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IMPROVING FACILITY-BASED MATERNAL AND NEONATAL HEALTH SURVEILLANCE SYSTEMS IN HAITI

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2010

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ABSTRACT

IMPROVING FACILITY-BASED MATERNAL AND NEONATAL HEALTH SURVEILLANCE SYSTEMS IN HAITI

By Allison Schachter

Haiti's current health system does not accurately identify and collect information related to maternal deaths and pregnancy outcomes. As a result, the Centers for Disease Control and Prevention's Health System Recovery Team (HSRT), in collaboration with Haiti's *Ministère de la Santè Publique et de la Population* (MSPP) is currently working to strengthen the existing surveillance system and improve the quality of maternal care. To expand upon current efforts to identify and reduce maternal mortality, HSRT now wants to link maternal and neonatal outcomes and monitor the impact of its programs throughout the continuum of care, with the goal of identifying areas for intervention. As neonatal health is closely linked to ante- and intra-natal care, understanding the relationship between neonatal and maternal outcomes is crucial to determining the current state of reproductive health as well as the impact of HSRT programming. Without a strong vital registration and neonatal register system, it is difficult to identify patterns in maternal and neonatal outcomes and therefore develop approaches that can help to mitigate the high maternal mortality and neonatal deaths currently experienced in Haiti, 380 per 100,000 live births and 31 per 1,000 births respectively.

In an effort to better inform MSPP of the case burden of neonatal morbidity as well as neonatal mortality, this special studies project, identifies areas for improvement within exciting data collection process and quality. Based on key informant interviews and line-listing registries collected at 3 Haitian health facilities in December 2014, areas for improvement were identified, best practices were determined and a detailed implementation plan was created. The detailed implementation plan includes the program framework, timeline and details on activities. This plan will be used by CDC/MSPP in piloting an improved neonatal surveillance program in 2 Haitian facilities.

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GLOSSARY

ANC	Antenatal Care
BEmOC	Basic Emergency Obstetrics Care
DIP	Detailed Implementation Plan
EmOC	Emergency Obstetrics Care
HAS	Hôpital Albert Schweitzer Dechappelles
HSN	Hôpital Saint Nicholas in Artibonite
HSRT	Health System Recovery Team
ICD-10	International Statistical Classification of Diseases, 10th revision
MCH	Maternal and Child Health
MCH	Maternal and Child Health
MDG	Millennium Development Goals
MSPP	Ministère de la Santè Publique et de la Population
PNC	Postnatal Care
POSS	Pregnancy Outcome Surveillance System
SDSH	Santé Pour le Développment et la Stabilité d' Haiti

CHAPTER I: INTRODUCTION

The Centers for Disease Control and Prevention's Health System Recovery Team (HSRT) has been working since 2010 to improve emergency obstetric care (EmOC) in Haiti and thereby help reduce the number of maternal and neonatal mortalities. Like many other developing countries, Haiti's current health system does not accurately identify and collect information related to maternal deaths and pregnancy outcomes. As a result, HSRT, in collaboration with Haiti's *Ministère de la Santè Publique et de la Population* (MSPP) is currently working to strengthen the existing surveillance system and improve the quality of maternal care. To expand upon current efforts to identify and reduce maternal mortality, HSRT wants to link maternal and neonatal outcomes and monitor the impact of its programs throughout the continuum of care, with the goal of identifying areas for improvement. As neonatal health is closely linked to ante-intra-and postnatal care, understanding the relationship between neonatal and maternal outcomes is crucial to determining the current state of reproductive health as well as the impact of HSRT programming. Without a strong vital and neonatal registry system, it is difficult to identify patterns in maternal and neonatal outcomes and therefore develop approaches that can help to reduce the high maternal mortality and neonatal deaths currently experienced in Haiti, 380 deaths per 100,000[1] live births and 25 deaths per 1,000 births respectively. [2]

This Special Studies Project (SSP) identified current practices in registration, monitoring and information sharing in the pediatric wards for neonates, infants up to 28 days, in Haiti. The SSP identified information collection practices as well as the information flow process from the maternity to pediatric ward.

Based on this information, recommendations were developed for future programming to integrate maternal and neonatal outcomes. The program will be piloted in 2015 in collaboration with 2 Haitian health facilities. The SSP serves as an implementation guide.

The SSP begins by discussing the current state of maternal mortality and neonatal outcomes in Haiti as well as current efforts by the Centers for Disease Control and Prevention to improve maternal mortality and neonatal outcomes. Chapter 2 provides an overview of previous efforts to improve reproductive and maternal health in Haiti as well as current efforts to improve vital registration for maternal mortality and neonatal outcomes in the developing world. The chapter will identify what other countries, with limited resources and infrastructure, are doing to link neonatal and maternal outcomes and improve reporting systems. Chapter 3, Methodology, identifies steps taken to collect information from participating hospitals, as well as provide additional information on the hospitals selected for interview and data collection. Chapter 4, Results, includes descriptive statistics from health facilities visited in Haiti as well as observations from line-registry reviews and key informant interviews. Chapter 5 includes a discussion of findings as it relates to CDC's work in Haiti. The SSP deliverable and the detailed implementation plan (DIP), are located in Appendix C and present recommendations for HSRT's FY 15-16 efforts to link neonatal outcomes to existing efforts to improve the pregnancy outcome surveillance system.

Linking Maternal and Infant Outcomes

An estimated 3.6 million infants die within the first 4 weeks of life, globally; maternal health complications relate to 1.5 million of those deaths.[3] Delivery complications such as prolonged labor, preeclampsia and maternal infection, are responsible for 50% of maternal deaths, 33% of

stillbirths and 25% of neonatal deaths and can also be attributed to childhood disability.[4] Having access to EmOC packages has led to large decreases in neonatal mortality as identified in a systematic review of global data. [5]

Literature suggests that successful interventions to improve maternal and neonatal health outcomes need to work across the spectrums of care, including pre-natal, intra and postpartum care[6] as these areas of care are "inextricably linked."[7] Recognizing that these areas of care are connected has implications for maternal and neonatal health programming. Typically, programming has addressed these areas separately, but the most effective programming focuses on the continuum of care. Developing these types of programs can provide greater efficiency in use of resources, reduce duplication of work and allow beneficiaries to identify and connect to resources.[8] This special studies project concentrates on how the HSRT program can work to integrate neonatal outcomes into the continuum of care and current programming.

The State of Maternal and Infant Mortality in Haiti

Haiti's current maternal mortality ratio, the annual number of deaths of women from pregnancy-related causes per 100,000 live births, is the highest in the Western Hemisphere at an estimated 380 per 100,000 live births in 2013.[9] While there has been a downward trend in maternal mortality since the early 1990's the number continues to be high. The current neonatal mortality rate, the probability of dying between birth and 28 days per 1,000 live births was estimated at 25 per 1,000 live births in 2013.[10] These high rates are due in part to Haiti's limited resources for maternal care, a shortage of maternity clinics and qualified midwife and health practitioners as well as difficulty and expensive health facility transportation costs.[11]

Haiti has made significant efforts to reduce maternal mortality since the introduction of the

Millennium Development Goals (MDGs) in 2000; MDGs 4 and 5 focus on the improvement of child health and reduction of maternal mortality. Prior to the 2010 earthquake, Haiti had experienced a 40% reduction in the maternal mortality rate as well as the under-five mortality rate which equates to a reduction of maternal mortality from 620 to 350 per 100,00 live births and a reduction of the under-five mortality rate from 151 to 80 per 1,000 live births from 1990 to 2010.[12] The 2010 earthquake caused this steady decrease to stagnate.

Antenatal care is widely utilized in Haiti although most women do not deliver in health facilities; in a 2011 report, an estimated 85% of pregnant women receive antenatal care from skilled health personnel and 54% of pregnant women have 4 or more antenatal visits.[13] Such findings raise questions about the quality of prenatal and care received at the time of delivery, as well as a women's understanding of signs of complications.

Too often countries with high maternal and neonatal mortality rates also have poor surveillance and as a result, statistics misrepresent the state of pregnancy outcomes and can underestimate the severity of the situation. Vital statistics, which are integral to public health decision making and programming, are often the least accurate in areas where situations require the most improvement.[14] Furthermore, neonatal deaths often go underreported, as neonates born in countries with poor reporting mechanisms are often not registered prior to early neonatal deaths.[15] While access to skilled birth attendants and community based interventions have proven to be successful and cost-effective means for reducing maternal and neonatal mortality, these efforts need to be accompanied by valid health statistics in order to develop appropriate programs and monitor interventions.

One barrier to reducing maternal mortality in Haiti is the inability to properly identify and count

an accurate number of pregnancy related deaths. This is in part due to misclassification of maternal mortality as well as the frequency of home birth in Haiti.

Centers for Disease Control and Prevention in Haiti

The Centers for Disease Control and Prevention opened its Haiti office in 2002, and focused its efforts on preventing and treating HIV/AIDS infections, "increasing laboratory and strategic capacity and building health care infrastructure."[16] Following the 2010 earthquake, CDC received funding to reestablish and strengthen Haiti's health system, and thereby expand its efforts in Haiti to include HIV, tuberculosis, cholera and safe water.[17] As part of this effort, CDC identified seven interagency Public Health Legacy Goals, which continue to guide CDC activities in Haiti. These include:

> "1) Eliminate mother-to-child transmission of HIV,
>
> 2) Eliminate the threat of cholera,
>
> 3) Eliminate Lymphatic Filariasis,
>
> 4) Ensure a robust, sustainable, self-correcting public health system,
>
> 5) Reduce the under-five mortality rate from vaccine-preventable diseases by 35%,
>
> 6) Reduce maternal mortality by 30%, and
>
> 7) Reduce the prevalence of TB by 25%."[18]

In order to achieve these goals, CDC concentrated on health system strengthening interventions. This included efforts to develop a national surveillance system and camp-based system for the internally displaced population, improve the capacity of the national laboratory, and to provide continuous care for individuals suffering from chronic conditions such as HIV/AIDS and tuberculosis. Furthermore, CDC tackled public health problems that existed prior to the

earthquake such as inadequate water and sanitation infrastructure, roads and improving community and obstetrical care.[19] The CDC formed the Health System Recovery Team to work specifically on Haiti's diverse needs following the earthquake.

CDC and Maternal Health

The special studies project will focus on CDC's efforts to achieve goal 6, reduce maternal mortality by 30%. In order to meet this goal, HSRT and MSPP are working to improve emergency obstetrics care. Programming focuses on three areas: access to institutional deliveries, quality emergency obstetric and neonatal care; access to quality antenatal and postnatal care; and establishment of surveillance and response system. It aims to achieve the following four objectives:

> **Objective 1:** By 2015, 50% of pregnant women in catchment areas have institutional deliveries and access to quality emergency obstetric care
>
> **Objective 2:** By 2015, 75% of pregnant women in targeted areas receive the recommended frequency and quality of Antenatal (ANC)/ postnatal care (PNC)
>
> **Objective 3:** By 2015, a scalable maternal death surveillance and response system is established in 100% of targeted facilities and selected communities
>
> **Objective 4:** By 2015, 100 % of EmOC facilities have improved their Data Management and Surveillance System for Maternal and Newborn Health[20]

HSRT's ongoing activities include the development of a pregnancy outcome surveillance system (POSS), which is aimed at improving a facility's ability to identify risk factors and complications. Other activities include infrastructure improvements to health facilities, clinical

training, and improvements to antenatal and postnatal care.[21]

The POSS program identified "data quality [that] generally does not facilitate linkage of maternal and newborn outcomes"[22] as a weakness in Haiti's maternal health surveillance system. POSS therefore looked to expand surveillance capacity to include neonatal indicators to better inform HSRT and MSPP.

This special studies project developed a baseline understanding of the type of neonatal and maternal health information collected in pediatric wards to better understand how information can be integrated and practices improved.

