of programmatic funding. Officers of the Assembly interviewed said they believed that every disbursement to health was a disbursement for MNCH related services since investments such as CHPS compounds, emergency ward and model schools for girls all ultimately benefitted MNCH.

> *"We have a lot of maternal and child health problems in the communities. That is why we are now shifting our attention from education infrastructure to health. I am spending more on health than education. I want to at least construct not less than one CHPS compound in every single electoral area. That is my target now."* (District Assembly Officer, District A)

Tables 8, 9 shows the irregular patterns of disbursements to the two study districts. In 2017 and 2018, District A disbursed more of its resources to Health whiles District B disbursed more of its resources to Education.

How are disbursement decisions made?

The local government budget process is influenced by the needs of the communities as well as the prioritization process based on the central government's budget ceiling given to the District Assembly. The District Planning Committee Unit (DPCU) which comprises officers of the District Assembly, Chairpersons of Committees of the District Assembly and Heads of Departments coordinate the process.

TABLE 5 District assembly B's financial support for programmes of the district health system from 2004–2015.

Year	Health programmes funded by the DA	Amount of funding support (GH¢)	Total cost of the programmes carried out by the district health system for the particular year (GH¢)	Percentage of the total cost the municipal assembly's support to DHS programs
2004	NID (National)	2,100	25,365	16.9%
	Cholera (Local)	2,185		
2005	NID (National)	4,600	56,685	11.6%
	Malaria (National)	2,000		
2009	NID (National)	10,058.50	115,694.73	10.3%
	Research (local)	1,816		
2010	H1NI flu (National)	3,000	90,780.44	3.3%
2011	NID (National)	15,088.32	112,578.32	19.1%
	Cholera (local)	6,371		
2014	NID (National)	2,080	68,933.73	3%
2015	NID (National)	15,440	112,761.55	13.7%

NID, national immunization days; DA, district assembly.

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The budget process, which was similar in both study districts, began with the DPCU in the Assemblies engaging the communities in meetings with citizens to gather information on their needs.

> *"We do community durbars, town hall meetings just to inform them and most of the time, you will hear the honorable DCE on radio. Almost every week community radio sensitizes the community on what the assembly is doing and our next plan"* (Assembly Officer, District A)

TABLE 6 District assembly A's disbursement for district health system health infrastructure from 2007 to 2018.

Year	Community/facility	Budgeted cost of project (GH¢)	Amount disbursed by the district assembly (GH¢)	Percentage of budgeted cost disbursed by district assembly (%)
2007–2009	CHPS A1	33,339.57	33,339.57	100%
2011	CHPS A2	76,915.96	72,255.71	93.9%
2011–2013	Health centre A3	43,416.45	45,571.40	104.9%
2012–2013	CHPS A4	56,754.37	53,067.53	93.5%
2012	CHPS A5	30,426.60	10,563.91	34.7%
2012–2013	CHPS A6	45,488.14	44,797.03	98.5%
2016–2018	District hospital A7	258,880.75	78,732.11	30.4%
2017–2018	CHPS A8	239,534.57	174,000.00	72.6%
2018–2019	CHPS A9	249,914.00	208,671.70	83.5%
2016–2018	CHPS A10	32,620.00	32,620.00	100%

TABLE 7 District assembly B's budget and expenditure on health infrastructure from 2012 to 2019.

Year	Community/facility	Budgeted cost of project (GH¢)	Amount disbursed by the municipal assembly	Percentage of budgeted cost disbursed by district assembly (%)
2015–2017	CHPS B1	184,300.73	184,300.73	100%
2016–2018	CHPS B2	179,339.64	192,217.05	107.1%
2012	CHPS B3	85,385.33	11,972.19	14%
2012	CHPS B4	87,183.35	12,221.54	14%
2012	CHPS B5	86,130.52	12,078.67	14.3%
2012	CHPS B6	85,662.95	12,247.50	14.3%
2015–2017	CHPS B6	181,964.90	112,629.01	61.9%
2015–2019	CHPS B7	177,320.33	136,000.00	76.7%
2016–2018	CHPS B8	110,622.54	96,241.36	87%
2014–2019	CHPS B9	94,333.58	89,616.75	94%
2009–2012	CHPS B10	58,603.90	52,532.27	89.6%

TABLE 8 Percentage of district assembly A's revenue disbursed to health, education, and sanitation departments from 2013 to 2018.

Year	Health	Education	Sanitation
2013	10%	10%	11%
2014	37%	25%	28%
2015	19%	14%	6%
2016	11%	21%	11%
2017	42%	23%	10%
2018	47%	28%	12%

TABLE 9 Percentage of district B's revenue disbursed to health, education, and sanitation departments.

Year	Health	Education	Sanitation
2013	2%	4%	31%
2014	1%	2%	14%
2015	2%	18%	17%
2016	14%	23%	10%
2017	26%	41%	20%
2018	3%	12%	4%

The heads of various departments were also asked to bring their departmental needs as inputs into the budget process. These inputs were fed into the development of four-year medium-term plans within the ceilings received for their budgets from central government. The needs were prioritized to fit into the ceiling given by central government. The budget developed was sent to the Finance and Administration subcommittee for scrutiny before been submitted to the Executive Committee of the District Assembly. From there, it was sent to the General Assembly for approval of the final budget, spelling out how the Assembly intended to disburse the financial resources.

> *"Before we do our medium-term development plan, there is need assessment where we go to the communities and do stakeholder consultations. At times, their needs are more than necessary so we have to prioritize the community needs".* (District Assembly Officer, District B)

The Central Government and local political leaders were very influential at the prioritizing stage of the budget process. The need for choices to be made generated the intense lobbying and the use of power to prioritize the budget items. The prioritizing process resulted in 'elite capture" of projects in some instances despite efforts to make the process as objective as practicable. The percentage of the revenues of the District Assemblies disbursed to health in relation to two major departments of the DAs revealed an irregular and inconsistent disbursement pattern from 2013 to 2018 as shown in Tables 5, 6 below. In 2018 for instance, 47% of District Assembly A's financial resources was disbursed to Health, whiles District Assembly B disbursed 3%. In that same year (2018), District A disbursed 28 and 12% to education and Sanitation departments, whiles District B disbursed 12 and 4%, respectively.

Key Informants mentioned that in spite of this theoretical structured process, the District Assembly's disbursement was influenced by political factors such as the ability of stakeholders to lobby the District Assembly authorities.

> *"You channel your lobbying through the Social Services Committee (SSC) to the Executive Committee (EXECO) and through the EXECO to the General Assembly. But if the General Assembly approves and you need the work to be done, then you have to lobby the DCE so that he can release the funds. The same applies to the MP's fund"* (Health Officer, District A)

> *"After you have finished preparing your budget, the government of the day will choose what the Common Fund should be used for. For instance, maybe the government needs 3 classrooms or CHPS compounds or a number of bore-holes. So, this can influence the budget we have prepared already because the project that the government is proposing might not be in the budget, so you have to drop some to suit the needs of the politician. So, when it happens like that, we roll it over to the following year."* (District Assembly Officer, District B)

> *"Yes, politics play a part in it. The politicians know their stronghold. Being a traditional leader, I have a fair idea of the communities' needs and the distribution. So, when it comes to prioritization. We know which areas to prioritize. We don't have the power to stop them (politicians) but we can lobby".* (Assemblyman District A)

Occasionally, situational factors like rainstorms and security issues influence the capacity of the DAs to disburse resources. This was confirmed by participants in the study:

> *"Maybe there is a rainstorm somewhere or a CHPS compound unroofed by rains. With that one, we have to get some money to them. We usually go for some contractors who can pre-finance it when such things happen and we pay afterwards"* (Assembly Officer, District A)

> *"let's say if there's security issue right now, we have to deal with it till it is over, because if we allow it to escalate, then it means our work in the district will be affected"* (Assembly Officer, District B)

Decision space, power, and disbursement of financial and other resources

The three sources of funding to the district assemblies as shown in Figures 5, 6 reveals that the District Assembly Common Fund (DACF) received from central government formed the highest source. Also, the District Development Facility (DDF) is a donor pooled fund allocated by central government. The internally generated fund which was within the control of the district assemblies was meagre. The officers of the District Assemblies (DAs) had no power over how much money they received from the national level and their receipts did not depend on how much they needed to deliver services to their departments or communities, but rather how much the national level had to offer. The district assemblies' control over their revenue sources and central government allocations for their budgets was limited. Though decision space involves a complex determination of how many choices over different and the use of funding local officials are allowed (Bossert) the study decided that if receipts from central government was less than 25% of the DAs' budget, their decision space will be determined as narrow. If receipts are more than 75% of their budgets, their decision space will be classified as wide. If it falls in between 25 and 75%, the decision space will be determined as moderate. From the study, District A received 44.7–75% of the budgeted funds from Central Government between 2013 and 2018 whiles District B received 42–83% in the same period (Figures 5, 6). This placed District A in the moderate decision space classification from 2013 to 2018 except for 2016 when 75% of their budget was realized, hence the district was classified in the wide decision space category for that year. District B experienced moderate decision space for 2013, 2014, 2017, 2018 and had 77 and 83% of their budget in 2015 and 2016 respectively, classifying their decision space as wide in the 2 years. The reduction of 30–41% in requested financial resources received by the District Assemblies in addition to a very irregular inflow. Adversely influenced their decision space. This assertion was expressed by participants.

> *"Most times they serve us with a letter, indicating that this is our money, for this Assembly for this particular quarter. We don't have any say."* (Assembly Officer, District B)

> *"Normally, the government brings what we call budget guidelines and, in the guidelines, they give us the ceiling."* (Assembly Officer, District A)

> *"Sometimes we have two or three quarters arears"* (Assembly Officer, District A)

The inadequate budgets and irregular flows rather than the felt needs of citizens determined how much of the local needs the District Assemblies were able to meet in a particular year.

Discussion

Our findings suggest that even when summed up, the revenue from the three major sources of funding for district assemblies in Ghana is inadequate. Resource flows are moreover irregular and unpredictable. Though a formal process of developing district plans and budgets that involves consultations with communities and the decentralized departments occurs, the final budgets received l are only 42–83% of what is needed to execute these plans. This constrains decision space. The formal budget process are interrupted with the influence of powerful actors resulting in irregular and uncertain expectation of financial resources at the District Assemblies for disbursement. Moreover, apart from the formalized prioritization processes, in the context of multi-party democracy, political processes and lobbying also influence final disbursement decisions. Funding of the district health system by the local government is limited.

Central Government transfers which comprised the District Assembly Common Fund (DACF) and the District Development Facility (DDF) formed the major part of the financial resources of the district assembly. The amount of money from these two sources was consistently lower than the resource needed to fully finance district developmental and service delivery plans including health. Also, the total amount of District Assembly Common Fund allocated by Parliament influenced the capacity of the Assembly to disburse financial resources. This amount is prescribed by law, with Article 252 of the Constitution of Ghana stipulating that 'not less than 5 % of the total revenues of Ghana' should be shared among the districts.

Locally generated revenue (IGF) was limited in both districts and even more so in the less developed District A. The capacity of the District Assembly to compliment the Government transfers was limited by their inability to collect enough local generated revenue (IGF) from the citizens in the district. This made it difficult for the District Assemblies to adequately support District Health Systems.

The District Assemblies did not appear to have much power to influence the central government on the issues of budget ceilings for central funds. At the same time the limited local revenue generation (IGF) does not confer enough power for the District Assemblies to challenge the dictates of the central government even if they 'do not agree'. These findings are similar to studies done in Kenya in which sub county managers experienced loss of autonomy and resources in a paper by Nyikuri et al. titled "We are toothless and hanging, but optimistic" (27). The study into the Utilization of the District Assemblies' Common Fund (DACF) done in the New Juaben Municipality and published in 2013 revealed that the District Assembly does not receive the total amount of DACF budgeted for each year. The findings in that study were that the DACF received in 2008, 2009, and 2010 were 46.67, 51.33, and 40.75% (11). The phenomenon of inadequate resource flow from central government is therefore a long standing issue that significantly influences the ability of the district assemblies to disburse enough resources to its departments and decentralized units.

The possibility of policy elites and officials capturing resources and the democratic process has long been a concern in democratic theory of decentralization. This is because the shift of power from the centre to the periphery is premised on the belief that local democratic institutions are the key to people being able to govern themselves but this is not wholly true (28). According to Ahwoi (29), one reason that accounts for this is the fact that the District Chief Executives are appointed by the president and therefore makes them defenders of central Government priorities rather than advocates of local priorities and interest (29). Also, Chiefs and traditional authorities, by virtue of their virtual exclusion from the local government system, have been rendered ineffective for forcefully articulating local priorities through the formal District Assembly processes of budgeting and prioritizing.

In line with the Bossert decision space approach, successful implementation of the devolution of the health system will depend on understanding the choice and decision space that is transferred from the central Ministry of Local Government to the District Assembly. It also depends on how much power is transferred to local officials of the District Assemblies to enable them exercise their discretion in disbursement of financial and other resources to the health department to run the needed health programmes (30). Hence the observation that the guidelines for the DDF and DACF created irregular patterns of moderate and high decision space for the officers of the District Assemblies was significant. The programmes that were national in nature like National Immunization Day campaigns (NID) in District B and HIV programmes in District A received support from the assemblies shows the influence of the national level on disbursement decisions to the District Health System. The DDF and DACF were mainly disbursed for infrastructure and capital expenditure. Contextual factors may serve as a source power to influence policy actors' action, inaction, and choice (31). The resource constrained economic context of Ghana is undoubtedly part of the reason for the limited central transfers to the district assemblies as well as the challenges with additional local resource mobilization. The resulting reduction of 30–41% in financial resources in the budget that were actually received by the District Assemblies in addition to very irregular inflow limited decision space, hence decisions made based on the budgets were not carried out as expected.

If devolution of health to local government is to lead to improved performance of the district health systems and population health outcomes, decentralization policies should also focus on increasing central funds transfers to districts assemblies and support the District Assembly's ability to generate substantial IGF. Additional to increased resource availability, there will be a need to strengthen the selection of what to fund with the resources. Also, there should

be monitoring and evaluation of the impact of the programs and activities prioritized by district assemblies for funding on population health outcomes. It will be important to explore policies and strategies that will regulate the balance of power between community members and their representatives, politically appointed officers like the District Chief Executives (DCEs), technocrats and public servants and officers of District Assemblies in the decentralized departments and agencies. This can help to promote prioritization of disbursement decisions that respond more to local situational analysis and needs and limit undue political influence over the disbursement of central government allocations and Internally Generated Funds. Sub-optimal prioritization will further adversely affect the health and wellbeing of communities in the context of limited resources. Before the devolution of the District Health System to the District Assemblies using Act 936 (Local Government Act 2016) is implemented, the Ghanaian Parliament should open a dialogue with the District Assemblies about increasing the minimum of 5.0% of the national revenue set aside to be shared among all District Assemblies. Technical analysis should be commissioned to ascertain the minimum percentage that may be more reasonable in terms of moving forward human development, population health and well-being at district level to inform the debate. It will also be necessary to build capacity for district level officials and decision makers on local situational analysis, planning and selection of interventions for improving population health to help the assemblies look beyond infrastructure development and centrally initiated programs.

Limitations of the study.

We used the sources of finance and other resources of the District Assemblies as a proxy for the financial capacity and did not study the human resource skill mix and its influence on the decision-making processes on resource mobilization. This may have affected the interpretation of the relative amounts of the sources of financial resources of the District Assemblies that needed to be disbursed in particular ways. Also, we did not study the capacity of the District Health System to influence the disbursement of resources from the District Assemblies in terms of lobbying and relationship to the District Assemblies.

Conclusion

The District Assemblies disbursed funds to the District Health Systems, but the high level of dependence on central government for financial resources associated with ceilings imposed on government allocations adversely influenced the power and decision space of the officers to disburse financial and non-financial resources to the District Health System. Also, though most of the budget was disbursed for infrastructure, there were reduced allocation of resources for services. Though the District Assemblies tried to be objective by involving its citizens in the selection of expenditure. Contextual factors like politics, economics, legal and situational factors working in an interrelating manner had significant influence as constraints as well as opportunities for disbursement of funds. This study confirmed the starting theorization that the disbursement of financial and other resources by the District Assembly to the District Health System was influenced by financial capacity of the District Assembly to disburse these resources, the decision space of the District Assembly under the model of decentralization, the power and use of power by stakeholders and context.

Recommendations

The District Assemblies should be encouraged to support services and programmes of the District Health System aside the infrastructural support. Officers of the District Health System should be trained in lobbying skills to enhance their capacity to influence disbursement for services and programmes. Another important assessment that should be considered before the implementation of devolution of the District Health System is the readiness of the District Assemblies in terms of financial capacity, power relations and decision space available to officers as well as the effectiveness of the vehicle for articulating local needs through the formal budgeting systems.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

AA, IA, and NE: conception or design of work. AA: data collection and final approval of the version to be published. AA and IA: data analysis and interpretation, drafting the article, and critical revision of the article. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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"We have nice policies but…": implementation gaps in the Ghana adolescent health service policy and strategy (2016–2020)

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Introduction: Although policies for adolescent health exist in Ghana, their implementation is challenging. Availability of services for adolescent sexual and reproductive health and adolescent mental health remains less than desired, with adolescent mental health being particularly neglected despite being an important contributor to poor health outcomes. This study presents an analysis of gaps in the implementation of the Ghana Adolescent Health Service Policy and Strategy (2016–2020), including how and why the context influenced the observed implementation gaps.

Methods: Data for this study is drawn from 17 in-depth interviews with purposefully identified key stakeholders in adolescent mental, sexual, and reproductive health across the national and subnational levels; four focus group discussions (FGDs) with district health management teams; and 11 FGDs with adolescents in and out of schools in four selected districts in the Greater Accra region. Data were analyzed using both inductive and deductive approaches. The deductive analysis drew on Leichter's conceptualization of context as structural, cultural, situational, and environmental factors.

