



**CLCD  
GHANA**

**LEVERAGING LESSONS FROM  
PRACTICE AND RESEARCH  
TO GUIDE ACTIONS TOWARD  
ACHIEVING SUSTAINABLE  
DEVELOPMENT GOAL FOR  
NEONATAL MORTALITY**

**AUGUST 2018**



**CENTER FOR LEARNING AND CHILDHOOD DEVELOPMENT**

**ADVANCING RESEARCH, PROMOTING LEARNING AND SAVING LIVES**

A photograph of two young girls from behind, looking out over a green field. The girl on the left has dark braided hair with a white bow, and the girl on the right has braided hair with pink bows. They are both wearing patterned dresses. The background is a soft-focus green landscape.

## PROJECT DETAILS

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## Abbreviation Table

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<b>AAR</b>	- Annual Rate of Reduction
<b>ANC</b>	- Antenatal care
<b>CHPS</b>	- Community-Based Health Planning and Services
<b>CLCD</b>	- Center for Learning and Childhood Development
<b>DHS</b>	- Ghana Demographic and Health Surveys
<b>GHS</b>	- Ghana Health Services
<b>HBLSS</b>	- Home-Based Life Saving Skills
<b>IPTp</b>	- Intermittent Preventive Treatment
<b>ITNs</b>	- Insecticide Treated Bed Nets
<b>KMC</b>	- Kangaroo Mother Care
<b>LiST</b>	- Lives Saved Tool
<b>MDG</b>	- Millennium Development Goal
<b>mHealth</b>	- Mobile Health
<b>MICS</b>	- Multiple Indicator Cluster Surveys
<b>mMentoring</b>	- Mobile Mentoring
<b>NGO</b>	- Non-Governmental Organization
<b>NICU</b>	- Neonatal Intensive Care Unit
<b>NMR</b>	- Neonatal Mortality Rates
<b>ORS</b>	- Oral Rehydration Solution
<b>SDG</b>	- Sustainable Development Goal
<b>TBA</b>	- Traditional Birth Attendant

## Executive Summary

Over the years, neonatal mortality rate in Ghana has declined at an appreciable rate from a high of 60.1 deaths per 1,000 live births in 1967 to 26.9 deaths per 1,000 live births in 2016. Recognizing that neonatal mortality rates in Ghana remain unacceptably high, the Ministry of Health developed and launched the Ghana National Newborn Health Strategy and Action Plan for 2014-2018.

The strategy and roadmap aimed to reduce by five percent annually, the number of babies who die in the neonatal period. Following this, Ghana has signed on to the newly adopted Sustainable Development Goals (SDGs) committing to reduce neonatal mortality to less than 12 neonatal deaths per 1,000 live births by 2030.

To date, however, we have insufficient understanding of the interventions that drove the declines in neonatal mortality rates. Furthermore, very few studies have attempted identifying the high impact interventions at the sub-national level or examined the social, policy, and programmatic contexts that contributed to reductions in neonatal mortality in Ghana. The objectives of this project were therefore to.

- First, determine how coverage of proven newborn interventions contributed to the patterns of decline in neonatal mortality in three key regions of Ghana (Northern, Volta, and Upper West Regions) during the MDG era.

- Second, identify policies, program strategies, and community actions that led to the drastic declines in neonatal mortality rate in the Northern Region of Ghana in the MDG era.
- Third, identify what evidenced-based newborn interventions need to be prioritized for the Northern, Volta, and Upper West Regions of Ghana to each reach the SDG target of at most least 12 deaths per 1000 live births.

This project made use of the Lives Saved Tool (LiST), a multi-cause model of mortality that estimates changes in under-five and neonatal mortality rates and deaths, maternal mortality ratios and deaths, stillbirth rates and deaths, causes of death using country-specific health status, changes in child and maternal health intervention coverage levels and effect sizes of interventions based on the best available evidence. Subnational data from multiple sources were triangulated to obtain inputs for LiST.

Data about the total population at the subnational level was extracted from the Ghana census conducted in 2010. For coverage of interventions and measures of the health status of the population, we identified all available nationally representative surveys conducted in Ghana during the MDG era. The primary data sources used were the Ghana Demographic and Health Surveys (DHS) for 2003, 2006, 2008, 2011 and 2014, and the Multiple Indicator Cluster Surveys (MICS) for 2006 and 2011. All LiST analyses were conducted using Spectrum version 5.70 (released June 27, 2018).

Qualitative in-depth interviews were conducted to complement the findings of the quantitative study. These involved thirty eight informants (including three government health officials, 12 health workers, seven staff from non-government organizations, and 16 community leaders, including traditional birth attendants and local chiefs).

Third, document review was done to alleviate any inconsistencies in data from the interviews and helped fill in programs and policies at the government level that had been implemented in the Northern Region that were not discussed in the interviews.

The in-depth interviews and documents gathered were analyzed separately. In-depth interviews were analyzed thematically, using an inductive approach. The documents were coded using a deductive coding approach. A triangulation approach enabled the combination of programs and policies that were mentioned in the document review and the interviews. All interviews were conducted after informed consent. Ethics approval was provided by the Ghana Health Services (GHS-1689) and Oakland University, Michigan (1209081-1).

Both the quantitative and qualitative data converged to suggest that multiple interventions and strategies contributed to declines in neonatal mortality in all three regions. Of significance was interventions that focused on having a required skilled attendant at birth. For the Volta and Upper West Regions, labor and delivery management accounted for about a third of the decline in the newborn deaths. In the Northern Region, the biggest proportion of the decline was attributed to control and management of infections in newborns (sepsis and pneumonia).

The quantitative analysis also shows that there were some variations in the kinds of interventions that led to the decline in NMR across the three regions. For example, malaria prevention through the use of insecticide mosquito nets and intermittent preventive treatment of malaria during pregnancy were important contributors to the decline in mortality in the Upper West Region, but not in the Northern or Volta Regions.



Moving ahead, while the model suggests that if the current rate of decline in NMR persists, only the Volta Region will meet the SDG goal of 12 deaths per 1000 live births, the model suggests that in the context of limited resources, the Northern Region be prioritized, as it will still have the highest NMR among the three regions by 2030. If adequate resources are available, the results demonstrate that different interventions may need to be prioritized across the three regions. For example, in the Volta Region, interventions to detect and treat syphilis and age appropriate breastfeeding should be part of any package of interventions delivered.

In addition, improving clean postnatal practices will account for about 50% of the newborn lives saved. In the Northern and Upper West Regions, however, a stronger focus should be on labor and delivery management and infection control and management, as well as neonatal resuscitation. Irrespective of the geographic location, labor and delivery management is a critical intervention that should be implemented, as it will account for about 10-25% of further reductions in newborn deaths.

The qualitative results provide several core strategies that Savannah Signature can adopt to help the three regions achieve its SDG for NMR. The strategies that supported the reductions in neonatal mortality in the Northern Region appeared to have been built on five main pillars, which are recommended below.

Areas where Savannah Signature can leverage its focus on technology to further make a difference include capacity strengthening, infrastructural support, incentivization of skilled delivery uptake, promotion of safe birth practices, and partnership with community stakeholders.

**1. Build Capacity:** leverage its investment in technology to increase the capacity of facility and community level workers to provide quality newborn care.

**2. Provide infrastructure:** The results support the need to provide the infrastructure and essential resources (e.g. incubators, medication, resuscitation machines, and oxygen) needed at health facilities to save newborn lives.

**3. Provide incentives:** Create monetary and non-monetary-based incentives to increase skilled attendants at birth.

**4. Promote safe birth practices:** Improving infection prevention and control practices both at the health facility deliveries and at community-based TBAs settings. In particular, a special effort would be needed to further promote life-saving infection control practices like handwashing and clean cord care.

**5. Partner with community leaders to educate:** The health education approaches that were used in the Northern region were successful because they utilized influential leaders and mother-to-mother support groups. A comprehensive review of newborn related interventions that make a difference advocated for such community focused approaches. Savannah should continue to focus energy in working with community leaders, particularly the magajiyas and local chiefs.

## Introduction

Globally, immense progress has been made to improve maternal and child survival in recent years [1]. Between 1990 and 2015, maternal mortality fell to 216 deaths per 100,000, representing a 44% decline [2].

During the same period, substantial progress was also made towards the Millennium Development Goal (MDG) target of reducing under-five mortality by 75%. The under-five mortality rate declined from an estimated 91 deaths per 1,000 live births in 1990 to 43 deaths per 1,000 live births in 2015 [3]. Neonatal mortality declined at a slower rate. While the global burden of neonatal deaths declined, progress was uneven and neonatal mortality rates remain unacceptably high in many parts of the world [1,3].

Recent data from the World Health Organization (WHO) show that an estimated 2.6 million of the 140 million babies die within the first 28 days of birth, equivalent to approximately 7,000 neonatal deaths occurring per day [4]. Accounting for more than 40% of deaths in children under five, the major causes of neonatal mortality are preterm birth complications, birth asphyxia, and sepsis [5]. Most of these deaths are preventable or treatable with timely health interventions [6].

In the newly adopted Sustainable Development Goals (SDGs), the global community has committed to reduce neonatal mortality to less than 12 neonatal deaths per 1,000 live births by 2030 [7].

Given the variable progress achieved during the MDG era, country roadmaps towards ending preventable neonatal deaths will vary, with some countries better positioned than others to achieve accelerated progress in the SDG era.

To date, however, we have insufficient understanding of the neonatal interventions that drove the declines in neonatal mortality rates in the MDG era. Furthermore, very few studies have attempted identifying the high impact interventions at the sub-national level or examined the social, policy, and programmatic contexts that contributed to reductions in neonatal mortality in the past [8–11].

As national estimates often mask sub-national disparities, studies that focus on the sub-national level are urgently needed to inform local strategic planning and programming to set subnational regions on the trajectory to end preventable neonatal deaths.

The overarching goal of this project was to conduct a robust situational analysis in three key regions of Ghana (Northern, Volta and Upper West Regions) with an emphasis on evidence-based interventions and contextual factors to guide the successful implementation and sustainability of neonatal interventions in these regions and beyond. We argue that such is required to put these regions on the trajectory towards the SDG target of 12 neonatal deaths per 1,000 live births by 2030.