The special studies project produced a detailed implementation plan (DIP). The DIP serves as a guide for CDC/MSPP efforts to pilot a program to improve neonatal surveillance capacity and includes a program framework and objectives, details on activities and responsibilities as well as timeline for the upcoming 18 months, through the 2016 government fiscal year. The pilot program expands POSS activities beyond the maternity ward into the pediatric ward. At present time, activities have yet to be implemented.

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CHAPTER II: LITERATURE REVIEW

IMPROVING MATERNAL AND CHILD HEALTH IN HAITI

To better understand practices to reduce maternal and neonatal mortality, the literature review begins with an overview of programs aimed at reducing maternal mortality and improving neonatal outcomes in Haiti since 2000, the year in which the Millennium Development Goals were set. MDG 5 focuses on the reduction of maternal mortality and specifically to "[r]educe [maternal mortality ratio] by three-quarters, between 1990 and 2015."[23] It is estimated that over 10,000 NGOs were working in Haiti even before the earthquake. As a result, the literature review is by no means a comprehensive review of all NGOs working in Haiti, but instead focuses on donor initiatives, which encapsulates work of many of the larger NGOs in Haiti.[24] By better understanding what programs have been implemented in Haiti to date, it allows the Centers for Disease Control and Prevention to better understand how its own programming fits into the landscape of maternal health programming in Haiti as well as identify gaps in interventions amongst international actors and avoid duplication of efforts.

HISTORY OF MATERNAL AND CHILD HEALTH FUNDING IN HAITI

There are several international organizations and governments that are leading the way in improving maternal and child health around the world. These include: The World Bank, UNFPA, UNICEF, the European Commission, the Global Fund, the GAVI Alliance and the U.S Government through USAID.[25] This is similar to the landscape of funders who have been working in Haiti over the past several decades. Each of these organizations has focused on a different area within reproductive health, although there is much overlap. Figure 1 illustrates the different domains of donor organizations working on reproductive health in Haiti. [26]

USAID:

USAID has been Haiti's largest donor in terms of dollars since 1973.[27] In fiscal year 2012, USAID dedicated USD 11.7 million to maternal and child health programming in Haiti. USAID's programming in Haiti focuses on the US government identified "Development Corridors" which include the Cap-Haitian, Saint Marc and Port-Au-Prince Corridors. [28]

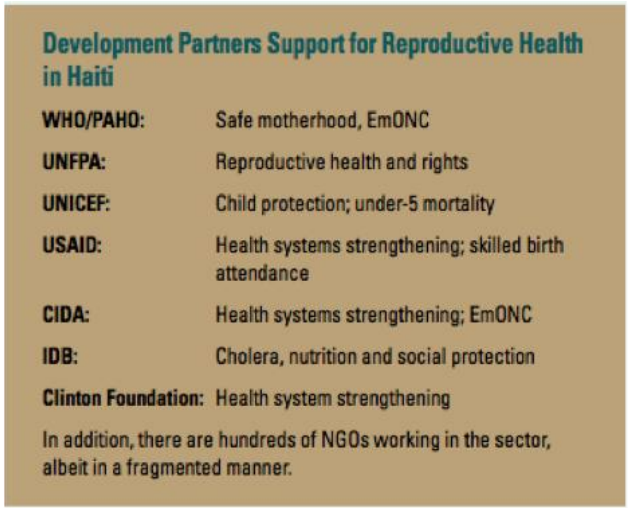

Figure 1: Development Partners Support for Reproductive Health in Haiti

In 2012, the United States Government developed a five- year strategic plan for health in Haiti outlining its four health objectives through 2017. Objective 2 is to "increase access to quality integrated health services with a focus on maternal and child health, nutrition, family planning/reproductive health, HIV and other infectious diseases and disabilities."[29] Programs have emphasized health management system development including financial, information and health commodities management. Programs focus on ante and postnatal care, vaccination campaigns, increasing deliveries attended by skilled birth attendant and health facility rehabilitation.[30] In 2013, Haiti was identified as a USAID maternal and child health (MCH) priority country, the only country selected from the Latin American and Caribbean region.[31]

Historic USAID programs include the *Super Matrone* program that was first implemented in 1994 and trained prenatal and delivery room staff.[32] In 2004, USAID began the "Healthy Mothers, Healthy Children" 5-year program in Petit- Goave. The program improved access to

ante and post natal care and established a referral network for maternal care amongst other improvements to maternal, newborn and under five programs.

In the 2008 Maternal and Child Health Portfolio Review and Assessment, USAID's *Santé Pour le Développment et la Stabilité d' Haiti* (SDSH) program was identified as the MCH flagship program. SDSH was implemented from 2007-2012. The SDSH program was founded on to "better the lives of the country's most vulnerable citizens [t]hrough innovative performance-based financing agreements, technical assistance, and health care services rooted in the community."[33] The program had 8 different components, which focused on improving maternal and child health, and emphasized the need to reduce Haiti's high maternal mortality ratio. To do this, SDSH focused on improving accessibility to antenatal and obstetric care by encouraging women to deliver in health facilities or utilizing a skilled birth attendant when they were unable to deliver at a facility. Final program reports stated that 92% of women had a birth plan, an increase from 10% at baseline. [34] USAID has continued its commitment to reducing maternal mortality in Haiti with the USAID Maternal Health Vision for Action, released in June 2014, which established the goal of ending preventable maternal mortality by 2035, and a global target of no more than 50 maternal deaths for every 100,000 live births.[35]

CIDA

The Canadian International Development Agency (CIDA) is the second largest bilateral donor in the health sector. Canada has provided development aid since 1968, with a temporary withdrawal of funds from 1991 to 1994 during the period of Haiti's military regime.[36] Prior to 2002, CIDA had focused on funding civil society organizations and small NGOs but soon recognized that this type of model did not lead to large and sustainable change and shifted its strategy. In 2014,

CIDA named Haiti one of its countries of focus. CIDA works primarily in the Artibonite, Southeast, Nippes, and Northeast departments.[37]

Among other projects, CIDA and PAHO/ WHO have been leading the *Soins Obstetricaux Gratuits* (SOG) and *Soins Infantils Gratuits* (SIG) programs, which were launched in 2008 and 2010 respectively. The program, which started with 50 facilities in Haiti, and was to be expanded following the 2010 earthquake, paid health facilities to provide pregnant women free childbirth services and care before and after birth. This included: funds to the hospital for services, refunds to pregnant women for transportation costs to the facilities and payment to traditional birth attendants. In order for facilities to receive payment, they had to use standardized records of care for each woman as well as utilize the Perinatal Information System to monitor performance.[38]

In 2011, the CIDA, PAHO/WHO partnership developed another program entitled *Manman ak timoun an Sante*, Mother and Child Health Project, which continued to provide access to free care. It also provided additional support through the development of sustainable financing mechanisms as well as worked to develop linkages between minimum care packages and secondary healthcare.[39] Other programs included: Project to Support the Haiti Health System Strengthening (PADESS), Project to Support Management Health Capacity (PARC), Project to Support the Fight against Maternal Mortality (PALM), FSE (Local Fund Health Education and the Fund Management Center) and the Project to Support Reproductive Health (PASR).[40] These projects focused on institutional capacity at MSPP by providing access to Master's degree programs through a partnership with the University of Montreal and providing supplies and materials and improved capacity of existing health facilities. The PALM project in particular provided training for traditional birth attendants and EMoC training. It worked to improve

quality of obstetrical care in two or three reference hospitals, including support of training of traditional birth attendants and emergency obstetrical care.

UN AGENCIES

UN Agencies, UNFPA and PAHO/WHO have been active in maternal health programs in Haiti. Haiti has received funds as part of UNFPA's Maternal Health Thematic Fund, which was established in 2008. The project funded programs including Haiti's Nurse-Midwives program, which increased the number of midwives in Haiti and established four pilot clinics across Haiti to provide Basic Emergency Obstetric Care (BEmOC). Furthermore, the Maternal Health Thematic Fund created a nationwide campaign to promote family planning availability in health facilities and as part of post-partum care; assessed EmOC at all facilities; and improved monitoring and evaluation of these services at a central and provincial level

Another important organization working to improve health in Haiti is Partners in Health (PIH). PIH has been working in Haiti since 1987 as health service providers. The organization, locally known as *Zanmi Lasante*, works primarily in the Central Plateau and the Lower Artibonite Valley and serves a catchment area of approximately 1.2 million people. The organization has continued to expand opening a University Hospital in Mirebelais in March 2013. [41]

While significant investment has been made in maternal and child health in Haiti, there are still significant improvements needed to reduce maternal and neonatal mortality. The above illustrates where investment has been made but also demonstrates an overlap in the type of investments being made and geographic location of interventions. The next section illustrates

how investment in information systems and surveillance are an integral component to improving MCH outcomes.

Best Practices for Maternal and Neonatal Registries

While improved data sources are an important step in improving poor health outcomes, it is in situations where they are most needed that the investment is not often made. A 2010 article emphasized the importance of improving data surveillance and collection for the reduction of preterm birth and stillbirth and stipulated the need for the development of standardized classifications for stillbirths and neonatal deaths as well as streamlined data collection processes through the use of a stillbirth death certificate.[42] The article stated that one barrier to improving data collection related to neonatal outcomes is that existing standard classification have been developed for use in a high-income setting and therefore often require laboratory and pathological screenings of the infant as well as the placenta.[43]

Recommendations have been made for the WHO to develop guidelines for assessing vital registrations to allow for appropriate improvements.[44] Criteria for assessing vital registrations are divided into four areas such as generalizability, reliability, validity and policy relevance. In response to recommendations, in 2012 the WHO released "Application of ICD-10 to deaths during pregnancy, childbirth, and the puerperium: ICD-Maternal Mortality (ICD-MM)." This guidance was intended to "facilitate consistent collection, analysis and interpretation of information on maternal deaths."[45] The document includes groupings related to cause of death and differentiates between different potential complications. The coding system aids clinicians in correctly identifying maternal death, which is often incorrectly categorized.

Another initiative aimed at improving data collection of maternal and neonatal outcomes is the harmonized Reproductive Health Registries (hRHR) initiative currently being undertaken by the Norwegian Institute of Public Health (NIPH). hRHR works to streamline and improve the way vital statistics are collected in developing countries by improving data and data collection systems. NIPH argues that there is a lack of an accurate denominator when public health actors and clinicians calculate maternal mortality or neonatal mortality rates. In order to improve indicators, organizations need to collect more useful information and in a more standardized approach.[46] The initiative works specifically in a low and middle-income country context to identify the minimum amount of information needed to "accurately capture performance on the indicator."[47]

Application of MCH registry programming

Research and evaluations on the implementation of efforts to improve neonatal and maternal registry information are limited in number and scope. There are several countries that have been proactive in improving their systems, which are illustrated below.

A study in Indonesia examined the utility of data collected in rural health facilities, what variables were being collected and percent of health workers correctly entering information. This information was then used to determine number of neonatal deaths occurring annually and inform health policy and practice for neonatal and obstetric care.[48] Like, Haiti, the health registries were not sophisticated and only collected a limited amount of information. For each pregnancy, the outcome, duration of gestation and date of delivery was recorded. In the neonatal registry, information was collected on names of mother and father, child, date of birth, place of birth and if applicable date and place of death. The system was not standardized and data was collected haphazardly and maintained in the health workers personal notes and not in

standardized documents. In order to confirm records for those that were not linked to the pregnancy registry, information was also collected from immunization records. Health workers were collecting additional information that was of interest to researchers, however it was entered on discharge cards, which were held by the mother and not by the hospital.[49]

An important lesson researchers learned was that while some variables were universally collected, there was no standard metric for entry. For example, the researchers found completeness in health workers collecting birth weight, however there were clear outliers that were not properly measured or recorded in different units. Discrepancies in data collection or systematic errors in any variable suggested lack of clarity on the definition of the variable and that further training and explanation may be required. Researchers recommended the development of standardized tools.

