

Impact of Community Health Interventions on Maternal and Child Health Indicators in the Upper East Region of Ghana

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Abstract

Background

This paper reports on results of a health system strengthening programme implementation research in the Upper East region of northern Ghana where critical interventions to accelerate and strengthen the health delivery were implemented. Transformative interventions implemented included empowering community leaders and actors to actively participate in health delivery, strengthening the referral systems through the provision of community transport systems, provision of basic medical equipment to community clinics, and improving the skills of critical health staff training.

Methods

A mixed method design was used to evaluate the impact of the interventions. A quantitative evaluation employed a flexible research design to test the effects of various component activities of the project. For these analyses a pre-and-post randomized cluster design was used. For the qualitative data focused group and individual indepth interviews were employed to gauge the views of different stakeholders associated with the implementation process.

Results

Significant improvements in key maternal and child health indicators such as antenatal and postnatal care coverage (ANC and PNC) were observed. Similarly, there were significant increases in delivering of children in a health facilities and deliveries assisted by skilled health personnel after the intervention compared to before intervention situation in the region. There has also been increased uptake of women providing oral rehydration salts (ORS) for treatment of diarrhoea, as well as marked reductions in upper respiratory infections (URI).

Conclusions

Results from a pre-and post-evaluation impact assessment of interventions implemented in these health deprived parts of Ghana show that the programme had a strong positive impact on the functioning of Ghana's health delivery system known as Community-based Health Planning and Services programme and induced visible changes in key indicators of health system performance.

Background

The state of maternal and child health in low-and middle-income countries (LMICs), especially in sub-Saharan Africa (SSA), remains a major global concern [1]. While from 2000 to 2017, the global maternal mortality ratio declined by 38 per cent – from 342 deaths to 211 deaths per 100,000 live births, it was less than half the 6.4 per cent annual rate needed to achieve the Sustainable Development global goal of 70

maternal deaths per 100,000 live births [2]. Globally the under-five mortality rate has dropped by 41%, from 87 deaths per 1,000 live births in 1990 to 51 per 1,000 in 2011, but the annual rate of reduction could not achieve the millennium development goal 4 (MDG 4) by 2015 in many LMICs [3]. Despite improvements in immunization rates, widespread efforts to prevent maternal-to-child transmission of HIV (PMTCT), and other initiatives that have radically increased survival among children under 5, the proportion of deaths that occur within the first month of life (the neonatal period) remained high, accounting for about 33% of overall childhood mortality. Globally, reduction in neonatal mortality rates have been significantly slower (1.8% per year) than declines in under-five mortality (2.5% per year) [4, 5].

Ghana failed to meet the Millennium Development Goal (MDG) 4 target of reducing by two-thirds, between 1990 and 2015, the under-five mortality rate (U5MR) [6]. Despite the fact that programs have become more effective in addressing under-five mortality, the proportion of deaths occurring in the neonatal period (first 28 days after delivery) have declined marginally in recent years. The neonatal deaths (deaths occurring during the first month of life per 1000 live births) constitute about 71 per cent of infant deaths and 48 per cent of deaths in children under 5 years of age in Ghana [7]. Neonatal mortality rates (NMRs) have not improved much in the past 10 years. Between 2008 to 2014, NMR declined marginally from 30 per 1000 live births in 2008 to 29 per 1000 live births in 2014 [7, 8]. Also, in the Upper East region, NMR increased from 17 per 1000 live births in 2008 to 24 per 1000 live births in 2014 [7, 8].

Ghana's Community-based Health Planning and Services (CHPS) was launched in 2000 to scale-up community-based primary health care strategies that were tested by an experimental study conducted in the Kassena-Nankana district famously known as the 'Navrongo Experiment.' CHPS represents one of Ghana's flagship approaches to achieving "Universal Health Coverage" and its strategies represent an approach to expand the provision of basic curative and preventive integrated care that improves health and reduces maternal and child mortality.

However, following close to a decade of implementation it became apparent that progress on the national rollout of CHPS was not progressing as initially envisioned. Questions had emerged as to whether the original conceptualization of CHPS at its birth was what is being implemented, apart from its slow pace of progress. Consequently, the Ministry of Health (MoH) of Ghana commissioned a team to conduct national monitoring of the programme implementation and to ascertain from both national leaders and implementers at the district level their opinions about the progress of the CHPS programme leadership [9]. Results from the monitoring team were quite informative and provided pointers for reform; 1) that there was a lack of practical understanding of CHPS implementation; 2) that CHPS has become a static, clinic service programme of constructing health post rather than community-driven programme; 3) managers often wait mainly for resources from central government rather than mobilizing local resources from communities; 4) that no provision of budget-lines to cover startup costs; 5) that there was heavy investment in recruitment and training without concomitant investment in equipment, and 6) poor leadership and supervision. In response to these challenges, a programme of health systems implementation research was launched in 2009 in the Upper East region known as the Ghana Essential

Health Intervention Programme (GEHIP), with financial support from the Doris Duke Charitable Foundation.

GEHIP's programme was a plausibility trial where the poorest three of seven districts in Upper East Region at the time received strategic interventions that addressed the key challenges identified by the Binka et al committee but anchored on the World Health Organizations framework of health systems strengthening [10]. Results from the GEHIP interventions were transformative: impact of GEHIP interventions on health systems strengthening activities reduced neonatal mortality by approximately one half [11]. Besides the mortality impact, the GEHIP programme demonstrated feasible and effective means of accelerating the expansion of CHPS coverage [12].

The Korea International Cooperation Agency's (KOICA) programme of interventions in the Upper East Region dubbed KOICA CHPS+ conceptualized since 2014 aimed to find ways to support Ghana's CHPS programme with a specific objective of revitalizing the Community Health Volunteers (CHVs) and the community-based primary health approach that CHPS originally envisioned, while incorporating robust health system strengthening approach in the process. In the process, KOICA was introduced to the successful GEHIP programme and decided to incorporate key elements of GEHIP into KOICA's support for CHPS strengthening throughout all districts of the Upper East. In this regard, KOICA's operational model was not just provision of financial resources but also providing technical support to Ghana Health Service.

KOICA's project was titled *CHPS+* because it aimed to improve Ghana's existing health delivery programme (CHPS) through the strengthening of CHPS by revitalizing the very principle of community-based primary health care (CBPHC) as originally espoused at the Alma Atta Declaration [13-15]. In this regard, the CHPS+ project focused on strengthening district-wide health delivery system focusing on the essential aspect of CHPS, while incorporating some of the transformative interventions identified by GEHIP.