More specifically, the project aimed to link health gains to high impact interventions by evaluating the impact of different neonatal interventions on neonatal mortality in these regions during the MDG era. Cognizant of the role of contextual factors in facilitating or hindering progress, the project also aimed to elucidate the role of contextual factors and provide lessons learned for the improvement of the content, quality and implementation of priority interventions.

The objectives of this project were three-fold. First, we assessed how coverage of proven newborn interventions contributed to the patterns of decline in neonatal mortality in the Northern, Volta, and Upper West Regions of Ghana during the MDG era.

Second, we delineated policies, program strategies, and community actions that led to the drastic declines in neonatal mortality rate in the Northern Region of Ghana in the MDG era.

Last, we identified what evidenced-based newborn interventions need to be prioritized for the Northern, Volta, and Upper West Regions of Ghana to each reach the SDG target of at most least 12 deaths per 1000 live births.

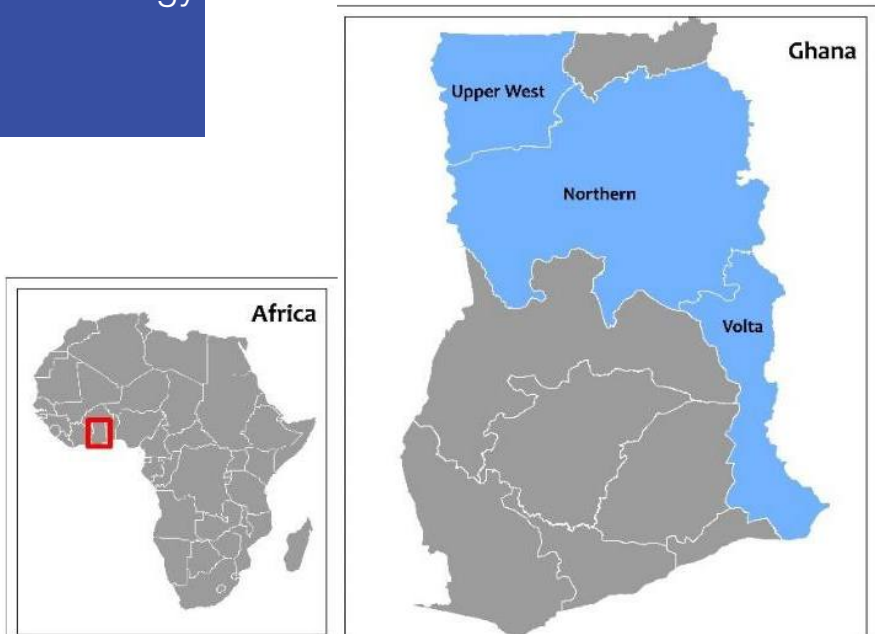
The findings of this project provide evidence to support the identification, prioritization and scale-up of high-impact, evidence based interventions to attain the SDG target and bridge the inequity in health gains across geographical strata.



## Approach and Methodology

The situational analysis included three regions of Ghana: Northern, Volta, and Upper West Regions (Figure 1). Taken together these three regions represent 21.5% of the country's population [12]. The project had two phases. Phase 1 relied on subnational coverage data from recent nationally representative household surveys to address the questions: How have historic changes in intervention coverage impacted neonatal mortality rates at the subnational level? What high impact interventions will drive further reductions in neonatal mortality rates during the SDG era? Phase 2 was a qualitative study to contextualize the policies, program strategies, and program inputs that led to neonatal mortality reductions during the MDG era.

*Figure 1: Map of Ghana and Selected Regions*



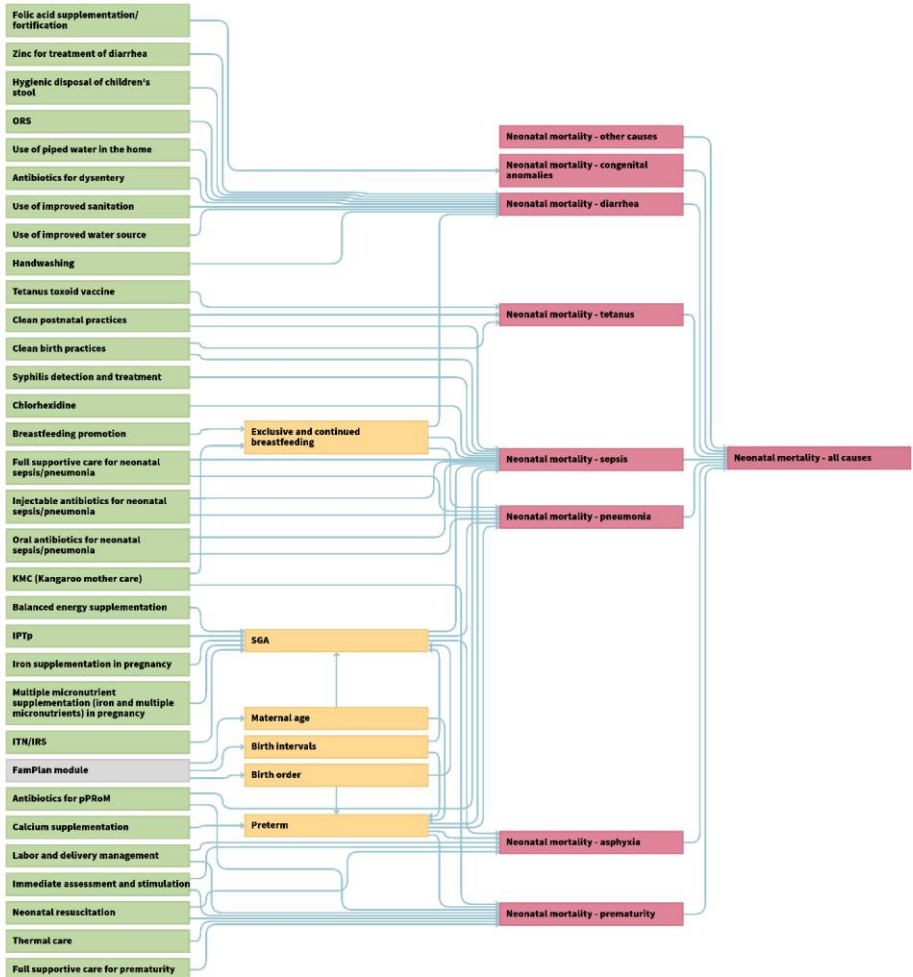
This project made use of the Lives Saved Tool (LiST), which was developed and is maintained by Institute for International Programs (IIP) at Johns Hopkins Bloomberg School of Public Health with funding from the Bill and Melinda Gates Foundation. LiST is used for prospective program planning and prioritization, retrospective program evaluation and to support advocacy at the local, national, or global level [13].

LiST is a multi-cause model of mortality that estimates changes in under-five and neonatal mortality rates and deaths, maternal mortality ratios and deaths, stillbirth rates and deaths, causes of death using country-specific health status, changes in child and maternal health intervention coverage levels (e.g. clean cord care) and effect sizes of interventions based on the best available evidence [14].

Country- specific baseline data are available in LiST by default, and subnational modelling can be conducted with additional inputs. Based on inputs, LiST estimates the number of lives saved (i.e. additional deaths averted) as well as changes in mortality rates overall, by cause and by intervention as outputs. Further details about LiST can be found at [www.livessavedtool.org](http://www.livessavedtool.org).

There are currently over 70 different health interventions represented in the LiST framework and these interventions span the continuum of care for maternal, neonatal, and child health (MNCH) from the peri-conceptual period through age 5. Of the health interventions modelled in LiST, 31 have an impact on neonatal mortality. Figure 2 shows the general framework for how LiST models both the direct and indirect effects of the neonatal interventions on mortality.

Figure 2: Framework for Neonatal Mortality in LiST







## Data Sources and Analysis

To estimate the impact of scaling up interventions on maternal, newborn, and child health, and stillbirths, LiST requires three inputs:

- Estimates of population-level coverage of high impact evidence-based interventions,
- Measures of health status including mortality and causes of death, and
- Efficacies of interventions and affected fractions.

Subnational data from multiple sources was triangulated to obtain inputs for LiST. Data about the total population at the subnational level was extracted from the Ghana census conducted in 2010. For coverage of interventions and measures of the health status of the population, we identified all available nationally representative surveys conducted in Ghana during the MDG era.

The primary data sources used were the Ghana Demographic and Health Surveys (DHS) for 2003, 2006, 2008, 2011 and 2014, and the Multiple Indicator Cluster Surveys (MICS) for 2006 and 2011. Coverage indicators were available for 11 of the 31 neonatal interventions available in LiST. In the case neither subnational nor national values were available, no changes in coverage were modeled for that specific intervention (e.g. kangaroo mother care). Default values for intervention efficacies and population affected fractions as presented in the current LiST model were applied.

To help us understand the extent to which reductions in neonatal mortality could be attributed to increases in intervention coverage in the MDG era, LiST models were analyzed to estimate changes in mortality rates between the period of 2003 – 2014, and the relative contributions of neonatal interventions to mortality reductions.

To identify what evidenced-based newborn interventions need to be prioritized for the Northern, Volta, and Upper West Regions of Ghana to each reach the SDG target, we considered two scenarios in LiST.

- *Historic trends*: First, based on past trends (2003-2014) in mortality reductions, we projected neonatal mortality from 2015 to 2030 in the three regions.
- *Universal coverage*: Intervention coverage values in 2015 were linearly scaled up to reach near universal levels (95%) by 2030. For instances where estimated baseline coverage values were at or higher than 95%, coverage was kept constant and not scaled down between 2014 and 2030. LiST was used to estimate the potential reductions in neonatal mortality that could be expected between 2015 and 2030 because of changes in the coverage of interventions under this scenario.

All LiST analyses were conducted using Spectrum version 5.70 (released June 27, 2018).