A facility based maternal and perinatal health surveillance system aptly named "BABIES (Birth weight and Age-At Death Boxes for Intervention Evaluation System)" was utilized by hospitals in Afghanistan as well as Uganda. BABIES was developed due to a lack of records standardization and was specifically intended to be used in low-resource environments as a means of improving quality of care and to reduce mortality. The system collected basic information that was used by program implementers to better understand the distribution of deaths.[50] The tool was often used in combination with other assessment tools to identify cause of death.

In Afghanistan, the program was implemented as a result of efforts to remodel the hospital's service delivery system and improve record keeping, which was poor and inconsistent. The system collected the minimum amount of data, identified as birth weight, outcome and perinatal

period of death. Researchers concluded that it was possible to implement a simple surveillance system in a low-resource setting that was capable of providing sufficient information to improve maternal and neonatal outcomes and could be used to develop intervention packages.[51]

Extensive work has been done in Tanzania to better understand underlying issues in maternal and neonatal mortality as well as to understand potential points of intervention for improvement. For example, one study focused on the transfer of the neonate from the maternity to the pediatric ward as a point of intervention that potentially has a great impact on the outcome of the infant.[52] The study identified the following areas that should be included on birth registry forms: "maternal health conditions before and during pregnancy, parent's socio-demographic characteristics, complications during labor and delivery and information on the newborn (sex, gestational age, birth weight, apgar score and child status) in four categories."[53] The conditions were particularly important for understanding risk of neonatal morbidity or mortality related to the mother's condition pre, intra and post-delivery.

In summary, while there is evidence supporting the need to develop strategies for improving health registry information, there is no gold standard for collecting information. As a result, many programs have failed to accurately identify the number of infant and maternal mortalities and collect information that can inform practice. This special studies project will contribute to the development of standards that can be used in Haiti and, perhaps, in similar settings globally.

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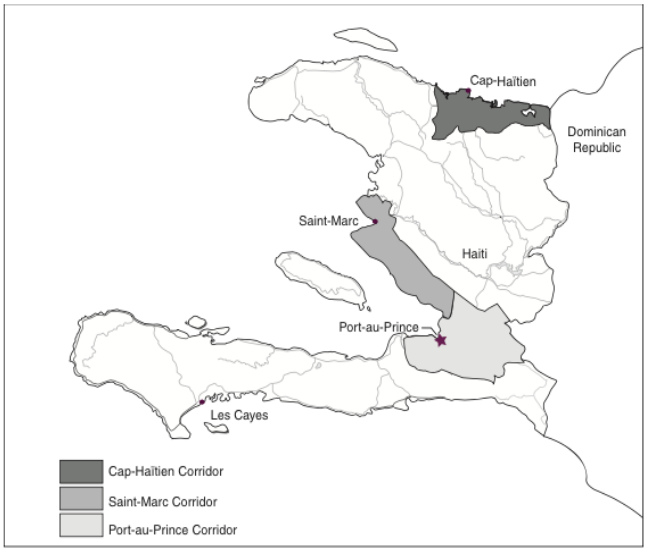
[38] World Health Organization, "Free Obstetric Care Haiti," (Geneva, Switzerland2010).
[39] Souad Lakhdim, "Paho/Who, the Government of Haiti and Canada Launch Project Manman Ak Timoun an Sante in Port-Au-Prince," news release, 2011, http://www.paho.org/hq/index.php?option=com_content&view=article&id=5876&Itemid=1926.
[40] Prins et al., "Usaid/Haiti Maternal and Child Health and Family Planning Portflio Review and Assessment ".
[41] "Partner's in Health's Work in Haiti ".
[42] J. E. Lawn et al., "Global Report on Preterm Birth and Stillbirth (1 of 7): Definitions, Description of the Burden and Opportunities to Improve Data," *BMC Pregnancy Childbirth* 10 Suppl 1 (2010).
[43] Ibid.
[44]Mahapatra et al., "Civil Registration Systems and Vital Statistics: Successes and Missed Opportunities."
[45] World Health Organization, "The Who Application of Icd-10 to Deaths During pregnancy, Childbirth and Puerperium: Icd Mm," (France2012).
[46] Aleena Wojcieszek et al., "Harmonized Reproductive Health Registries (Hrhr): Developing Indicators and Minimum Datasets to Improve Uptake of the Who Essential Interventions in Reproductive, Child and Maternal Health ".
[47] ibid.
[48]Leona Burke et al., "Utility of Local Health Registers in Measuring Perinatal Mortality: A Case Study in Rural Indonesia," *BMC Pregnancy and Childbirth* 11, no. 1 (2011).
[49] Ibid.
[50] K4 Health, "A Step-by-Step Approach: The Program Management Cycle," in *The Healthy Newborn*.
[51] M. M. Dott et al., "Implementing a Facility-Based Maternal and Perinatal Health Care Surveillance System in Afghanistan," *J Midwifery Womens Health* 50, no. 4 (2005).
[52] Blandina Mmbaga et al., "Transfer of Newborns to Neonatal Care Unit: A Registry Based Study in Northern Tanzania," *BMC Pregnancy and Childbirth* 11, no. 1 (2011).
[53] Ibid.

CHAPTER III: METHODS

In order to better understand the data flow process and type of information collected related to neonatal outcomes and maternal health, information was collected from 3 health facilities that are currently partners in the EmOC project, of which there are 16 in total. Information was only collected for facilities that had submitted information for 2013 so that maternity ward data could be compared for the same time period.

The United States' Governments efforts in Haiti have focused on three areas known as the "development corridor." The US government wide strategy for Haiti calls for "funding to stimulate economic activity and improve basic service delivery in three geographic development corridors between 2011 and 2015."[54] These areas were selected with the assistance of the Government of Haiti and are known as the Cap-Haitian (also referred to as the Northern Corridor), Saint Marc Corridor and Port-au-Prince Corridor (also referred to as the Cul-de-Sac Corridor). Each development corridor is further organized to include Haiti's departments and communes. Haiti is organized into 10 departments, which are further organized into *arrondissement* and then into communes. MSPP is the national



Sources: Multiple U.S. Government Agencies, *Post-Earthquake USG Haiti Strategy: Toward Renewal and Economic Opportunity* (Washington, D.C., January 2011); Map Resources,(map).

Note: A State document notes the Port-au-Prince Corridor is located in and just to the north of Port-au-Prince, extending east to the Dominican Republic border and encompassing the entirety of the Cul-de-Sac watershed; the Saint-Marc Corridor will be anchored by the municipality of Saint-Marc in the Department of Artibonite and will continue down the west coast of Haiti encompassing the Cabaret/Saint-Marc watersheds; the Cap-Haïtien Corridor includes the area around Cap-Haïtien, and continues to the Haiti-Dominican border in the east and encompasses the entirety of the Limbe and Cap-Haïtien watershed on the western end.

Figure 2: Map of USAID Development Corridors

public health organization and each of the 10 departments has its own Directorates, which report directly to MSPP.[55] Figure 2 illustrates the USAID development corridors.[56]

The development corridors were identified by USAID in its 2011 Post-Earthquake USG Haiti Strategy, which outlined goals for all US agencies working in Haiti. They were selected as part of the Government of Haiti's attempt to decentralize Haiti and "decongest Port-au-Prince" by focusing development activities in areas outside of the capital. Furthermore, facilities selected to be part of the EmOC project were "upper-level" healthcare facilities and had comprehensive emergency obstetrics care facilities.[57]

The POSS program is currently implemented in 11 communes in 3 of Haiti's departments. For the purposes of this project, information was collected from 3 hospitals in 3 different communes: Saint Marc, Milot and Cap Haitian. An estimated 111,950 women of reproductive age live in the three communes.[58]

The three facilities were as follows:

1. *Hôpital Sacre Coeur de Milot (Milot)*: *The Hôpital Sacre Coeur de Milot* is a tertiary care medical center and private institution and official referral center operated by the Crudem Foundation.[59] The center boasts a maternity ward and neo-natal unit. Services include: a child vaccination program, family planning, child growth monitoring, antenatal care services, prevention of maternal to child transmission of HIV program (PMTCT), normal delivery services, sick child services and

comprehensive EMoC amongst other services.[1]

2. *L'Hôpital Universitaire Justinien* (*Justinien*): *Justinien* is a government run teaching hospital located in Cap Haitian. It has two-hundred-fifty beds.[60] The hospital provides access to the following services: growth monitoring, sick child, family planning, antenatal care, PMTCT, delivery and comprehensive EmoC
3. *Hôpital Saint Nicholas in Artibonite* (HSN): *Hôpital* Saint Nicholas, the largest public hospital in Saint Marc, operates as a partnership between MSPP and Partners in Health. [61] It is a commune reference hospital and a public institution. HSN provides the following services: growth monitoring, sick child, family planning, ANC, PMTCT, delivery and caesarian sections. HSN has a newly revitalized maternity ward.

RESEARCH DESIGN

In order to best identify information that is collected both consistently and informally as well as to understand the data flow-process, a mixed-methods approach was used. Quantitative data included a line-listing of information from the pediatric ward. Qualitative data included interviews with chief nurses in the pediatric wards.

Procedures

Line Listings: Line-listings were collected from pediatric wards for 2013. Information was only collected for individuals with a birth date 30 days or less from the date of entry. Although a neonate is defined as infants 28 days and younger, knowing the inaccuracy in collecting birthdates from previous CDC work in the facilities, it was decided to collect information for all

[1] Comprehensive EMoC is defined by the WHO as a facility that can perform the core emergency obstetrics care procedures as well as surgery such as caesarian sections and can perform blood transfusions.

entries with a birth date within the last 30 days. Identifying information such as name and mother's name was not included on the data collection forms for privacy reasons.

Indicators collected varied by institution. Information was collected for the 2013 period due to previous work that had been done to collect maternity ward data for the same period. Collecting data for the same period in 2013 allowed program staff to triangulate information from the maternity ward with outcomes identified in the pediatric ward.

A total of 579 line listings were collected at HSN for the period of January-August and December of 2013. For Milot 191 were collected from the outpatient registry for the period of January-June and December 2013. 174 line-listings were collected at Justinien for the period of January-February 2013.

Interviews

Hour-long interviews were conducted with the Pediatric Chief Nurses in Creole and French to identify characteristics of the data collection process. Questions included those related to data management and entry, how information was relayed from the maternity ward to the pediatric ward, when infants were transferred and how, and the process for entering and identifying missing information. Interviews determined the level of communication and coordination between the maternity and pediatric wards, the type of information that was collected and being collected consistently and to identify potential areas for intervention to improve data quality and consistency.

Furthermore, Chief Nurses provided additional documentation such as referral forms and chart templates to demonstrate the type of information that was already being collected by the wards and what type of information may be collected, but not entered in the MSPP registries.

PLANS FOR DATA ANALYSIS

Information collected in the data registry was entered and cleaned in excel and analyzed using SAS 9.3 Statistical software. Descriptive statistics identified number of deaths and burden of disease in each facility. Information and indicators were compared between the pediatric and maternity ward to identify which variables were being collected in both wards and what information would be important to include going forward and in which registry. This also informed whether or not it was feasible to join datasets for further analysis.

Qualitative interviews were reviewed to identify the data flow process as described by the chief nurse. This information was organized in an infographic to visually show the transfer of information between wards as well as they type of information being shared when applicable. This allowed for the identification of communication and collaborative strategies. Furthermore, the qualitative interviews were consulted to identify the information being collected by chief nurses, which may differ from those included in the line-listings.

Once gaps or areas for improvement were identified, the literature review and best practices were consulted for the development of recommendations for future programming.

ETHICAL CONSIDERATIONS

IRB approval was received from the Centers for Disease Control and Prevention as part of the Pregnancy Outcomes Surveillance System program. Additional, IRB approval was not required from Emory University as protocol states that information collected from this special studies project will not be used to develop generalizable approaches outside of Haiti and will instead be used to improve ongoing programs in Haiti.