Specific interventions implemented in CHPS+ included reactivating and empowering community actors to actively participate in health delivery, strengthening the referral systems through the provision of community transport systems, and providing medical and other equipment to CHPS+ compounds, subdistrict health centres and district hospitals, to facilitate effective health care delivery. In addition, skills improvement training was provided to personal at all levels, from the community to the district level, including management and leadership training to subdistrict, district and regional managers and supervisors. To motivate the CHVs to support the health delivery effort, different incentive schemes were implemented. The overall aim of these interventions was to ensure improvement in certain health outcomes, including increased visitation of both CHOs and CHVs to households within the community to provide care, improvements in ANC visits by pregnant women and mothers, increased skill deliveries, improvements in immunization, etc.

Theory Of Change And Implementation

The logic model articulated by KOICA CHPS+ is that if the series of complementary innovative interventions are implemented as envisioned, they should result in improvements in maternal and child health outcomes and should ultimately result in improved survival. To achieve this, interventions were designed and implemented to strengthen the community component of the healthcare continuum by strengthening community volunteers through training and provision of logistics to promote healthcare, strengthening the capacity of the community health nurses through quality improvement training and provision of critical quality equipment (medical and non-medical) to the CHPS compounds and higher level health facilities such as health centres and district hospitals at the subdistrict and district levels, to facilitate delivery of quality health delivery. To strengthen overall supervision and governance in leadership and management of the district health system, leadership and management training was conducted for District Health Management Teams (DHMT) and the Regional Health Management Team (RHMT). The health information system was also strengthened by designing data collection tools that facilitated meticulous implementation data collection for monitoring progress of implementation. Finally, to strengthen the referral system three-wheeler motorized bikes known as motorking were procured and stationed in the communities to serve as emergency transport for transporting patients (women and children) to the nearest higher-level facilities. The premise is that if the manpower needs and necessary medical/non-medical equipment are provided, coupled with proper training of the cadre of health workers (community health nurses and community health volunteers) as well as sub-district and district leadership to enhance supervision, the result will be improved service delivery which will then translate into improved health and survival of mothers and children. The different regimen of services and training are captured in the theory of changed diagram represented in Figure 1 below.

Design, Data And Analytical Strategy

Design

The CHPS+ project included an elaborate project evaluation designed to 1) provide rigorous quantitative estimates of the project on desired outcomes; 2) provide detailed qualitative evidence that augments the main quantitative impact of the project; and 3) provide detailed explanation of the processes that led to quantitative impact. Accordingly, the evaluation used a mixed methods research design combining both qualitative and quantitative designs. Qualitative evaluation using in-depth interviews (IDIs) and focus group discussions (FGDs), describes the processes and procedures that explain the causal impact of the project on desired outcomes. The qualitative aspects focused on understanding knowledge acquisition, competencies, behavioral and attitudinal changes that occurred among service providers and recipients that may have led to improvement in health outcomes. The quantitative impact evaluation used survey data and other available service delivery and administrative data to provide causal estimates of the impact of the project.

The CHPS+ project was composed of different interventions targeted at different levels of the healthcare system. At the community level, a total of 120 CHPS zones were randomly selected across all the districts in the Upper East region to support health service delivery at the community level using different incentive

schemes as motivations, and the provision of a sustainable emergency referral system to transport mothers and children to higher level facilities. For purposes of evaluating differential impacts of the different incentive schemes and the emergency referral system, the 120 CHPS zones were further subdivided into different sub-categories to reflect the different incentive schemes. The different interventions sought to evaluate: 1) Effectiveness of the different incentive schemes for Community Health Volunteers (CHVs); 2) Effectiveness of the Sustainable Emergency Reference System (SERC), and 3) the combined effect of the CHVs and SERC. Evaluation of CHVs incentives and SERC was based on a cluster-based randomized controlled trial, with a pre-and-post intervention data collection scheme. In addition to the community level interventions, the project also implemented interventions at the health centre (HC) level, sub-district, district and at the regional levels where personnel at the levels were provided with different types of skills through targeted training, including emergency management, leadership and management skills. The facilities at the different levels – health centres through to the regional level were provided with equipment and personnel trained on how to manage these equipment.

The quantitative evaluation employed a flexible research design that permitted testing the effects of various component activities of the project. Since many of the component interventions are at the community level and impact is measured at the individual level, the design was based on a cluster-based quasi-randomized design whereby individual-level data was collected using a well-structured survey instrument. The overall impact of the CHPS+ project is based on a pre-and-post design.

To aid explanation of the quantitative results qualitative interviews were conducted at baseline and endline to clarify how the CHPS programme works, roles and activities of CHO/CHN/midwives, supervision, community engagement in the CHPS+ programme and suggest appropriate ways to promote maternal and child health programmes.

While we have discussed the detailed design of the KOICA CHPS+ project, it is important to note that this paper is not seeking to evaluate the different intervention subcomponents of the project; instead, we seek to report on the overall impact of the intervention on maternal health indicators pre-and-post the interventions.

Data

The main source of data for the overall impact evaluation of the CHPS+ project is two rounds of household surveys. The first round is the GEHIP end line survey which was conducted in 2014/2015. This served as the baseline data for CHPS+ since KOICA's project built on the GEHIP project. This survey interviewed more than 7600 women in their reproductive age (15-49 years) across the region on various indicators, including all the outcome indicators for the CHPS+ project (see section 2.2 below). The second round is an endline survey, also similar to the CHPS+ midline and baseline surveys.

The samples for both baseline and end line were designed to obtain random samples of women in their reproductive ages (15-49) that is representative of the region's rural population. In both cases, a two-stage cluster random sampling procedure was used. In the first stage a random sample of census Enumeration

Areas (EAs) was selected from the region's rural population. To ensure proportionality according to population size, in both baseline and end-line, the number of EAs sampled from each district was based on the district's contribution to the region's rural population. A complete listing of all households in these EAs was conducted and this served as the sampling frame for the second stage. At the second stage sampling, a roughly equal number of households were randomly selected from the listed EAs. All eligible women (women aged 15-49 years) in the sampled households were interviewed. Households were then sampled from these strata and all women within sampled households were interviewed.

It is important to highlight some differences between the baseline and end-line sampling. First, the number of EAs in the baseline was increased from 72 to 160 EAs. The average number of women interviewed per EA decreased from baseline to end line. In both cases, sampling weights were computed and applied to account for the unequal probability that a woman is sampled across the various EAs.

It is also important to note that the data collection processes were similar across the two surveys. In both cases, electronic-based data capture using the data entry Apps and Servers of survey CTO were employed. Data collection in the baseline took place from October 2014 to February 2015 while the data collection for the end line survey took place from June-August 2020.

The analyses of the household survey were supplemented with findings from the end-line qualitative assessments. The sampling for the qualitative assessments involved a multi-stage sampling method to sample the respondents for the study. The first stage involved the selection of districts. The region was divided into three zones: east, central and west zones. In the East zone we randomly selected four districts (Bawku Municipal, Binduri, Pusiga and Garu-Tempene districts), in the central zone, we randomly selected two districts (Bongo and Talensi districts) and in the western zone we selected all four districts (Kassena-Nankana Municipal, Kassena-Nankana West, Builsa North and South Districts). In all ten districts were selected: four each from the Eastern and Western zones, and two from the Central zone.