Results: Of the 23 planned strategies and programs for implementing the policy, 13 (57%) were partially implemented, 6 (26%) were not implemented at all, and only 4 (17%) were fully implemented. Multiple contextual factors constrained the policy implementation and contributed to the majority of strategies not being implemented or partially implemented. These factors included a lack of financial resources for implementation at all levels of the health system and the related high dependence on external funding for policy implementation. Service delivery for adolescent mental health, and adolescent sexual and reproductive health, appeared to be disconnected from the delivery of other health services, which resulted in weak or low cohesion with other interventions within the health system.

Discussion: Bottom-up approaches that engage closely with adolescent perspectives and consider structural and cultural contexts are essential for effective policy implementation. It is also important to apply systemic and multi-sectoral approaches that avoid fragmentation and synergistically integrate policy interventions.

KEYWORDS

adolescents, youth, sexual health, reproductive health, mental wellbeing, mental health, Ghana, implementation

1 Introduction

Globally, 1.3 billion adolescents comprise 16% of the world's population (1). An estimated 23% of the population in West and Central Africa are adolescents, and this percentage is predicted to grow to 32% between 2019 and 2030 (2). In Ghana, where this study was conducted, adolescents (10–19 years) comprise approximately 22% of the population (3).

Adolescence, the period between childhood and adulthood (ages 10–19 years), is a very turbulent period marked by various physiological, psychological, physical, and social changes and sexual development. This is also the phase where habits are formed in relation to diet, physical activity, substance abuse, and sexual activity, which can safeguard the health of adolescents or put them at risk in the future (1). According to the World Health Organisation (WHO), 1.1 million adolescents die each year, with the leading causes of death being road injuries, suicide, and interpersonal violence (4). In terms of years lost to disability (YLD), the five top causes among 10–14-year-olds are unipolar depressive disorders, iron deficiency anemia, asthma, back and neck pain, and anxiety disorders. This picture is similar for 15–19-year-olds, with the only difference being that asthma is replaced by alcohol use disorders among men (5). Adolescent health should be a global health priority as it will have profound implications for social, political, and economic development.

While adolescent pregnancy, childbirth, and early child marriage have declined globally, these remain disproportionately high within the West African sub-region (6). According to the Ghana District Health Information Management System (DHIMS), in 2020, a total of 109,888 teenage pregnancies were recorded, with 2,865 being among girls aged 10–14 years. These may be underestimated since home deliveries, which are not captured in the DHIMS, still occur in Ghana. Similarly, child marriages continue to be high, with 79,733 girls aged 12–17 years reported to be married or already living with a man, thus contributing to high incidences of adolescent pregnancy and childbirth (7).

Adolescent health and wellbeing is a stated priority in West Africa. In 2016, the West Africa Health Organisation (WAHO), the health branch of the Economic Community of West African States (ECOWAS), developed an orientation manual for the development of national strategies for adolescent and youth health in the countries of ECOWAS (8). The manual aims to help governments develop or update national strategies, policies, and programs for adolescent and youth health, including Adolescent Sexual and Reproductive Health (ASRH) policies. In Ghana, the Adolescent Health Service Policy and Strategy (2016–2020) mirrors the strategies and policies for adolescent health in the ECOWAS manual with a focus on sexual and reproductive health, HIV/STIs, mental health conditions, communicable and non-communicable diseases, interpersonal violence, as well as intentional and unintentional injuries (9).

Mental health has been and remains a neglected priority in Ghana and globally. Despite the introduction of community-based mental health workers in 2007, access to mental health services remains generally low at the primary healthcare level, and access is even lower for adolescents (10, 11). However, mental health services for adolescents are very important, as approximately 75% of mental health conditions develop in the period of adolescence (12). Several studies have shown that unresolved mental health conditions experienced during adolescence continue into adulthood and impact other health outcomes (13, 14). Furthermore, poor mental health is often related to other health and developmental issues, such as low educational achievements, substance abuse, violence, and poor reproductive and sexual health (12). Thus, it is imperative that mental health services to adolescents are prioritized to mitigate the triggers that can lead to risky sexual behaviors, substance abuse, low educational achievements, violence, and poor nutrition (12).

The Adolescent Health Service Policy and Strategy (AHSPS) (2016–2020) was developed by the Ghana Health Service and the Ministry of Health, with inputs from the National Population Council, Ghana Education Service, National Youth Authority, the National Commission for People with Disabilities, and various non-governmental organizations and development partners. The vision of the AHSPS (2016–2020) was "*to improve the health status of adolescents and young people through equitable access to appropriate, comprehensive, gender-sensitive, quality and cost-effective adolescent and youth responsive health information, education and services*" (9).

Despite the existence of this comprehensive adolescent health policy in Ghana, observation suggests that many challenges the policy was aimed to address continue to persist, resulting in several gaps between the stated policy objectives and what occurs in practice. Understanding how the policy was implemented and why policy implementation gaps persist is necessary to inform future policies with lessons learned.

Several studies have explored different aspects of policies and interventions for adolescent health that may help explain gaps in policy implementation; however, most focused on only specific aspects of adolescent health. These included analyses of barriers and facilitators of implementation of policies for reducing adolescent pregnancy in Ghana (15), barriers to access and provision of adolescent sexual and reproductive health services (16–18), care-seeking behaviors and how that affects the provision of mental health (19), barriers to low uptake of contraception (20), and awareness of rights with regards to reproductive health (21–24). Thus, the literature contains a somewhat fragmented narrative that covers particular interventions or challenges rather than convey a comprehensive analysis of a holistic national policy to understand how and why the policy was implemented within its specific context. Context can nonetheless be an important part of the explanation of the "how and why" of policy implementation gaps and therefore requires careful analysis.

The objective of this study is to report the analysis of the Ghana Adolescent Health Service Policy and Strategy (2016–2020), including its contents, how the policy was implemented, which gaps in implementation were observed, and the important role of context in policy implementation. This study is drawn from a larger multi-country study on adolescent health in West Africa, which aimed to understand how and why adolescent mental, sexual, and reproductive health and wellbeing policy and program priorities are implemented at the primary care level in Ghana, Niger, and Burkina Faso. We hope that it will be of relevance to those interested and engaged specifically in improving adolescent health in similar settings and advancing understanding of policy implementation more generally.

2 Methods

2.1 Study design

The study was a qualitative single case study design. We defined the case as a national adolescent health policy with a completed implementation period. We purposefully chose the Ghana Adolescent Health Service and Policy Strategy document (2016–2020), after mapping different policy documents and legislation on adolescent health in the 10 years preceding the study (2011–2021). At the time of the study, the Adolescent Health Service and Policy Strategy document (2016–2020) met the eligibility criteria of a contemporary policy with a completed implementation policy period.

2.2 Study setting

The study was conducted in the Greater Accra region, one of 16 administrative regions of Ghana. Greater Accra is the most urbanized region in the country, with 91.7% of its total population living in urban centers (3). The Greater Accra was purposively selected because of three considerations. First, it comprises people with diverse cultural, religious, educational, and ethnic backgrounds, thus making it an ideal setting for the analysis of policy implementation. Second, Greater Accra is the administrative capital of Ghana, and it was easy to access relevant national and sub-national level stakeholders who were involved in the development and implementation of the AHSPS document. Third, it is the region where the research institution was based, thus making the study feasible within available resources.

Four districts were purposively selected within the region to aid the understanding of how the policy was implemented at the primary care level. Criteria for selection were driven by our intention to get a mix of the varying district contexts of highly urbanized, rural, and peri-urban, as well as districts where the Ghana Education Service and Ghana Health Service authorities allowed access for the research team to work in.

2.3 Methods and participants

The data was collected between June 2021 and December 2022 using a combination of multiple qualitative methods. These included desk review of policy documents, key informant in-depth interviews, and focus group discussions (FGDs).

An initial desk review of gray and published literature, policy documents, and legislation was conducted between June 2021 and October 2021. Purposive and snowballing sampling was used to identify and recruit participants for the key informant in-depth interviews. The initial list of key stakeholders at national and subnational levels to interview was derived from the lists of stakeholders involved in policy development and implementation compiled from the desk review. Subsequently, in the interviews with these purposively selected participants, they were asked about any other stakeholders. This led the researchers to several other relevant stakeholders in a snowballing approach. Seventeen national and sub-national stakeholders were interviewed in total. They included eight policymakers and program heads/officers in governmental institutions, four stakeholders from non-governmental organizations involved in adolescent sexual reproductive health, one non-governmental organization involved in mental health, four development partners funding adolescent health, and one international research and policy organization in sexual health and reproductive rights. Interviews were held virtually via ZOOM® or in person at various offices with observance of all applicable COVID-19 protocols (wearing face masks, hand washing, and social distancing). The choice of in-person or online interviews was left to participants to decide, amidst the COVID-19 concerns in 2021. Nine participants opted for an online interview and eight for in-person interviews. While in-person interaction is preferred in qualitative research to enable the identification of non-verbal clues, the researchers found that for senior policymakers, there was less distraction during virtual interviews as opposed to in-person interviews.

Four FGDs were held with District Health Management Teams (DHMT) and 11 FGDs with adolescents in and out of school aged 14–19 years. To recruit adolescents in school for the focus group discussions (FGDs), all junior and senior high schools in the four selected districts were mapped and stratified into rural and urban, public and private, and boarding and day schools. Schools were purposively selected in collaboration with the district education offices to ensure representation of rural and urban, and day and boarding schools. To identify and reach out-of-school adolescents for FGDs, the researchers consulted community and opinion leaders about where to find them. The FGDs with DHMTs took place at the district health directorate offices. The DHMT comprises the District Health Director, District Director of Nursing Service, District Health Public Nurse, District Accountant, District Health Promotion Officer, District Nutritionist, District Adolescent Focal Person, and a Mental Health Officer. Representations of DHMT in the FGDs are captured in Table 1.

FGDs with in-school adolescents were conducted in their schools and with out-of-school adolescents at venues where they worked and congregated, such as car washing bays and markets. As with in-depth interviews, all national COVID-19 protocols were observed during FGDs. This included wearing masks, washing hands, socially distancing, having the discussions in well-ventilated rooms with open windows, and limiting the number of people, including members of the research team, present at a time to 10–15 people. Participation in the study was voluntary, and participants gave their written consent before any primary data collection. Additionally, for adolescents in school, consent was also sought and granted by the School Health Programme (SHEP) Coordinator of the district, who acted as guardian for adolescents younger than 18 years in boarding school. For out-of-school adolescents younger than 18 years, consent was sought from parents and guardians.

2.4 Data collection tools

All interviews and FGDs were informed by semi-structured question guides. Question guide for interviews with national and sub-national stakeholders focused on exploring their knowledge, experiences, and perceptions about policies and programs for adolescent sexual and reproductive health and adolescent mental health and wellbeing. It contained questions about their interests, perceived power, influence over the design and implementation of policies and programs, the status of implementation, perceptions

TABLE 1 Composition of focus group discussions with district health management teams, Greater Accra Region, Ghana, 2012–2022 ($n = 22$).

FGD with DHMTs	Present at FGD	Total number of participants
FGD District 1	District Health Director, District Accountant, District Director of Nursing Services (DDNS), District Public Health Nurse	4
FGD District 2	District Health Director, District Public Health Nurse, District Accountant, District Health Promotion Officer, District Director of Nursing Services (DDNS)	5
FGD District 3	District Health Director, District Public Health Nurse, District Accountant, District Health Promotion Officer, District Director of Nursing Services (DDNS), District Nutritionist, District Adolescent Focal Person	7
FGD District 4	District Health Director, District Public Health Nurse, District Accountant, District Health Promotion Officer, District Director of Nursing Services (DDNS), Mental Health Officer	6

TABLE 2 Demographic characteristics of adolescent focus group participants, Greater Accra Region, Ghana 2022 ($n = 82$).

Focus group discussions with adolescents	Age range (years)	Number of participants	Level of education
FGD 1 (Girls)	16–18	8	Senior High School
FGD 2 (Boys)	17–19	8	Senior High School
FGD 3 (Girls)	16–19	8	Senior High School
FGD 4 (Boys)	16–19	9	Senior High School
FGD 5 (Girls)	14–17	6	Senior High School
FGD 6 (Boys)	16–18	6	Senior High School
FGD 7 (Girls)	16–19	8	Senior High School
FGD 8 (Boys)	17–19	8	Senior High School
FGD 9 (Boys)	14–19	5	Out of School Adolescents
FGD 10 (Boys)	18–19	8	Out of school Adolescents
FGD 11 (Girls)	14–19	8	Out of School adolescents

of effectiveness, contextual facilitators, challenges, and whether they felt there was a need for de-implementation of any of the programs.

The FGD question guide for DHMTs explored how micro-level decisions for adolescent health services were made and how they were implemented at the primary care level. It also sought information on how resources were mobilized and used for adolescent health services.

The FGD question guide for adolescents explored their understanding of sexual and reproductive health, mental health and wellbeing, challenges they faced, services available to them, perceived effectiveness of these services, and the ways that the services could be improved.

The KI interview and FGD guides were developed by the research team based on the objectives of the study and informed by reviews of literature and policy documentation, as well as an in-depth understanding of the local policy context in Ghana. Question guides for interviews and FGDs were piloted and refined after a few initial interviews/FGDs.

Basic demographic details on participants' age, sex, and location were also collected for the adolescent FGDs (see Table 2). The interview guides were translated into Twi and Ga-Adangbe, the two most common local languages in the study areas for the interviews with out-of-school adolescents. All other interviews as well as the FGDs with adolescents in school were conducted in English, which is the official language of instruction in schools and workplaces in Ghana.

2.5 Theoretical framing and approach to data analysis

To analyze the context, we drew on Leichter's categorization of context into situational, structural, cultural, and environmental factors (25, 26). We interpreted context as not just "external" but as permeating across the macro (i.e., systems), meso (i.e., organizational), and micro (i.e., individual and interpersonal) levels (27–30). In Leichter's categorization of context, the environmental context refers to international factors outside Ghana, such as global agreements to which the country is a signatory, the Sustainable Development Goals (SDGs), and obligations and pressures arising thereof that affect policy and program implementation. Structural factors are the "persistent features of a nation-state and provide an enduring part of the context within which public policy is made" (25). These include systems such as the economic base, political institutions, and demographic structures. The situational context describes transient and impermanent events that nevertheless can potentially influence policy and its implementation. Examples include health security issues such as the COVID-19 pandemic, communal conflict, and natural disasters.

Political culture, cultural norms, religion, traditional values and institutions, and arrangements are all part of the cultural context. We conceptualized implementation as the stage where decisions that become authoritative for society (policies) have agendas that have been set, and strategies to achieve them formulated are carried into execution.

We explored the links between context and policy implementation processes. However, it is important to mention that it is not the only context that can explain policy implementation and any gaps observed. Walt and Gilson's policy triangle framework, which stipulates that context, actors, process, and content will all influence policy implementation and ultimately outcomes (26), was important to keep in mind as the broader conceptualization within which our analysis is nested. Our exploration of context is a deep dive into one cluster of potential explanatory factors rather than all clusters of factors. In this analysis, we focused on how and why context affects program implementation (part of the process), leading to implementation gaps. We, however, acknowledge that actors and content can also influence implementation and implementation gaps.

All KI interviews and FGDs were audio recorded and transcribed verbatim by a research assistant and were checked for quality assurance by the first author. Focus group discussions, which were conducted in the local language, were translated into English and transcribed into English. The transcripts from interviews and FGDs were coded and then analyzed with the support of qualitative analysis software, QSR NVivo version 20. To ensure intercoder reliability, the first and second authors who were part of the interviews coded the transcribed interviews, and FGDs and compared their coding using the inter-comparison coding query feature in NVivo 2020. They coded the text from the transcripts in relation to the study objectives and the conceptual framework described earlier. They used both deductive and inductive methods to create the codes. The deductive codes were created based on literature reviews and the conceptual framework of the study, while the inductive codes were created after multiple readings of the transcribed texts. All other authors were involved in the data analysis and interpretation, and they reviewed the findings from the study and agreed on themes and codes for analysis.

Validity, reliability, integrity, and trustworthiness of data and findings are important considerations of research studies. To ensure the safety and wellbeing of minors involved in our research, we obtained proper consent from parents using assent forms. By doing so, we also aimed to guarantee that the adolescent's best interests were always at the forefront of our work. In our qualitative study, validity and trustworthiness were assured through a clear and transparent approach to the steps in the data analysis, triangulation of findings between the different methods (documents, interviews, and FGDs), and implementation of measures to minimize potential bias during the data collection and analysis. In qualitative work, potential bias in data collection, analysis, and interpretation can be introduced by the social locations of researchers who may possess advanced educational and socio-economic status than participants, in our case, adolescents who took part in the interviews and FGDs. We addressed this by maintaining critical reflexivity on the researchers' positionality and constantly being aware of how personal attributes which accorded power could have potentially affected the research process and the resultant data. Interviewers reflected on the contents and processes of data collection, including non-verbal clues, researchers' positionality, and the resultant biases after each interview and FGD. This was done individually as unstructured notes in field diaries and in pairs after returning from the data collection in the study sites. Furthermore, all-team weekly meetings were regularly held to monitor the work, and parts of these weekly meetings were used to reflect on the analytical themes, positionality, and resultant biases and triangulate emerging findings among the respondent groups and methods.

2.6 Ethical considerations

Ethical approvals were obtained from the Ghana Health Service Ethics Review Committee (GHS ERC 021/05/21) and the University of Leeds (MREC 21-010 External - AdoWA project). All primary data collection was conducted following the obtaining of informed consent. Where adolescents less than 18 years old were involved, informed consent was obtained from parents or guardians. Participation was voluntary, and participants had a choice to withdraw at any time during the data collection and were assured of anonymity and confidentiality in reporting the findings.

3 Findings

We first present a summary of the main objectives of the Adolescent Health and Service Policy Strategy (2016–2020) and their implementation status at the end of the 5 years covered by the policy. We then present our findings on the context and how and why it influenced policy implementation, structured by the categories in Leichter's framework.

3.1 Implementation of adolescent health service policy and strategy (2016–2020)

Table 3 summarizes the eight policy objectives of the Adolescent Health and Service Policy Strategy document (2016–2020) and corresponding strategies and programs planned for implementation of each objective as well as the implementation status of each planned strategy and program. From the analysis, we categorized the implementation status as (a) fully implemented, (b) partially implemented, and (c) not implemented at all.