[54] United States Government Accountability Office, "Haiti Reconstruction: U.S. Efforts Have Begun, Expanded Oversight Still to Be Implemented."
[55] Ministère de la Santé Publique et da la Population, "La Direction Générale," http://mspp.gouv.ht/newsite/?p=485.
[56] United States Government Accountability Office, "Haiti Reconstruction: U.S. Efforts Have Begun, Expanded Oversight Still to Be Implemented."
[57] Centers for Disease Control and Prevention, "Poss Implementation Protocol."
[58]Ministère de la Santé Publique et da la Population, "La Direction Générale".
[59] The Crudem Foundation, "About Crudem," http://crudem.org/about-crudem/.
[60] Konbit Sante, "Justinian University Hospital (Juh)," https://konbitsante.org/justinian-university-hopital-juh.
[61] Chemonics, "Haiti Recovery Initiative Ii, Final Report," (2013).

CHAPTER IV: RESULTS

Findings demonstrated the need for a dynamic surveillance system, one that correctly identifies neonatal morbidity and mortality and triggers response. The data highlighted the poor quality and standardization of indicators and data entry practices. Key informant interviews identified gaps in early neonatal death reporting as well as insufficient information sharing mechanisms between the maternity and pediatric wards. Certain gaps in reporting and issues with data quality were seen amongst all three institutions and allowed for the development of general recommendations. Studying each institution individually highlighted successes for replication at other institutions in addition to unique weaknesses in reporting capacity. As anticipated, data analysis reflected the poor condition of neonatal morbidity and outcomes in Haiti.

A total of 174 line-listings for newborns less than 30 days old was collected at *Justinien* for the period of January-February 2013 and 579 at HSN for January-August and December 2013. Information for *Milot* is not presented, as we were only granted access to outpatient clinic files, which have limited utility in the scope of the special studies project.

The information was analyzed to determine morbidity caseload and the number of neonatal deaths in the pediatric ward. These numbers represented the burden amongst newborns that presented with a complication in the pediatric ward and include those born in the community and in the health facility. Additionally, it included both suspected and confirmed cases.

The table below does not include all clinical impressions observed at the health facilities, but includes those that are particular interest to the project, including the leading causes of neonatal mortality as well as those conditions that were most commonly observed in the facility.

Figure 3: Pediatric Ward-Neonatal Complications

	Justinien		*HSN*	
	For January-February 2013		For January-August and December 2013	
	Frequency	Percent	Frequency	Percent
Total Line listings	174		579	
Neonatal Death Percent of Neonates presenting with a complication in the pediatric ward that result in death	26	14.94%	53	9.15%
Sepsis	8	4.60%	28	4.84%
Maternal-Fetal Infection	66	37.93%	171	29.53%
Jaundice	3	1.72%	12	2.07%
Hypoxia	31	17.82%	8	1.38%
Severe Hypoxia	5	2.87%	2	0.35%
Syphilis	5	2.87%	25	4.32%

Information cannot be generalized to the external population as numbers reflect only those seeking care for complications and total births in the hospitals' catchment area remains unknown. It can however be used to determine what conditions produced the greatest burden for health practitioners and the frequency at which the pediatric ward was combating life threatening conditions. Information also represents a short time period and therefore may not represent general trends at the institution.

The three leading causes for newborn deaths globally in 2013 were complications from pre-term birth, intra-partum complications and severe infections, including sepsis, meningitis and tetanus.[62] The data analysis demonstrated that the hospital staff is frequently managing life threatening conditions and it is important to ensure they have the capacity to manage the cases. This underscores the need for accurate reporting to ensure that interventions are aligned with population needs.

PEDIATRIC REGISTRY

As none of the facilities had separate neonatal ward registries, information collected for newborns was located in the same registry as all pediatric patients. Neonates were identified by determining which patients were less than 30 days old at the time of admission. Only neonates that suffered from complications were officially entered into admission. This included newborns that were born at the health facility and either suffered complications during delivery, while being observed in the maternity ward or as a result of a complicated delivery, newborns that were born outside of the facility and were referred by clinics and facilities and those that were born in the community and were exhibiting signs of complication. Additional information was collected for all newborns born at the facility at the time of delivery and was maintained in the maternity ward registry. Indicators included date of delivery, whether the baby was born alive and if alive, if the newborn was alive at discharge; weight of newborn; vaccinations; gender; and Apgar score. Nurses relied on personal notebooks rather than standardized data collection tools, such as morbidity books, to collect patient data. As a result, registries were often poorly organized, difficult to read and indicators not consistently collected for each month.

All three institutions collected information on infant name, sex, and weight at birth, clinical impressions and outcome at discharge. This information was not always regularly collected and was often reported using different terminology and metrics. Location of delivery and mother's condition, information that is helpful to the project, was collected sparingly. Within an institution, different terminology was used to identify the same conditions, reducing the utility of information. For indicators such as weight, information was sometimes collected in different units of measure within the same registry. For example, at the *L'Hôpital Universitaire Justinien* if an infant was premature, sometimes it was entered as "*prématuré*" other times it stated "*nè à*

32.4 semaines [born at 32.4 weeks]."Additionally, without standard use definitions, indicators such as premature rupture of membranes were sometimes entered as "PRM" or as "RPM." Another limitation was that not all entries contained a final diagnosis and it was unclear whether or not this was due to issues with diagnostic capacity or if it because nurses did not complete the registry once a diagnosis was determined. Pediatric registries did not also use unique identifiers for newborn patients and therefore it was not possible to determine if the patient was a repeat visit or to link information to mother's records.

Neonatal information was also maintained in the maternity registry and included limited information on the health status of the newborn. Experience from previous POSS program implementation in the maternity ward found mothers and infants were not always staying at the facility for 24 hours following delivery. As a result, data collected potentially underreported neonatal deaths for facility-delivered newborns. Additionally, there was misclassification between stillborn deaths and early neonatal deaths that occur within minutes of delivery. Nurses were often checking newborns off as stillborn deaths when they died within minutes of delivery. This further reduces the accuracy in neonatal mortality figures.

Data Collection Processes

Interviews highlighted poor neonatal transfer procedures and information sharing amongst the maternity and neonatal wards. Chief Nurses were asked about pediatric staff's participation in delivery, coordination of neonatal transfer and data sharing processes. With the exception of *Justinien*, pediatric staff was always present at deliveries where there was a complication. *Milot* defined this as when a mother was not delivering "normally". *Justinien* noted that if there was a complication during delivery, a pediatric doctor rushed to the maternity ward. Hospital staff was

currently developing a plan to determine if there was room for the pediatrician to be present during complicated deliveries.

Key informant interviews also identified practices for neonatal transfer between the maternity and pediatric ward as well as information that was relayed during the transfer process. All three institutions utilized a form for transferring newborns from the maternity ward to the pediatric ward; however, HSN was the only institution that had a unique form for neonates. As a result, HSN was able to collect information related to complications not only during delivery but during pregnancy and previous deliveries as well.

Nurses at all three facilities noted the difficulty in obtaining information for neonates who were delivered outside of the facility. Typically they relied on family members and mothers to provide key details on the delivery and any known complications. In particular, one nurse when asked whether or not the facility worked to obtain missing information on the neonate status, stated that this was for MSPP to control and that the facilities responsibility was to provide care.

Flow charts for each facility were developed to illustrate the transfer processes and information flow at the facility. These can be found in Appendix A.

***Hôpital de Sacre Coeur Milot*:** During the key informant interview, the Chief Pediatric Nurse stated that staff from the pediatric ward was called to the maternity ward anytime a mother was not delivering "normally." All neonates received a complete evaluation before determining whether or not the newborn needed to be transferred to the pediatric ward. The information collected during this examination was stored in the mother's dossier. If it was determined that a neonate needed to be transferred to the pediatric ward, a transfer form was completed by either

the pediatric or maternity ward staff depending on the circumstances surrounding the delivery. However, unlike other institutions, the form used for transfer was a generic form, which did not include places for key indicators related to the mother's health or delivery.

The utility of data collected at *Milot* was limited by access to only the outpatient registry, which included those patients who were seen in the clinic and were not admitted to the hospital. The in-patient registry was still viewed and indicators were identified, and line listings were collected from the outpatient registry. Also, at *Milot* unlike the other institutions, all nurses were responsible for entering information into the registry, and the Chief Nurse was responsible for its maintenance.

***L'Hôpital Universitaire Justinien*:** Unlike other participating health facilities, pediatric staff was not always present for deliveries and did not have a policy in place for assistance during complicated deliveries. Instead, if the newborn needed medical attention the doctor from the maternity ward rushed to the pediatric ward following the delivery. The Chief Nurse emphasized that the maternity doctor always came with the newborn. This raised questions of availability of emergency medical care for the newborn in the maternity ward. The Chief Nurse stated that room was an issue and as a result, there was not enough room for the pediatric doctor to be present during the delivery or for the neonate's care. Renovations were expected to begin on the maternity and pediatric ward to rectify the space problem.

The quality of the pediatric registry was poor and it was often difficult to ascertain information from the registry due to a lack of consistency in what was being collected and lack of consistency in data format. In particular, the age of the patient was often difficult to determine as there was no separate indicator. Instead there was an indicator for admission and birth date,

allowing an age to be determined. For example, for the same indicator Date of Birth, it was sometimes entered as a date; at other times it was entered as an age such as *2 jour*, or two days.

Hôpital Saint Nicolas de Saint-Marc: The quality of the registry at HSN exceeded that of the other two facilities. Terminology was consistently used for clinical impressions and diagnosis. This may be in part due to registry management practices. Unlike *Milot*, which had all nurses entering information in the registry, the registries maintenance was the responsibility of the Chief Nurse. Furthermore, HSN utilized a neonatal transfer sheet that was unique to the transfer of neonates from the maternity ward to the pediatric ward and included indicators on delivery, previous pregnancies and antenatal complications. A complete list of indicators is listed in the data flow chart in Appendix A. Forms were not however analyzed to determine the completeness of forms or to understand how rigorously this form is used.

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[62] Healthy Newborn Network, "Newborn Numbers," http://www.healthynewbornnetwork.org/page/newborn-numbers#Why_newborns_are_dying.

CHAPTER V: DISCUSSION

Initially HSRT wanted to identify strategies for developing linkages between information collected in the pediatric and maternity wards. However, following an analysis of the line-listings of pediatric registries for three institutions it was determined that, at present, linking the maternal and neonatal data was not feasible. Current practices did not include use of unique identifiers or enough unique data to create statistical linkages. However, review of pediatric data and interviews with chief nurses, complimented by the ongoing work of POSS in the maternity ward, allows for system improvements that enhance data and surveillance information being collected in the maternity ward and allow MSPP to estimate and identify neonatal deaths at the facility, quality of care, and case load of neonatal morbidity.

Data collection practices led to a poor understanding of the current morbidity and mortality of neonates in the health facilities. Information related to stillborn deaths, early neonatal deaths and the burden of neonatal conditions was not an accurate representation of the current situation and as a result, CDC/MSPP was not able to serve the needs of the population with the current system. Without a complete understanding of the burden of conditions in the pediatric ward, facilities were unable to make well-informed improvements and therefore, an improved surveillance system is a necessary step to improve neonatal outcomes.

As part of the special studies project a detailed implementation plan (DIP) was developed to provide recommendations and strategies for improving neonatal surveillance and outcomes. The DIP will be used for a pilot program to improve neonatal surveillance in participating POSS institutions. The pilot includes 2 facilities. The DIP includes a framework for activities to monitor progress, timeline for implementation as well as details on activities necessary to meet

objectives. Results from data collection highlighted three priority areas to improve neonatal morbidity and mortality and improve outcomes. This includes, poor communication amongst pediatric and maternity ward staff; lack of data on the conditions of all neonates in the maternity ward and poor data quality and data entry practices in the pediatric ward. Recommendations focus on three areas, which are described in more detail in the detailed implementation plan (Appendix C).