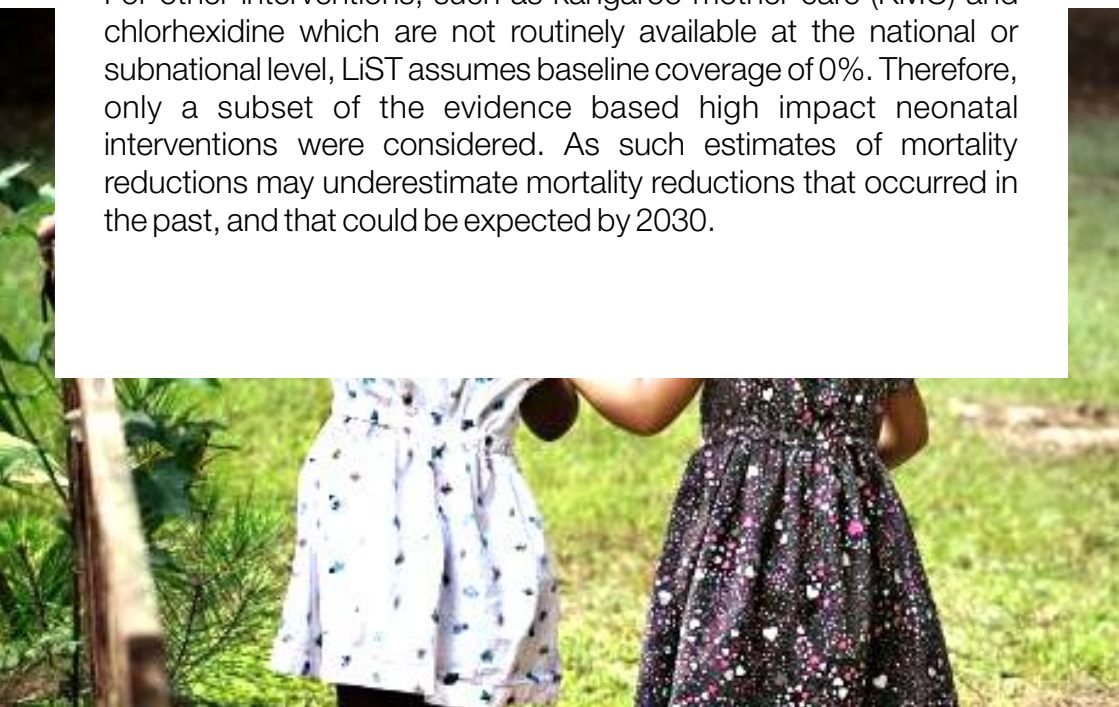


## Limitations

There are several limitations worth noting. While LiST can model 31 neonatal health interventions, coverage data was not available for several high impact interventions such as full supportive care for prematurity, antibiotics for neonatal sepsis/pneumonia and chlorhexidine. In the absence of coverage data, LiST uses several strategies depending on the intervention.

For facility-based interventions provided at or around the time of childbirth, LiST relies on assumptions based on utilization indicators. For example, default coverage of neonatal resuscitation is assumed to be universal (100%) for all deliveries occurring in a health facility.

For other interventions, such as kangaroo mother care (KMC) and chlorhexidine which are not routinely available at the national or subnational level, LiST assumes baseline coverage of 0%. Therefore, only a subset of the evidence based high impact neonatal interventions were considered. As such estimates of mortality reductions may underestimate mortality reductions that occurred in the past, and that could be expected by 2030.



## **SETTING:**

The qualitative component of the study was carried out in the Northern Region, which is the largest of the ten regions in Ghana, encompassing 70,384 square miles [15]. It is subdivided into 13 districts. This region has a population of 2.86 million, and 15.5% of the population lives in poverty [16,17]. The region has seen a rise in the number of health professionals in the past decade, but still faces inadequate number of health professional per population size.

In 2003, there were only 27 doctors and 831 nurses that were working in the Northern Region, but by 2014, these numbers increased to 117 doctors and 4,438 nurses [17,18]. Additionally, there is a total of 181 government health facilities, 83 being Community-Based Health Planning and Services (CHPS) compounds [19]. Poor health infrastructure has led to an influx of non-governmental organizations (NGOs) into the Northern Region to provide additional support to the communities.

## **DESIGN OVERVIEW:**

The qualitative portion of the study was conducted to gain contextual understanding of the interventions that contributed to the significant decline in neonatal mortality in the Northern Region. The two methods that were used for data collection were in-depth interview and document review.

The in-depth interviews were used to identify key programs, and activities from 1993- 2014 that set apart the Northern Region compared to other regions in Ghana. Government reports and policy plans were reviewed to identify major neonatal health-related programs and policies implemented by the government of Ghana generally, and the Northern Region specifically.

## **IN-DEPTH INTERVIEW:**

### **PARTICIPANTS:**

Thirty eight informants were interviewed for this study. The informants included three government health officials, 12 health workers, seven staff from non-government organizations, and 16 community leaders, including traditional birth attendants and local chiefs. The inclusion criteria for key informants included those who could provide historical information about programs, policies, and activities that were implemented in the Northern Region over the past 20 years (1993-2014). Below the procedures for sampling, interviewing participants and analysis are described below. First the procedure for the semi-structured interview is described, followed by the document review.

### **SAMPLING:**

The key informants were recruited through snowball and maximum variation sampling approaches. The Ministry of Health in Accra was initially contacted to identify key informants. Most of the individuals on the initial list of participants was from Tamale, the capital city of the Northern Region. Each of the individuals on the list were interviewed and after the interview, the interviewer asked the participant if they could recommend an additional key informant who meets the inclusion criteria. Since, there are 13 districts within the Northern Region, the research team sought to vary the geographic locations of the participants, in particular, those that have also seen declines in neonatal mortality.

Thus, data on neonatal mortality from the regional office of the Ghana Health Services in Tamale were obtained. There was only data for neonatal mortality rates from 2014. As a result, only districts with neonatal mortality rates of 0-1 death per 1,000 live births were selected. Five districts were selected using this approach, and each district snowball sampling was used to identify community leaders and health workers who have been involved in neonatal health initiatives.

### **INTERVIEW CONTENT AND STRUCTURE:**



**Picture of Research Team at Ghana Health Service Regional Health Directorate, Tamale**

The research team consisted of a local research assistant from Tamale, two undergraduate students from Brown University, a graduate student from Oakland University, and the Co-Director of the Center for Learning and Childhood Development (CLCD). Interviews were conducted in both English and the local languages.

The main topics of the interview included: program history, policies, policy implementation, programmatic inputs, community engagement, best practices, strategies and success stories that relate to neonatal mortality. Each interview lasted between 25-60 minutes. Participants also completed a background questionnaire that captured their gender, number of neonatal health projects they have been involved with, type of informant (government official, non-government official, community leader, and health cadre), current position, and location. All the interviews were audio recorded and transcribed verbatim by the research team after each interview. The research team also met daily to discuss the themes of each interview. Data saturation was used to determine the final sample size of 38 interviews.

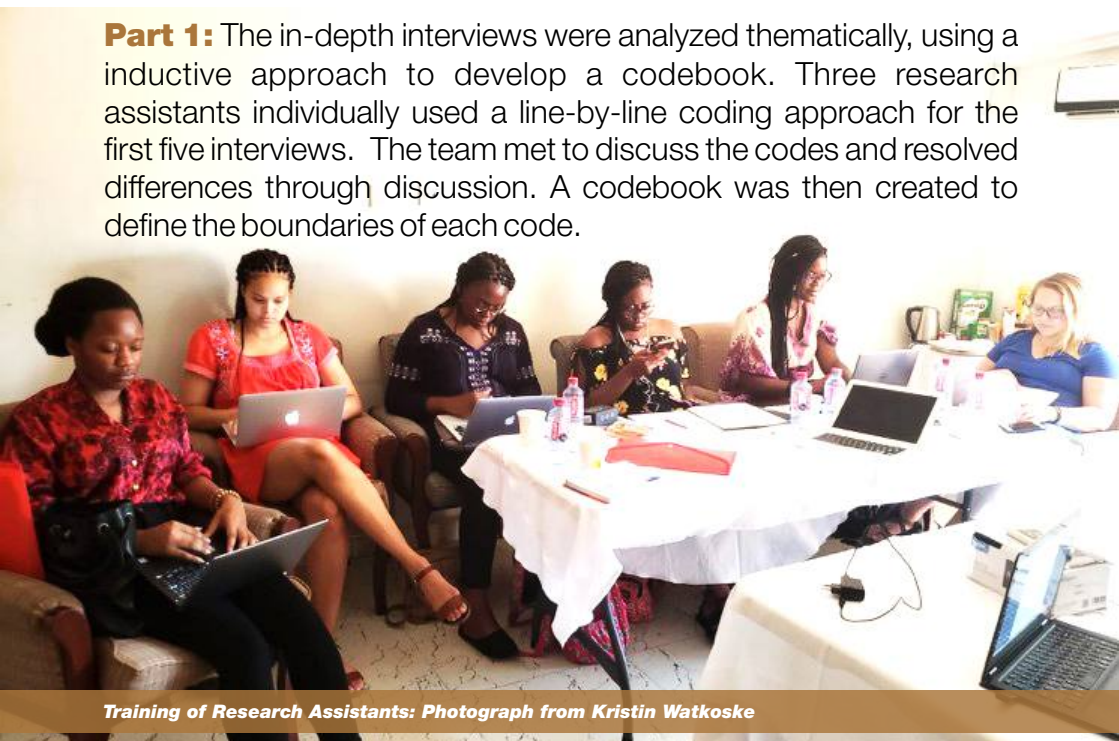
## DOCUMENT REVIEW:

The document review was designed to identify helped alleviate any inconsistencies in data from the interviews and helped fill in programs and policies at the government level that had been implemented in the Northern Region that were not discussed in the interviews. The document review was conducted by four research assistants. They searched the internet for policies and interventions that were implemented in the Northern Region of Ghana from 1993 to 2014. They reviewed a total of 24 documents covering 18 different interventions. A list of all the documents that were reviewed are presented in Figure 4.

## QUALITATIVE ANALYSIS:

The analysis were of two parts. The first was the analysis of the in-depth interview and the second was the analysis of the documents.

**Part 1:** The in-depth interviews were analyzed thematically, using an inductive approach to develop a codebook. Three research assistants individually used a line-by-line coding approach for the first five interviews. The team met to discuss the codes and resolved differences through discussion. A codebook was then created to define the boundaries of each code.