The second stage involved selecting respondents for the survey. Purposive sampling method was employed to select health professionals (District Directors of Health Services and the Sub-District Heads and District Public Health Nurses, Community Health Nurses and Midwives) and community stakeholders (traditional leaders, traditional birth attendants, community health volunteers, older men and women, women and men of reproductive age). Participants for the FGDs were identified through key informants in the communities. The FGDs and IDIs explored community stakeholders' views about CHPS.

Ethical approval

Ethical approval for the study was obtained from the Institutional Review Board of the Navrongo Health Research Centre (NHRCIRB262). All participants interviewed willingly agreed to participate in the surveys and provided informed consent.

Limitations

A major limitation of this study is the fact there may have been other programmes that may have been independently implemented by other donors that we may not be aware of which could have impacted on the results. To our knowledge however, no such large-scale interventions were concurrently ongoing at the time of the KOICA interventions. Another limitation is that the pre-post approach makes it impossible to separate the impact of the project from the expected improvements in the project's outcome indicators overtime. Thus, the results presented in this paper could potentially overstate the impact of the project.

Results

Background characteristics of respondents

Table 1 reports on the background characteristics of women and children in the household surveys at two survey rounds. The total number of women surveyed at baseline was 7,693, and 4,694 at endline. The corresponding number of children were 3,501 at baseline and 2,669 at end-line.

The distribution of women interviewed showed that the sample was made of young women across the two samples (26.0% at baseline and 23.9% at endline were less than 20 years old). More than half of the women were married/cohabiting across all the two periods (60.6% at baseline and 59.0% at endline). An appreciable fraction of the women across all survey years had no formal education (48.6%, and 38.2% respectively) and only a small proportion had at least secondary or higher education, with 11.7%, and 15.5%, at baseline and endline respectively. However, the level of education improved over the two surveys. More than half of the women were illiterate at baseline (59.5%) and endline (51.7%).

The largest ethnic group was the Frafra group representing 28.0% of women at baseline and 33.9% at endline. The most dominant religion was Christianity from baseline (66.3%) to endline (69.9%). Farming and being a student was the most featured occupation of the women 27.1% and 35.8% at baseline and endline respectively were farmers whilst 25.8% and 21.4% at baseline and endline respectively were students. Ownership of mobile phones increased significantly from baseline (40.8%) to endline (65.2%).

More than half of women at baseline (57.6%) had no insurance. However, the situation improved a little, with above half (52.4%) at endline insured. There was no clear trend in the distribution of women in the wealth groupings across the study arms even though some marginal differences were observed.

Table 1

Respondents Background Characteristics

INDICATOR	BASELINE (%)	ENDLINE (%)
Number of women (N)	7,693	4,694
Number of Children (N)	3,501	2,669
Woman's Age group		
15-19 years	26.0	23.9
20-24 years	16.9	18.4
25-29 years	13.3	15
30-34 years	12.3	11.4
35-39 years	12.9	11
40-44 years	10.7	10.4
45-49 years	8.8	9.9
Marital Status		
Never Married	32.8	32.7
Currently married/cohabiting	60.6	59
Widowed	1.1	5.4
Divorced/Separated	5.6	2.9
Education		
None	48.6	38.2
Primary	16.1	29.4
JHS/JSS	23.6	16.9
Secondary +	11.7	15.5
Literacy		
Literate	40.5	48.3
Not literate	59.5	51.7
Ethnic group		
Buli	13.3	10.1
Kusasi	19.7	24.5
Frafra	28.0	33.9
Kassem/Nankam	22.6	13.1

Other	16.5	18.4
Religion		
Christianity	66.3	69.9
Traditional African Religion	8.4	4.6
Islam	23.1	24.3
No religion/Other	2.2	1.1
Occupation		
No Occupation	11.2	8.5
Farming	27.1	35.8
Trading/Selling	16.7	13.0
Hairdressing/dressmaking	10.0	12.4
Student	25.8	21.4
Other	9.3	9.0
Access and or, ownership of Mobile Phone		
Owns Phone	40.8	65.2
Has access within the compound	38.6	33.7
Access in community/no access	20.6	1.1
Insurance Status		
Currently insured with NHIS	42.4	52.4
Not currently insured	57.6	47.6
Household wealth		
Poorest	19.1	20
Poorer	19.4	20
Middle	20.4	20.4
Richer	19.9	20.9
Richest	21.1	18.7
District		
Bolgatanga Municipal	7.1	7.4
Bongo	9	9.7

Builsa	13.8	10.6
Kassena-Nankana Municipal	13.8	7.7
Kassena-Nankana West	9.4	7.4
Garu Tempane	17.5	15
Bawku West	7.7	9.7
Talensi-Nabdam	12	14.3
Bawku Municipal	9.6	18.1

Impact of Project on CHPS

Table 2 presents regression results showing the effect of the KOICA CHPS+ project on functioning of CHPS in the Upper East Region. The main indicators used are being visited at home by any health personnel in the last three months, being visited at home by a CHO in the last three months, being visited at home by a CHV in the last three months, and women visiting a health facility in the last three months. For each outcome we present odds-ratios from a logistic regression along with 95% confidence intervals. In each case, we present the before-after comparison between baseline and endline.

The first three columns show significant improvement in CHPS functioning between baseline and endline. The table shows statistically significant improvement in odds of being visited at home by a health personnel in the past three months (1.44 times more between baseline and endline), the odds of being visited at home by a CHO was 1.74 times more and the odds of being visited at home by a CHV was 3.34 times more, all statistically significant at 1 % level. Column 4 shows there was no significant change in the likelihood of visiting a health facility in the last three months. Even though the odds-ratio shows there was a 5% reduction in the likelihood between baseline and endline, this is not statistically significant. Improvements in home visits as shown by these results have been corroborated by the qualitative findings, as recounted in the text below by respondents from in-depth interviews:

....." Since my wife gave birth on 13th April 2020, the nurses have been coming to her, especially when the baby is having a problem" (IDI_CHMC_Jagsa_Gwedema_Builsa South)

...." Community volunteers do home visits and support in immunization against certain diseases. They also mobilize community members for health activities such as health meetings, communal labour, durbars etc." (FGD_Pregnant_Woman-Bok Sapiliga_Binduri)

Table 2 also shows that the significant predictors of women being visited at home by health personnel were age and occupation. Across the first three columns, the likelihood of being visited at home increases

with age up until age 34 and thereafter records a progressive decline. Women in all occupation groups were more likely to report being visited at home compared with those with no occupation.