AREAS FOR IMPROVEMENT:

Because facilities do not maintain one complete and thorough registry for all births at the facility, CDC/MSPP must work with both the pediatric and maternity ward to improve neonatal surveillance. The limited amount of information collected in the maternity ward registry means that a lot is unknown when a newborn is discharged. Most women who deliver at the facility are not being observed nor do they stay at the facility for 24 hours as required by the World Health Organization. This is a missed opportunity to both capture information within the early neonatal period, but also a chance to ensure newborns are receiving the first postpartum visit. Appendix B illustrates WHO recommendations for neonatal postpartum visits. WHO revised recommendations for neonatal monitoring in developing countries to encourage facilities to conduct the first postnatal checkup prior to the newborns discharge from the facility. Neonatal deaths are most common in the early neonatal period, within the first 24 hours; 50% of maternal deaths and 40% of neonatal deaths occur within 24 hours and approximately 66% of all maternal and newborn deaths occur within 2 days of delivery. [63] Ensuring adherence to WHO guidelines for post-partum monitoring which requires observation of mother and child for the first 24 hours and at a minimum, 12 hours can mitigate this issue. Improving neonatal monitoring is important

in ensuring quality of care and ensures that potential risk factors are identified prior to hospital discharge.

Misclassifications of early neonatal deaths further compound this issue. Neonatal data collected in the maternity ward often miscategorizes early neonatal and stillbirth deaths, particularly when a newborn dies within minutes of a delivery. The maternity ward registry currently includes checkboxes for the status of the neonate at delivery and at time at departure, but does not capture time of death. This is one area for data improvement. It is therefore important to provide updated training on differentiating between stillborn deaths and early neonatal deaths in the registry and include time of death in neonatal mortality reporting.

Following improvements outlined in the DIP, the improved system collects time of death and provides for more rigorous monitoring, allowing for more accurate frequencies of neonatal deaths. Knowing when most neonatal deaths occur, whether newborns are dying minutes after delivery or hours, allows for the implementation of more appropriate interventions. For example, if the data demonstrates that there are numerous early neonatal deaths, occurring within minutes of delivery, it might trigger the need for improved neonatal resuscitation training.

Other areas that were identified in the results section include data entry practices and transfer procedures. Poor data quality has made it difficult to determine neonatal morbidity and caseload. The pilot program gives MSPP a better sense of the number of neonates seeking care for life threatening conditions and the systems' management capacity.

Improvements in transfer form procedures also improve what is known about place of delivery and complications. Pediatric nurses can refer to transfer sheets to determine place of birth and

any known complications in providing care. For forms to be successful in improving surveillance, data entry will be standardized. This includes the standardization of data entry as well as consistent terminology of diagnosis and clinical impressions. Also by encouraging the use of improved neonatal transfer procedures, additional information on the delivery and complications can be captured by the pediatric ward and also used to inform treatment.

By improving the data collected in the pediatric ward, CDC/MSPP can better understand what conditions patients are seeking healthcare for and number of newborns coming in with life-threatening conditions.

LIMITATIONS

In determining recommendations for improving neonatal surveillance, it was important to ensure that interventions worked within the current infrastructure and available resources and were not seen as too burdensome for practitioners. Activities include ongoing monitoring to determine practitioners' attitudes and practices in regards to new programming.

A continued limitation of the POSS project is a lack of unique identifiers that can be used systematically for all data collected on patients. Until a system-wide approach for unique identifiers is implemented, it is difficult to connect information from the facility to the community as well as between the pediatric and maternity ward. A long-term goal of the project is to utilize unique identifiers, allowing for more thorough evaluation of data including understanding of impact of place of delivery as well as track treatment through the postpartum period.

Additionally, because neonatal data is part of the pediatric registry, it was important that revisions were not too specific to neonates alone since neonates only represent a portion of the information collected in the pediatric registry.

ONGOING CDC ACTIVITIES

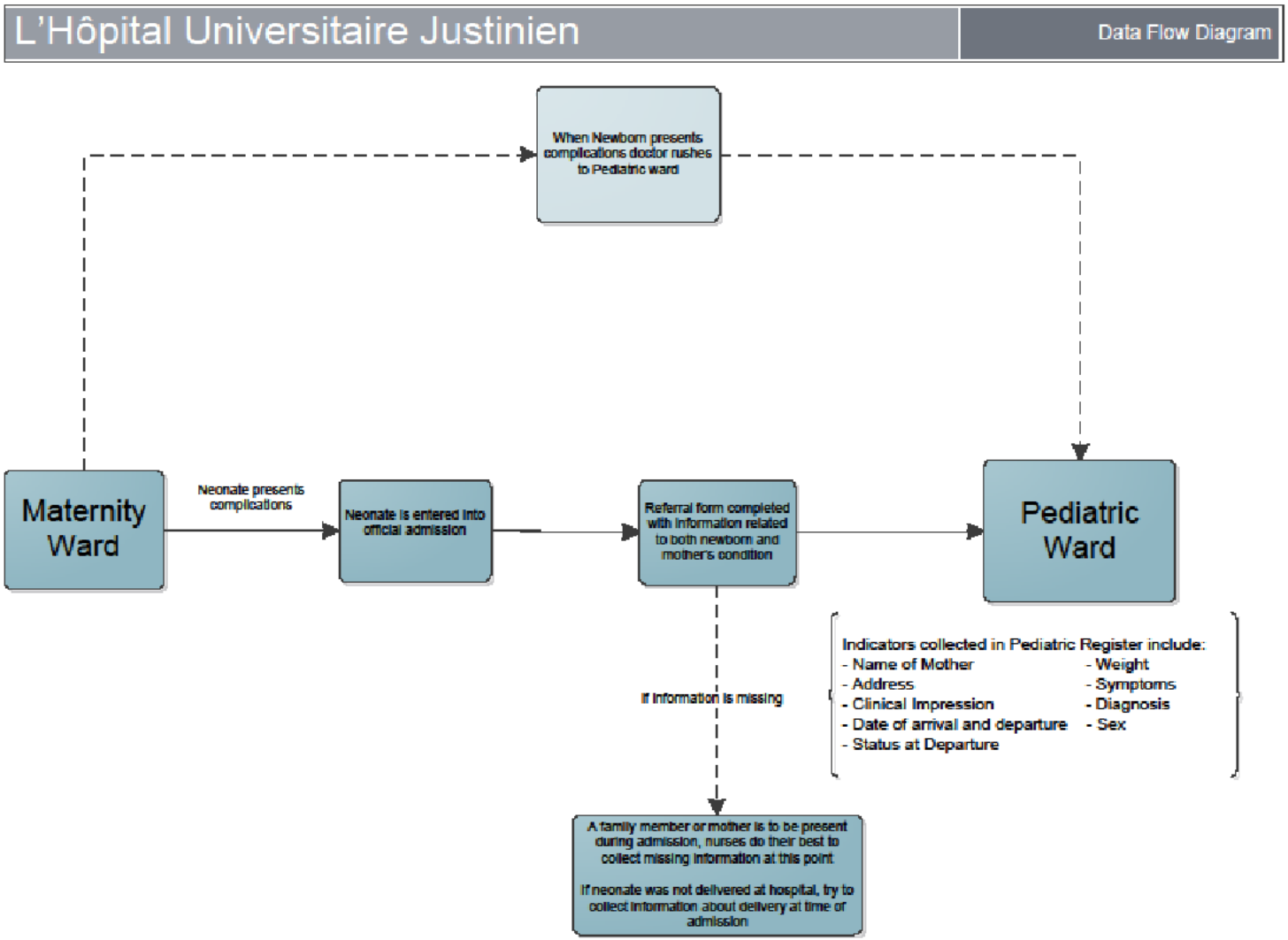
As the neonatal surveillance system is just one component of POSS, it was important that recommendations coordinated with other activities in the POSS program and the community based surveillance program (CBS). CBS works towards tracking all pregnancies in the community and all pre- and postnatal visits for women regardless of whether or not they deliver at home or in the facility. In the future, CBS and facility-based surveillance will be integrated to provide monitoring of mother and newborn throughout the delivery and postpartum. Therefore indicators and data collection instruments need to remain compatible. CBS is still in the development stages and is not operational in all intervention areas, however implementation strategies need to account for future linking of community and facility based surveillance.

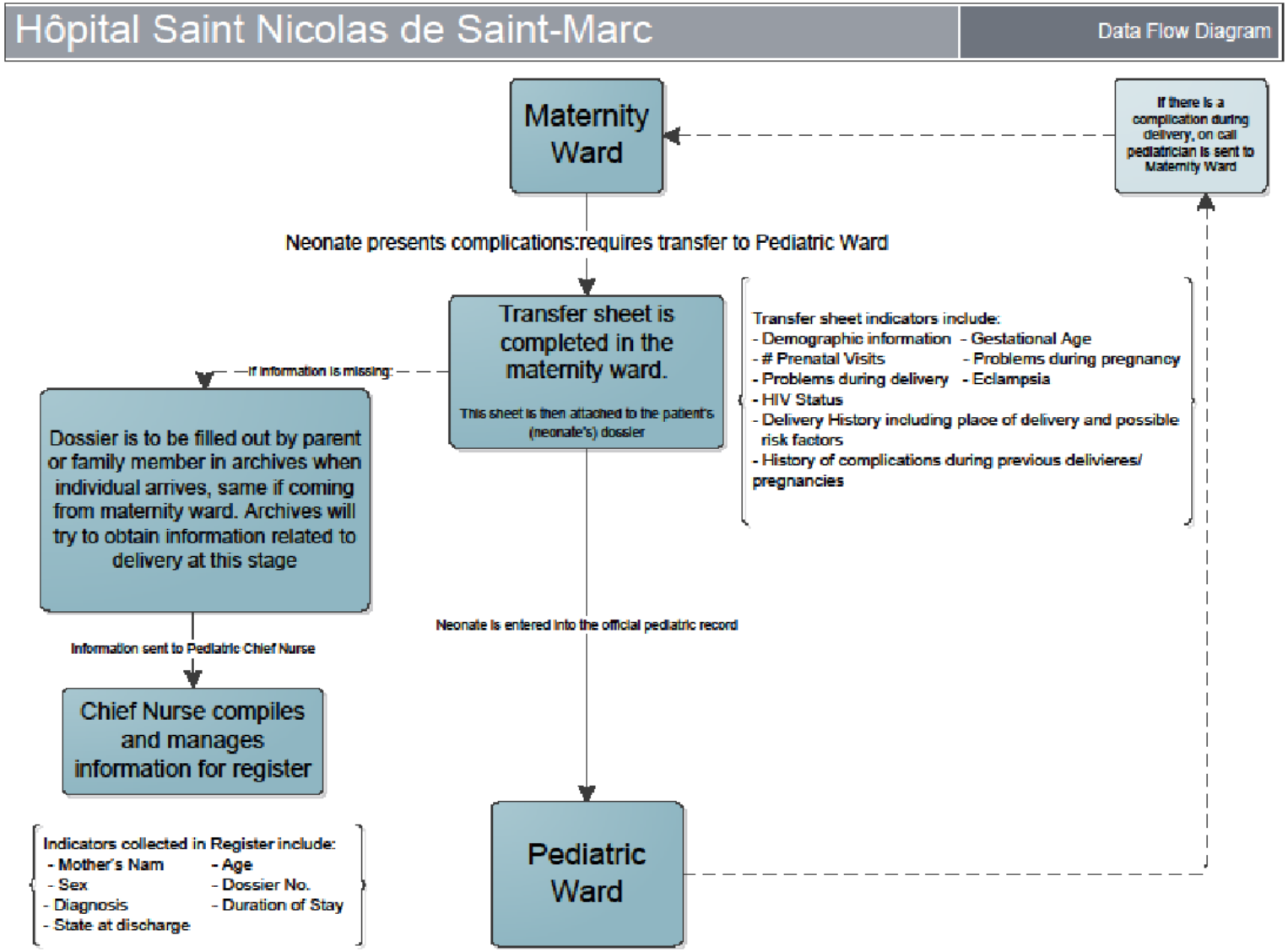
Furthermore, CDC/MSPP recently revised the pre and postnatal guidelines as part of the POSS program. The neonatal postpartum care recommendations in the DIP compliment rather than duplicate activities outlined in the revised guidelines, which focuses on maternal rather than neonatal care. The POSS program works in collaboration on trainings on postnatal care and provides another avenue to emphasize the importance of neonatal monitoring for the first 24 hours of life.