*Training of Research Assistants: Photograph from Kristin Watkoske*

The codebook was systematically applied to the remaining transcripts. From the codes, the research team identified common themes about interventions that contributed to reductions in neonatal mortality. The interventions were further organized into facility-level interventions, community level-interventions, and policy level interventions. The goal was to provide specific approaches that can be used to impact different level of influence on neonatal health outcomes. The team also identified themes around persistent health challenges that need to be addressed to reach the SDG goals.

**Part 2:** The documents were coded using a deductive coding approach as the team was specifically interested in identifying focused coding technique with the following categories: program inputs, program outputs, coverage, intervention gaps and intervention partnerships.

After the analysis of the transcripts and the documents, the research team developed a timeline based on the interviews and document review, plotting the neonatal health-related programs and policies that made the most impact from 1993 to 2014 in the Northern Region of Ghana. Using a triangulation approach, the research team combined programs and policies that were mentioned in the document review and the interviews to complete the timeline from 1993 to 2014.

## **Ethics**

All participants signed an informed consent before the interview began. Ethics approval was provided by the Ghana Health Services (GHS-ERC 15/07/17) and Oakland University, Michigan (1209081-1). Participants in the study did not receive any compensation.



## HISTORIC TRENDS IN HEALTH INDICATORS, 2003-2014:

Overall, historical patterns of coverage for the period 2003 to 2014 showed dramatic variation by intervention (Figure 3). From 2003 to 2014, improvements in the coverage of insecticide treated bed nets (ITNs) outpaced all other interventions examined.

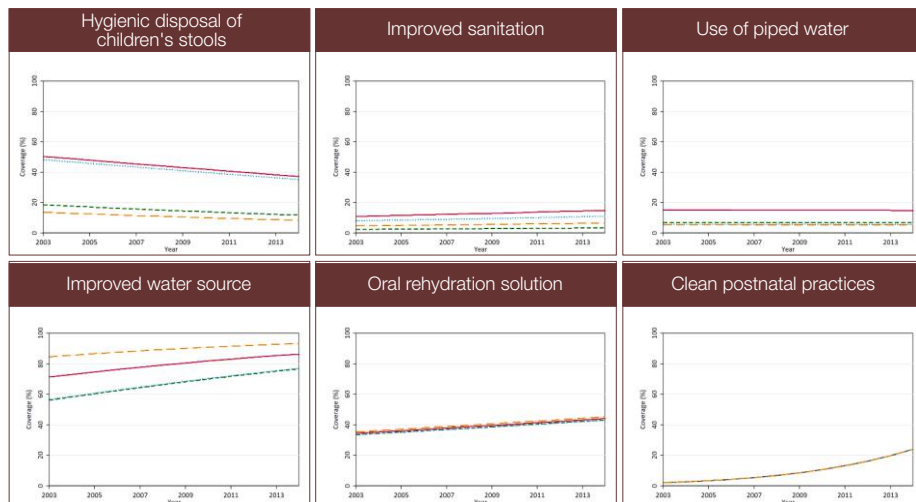
Changes in the coverage of health facility deliveries, iron supplementation, intermittent preventive treatment (IPTp), oral rehydration solution (ORS), and clean postnatal practices occurred at a much slower pace.

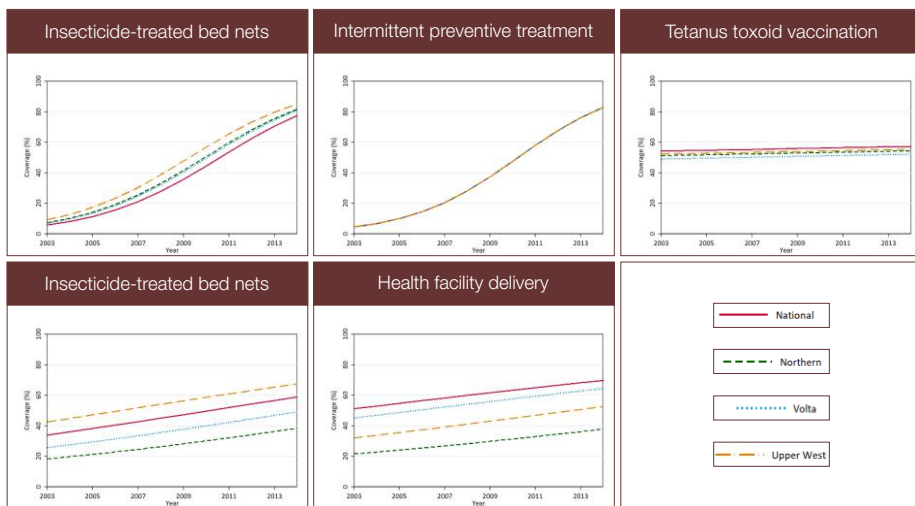
Coverage of improved sanitation, tetanus toxoid vaccination and use of piped water remain stagnant in the period.



## Findings

*Figure 3: Coverage of Select Neonatal Health Interventions, Ghana 2003-2014*





## DETERMINANTS OF NEONATAL MORTALITY RATES, 2003 – 2014:

Neonatal mortality rates (NMR) in the three regions exceeded the national rate of 34 deaths per 1,000 livebirths in 2003, according to LiST estimates based on subnational data from the Ghana DHS in 2003 (Table 1). By 2014, NMR varied by region with the highest NMR in the Northern region (36 deaths per 1,000 live births) and the lowest in the Volta region (21 deaths per 1,000 livebirths).

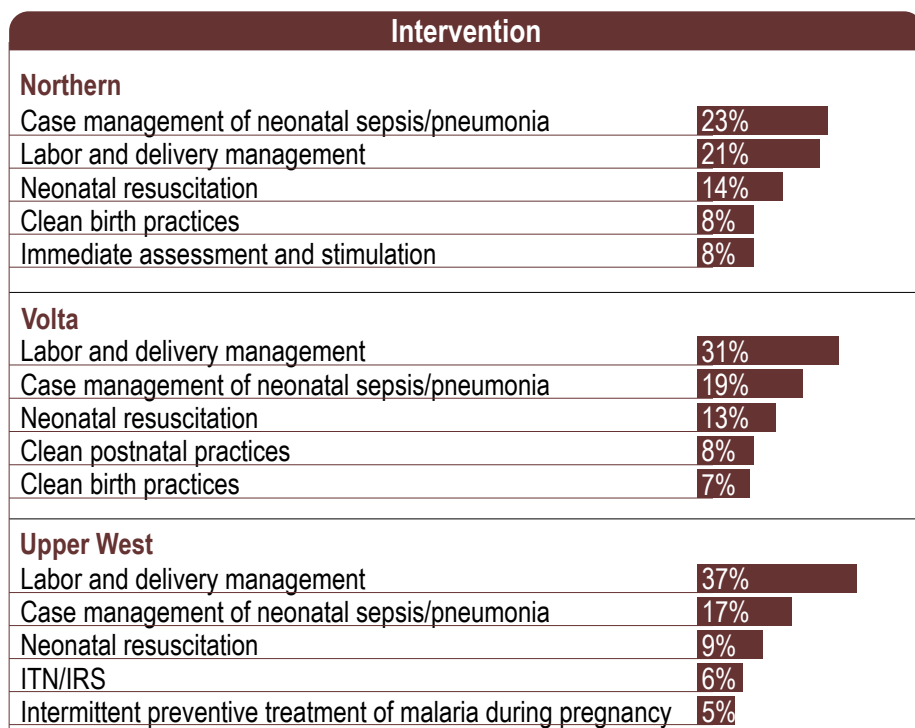
The reductions in NMR were in large part attributable to increases in the coverage of case management of neonatal sepsis and pneumonia, improvements in labor and delivery management, neonatal resuscitation, clean postnatal practices and malaria interventions (ITNs and IPTp) (Table 2). Overall, the scale-up of these intervention between 2003 and 2014 led to annual rates of reduction of higher magnitude than the national in the Volta region, and lower than or at the national average in the Northern and Upper West regions. Notably, the Volta region started with an NMR exceeding the national average in 2003, and by 2014, the NMR in the Volta region was substantially lower than the national average.

Table 1: Estimates of Neonatal Mortality Rates and Associated Annual Rates Of Reduction, 2003-2014

Regions "	2003	2014	ARR
National	34	24	3%
Northern	43	36	2%
Volta	39	21	6%
Upper West	35	26	3%

ARR: Annual rate of reduction.

Table 2: Relative Contributions Of Health Interventions To Reductions In Neonatal Mortality Rates, 2003 - 2014



## **PROJECTED TRENDS IN NEONATAL MORTALITY RATES, 2015-2030:**

If we applied the annual rates of reduction in NMR observed during 2003 to 2014 to project to 2030, the Volta region would meet the target of 12 deaths per 1,000 livebirths by 2030 (Table 3). However, the Northern and Upper West regions would not meet the targets, though substantial declines will be observed.

We considered an alternate scenario, assuming universal coverage of the 11 interventions for which estimates of coverage were available. Under this scenario, the annual rates of reductions in NMR would be similar across all regions (2%). Furthermore, none of the regions would meet the target of 12 deaths per 1,000 livebirths.

One explanation for the difference in results under the two scenarios is that the historic trends scenario applies the ARR experience between 2003 -2014 to the NMR in 2015 in order to estimate NMR. This scenario assumes that the same level of programmatic effort would continue in 2015 to 2030 but does not provide evidence as to which interventions would drive the mortality reductions. For the universal scenario, the assumption is that coverage levels of the neonatal interventions considered would reach 95% by 2030.

In the Northern and Upper West regions, reductions in mortality will be driven by improvements in the coverage of labor and delivery management, clean postnatal practices and case management of neonatal infections (Table 4). In the Volta region, half of the reduction in NMR will be a result of improvements in the coverage clean postnatal practices.

While these results indicate what interventions should be prioritized, it should be noted that several high impact interventions such as chlorhexidine were not modelled. As such the projected trends in NMR are likely to be underestimates of what will occur.