Column 4 of Table 2 shows that the significant predictors of visiting a health facility in the last three months are age, education, marital status, and insurance coverage. There is a non-linear relationship between age and likelihood of visit to a health facility. While women age 20-39 were more likely to visit a health facility, those aged 40-49 were less likely to visit a health facility compared with those under 20 years. In terms of education, those with some level of education were more likely to visit a health facility compared with those without any formal education. Women who are currently or have been previously married were less likely to visit a health facility in the last one month compared with those who are never married. Finally, consistent with expectation, women who had insurance coverage were twice as likely to visit a health facility in the last three months compared with women without insurance.

Table 2

Effect of KOICA CHPS+ project on functioning of CHPS

	(1)		(2)		(3)		(4)	
	Visited at home by any health personnel in last 3 months		Visited at home by a CHO in the last 3 months		Visited at home by a CHV in last 3 months		Visited a health facility in last 3 months	
VARIABLES	ORs	95% CI	ORs	95% CI	ORs	95% CI	ORs	95% CI
Baseline (ref)								
End line	1.44***	(1.31 - 1.58)	1.74***	(1.56 - 1.94)	3.34***	(2.82 - 3.97)	0.95	(0.88 - 1.03)
Age: 15-19 (ref)								
Age: 20-24 years	1.56***	(1.31 - 1.87)	1.27**	(1.05 - 1.53)	1.24*	(0.99 - 1.57)	2.33***	(1.93 - 2.81)
Age: 25-29 years	1.65***	(1.33 - 2.04)	1.40***	(1.12 - 1.75)	1.14	(0.84 - 1.54)	3.24***	(2.53 - 4.14)
Age: 30-34 years	1.77***	(1.39 - 2.26)	1.54***	(1.16 - 2.04)	1.30	(0.94 - 1.81)	3.09***	(2.44 - 3.91)
Age: 35-39 years	1.65***	(1.29 - 2.09)	1.33**	(1.00 - 1.75)	1.25	(0.89 - 1.76)	2.76***	(2.13 - 3.59)
Age: 40-44 years	1.48***	(1.14 - 1.92)	1.30*	(0.97 - 1.74)	1.29	(0.92 - 1.81)	2.11***	(1.61 - 2.77)
Age: 44-49 years	1.23	(0.94 - 1.62)	1.07	(0.77 - 1.48)	1.16	(0.81 - 1.68)	1.80***	(1.36 - 2.40)
Education: none (ref)								
Education: primary	1.32***	(1.12 - 1.56)	1.14	(0.96 - 1.35)	1.16	(0.94 - 1.44)	1.42***	(1.19 - 1.68)
Education: Middle/JHS	0.97	(0.82 - 1.15)	0.92	(0.75 - 1.13)	0.76**	(0.58 - 1.00)	1.14	(0.96 - 1.36)
Education: secondary+	0.97	(0.79 - 1.19)	1.04	(0.84 - 1.29)	0.89	(0.69 - 1.14)	0.86	(0.72 - 1.03)
Wealth:								

poorest (ref)								
Wealth: Poorer	1.08	(0.91 - 1.28)	1.02	(0.84 - 1.24)	0.98	(0.77 - 1.24)	1.04	(0.90 - 1.21)
Wealth: Middle	1.06	(0.87 - 1.29)	1.10	(0.90 - 1.34)	1.01	(0.80 - 1.29)	1.06	(0.91 - 1.24)
Wealth: Richer	1.11	(0.93 - 1.33)	1.15	(0.95 - 1.39)	0.94	(0.74 - 1.21)	0.87*	(0.75 - 1.01)
Wealth: Richest	1.04	(0.85 - 1.28)	1.00	(0.81 - 1.25)	0.94	(0.73 - 1.21)	0.72***	(0.61 - 0.85)
Occupation: none (ref)								
Occupation: Farming	1.32***	(1.07 - 1.64)	1.28**	(1.01 - 1.63)	1.28*	(0.96 - 1.71)	1.54***	(1.29 - 1.85)
Occupation: Trading	1.32***	(1.08 - 1.62)	1.23*	(0.99 - 1.52)	1.42**	(1.05 - 1.91)	1.26**	(1.04 - 1.52)
Occupation: hairdressing	1.25**	(1.00 - 1.56)	1.28**	(1.03 - 1.59)	1.33*	(0.97 - 1.81)	1.25**	(1.03 - 1.51)
Occupation: Student	0.93	(0.69 - 1.24)	1.07	(0.81 - 1.42)	1.45**	(1.03 - 2.03)	0.58***	(0.46 - 0.73)
Occupation: Other	1.16	(0.92 - 1.46)	1.17	(0.93 - 1.47)	1.24	(0.92 - 1.67)	1.35**	(1.06 - 1.71)
Marital: Never married								
Marital: married	2.36***	(1.92 - 2.90)	1.44***	(1.11 - 1.87)	1.18	(0.90 - 1.56)	4.64***	(3.83 - 5.61)
Marital: Widowed	1.73***	(1.30 - 2.32)	1.26	(0.91 - 1.74)	1.15	(0.79 - 1.68)	2.62***	(2.00 - 3.43)
Marital: Divorced	1.34	(0.93 - 1.92)	0.88	(0.58 - 1.33)	1.21	(0.79 - 1.88)	2.89***	(2.05 - 4.06)
Ethnicity: Buli								

Ethnicity: Kusasi	0.88	(0.62 - 1.26)	0.76	(0.53 - 1.11)	0.58**	(0.38 - 0.88)	1.37***	(1.08 - 1.73)
Ethnicity: Frafra	1.46**	(1.08 - 1.97)	1.18	(0.86 - 1.63)	1.44*	(1.00 - 2.09)	1.79***	(1.40 - 2.30)
Ethnicity: Kassem	1.13	(0.82 - 1.57)	0.61***	(0.42 - 0.89)	0.86	(0.56 - 1.33)	0.95	(0.73 - 1.24)
Ethnicity: Other	0.90	(0.63 - 1.27)	0.79	(0.55 - 1.12)	0.81	(0.55 - 1.19)	1.71***	(1.33 - 2.20)
Religion: Christian (ref)								
Religion: traditional	1.26**	(1.03 - 1.54)	1.26*	(0.97 - 1.65)	1.09	(0.82 - 1.45)	1.00	(0.82 - 1.22)
Religion: Muslim	1.04	(0.86 - 1.24)	1.24**	(1.02 - 1.50)	1.08	(0.84 - 1.38)	0.99	(0.85 - 1.15)
Religion: Other	1.03	(0.69 - 1.54)	1.05	(0.66 - 1.67)	1.04	(0.55 - 1.99)	1.05	(0.76 - 1.46)
Not insured (ref)								
Insured	1.10*	(0.99 - 1.22)	1.09*	(0.99 - 1.21)	1.00	(0.87 - 1.15)	2.01***	(1.80 - 2.26)
Constant	0.04***	(0.03 - 0.07)	0.06***	(0.04 - 0.09)	0.02***	(0.01 - 0.04)	0.10***	(0.07 - 0.15)
Observations	12,386		12,386		12,386		12,386	
Wald chi- square	477.66		373.51		497.18		1332.95	
Pseudo-R ²	0.0810		0.0756		0.1868		0.2514	
Notes: Table reports results from logistic regression models. ORs denotes Odds ratio from Logistic regression. 95% CI denotes 95% confidence interval. In all regressions standard errors are clustered at enumerator area level. ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.								