Fully implemented refers to strategies and programs that were executed as originally planned. Partially implemented refers to strategies and programs that were started but were halted or not fully executed for some other reasons. Not implemented at all refers to strategies and programs that were never executed. Both partially and not implemented at all strategies and programs are considered manifestations of policy implementation gaps. A Supplementary Data file with the full policy objectives, sub-objectives, and their planned implementation strategies in the Adolescent Health and Service Policy Strategy document (2016–2020) is available.

3.1.1 Fully implemented

Of the 23 planned strategies and programs for implementation of the eight objectives of the Adolescent Health Service Policy and Strategy (2016–2020), only four (17%) were fully implemented. These

TABLE 3 Implementation status of Adolescent Health and Service Policy Strategy document (2016–2020) objectives.

Stated policy objectives	Strategies/programs for implementation	Implementation status
1. To improve access to information on health and health services relevant to the age-and gender-specific needs of adolescents and young people to enable them to make informed decisions	1.1 Mass Media Campaign	Implemented
	1.2 Comprehensive Sexuality Education	Not Implemented
	1.3 Adolescent Ambassadorial Challenge (School Clubs)	Partially Implemented
	1.4 Social Media Strategy (Mobile App, known as the YMK App)	Partially Implemented
	1.5 Adolescent Reproductive Health Clubs	Partially Implemented
2. To build the capacity of health service providers and support staff to enable them to have the required knowledge, skills, and a positive attitude toward the provision of effective adolescent and youth-responsive services at all levels	2.1 Capacity and Skills training	Partially Implemented
	2.2 E-learning Programme	Implemented
3. To improve access to a specified package of health services that are of high quality, gender sensitive, disability-responsive in an appropriate environment at all levels	3.1 Development of adolescent health service and policy document in Braille for the visually impaired	Implemented
	3.2 School-health based services	Partially Implemented
	3.3 Safety Net Program	Partially Implemented
	3.4 Comprehensive Abortion Care	Partially Implemented
	3.5 Girls in Iron and Folic Tablet Supplement (GIFT) Programme	Partially Implemented
	3.6 Mental Health Training	Partially Implemented
4. To develop and advocate for relevant enabling environment including protective health policies, and legislative framework to support the provision of Adolescent and Youth Responsive Health Service (AYRHS) at all service delivery and management points	4.1 Advocacy for the change in conflict between age of sexual consent and age for marriage in the constitution	Not implemented
	4.2 Enforcing laws for control of exposure, marketing, and access to unhealthy products, including Tobacco, Alcohol, beverages high in salt, sugar, and unhealthy fats	Partially implemented
5. To promote partnership and inter-sectoral collaboration among adolescent and youth groups, relevant institutions and communities in the provision and utilization of Adolescent and Youth Responsive Health Service	5.1 National Adolescent Health Committee	Partially Implemented
	5.2 The Ghana Adolescent Reproductive Health Project executed by Palladium	Implemented
6. To develop innovative strategies to address financial barriers for AYRHS to strengthen research for evidence-informed policies and interventions in AYRHS	6.1 Resource Mobilization strategies through networking and leveraging with relevant institutions	Partially Implemented
7. Strengthen research for evidence-informed policies and interventions in AYRHS	7.1 Research Advisory Team	Not Implemented
	7.2 Comprehensive Research Agenda on AYRHS	Not Implemented
	7.3 WHO Web-Based Platform for Monitoring Adolescent Services to inform AYRHS policies, programs	Partially Implemented
8. To strengthen management, leadership, and support systems for AYRHS	8.1 Review of existing leadership and governance structures	Not Implemented
	8.2 Improving supply chain systems to meet regular logistic and commodity needs at facility and service delivery points	Not implemented

four were the mass media campaign under Objective 1, the e-learning program under Objective 2, the development of adolescent health service and policy document in Braille for the visually impaired under Objective 3, and the Ghana adolescent reproductive health strategy executed by Palladium under Objective 5 (Table 1).

3.1.1.1 Mass media campaign under strategies and programs to achieve objective 1

To achieve objective 1 of the policy, which was to improve access to information on health and health services relevant to the age and gender-specific needs of adolescents and young people to enable them to make informed decisions, several Social and Behavioral Change Communication (SBCC) strategies were to be developed. They were expected to target specific groups such as adolescents in and out of school, adolescents with a disability, adolescents in vulnerable and underserved communities, and the general population of adolescents not in any of these categories. Only one out of the five planned strategies were fully implemented. This was the strategy of using mass media messaging to influence and change the underlying norms and attitudes that perpetuate poor health outcomes for young people. Interventions

included, but were not limited to, radio and TV talk shows. They also comprised mass media interventions which were community-based and were implemented with other partner agencies to improve access to health information to adolescents to help them make informed decisions.

> *…We frequently have radio discussions. Sometimes there are slots that we go in for depending on what topic is on the burner. So, if this month we want to do something on STIs, we will look for radio slots. Normally, it is with Curious minds. That is on the Ghana Broadcasting Corporation (GBC) … They have a slot at the GBC, and we have been able to ride on that platform. We also work with the Ministry of Gender, Children, and Social Protection for their "Girls, Girls" Talk Show. We normally give them resource persons because it is for Adolescent Sexual and Reproductive health and gender-based violence"*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.1.1.2 E-learning platform

Objective 2 of the Adolescent Health and Service Policy Strategy document (2016–2020) was to build the capacity of health service providers and support staff to enable them to have the required knowledge, skills, and a positive attitude toward the provision of effective adolescent and youth responsive services at all levels. Out of two strategies, only one was implemented, and it was an e-learning platform created for adolescent health training, which led to wider coverage and proved to be cost-effective. It was particularly useful due to the challenges of COVID-19.

> *… We were running face-to-face until Covid came then we moved online. So, we do online training, these days than face to face. So out of this, we have an e-learning programme for Ghana Health Service, open to all. We've been able to train more service providers ever since we went online as we can reach a lot of people.*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.1.1.3 Development of adolescent health service and policy document in braille for the visually impaired

The intervention to develop an adolescent health service and policy document in Braille for the visually impaired was also fully implemented. It did not appear to be affected by contextual challenges such as resource availability or the clash with cultural context that affected some other strategies and programs.

3.1.1.4 The Ghana adolescent reproductive health strategy executed by palladium

Different initiatives were aimed at promoting partnership and inter-sectoral collaboration among adolescent and youth groups, relevant institutions, and communities in the provision and utilization of adolescent and youth-responsive health services. One of these was the Ghana Adolescent Reproductive Health Project, which was funded by UK DFID, executed through Palladium, and involved moving adolescent health provision from adolescent corners to adolescent delivery points.

> *"… any designated place for seeing to the health of adolescents, is now classified as a service delivery point because we want to move away from the corners to a place where you do not have a specific corner. So, it can be a desk in the entire facility, but the entire facility knows that an adolescent is coming in and there is a service provider responsible for helping the adolescent through the various stages when they come. It can also be a person moving around as an outreach point… So as of the end of 2020, we had 1,674 adolescent service delivery points."*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.1.2 Partially implemented

A majority (57%), that is, 13 of the 23 planned strategies and programs were partially implemented. These included the Adolescent Ambassadorial Challenge (School Clubs), Social Media Strategy (Mobile App, known as the You Must Know (YMK) App), and Adolescent Reproductive Health Clubs and under objective 1; health service providers and support staff capacity building under objective 2; School health-based services, Safety Net Program, Comprehensive Abortion Care, Girls in Iron and Folic Tablet Supplement (GIFT) program, and Mental Health Training under objective 3; Enforcing laws for the control of exposure, marketing and access to unhealthy products including tobacco, alcohol, beverages high in salt, sugar, and unhealthy fats under objective 4; national adolescent health committee under objective 5; and resource mobilization strategies through networking and leveraging with relevant institutions under objective 6 (see Table 1). In the next sub-sections, we describe the three most prominent strategies in this large group.

3.1.2.1 Adolescent ambassadorial challenge

To reach in-school adolescents, reproductive health clubs were launched across the country to target adolescents in school with age-appropriate and gender-sensitive interventions. As part of their activities, the school clubs were challenged to develop innovative ideas to promote sexual and reproductive health among young people. Consequently, an Adolescent Ambassadorial Challenge was launched in senior high schools (SHSs) in 2019, during which some adolescents in senior high schools all over the country were assembled and pitched potential solutions to adolescent health challenges. Innovative ideas included how to fight teenage pregnancy and stop substance abuse. Winners were given a cash prize of 10,000 cedis (approximately USD 840) to implement their ideas, which provided a huge incentive to ensure the success of the program.

> *So as part of the club initiative, club members every year are supposed to come up with a project to promote sexual and reproductive health and then we award. Sometimes too they get funding for their projects. So, they come and pitch. Some of them may do it before they come so that they can win funds, but others too will carry it out and come and tell us what they did for the funds to be reimbursed.*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.1.2.2 Capacity and skills training

Objective 2 of the Adolescent Health and Service Policy Strategy document (2016–2020) was to build the capacity of health service providers and support staff to enable them to have the required

knowledge, skills, and a positive attitude toward the provision of effective adolescent and youth responsive services at all levels. Apart from the e-learning strategy, which was fully implemented, another adopted strategy was improving the knowledge, attitude, and skills of service providers and support staff in Adolescent and Youth Responsive Health Service (AYRHS). To do this, the adolescent training manual for all health workers was revised to improve the knowledge, attitude, and skills of service providers and support staff in AYRHS. This newly designed training manual involved multiple cadres of service providers.

> *…we had to revise our training manual and design a training that will target the various cadres of service providers. So, we have a system modular program. We were running face to face until Covid came then we moved online. So, we do online training, these days than face to face. So out of this, we have an e-learning programme for Ghana Health Service, open to all. We've been able to train more service providers ever since we went online as we can reach a lot of people.*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.1.2.3 Comprehensive abortion care services

Objective 3 of the policy was to improve access to safe abortion services using the CAC approach as per the laws of Ghana (Ghana Abortion Law 1985). This law stipulates that abortion is legally permitted where the pregnancy is a result of rape, incest, or defilement, where there is a substantial risk of a physical abnormality or disease occurring in the unborn child, and where continuing with the pregnancy would risk the mental or physical health or the life of the pregnant mother (31). Although the law existed, the mental and physical grounds, as indicated in the ACT where women could seek abortion services, were not readily available in public hospitals. From 2006, the protocols and standards to regulate the provision of comprehensive abortion care were completed but had not been adopted in the public health service. These services were mainly being provided by private health institutions in partnership with other non-governmental organizations, which included the provision of abortion services to the extent permitted by the law, post-abortion care, counseling, and provision of family planning services to prevent unwanted pregnancy, and linkages to other services and information and education on the dangers of unsafe abortions. In 2021, with funding from the Buffet Foundation, CAC services were integrated as part of services in reproductive and child health (RCH) in the Ghana Health Service.

> *"…previously if you walked into a primary care facility and you wanted to get an abortion, you will not get providers who are designated for that. But now we have, providers and if per the law you qualify, the service will be provided for you."*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.1.3 Not implemented at all

Six out of the 23 (approximately 26%) planned strategies and programs were not implemented at all. These were comprehensive sexuality education under objective 1, advocacy for a change in the conflict between the age of sexual consent and the age for marriage in the constitution under objective 2, establishment of a research advisory team and development of a comprehensive research agenda for AYRHS under objective 7, and review of existing leadership and governance structures and improvement of supply chain systems to meet regular logistic and commodity needs at facility and service delivery points under objective 8 (Table 1).

3.2 Context and implementation gaps

Several contextual factors contributed to plans and strategies being partially implemented or not implemented at all. Using our conceptual framework, we present our findings on how structural, situational, cultural, and environmental factors influence adolescent health policy implementation. Our findings are summarized in Figure 1 and explained with illustrative quotes from our interviews in the text below.

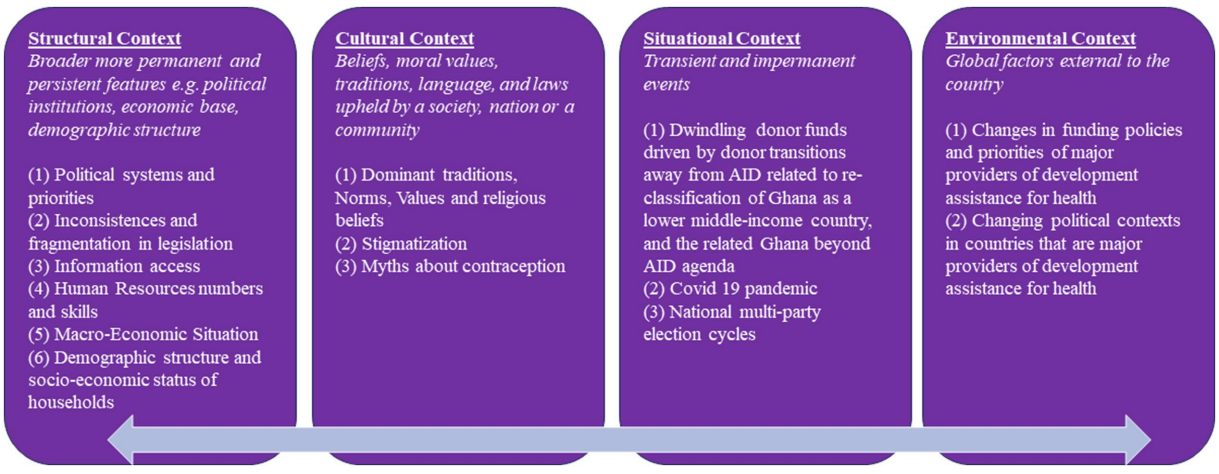

FIGURE 1
Contextual factors and adolescent health policy implementation and outcomes in Ghana.

3.2.1 Structural context

Key structural constraints to policy implementation comprised inconsistencies and ambiguities in legislation, lack of awareness of programs and interventions, lack of human resources and skills, and a poor funding environment. In some cases, context was itself a driver of the problem that the strategy sought to address as well as a constraint to the implementation of the strategy to address the problem. Specifically, objective 4, to develop and advocate for a relevant enabling environment including protective health policies and legislative framework to support the provision of Adolescent and Youth Responsive Health Service (AYRHS) at all service delivery and management points, was effectively an effort to change constraining structural, contextual factors.

3.2.1.1 Political system and priorities

Ghana returned to a multi-party democratic system in 1992 after over a decade of military rule. Two political parties, the National Democratic Congress (NDC) and the New Patriotic Party (NPP), have dominated democratic elections since 1992. Although the NDC labels its ideology as social democratic and the NPP as liberal democratic, their social policy priorities in health and education have been similar. Thus, the NPP initiated pro-poor socialist policies and programs such as the National Health Insurance Scheme (NHIS) (32), the Livelihoods Empowerment Against Poverty (LEAP), a cash transfer program for the bottom 20% of Ghana's poor, and the School Feeding Programme between 2000 and 2008 (33). The NDC continued to maintain these social welfare programs after winning subsequent elections in 2008 and 2012[10] and increased LEAP cash transfers. After winning the elections in 2016, the NPP instituted the free Senior High School (SHS) policy in 2017 (34). Adolescents are potential beneficiaries of all these social programs. Current political system and priorities could, therefore, be described as enablers rather than constraints to adolescent health policy implementation.

The constraints are driven by other structural, contextual factors that modify the effectiveness of these social safety net programs that should benefit adolescents (32). For example, even though adolescents under 18 years are to be exempted from user fees, under the NHIS, this was not always the case in practice because of inadequate funding (35). The huge unpaid bills of providers by the scheme meant that they were not eager to service NHIS clients or stock adequate quantities of medicines covered by the NHIS. Adolescents in school could sometimes not access medications with the NHIS cards at school sickbays, and adolescents out of school complained that the NHIS was not working for them and they were paying bills out of pocket.

3.2.1.2 Inconsistencies and fragmentation in policies and legislation

Several acts of Parliament and legislative instruments provide frameworks, support, and guidance for adolescent health policy and service delivery in Ghana. Unfortunately, they are fragmented with resultant inconsistencies, which can sometimes lead to implementation challenges. For example, the age of consent to sex in the Criminal Offences Act 1960 (Act 29) is 16 years. The legal age at which one becomes an adult in the Children's Act 1998 (Act 560) is 18 years (36). Policymakers in the interviews argued that this inconsistency between the age of consent and the age when a child becomes an adult and can legally marry constrained the implementation of several programs targeted at reducing teenage pregnancy and child marriages.

> *"… the age of consent is 16 and then we are saying a child becomes an adult at 18. We are saying we want to prevent teenage pregnancy, but if at 16 years a teenager can give consent to have sex without any legal implication, then you realize that it's going to be a challenge."*
>
> *Interview with Development Partner.*

The interviewees wanted the age of consent to be raised to 18 years to be consistent with that of the age at which one becomes an adult to provide clarity and effective support to programs that seek to prevent teenage pregnancies and child marriages.

Another example of inconsistent and or conflicting legislation at the time of the study was Ghana's Criminal Offences Act (1970). Section 57:1 of the Ghana Criminal Offences Act of 1970 states that "a person who attempts to commit suicide commits a misdemeanor" (37). This law implies that anyone who attempts to commit suicide and fails is liable to arrest and prosecution and could face criminal sanctions upon conviction. This was at variance with the Mental Health Act 846 of 2012, which seeks to ensure the rights of persons with mental disorder and suicidal behavior. Stakeholders in mental health have been advocating for the decriminalization of suicide but have not had any success in repealing the law in the Ghana Criminal Offences Act of 1970 at the start of our data collection. The use of words such as "idiots" and "imbeciles" in the legal language of the law to describe people living with mental health conditions also worsens the stigma associated with persons with mental health challenges.