*Table 3: Projected Estimates of Neonatal Mortality Rates and Associated Annual Rates of Reduction, 2015-2030*

Region	Historic trends			Universal coverage		
	2015	2030	ARR	2015	2030	ARR
Northern	36	28	2%	36	26	2%
Volta	20	10	6%	20	15	2%
Upper West	26	18	3%	26	19	2%

*Table 4: Relative Contributions of Health Interventions to Reductions in Neonatal Mortality Rates, 2015 - 2030*

Intervention	
<b>Northern</b>	
Labor and delivery management	24%
Clean postnatal practices	21%
Case management of neonatal sepsis/pneumonia	19%
Neonatal resuscitation	9%
Case management of premature babies	5%
<b>Volta</b>	
Clean postnatal practices	50%
Syphilis detection and treatment	9%
Age-appropriate breastfeeding practices	9%
Labor and delivery management	8%
Case management of neonatal sepsis/pneumonia	7%
<b>Upper West</b>	
Labor and delivery management	27%
Case management of neonatal sepsis/pneumonia	20%
Clean postnatal practices	15%
Neonatal resuscitation	11%
Case management of premature babies	5%

## RESULTS OVERVIEW:

The major themes that emerged from the interviews are organized around three major themes: 1) key interventions, 2) challenges to intervention implementation, and 3) future recommendations to meet the SDG goal for newborn health. In Table 5, a summary of the intervention strategies and activities, as well as the key problems and challenges experienced are provided.

*Table 5: Summary of key Interventions and strategies that led to decline in neonatal mortality in the Northern Region of Ghana: Results from qualitative interviews*

Rtqdrqgo	intervention	Challenge	Strategies/Activities	Outcome
Home delivery	Hospital delivery	Hard to adapt, traditional beliefs (strong women deliver at home / women think TBA are not capable)	Health education, incentivization	More women attend ANC + postnatal, deliver at hospital
Harmful practices at facility and community	Infection prevention and control practices, training / health education	Hard to adapt (ex. Chlorhexidine), lack of logistics	Workshops (sanitary practices), supply of logistics (i.e gloves, delivery table, soap...), community participants (chiefs, support groups, champions etc.)	Less preventable deaths
Access to care	Community emergency transport system, national health insurance	Persistent geographic barriers, not enough vehicles and fuel	Yellow-yellow, motorbikes, champions with cars, free ANC and postnatal up to 3 months, health talks	More facility deliveries, increased access to care
Childhood killers (pneumonia, tetanus, measles, polio, malaria, diarrhea, etc...)	Immunization, resuscitation, essential newborn care, malaria prevention	Knowledge deficit	ANC card (record of immunizations), Bed nets, routine home immunization (community health nurse), home visits, ORT	Less preventable deaths
Harmful traditional beliefs	Health talks, training for TBA	Hard to adapt to change	Health talks at facility, mother-to-mother, community participants, incentivization,	Less preventable deaths

## **MAJOR THEMES FROM QUALITATIVE INTERVIEWS:**

The key interventions are organized around three sub-themes: health facility, community, and policy level interventions. In the Appendix, Table 6 we provide quotes from participants that discuss the interventions that were implemented at the facility, community and policy level

### **FACILITY LEVEL INTERVENTIONS**

#### *Increasing access and quality of care.*

In an attempt to combat neonatal mortality, many facility level interventions were implemented to increase access to and quality of care. Firstly, more public hospitals were built in the region to accommodate the growing health needs, such as the Tamale West Hospital and the Tamale Central Hospital. The increased number of health facilities in the area eliminated many geographic barriers that mothers face in accessing care. A number of these facilities, particularly government hospitals, invested in neonatal intensive care units (NICU) to better care for ill or premature newborns. The greater presence of NICUs in the region has significantly helped reduce neonatal mortality.

#### *Providing Essential Newborn Care.*

Coupled with infrastructural changes, hospital level policies were also implemented to ensure better care for newborns. The essential newborn care strategy took a holistic approach to provide neonatal health. The policy encouraged health workers to:

*vaccinate the baby at birth, [...] provide cord care, [...] give vitamin K, [...] keep the baby warm, use sterile items to prevent infection, promote breastfeeding in the first 30 minutes of life, and keep the baby to the mothers' skin for within the first hour of life*

Facilities without NICUs focused on keeping premature babies warm through Kangaroo Mother Care. Mothers were made to wrap their premature babies close to their chest, allowing their body heat to warm their child. This intervention was incredibly effective and cost-efficient in resource-deprived areas. Furthermore, facilities placed heavy emphasis on resuscitation practices, ensuring that the baby could breathe if complications were to arise. With asphyxia being a common cause of death after birth, health workers were trained on resuscitation practices as well as given equipment to help neonates breathe. Many of the NGOs interviewed reported that they developed workshops at the facility level to train doctors, nurses, and midwives involved during the delivery process. These workshops included hands-on training to correct harmful practices at the facility level.

### *Better Infection Control.*

Lastly, health facilities implemented better infection prevention and control practices by placing a greater emphasis on hygienic practices. Health staff was trained in how to sterilize equipment between uses. For example, midwives sat in on workshops that taught them how to properly sanitize utensils used to cut the cord after delivery. Health staff was trained on the importance of handwashing in addition to other hygienic practices in preventing transferable illnesses. Hospitals also separated neonates that had never left the facility from sick babies returning to the hospital after being taken home. The separation of newborns in the facility greatly reduced cross contamination and sepsis. Overall, health facilities placed a greater focus on infection prevention strategies to help prevent neonates from dying of preventable causes.

### *Community Based Interventions.*

At the community level, neonatal health-related interventions implemented between 1993 and 2014 in the Northern Region focused on increasing access to care and facilitating knowledge dissemination.



Officials at Ghana Health Service and numerous NGOs partnered with community members, health workers, and leaders throughout the region to identify and address the major causes of neonatal mortality. By identifying the barriers to safe delivery and harmful newborn care practices, the Ghanaian government and their development partners have been able to design, develop, and implement interventions that empower and equip community members with the resources needed to facilitate newborn survival. The major contributors to neonatal mortality identified at the community level were lack of access to health care facilities due to both geographical and financial constraints, home delivery, problematic beliefs and practices surrounding pregnancy and newborn care, and knowledge deficits concerning healthy pregnancy and newborn care practices among various community actors. These issues were targeted through a series of interventions that broadly focused on logistics development and health education.

*Addressing Lack of Accessibility to Maternity Care.*



To combat the lack of accessibility to health facilities among people living in communities farther away from urban centers, community emergency transport systems were established in districts across the Northern Region. Ambulances

were provided to transport women in labor to health facilities, and community members were assigned the task of driving and maintaining the vehicles. This intervention led to a reduction in the number of home deliveries conducted by TBAs.

The establishment of community emergency transport systems also alleviated the burden of travel on pregnant women living in these areas who are often forced to navigate poor roads, rivers, and the consequences of the rainy season in order to access care at the facility level. In addition to the provision of means of transportation, the Ghanaian Ministry of Health established CHPS zones across the Northern Region to combat the problem of accessibility.

Nurses were relocated to CHPS zones to provide health services and health education to people living in communities, an initiative that effectively addressed the lack of health facilities and health care personnel in these areas. The growth in the number of welfare clinics in communities across the Northern Region provided the opportunity for new mothers to bring in their newborns for check-up appointments, enabling health workers to identify any potential danger signs or health problems in the neonate in a timely fashion.

### *Increasing Access to Skilled Delivery at Birth.*

Several strategies were used to address low utilization of health facilities during pregnancy and delivery. To increase the number of women delivering at the facility, the community used incentives as a strategy - in exchange for delivering at the facility, the mother would receive a hot bath and a hot beverage; if the mother gave birth to a baby girl, she would receive a new dress, free ear piercing, and earrings. These incentives were also used to encourage the mothers to encourage other pregnant women to attend the facility for delivery.

In addition to incentives, there were many individuals in various communities that were used to educate community members on newborn care and the benefits of facility delivery. These individuals included volunteers, community health nurses, and community participants.

### *Promoting Health Education.*

To address knowledge deficits among caregivers and health workers in the community setting, several interventions centering health education were implemented. With the guidance of NGOs, local drama groups orchestrated plays that showcased healthy pregnancy and newborn care behaviors.

Community volunteers and health workers were trained by Ghana Health Service and various NGOs on safe delivery and newborn care practices and commissioned to spread this information among caregivers in their respective communities. These informants went house-to-house encouraging women to deliver at health facilities to reduce the risk of maternal and neonatal mortality associated with home delivery.

The women were encouraged to report their pregnancies to health facilities early; regularly attend antenatal care appointments for monitoring and evaluation purposes; eat a well-balanced diet to prevent conditions such as anemia; watch for danger signs during pregnancy and after delivery; refrain from using local drugs or foreign substances to treat the umbilical cord; early initiation of breastfeeding within the first thirty minutes, practice of exclusive breastfeeding, and bring their newborns for postnatal care visits.

Moreover, community participants were strategically used to disseminate information regarding neonatal mortality at the community level. These community participants included chiefs, *women leaders in the community called Magajiyas who spoke to the women in the community*, mother-to-mother support groups, newborn champions, religious leaders.

The chiefs were used to educate and sensitize the community to the dangers that newborns face. The chiefs spoke to everyone in the community, including fathers, to increase awareness about the importance of facility delivery, safe newborn care practices, and danger signs to watch for in the newborn. Additionally, some chiefs would split up the community and make a competition out of the number of women delivering at a facility. For example, a community leader said:

*“if some town like this you divide it into four, you tell this area, last month your area, this number of people come to deliver to the health center, so it will look like they are doing a challenge now, so they all will try to deliver now, they don't want another area to beat them. Because of that, it also helped us to reduce deaths of the children.”*

There were also women leaders in the community called *Magajiyas* who spoke to the women in the community. As female community leaders, the women were more willing to listen and trust information from them. Other community participants included members of the mother-to-mother support groups.

The mother-to-mother support groups participated in health education, created awareness, and encouraged women to deliver at the health facility. The support groups built trust among the women so they continued to come back for health education, and the mothers were taught at a level that they could understand.

Newborn champions were used as an advocacy tool to increase awareness and send messages to the community about newborn health. The champions were respectable individuals in the community such as local artists, media men, and religious figures. Lastly, many religious sites were used in the community to disseminate important information.

For instance, many of the mosques and churches would pray and make announcements to the community, which also sensitized the community members about newborn care practices.

Lastly, community health volunteers and village volunteers were extremely important at the community level. For example, a community leader mentioned that: *“the village volunteers, they are between the workers and the townspeople”* They were used as a link in the community between the community health workers and the community members.

