

The Mortality Assessment for Health Programs (MAP) System

**An NGO Field Manual for Registering Vital Events and Assessing
Child Survival Outcomes Using the Care Group Model**

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First Edition

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“The Mortality Assessment for Health Programs (MAP) System: An NGO Field Manual for Registering Vital Events and Assessing Child Survival Outcomes Using the Care Group Model”

Abstract:

This manual is a guide for non-governmental organizations carrying out child health programs to assess under-five mortality rates and evaluate programs using the CARE Group Model. By following this manual’s methodology to establish a Mortality Assessment for Health Programs (MAP) System, organizations can collect valid and precise information about vital events and detect statistically significant changes in under-five mortality rates over the life of a child health program. Our hope is that NGOs will find this manual practical and feasible to assess correlations between program activities and mortality trends in a variety of settings.

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Acronyms and Definitions

CBR	Crude birth rate
DHS	Demographic and health survey
MAP	Mortality Assessment for Health Programs
NGO	Non-governmental organization
U5MR	Under-five mortality rate

Introduction

Reducing child mortality constitutes one of the most important priorities of non-governmental organizations (NGOs) carrying out child survival programs throughout the world. Though NGO-directed child survival programs have played an important role in improving child health outcomes in developing countries, weak or non-existent vital registration systems in many low-resource settings make it difficult for NGOs to assess if their programs are reducing child mortality. Adding to this difficulty is the reluctance of many NGOs to help governments monitor vital events within their child survival program communities. This may be due to concerns about the costs, feasibility, and accuracy of these efforts in sub-national, district, or sub-district populations. Without this crucial information, however, NGOs and their government counterparts cannot gain an understanding of how well their programs are performing in reducing childhood mortality in the communities that they serve.

How does the Mortality Assessment for Health Programs (MAP) system's use of the 'Care Group Model' provide an opportunity for measuring mortality rates in 'real-time'?

The MAP system draws on the Care Group Model, with its strong network of community volunteers, to provide an organizational structure that allows for the high coverage of vital events registration. This system provides the opportunity for 'real time' assessments of mortality rates. (The Care Group Model is discussed in greater detail in Section 1). Owing to the fact that Care Group Volunteers maintain consistent contact with all members of their communities through monthly (or sometimes semi-monthly) household visits to deliver health messages and collect health status information, vital events such as births and deaths can be collected routinely for the entire program area. The unique supervisory structure of the Care Group Model helps ensure accountability and support at each level of the program. We draw on these strengths of the Care Group Model to provide the crucial oversight and quality assurance necessary to achieve reliable and valid vital events data through the MAP system approach.

Perceived barriers to measuring mortality and how they are addressed by the MAP system

Although the under-five mortality rate (U5MR) is widely regarded as the most critical indicator for assessing the effectiveness of a child survival program, perceived barriers often discourage program managers from monitoring it. Some of these perceived barriers are presented below, along with how the MAP system can address them.

Perceived Barrier 1: *“It is prohibitively expensive.”*

The MAP system relies on community volunteers to collect information on births and deaths as part of their regular work activities that take place when they visit households. This makes it possible to routinely register vital events at minimal additional cost and eliminates the need for repeated and relatively expensive mortality assessments based on retrospective household surveys.

Perceived Barrier 2: *“The sample sizes and time periods necessary to detect changes in mortality rates are too substantial.”*

Since the MAP system attempts to ensure that all program beneficiaries are contacted at least monthly by community volunteers, vital events data can be routinely collected in an accurate and timely manner from every mother in the program area and used to detect mortality trends for the *entire* program area – no samples are needed. Mortality rates can then be assessed **on an annual basis** in most programs. If a system of universal registration of vital events is in place (as opposed to registering vital events from a sample of households), **a baseline of only 50 under-five deaths a year need to be registered in order to calculate a reasonably accurate under-five mortality rate over the course of the project (with a 95% confidence interval of roughly $\pm 30\%$ of the calculated rate, depending on the number of births)**. To give an illustration, in a population of 100,000 people with a crude birth rate (CBR) of 30 (typical for a developing setting) and an under-five mortality rate of 75, there would be approximately 3,000 births a year and 225 deaths, which would more be more than enough vital events to compute a robust under-five mortality rate.