> *"… if you attempt suicide and you fail, woe betides you! You are going to jail. That is certainly a policy that is not good enough. We are making the effort to repeal it in conjunction with some NGOs."*
>
> *Interview with National Level Programme Officer/Policymaker.*

To change acts of Parliament often takes long-term engagement, effort, and skills in policy advocacy and intersectoral effort that goes well beyond the health sector. The failure to resolve some of these inconsistencies, such as changing the conflict between the age of sexual consent and age for marriage in the constitution in the medium-term frame (5 years) of the implementation of the adolescent health policy, was therefore perhaps not surprising. Similarly, enforcing laws for the control of exposure, marketing, and access to unhealthy products, including tobacco, alcohol, and beverages high in salt, sugar, and unhealthy fats, were only partially implemented.

On a positive note and confirming that long rather than short-term effort is needed to address some contextual challenges, such as the need to change legislation, on 29 March 2023, the Parliament of Ghana approved amendments to the Criminal Offences Act of 170, which previously made attempted suicide a criminal offense (38). Individuals who attempt to take their life will now be regarded as needing mental health support (38). The Suicide Law is currently waiting for assent from the President to be repealed. The successful change in this law followed sustained advocacy from civil society organizations as well as the engagement of key members of the Parliament who were initially opposed to the repealing of the Law.

3.2.1.3 Information access

While several policies on adolescent health exist, there was a general lack of information provision about these policies on adolescents. In all the FGDs with adolescents, none of them could identify any policy in place for adolescent health and development. At the primary care level, some health providers were not aware of the various policy and implementation strategy documents for adolescents. The You Must Know (YMK) app was developed by the Ghana Health Service, with support from the UK Foreign, Commonwealth, and Development Office (FCDO) and the United Nations Fund for Population Activities (UNFPA), to enable adolescents to have easy access to information on Adolescent Sexual and reproductive health (ASRH) as well as adolescent mental health (AMH) and wellbeing on their mobile phones, had very low usage. Only approximately 1,200 downloads had been recorded at the time of the study in 2021. Although this app has trained adolescent health workers to provide counseling through a live chat feature, the main targets of the intervention, i.e., adolescents of 15–19 years, could not access this application while in school. Junior and senior high schools in Ghana, whether day or boarding, generally do not allow pupils to bring and use personal phones in school. Moreover, even at home, not all adolescents in Ghana have access to their own mobile phones.

> *"…The challenge is that those in school cannot use it because GES does not allow mobile phones. So that is the challenge but those who have finished school and all that, they have access. So it is through demand creation… we are creating a lot of demand for it and we are getting funding from USAID to create the demand for it."*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.2.1.4 Human resource numbers and skills for program implementation

In the 2016–2020 Adolescent Strategy document, the strategy for adolescent mental health was the "integration of mental health into all adolescent health services." The provision of basic mental health services, including suicide prevention and care, was expected to be done at all adolescent service points.

> *"… so every service provider who sees to adolescent is supposed to do this basic mental status exam, teach coping strategies and mechanism, teach life skills, teach some social support for those with drug abuse, sexual based violence victims, those with suicidal tendencies, those who are depressed, and other mental health conditions and they have to manage drug abuse, conditions related to stress, emotional behavior, and all those things…"*
>
> *Interview with National Level Programme Officer/Policymaker.*

Interviews with frontline health workers at primary health facilities showed that only a few facilities offered these services because of inadequate numbers of community mental health officers trained to assess, diagnose, and provide primary mental healthcare. The few available were inequitably distributed, with urban primary care facilities better resourced than rural ones. Psychiatric nurses, similarly, were only available in a few sub-district health centers in all four study districts. Other mental health professionals, such as psychiatrists, psychologists, and occupational therapists, were not available at the primary care level, and very few at referral level facilities.

> *"…at every district, we have a psychiatric nurse, so that's not bad. The other challenge we have is with psychologists and clinical psychologists. The numbers are better now than some ten years ago but we need more. This country requires not less than 100 clinical psychologists and as we speak, in the public sector it's just probably just about 20. We should have not less than 200 psychiatrists. The number now is around 50. The numbers are woefully inadequate. And I really cannot envisage a time when we have adequate numbers of psychiatrists, so we require the middle-level cadre."*
>
> *Interview with National Level Programme Officer/Policymaker.*

For the same reasons of inadequate human resource capacity, a research advisory team to develop a comprehensive research agenda was not implemented at all.

> *"…Research is one of our weakest areas. Aside from supporting students who come around to collect data, we hardly on our own do we initiate, we do not. We hardly do any research in adolescent health."*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.2.1.5 Weak macro economic base and funding for adolescent health

Ghana's Gross Domestic Product (GDP) *per capita* in current US dollars for 2021 was estimated by the World Bank at US$ 2,363 (39). Despite the government's commitment to the Abuja Declaration in 2001, which recommended 15% of the government's budget to be channeled to health, the target had not been attained (40). The Government of Ghana's budget allocation for health in 2022 was only 7.6% of the total budget. This was grossly inadequate with regard to the amounts needed to support all health programs and interventions, including adolescent health (41).

Funding for implementing adolescent health programs in the policy we studied was mainly through Development Assistance for Health (DAH). Successful initiatives such as the Innovative adolescent programming, "You Only Live Once (YOLO)" television show, and the Adolescent Ambassadorial Program, where adolescents in senior high schools across the country were assembled to pitch solutions to adolescent health challenges, required continuous funding. However, their longevity came to a halt after the policy period and the end of the external funding. YOLO only came back on TV screens in 2023 when new external funders supported it.

A national adolescent health committee was instituted but funding constraints meant that the committee was not able to meet as regularly as it was supposed to.

> *"… our programs have been heavily donor-driven. Government only pays the salaries and provides the structures. The operational things, we do not have adequate funds for them. When somebody is abused, service providers are forced to charge the victims to go and testify in court. We have nice policies…we spend so much to develop the policies and we do not implement them"*
>
> *Interview with National Level Programme Officer/Policymaker.*

At the sub-national level, District directors of health across the selected study sites also raised the same challenge of the lack of consistent long-term funding for adolescent health policies and programs raised by national-level actors. They complained about regular stockouts of essential logistics and commodities needed at service delivery points, including poorly equipped adolescent health corners.

> *"Unfortunately, we have beautiful policies, but when it comes to resourcing the adolescent sexual and reproductive health area, we do not see that. There aren't any step-down funds. So we are not able to do much for the adolescents. Take this adolescent corner for example, it is the only one in the district, but you'll realize that there's very little here. There is not a place for adolescents to even sit to comfortably watch a film or a documentary that will help them.*
>
> *FGD with District Health Management Team.*

The high dependence of adolescent health policies and programs on DAH for implementation meant that providers of DAH had a lot of power to influence implementation priorities. The inadequate government funding meant that scaling up and sustained implementation of policies and programs was often not done.

> *"…we have all these beautiful policies, and that's what we are good at as a country but when it comes to implementation, there's a gap and it's not just a small gap, it's a huge gap. So, until we start looking at the implementation of the policy by some quantum of funds, then we will still be where we are 10 years from now."*
>
> *Interview with NGO in ASRH.*

Developmental partners agreed about the inadequate government funding but reiterated that their funding is supposed to identify what works and that it remains the government's responsibility to scale up and sustain programs.

> *"… a lot of the funding comes in to address specific gaps or bottlenecks… We put funding in a situation to demonstrate that with proper funding and support, there are successes that should be replicated by the government. The issue has always been whether there is funding for replication so… at the end of the day, a lot of it is donor driven and that makes the achievement of the policy somewhat not as we would want it to be."*
>
> *Interview with Development Partner.*

The National Health Insurance Scheme (NHIS) is a government-funded mechanism for ensuring universal health coverage in Ghana and could potentially support some aspects of adolescent health service delivery. However, it faced challenges. Long delays in reimbursement of service providers by the government have led to some government health facilities refusing to take clients on the NHIS. In two out of the three out-of-school adolescent FGDs, adolescents indicated that services at public facilities that were supposed to be covered by the NHIS were not free. In addition, there were frequent stockouts of covered medicines, leading clients to purchase them out of pocket. Infrastructural challenges also meant that adolescent health corners were not very operational. None of the districts in the study sites that were visited had a functional adolescent health corner.

> *"You know something? Nowadays, if you take your health insurance to the hospital, they do not take care of you well. It exists only in name. It does not work. You cannot take your health insurance card to the hospital. If you go with your health insurance, you will only be given "Paracetamol." [Translated from Pidgin to English]*
>
> *FGD with out-of-school adolescent boys.*

Adolescents in school also expressed similar concerns about not being able to access medications with their NHIS cards at school clinics run by the Ghana Health Service under the School-Based Health Services Programme. This was the reality in all schools visited during this study. While adolescent health services were available, medicines were usually out of stock, and adolescents in school had to pay out of pocket for medications.

> *"…the last time, I was not feeling well. It was my stomach. So, I went to the school nurse. She gave me milk of magnesia and vitamin C and she said I will pay GHS 6. When I'm sick again, I will not go to the sickbay again because when I am coming to school, my mum does not give me money to buy medicines.*
>
> *FGD with in-school adolescent girls.*

To strengthen research for evidence-informed policies and interventions in AYRHS, some attempts were made to generate evidence to inform policies and interventions through a WHO Web-Based Platform for Monitoring Adolescent Services. This was, however, implemented in only a few facilities. The Ghana Health Service did not have the funding to conduct robust research in adolescent health interventions.

> *When you want to measure perceptions of quality, you have to do a survey. So, it happens but in pockets. During our routine monitoring, we use the WHO Web-Based Platform for Monitoring Adolescent and Youth Friendly Health Service… That gives us an idea whether the training we are doing is being translated into practice… So that we can have the perception of quality in real-time without doing a survey. But the challenge with that one is that it is only in 22 facilities.*
>
> *Interview with National Level Programme Officer/Policymaker.*

3.2.1.6 National demographic structure and socio-economic status of households

The population of Ghana, according to the 2021 census, was almost 31 million, a 5-fold increase from 1960. Adolescents account for 22% of the population, and young people below the age of 18 years account for 41.8% of the population (42). This demographic structure means that there is a high dependency ratio. This is coupled with high unemployment rates and means that many households face socio-economic challenges. Various stakeholders, including national-level policymakers, district health management teams, non-governmental organizations, and developmental partners, indicated that the household socio-economic conditions of many adolescents left them in precarious situations of great vulnerability as far as ASRH and AMH are concerned.

> *"…you can empower a young lady with information but if men come around and meet her with a very hungry stomach and offers*

> *her some help in exchange for sex, she may not be able to escape that risk if they do not have the means to make a living. That is the reality."*
>
> *Interview with NGO in ASRH.*

3.2.2 Cultural context

3.2.2.1 Norms and values

In Ghana, sex is usually not discussed between children and parents. Children who ask questions about sex are likely to be labeled as 'bad children'. Regardless of whether it is actually practiced or not, chastity is upheld as a virtue, and abstinence is expected (43). Pregnancy before marriage is deeply frowned upon. The conflicts that sometimes occurred between these deeply held values and norms and actual behavior created several challenges for both the providers and adolescents. Adolescents felt shy to access family services or express a need for contraception for fear of being stigmatized.

> *Respondent 2: Sometimes the reason why we are not able to go to the hospital is because of shyness.*
>
> *Respondent 1: You can go there to meet someone's mother and tell her that you need a condom. It would be some way.*
>
> *Excerpt of FGD with out-of-school adolescent boys.*

The uptake of family planning services among sexually active adolescents was hampered by various myths and misconceptions surrounding contraceptives among adolescents.

> *…they say it will make them infertile and fat and if it's an IUD, it can travel to their heart, but we know a lot of them are sexually active from our data. About 14% of adolescents are accepting family planning but we wish this could increase. So, we have been focused a lot more on addressing these myths and misconceptions.*
>
> *Interview with National Level Programme Officer/Policymaker.*

The Girls in Iron Folate (GIFT) programme, which was initiated with funding from the World Food Programme and UNICEF to provide folic tablets each day across the country to adolescent girls in and out of school, hit several roadblocks as community members did not understand what the pills were for. Some misinformation circulated on WhatsApp that the pills were contraceptives. This led to stiff opposition from community members who asked adolescent girls to refuse the capsules. The values of chastity ingrained in Ghanaian society mean that there is usually stiff opposition to the promotion of contraceptives for adolescents because they are perceived to promote immoral behavior, and any link to that is met with contempt.

> *We are having some challenges with the GIFT because people are saying the folic acid we give to the adolescents are laced with contraceptives so it's also a challenge we are trying to address through social behavioral change.*
>
> *Interview with National Level Programme Officer/Policymaker.*

To reduce adolescent pregnancy-related school dropout rates, the Safety Net Programme was implemented in collaboration with the Girls Education Unit of the Ghana Education Service and the Department of Social Welfare of the Ministry of Gender, Children, and Social Protection in 2017 to support adolescent girls who get pregnant while in school to enable them to continue their education. At the time of the study, the program had supported over 4,000 adolescent girls and had been scaled up nationally. The program also supports the mother and child until the child is 1 year old.

> *… we designed a program called the safety net program …basically, when you are pregnant and you opt to keep the pregnancy, we follow you up through home visits and help you to acquire some basic things; then when you deliver and want to go back to school, we send your name to the girls' education office and then they follow up and ensure that you go back to school and if you need any social support, we refer you to the social welfare.*
>
> *Interview with National Level Programme Officer/Policymaker.*

Stigma at the personal and interpersonal levels, however, deterred adolescent girls from fully taking advantage of this program.

> *"There is a policy in Ghana that allows young people who get pregnant to return to school and we know that it is not being practiced not because people do not know about it but because the school environment is sometimes not healthy enough. The young people themselves fear stigma. In some situations, they do not even have uniforms and other materials that will allow them to go back to school."*
>
> *Interview with NGO in ASRH.*

Religion is closely tied to values and norms and has played an important role in the implementation of adolescent health programs in Ghana. Ghana is a deeply religious country, with approximately 71.3% of the population professing to be practicing Christianity and approximately 19.9% practicing Islam (3). Various stakeholders indicated that the highly religious nature of the country did not always facilitate the delivery of mental wellbeing or adolescent reproductive health services.

> *"…As Ghanaians in general or Africans, we focus too much on spirituality. Honestly, I'm a very good Christian but sometimes it's too much. We go to church from Sunday to Monday. It's all stress. Sometimes, the spirituality has some negative effects on us. When I was in form two, I remember there was a prophetess. She was a parent but then she used to come and pray with us and then one time, she told someone that "Oh I saw that your parents had an accident." The person cried the whole day and could not focus. So, you see, some of these things, they do not help. They do not help at all."*
>
> *FGD with adolescent boys in school.*

There was strong opposition to the implementation of a Comprehensive Sexuality Education (CSE) Programme from religious groups, who felt the program was not congruent with the socio-cultural as well as religious values of the community. Ultimately, the policy had to be halted.

> *"… just look at what happened to CSE in this country a couple of years ago when it came out. And I keep telling everybody it was only because the tag demonic was attached to it. And that boils down to*

> *our whole concept of religion and how we see things in this country. So once CSE became demonic and a satanic agenda, there was nobody ready to lift a finger or a hand to say that "Oh I understand what CSE is and I support it"*
>
> *Interview with Donor/Developmental Partner.*

Various policymakers intimated that the resistance and confusion that followed the proposals for the implementation of the CSE program were due to misinformation and the inclusion of socially and culturally unacceptable materials from other contexts which had explicit content on homosexuality.

Adolescents, on the other hand, tended to indicate the importance of a comprehensive sex education program to enable them to make informed decisions.

> *"I feel like there are a lot of restrictions even talking about sex in the presence of adults. I feel like most of these teenage pregnancies will not have resulted. Because there is no room for discussion to talk about these things, adolescents are not well informed about certain things so, it just brings up certain unwanted issues."*
>
> *FGD with adolescent boys in school.*

Not all adolescents, however, agreed with the need for a comprehensive sexuality education program that promotes the use of contraceptives. In two out of the four FGDs conducted with adolescent boys in school, four adolescent boys aligned their stance with that of the education service that abstinence was the only option that should be made available to adolescents.

> *As for me, I would not support the campaign for sharing condoms or maybe contraceptives, but I would only support the campaign for total abstinence. I mean, where has morality run away to? We should be moral. That would be the better option to me.*
>
> *FGD with adolescent boys in school.*

Adolescent boys in two out-of-school FGDs, on the other hand, agreed with the use of contraceptives. The advocacy for the use of contraceptives by out-of-school adolescent boys might be attributed to the fact that they are engaged in some work that allows them to buy such commodities and have some autonomy in making decisions that affect their sexual reproductive health, as compared with adolescents who were under the guidance of the parents and teachers.

3.2.3 Situational context

Apart from the cultural and religious values, the failure of the Comprehensive Sexuality Education Programme was furthered by an imminent election in 2016 and the indication by many religious groups that they would not vote for the incumbent if the policy went through under their watch. Following the change in government in 2017, the next government has also been reluctant to reintroduce such a socially divisive program with widespread opposition. Even though some national-level policymakers and developmental partners indicated that there had been some consultations and the name of the program has been changed to Reproductive Health Education, reintroducing the program has been low on the government agenda, and it remains on the shelf.

Another example of national multi-party election cycles affecting the implementation of policy is the levy or taxation for mental health, referred to in the Mental Health Law. The Ghana Mental Health Act of 2012, Act 846, states in section 88 (3) that mental healthcare is free, and apart from financing through the National Health Insurance Scheme, the Minister of Finance shall prescribe the appropriate levy or taxation for mental healthcare funding through Parliament. A stakeholder in mental health indicated that even though introducing a mental health levy could potentially help improve funding for adolescent mental health, the tax had not started implementation. He explained that with the introduction of the COVID-19 levy in addition to the already existing levy for the National Health Insurance Scheme, citizens were already burdened with taxes. Introducing the implementation of the mental health levy would make the government unpopular at a time when a national election was imminent in 2024.

> *"… government is not too keen on tax now because the populace also feels overburdened, and the government is responding by scrapping what they call nuisance taxes. So if, they are scrapping taxes, then it seems counterproductive to say that a new tax should be established. So, they have not been too keen on that. That is the, if you talk to them, both publicly and in private, that is their main challenge.*
>
> *Interview with National Level Programme Officer/Policymaker.*

Ghana was designated as a lower-middle income country in 2011 by the World Bank (44). In 2017, the newly elected President of Ghana started a "Ghana beyond Aid" campaign, which sought to progressively wean the country from donor dependency toward self-sufficiency. Both of these situational factors have, therefore, reduced DAH flows, including adolescent health.