The volunteers would talk to the parents and teach basic newborn care, this was beneficial in the community because volunteers could explain the information in a way that the mothers would understand. Additionally, if there was a problem with a mother or her newborn child, the volunteers could go and inform the community health workers of the situation. These strategies and activities were impactful in the reduction of neonatal mortality in the Northern Region at both the facility and community level.

### *Capacity Development of Frontline Community Workers.*

Another integral component of neonatal health-related community-level interventions was capacity-building. Following training conducted by Ghana Health Service and partner NGOs centered on neonatal care practices and strategies to identify danger signs in neonates, community health workers were assigned to follow up newborn babies in the communities to mitigate the problem of low postnatal care engagement. In an effort to reduce the number of home deliveries, **Ghana Health Service trained TBAs on the dangers of conducting deliveries outside of the institutional setting and established a system that positioned them as link providers between pregnant women and health facilities.**

Instead of conducting the deliveries themselves, TBAs were trained to take expectant mothers to the health facilities upon the onset of labor. These community-level interventions have been instrumental in reducing the rate of neonatal mortality in the Northern Region and addressing disparities in neonatal health outcomes between urban centers and communities.

### *Challenging harmful pregnancy and birth practices .*

Harmful traditional beliefs and practices surrounding pregnancy and newborn care were also challenged. The health talks were buttressed by the support of key stakeholders such as chiefs, opinion leaders, and queen mothers. At Durbar's - major festivals at which community leaders communicate important information with their constituents - chiefs, opinion leaders, and newborn champions encouraged expectant mothers and their husbands to follow the advice of the community volunteers and health workers.

Through the Mother-to-mother support groups, women could share their experiences regarding antenatal care attendance, exclusive breastfeeding, safe cord care practices, and postnatal engagement with health facilities with one another in an informal and intimate setting. **The involvement of husbands and mothers-in-law in support groups allowed these influential figures to become better informed about safe delivery and newborn care practices so they could play their part in promoting positive neonatal health outcomes.**

### *Partnering with TBAs for Safe Delivery in the Home.*

Participants reported that community health nurses and community health volunteers also supported newborns at the community level. TBAs were instructed to bring women to the facility for delivery. In the case of an emergency delivery, the TBAs were trained to conduct the delivery and take the mother and newborn to the health facility immediately afterwards for assessment.

The TBAs were also required to discuss the reasons the mother delivered in the home instead of coming to the facility. When TBAs brought the mothers to the facility for delivery, they were incentivized with items such as bars of soap. At the end of the year, they organized a get together with food and drinks and the TBA who brought the most women to the facility for delivery during the year would get a reward for her effort.

In addition to TBAs, there were community health nurses that visited pregnant women and newborns in the home. Because of the lack of transportation for some women in rural communities, the home visitations were helpful. The home visits included free antenatal care and free post-natal care.

#### POLICY LEVEL INTERVENTIONS:

The interventions implemented at the community and facility level were aligned with key national level neonatal health policies and bolstered by a heightened national attention to newborn deaths after 2010. At the policy level, both the document reviews and in-depth interviews showed that neonatal health-related interventions in the Northern Region focused on capacity-building of health workers, resource provision, and health education.

The list of policies described in this section is not exhaustive but covers some of the major neonatal health-related policies implemented between 1994 and 2014. Figure 5 summarizes the international, National, and Regional neonatal interventions found through the document review that were implemented from 1993-2014. Community-Based Health Planning and Services (CHPS) Program was introduced in 1994 as the “Navrongo experiment” in Northern Region and was approved for scale-up and implementation in 1999.

Community health nurses were placed in compounds to provide vaccinations, health education, family planning, and treat malaria and acute respiratory infections in children. In communities with CHPS, the status of children improved and male involvement in family planning increase



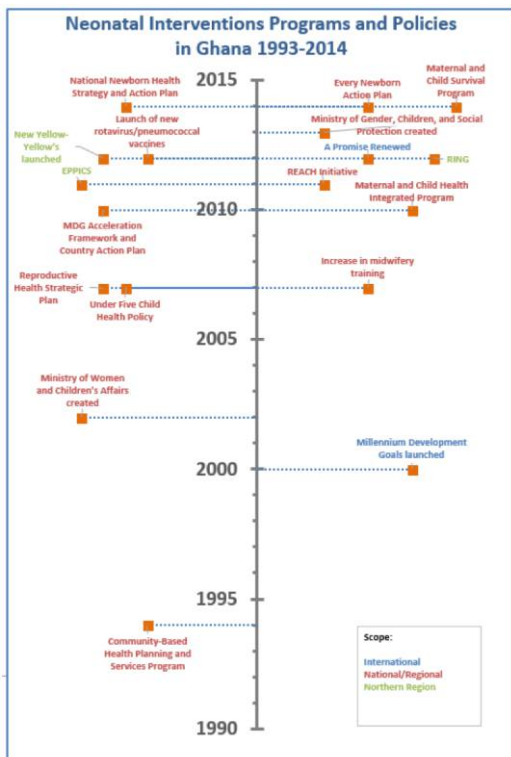
*Photograph was taken at Ghana Health Services in Tamale  
Photograph by Kristin Watkoske*



Figure 4: List of Interventions from 1993-2014 from the Document Review

Year Initiated	Intervention
1994	Community-Based Health Planning and Services Program
2000	Millennium Development Goals launched
2002	Ministry of Women and Children's Affairs created
2007	Under Five Child Health Policy
2007	Increase in midwifery training
2007	Reproductive Health Strategy
2010	Maternal and Child Health Integrated Program
2010	MDG Acceleration Framework and Country Action Plan
2011	REACH (Renewed Efforts Against Child Hunger) Initiative
2011	EPFICS (Encouraging Positive Practices for Improving Child Survival)
2012	Launch of new rotavirus/pneumococcal vaccines
2012	New Yellow-Yellow's launched
2012	A Promise Renewed
2012	RING (Resiliency in Northern Ghana)
2013	Ministry of Gender, Children, and Social Protection
2014	Every Newborn Action Plan
2014	National Newborn Health Strategy and Action Plan
2014	Maternal and Child Survival Program

Figure 5: Timeline of Neonatal Policies and Programs Implemented from 1993-2014



Following this, the Under Five Child Policy and the Reproductive Health Strategic Plan were concurrently launched in 2007 with a broad focus on capacity development of health workers and TBAs, as well as health education. The Under Five Child Policy (2007) was adopted as a national strategy to increase skilled attendants and facility delivery, antenatal care, cord care, clean birth practices and sanitation, and education and training of health workers. Through the Reproductive Health Strategic Plan (2007-2011), the Ghana Health Services created videos, visual aids, and community trainings on Home-Based Life Saving Skills (HBLSS).

Data were collected on the availability of NICUs, readiness of health facilities to conduct resuscitation procedures, and skilled care for vulnerable newborns. TBAs were targeted in birth asphyxia prevention trainings, support groups for mothers and their families were also established. Moreover, these interventions were coupled with counseling support, job aids, and educational materials at antenatal care (ANC) centers.

Three years after these two plans were launched, the government implemented the Maternal and Child Health Integrated Program (2010 and 2014). The overarching intent of this plan was to strengthen the capacity of the midwives and nurses to provide newborn resuscitation and essential newborn care. Reference manuals in midwifery education were created in conjunction with mobile mentoring (mMentoring) to ensure retention of competencies. Subsequently, two Northern Region specific public programs were launched.

One was the Encouraging Positive Practices for Improving Child Survival (2011-2015) implemented in the East Mamprusi District of the Northern Region and the Resilience in Northern Ghana (2012-2019) program.

Some of the past interventions including increasing skilled attendance at birth and training TBAs were repeated. What were unique to these plans were: 1) the development of a motorcycle ambulance system, 2) establishment of a Community Pregnancy Surveillance System, 3) health education targeting community members, 4) women receiving livestock and domestic animals to enhance economic prospects, and 5) encouragement of men to engage in family care.

### *A Stronger Focus on Newborns.*

It was in 2014 that for the first time, the country developed a newborn specific strategic plan through the Every Newborn Action Plan and the National Newborn Health Strategy and Action Plan. There was stronger focus on facility-level interventions including delivery management, postnatal care, and neonatal resuscitation, including life-saving maternal and newborn commodities on the essentials medicines list.

Unlike under plans, these two documents provides a plan for strengthening data on neonatal health outcomes Also, in 2014, the Maternal and Child Survival Program was introduced and provided education to midwifery and nursing schools as well as supported the expansion of CHPS through grants. As a result, the program saw a 50% reduction in intrapartum stillbirth and 56% reduction in 24-hour newborn mortality across 40 study sites.

### **CHALLENGES TO IMPLEMENTATION OF INTERVENTION:**

Earlier initiatives to achieve the Millennium Development Goal of reducing child mortality failed to adequately address the issue of neonatal health, leaving newborn babies in a particularly vulnerable position as many of their unique needs remain unmet.

In the context of the Northern Region, this oversight translated into an insufficient amount of data on neonatal mortality, a limited understanding of the barriers to positive neonatal health outcomes, and deficiencies in the amount of manpower and resources invested into neonatal health-related capacity building.

As policymakers and health workers became increasingly aware of the need to treat neonates as a separate entity, a series of neonatal health-related interventions were implemented in the Northern Region. While these programs have had a large impact, it is important to note the challenges that were faced during the implementation process at both the facility level and the community level. Table 7 gives examples of quotes from participants on the challenges they faced during the implementation of the neonatal health interventions.

At the facility level, a lack of logistics proved to be a great challenge to neonatal health-related interventions. The absence of functional NICUs, handwashing stations, and life-saving equipment and medications in several health facilities hindered health workers from making complete use of the skills they gained from attending trainings facilitated by Ghana Health Service and partner NGOs. The lack of healthcare personnel, physicians, in particular, placed women who live further away from urban centers at a disadvantage.

Frequent transfers and rotations of health staff across various facilities occasionally caused disruptions during intervention implementation. Additionally, delays in the government insurance payment process limited the breadth of influence of a number of facility-level interventions.

In delineating trends in neonatal health outcomes, Ghanaian policymakers and health officials discovered alarming disparities in the rates of neonatal mortality between those living in urban centers and those living in rural communities in the Northern Region.