Perceived Barrier 3: *“The level of supervision necessary to maintain a valid system of vital event registration would not be feasible.”*

The built-in system of supervision for the Care Group Model provides continuous, involved oversight of program staff at all levels that could support the collection of complete and accurate vital events information for a MAP system. The Care Group Model utilizes a first-level Supervisor (often called a Care Group Promoter) who travels to each village in the program area to meet with the volunteer members of a Care Group, all of whom reside in the same village or community. At that time, the Care Group Promoter receives from the Care Group Volunteers verbal reports about births and deaths. The Care Group Promoter passes this information on to the next Supervisory level, where it is carefully reviewed for completeness and to determine if follow-up and verification is required. Since Care Group Promoters are in each community as part of their regular work, they are able to verify all vital events on a biennial basis to ensure the validity of all collected data.

Taking advantage of the structure of the Care Group Model provides an opportunity for NGOs to overcome perceived barriers to mortality measurement and use vital event data through a MAP system to assess their health programs.

Measuring mortality to assess health programs

For the past several decades, most NGO child survival programs have left vital events registration and mortality assessments to outside researchers and specialists, primarily because of the perceived barriers cited above. However, the emergence of the Care Group Model has shown that registering vital events and calculating under-five mortality with program volunteers and local supervisory staff both engages and motivates community stakeholders by informing them about program progress in averting preventable child deaths. Success stories from NGO-led child survival programs in Mozambique, Malawi, and Cambodia attest to the effectiveness of the Care Group Model in not only collecting mortality data, but in utilizing this data to drive informed programmatic decision-making and improve program performance in reducing under-five mortality (Care Group Manual, 2004). This level of engagement with communities and community-based volunteers in the process of measuring vital events represents an exciting opportunity for strengthening child survival programming and demonstrating results, and forms the foundation of the MAP system's approach.

SECTION ONE

How to Use This Manual

1.1 Practical purpose of this field manual

This manual is a guide for child health programs using the Care Group Model on how establish a Mortality Assessment for Health Programs (MAP) System to assess changes in under-five mortality rates. It provides a method that assumes a program structure similar to the Care Group Model. Using this manual, programs can collect reasonably valid and precise information about vital events that can be used to evaluate health programs. Our hope is that NGOs will find this manual practical and feasible to assess correlations between program activities and mortality trends in a variety of settings.

Section 1 will include a brief description of the Care Group Model, an explanation of why the manual focuses exclusively on measuring mortality, and a clarification of our assumptions about what activities Care Groups should (or will be) performing that make mortality measurement responsibilities a feasible addition to a health program. Section 2 will provide tools for helping programs decide if an MAP system is a good choice for implementation, including how to manage various stakeholder expectations for a MAP system. Section 3 will explain the process of establishing and managing a MAP system, including creating data collection tools, mapping the community, and collecting routine data on pregnancies, births, and under-five deaths.

Section 4 will illustrate how to analyze and interpret under-five mortality data, including how to calculate under-five mortality rates, when to use under-five mortality rates to assess health programs, how to determine if a mortality trend exists using **EPI Info 7**, and examples of how to present mortality data. Section 5 will describe the quality assurance process for ensuring the validity of all pregnancies, births, and deaths recorded by the MAP system, including specific responsibilities for each tier of the Care Group Supervisory structure. Section 6 will include appendices and examples of forms relevant to the collection of data relating to births and deaths, including detailed instructions for how to construct a Vital Events Database utilizing **Microsoft (MS) Excel** software. The manual will conclude in Section 8 with a list of references to consult for further information.