> *"So of course, in Ghana, with the Ghana beyond aid agenda, donor funds are dwindling, as Ghana moves to middle income there are some donors that will focus on poorer countries and not middle-income status countries."*
>
> *Interview with NGO in ASRH.*

The advent of COVID-19 also meant that a lot of resources were diverted to COVID-19 interventions, leaving adolescent health programs underfunded. In addition, donor countries hard hit by COVID-19 had to redirect funding toward their own health funding. COVID-19 also affected the implementation of programs. The National Adolescent Health Ambassador's challenge organized for Senior Secondary Schools by the Ghana Health Service had to be halted due to the pandemic and has not resumed subsequently.

> *…recently, COVID has also impacted funding. US government policy is also a major factor in funding. Brexit, whether we like it or not has also caused some challenges for funding.*
>
> *Interview with NGO in ASRH.*

3.2.4 Environmental context

Several environmental contextual factors were affecting the implementation of the adolescent health policy. Brexit in the UK led to some funding cuts that affected UK overseas development assistance for health. The United States was also a substantial funder of various adolescent health programs. The election of Donald Trump in 2016 led to a change in US foreign policy that affected funding for

adolescent health interventions and programs being rolled out in many low-and middle-income countries, including Ghana.

In addition, the focus of many funding agencies has changed. Stakeholders indicated that while adolescent health remains on the agenda for many funding agencies, changes in global health policy with attention being focused on pressing issues such as climate change have also diverted attention from adolescent health.

4 Discussion

In this study, we have presented an exploration and analysis of the implementation of the Ghana Adolescent Health Service Policy and Strategy (2016–2020), focusing on how and why context acted as a driver of some of the observed implementation gaps in policies and programs. Structural, cultural, situational, and environmental contexts all affect policy implementation gaps to varying degrees. Our analysis suggests that different contextual factors often acted in an interrelated rather than independent manner. For example, structural challenges related to resource constraints in the macro-economic context of a lower middle-income country were exacerbated by the situational, contextual challenge of COVID-19. The COVID-19 response influenced the diversion of already inadequate funding from adolescent health and other programs and sectors, due to the urgent need to deal with the pandemic (45). The situational context was compounded by environmental contextual factors affecting bilateral DAH policies, such as Brexit in the UK and the election of Donald Trump in the US.

Explicit cultural norms that promote chastity and abstinence among adolescents meant that programs such as the Comprehensive Sexuality Programme were frowned upon and were unable to move into implementation, despite the reality of some adolescents being sexually active. Norms and values also sometimes created barriers for adolescents who wanted to access adolescent health services because of the stigma associated with sexual activity in adolescents (18, 46). Our findings are similar to other studies that have examined the multiple levels of influence on adolescents' sexual and reproductive health decision-making (18, 47). These studies found that the communities had mostly negative perceptions of adolescent sexual activity. Most women and young girls felt that they were expected to behave modestly to gain respect from the community. At the same time, they were inadequately informed about sexual and reproductive health. These attitudes surrounding sexual and reproductive health have impacted policymaking and implementation for adolescent health. In the study by Challa and colleagues, sexual health education was identified as being necessary. However, personal opinions of policy actors about adolescent sexual health impacted the implementation of sexual and reproductive health policies that could address some of these needs (47).

Our finding that context is an important determinant of gaps in policy implementation confirms observations from other studies in Ghana (8), Uganda, South Africa, Zambia, India, Nigeria, and Honduras (19, 25, 32, 33). This effect is observed not only in adolescent health but in other health policies and programs. For example, a study that comprehensively analyzed the decisions and actions surrounding the pilot of the capitation policy for provider payment for primary care in Ghana also pointed to several contextual factors, such as technical considerations, contestations, and political responsiveness among the challenges leading to observed implementation gaps (48).

Another important observation from our study is that Adolescent Mental Health (AMH) is a neglected priority. In this study, despite the challenges, some funding for adolescent sexual reproductive health programs was reportedly trickling in from funders, and resources and funding for mental health in general and adolescent mental health, in particular, was practically non-existent. There were very limited or no mental health primary care services for adolescents in Ghana, including no specialists in mental health in primary healthcare clinics (49). In 2007, to improve access to mental health services, the Kintampo Project to train health workers in mental health was started to train community-based mental health workers. These included Community Mental Health Officers and Community Psychiatric Nurses (50). The numbers were, however, still inadequate at the time of the study as the program has stalled. In addition, because of political expediency, the mental health levy to increase funding for mental health service delivery had stalled. The lack of attention to adolescent mental health appears to be similar across sub-Saharan Africa despite their importance in the burden of disease data (11, 51, 52). A study of adolescent mental services, policies, and legislation in Ghana, Uganda, South Africa, and Zambia found that legislation, policies, programs, services, and human resources are scarce (53, 54).

One somewhat unexpected finding from our study is that contextual challenges can trigger innovation through the attempts to deal with them. For example, the advent of COVID-19 meant that capacity-strengthening sessions had to be moved online. This enabled the Ghana Health Service (GHS) to effectively incorporate adolescent health training for all cadres of health staff. The internet allowed the training of a larger number of health workers with comparatively fewer resources than required for in-person training. Resource-constrained countries can leverage the utility of internet-based online training to strengthen the capacity of healthcare professionals to offer adolescent-friendly services. In this regard, social media can also be leveraged to create awareness and drive attention to policies and program interventions among healthcare workers, adolescents themselves, as well as the general public (55).

Policy elites with influence can generate support for changes in the legislature, as the successful amendments to the Criminal Offences Act of 170, which previously made attempted suicide a criminal offense, have shown (38). Sustained advocacy from civil society organizations as well as key governmental institutions while looking out for windows of opportunity can help to align inconsistent and contradictory laws. We found that advocacy helped to bring about the revision of the old legislation in Ghana so that individuals who attempt taking their life could be regarded and treated as needing mental health support rather than as criminals (38).

Stakeholder meetings that engage key community members are also important in ensuring the success of programs. Programs such as the Comprehensive Sexuality Programme (CSE) and the Girls in Iron Folate (GIFT), which encountered roadblocks, could have benefitted from prolonged stakeholder engagements before implementation. Various studies have also emphasized the importance of community engagement in the successful implementation of adolescent programs (56, 57). Engaging

community stakeholders can bring to the fore values and norms that are upheld in a society and allow for a tailoring of programs around such norms and values.

4.1 Limitations of the study

We acknowledge two potential limitations of our study. First, our results from adolescents primarily reflect views of school pupils aged 13–18 years and those out-of-school adolescents who are more easily accessible. We had difficulty gaining access to out-of-school adolescents as they were not in an organized setting such as the school system. Vulnerable adolescent groups, such as head porters in the study district, could not be reached due to language barriers and the inability to recognize an association to broker trust between the researchers and the participants. In the case of out-of-school adolescents younger than 18 years, parental consent could also not be easily obtained. To minimize implications, two subsequent FGDs were conducted through community leads and artisanal associations. Second, we were able to visit only four districts in the Greater Accra Region, meaning that while we were able to explore the implementation of adolescent policies in greater depth, our results primarily reflect these settings and may not be fully generalisable.

5 Conclusion

Analysis of context and its potential enabling or hindering effects on policy implementation should be an essential part of health policy and program decision-making and implementation to help identify potential challenges related to context and address them to reduce implementation gaps. It is important to design synergistic and integrated approaches to policies and programs and their implementation that take a holistic view of adolescents rather than fragment services and interventions into components that may operate in parallel. Bridging adolescent health policy implementation gaps requires more systemic thinking and bottom-up approaches that engage closely with adolescent perspectives and pay attention to structural and cultural contexts. Governments must find creative ways to raise sustainable funding for adolescent health programs. Furthermore, there is a need to increase advocacy for better awareness and funding of policy and program development and implementation to address adolescent health and wellbeing issues.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ghana Health Service Ethics Review Committee (GHS ERC 021/05/21) University of Leeds (MREC 21-010 External - AdoWA project). The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

IA and TM designed the study protocol. EA, ND, and SA led the conduct of KI interviews and FGDs supervised by IA and TM. Data analysis was done by EA, ND, and PA. EA led the conceptualization and drafting of this paper. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1198150/full#supplementary-material

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The role of community engagement toward ensuring healthy lives: a case study of COVID-19 management in two Ghanaian municipalities

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Introduction: Community engagement is one of the important requirements for strengthening health delivery in communities in a bid to achieve sustainable development goal 3, target 3.3 (SDG 3.3). The World Health Organization has strongly encouraged the use the five levels of community engagement, which are informing, consulting, planning, collaborating, and empowering communities in order to build resilience and to enable them contribute to the fight against diseases and for the uptake of health interventions. This study sought to explore and describe from the view of government institutions in Ghana how they engaged communities in COVID- 19 management and vaccine acceptance and how the communities within two municipalities also perceived the engagement process as well as the lessons that can be learned in engaging communities to deal with other health challenges and interventions toward the attainment of SDG 3 target 3.3.

Materials and methods: This case study qualitative research project employed in-depth interviews among 36 respondents composed of government officials (the Ghana Health Service (GHS), the Information Services Department (ISD), the National Commission on Civic Education (NCCE) and two Municipal Assemblies), and community leaders and 10 focus group discussions among 87 men and women most of whom were natives and some migrants in two administrative municipalities in Ghana. Data were collected from June to September 2021. Audio interviews were transcribed and uploaded to Nvivo 12 to support triangulation, coding, and thematic analysis. Ethical approval was obtained from the University of Health and Allied Sciences' Research Ethics Committee and all COVID-19 restrictions were observed.

Results: The findings revealed that all the four government institutions educated and informed the communities within their municipalities on COVID-19 management and vaccine acceptance. However, the Ghana Health Service was the most effective in the engagement spectrum of the other

four; consulting, involving, collaborating, and empowering communities in the process of COVID-19 management and vaccine acceptance. The GHS achieved that through its CHPS program, which ensured a decentralized health service provision system with multiple programs and leveraging on its multiple programs to reach out to the communities. Government institutions such as the NCCE and the ISD faced challenges such as limited funding and support from the government to be able to carry out their tasks. Additionally, they were not involved with the communities prior to the pandemic and for that matter, they did not have access to community systems such as committees, and existing groups to facilitate the engagement process.

Discussion: Using communities to support Ghana's attainment of the SDG 3 target 3.3 is possible; however, the government needs to provide funds and resources to the institutions responsible to enable them to carry out community engagement effectively. Also, promoting decentralization among institutions can strengthen community engagement processes. It is important that state institutions continue to strategize to empower communities in order to promote their participation in healthcare interventions and in the fight against infectious diseases in Ghana.

KEYWORDS

Ghana, community engagement, sustainable development goal 3, COVID-19, community-based health planning and services, government institutions, healthy lives

1 Introduction

Community engagement is essential for the delivery of primary health care and a people- centered care (1–4). This is because community engagement contributes to community buy-in to health interventions (5, 6), and ensures effective health advocacy and better healthcare service quality, which in turn influences clients' satisfaction (7, 8). Effective community engagement enhances and increases the responsiveness of the healthcare system to clients' health needs (9). Therefore, community engagement is essential for the effective implementation of health interventions such as those addressing communicable diseases, non-communicable diseases and maternal and child health among others (10–12). Nevertheless, existing evidence suggests that community engagement and intersectoral engagement have been the weakest link to primary health care since the Alma Ata declaration in 1978 (1). Thus, in order to achieve sustainable development goal 3: "Ensure healthy lives and promote well- being for all at all ages" (13), there is the need for a broader understanding of community engagement to support community empowerment to facilitate shared decision-making and to increase participation in the design and execution of health interventions (14–16).

Community engagement is useful for creating local and context-specific solutions for the prevention and response to health needs, which can facilitate the attainment of the set targets for sustainable development goal 3 (SDG 3) (13). The need for extensive community engagement in achieving SDG 3 target 3.3: "By 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases, and other communicable diseases" (13) is urgent and critical with the advent of pandemics such as Ebola and COVID-19. Documentation of experiences on community engagement with the advent of COVID-19 will help to inform future community engagement efforts in other areas of healthcare, which can contribute toward the attainment of the set targets of SDG 3.

This qualitative case study sought to explore and describe how the Ghanaian government through the Ghana Health Service (GHS) assisted by the, Information Services Department (ISD), National Commission on Civic Education (NCCE) and the Municipal Assemblies, engaged communities to support the fight against COVID-19 using the WHO's community engagement framework. It also explored how the selected communities experienced the engagement process. Thus, the lessons from this study are useful for future policy-making and designing interventions toward Ghana's quest to achieve the set targets of SDG3.

1.1 Community engagement defined

The World Health Organization (WHO), defines community engagement as: "…developing relationships that enable stakeholders to work together to address health-related issues and promote well-being to achieve positive health impact and outcomes" (17). The WHO's (17) definition presents three main components, which are actors/stakeholders, developing the process, and the purpose of engagement. Stakeholders are perceived as the different parties that have an interest in the process, which comprises multiple communities that could include community members, patients, health professionals, policy-makers, and supporting sectors (18). The process suggests the different stakeholders strive to create a relationship that is based on respect, trust and a sense of purpose (17).

The framework proposes a spectrum of five components: (1) Informing the community of policy directions of the government; (2) Consulting the community as part of a process to develop government policy, or build community awareness and understanding; (3) Involving or planning with the community through a range of mechanisms to ensure that issues and concerns are understood and considered as part of the decision-making process; (4) Collaborating with the community by developing partnerships to formulate options and provide recommendations and; (5) Empowering the community to make decisions and to implement and manage change (19).

1.2 Context of community engagement in Ghana

One of the key approaches to the Ghanaian government's fight against COVID-19 was to mandate key governmental agencies that are authorized to work with communities such as the District/ Municipal Assemblies, the Information Services Department (ISD), National Commission for Civic Education (NCCE) and the Ghana Health Service (GHS), to engage with communities. The ISD, which is the oldest of the institutions was created prior to independence era and later transformed into the Department of Information. It serves as an effective unit for disseminating information from the Government. Specifically, to bridge the communication gap between the government and the governed (20). The NCCE on the other hand is aimed at creating awareness of government policies, programmes and activities through effective communication strategies using qualified human resources and state of the art technology to enhance national development, they also collate and assess public reaction to government policies and disseminate information on the activities of state officials and policies (21). The district assembly is aimed at decentralizing in order to ensure citizen participation by giving citizens the opportunity and power to engage in discussions and to contribute to decision- making processes affecting their districts. Consequently, citizen's participation is pivotal to the decentralization programme of Ghana and such participation may involve information sharing, consultation, service access, election, and collaboration among others (22). Similarly, in the health sector, Ghana health service has made attempts to strengthen community engagement to ensure early and timely delivery of health services, and to improve the responsiveness of the healthcare system to curb widespread infections and reduce stress on the healthcare system in order to save lives (23, 24). As part of this measure, Ghana introduced the community-based health planning and services (CHPS) concept in 1997 with the following objectives: to strengthen health delivery through the mobilization of community leadership decision-making systems, and resources in a defined catchment area; the placement of reoriented frontline health staff with logistic support; and community volunteer systems to provide services according to the principles of primary health care (25, 26). Subsequently, the Ghana Health Service (government's health service provision agency) and its partner organizations have established CHPS facilities in most districts to offer primary health care in communities.

2 Methods

2.1 Study design

The study used a case study qualitative approach to explore and describe the Ghanaian government's community engagement efforts toward COVID-19 prevention, management, vaccine preparedness and acceptance in two municipalities in the Volta Region of Ghana. The study presented how these communities experienced the engagement process. Using in-depth interviews (IDIs) and focus group discussions (FGDs), the study explored in-depth knowledge on the Ghanaian government's initiative through government institutions such as the Municipal Assembly, Ghana Health Service, Information Services Department, the National Commission on Civic Education and community experiences.

2.2 Study areas

The Volta Region was chosen for the study, because it recorded the lowest vaccine acceptance rate (32.50%) at the time of the study (27). Historically, the region has been observed by the Ghana Health Service as having the top 20 districts with the highest number of unimmunized children in the country, according to a 2021 report (28).

2.3 Selection of study sites

Two municipalities dubbed Municipality A* and Municipality B* were purposively selected for the study, because they are among the most urbanized municipalities in the region. The choice was aimed at understanding how urban populations engage with the healthcare system and other governmental entities in providing health interventions. Both municipalities have a fair proportion of the rural population and Municipality B also has migrant settlements mostly made up of persons from the Republic of Togo, with which it shares boundaries.

The Ghana Health Service operates a decentralized administrative system with offices at the national, regional and municipal levels, sub-district offices, hospitals, health centers, and CHPS facilities in each region (14). To ensure that the study was reflective of the different levels of health service delivery, a multi-stage random sampling technique was used to select a sub-municipality and a CHPS facility for the study in each of the two study municipalities. In the first stage, the names of all the sub-municipal health directorates in each study municipality were obtained from their respective Municipal Health Directorates. The names were written on pieces of paper, which were folded and an observer selected one sub- municipality for the study. In the second stage, all CHPS compounds under the selected sub- municipality were written on pieces of paper, which were folded and the observer randomly picked one. To ensure that community experiences were also captured in the study, a third stage was included, which concerned writing down the names of communities under each selected CHPS facility, folding it and letting the observer randomly select one to participate in the study.

2.4 Selection of study participants and sampling

From each of the study sites, one Municipal Health Service manager, one sub-municipal health service manager, two healthcare providers from the selected CHPS compounds, one official from each of following institutions: the Municipal Assembly, NCCE, and ISD respectively, and some of the community elders were purposively sampled to participate in IDIs (Table 1). A cross-section of women, men, and migrants of different age groups who were available and willing to participate in the study were conveniently sampled to participate in FGDs consisting of 6 to 13 participants. The interviews sought to understand how the Municipal Assembly,

TABLE 1 List of data collection methods and categories of respondents.