Table 3 presents the impact of the project on ANC visits, deliveries supervised by skilled health personnel and deliveries in health facilities. Column 1 presents the results for four or more ANC visits. The results show a statistically significant increase in the likelihood of four or more ANC visits by pregnant women by 76% between baseline and end line. The results also show that there was a significant positive impact on delivery supervised by skilled personnel and deliveries taking place in health facilities.

Again, results from the qualitative interviews with women in the communities show that community members themselves have noticed improvements in services provided by the health workers, as recounted by a woman in a focus group discussion session in one of the communities:

“We have received many services from the health workers. At first when you get pregnant and no one comes to check on you then you would give birth to an unhealthy baby, but today we have the nurses weighing us and following upon us to ensure we are healthy with our unborn children.” (FGD-NURSING MOTHERS-NYARIGA-BONGO)

Column 1 of Table 3 shows that major determinants of ANC attendance are occupation, marital status and insurance coverage. The likelihood of 4 or more ANC is higher among all occupation groups compared with women with no occupation. However, the effect was statistically significant for those engaged in trading or hairdressing. Even though insurance is not required to access ANC services for pregnant women, the results still show that women with insurance coverage are more likely to have 4 or more ANC visits.

Columns 2 and 3 show that age, education, occupation, religion and insurance coverage are significant determinants of delivery in health facility and delivery supervised by skilled health personnel. Older mothers were less likely to deliver in a health facility or had a supervised skilled delivery compared with those aged 15-19 years. Skilled delivery and facility delivery are both increasing the level of education. Again, women in all occupational categories were more likely to deliver in a health facility and have their delivery supervised by skilled personnel compared with those without occupation. Finally, women with insurance were more likely to deliver in health facilities and have their deliveries supervised by health personnel.

Table 3

Effect of CHPS+ on ANC visits and Facility Delivery

	(1)		(2)		(3)	
	Had 4 or more ANC visits		Delivered by skilled health personnel		Delivered in a health facility	
VARIABLES	ORs	95% CI	ORs	95% CI	ORs	95% CI
Baseline (ref)						
End line	1.76***	(1.53 - 2.02)	1.70***	(1.47 - 1.96)	1.70***	(1.45 - 1.98)
Age: 15-19 (ref)						
Age: 20-24 years	0.86	(0.48 - 1.54)	0.70	(0.42 - 1.18)	0.63*	(0.38 - 1.04)
Age: 25-29 years	1.03	(0.54 - 1.95)	0.70	(0.43 - 1.15)	0.57**	(0.35 - 0.92)
Age: 30-34 years	0.89	(0.46 - 1.73)	0.62*	(0.37 - 1.03)	0.52**	(0.32 - 0.87)
Age: 35-39 years	0.87	(0.44 - 1.70)	0.46***	(0.27 - 0.78)	0.43***	(0.26 - 0.71)
Age: 40-44 years	1.14	(0.56 - 2.32)	0.50***	(0.30 - 0.84)	0.42***	(0.25 - 0.71)
Age: 44-49 years	1.46	(0.55 - 3.85)	0.58*	(0.31 - 1.06)	0.47**	(0.26 - 0.84)
Education: none (ref)						
Education: primary	1.08	(0.76 - 1.53)	1.00	(0.80 - 1.25)	1.09	(0.86 - 1.38)
Education: Middle/JHS	0.96	(0.64 - 1.44)	1.66***	(1.18 - 2.33)	1.66***	(1.22 - 2.28)
Education: secondary+	1.56	(0.88 - 2.77)	3.08***	(1.83 - 5.20)	2.77***	(1.72 - 4.48)
Wealth: poorest (ref)						
Wealth: Poorer	1.14	(0.77 - 1.69)	1.12	(0.86 - 1.47)	1.05	(0.81 - 1.37)
Wealth: Middle	1.34*	(0.96 - 1.85)	1.11	(0.86 - 1.44)	1.10	(0.84 - 1.43)
Wealth: Richer	1.02	(0.73 - 1.43)	1.18	(0.88 - 1.57)	1.18	(0.89 - 1.56)
Wealth: Richest	1.33	(0.87 - 2.06)	1.24	(0.89 - 1.73)	1.04	(0.74 - 1.46)

Occupation: none (ref)						
Occupation: Farming	1.02	(0.66 - 1.58)	1.01	(0.76 - 1.34)	1.05	(0.80 - 1.38)
Occupation: Trading	1.69**	(1.04 - 2.75)	1.83***	(1.34 - 2.50)	1.96***	(1.44 - 2.67)
Occupation: hairdressing	1.62*	(0.94 - 2.78)	1.81***	(1.27 - 2.57)	1.69***	(1.20 - 2.38)
Occupation: Student	1.78	(0.63 - 5.01)	1.62	(0.66 - 3.94)	1.70	(0.65 - 4.46)
Occupation: Other	1.23	(0.66 - 2.31)	1.45*	(0.94 - 2.23)	1.82***	(1.17 - 2.83)
Marital: Never married						
Marital: married	1.80**	(1.11 - 2.91)	1.10	(0.73 - 1.65)	0.95	(0.63 - 1.42)
Marital: Widowed	5.47	(0.70 - 42.61)	0.93	(0.42 - 2.05)	0.92	(0.41 - 2.07)
Marital: Divorced	0.90	(0.44 - 1.84)	0.83	(0.46 - 1.50)	0.63	(0.36 - 1.10)
Ethnicity: Buli						
Ethnicity: Kusasi	1.10	(0.73 - 1.65)	1.10	(0.71 - 1.70)	0.88	(0.54 - 1.43)
Ethnicity: Frafra	1.12	(0.77 - 1.62)	1.17	(0.75 - 1.82)	1.13	(0.71 - 1.77)
Ethnicity: Kassem	1.68**	(1.06 - 2.67)	1.00	(0.66 - 1.50)	1.41*	(0.94 - 2.12)
Ethnicity: Other	1.14	(0.70 - 1.84)	1.40	(0.90 - 2.18)	1.14	(0.73 - 1.79)
Religion: Christian (ref)						
Religion: traditional	1.13	(0.76 - 1.68)	0.70**	(0.51 - 0.95)	0.72**	(0.52 - 0.99)
Religion: Muslim	0.79	(0.57 - 1.08)	1.15	(0.85 - 1.54)	1.05	(0.77 - 1.42)
Religion: Other	0.56	(0.26 - 1.19)	0.43***	(0.27 - 0.68)	0.43***	(0.26 - 0.71)
Not insured (ref)	-		-		-	
Insured	1.37**	(1.08 -	1.29***	(1.09 - 1.52)	1.27***	(1.07 -