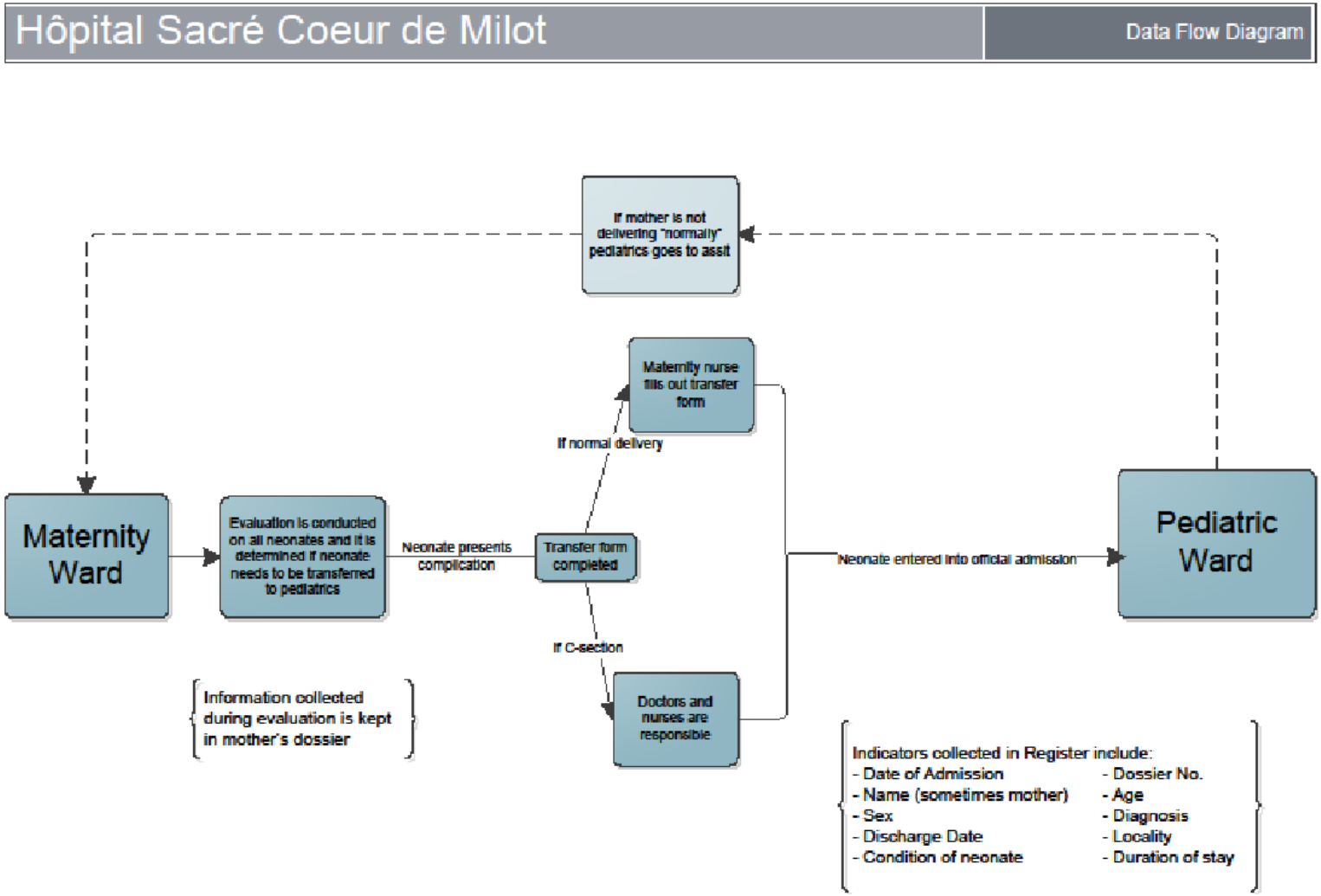
Improvements to neonatal surveillance and monitoring will be impactful for all POSS programming. Recommendations allow for CDC/MSPP to plan appropriate interventions that are tailored and responsive to the evolving situation in the maternity and pediatric ward.

[63] World Health Organization et al., "Integrated Management of Pregnancy and Childbirth: Pregnancy, Childbirth, Postpartum and Newborn Care: A Guide for Essential Practice," (2006).

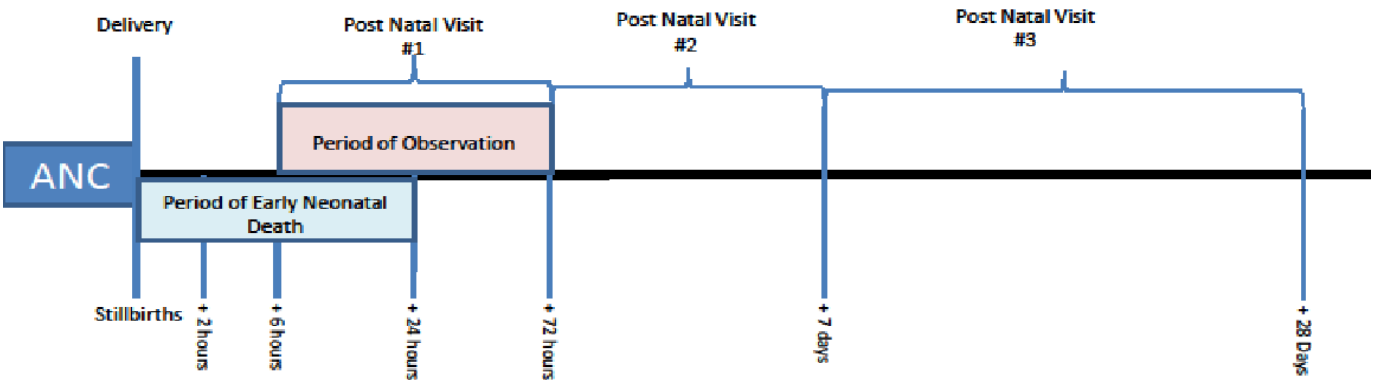
APPENDIX A: DATA COLLECTION FLOW CHARTS




Hôpital Saint Nicolas de Saint-Marc
Data Flow Diagram
Maternity Ward
If there is a complication during delivery, on call pediatrician is sent to Maternity Ward
Neonate presents complications:requires transfer to Pediatric Ward
Transfer sheet is completed in the maternity ward.
This sheet is then attached to the patient's (neonate's) dossier
Transfer sheet indicators include:
- Demographic information - Gestational Age
- # Prenatal Visits - Problems during pregnancy
- Problems during delivery - Eclampsia
- HIV Status
- Delivery History including place of delivery and possible risk factors
- History of complications during previous delivieres/ pregnancies
If information is missing:
Dossier is to be filled out by parent or family member in archives when individual arrives, same if coming from maternity ward. Archives will try to obtain information related to delivery at this stage
Information sent to Pediatric Chief Nurse
Chief Nurse compiles and manages information for register
Indicators collected in Register include:
- Mother's Nam - Age
- Sex - Dossier No.
- Diagnosis - Duration of Stay
- State at discharge
Neonate is entered into the official pediatric record
Pediatric Ward


Hôpital Sacré Coeur de Milot
Data Flow Diagram
If mother is not delivering "normally" pediatrics goes to assit
Maternity Ward
Evaluation is conducted on all neonates and it is determined if neonate needs to be transferred to pediatrics
Neonate presents complication
Transfer form completed
If normal delivery
Maternity nurse fills out transfer form
If C-section
Doctors and nurses are responsible
Neonate entered into official admission
Pediatric Ward
Information collected during evaluation is kept in mother's dossier
Indicators collected in Register include:
- Date of Admission
- Name (sometimes mother)
- Sex
- Discharge Date
- Condition of neonate
- Dossier No.
- Age
- Diagnosis
- Locality
- Duration of stay

APPENDIX B: WHO RECOMMENDATION FOR POSTNATAL VISITS



APPENDIX C: DELIVERABLE

A Framework and Implementation Plan for POSS: Neonatal Data Collection Improvement Program

Pregnancy Outcome Surveillance System

Health System Recovery Team

Current State of Maternal and Neonatal Health in Haiti

Haiti's current maternal mortality ratio, defined as the annual number of deaths of women from pregnancy-related causes per 100,000 live births, is the highest in the Western Hemisphere at an estimated 380 deaths per 100,000 live births in 2013.[64] While there has been a downward trend in maternal mortality since the early 1990s, the number of maternal deaths continues to be high. The current neonatal mortality rate, defined as the probability of dying between birth and 28 days per 1,000 live births, was estimated at 31 deaths per 1,000 live births in 2012.[65] These high rates are in part due to Haiti's limited amount of resources for maternal care, a shortage of maternity clinics, qualified midwives and health practitioners, as well as difficult and expensive health facility transportation options.[66]

Haiti has made significant efforts to reduce maternal mortality since the introduction of the Millennium Development Goals (MDGs) in 2000; MDG 4 and 5 focus on the improvement of child health and reduction of maternal mortality. Prior to the earthquake, there was a 40% reduction in the maternal mortality rate and the under-five mortality rate combined between 1990 and 2010, which equates to a reduction of maternal mortality from 620 to 350 per 100,00 live births and a reduction of the under-five mortality rate from 151 to 80 per 1,000 live births.[67]

Focus on Neonatal Outcomes

As in other developing countries, most of the maternal deaths in Haiti are due to complications such as hemorrhage, puerperal infection, pre-eclampsia/eclampsia, obstructed labor, and complications resulting from unsafe abortion.[68] These conditions are treatable when timely, adequate, and high-quality emergency obstetric care (EmOC) services are accessible. In Haiti, 80% of the estimated 300,000 women who become pregnant annually attend at least one

antenatal visit,[69] but only 54% complete the standard four visits recommended by the World Health Organization (WHO).[70] Moreover, only 26% of pregnant women deliver at health facilities with the assistance of a skilled provider.[71]

Neonatal outcomes are intrinsically linked to maternal health and delivery complications. An estimated 3.6 million infants die within the first 4 weeks of life, globally; of those, maternal health complications relate to 1.5 million of deaths.[72] Delivery complications such as prolonged labor, preeclampsia and maternal infection, are responsible for 50% of maternal deaths, 33% of stillbirths and 25% of neonatal deaths and can also be attributed to childhood disability.[73] Having access to EmOC packages has led to large decreases in neonatal mortality. [74]

Literature suggests that successful interventions to improve maternal and neonatal health and outcomes should work across the spectrums of care, including pre-natal, intra and postpartum care[75],[76] as these areas of care are "inextricably linked".[77] Recognizing that these areas of care are connected has implications for maternal and neonatal health programming. Typically, programming has addressed these areas, maternal, neonatal and pre-pregnancy health separately, but the most effective programming should focus across the continuum. Developing these types of programs can provide greater efficiency in use of resources, reduce duplication of work and allow individuals to identify and connect to resources.[78]

In order to improve neonatal outcomes in Haiti, a better understanding of the current neonatal morbidity caseload as well as the quality of care needs to be identified. This requires a more robust neonatal outcome surveillance system.

How to use the Detailed Implementation plan

The detailed implementation plan serves as a guide for CDC/MSPP to pilot the expansion of POSS into neonatal outcomes. The guide includes a project framework including rationale and objectives, a detailed outline of proposed activities and a timeline for implementation. The tools identified in the DIP are included in the appendices. Following the pilot program, success will be evaluated to determine what program elements were successful, which require improvement and assess for scale up to other POSS institutions.