Study participants who participated in IDIs	Municipality A	Municipality B
District Health Officials (1 municipal and 1 sub district)	2	2
Frontline workers in CHPS compounds	2	2
District Assembly officials	1	1
National commission for civic education	1	1
Information services department	1	1
Chiefs and queen mothers	2	2
Community Elders	2	2
Religious Leaders (Christian, Moslem, Traditionalist)		
Herbalists	2	2
Assembly persons	1	1
Community healthcare volunteers	2	2
Total	**18**	**18**
Study participants for FGDs		
Women below 30 years	8	8
Women above 30 years	10	8
Men below 30 years	9	9
Men above 30 years	9	8
*Migrant men	0	7
Migrant women	0	7
Total	**36**	**47**

*Municipality A does not have migrant settler communities; thus, no interviews were conducted for such a category.

GHS, NCCE, and the ISD engaged communities in the COVID-19 vaccination rollout and uptake. Saturation was attained when no new information was obtained from study participants, which is in accordance with qualitative enquiry (29). Participation was voluntary and those who were not interested were automatically excluded as were those who were mentally challenged.

The three components of the WHO's definition of community engagement (categories of stakeholders, processes used to engage communities, and the purpose of the engagement), were used to guide the selection of the stakeholders, design of the IDI and FGD guides and to determine the focus of the study, which was on COVID-19 interventions (details of the questions for each spectrum of engagement has been included as Supplementary Appendix 1). This manuscript is drafted from a larger study and other aspects have been reported in another paper (30).

2.5 Data collection, quality control management and analysis

Four graduate data collectors were trained by the first author, MA, a medical and organizational anthropologist to conduct the interviews in the Ewe language for community members and in English for the government officials.

To ensure rigor, the study guides were pre-tested among eligible participants from a municipality similar to the municipalities selected for the study. The pre-testing process guided in the revision of the guides to ensure validity and reliability. In-person interviews were conducted in English with the government officials and in Ewe with the community members. Migrants were interviewed in French, as majority of them are from Togo and cannot speak English nor the Ewe dialect spoken in Ghana. Interviews were recorded using a digital audio recorder and later transcribed verbatim to preserve respondents' views and experiences. The average duration of IDIs was 50 min and FGDs was 1 h. Meetings were held between MA and the data collectors every week to ensure the trustworthiness of data.

Transcribed data (IDIs and FGDs) were uploaded onto a computer and transferred onto a qualitative software NVivo 12, to support data coding. The data was triangulated and analyzed thematically. Deductive and inductive coding were carried out by LK, WE, AK and MK through carefully reading data, thinking critically and paying attention to the study questions, which were based on the five levels of community engagement (31). MA validated the codes by crosschecking them with the study questions and with a sample of study participants' responses. Matrixes were developed from the coded data to support further analysis. The themes generated from the analysis report on how government institutions conducted engagement activities in the two study municipalities, challenges, gaps, future plans and community experiences. Face validity was established through reflections on the themes derived from the data during dissemination seminars at which the data was shared with local officials and community members in the two study districts. The participants confirmed that our study findings truly reflected their experiences. The drafting of the contents of this manuscript is guided by the "Consolidated criteria for Reporting Qualitative research" (COREQ) Checklist (32).

2.6 Ethics statement

The University of Health and Allied Sciences' (UHAS) Research Ethics Committee (REC) approved the study [UHAS-REC A.5 (5 L 20–21)]. Potential study participants were approached and informed of the study and those who were willing to participate were taken through a consenting process. The consent form contained the following information: purpose, procedure, contact details of the principal investigator and the REC administrator, plan to disseminate study findings, date of consent, and signature columns for the interviewer and interviewee. Two copies of the consent form were completed, one was given to the study participant and the second copy was kept by the study team. Participation was voluntary and those who were not interested were automatically excluded, as well as those who were mentally challenged and persons under 18 years old. COVID-19 protocols were observed throughout the study. Interview participants were offered disposable masks and their hands were sanitized before consenting and participating in the interview. The data sets were anonymized to protect study communities and participants' identities and were accessible to only the study team. Community entry was carried out in the study municipalities and study communities. The study team visited and sought permission

from all gatekeepers (municipal chief executives, municipal health directors, CHPS compounds, officials of the NCE, and ISD, Assembly members, chiefs, and opinion leaders in the two municipalities).

3 Results

This section presents findings firstly, from government institutions on account of how they engaged communities and secondly, on how communities experienced and perceived the engagement process with these government institutions. Generally, findings from the IDIs and the FGDs suggest that all the four government institutions educated and informed the communities within their municipalities on COVID-19 management and vaccine acceptance. However, the Ghana Health Service was the most effective in the engagement spectrum of informing, consulting, involving, collaborating, and empowering communities in the process of COVID-19 management and vaccine acceptance. The GHS achieved this through its CHPS program, which ensured a decentralized health service provision system with multiple programs, which it leveraged to reach out to the communities.

3.1 Government officials' engagement activities

The government workers from the four institutions (Ghana Health Service, Municipal Assemblies, the National Commission for Civic Education, and the Information Services Department) participated in IDIs and responded to questions concerning the levels of engagement such as informing, consulting, involving/planning, collaborating and empowering communities to make decisions on health issues.

3.1.1 Informing communities about COVID-19

The government officials were asked questions about how they informed the communities in the catchment area on COVID-19 programs, the means they used to inform them, the processes used, the languages used among others. Findings from the IDIs revealed that all the four institutions informed the communities in their catchment area and educated them on COVID- 19 and vaccine acceptance. The institutions used channels such as the radio, information vans and existing community information systems. Additionally, the institutions used community gatekeepers such as elders, chiefs, and assemblymen. All the institutions utilized flyers and communicated mostly in the native language (Ewe). The GHS' CHPS facilities used routine health care programs like immunization services, child welfare clinics (CWC) and community groups that they formed prior to the advent of COVID-19, including mother-to-mother support groups among others, to reach out to communities.

3.1.1.1 Ghana health service

The study participants revealed that the GHS used the CHPS facilities as a major avenue to engage with communities. The CHPS compounds, which are located close to or within the communities, built relationships with communities over time. Additionally, the CHPS facilities initiated the formation of community groups prior to the advent of COVID-19 such as community health volunteers, mother-to-mother support and men support groups, which they leveraged to inform communities about COVID-19 management and vaccine acceptance. Also, the Regional Health Directorate (this is the administrative wing of the GHS at the regional level) encouraged the CHPS facilities to form community health management committees on COVID-19 prevention and management and vaccine campaign groups to provide information and education on COVID-19 to the communities. Furthermore, IDIs with health workers and health managers revealed that the Ghana Health Service informed the communities within their jurisdiction about COVID-19 prevention, management, and vaccine acceptance using the following methods: community durbars to educate them on COVID-19 in the indigenous language (Ewe) and using social gatherings such as church activities, funerals in the communities as a platform to inform and educate them on COVID- 19. Another platform that the CHPS facilities used was community gatekeepers such as chiefs, queen mothers, and elders, whom they held meetings with to inform them, and they in turn passed the messages to their communities. They also used routine health programs and health delivery access points such as antenatal clinics, post-natal clinics, child welfare clinics (CWC), and outpatient department platforms to inform and educate the community members. The CHPS facilities with the support of the District Health Directorates designed COVID-19 messages and used community resources such as the local community radio, the Community Information Centers, and beating gong-gong [local drums] to disseminate COVID-19 messages to the communities. They also used durbars to educate the communities and to encourage them to take vaccines. A health manager reported that this initiative influenced the community members to vaccinate "We went to areas that we have identified as places which need to be vaccinated. So, we selected those places. And when it came, we went round educating them. Luckily for us, the people participated well during the first round of vaccination." (Health Manager, Municipality A).

3.1.1.2 Municipal assemblies

Municipality A and Municipality B assemblies reported that they designated the NCCE and the ISD to inform and educate the communities on COVID-19. The NCCE indicated that they met the chiefs prior to the visits to the communities to seek their permission to carry out the education. Other strategies included educating community focal persons and unit committee members (unit committee is the lowest level of the decentralized district assembly system, which is based in communities) and gatekeepers such as chiefs, elders and religious leaders to use their privileged positions to educate the community members. They also utilized community resources such as community information centres and radio stations to inform the communities. They printed leaflets containing COVID-19 preventive information. In addition, the assemblies communicated in the English and Ewe languages to communities in order to ensure that all the members of the communities understood the messages.

3.1.1.3 The national commission for civic education

The National Commission for Civic Education (NCCE) in the two municipalities revealed that due to the ban on social gatherings they were meeting the communities in segments, based on the existing associations and the various traditional and social groupings. They met the chiefs prior to the visits to the communities to seek their permission to carry out the education. They broadcasted COVID-19 education messages at dawn and dusk in order to reach the entire community. They used the community information system like the

GHS and the municipal assemblies to inform the communities of COVID-19 management and vaccine acceptance.

However, the NCCE reported that the community members were not enthused with the education on COVID-19 and it did not influence their behavior either. They also admitted that though their van was old they were able to put it to good use by mounting a megaphone speaker on it. They also indicated that they are able to visit the community to educate them about prevention and vaccine acceptance as an interview participant shared the experience: "We organize the people through the Assembly member and the chiefs, so they beat gong for the people to come out. We talked to them about the pandemic. We have educated them on the vaccine as well but they did not take it kindly with us." (NCCE Official, Municipality A).

3.1.1.4 The information services department

The ISDs in the two municipalities reported that they used existing radio stations to broadcast information in the Ewe language to the communities and they also used public places such as the market square. There was a collaborated effort between the ISD in Municipality B and the two other government institutions - GHS and NCCE as they reported that they used the jingles prepared by the GHS to educate the communities in the local language. They further teamed up with the NCCE and the GHS to visit the communities because it was exceedingly difficult for them to reach all the communities within the municipality. as the van assigned to them had broken down. Other hurdles faced by Municipality B included community members demanding money from them and misconceptions about the COVID-19 vaccines, which they put in a lot of effort to convince the communities that it is good.

3.1.2 Consulting

The government officials were asked questions that centered on how the feedback or opinion of the communities on the different occasions was included in proposals on COVID-19 programs, how the feedback from the communities was included or used to implement COVID- 19 programs, and how the communities were provided with feedback on how their inputs influenced the COVID-19 programs that the government institutions undertook.

3.1.2.1 Ghana health service on consulting

Study participants from the GHS indicated that they consulted the communities, took their views on proposals in their programs on COVID-19 management and vaccine acceptance, and implemented those they deemed appropriate. A municipal health manager cited an instance when the Ghana Health Service requested that every household should acquire a Veronica bucket for handwashing but various communities suggested using tippy taps as an alternative because they could not afford the cost of the Veronica bucket and it was widely accepted. Additionally, ISD also offered the communities the opportunity to communicate their proposals to them whenever they wish. The ISD offices in the two municipalities reported that they consulted the communities on COVID-19 issues, but their primary responsibility was to disseminate information and update the municipal assembly on the communities' concerns. They indicated that it is the municipal assembly's responsibility to incorporate the community's concerns, so they often conveyed community concerns to the assembly, which in turn incorporated such concerns into their plans.

"Usually, when we meet with them, we get instant feedback. But we also make an allowance that should they have enough information to give to us, they can contact us to give it to us through the community health committee members." (Health Manager, Municipality A).

"So, when we take their views, then we see how to integrate it into whatever we are doing. So, we see how best to integrate whatever they want, not what we want, but then we see to it that it is the best for them and us." (Nurse, Municipality B CHPS facility) However, a health manager in one of the sub-district health facilities in Municipality A said that the facility had never received any suggestion from the community for consideration since the emergence of COVID-19 (Assistant Health Manager, Municipality A).

3.1.2.2 The municipal assemblies on consulting

The two Municipal Assemblies consulted with the communities and groups on how to stop the spread of COVID-19, and suggestions made by the community members were taken into account and implemented. For instance, Municipality A created satellite markets and changed the market days as requested by community members to reduce the congestion at the central market to reduce the risk of transmission. Municipality B also included the needs of the community in the municipal assembly's medium- and long-term plans. An official shared the interactions with the communities and the various proposals that the communities made to the assembly:

"Yes, we do [accept community proposals]. For instance, somewhere last year [2020], we even selected some businesses from various communities and brought them here to solicit their views… some of these proposals are long-term, and others are medium- term. So, we have incorporated them into a plan. …For instance, one of their major challenges was opening of the border. The Assembly has tried to communicate that to the government. The second one is the provision of water…The Assembly has committed its funds to drill a mechanized borehole for the people so that they can practice hygiene…Yes, we could not go back to the community and do the announcement as we used to do in terms of coordinating." (Assembly official, Municipality B).

3.1.2.3 National commission for civic education on consulting

The findings also reveal that although the NCCE in Municipality A consulted the community in addressing COVID-19 management and vaccination issues, they did not immediately address the proposals given by communities at the municipal level; instead, they sent communities' suggestions to the national headquarters of the NCCE for consideration. They added that some of the proposals that were health-related were referred to the GHS for consideration. In contrast, the NCCE office in Municipality B said that they had not consulted any of the communities within the municipality, because the majority of them did not believe that COVID-19 exists.

3.1.2.4 The information services department on consulting

Additionally, ISD also offered the communities the opportunity to communicate their proposals to them whenever they wish. The ISD offices in the two municipalities reported that they consulted the communities on COVID-19 issues, but their primary responsibility was to disseminate information and update the

municipal assembly on the communities' concerns. They indicated that it is the municipal assembly's responsibility to incorporate the community's concerns, so they often conveyed community concerns to the assembly, which in turn incorporated such concerns into their plans.

3.1.3 Planning/involving

Study participants from government institutions were asked how they had been working with communities in taking their views in planning programs on COVID-19 and how they had been guiding them to propose alternative interventions on COVID-19.

3.1.3.1 Ghana health service on planning

All the Ghana Health Service facilities reported that they planned COVID-19 activities with the community members. They used channels such as community durbars, Child Welfare Clinics, and Parent-Teacher Association meetings. During such occasions, community members' views were sought on how to prevent COVID-19 and how to successfully roll out the COVID-19 vaccines.

Additionally, a CHPS facility in Municipality A reported that it had reactivated health committees before the advent of COVID-19, and these meet every 3 months. So, they were leveraging on it to have regular stakeholder consultations with community gatekeepers and institutional heads in planning on COVID-19 management and vaccine acceptance. A nurse from a CHPS facility in Municipality B also reported that they engaged the community for planning purposes by first contacting the Community Health Management Committee (CHMC), which is a committee that was created at the community level to support the CHPS facilities. Also, health officials reported that they had developed relationships with the communities and earned their trust by participating in community activities such as funerals and community meetings. Such interactions helped communities trust that the health workers cared about them, which always made them willing to plan with the health workers toward the delivery of health interventions.

> "We make sure that we engage them, communicate the message to them to understand, take time to address every concern that they have, so we will have a shared common vision." (Health Manager, Municipality A).

> "Because of that good collaboration between the community and the health facility, any time we approach him [community chief], he normally listens to us. So, in terms of the planning towards COVID-19, we plan together." (Nurse, Municipality B CHPS facility).

3.1.3.2 The municipal Assembly's experiences in planning with communities

The findings also revealed that both Municipality A and B assemblies included community opinions when planning COVID-19 events and activities by seeking the opinion of community gatekeepers such as chiefs, opinion leaders, and assembly members. Also, leaders of community groups and associations such as market women groups, drivers' unions, motorbike riders' associations, and small-scale business associations in the municipalities were involved in planning and decision-making on COVID-19 interventions. They reported that with such constant engagement, the various stakeholders listen to them and implement the recommended directives.

"When we engage them, we also listen to them and we give them the message on how to prevent the spread of the disease. …For example, we met the drivers, we told them to always make sure everybody is in a nose mask before getting in their vehicles. So if you are not in a nose mask, they insist that you buy one around and put it on before joining their vehicle" (Assembly Official, Municipality A).

3.1.3.3 National Commission for civic education on planning

Additionally, the findings revealed that the NCCE in Municipality A usually allowed the communities to give them feedback after informing and educating them to help them plan future activities. "… With the communities, when we go, after our education, we ask them to tell us their understanding and they should tell us what they feel we should do better next time." (NCCE official, Municipality A) The municipality B NCCE on the other hand reported that they only notified the Chiefs and the Assemblymen whenever they wanted to have programs including COVID-19 programs in the communities, however, the communities were not involved in the planning of health intervention activities including COVID-19.

3.1.3.4 Information services department on planning

The information services department of Municipality A and B reported that they obtained feedback on community needs at community durbars after they had presented their information.

An ISD official from Municipality B cited an instance when Municipality B Assembly presented sanitizers and face masks to communities to facilitate COVID-19 observance after the NCCE had informed the assembly of such a request from the community.

3.1.4 Collaborating

Study participants from the government institutions were asked how they had been working with the communities in their catchment area to find possible solutions to fighting COVID-19 and how they had been seeking community advice on COVID-19 programs.

3.1.4.1 Ghana health service on collaboration

Study participants from the GHS indicated that the different channels that they used to engage the communities had helped to create partnerships between them and the communities because it had enabled the communities to present their views, some of which had been implemented. Instances where the GHS received feedback from communities on languages to communicate in and the need for communities to improvise the use of Veronica buckets by using tippy taps created from local materials were cited. Also, a community donated COVID-19 prevention items to a health facility to enable them to observe the protocols at the facility.

The Ghana health service reported that they had been seeking community advice through meetings with elders and soliciting their help. A nurse from a CHPS facility in Municipality A cited an instance when they sought the help of a community under their catchment area for help and they referred them to reach people within the community who could help the health facility.

> "We have committee members that we have been working with, so to get solutions for solving these problems, we let them point out those in the community who can help us to enable us to help the community. So, they …showed us the people and we contacted them to plead with them to help us …. So, they provided the things that we needed such as soap, water, hand sanitizer, and other materials." (Nurse, Municipality A CHPS facility).

The GHS participants in the two municipalities reported extensive collaborative relationships with the communities in their catchment area over the years. They leveraged such collaboration for interventions concerning COVID-19. The health managers at the Municipal level ensured that the CHPS facilities used the following strategies: community meetings, regular calls to communities to update them on important health activities and diseases, and through a community-based surveillance volunteer group. Municipality B cited examples that it was through the management committee's insistence that they had to create a treatment center in the municipality for COVID-19 patients and also extended the language for informing communities to Ewe and English.