		1.76)			1.52)
Constant	4.20***	(1.76 - 10.04)	3.22***	(1.57 - 6.57)	4.29*** (2.11 - 8.71)
Observations	6,163		6,163		6,163
Wald chi-square	171.62		244.11		271.53
Pseudo R ²	0.0576		0.0878		0.0882
Notes: Table reports results from logistic regression models. ORs denotes Odds ratio from Logistic regression. 95% CI denotes 95% confidence interval. In all regressions standard errors are clustered at enumerator area level. ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.					

Table 4 presents the effect of the CHPS+ project on immunizations. Two main outcomes are used to assess the impact on immunization: 1) an indicator that a child one year or older received a measles vaccination and 2) an indicator that children over one year received three doses of DPT vaccination. The results show significant improvements in immunization coverage between baseline and endline. The likelihood of measles immunization and three doses of DPT immunization increases by 10% and 35% respectively between baseline and end line at both are statistically significant at conventional levels.

The above improvements in immunization and allied services could be attributed to the active mobilization of women in the communities to visit health facilities for ANC, PNC, and related services, as recounted by a mother captured in the following text from a focus group discussion:

“Their role in maternal and child health as volunteers as I earlier mentioned is to announce to the pregnant women and nursing mothers on the days they are to come for ANC, PNC, and CWC services. They also trace these women if they fail to turn up on such days for their respective services. (FGD_Men_Sheaga_Talensi)

Other determinants of immunization coverage are the age of the mother, occupation, ethnicity, and insurance coverage. The likelihood of being immunized is increasing in the age of the mother. Also, children born to currently or previously married mothers are less likely to be immunized compared with children born to never married women. Immunization coverage is higher among children born to mothers with some occupation compared with those who have no occupation. Children born to Frafra, Kusasi, or Kassem/Nankani ethnic groups were less like to have both immunizations. Also, children whose mothers were covered by the National Health Insurance Scheme were less likely to be immunized compared with those born to mothers without health insurance.

Table 4

Effects of KOICA CHPS+ on immunizations

	(1)		(2)	
	Measles vaccination		3 doses of DPT vaccine	
VARIABLES	ORs	95% CI	ORs	95% CI
Baseline (ref)				
End line	1.10**	(1.02 - 1.19)	1.35***	(1.20 - 1.52)
Age: 15-19 (ref)				
Age: 20-24 years	2.32***	(1.74 - 3.10)	1.68***	(1.16 - 2.45)
Age: 25-29 years	3.09***	(2.31 - 4.13)	1.87***	(1.27 - 2.76)
Age: 30-34 years	3.39***	(2.49 - 4.62)	2.13***	(1.37 - 3.33)
Age: 35-39 years	4.63***	(3.20 - 6.72)	2.61***	(1.64 - 4.15)
Age: 40-44 years	5.87***	(3.99 - 8.63)	3.34***	(1.84 - 6.06)
Age: 44-49 years	9.45***	(5.24 - 17.05)	3.07***	(1.59 - 5.93)
Education: none (ref)				
Education: primary	0.98	(0.83 - 1.17)	0.80	(0.61 - 1.05)
Education: Middle/JHS	0.94	(0.76 - 1.17)	1.02	(0.72 - 1.46)
Education: secondary+	0.83	(0.65 - 1.07)	0.92	(0.65 - 1.30)
Wealth: poorest (ref)				
Wealth: Poorer	1.08	(0.89 - 1.32)	1.24	(0.93 - 1.67)
Wealth: Middle	1.06	(0.85 - 1.30)	1.17	(0.86 - 1.59)
Wealth: Richer	1.09	(0.85 - 1.38)	1.08	(0.80 - 1.45)
Wealth: Richest	1.04	(0.83 - 1.30)	1.13	(0.83 - 1.53)
Occupation: none (ref)				
Occupation: Farming	1.17	(0.94 - 1.44)	1.28*	(0.96 - 1.69)
Occupation: Trading	1.38**	(1.07 - 1.78)	1.27	(0.93 - 1.75)
Occupation: hairdressing	1.50***	(1.15 - 1.96)	1.51**	(1.07 - 2.14)
Occupation: Student	1.53	(0.87 - 2.71)	1.45	(0.76 - 2.77)
Occupation: Other	1.08	(0.83 - 1.40)	1.06	(0.75 - 1.51)
Marital: Never married (ref)				

Marital: married	0.99	(0.75 - 1.31)	0.93	(0.60 - 1.43)
Marital: Widowed	1.18	(0.50 - 2.81)	0.57	(0.21 - 1.58)
Marital: Divorced	1.33	(0.82 - 2.15)	0.92	(0.48 - 1.75)
Ethnicity: Buli (ref)				
Ethnicity: Kusasi	0.86	(0.64 - 1.14)	0.67*	(0.44 - 1.02)
Ethnicity: Frafra	0.99	(0.75 - 1.30)	0.65**	(0.44 - 0.98)
Ethnicity: Kassem	1.20	(0.90 - 1.60)	0.55***	(0.38 - 0.79)
Ethnicity: Other	1.02	(0.73 - 1.43)	0.82	(0.53 - 1.28)
Religion: Christian (ref)				
Religion: traditional	0.90	(0.64 - 1.26)	1.26	(0.81 - 1.94)
Religion: Muslim	0.95	(0.79 - 1.16)	1.13	(0.86 - 1.49)
Mother not insured (ref)				
Mother insured	0.54***	(0.47 - 0.63)	0.42***	(0.33 - 0.52)
Constant	0.91	(0.55 - 1.50)	4.83***	(2.48 - 9.40)
Observations	5,330		5,332	
Wald chi-square	294.30		236.67	
Pseudo-R ²	0.0487		0.0597	
Notes: Table reports results from logistic regression models. ORs denotes Odds ratio from Logistic regression. 95% CI denotes 95% confidence interval. In all regressions standard errors are clustered at enumerator area level. ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.				

Finally, Table 5 presents the results for the effect of the project on seeking appropriate care for children with childhood symptoms. Again, two outcome indicators are considered: 1) an indicator for taking Oral Rehydration Salts (ORS) by children with diarrhea, and 2) an indicator for seeking care at health facilities for children showing symptoms of upper respiratory infections (URI). The sample for both regressions is restricted to children showing both symptoms, thus the lower sample sizes for those regressions.