Current Practice

A recent review of the pediatric registrars at *Hôpital Saint Nicolas (HSN), Hôpital Universitaire Justinien (Justinien), and Hôpital Sacre Coeur de Milot (HSC Milot),* as well as interviews with the pediatric chief nurses of these institutions, highlighted successful practices as well as areas for improvement in neonatal surveillance. Data collection highlighted three areas for concern related to data quality, monitoring of neonates and the data capture process. Only neonates that exhibit complications are transferred to the pediatric ward and thus are captured in the pediatric registry and as a result, a lot remains unknowns for newborns who are healthy at the time of discharge. As newborns are not abiding by WHO guidelines to stay for 24 hours following delivery, there are potentially early neonatal deaths that are not being captured. Furthermore, the time of death for early neonates is not collected in the registries. This has implications for how resources are allocated. Understanding the situation more fully will allow for more targeted and appropriate interventions. Additionally, information is not being collected in a standardized fashion and it is therefore difficult to determine current neonatal caseload and morbidity. Information is not collected using consistent terminology or metrics, making analysis difficult.

And lastly, improvements can be made to the process for collecting data for neonates that are transferred from the maternity ward as well as those who arrive seeking care and delivered outside of the facility. Improving this process will allow for a more thorough understanding of possible delivery complications and their implications for the neonates health and can alert clinicians to potential problems and risks.

Pediatric Registry

Facilities did not maintain separate registry books for neonates and instead information wa0s captured in a general pediatric registry. Infants were entered into the official registry once they had been transferred to the pediatric ward due to a complication. Additionally, the maternity ward collected a limited amount of information on neonatal status. Indicators included date of delivery, whether the baby was born alive and if alive, if the newborn was alive at discharge; weight of newborn; vaccinations; gender; and Apgar score.

All three institutions' pediatric registry collected indicators for infants name, sex, and weight at birth, clinical impressions and outcome at discharge. This information however was not collected consistently for all patients and in particular, information was missing for infants name and in some instances the mothers name was used when the neonates name was unknown. Furthermore, each institution was not consistent in the terminology they used for clinical impressions. For indicators such as weight, information was sometimes collected in different units of measure within the same registry. For clinical impressions, information did not use standard terminology and terminology was not used consistently throughout the registry.

Additionally, it is difficult to ascertain whether or not individuals were born in the facility. Unique identifiers were not used consistently for patients and information on whether it was a

new or return case was not uniformly collected. While dossier numbers were available in the registry, these were created by the archive office and not consistently used for the same patient.

PROCESSES:

Chief Nurses were asked about neonatal transfer and admission and data collection and management practices during key informant interviews. Interviews highlighted the pediatric ward's participation during delivery and coordination of neonatal transfer and emergency care. With the exception of *Justinien*, pediatric staff was always present at deliveries when there was a complication. *Milot* defined this as when a mother was not delivering "normally". *Justinien* noted that if there was a complication during delivery, a pediatric doctor would rush to the maternity ward although they were currently developing a plan to determine if there was room for the pediatrician to be present during complicated deliveries.

Key informant interviews also identified practices for transfer of neonates as well as information that was relayed during the transfer process, as this is one potential time where information can be lost due to poor communication. All three institutions mentioned utilizing a form for transferring newborns from the maternity ward to the pediatric ward; however, *HSN* was the only institution that had a unique form for this situation. As a result, *HSN* was able to collect information related to complications not only during delivery but also during pregnancy and previous deliveries as well.

Nurses' at all three facilities noted the difficulty in obtaining information for neonates who were delivered outside of the facility. Typically they relied on family members and mothers to provide key details on the delivery and any known complications. In particular, one nurse when asked

whether or not the facility worked to obtain missing information on the neonate's status, stated that this was for MSPP to control and that the facilities responsibility was to provide care.

Objectives

The main objective of the pilot program is to integrate neonatal outcomes into current Pregnancy Outcome and Surveillance System (POSS) programming. As per POSS objectives, neonatal outcomes fall into the continuum of care, and by monitoring neonatal outcomes MSPP and CDC can be more effective in responding to and reducing neonatal and maternal mortality. It is important that the program improves the quality of data currently being collected on neonatal outcomes and also ensures the establishment of a system for routine data collection that can lead to action, as it is essential that results be turned into practice. To ensure this, the pilot program will focus on three areas: (1) Improved data collection standards and quality; (2) Increased information collected related to delivery in the pediatric ward including transfers and new cases; (3) Improved clinician knowledge and practices of maternal and neonatal care.

Rationale

By improving the data collection tools and mechanisms utilized by the Haitian Ministry of Public Population Health (*Ministère de la Santé de Publique et de la Population, MSPP*), the Haitian government can develop a more accurate understanding of the neonatal health situation. Accurate and more thorough data will allow for identification of underlying circumstances relating to neonatal death, how they relate to conditions during delivery and their association with overall maternal health. This in turn can be used for strategic planning and more targeted programming and help avoid future maternal and neonatal deaths.

APPROACH

The proposed project will be piloted at the *Hôpital Albert Schweitzer* and the *Hôpital Sacre Coeur de Milot.* The pilot program will include the implementation of revised data collection tools, implementation of a neonatal checklist for use in the maternity ward and development of guidelines and best practices manuals, as well as workshops for pediatric and maternity ward staff with a goal of improving and learning best practices.

Activities for this project were developed from a formative research trip conducted in Haiti in December 2014. This information allowed program staff to identify current practices as they relate to data collection and management of neonatal indicators in the pediatric ward, as well as an understanding of the relationship between the pediatric and maternity wards.

The proposed project is part of the Pregnancy Outcomes Surveillance System (POSS) Program, jointly facilitated by the U.S. Centers for Disease Control and Prevention (CDC) and MSPP in Haiti. This program works in 16 health facilities in the North (*Nord*), North-East (*Nord-Est*) and Artibonite departments in Haiti. The 16 participating facilities are upper-level healthcare facilities and/or comprehensive emergency obstetric care facilities located in 11 different communes. The program works to implement continuous monitoring of pregnancy outcomes and relevant complications in partner facilities. The program includes efforts to improve data collection and data collection tools, identification and reporting of pregnancy risk factors and complications.

Current programming has only occurred within the maternity wards and has not extended to the pediatric wards. To fulfill POSS's objectives, the project recommends areas to strengthen current

efforts in the pediatric ward, which, if implemented, can improve newborn and maternal care, and allow for improved care along the continuum.

Implementing Institutions

HSC Milot

The *Hôpital Sacre Coeur de Milot* is a tertiary care medical center and official referral center operated by the Crudem Foundation, a private not for profit organization. The 122 bed facility includes a pediatric wing, maternity services, a prosthetics unit and laboratory. The center boasts a maternity ward and neo-natal unit. Services include: a child vaccination program, family planning, child growth monitoring, antenatal care services, prevention of maternal to child transmission of HIV program, and normal delivery services. The facility also has a Neonatal Intensive Care Unit. [79,]

HAS

Hôpital Albert Schweitzer Dechappelles (HAS) is a 131bed hospital located in Dechappelles in the Artibonite Valley. It is as a non-profit private institution. Facility services include a neonatal intensive care unit, child vaccination, growth monitoring, sick child services, family planning and antenatal care and a neonatal intensive care unit. HAS is the only facility within a 610 square mile radius that can provide care for women with high-risk pregnancies.[80]

PROJECT FRAMEWORK

Narrative Summary
Outcome 1: Improve monitoring process post- partum for mother and neonates
Output 1.1: Increase catchment of births, neonatal deaths and stillbirths in the maternity ward
Activity 1.1.1 Develop protocol for data entry of neonatal indicators in maternal registry
Activity 1.1.2 Pilot protocol at HAS and Milot
Activity 1.1.3 Conduct Training on the use of maternity registry for neonatal indicator data collection at Milot for Health Practitioners
Activity 1.1.4 Conduct Training on the use of maternity registry for neonatal indicator data collection at HAS for Health Practitioners
Activity 1.1.5 Refresher Training on the use of maternity registry for neonatal indicator data collection
Activity 1.1.6 Line-listings sent to Atlanta for preliminary analysis and monitoring of data quality
Output 1.2. Increase pediatric nurse/doctor attendance during delivery
Activity 1.2.1 Identify appropriate staff to be present in delivery room
Activity 1.2.2 Develop protocol for pediatric on-call procedures
Activity 1.2.3 Pilot protocol for on-call procedures
Outcome 2: Improve quality of data collected related to maternal and neonatal outcomes
Output 2.1 Standardize data entry procedures for pediatric registry to include standard indicators for neonatal and maternal health outcomes
Activity 2.1.1 Provide training for staff on data entry in pediatric registry
Activity 2.1.2 Conduct Review of pediatric registry
Output 2.2 Develop tools for transfer of neonates and arrival of neonates delivered outside of the facility
Activity 2.2.1 Standardize indicators being collected in neonatal-maternity ward transfer and new arrivals form
Activity 2.2.2 Provide training for staff on data entry
Activity 2.2.3 Pilot MSPP Approved Transfer/ Arrival Form
Output 2.3 Improve data quality and management
Activity 2.3.1 Conduct Training on data analysis for data specialist/M&E specialist at Milot
Activity 2.3.2 Conduct Training on data analysis for data specialist/M&E specialist at HAS
Outcome 3: Increase knowledge of post-partum monitoring
Output 3.1: Increase adherence to WHO recommended post-partum monitoring practices
Activity 3.1.1 Provide Refresher training on WHO Post-partum care guidelines
Activity 3.1.2 Develop Neonatal Checklist for use in Maternity Ward
Activity 3.1.3 Train Maternity ward staff on the use of the neonatal checklist
Activity 3.1.4 Pilot neonatal checklist
Activity 3.1.5 Survey maternity ward staff on use of neonatal checklist

ACTIVITY DETAILS:

In order to facilitate better registry collection strategies, existing instruments have been improved to ensure that important indicators are consistently reported and collected. Program staff was cognizant of working within existing infrastructure and utilizing existing tools as much as possible as not to increase current workload. No new registry collection tools will be introduced, but instead focus will be on accurate and consistent completion as well as utilizing current indicators to ensure important information is captured. In addition to utilization of existing instruments, a neonatal transfer form and checklist are introduced for entry in maternity ward.

1. **Neonatal Transfer Form:**

To guarantee that pertinent information such as infant's delivery, maternal status, and delivery complications are shared amongst members of the maternity and pediatric wards and captured in the pediatric registry, a revised transfer form that includes all important indicators was developed.

Utilizing best practices identified at HSN, the transfer form ensures information related to the mother's delivery and complications are shared and captured when an infant is transferred from the maternity ward to the pediatric ward. HSC Milot in particular, had a generic form that was used for transferring infants but it did not include prompts for indicators related to maternal status, delivery, pregnancy and history, and complications.

The transfer form is completed in the maternity ward and is provided to the on-call pediatric doctor or nurse when an infant is transferred to the pediatric ward. This process fits within pre-existing mechanisms for infant transfer and strengthens communication between wards and ensures that pertinent information is relayed to all parties. Additionally, by utilizing a form that

dictates the information of interest, there is greater likelihood that this information will be captured for pediatric ward and CDC/MSPP's use.

The form is also used for all infants entering the facility for treatment in the pediatric ward, ensuring that key information is captured for all neonates treated at the health facility, including those born at home or at another health center. This form is available in the registration office where all patients go when they first arrive at the hospital. Registration staff asks individuals arriving at the facility with an infant if the child is under 30 days, and if yes, they are provided with the additional transfer form to complete. This allows for delivery history and previous pregnancy outcomes, to also be collected for neonates delivered outside of the facility. An example of the form can be found in Appendix D.