1.2 An overview of the Care Group Model

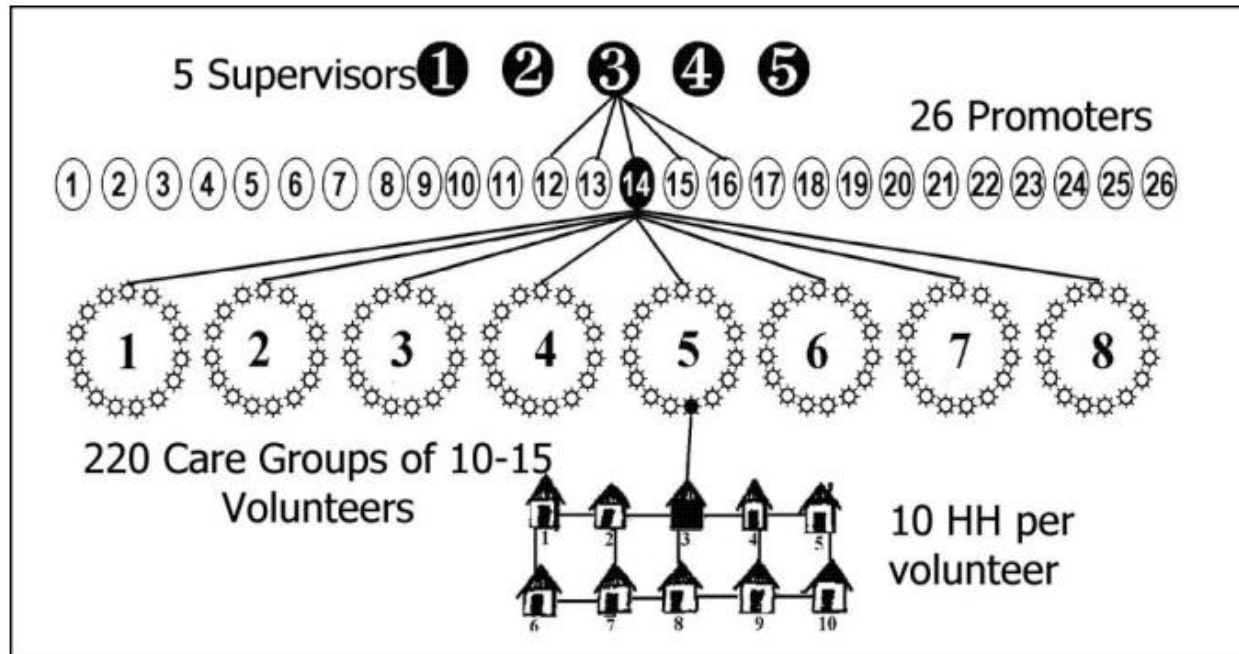
The 'Care Group Model' is a community health volunteer framework that provides a structure for health programs to reach every household in large populations while maintaining cost efficiency so that the program can be maintained in resource-constrained settings. Designed by World Relief in 1995 by drawing on other successful child survival program models such as the

Census-Based, Impact-Oriented Approach, the framework creates a vast network of well-trained and well-supported community-based volunteers to carry out program activities. This approach proved to be highly effective in reducing child mortality in the first Care Group program conducted by World Relief in Gaza Province, Mozambique, and it has since been successfully replicated in numerous field sites around the world by a large number of NGOs, with similarly positive results as assessed by dramatic improvements in the coverage of key child survival interventions at low cost (Edward et al., 2007).

The Care Group Model clusters its human resources into a network of tiers to facilitate the support and supervision for large numbers of volunteers. The Care Group itself consists of 10 to 15 volunteers who each carry out the program's health promotion and routine data collection activities amongst each volunteer's 8-10 assigned households. Each Care Group is overseen by a paid Promoter, who provides training, supervision, and support to as many as 8 Care Groups through meetings with each group at least once a month and in some cases every two weeks. (Different titles are used by different programs for this person, but in this manual we will refer to this person as a Promoter.) Each Care Group will also elect one Volunteer to be the Care Group Leader who will be responsible for organizing meetings, resolving internal disputes, and aiding in re-training of other Volunteers if necessary. At each Care Group meeting, one new health message is taught to the volunteers to take back to their households, and any occurring vital events prior to the subsequent Care Group meeting are reported by the Care Group Volunteer.

Since the Care Group Volunteer meets with each mother in his/her catchment area at least every month, this provides the opportunity for the Care Group Volunteer to note whether a vital event has occurred during that period and to report it to the Promoter who can then pass this information along in his/her monthly report to the next higher level. A vital event is formally defined as a birth, death or migration (in or out of a defined geographic area) but in this manual pregnancies will be tracked as well. Promoters then report vital events upwards to their Supervisors, who themselves provide oversight for five or more Promoters. Depending on the size of the program, there may be several Supervisory levels above the Promoter. The Supervisors report directly to the Program Director, thus completing a well-connected chain of command to increase accountability and enhance workforce support at every level of the program (Figure 1).

Figure 1: Example of the Care Group Model Structure in Mozambique (World Relief)



1.3 Necessary conditions for implementing a Mortality Assessment for Health Programs (MAP) System

This manual proceeds from a set of assumptions regard how the child survival program will be implemented. We will describe these assumptions below.

The most importation assumption is that the NGO is or will be carrying out a health program using the Care Group Model in a geographically-defined area. Volunteers will be visiting all households with a woman of reproductive age in the program area on at least a monthly basis, and thus will have established a strong rapport and level of trust within the community to facilitate the capturing of pregnancy, birth, and death information from all households. The health program will also operate for at least three years, the minimum length of time for most program activities to have a measureable impact on mortality rates. Though the MAP system described in this manual will be able detect changes in child mortality in shorter periods, we encourage mortality monitoring efforts to be undertaken for programs with a life span of at least three years.