The results show an increase in the likelihood of both outcomes at the end line compared with the baseline, although neither is statistically significant at the 95% level. The results also show that those children with diarrhea were 41% more likely to have had ORs at the end line compared with the baseline. Also, children with URI were 38% more likely to receive care at a health facility in the end line compared with baseline. Table 5 also shows that the age of the mother, education and ethnicity are significant determinants of children receiving ORS when they have diarrhea or seeking care for URI.

Table 5

Effects of the CHPS+ Project on ORS use and health seeking for URI

VARIABLES	Took ORS when ill with diarrhea		Sought care at facility when ill with URI	
	ORs	95% CI	ORs	95% CI
Baseline (ref)				
End line	1.41	(0.87 - 2.26)	1.38	(0.82 - 2.32)
Age group (15-19 ref)				
Age group: 20-24	2.38*	(0.95 - 5.95)	2.48	(0.78 - 7.89)
Age group: 25-29	2.26*	(0.88 - 5.76)	2.60	(0.79 - 8.54)
Age group: 30-34	3.45**	(1.25 - 9.52)	1.90	(0.59 - 6.15)
Age group: 35-39	2.88*	(0.98 - 8.51)	3.55**	(1.13 - 11.09)
Age group: 40-44	1.65	(0.52 - 5.20)	10.49***	(2.06 - 53.45)
Age group: 45-49	6.35**	(1.23 - 32.70)	30.12***	(4.06 - 223.40)
Education: None (ref)				
Education: Primary	1.94**	(1.09 - 3.43)	1.09	(0.59 - 2.00)
Education: JHS/JSS	0.92	(0.43 - 1.96)	0.72	(0.31 - 1.65)
Education: SHS+	1.13	(0.60 - 2.14)	0.53**	(0.29 - 0.96)
Wealth: Poorest (ref)				
Wealth: poorer	0.88	(0.45 - 1.72)	0.80	(0.38 - 1.72)
Wealth: Middle	0.40***	(0.21 - 0.77)	0.48*	(0.23 - 1.00)
Wealth: Richer	0.88	(0.45 - 1.72)	0.58	(0.26 - 1.28)
Wealth: Richest	0.85	(0.43 - 1.66)	1.63	(0.53 - 4.98)
Occupation none (ref)				
Occupation: farming	1.64	(0.77 - 3.49)	0.69	(0.22 - 2.10)
Occupation: Trading	1.24	(0.47 - 3.24)	0.92	(0.36 - 2.35)
Occupation: Hairdressing	1.51	(0.63 - 3.62)	1.23	(0.45 - 3.36)
Occupation: Student	7.63**	(1.01 - 57.44)	1.70	(0.16 - 17.69)
Occupation: other	0.82	(0.32 - 2.12)	0.54	(0.20 - 1.44)
Marital: Never married (ref)				

Marital: Married	1.11	(0.60 - 2.06)	0.96	(0.36 - 2.62)
Marital: Widowed	3.94	(0.39 - 39.43)	0.47	(0.11 - 2.10)
Marital: Divorced	0.44	(0.13 - 1.49)	0.84	(0.13 - 5.22)
Ethnicity: Buli (ref)				
Ethnicity: Kusasi	1.32	(0.51 - 3.37)	7.76**	(1.08 - 56.00)
Ethnicity: Frafra	2.51**	(1.04 - 6.03)	8.29**	(1.34 - 51.30)
Ethnicity: Kassem	0.40	(0.13 - 1.26)	10.04**	(1.30 - 77.84)
Ethnicity: Other	1.13	(0.43 - 2.93)	5.56*	(0.81 - 38.35)
Religion: Christian (ref)				
Religion: traditional	0.82	(0.30 - 2.27)	0.99	(0.28 - 3.58)
Religion: Muslim	1.27	(0.73 - 2.23)	0.96	(0.53 - 1.73)
Mother not insured (ref)				
Mother is insured	1.13	(0.77 - 1.67)	1.11	(0.61 - 2.00)
Constant	0.19*	(0.04 - 1.00)	0.10*	(0.01 - 1.11)
Observations	654		495	
Notes: Table reports results from logistic regression models. ORs denotes Odds ratio from Logistic regression. 95% CI denotes 95% confidence interval. In all regressions standard errors are clustered at enumerator area level. ***, ** and * denote statistical significance at 1%, 5% and 10% respectively.				

Summary, conclusions, and discussion

The KOICA CHPS+ aimed to improve Ghana's existing health delivery programme through strengthening components of the CHPS programme as originally designed in its formative years. These interventions included reactivating and empowering community actors to actively participate in health delivery, strengthening the referral systems through the provision of community transport systems, and providing medical and other equipment to CHPS+ compounds, subdistrict health centres and district hospitals, to facilitate effective health delivery. In addition, skills improvement training was provided to personal at all levels, from the community to the district level, including management and leadership training to subdistrict, district and regional managers and supervisors. Reference details above.

Results show that overall, the programme has had a strong positive impact on the functioning of CHPS in the Upper East Region. This manifested in the increased likelihood that women are visited at home by CHVs and CHOs. This improvement in CHPS functioning resulted in concomitant improvement in key maternal and child health indicators. ANC coverage improved significantly as illustrated by a 76%

increase in the likelihood of pregnant women having four or more ANC visits. Similarly, both the odds of delivering in a health facility or assisted in delivery by skilled health personnel increased significantly between the baseline and the endline. In addition, there was a significant improvement in immunization coverage. The results also showed improvements in the likelihood of taking ORS and seeking care at a health facility for children when they have URI. While not statistically significant, the magnitude of the change in the coefficients is worthy of note.

These improvements are incredibly significant given the context of the period when the endline survey was conducted. The endline survey was conducted during the third quarter of 2020 (June - August) which coincided with the period of intense transmission of the COVID-19 pandemic in Ghana and thus likely to negatively impact facility attendance. Indeed, evidence from other parts of the world show that the COVID-19 pandemic had a disruptive impact on facility attendance [16]. The World Health Organization (WHO) reports that analysis of “five key essential health service indicators, including outpatient consultation, inpatient admission, skilled birth attendance, treatment of confirmed malaria cases and provision of the combination pentavalent vaccine in 14 countries finds a sharp decline in these services between January and September 2020 compared with the two previous years.” [17]. Similarly, work done by UNICEF Ghana also highlighted how nearly one million children below one year of age have been missing out on routine essential health services [18].

Finally, it should also be pointed that the 120 CHPS zones that we selected for the community-level interventions were among the least in terms of ranking in their health profile. To justify the selection of CHPS zones for intervention all CHPS zones in the Upper East region were ranked based on principal component analysis conducted using key socioeconomic and health indicators. Based on these analyses, the CHPS zones were ranked from the least to highest, based on their socioeconomic and health profile, and based on those scores the least 120 CHPS zones selected. Thus, the results should be viewed taken into consideration the context of the communities prior to the introduction of the interventions.