> "Through the community members, the community meetings, and the reviews that we do. In Municipality B, we have a policy. Every month, even if you are a CHPS compound, call your community members and tell them the pattern of diseases that you are finding. Tell them the number of people you immunized in your catchment area, tell them the number of people who come to the hospital, and the type of diseases they are bringing to the hospital… We have these Community-based Surveillance Volunteers who also report on community events. So, we use that feedback from the community to tailor education and the way we go about our work." (Health Manager, Municipality B).

> "We also have Public Health Emergency Management Committee meetings which include the chiefs and we have been having these Public Health Emergency Management Committee meetings every two weeks. So, it is also a means of giving feedback to the communities and the chiefs also contribute at that Public Health Emergency Management Committee meeting. So, it is more of a debriefing on whatever that is happening and they also give advice and we implement it." (Health Manager, Municipality B).

The two GHS authorities in the two municipalities reported that the collaboration had contributed to an effective flow of information between the GHS and the communities, which culminated in trust and a supportive relationship. A sub-district manager cited an instance of a community leader supporting one of the health facilities, when they asked for help to enable the facility to practice the COVID-19 protocols is reported as follows:

> "We do this through durbars. We realized that some of the facilities do not have veronica buckets like my own for instance. So, during the durbar, we made it known to the community and then they also came out with the view that some of them can supply and …the assemblyman for this particular community, donated the veronica bucket to us with some toilet rolls." (Sub District Manager, Municipality A).

A few health officials reported that they had not sought the communities' views, as they perceived them as ignorant, so they carry out education to the communities most of the time. However, one official admitted that they had not made efforts to seek the community's experience:

> "If I say I do seek their advice, I would say I am telling lies, because most of the time, I do the telling….: Yes, I do the education…. We the health professionals especially in this sub-district usually do the talking and the people seem to be ignorant, but I think I already have one problem which is we usually do not ask them much about their opinion." (Sub District manager, Municipality A).

3.1.4.2 Municipal assembly on collaboration

The findings also suggest that Municipality A assembly usually, worked together with the community to receive views from community members, however, some of the views were not implementable. They cited two instances, the first where a community proposed that they used a local plant to treat COVID-19, which they could not accept, because it had not been medically proven to be efficacious. In the second instance, the Municipality A assembly reported that the community supported them in identifying a facility for admitting persons who got infected with COVID-19. Municipality B assembly on the other hand, reported that they were unable to go down to the community to receive their feedback, because they were being cautious due to the spread of the disease.

"During the engagement with the community, we always bring issues before them for their inputs. So, for example, when it came to where to host people infected with the COVID-19, we had to engage the community. So that is when the idea came that there is one abandoned building somewhere in town, which can be put to that use. So that idea came from the community. So, we went to visit the place and we saw that the place is a bit isolated. If the assembly can put a few touches to it, that place can be useful. And it has worked on well." (Assembly official, Municipality A).

3.1.4.3 NCCE on collaboration

The NCCE of Municipality B said that their role was solely to educate communities. The NCCE.

in Municipality A reported that it had education clubs in schools, which provided them with reports on activities in the schools. The Municipality A NCCE indicated that they usually met with the gatekeepers such as chiefs who present the communities' suggestions to them for further action.

> "In some of the communities, we have our patrons over there. We also have our civic education clubs in the schools. So, we get reports from them. We also have the community child protection committees. Also, Plan International came in to provide a lot of logistics and other personal protective equipment (PPEs). So, after the community engagement or before we go, we interact with the opinion leaders such as the chiefs, the community protection officers, and other notable people in the community. So, we all sit down and discuss whatever they tell us. So, that's what we normally do so that it would improve our next line of action." (NCCE official, Municipality A).

> "We are to go to educate them. The possible solution is education, to change their mindset about the pandemic. That is what we are doing." (NCCE Official, Municipality B).

The findings also indicated that the experience of the NCCE is not different from the GHS and the district assemblies. Whilst Municipality A reported that they encouraged the communities to give them feedback on their activities, which were usually incorporated into NCCE's activities,. Municipality B reported that they did not seek advice or feedback from their communities.

> "We ask them to tell us what they think about the way we are performing our duties. We ask them to tell us what they think about the education, the dawn broadcast, the meetings, and the seminars." (NCCE Official, Municipality A).

3.1.4.4 ISD's Activities on collaborating with communities

The ISD study participants in the two municipalities indicated that the community members usually gave them feedback after they provided them with information at community meetings and community suggestions that concern health issues to the Municipal Health Directorate for them to act and other general needs to the municipal assemblies that are responsible for such communities. They indicated that because they lacked the resources to respond to communities' health needs, they focus on informing communities communicating their needs to institutions that are mandated or have the resources to address those needs. The ISDy also indicated that some of the feedback that they got from the community was wrong perceptions, which they corrected.

3.1.5 How the government institutions empowered the communities

Questions on empowerment that were posed to government officials were ways in which government institutions equipped the communities with knowledge on COVID-19, how government institutions supported the communities to identify resources that can be used to support their fight against COVID-19, and how the government institutions had equipped them to take their own decisions on the fight against COVID-19. Out of the four institutions that were interviewed, only the GHS reported that they had been able to empower the communities, the municipal assemblies, the ISD, and the NCCE did not have an instance where they had been able to empower communities.

3.1.5.1 Ghana health service's experiences in empowering communities

Majority of the GHS facilities in the two study municipalities empowered the various communities under their catchment area on the prevention and management of COVID-19. They recommended to the communities to improvise Veronica buckets by using old gallons to make tippy taps and place them at vantage points in all households for hand washing. They also encouraged them to sew face masks by using old cloths, educated them to cover their nose and mouth when coughing as well as on the proper usage of nose masks. Other activities were proper hand washing with soap under running water, the use of hand sanitizers, adherence to social distancing and reporting to health authorities of any suspected case exhibiting COVID-19 signs and symptoms. However, some of the Ghana Health Service facilities reported that they did not empower the community members to use their resources in the fight against COVID-19.

> "We did not tell them how to use their resources to support the COVID-19 fight." (Nurse, Municipality A CHPS facility).

> "I would not say there is much support from my end to identify the resources that can be used to fight COVID-19." (Health Center in-charge, Municipality B).

3.2 How communities experienced engagement

Study participants such as gatekeepers and a cross-section of community members from 18 years and above shared their experiences on how they were informed, consulted, involved, or participated in planning, collaborated with, and empowered to take decisions on COVID-19.

3.2.1 Informing communities on COVID-19 management and vaccination

The findings revealed that the government institutions informed communities about COVID- 19 prevention, as most of the study participants indicated that they were educated on safety protocols. They went ahead to provide accurate information about the safety protocols. However, only a few respondents provided some accurate information about the COVID-19 vaccines and mentioned GHS as the only government institution, which informed them about the vaccine.

3.2.1.1 Informing and educating communities on COVID-19 preventive measures

Findings from the FGDs and the IDIs from the community members showed that the GHS and the NCCE educated them on the COVID-19 safety protocols such as wearing nose masks, using sanitizers, hand washing, and avoiding handshakes and crowded places. They reported that both institutions adopted multiple strategies in providing information to them. The GHS they reported made use of more diverse strategies as compared to the NCCE in informing and educating communities. The GHS used community durbars, social gatherings, home visits, routine health programs, and the media, while the NCCE used the media and announcement vans.

> "… they [nurses] call us to the roadside and meet with the whole community and the chiefs and tell us about the protocols such as washing of hands, avoiding shaking of hands… They tell us all the time that when we adhere to those protocols the disease will be prevented." (Herbalist, IDI, Community A).

Few of the study participants stated that the nurses [GHS staff] also employed the home visit strategy. The nurses from the CHPS facilities and community health volunteers visited the homes of community members to educate them on the COVID-19 safety protocols.

> "They [nurses] visit us in our houses and tell us the things we should do such as how to wash hands. So, some time ago I had a hand washing facility in my house, but currently it is no longer here." (Herbalist, IDI, Community A).

The nurses at the CHPS facilities also used social gatherings such as funerals, schools, and churches to inform the community members about COVID-19. They visited these gatherings, educated the attendees on COVID-19 prevention, and taught them to observe the protocols. Study participants shared their experiences. FGD participants reported that the nurses who worked in the CHPS compounds took advantage of routine healthcare programs such as Child Welfare Clinic (CWC) sessions to educate the women on COVID-19 prevention. A study participant shared her experiences:

> "They talk to us about the disease [COVID-19] when we come for weighing too." (Female FGD Participant, Community B).

The study participants reported in IDIs and FGDs that the COVID-19 pandemic had made it impossible for community leaders to hold meetings with government stakeholders. Consequently, the GHS and NCCE used the mass media, specifically, radio to inform them about COVID-19 prevention. Most community members identified the GHS and the NCCE as the main source of education on the radio.

> "Most times like the district aspect, when you switch on your radio, you will hear that the people are from the health directorate and that they will be talking about COVID- 19. So, they will do education on COVID-19 for instance, how we should wash our hands, how we should protect ourselves with the mask and everything." (Church Elder, IDI, Community B).

> "Anytime we tune to the radio, they [NCCE officials] talk on it and teach about how the COVID-19 disease is and how we can take care of ourselves so that we do not get the disease." (Female FGD Participant 30 years or less, Community B).

Study participants confirmed that the NCCE also used vehicles fitted with public address systems to educate communities in Ewe, on how they can protect themselves from COVID-19.

> "… They [NCCE] come with their vans and they talk about health issues, how to keep ourselves safe from the disease [COVID-19]." (Assemblyman, IDI, Community A).

> "They (NCCE) use a van with a public address system at the top and they use Ewe [indigenous language] to make the announcements." (Male FGD Participant above 30 years, Community B).

3.2.1.2 Informing communities about COVID-19 vaccination

The findings from the IDIs and FGDs with study participants from the communities revealed that education on the COVID-19 vaccination at the time of the study was not intense. When asked what the participants knew about the COVID-19 vaccine roll-out and the source of information, only a few of the respondents in the study communities reported that they were informed by GHS about COVID-19 vaccines and vaccine rollout. They further reported that the health workers in the CHPS compounds informed them about the vaccine. The CHPS facilities also used routine healthcare programs such as child welfare clinics (CWC), where women send their children for weighing and medical checkup to inform mothers of COVID- 19 vaccination. Additionally, GHS staff used interpersonal communication such as informing community members in their neighborhood about the COVID-19 vaccine.

> "For the CHPS compound staff, they asked them to make us aware of the vaccine and they did. So, they told us about plans for the vaccination. Since the vaccine has not arrived here yet, it was just the announcement that they made to us." (Herbalist, IDI, Community A).

> "Our nurses told us at the weighing (CWC) that they will be coming to administer the vaccine." (Female FGD Participant above 30 years, Community B).

A few of the study participants reported that they had not been informed about getting vaccinated. Some attributed the failure of the various government agencies to inform them of the vaccine to the fact that the available vaccines were meant for only top government officials and essential workers such as health workers. They expressed trust and confidence in the health workers, that whenever the vaccines became available, the health officials will vaccinate them.

> "The CHPS compound workers are not telling us anything, because the vaccine has not come to us yet. The vaccine has not come to the community yet, so they cannot tell us that they will vaccinate us or they will not vaccinate us. They are just waiting for the government to see whether they will bring it. We are also just waiting for them to see whether they will bring it. When they come, the CHPS compound will let us know about them." (Chief, IDI, Community A).

3.2.1.3 Planning or involving communities on COVID-19 management and vaccination

Interactions with gatekeepers and a cross-section of study participants from the communities revealed that a few of them were involved in the planning of COVID-19 programs. The study participants gave specific examples on occasions that the government institutions solicited their views or ideas in planning for COVID-19 prevention programs.

> "The one I can mention is, when they came to talk to us about the wearing of face masks, we agreed on using the cloth ones and they immediately went ahead to advise us to be using the cloth ones. So, I can say that our opinion was taken." (Female FGD Participant above 30 years, Community B).

> "In planning for programs, they meet and seek advice on how they should plan. Then the nurses too will tell us their thoughts …, when they realize that whatever we tell them is good, they accept it. But if they do not agree to what we say, they also suggest or give their views for us to consider." (Male Community Health Volunteer, IDI, Community B).

Some of the community members however indicated that they did not participate in the planning meetings. Several gatekeepers who participated in the IDIs as well as the community members who participated in the FGDs reported that they were not involved in planning of health programs. They explained that the health workers brought their plans to implement and, on some occasions, they only sought clarification to be able to support the implementation process.

> "When we meet, whatever they tell us to do, we only tell them how we think we can go about it. We do not tell them our ideas. We do not bring any ideas. They bring the idea and we tell them how we understand the idea." (Community Elder, IDI, Community A).

"They do not receive any other views from us than the nurses' thoughts which they implement. When they want to do some work in the community, they gather us and announce for us to come to the roadside and they explain the thing to us. When an.

aspect is not clear to us, we also ask them and they will explain to us before they start the work." (Female FGD Participant above 30 years, Community A).

> "They do not take plans from us. They make their plans and bring them to us. I do not remember having a meeting with them to make plans. The plans always come from their end to us." (Male, FGD Participant 30 years and less, Community B).

3.2.1.4 Consulting communities on COVID-19 management and vaccination

The views of all the study participants such as gatekeepers and a cross section of community members who participated in the study, were sought on how they were consulted on health programs including COVID-19. Some of them revealed that the government institutions consulted them and incorporated their views in the implementation of programs. The study participants cited instances when they chose to use face masks and it was accepted as a proof that the government institutions take their opinions into consideration.

> "I would say they took our opinion into consideration because, when we agreed on using the cloth masks, that was what was made readily available for us." (Female FGD Participant, 30 years or less, Community B).

> "Time after time, …the feedback we have given them or the proposals we have made to them, they go and modify their programs and come to us again with new strategies in combating the coronavirus." (Assemblyman, IDI, Community A).

> "When we meet and we share our ideas with them, they use the ideas to implement activities for us to see." (Female FGD Participant, 30 years or less, Community A).

Other study participants noted that some of their views were accepted if they did not involve the use of resources. Nevertheless, community views that concerned interventions that had a cost element were not implemented.

> "So they accept it but those that involve money, they leave it down for the community. They expect the community itself to do it. But those that demand ideas, they accept it gladly, because there will not be any financial commitment." (Community Elder, IDI, Community B).

Other study participants admitted that they shared their views but they indicated that they could not confirm whether their views were included in the implementation of programs, since the health workers did not confirm to them whether they were included.

Some of the study participants reported that their ideas were not included in the implementation of COVID-19 programs. Others confirmed that they had been having meetings and they had been making proposals, however, they were not sure whether their ideas were being incorporated because the government officials did not usually give them feedback.

> "… we have been having meetings and they have been writing minutes [government officials] but we do not know if they include it into their proposals. They do not tell us whether the discussions that we have been having are included in their works." (IDI with Chief, Community B).

> "They do not take our opinions; I guess they feel they know what is best for us." (Male FGD Participant, above 30 years, Community A).

3.2.1.5 Collaborating with communities On COVID-19 management and vaccination

Some of the gatekeepers and the other study participants reported that the government institutions particularly, the GHS collaborated with them in addressing health problems including in fighting COVID-19. They reported that the CHPS facilities worked with the community health volunteers and also used the existing community health committee to discuss their plans and only implement them after the committee has given them permission.

> "There is a committee for the CHPS. So, they do not do things on their own. Before anything, they meet the committee first and inform them. The committee also discusses it before giving permission to them to carry on." (IDI, Female Community Health Volunteer, Community A).

> "Whenever they face any challenges, they inform the volunteer. Then we also meet as a committee and meet the need." (IDI, Traditionalist, Community A).

> "When they are done with the directives they brought us, where the directive comes from, they make us aware of it. When we decide on issues, they come to us with the solutions and tell us what to do and inform us that they have accepted our suggestions." (IDI, Queen Mother, Community B).

Nonetheless, some community gatekeepers reported that there was no collaboration between them and the government institutions. They indicated that the government institutions have not created opportunities for them to meet them to offer advice for health programs.

> "I cannot say anything about that because for now they are not yet working with me to find a solution for COVID-19. They have not called us to any workshop on COVID 19 yet." (IDI, Male Community Health Volunteer, Community A).

> "With that one, they do not seek for our advice." (IDI, Community Elder, Community A).

3.2.1.6 Empowerment of communities on COVID-19 management and vaccination

Some of the study participants indicated that the information that the government institutions provided to communities on COVID-19 empowered them to take initiatives to prevent contracting the disease. However, others reported that they did not feel empowered enough to take the COVID-19 vaccine.

3.2.1.6.1 Adherence to COVID-19 safety protocols

Study participants reported in the IDIs and FGDs that the information that they received from the government institutions empowered them to make decisions on their own to safeguard their health by adhering to the safety protocols without being forced. They indicated that they practiced physical distancing, hand washing, wearing face masks, and using hand sanitizers. They indicated that their main source of empowerment was from the health workers, particularly those at the CHPS facilities.

> "…because they are the nurses, we have to accept whatever they tell us. So … since the disease came and the health workers at the CHPS compound told us to wear nose masks and wash our hands, we have been doing it on our own…" (IDI, Queen Mother, Community B).

> "Through their [the government institutions] teachings and training, we realized that if we do not comply with the preventive measures, we will contract the infection. So… we are able to make effective decisions to stay safe and healthy." (Male FGD Participant 30 years and less, Community B).

Study participants revealed that they applied the knowledge they gained from the education that they received from the government institutions by using local, easily accessible, and affordable materials to make their own handwashing stations (tippy taps and soap containers) and to sew face masks.

> "First, we did not know how to make a tippy tap for hand washing, but through them [the nurses], we know how to do it and when we go out for a while and come back home, we wash our hands or if we have sanitizers, we use them. So, I have realized that it is helping us to also prevent the virus." (IDI, Community Health Volunteer, Community B).