Another assumption is that the program resides in a relatively stable and secure population area without major fluctuations in population size, birth rates, or age-specific death rates due to non-programmatic influences such as natural disasters, epidemics, migrations or political/military conflict. Large population inflows or outflows, whether due to routine labor migrations or insecurity, severely limit the feasibility of capturing accurate mortality

information due to the inability of volunteers to maintain consistent contact with all households to capture all occurring births and under-five deaths. Significant fluctuations in birth rates and age-specific mortality rates will also make under-five mortality rate comparisons more difficult to interpret from year to year. Methods for measuring mortality in conflict, post-disaster, and highly mobile populations are discussed elsewhere in public health literature and are not the focus of this manual.

Care Group Volunteer stability is another assumption, as this is essential for maintaining a vital registration system. The Care Group Model's structure helps to ensure that Care Group Volunteers are a reliable, trusted, and constant presence in their communities. Programs with high staff turnover are unlikely to gain and maintain the trust of communities. This may present a more significant problem when implementing a Care Group project in urban areas due to increased opportunities to participate in other income-generating activities that may compete with Volunteers' project responsibilities. Trust is essential to the ability to collect sensitive information about births and deaths, or when trying to ensure that all births and deaths are captured.

While Care Group Volunteers do not need to be literate in order to function effectively, it is assumed that those at the Promoter level and higher will have the level of literacy and numeracy required to record information on births and deaths on reporting forms. Another important assumption is that Supervisory staff above the Promoter level will have the capacity to use an Excel spreadsheet (or a database program such as **MS Access** or **EPI Info**) to track, analyze, and interpret vital events information as described in the manual.

There are a few other conditions that must be met as well. Care Group Volunteers must be willing to remain in contact with all households in their catchment areas. Normally, Care Group Volunteers visit households with a pregnant woman or with a child 0-23 months of age (or in some cases, 0-59 months of age). However, a woman in a household that is not being visited by a Care Group Volunteer may become pregnant. Also, a household with a young child may move into the catchment area of a Care Group Volunteer. Vital events that occur in these households must be identified as well.

A community mapping exercise should be performed before the MAP system's implementation, and Care Group Volunteers must know that they are responsible for certain geographic areas, not just an assigned set of current households with pregnant women or young children. The Promoters and Supervisors providing oversight to the Care Group Volunteers must also be willing to increase the intensity of their supervision to ensure data quality at every level of the information chain. A high level of data quality is necessary for the community, program managers, government officials, and donors to believe that reported changes in mortality by the MAP system reflect the true situation.

1.4 Focusing on mortality

As previously related, mortality rates are the best indicators for assessing the most important goal of child health programs - reducing the number of child deaths. This manual focuses exclusively on how to measure changes in the under-five mortality rate to assess health programs and how to interpret any changes observed. While child health programs may be successful in changing health knowledge, behaviors, and service coverage, this does not necessarily mean the program is contributing to reductions in mortality in the communities that they serve.

By focusing exclusively on under-five mortality measurement, this manual fills a crucial gap in the monitoring and evaluation activities of many NGO health programs. Many NGOs currently rely on national or provincial-level demographic and health surveys (DHSs) conducted every five to ten years to estimate under-five mortality in their program area. However, local variations in under-five mortality are common, so estimates for larger geographic areas, even if they are relatively recent and accurate, may not provide an accurate estimate of the under-five mortality specific to the program area. This manual provides a practical method for collecting and using vital events data to assess changes in under-five mortality with sufficient statistical precision and quality.

Once NGOs are comfortable with the MAP system, new data can be collected as necessary, such as causes of death, deaths by population sub-groups, death by age groups, and maternal deaths. With evidence that child survival programs are making measurable reductions in mortality, NGOs can be empowered to demonstrate to mothers and their families, community leaders, governments, and donors that their programs are worthy of support. This manual seeks to give NGOs a toolset to make these arguments more convincingly and to help them focus their programs on activities that will enhance their mortality impact.

SECTION TWO

Deciding to Implement a Mortality Assessment for Health Programs (MAP) System

2.1: Should a MAP system be established?

The decision to establish a MAP system should be undertaken in consultation with the community, government officials, and donors. This is necessary to determine if conditions are favorable for a system's implementation, as well as to obtain stakeholder input and support for mortality assessment activities going forward. Criteria for system implementation include the considerations outlined below:

Is a goal of the program to reduce under-five mortality?