Abbreviations

ANC: Antenatal Care; CHOs: Community Health Officers; CHNs: Community Health Nurses; CHVs: Community Health Volunteers; CHMCs: Community Health Management Committees; CHPS: Community-based Health Planning and Services; CBPHC; Community-Based Primary Health care; DHMTs: District Health Management Teams; DHMT: District Health Management Teams; EAs: Enumeration Areas; FGDs: Focus Group Discussions; GEHIP: Ghana Essential Health Intervention Programme; IDIs: In-depth Interviews; MoH: Ministry of Health; PHC- Primary Health Care; KOICA: Korea International Cooperation Agency's; RHMT: Regional Health Management Team; SERC: Sustainable Emergency Reference System; TBAs: Traditional Birth Attendants; UER: Upper East Region.

Declarations

Ethical approval and consent to participate

The project was approved by the Navrongo Health Research Centre's Institutional Review Board (NHRCIRB262). For illiterates who could not read and write, the informed consent statement was read to them in the local language by the data collector and if they are satisfied, they are given a paper on which the consent statement is written for them to thumb print. All methods were conducted in accordance with the relevant guidelines and regulations from the Institutional Review Board of the Navrongo Health Research Centre.

All adult participants above 16 years granted informed consent but all those participants who are below 16 years informed consent was obtained from their parents or legal guardian.

Consent for publication

Not applicable.

Availability of data and materials

The data used in this paper are available from the corresponding author upon reasonable request.

Competing interest

The authors declare that there is no competing interest.

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Authors' contributions

ES led the conduct of data collection, supported data analyses and drafting of the manuscript; AAB led drafting of the manuscript and revisions; POA conducted the data analyses and supported drafting of the manuscript; CD reviewed the manuscript and provided comments on drafts of manuscript; PW supported data management analyses; TA supported data management and analyses; MA provided technical support for training of data collector, supported supervision of data collection and also supported in drafting of the manuscript; IK provided field support and conducted data integrity checks; JO provided intellectual support on design of project and reviewed and provided critical comments on manuscript; HL provided intellectual support on design of project and reviewed and provided critical comments on manuscript; HYL reviewed manuscript and provided comments; MSK provided technical support for

implementation of project and provided comments on manuscript; IL provided technical supervision and critical guidance during the implementation of the interventions; SH provided technical support and reviewed drafts of the manuscript for technical input; JKA provided leadership, supervising and technical guidance for implementation; JFP provided critical technical advice on the evaluation design and review drafts of the manuscript for technical input; PA provided oversight for the implementation of the project at the policy level and guided the analysis of the data; AO led implementation team in Navrongo and also provided comments on various drafts of the manuscript

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Figures

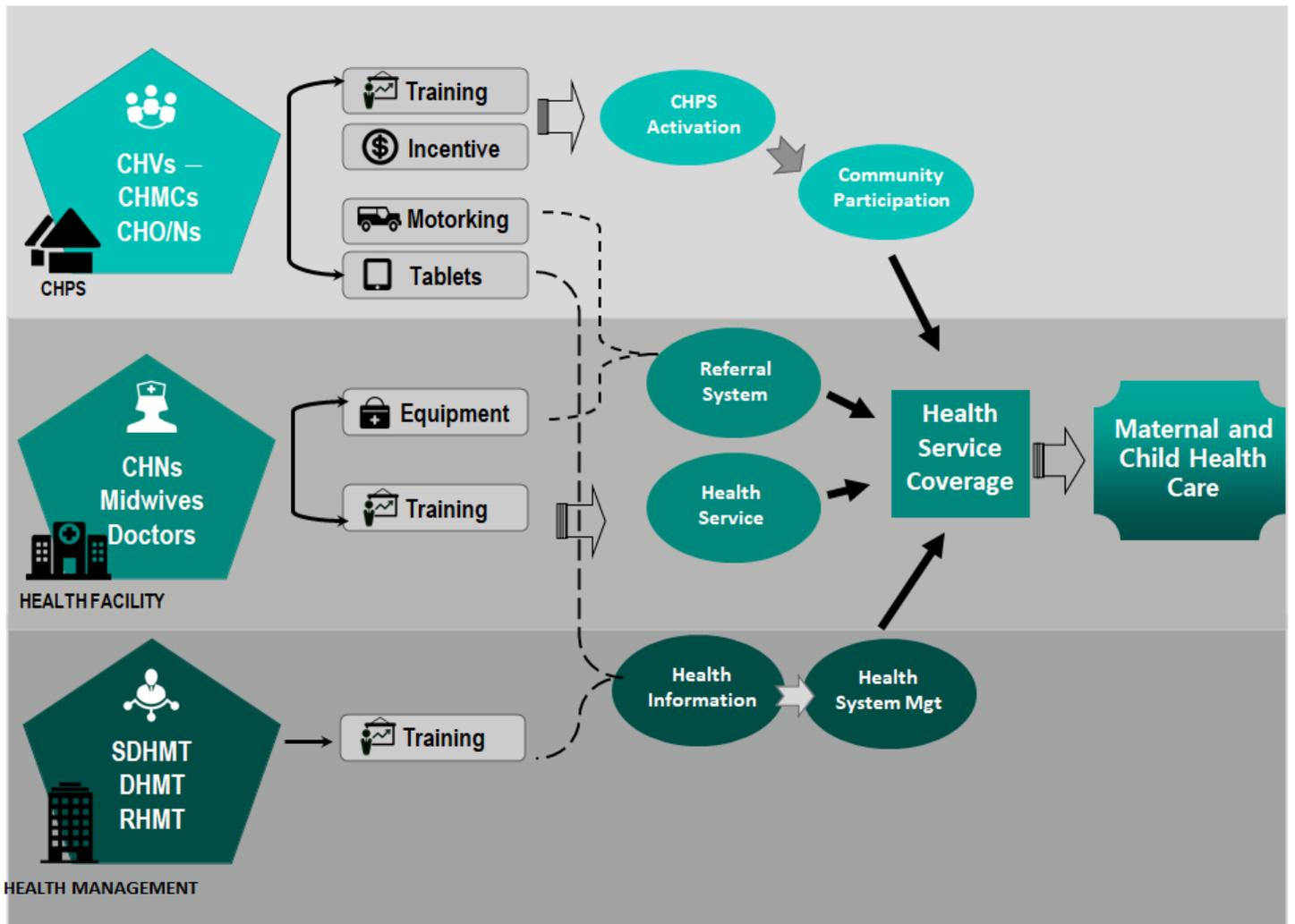


Figure 1

Theory of Change of CHPS+ Project