2. **Improved use of Pediatric and Maternity Ward Registry**

Currently the maternity ward collects a limited number of indicators on newborn health including status of the infant at birth (alive or deceased), Apgar score, and weight, whether they have received immunizations and whether the newborn is alive or dead at the mother's discharge. Information for healthy newborns is only captured in the maternity ward registry. However, current practices fail to capture all incidences of early neonatal mortality within the first 24 hours of life and properly identify time of death after delivery.[81] Nurses' check a box if the newborn dies prior to the mother's discharge but do not denote time of death. CDC/MSPP recommends improving utilization of current maternity ward registries to capture time of death and also improve data collection practices. At present stillborn deaths are often misreported and neonates who are born alive but die within the first few minutes of life are often incorrectly classified as stillborn. Trainings are provided to ensure this information is accurately captured. Furthermore, the observations box is rarely used for capturing information. CDC/MSPP

recommends that this box be used to collect information related to the infants' status at the mother's discharge and if the newborn died in the maternity ward, the amount of time between delivery and death.

3. Neonatal Care Checklist for Use in Maternity Ward

The following recommendation is an effort to improve quality of care in the maternity ward. Currently many mothers do not stay in the maternity ward for the required 24-hour observation period required by the WHO.[82] Additionally, coverage for post-partum visits in Haiti is low.[83] In order to increase time spent in the maternity ward prior to discharge, CDC/MSPP recommends that the first neonatal postpartum visit occur prior to hospital discharge. This will ensure closer monitoring of the newborn, improved surveillance of neonatal death as well as ensure that more newborns are receiving their initial postpartum visit.

A checklist, included in Appendix E, provides practitioners with a list of procedures that should be conducted prior to the discharge of a newborn. This includes ensuring that the mother has successfully begun breastfeeding, a final newborn screening and identification of any complications or need for special treatment.

TRAININGS

Training is provided on the use of the newly developed tools in order to ensure uniformity in the information entered, and to identify when information should be entered. This mitigates current issues of improper form entry and ensures data quality. Based on previous experience rolling out the POSS data collection tools, there will be a need for further trainings and follow-up to address problems that occur as data entry begins.

Following initial training, follow-up training are scheduled following analysis to identify gaps in what is being reported and to determine if there are any misinterpretations of data entry guidelines. Trainings are held with the nurses from the maternity ward and the pediatric ward to ensure that individuals are able to appropriately enter and interpret data that is being collected on the transfer sheets, and to ensure that information is being properly used once it is collected. As trainings are held with both pediatric and maternity ward staff, training sessions provide an opportunity to develop better communication between the wards by convening all parties interacting within the continuum of care model.

Trainings will be provided for the following areas:

a. Use of transfer form
b. Use of neonatal checklist
c. Use of neonatal indicators in maternity ward registry
d. Standardization of terminology used in data entry for pediatric registry

Additionally, data is being analyzed infrequently, making it difficult to connect cases across the wards. As facilities do not rely on unique identifiers, frequent analysis allows for easier cross-reference and triangulation of data information in the maternity wards as there will be fewer cases to compare. It is therefore recommended that data analysis occur on a more frequent and regular basis to allow for easier data analysis and triangulation of information across the maternity and pediatric wards.

Outline of project activities and timeline is attached in Appendix E and includes the necessary steps for implementation.

[64]United States Agency for International Development, "Acting on the Call: Ending Prevental Child and Maternal Deaths Report."
[65] Ministry of Public Health and Population, Haitian Childhood Institute, and ICF International, "2012 Haiti Mortality, Morbidity, and Service Utilization Survey: Key Findings."
[66] JHPIEGO, "Jhpiego in Haiti."
[67] Amibor, "What Will It Take to Maintain the Maternal and Child Health Gains Made in Haiti Prior to the 2010 Earthquake?: An Analysis of Past Progress, Trends, and the Prospects for the Realization of the United Nations Millennium Development Goals 4 and 5."
[68] World Health Organization, "Maternal Mortality Fact Sheet Number 348," (2010).
[69] Michel Cayemittes, Institut Haitien de l'Enfance Pétion-Ville, and Macro International Inc., "Dhs Final Reports: Enquête Mortalité, Morbidité Et Utilisation Des Services," (2007).
[70] World Health Organization, "Packages of Interventions for Family Planning, Safe Abortion Care, Maternal, Newborn and Child Health," (2010).
[71]Ibid.
[72]Bhutta et al., "Linkages among Reproductive Health, Maternal Health, and Perinatal Outcomes."
[73] Ibid.
[74] Ibid.
[75] Omrana Pasha et al., "Communities, Birth Attendants and Health Facilities: A Continuum of Emergency Maternal and Newborn Care (the Global Network's Emonc Trial)," *BMC Pregnancy and Childbirth* 10, no. 1 (2010).
[76] Kerber et al., "Continuum of Care for Maternal, Newborn, and Child Health: From Slogan to Service Delivery."
[77] Bhutta et al., "Linkages among Reproductive Health, Maternal Health, and Perinatal Outcomes."
[78] Ibid.
[79] The Crudem Foundation, "About Crudem".
[80] "Overview: Has Hôpital Albert Schweitzer Haiti," http://hashaiti.org/hospital/overview/.
[81] World Health Organization et al., "Integrated Management of Pregnancy and Childbirth: Pregnancy, Childbirth, Postpartum and Newborn Care: A Guide for Essential Practice."
[82] Ibid.
[83] Ibid.

APPENDIX D: NEONATAL TRANSFER FORM

transfert de la maternité _____
Nouveau _____

DEMOGRAPHIC

1. Nom ..... 2. Prenom ..... 3. Age .....
4. Date de Naissance ..... 5. Age Gestationnel Estime .....

HISTORIQUE DE L'ACCOUCHEMENT

6. Type d' accouchement
Physiologique .....
Césairenhe .....
Si césairenhe, motif
.....

7.Lieu Hôpital ..... Maison .....
Centre de Sante ..... Inconnu .....
Autre ..... Si, d'autre, oú .....

L'etat du bébé

8. DDR: __/__/__ 9. G___ P___ A___P___Ev___

10. Facteurs de risque pour un infection Absents ..... Présent .....
11. Si oui, specifiez
11a. Rupture prolongé des membranes .....
11b Liquide nauséabond .....
11c.Travail Premature .....
11d. Antibiotiques donnés pendant la travail .....
11.eFievre pendant le travail .....
Tempérture si connue .....

L'etat du l'mere

12. Eclampsie 13. MgSO4 14. Groupe Sanguin de la mere

15. Nombre de visites prénatales 16. Problemes durant Cette Grossessee

17. Problemes durant les grossesses antérieures

18.Statut VIH Seropositive Seronegative Si positive Date du début __/__/__

Si positive 19 .PTME reçu
20. Trithérapie ART
21. Autre .....
22. Date de déb __/__/__

23. Statut RPR Positive Négative Inconnu Si positive traitment reçu

APPENDIX E: NEONATAL CHECKLIST

MSPP Neonatal Checklist

To Be Completed 1 hour after delivery and 1 hour prior to Discharge

If the newborn is presenting any of the following symptoms, should be referred for further evaluation

- ***Stopped Feeding Well; Not suckling after 6 hours of age***
- ***History of Convulsions***
- ***Fast Breathing defined as a breathing rate >= to 60 per minute***
- ***Severe chest in-drawing***
- ***No spontaneous movement***
- ***Fever (temperature >= 37.5 degree C)***
- ***Any jaundice within 24 hours of life***

Within 24 Hours[84]	Check if Completed
1. Skin-to-skin contact/warmth	
2. Breastfeeding initiation *SEE SECTION II*	
3. Newborn Assessment *SEE SECTION III and IV*	
4. Eye Prophylaxis	
5. Vitamin K	
6. BCG	
7. Hep B.	
8. Check Cord: *CORD CARE: clean, dry cord care for those born in health facility; daily chlorhexidine during fits week of life who are born at home setting with high neonatal mortality* [85]	

SECTION II

Breastfeeding Assessment	Yes/No
Must observe at least one complete breastfeeding[86]	
1. Has your baby fed in the previous hour?	
2. Is there any difficulty?	
3. Is you baby satisfied with the feed?	
4. Have you fed your baby any other food or drinks?	
5. How do your breasts feel?	
6. *If baby is older than 24 hours,* How many times has your baby fed in the past 24 hours?	

SECTION III

Newborn Assessment[87]	Check if Completed
1. Assess Breathing	
2. Are movements symmetrical and normal?	
3. Is there swelling and/or bruising at the presenting part?	
4. Look at abdomen for pallor	
5. Is the tone normal?	
6. Weigh the Baby *if baby is <2500 see additional care for small babies*	
7. Check for signs of Jaundice and local infection	

Y/N	
1. Is the skin yellow? *If newborn is less than 24 hours, look at skin on face* *If newborn is >24 hours look at palms or soles*	
2. Are eyes swollen and draining pus?	
3. Are there skin pustules, especially around neck, armpits and inguinal areas?	

	4. Is there swelling, hardness or large bullae?		
	5. Umbilicus: is it red? Draining pus? Does redness extend to the skin?		
8. Check for Special Treatment Needs		Y/N	
	1. Has the mother had, within 2 days of delivery: fever > 38 degrees C or infection treated with antibiotics		
	2. Membranes ruptured >18 hours before delivery?		
	3. Mother tested RPR +?		
	4. Mother tested HIV+ *If yes, Is or has she been on ARV?* *Has she received infant feeding counseling?*		
	5. Is the mother receiving TB treatment which began < 2 months ago?		

[84] Japanese International Cooperation Agency, "Mother and Child Book."
[85] World Health Organization, "Who Recommendations on Postnatal Care of the Mother and Newborn," (Geneva, Switzerland2013).
[86] "Pregnancy, Childbirth,Postpartum and Newborn Care: A Guide for Essential Practice," (Geneva2006).
[87] Ibid.

APPENDIX E: TIMELINE

		Activities	Responsible Party	FY15 Q3	FY15 Q4	FY16 Q1	FY16 Q2	FY16 Q3	FY16 Q4
Output 1	Increase catchment of all births, neonatal deaths and stillbirths in the maternity ward and operating theater	Develop protocol for data entry of neonatal indicators in maternal registry	CDC/ MSPP	■					
		Pilot protocol at HAS and Milot	MSPP/HAS/Milot			■	■	■	■
		Conduct Training on the use of maternity registry for neonatal indicator data collection at Milot for Health Practitioners	CDC	■					
		Conduct Training on the use of maternity registry for neonatal indicator data collection at HAS for Health Practitioners	CDC				■		
		Refresher Training on the use of maternity registry for neonatal indicator data collection	CDC				■		
		Survey HAS/Milot Practitoners on utility of registry	CDC					■	
		Line-listings sent to Atlanta for preliminary analysis and monitoring of data quality	HAS/Milot				■		■
Output 1.2	Increase pediatric nurse/doctor attendence during delivery	Identify appropriate staff to be present in delivery room	HAS/Milot					■	
		Develop protocol for pediatric on-call procedures	CDC/MSPP/ HAS/Milot					■	
		Pilot Protocol for on-call procedures	MSPP/ HAS/Milot					■	
Output 2.1	Standardize existing data collection instruments to include standard indicators for neonatal and maternal health outcomes	Provide training for staff on data entry in pediatric registry	CDC	■					
		Conduct Review of pediatric registry	MSPP/HAS/Milot				■		
Output 2.2	Develop tools for transfer of neonates and arrival of neonates delivered outside of the facility	Standardize indicators being collected in neonatal-maternity ward transfer and new registration form	CDC/MSPP	■					
		Provide training for staff on data entry	CDC		■				
		Pilot MSPP Approved Transfer/Arrival Form	MSPP/HAS/Milot		■	■	■	■	■
Output 2.3	Improve data quality and management	Conduct Training on data analysis for data specialist/M&E specialist at Milot	CDC			■			
		Conduct Training on data analysis for data specialist/M&E specialist at HAS	CDC			■			
Output 3.1	Increase adherence to WHO recommended post-partum monitoring practices	Provide Refresher training on WHO Post-partum care guidelines	CDC			■			
		Develop Neonatal Checklist for use in Maternity Ward	CDC/MSPP	■					
		Train Maternity ward staff on the use of the neonatal checklist	CDC	■					
		Pilot neonatal checklist	MSPP/HAS/Milot		■				
		Survey maternity ward staff on use of neonatal checklist	CDC				■		■

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