Reasons for this gap included a lack of access to knowledge and health care services in the community setting. Interventions to address the problem of neonatal mortality at the community-level included the establishment of CHPS zones and NICUs in existing facilities; trainings for community health workers and volunteers on safe delivery and newborn care practices; health education programs for pregnant women and their family members on matters related to appropriate pregnancy behaviors, the advantages of delivering at a health facility as opposed to at home, safe newborn care practices, and family planning.

Despite efforts to increase engagement with health facilities for antenatal care visits, delivery, and postnatal follow-up appointments, accessing care remained an issue for many women due to poor roads and a lack of transportation mechanisms, leading to a continued reliance on well-meaning but ill-informed TBAs.

Problematic traditional beliefs and harmful practices surrounding pregnancy and newborn care also posed a significant challenge to the success of neonatal health-related interventions at the community level. The rootedness of several harmful newborn care practices regarding cord care, breastfeeding, and bathing also hindered initiatives to improve neonatal health outcomes. Achieving community-buy in as various interventions were implemented proved to be a difficult feat that required the strategic employment of influential community leaders and a concerted effort to disseminate knowledge in a culturally-aware manner.

Table 7: Summary of Quotes from Interviews that discuss Challenges to Implementation of Interventions from 1993-2014

<b>Challenges to implementation of interventions</b>		
<i>Sub Theme</i>	Participant	Quote
<i>Lack of Logistics</i>	Health worker - Principal Midwifery Officer	"Yes. (long pause) Logistics. The equipment, they are not enough. We have our 6 delivery beds. Certain times we can position 4 at a time. Sometimes if this one needs resuscitation the other needs and the things are not available."
	Senior Nursing officer- health worker	"the issue also has to do with finances and adequate resources, and adequate logistics and there are even currently there are some instances we get up some of the logistics are not really there"
<i>Disparities</i>	NGO worker-project manager	"That it's a huge problem when you go to the rural areas, it's a huge problem because health facilities over there, which consists mostly of CHP zones and health centers, are not well-manned. They do not have the capacity, they do not have the equipment."
	Superintendent Community Health Nurse	"some they can't come to access their health needs because there are some these things, rivers and during raining season, they can't come
	Community leader	It's not hygienic. They are suffering because they don't have the facilities but because they are used to it they look at it normal"
<i>Traditional beliefs and harmful practices</i>	Community leader	"You have to seek permission from the husband, or the leader of the house, of that family. Before you can do such a thing. And if you are not granted, you can't just on your own..."
	Government worker	"We have units that when the baby is sick instead of just leaving the baby there saying the baby has no even name, let's leave the baby and they do try traditional things and then give concoctions and the baby will die."
	Health worker-Nurse manager	"Here in the North here we have a drug which is let me say it works like the oxytocin given to women after delivery. So and they use it, it's a local drug so if you use it, you will get into labor. Knows if it's true labor. Whereas it's false labor that the woman has taken it, they will smear some on the abdomen, the vulva, so can you imagine what you have taken is working, what is on the exterior is also contracting, and then the cervix is not open. So they will come with a ruptured uterus. When you come with a ruptured uterus, what can they do to save this baby"

## PARTICIPANT RECOMMENDATIONS ON MEETING THE SDG ON NEONATAL MORTALITY:

Problematic traditional beliefs and harmful practices surrounding pregnancy and newborn care also posed a significant challenge to the success of neonatal health-related interventions at the community level. The rootedness of several harmful newborn care practices regarding cord care, breastfeeding, and bathing also hindered initiatives to improve neonatal health outcomes. Achieving community-buy in as various interventions were implemented proved to be a difficult feat that required the strategic employment of influential community leaders and a concerted effort to disseminate knowledge in a culturally-aware manner.

Accessing care continues to be a problem for pregnant women and community health workers. **With the lack of transportation, it is difficult for the community health workers to attend to the mother in the home. Pregnant women are asked to attend the facility for delivery, but there are not enough cars to transport the women to deliver at the facility.**

If there are multiple pregnancies in the community, the community health workers have to share the motorbike, which can lead to complications for the pregnant women. Many of the participants mentioned that increase in transportation capacity would lead to a larger decline of newborn deaths along with supplying drivers and fuel for the cars.

Another health challenge is poor health knowledge. Many mothers have a lack of knowledge about detrimental delivery and newborn care practices that contribute to the high number of preventable deaths. These detrimental practices include delivering at home, applying harmful substances to the cord, feeding the newborn unsanitary water from the bath. Therefore, an increase in health education is important for preventing newborn deaths.

Many of the community health workers, chiefs, religious leaders, and mother-to-mother support groups have successfully provided educational materials to some mothers. However, increased commitment to health education will further decrease the number of preventable deaths. In addition to mothers, there are healthcare providers that require more training to eliminate harmful practices. Increase of workshops within the teaching hospitals and NGOs will help build capacity in this area, leading to more experienced workers delivering newborns in the hospital.

Lack of equipment and logistics was a key health challenge that was mentioned across the community and government levels. Some of the equipment that is needed includes incubators, medication, resuscitation machines, and oxygen. The availability of equipment saves neonatal lives when there are complications during delivery. There is also a need for additional NICUs. NICUs have the appropriate facilities and equipment to take care of newborns.

This minimizes the transfer of diseases from newborns that have come from home and those who have stayed in the hospital. While increasing the availability of equipment in facilities is helpful in declining newborn rates, the participants also discussed how education is needed to maintain the equipment. Education on maintenance will help sustain the equipment for longer periods of times, reducing the need for frequent replacements.



Table 8: Summary of Quotes of Participants Recommendations on Meeting the SDGs by 2030

<b>Participants recommendations on meeting the SDG on neonatal mortality</b>		
<i>Sub Theme</i>	Participant	Quote
<i>Increase transportation</i>	Health worker- midwifery officer	“And transportation, transport, ambulance, no ambulance look at this hospital. A hospital like this no ambulance eenn”
	Community health worker	“So, you the nurse have to use the motorbike and reach there to help them. So, we were saying that if we don't get these motorbikes then we can't achieve this thing.”
<i>Increase health education</i>	Community Leader- zonal connected	“Social interventions, we should continue forming groups in town about health. Educating people about health. About child death importance of pregnancy. Breast milk, we should follow all these.”
	Health Worker- principle bio- stat assistant	“Yeah what I think needs... it's the education. The education. If the education didn't stop and the nurses are still on the education, advising the mothers, talk to them that they should be attending the facility, anytime they are pregnant; you attend the facility until you are due, you make sure you come to the hospital and deliver. These things will bring everything down.”
<i>Increased capacity</i>	Health worker -Midwife officer	“need to improve a lot, without training on the knowledge we can't meet the goal. But, if we are trained on the knowledge we can meet the goal.”
	Health worker	“I mean to build capacity and provide resources for newborn care right from the healthcare level right to the community level.”
	Government worker	“we need to continue to build capacity of our frontline workers even including the doctor's young doctors coming, you know we should really build their capacities practically”
<i>Increase logistics</i>	Community leader	“One. It must be constant supply of logistics, logistics must be available, if they are not what we have, all the gains we have made they will fall back. To logistic supply should be consistent.”
	Senior Nursing officer- health worker	“...continuous supply of logistics, oxygen, newborn care instruments and all that if they we are able to sustain them and continue with the good work, I think we should be able to achieve the SDGs”
	Government official	“You train people, they need logistics to work with and so for now, what I will want to be done is for us to get more logistics for our staff to implement all the trainings that they've attended. Because you attend trains

## Conclusion

Both the quantitative and qualitative data converged to suggest that multiple interventions and strategies contributed to declines in neonatal mortality in all three regions. Of significance was interventions that focused on having a required skilled attendant at birth. For the Volta and Upper West Regions, labor and delivery management accounted for about a third of the decline in the newborn deaths. In the Northern Region, the biggest proportion of the decline was attributed to control and manage of infections in newborns (sepsis and pneumonia).

The quantitative analysis also shows that there were some variations in the kinds of interventions that led to the decline in NMR across the three regions. For example, malaria prevention through the use of insecticide mosquito nets and intermittent preventive treatment of malaria during pregnancy were important contributors to the decline in mortality in the Upper West Region, but not in the Northern or Volta Regions.

Moving ahead, while the model suggests that if the current rate of decline in NMR persists, only the Volta Region will meet the SDG goal of 12 deaths per 1000 live births. This interpretation should be taken with caution, as other impactful interventions could not be modelled because of lack of data. Despite this limitation, the model suggests that in the context of limited resources, the Northern Region should be prioritized, as it will still have the highest NMR among the three regions by 2030.



If adequate resources are available, the results demonstrate that different interventions may need to be prioritized across the three regions. For example, in the Volta Region, interventions to detect and treat syphilis and age appropriate breastfeeding should be part of any package of interventions delivered.

In addition, improving clean postnatal practices will account for about 50% of the newborn lives saved. In the Northern and Upper West Regions, however, a stronger focus should be on labor and delivery management and infection control and management, as well as neonatal resuscitation. Irrespective of the geographic location, labor and delivery management is a critical intervention that should be implemented, as it will account for about 10-25% of further reductions in newborn deaths.

The qualitative results provide several core strategies that Savannah Signatures can adopt to help the three regions achieve its SDG for NMR. The strategies that supported the reductions in neonatal mortality in the Northern Region appeared to have been built on five main pillars, which are recommended below. Areas where Savannah can leverage its focus on technology to further make a difference are highlighted.

The results provide several opportunities for Savannah Signatures to further reduce neonatal mortality. The strategies that supported the reductions in neonatal mortality appeared to have been built on five main pillars and can be continued, given the successes that they have produced. We suggest areas where Savannah can leverage its focus on technology to further make a difference.

## 1. Build Capacity

Increase the capacity of facility and community level workers to provide quality newborn care. To this effect, the research team sees an opportunity for Savana Signatures to leverage its investment in technology to support this endeavor. Interview participants shared that some districts developed a WhatsApp platform for community health workers to talk to health professionals at Tamale Teaching Hospital and other experienced medical officers

When the district health facilities receive a patient, they can upload the patient's details onto the WhatsApp platform so that health experts can review the case and district hospitals can request for a referral if there are danger signs. This approach can be harnessed and modified by Savannah to expand access to this platform to other districts. Such an application could include an online and offline portion.