> "The people at the CHPS compound told us that even if we cannot get the big veronica bucket, we can perforate some containers and use them. As I earlier said, you can put a rope around the container, and by pulling the rope, water comes out for you to wash your hands. They said we should wash our hands under running water… When they first came with the message, everybody went ahead to do a hand washing facility in his or her house. Everybody was washing their hands under running water. They placed soap beside the handwashing facility. It means we all understood it." (IDI, Male Community Health Volunteer, Community A).

Study participants reported that some of the community members who were seamstresses and tailors voluntarily sewed nose masks and distributed them to other community members free of charge, while others took advantage of the situation to sew masks for sale. Also, the youth in the community organized themselves to make face masks and distribute them for free among community members.

> "Actually, we have a section of our youth who also saw the need to help fight against this deadly coronavirus. They educate us on community support. So, sections of the youth also go into making nose masks. So, they have made a lot of nose masks and distributed them to every member of the community. I took part in distributing those nose masks." (IDI, Assemblyman, Community A).

> "I said earlier that, when the disease was detected, our tailors used their own clothes to make face masks and some people said even though we have been hit by a disease, some people got an opportunity to make some money." (Male FGD Participant above 30 years, Community B).

Some community leaders reported that they were empowered by government agencies to take the initiative of educating their communities. They used social and religious gatherings to sensitize community members on COVID-19 prevention measures and to encourage them to observe them.

> "When we go into a gathering, we ourselves are able to announce that, the rules that the government has made, everybody should endeavor to obey." (Chief, IDI, Community A).

> "There are dangers involved if we do not obey their (health workers in CHPS facilities) advice. Their advice has made us to involve ourselves and give information to one another… As pastors or church leaders, we have been tasked that at least we should use 5 minutes to sensitize or to educate the congregants

> or the church members on COVID-19… Almost every Sunday we do it. Even if something happens and we are not able to do it before service starts, in the middle or in the midst of the service, we do it. So that is part of the empowerment." (IDI, Pastor, Community A).

3.2.1.7 Influence of community engagement on intention to get vaccinated.

Majority of the study participants reported that they had not been given ample information on COVID-19 vaccines, to enable them to make a firm decision to get vaccinated, so they were not willing to take the vaccine. They explained that the government institutions did not provide ample information for them concerning the vaccines as they did for the COVID-19 preventive measures. Others also indicated that while they were happy to observe the protocols, they were not willing to take the vaccine.

> "Concerning that vaccine, in fact, some of us will not accept the vaccine. Honestly, we say we are not receiving it. I can encourage people if I hear further clarification from the health institutions and I understand. Only then that I can encourage someone to also take it, because I also understand something and can explain to the person that he should also take it. But as they came just like that without giving us information about it, even though some of us are working with the health facility, we are scared." (IDI, Health Volunteer, Community B).

> "…I will not take the vaccine. I just do not want to take it. I will only take it if they give me detailed education on it." (IDI, Queen mother, Community B).

Despite the information provided to community members by the government institutions, some of the community members who participated in the study were unwilling to vaccinate.

> "Please I would say we should continue observing the safety protocols that we have been taught. Taking the vaccine is not an option for me. If something should kill me, it should not be a vaccine." (FGD participant, female, above 30 years, Community A).

> "I will never take it, let alone my children. They can come and kill me; I will not take it." (Male Migrant FGD participant, Community B).

> "When it comes and it turns out that I have the virus, when they give me the vaccine, I will accept it. …nobody will take it because there is no virus here. When you bring it to them, they will all say no! no! no!" (IDI, Fetish priest, Community B).

A few of the respondents were willing to take the vaccine. Their decision was based on the little information they had received from the government institutions and their trust in the government. Study participants believed that the vaccine was safe, it will prevent them from contracting COVID-19. Additionally, participants believed that the government will not set out to deliberately harm citizens by bringing a poisonous substance to inject them.

> "Oh yes, I will take the vaccine. They said [government officials] …that when I take the vaccine, I will be free and it will prevent the disease from attacking me, that is why people are taking the vaccine." (Chief, IDI, Community B).

> "Yes! That is what I have already said, the government cannot buy any infected vaccine to use to kill those under him. So, for me when they come, I will agree and go for the jab. Because it is clear to me." (Chief, IDI, Community A).

4 Discussion

The desire to achieve the SDG 3, which is anchored on good health and well-being of people, requires the full participation of community members in order to enhance a desirable health program implementation leading to its achievement. The 17 SDGs are integrated; they recognize that action in one area will affect outcomes in others and that development must balance social, health and environmental sustainability. In line with this, the study sought out the views of how community engagement could promote COVID-19 prevention and vaccine acceptance in Ghana and how this can serve as lessons for other infectious diseases. The study explored how communities experienced engagement using the WHO community engagement model in a low resource setting. The study also examined the influence of community engagement on intention to get vaccinated. The findings suggest that the Ghana Health Service was the most effective regarding the levels of community engagement such as informing, consulting, involving, collaborating, and empowering communities in the process of COVID- 19 management and its vaccine acceptance. The GHS achieved this through its CHPS program, which has enabled a decentralized health service provision system with multiple programs and a highly interactive system at the community level (22, 33). Similarly, other studies in Ghana have noted the influence of the CHPS program in community involvement resulting in effective implementation of healthcare interventions (33, 34). This is important to note considering that community engagement is the foundation of the CHPS programme (33). The CHPS initiative is Ghana's flagship strategy for achieving universal health coverage (UHC) and if it continues its community engagement effort especially in rural communities it will play an important role in Ghana's attainment of SDG 3 (35–37).

Interactions with study participants revealed that many community members adopted the COVID-19 prevention protocols (hand washing, distancing, masking), however, they were hesitant in getting the vaccine to protect them from severe COVID-19. Similar strategies were used by all the 16 regions and the world over in dealing with the COVID-19 prevention, however, there was no uniform strategy in promoting the vaccine, which could have affected willingness to vaccinate. Because, the initial vaccine consignment that the country received was meant for a select few, so, there was no uniform message provided to communities. Some of the different institutions adopted either a 'wait and see' approach and others went

ahead to inform the public but did not provide the vaccine. Others also provided opinion leaders the first dose but delayed in providing the second dose for vaccines that required two shots (30).

Anecdotally, individuals willingly accepted the preventive measures because they perceived the measures will not have any effect in their body, whilst in relation to the vaccine, individuals had trust issues regarding its perceived negative effects on them. Essentially, because of the rapid development of the vaccine (30, 34). This finding is not surprising considering that historically, the region has been observed by the Ghana Health Service as having the lowest rate of vaccine acceptance with the top 20 districts with the highest number of unimmunized children in the country (28). Additionally, it recorded the lowest vaccine acceptance rate (32.50%) in 2020 (27). An earlier paper from the current study reported that the causes for vaccine hesitancy included challenges such as insufficient logistics and myths and misconceptions about vaccines, which accounted for some community members' lack of trust in vaccines, resulting in their unwillingness to vaccinate (30). Also, Kuatewo et al. (34) have noted that in addition to the challenges mentioned, a popular song in the local language in the Volta Region encouraging community members not to vaccinate contributed to vaccine hesitancy.

Majority of the study participants reported that they had not been given ample information on COVID-19 vaccines, to enable them to make a firm decision to get vaccinated, so they were not willing to accept the vaccines. They explained that the government institutions did not provide enough and accurate information for them concerning the vaccines as they did for the preventive measures. This finding from the study contrasts with another study (38), where it was found that, in low- and middle-income countries, community engagement has been a critical enabler of effective responses to controlling communicable diseases (38). Similarly, community engagement was effective in responding to the 2014 Ebola outbreaks in the context of a weak healthcare system in Sierra Leone, where community response teams were instrumental in interrupting the local transmission through contact tracing, house-to- house visits, health facility and community reporting (21, 39).

The findings suggest that, government workers from the four institutions that participated in the study informed the communities in their municipality and educated them on COVID-19 and vaccine acceptance. This finding corroborates other studies, which found that community engagement is crucial for reaching marginalized people and promoting their participation in health and other social interventions (11, 12). This current study also compares with other studies on community engagement concerning experiences from outbreaks, which show that community engagement can take many forms and include different actors and approaches to prevention and control activities, including designing and planning, community entry and trust building, social and behaviour change communication, risk communication, surveillance and tracing and logistics and administration (6, 21, 40). Nonetheless, all these studies including the current one point to the effectiveness of using community engagement to promote acceptance of social interventions such as vaccine acceptance, which could lead to good population health. And once the health of the people is ensured, it would contribute toward the attainment of the set targets for SDG 3.

The study found that most of the time the NCCE, ISD and the district assembly rarely gave communities feedback on how their suggestions had influenced the COVID-19 programs that they were running. Such an approach contributed to distrust of government institutions and the void created led to misinformation resulting in mistrust, which contributed to vaccine hesitancy. Similarly, other studies have noted that community engagement has been limited to informing communities or engagement between government institutions with limited involvement of communities (19). Limited involvement of communities and 'top-down' approaches used within COVID-19 responses may not yield the needed vaccine acceptance, since they are likely to mistrust the intervention, resulting in hesitancy in the uptake of COVID- 19 vaccines and other health interventions (3, 4). Studies elsewhere have noted that there is a gap between community needs and how public services are rendered, because of the high tendency toward a top-down approach to community engagement (16, 41).

The findings revealed that the Ghana Health Service gave feedback to communities on their suggestions and contributions. Consequently, most of the community respondents trusted the GHS more than the other government institutions. Similarly, a study carried out by Islam et al. (42), found that community engagement in the form of feedback and involving residents led to successful management of the COVID-19 outbreak. Baltzell et al.'s (6) study found that the best strategy to ensure effective community engagement is to make it interactive between the community and institutions. Such a strategy will contribute to communities believing that their issues are important and will whip their interest in public interventions and help to forge lasting partnership.

Most of the Ghana Health Service facilities reported that they planned COVID-19 activities with the community members. Some of the channels used were gatherings such as community durbars, Child Welfare Clinics, and Parent-Teacher Association meetings. During such occasions, community members' views were sought on how to prevent COVID-19 and how to successfully roll out COVID-19 vaccines. This study's finding corroborates with studies carried out by Atkinson et al. (11) and Baltzell et al. (6), which found empowering communities to plan intervention activities played a role in successful disease control and elimination campaigns in many countries. The similarity in terms of the findings could be a result of the fact that health officials had developed a familial relationship with the community members and earned their trust by participating in community activities such as funerals and community meetings. Community engagement has been noted to help build trust in the healthcare system, which is crucial for effective healthcare delivery and clients' satisfaction (6, 36, 40). Community engagement serves as a platform for building community trust in the healthcare system and other government institutions responsible for providing social services. Thus, emphasizing community engagement is as crucial for community participation in activities toward achieving SDG 3.

In the area of collaboration, study participants from mostly the GHS' CHPS facilities indicated that they used different channels to create partnerships between them and the communities. It enabled the communities to present their views and some of those views were taken up and those that were not feasible were not taken. This contributed to the observance of the COVID-19 protocols in the communities. Additionally, by collaborating with the communities, it enabled the community leaders and the different community groups to educate their

members on the protocols, which contributed to sustaining the gains and ensuring that even when the institutions were not policing the communities, they still observed the protocols. This finding agrees with Ogundijo et al.'s (43) and Decouttere et al.'s (41) studies, that community engagement is a viable way for monitoring the spread of SARS-CoV-2 and ensuring effective collaboration. This is not new; experiences from fighting other infectious diseases such as malaria and Ebola revealed that collaboration between relevant authorities and communities contributes to good coverage and effective implementation of interventions (3, 17). The finding also provides lessons on how to ensure sustainability of intervention projects and that investing in collaboration is cost effective. Additionally, this finding indicates that achieving the SDG3 requires partnership with other agencies or sectors.

The study found that majority of the CHPS facilities within the GHS in the two study municipalities empowered the communities under their catchment area on the prevention and management of COVID-19 by training them to make their own soap locally for handwashing and making nose masks using pieces of cloth. This ensured that communities were able to take decisions that they were comfortable with and independently. Community engagement that empowers communities and utilizes community resources can contribute largely to the effective implementation of social and health interventions as well as the fight against pandemics (6, 41). Similarly, Head (44) has noted the importance of building the capacity of communities to engage effectively. In achieving the SDG3, this finding shows the need to engage in capacity building activities at community levels to ensure an empowered population. The desire to achieve the SDG 3, which is anchored on the good health and well-being of people, requires the full participation of community members in order to enhance a desirable health program implementation leading to its achievement. The 17 SDGs are integrated; they recognize that action in one area will affect outcomes in others and that development must balance social, health and environmental sustainability. In line with this, the study sought out the views of how community engagement could promote COVID-19 prevention and vaccine acceptance in Ghana and how this can serve as lessons for other infectious diseases. The study explored how communities experienced engagement using the WHO community engagement model in a low resource setting. The study also examined the influence of community engagement on intention to get vaccinated.

4.1 Strengths and weaknesses of the study

This study had some limitations and strengths. It was carried out prior to the country receiving adequate vaccines for community members and this made it difficult to have a complete understanding of community response to vaccination. A second limitation of the study is as it is typical in qualitative research, a limited number of government officials, community gatekeepers, and a cross-section of community members participated in the study, which does not enable generalization. Nevertheless, by interviewing different categories of community members and government officials and triangulating the data from the different sources, this study was able to bring out extensive views and experiences of the different stakeholders in community engagement. This study's strength lies in the fact that the nature of COVID-19 poses ethical dilemma, making person-to-person contact for such a study was complex and yet it was carried out successfully, thus, contributing literature to the very few qualitative in-person studies that have been carried out to understand government and community experiences in dealing with pandemics. Another strength of the study is that it is the first, as far as we are aware, to use the WHO community engagement framework to examine or assess COVID-19 management and vaccine acceptance using a qualitative approach.

5 Conclusion

This case study used the WHO's community engagement framework to describe how government institutions addressed COVID-19 management and vaccine acceptance in a Ghanaian context and the lessons that can be learned to facilitate the attainment of SDG 3 by 2030. The findings suggest that the GHS was able to maintain the most sustainable and effective way of engaging communities through its CHPS program. Also, the multiple programs at the CHPS level, the activities of Municipal Assemblies, and the Information Service Department facilitated the development of the different levels of engagement.

The findings further suggest that community engagement in the fight against infectious diseases toward attaining the set targets of SDG 3 in Ghana is feasible using the current system. Nevertheless, to make the current system effective, the government needs to empower and resource the different government agencies to enable them to carry out effective engagement exercises.

Additionally, to be able to sustain engagement processes, government institutions need a continued and long-term relationship with the community and this requires that the various institutions maintain continuous interactions with communities and not an on-and-off relationship. Our findings also suggest that the management of pandemics such as COVID-19 can be enhanced by the effective involvement of community members in preventive strategies and feedback mechanisms.

Even though the findings suggest that the current system is effective in curbing the transmissibility of infectious diseases, more needs to be done regarding the provision of factual and accurate information, to communities whilst dispelling misconceptions that impede the prevention of infections through vaccines.

Policy makers need to factor in community engagement as a core component of policy interventions when designing policies, as policy is only as good as its implementation is accepted by beneficiaries. Thus, making room for resources to be channeled toward community engagement in any social intervention is important for success.

The healthcare system needs to sustain the gains made over the years in community engagement processes. Nevertheless, it was noted that some of the healthcare providers did not practice all the levels of engagement, which compromised the quality of the information, especially on vaccination. It is recommended that community engagement efforts should be strengthened within the healthcare

system. Also, the other institutions need to emulate the GHS by using the existing community structures and systems to carry out community engagement to support the rollout or scale-up of interventions.

The Volta Region remains the region historically suspicious of vaccines and low in acceptance of healthcare interventions especially vaccination. It is important that special attention is given to the region in engagement processes to ensure that more gains are made, if Ghana is to achieve the set targets of SDG 3.3.

We recommend that more studies on community engagement should be done on other healthcare interventions in order to contribute to literature and policy. Exploring the dynamics of community engagement beyond COVID-19 to other interventions will be useful in contributing to knowledge and future policy.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the University of Health and Allied Sciences' Research Ethics Committee [UHAS-REC A.5 (5 L 20–21)]. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MA-A, LK, PD, and EW contributed equally to the paper. MA-A and EA conceptualized the study. MA-A trained LK, EW, AK, and MK to collect, code and analyze the data. EW, MK, LK, and AGK collected, coded, and analyzed the data. MA-A and PD supervised the data collection. MA-A, LK, PD, and EW drafted the manuscript. MK, LK, AKK, AB, SL, and EA reviewed the manuscript critically. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2023.1213121/full#supplementary-material

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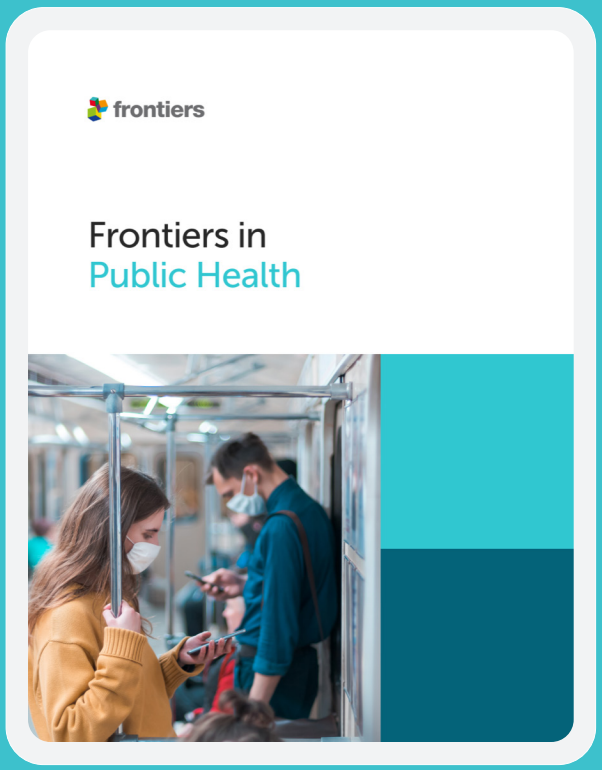

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