The online part would require data for communicating which would consist of voice calls, messaging, picture messaging and face calling. The offline portion would include all the regulated training modules and guidelines for taking care of the newborn. This would include guidelines for infection prevention and control practices, training on helping babies breathe, resuscitation, and essential newborn care for the well-baby, sick baby, and small baby. This would keep the community health workers up-to-date with training and information as policies and interventions change in the future

Additionally, the community health workers at the CHPS compound level could speak with experienced medical officers if they need assistance or if the patient needs to be referred to a larger facility. Ghana is one of the largest mobile markets in Africa. Nearly 10.11 million Ghanaians are active internet users, which is approximately one-third of the population [22]. Therefore, many individuals can access the app through their smartphone devices.

## 2. Provide infrastructure

The results support the need to provide the infrastructure and essential resources needed at health facilities to save newborn lives. These resources will include needed incubators, medication, resuscitation machines, and oxygen. The resources needed at the NICU should be prioritized because several studies show that newborn deaths are more common among babies that are born preterm or low birthweight.

They are the population that also need more intensive care at the NICU. Our organization, Center for Learning and Childhood Development, wants to work collaboratively with Savannah in this endeavor. We are already leading an effort to synthesize and summarize the literature on interventions to reduce mortality among preterm babies into lay language for health workers. This initiative can inform capacity development activities, as well as help identify key resources needed at the facility level to implement such life-saving interventions.

## 3. Provide incentives

Create monetary and non-monetary-based incentives to increase skilled attendants at birth. The results indicate that facility-based interventions can only go so far to reduce neonatal mortality. Recently, a review was conducted on the rate of neonatal mortality in facility-based deliveries in middle and low-income countries. The results indicated that there is a 29% reduced risk of newborn death if delivering at a health facility [20]. Studies show that one of the contributing factors to poor maternal and newborn health outcomes is the delay in reaching a health facility. The qualitative data show that this is still a problem and Savannah can strengthen the strategies that have been detailed in the results section.

#### **4. Promote safe birth practices:**

A major finding from the interviews was improving infection prevention and control practices throughout the Northern Region. These approaches were not only limited to facility deliveries alone but were extended to include community-based TBAs. Part of efforts to increase facility deliveries by providing incentives will partially address. However, a special effort would be needed to further promote life-saving infection control practices like handwashing and clean cord care.

Savannah Signatures could leverage on current efforts by the Ministry of Health to expand the use of chlorhexidine for cord care, which is one of the factors that led to reduced mortality. Of note, the Board Director of our organization is leading Ghana's effort at the Ministry of Health to expand the use of chlorhexidine in the country. Also, one of the pioneers of this intervention is also a Board Member of our organization. Their expertise could be harnessed to support this endeavor.

#### **5. Partner with community leaders to educate:**

The health education approaches that were used in the Northern region were successful because they utilized influential leaders and mother-to-mother support groups. A comprehensive review of newborn related interventions that make a difference advocated for such community focused approaches. Savannah should continue to focus energy in working with community leaders, particularly the *magajiyas* and local chiefs.

The mother-to-mother support groups encouraged mothers to deliver in the facility and exclusively breastfeed up for six months. The leadership of influential mothers and community members in the support group was successful because the pregnant mothers were more willing to listen and believe the community members or other mothers that have delivered.

Research conducted in rural Nepal has also looked at participatory women's groups and the effect they have on birth outcomes. There was a 30% reduction in neonatal mortality when women were enrolled in groups with a local women facilitator [21]. Relating to education, health approaches can be used here as well.

The WhatsApp platform for health workers that was described earlier did not include the mothers or any documents on regulated intervention guidelines. Going forward from this WhatsApp platform, Savannah Signatures could develop an application for community health workers and pregnant women to communicate and find resources about healthy and safe newborn practices.

Community health workers would be able to answer any medical questions the mothers might have. Using the application could be of particular benefit to mothers living in rural communities, where seeking permission from male household members to go to the hospital and transportation barriers make accessing health professionals difficult.

This application would enable mothers to inform community health workers of any incidents and receive advice. The offline portion would also include training for the mothers, but the focus of these trainings would be more centered on information needed for the survival of the newborn. Possible areas of interest include dangers of home deliveries, usage of local concoctions, and danger signs to be watchful of within the first 28 days of life. This application could also have reminders to attend antenatal and postnatal care visits for pregnant women and mothers.





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# Appendix

*Table 6: Summary of Quotes from Interviews that discuss Facility, Community, and Policy Level Interventions that has contributed to the decline in Neonatal Mortality from 1993-2014*

<b>Interventions</b>			
Major Theme	Sub Theme	Participant	Quote
Facility level interventions	<i>Increasing Access and Quality of care</i>	Health worker	"...I think before 2011 there was only 1 newborn care unit in the whole Northern Region, which was in this hospital. But beyond 2011 now we have a minimum of 6 in the Northern Region. Which is a very good lesson. There are newborn care units, but you also have small areas that they call newborn care corners..."
		Government worker	"we have the teaching hospital too that has a bigger newborn care unit with a specialist so that at the district hospital newborn care units if they cannot also manage then they also refer these cases to TTH where we have specialist and a newborn care"
		NGO worker- public health expert	"...so umm... I think uhh... I think there were like over 12 neonatal care units were sent"
	<i>Providing essential newborn care</i>	Government worker	"And then I already talked about training on helping babies breathe. And we also train them on helping babies survive, care for the small baby and then the care for every baby, every normal baby. And when the baby is small there is the way you should care for this baby including those who can be put on kangaroo mother care. You know that kind of thing"
		Government worker	"uhm, so far, what we have done mostly has been to look at essential newborn care in this first strategy. We concentrated a lot on essential newborn care that is immediately after the child is born."
	<i>Better infection control</i>	Senior Nursing officer- health worker	"So that's why we decided to separate them, those from home are in a separate unit but it's the same doctor and the same nurses same but the technique and the things we use they have separated."
		NGO worker – M & E Specialist	"Yeah, with sterilization of your environment, like which hygiene, hand washing has been encouraged, how to clean the baby, the things used to clean the baby after delivery, cord how to treat cord care cord care."
		Health worker	"What we use to recommend up until this year was using methylated spirit, methylated spirit is like about 5% alcohol, more than 5%, but that is what we use in the hospital."

Table 6: Continued...

Major Theme	Sub Theme	Participant	Quote
Community Level Interventions	<i>Addressing lack of accessibility to maternal care</i>	Government Worker	"And then we have community transport system in place when you easily call and then they transport so that they don't delay."
		Government worker	"...I think the CHIPS program where we have sent services closer to the people, you know. Which made it more accessible geographically."
		Superintendent Community Health Nurse	"Some of the communities, they are far from the health centers and hospitals, eh heh. And they don't come, they don't visit the hospitals unless they are seriously sick. So, we plan to go on outreaches and as we go there if they are sick, they are able to, they are free with us, any health problems they have, they will discuss it with us, and you will also tell them in case you are not well, or your child is not well, or your child is running temperature, you just bring the child to the hospital, don't buy drugs to try before coming"
		Community leader – mother to mother support group	"We were initiating policies and laws as I said earlier on when a woman is pregnant for two or three months we ask her to go to hospital and register herself and pick a folder and if she goes to the hospital and pick the folder and come to the house and dumped it we will not agree; the law will go against her."
	<i>Promoting health education</i>	Health worker	"There are a lot of vibrant groups in the community. Like we have the market women who form groups, you have the women who form this mother to mother support group so that if one mother has a problem then maybe she could use the support group and let them explain to them. So, they can explain at that level."
		Government worker	"Education always going on you know, we are always with them and the CHO, community health officer are always with them, community health nurses educating them in the communities doing outreach sessions."
	<i>Capacity development of frontline community workers</i>	Senior Nursing officer- health worker	"Yes, I think the health education at the community level because we have community health nurses and they carry out these health educations at the community level, home visiting, so when they do that they identify high risk babies and refer them to the nearest facilities for health interventions. And also, the health talks in some of the communities, like we have the Muslim community, the Christian community and we have some other organizations, local organizations in the communities and they do organized health talks there, churches, churches have also helped to educate mothers on the newborn care especially the signs and then the rates and that has also reduced things, neonatal deaths in the Region"
		NGO worker, public health expert	"We train basic agents at the community level, we train community health nurses, we train midwives, we train doctors, we train medical assistants, all calibers of nurses who are in the process of caregiving. So, they were all trained."

Table 6: Continued...

		Government worker	"At the community what we did was we also trained community-based agents, volunteers, we also trained TBAs, then umm mother-to-mother support groups. These people were trained basically not for TBAs to deliver but they were trained as link agents"
	<i>Challenging harmful pregnancy and birth practices</i>	Health worker	"there is still a lot of people who be, uh, have harmful practices okay, but there is a lot drive in them in teaching communities, teaching mothers on the harmful practices"
		Community leader – assembly man	"There were some black medicine they were taking, and told them that they should stop using the medicine and should always see the doctors or the mid-wives so that they will more about what to do and what not to do."
	<i>Partnering with TBAs for safe delivery in the home</i>	Government worker	"TBAs were even motivated those days, you bring a client or a patient to the facility to deliver, they will give you some incentive so that you feel happy"
		Community leader	"Even if a mother delivers in the community. Because they know of this intervention. They quickly bring the person to come and apologize for the reasons why they could not bring to the clinic and why the woman delivered in the house"
		Health worker- principal midwifery officer	"Traditional birth attendance, they are the people they are the people, you know the villages, they, they, they travel, they, they were the people organizing so now the TBA, some of them are being trained. Actually, the training has been given to them, how to handle a pregnant woman in labor until she delivers."
Policy Level Interventions	<i>A stronger focus on newborns</i>	Health worker	"One of the key things that has actually changed was that they now realize that we need to focus on the newborn as a maybe a different entity because the things that really worked for the older child doesn't necessarily work for the newborn "
		NGO worker- project manager	"A lot of international NGOs have focused their attention on the Northern Region with interventions that would work towards reducing neonatal mortality."
		Health worker	"So, one of the things I really think contributed to this change is, I mean the change in policy in the whole country in the way we look at the newborn"



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