Implementing a MAP system requires a commitment by NGOs in collecting under-five mortality information and using this information to track changes in mortality rates over time to assess program effectiveness. It should be emphasized that while under-five mortality rates constitute the 'gold standard' as an overall health program *impact* indicator, obtaining these rates will not be useful for NGOs in determining the causes of deaths, prioritizing specific child survival interventions based on their individual effectiveness, or providing evidence that statistically significant changes in under-five mortality were directly *caused* by program activities in the absence of an experimental randomized control trial with a true 'control' group for comparison. Rather, NGOs are able to use under-five mortality information to determine if mortality trends are headed in the right direction and if a statistically significant change in mortality rates has been observed that can be *correlated* with the program's activities. If a reduction in the rate in the program area is much greater than trends at the national and/or regional level, in the absence of other clear explanations, NGO's can be reasonably confident that the program is contributing to excess reductions in mortality.

Will the Care Group Model be fully operational within the program area?

The success of an under-five MAP system in collecting high-quality vital event data requires at least monthly visits to all beneficiary households by Care Group Volunteers to record complete community birth and death information. Additionally, the Care Group supervisory structure must ensure that quality assurance mechanisms are in place to verify data accuracy and follow-up on inconsistencies.

Does mortality occur often enough in the program area to measure changes over time?

If under-five mortality rates in the program area are already relatively low or if the beneficiary population is small, it will be difficult for the program to register enough vital events to statistically detect changes in under-five mortality rates. For this reason, it is recommended that the program duration is **at least three years**, with an expected number of under-five deaths in program area of **at least 50 per year at baseline**. This estimate can be made using existing data for estimating the population of the program area and national-level under-five mortality rates.

To calculate the expected number of under-five deaths in your program area, first determine the country's under-five mortality rate (number of deaths per 1,000 live births) and crude birth rate (number of live births occurring during the year, per 1,000 population) from a current source such as the World Bank (<http://data.worldbank.org/indicator/SH.DYN.MORT>). Next, divide the crude birth rate by 1,000 and multiply this number by the program area population; the resulting number will be the expected number of live births in the population per year. Finally, multiply the under-five mortality rate by the expected number of live births in the population per year and divide by 1,000 to determine the expected number of under-five deaths in your program area per year.

An example calculation is provided below for a program implemented in Tanzania with a program area population of 40,000.

Example: Calculating expected number of under-five Deaths in a program area in Tanzania

Example Tanzania Program Statistics

Program population: 40,000

Under-five mortality rate: 92 per 1,000 live births

Crude birth rate: 41 per 1,000 population

Calculating Expected Number of Under Five Deaths in One Year

1. Calculate expected number of births in one year

$$(41 \times 40,000)/1,000 = 1,640 \text{ expected births}$$

2. Calculate expected number of under-five deaths in one year

$$(92 \times 1,640)/1,000 = 150.9 \text{ expected under-five deaths}$$

We would expect 151 deaths in the program area each year. This is greater than the minimum of 50 that we recommend for implementing the MAP system.

Other examples of expected numbers of under-five deaths in different situations can be found in the table below. Red-shaded boxes indicate contexts where mortality measurement may be difficult because of either low levels of under-five mortality levels or small program populations. Green-shaded boxes indicate situations where there are sufficient numbers of vital events in a year to detect meaningful changes in mortality rates over the life of a three year program.

Table 1: Expected number of under-five deaths per year based on program population size and country statistics

Expected Number of Under-Five Deaths Per Year							
			Expected Number of U5 Deaths by Program Pop. Size				
Country	U5MR*	CBR*	20,000	40,000	60,000	80,000	100,000
Honduras	24	27	13	26	39	52	65
Cambodia	51	22	22	45	67	90	112
Pakistan	87	27	47	94	141	188	235
Ethiopia	106	31	66	131	197	263	329
Sierra Leone	174	39	136	271	407	543	679

*Source: World Bank, 2011.

Is the beneficiary population relatively stable?

In order to obtain accurate vital event information through regular Care Group Volunteer visits to beneficiary households, the beneficiary population should be located in a relatively stable and secure setting with minimal and/or stable migration patterns, and circumstances that may result in large fluctuations in birth rates and age-specific mortality rates (such as natural disasters or disease outbreaks) should not be present. Large population inflows or outflows may make it difficult for Care Group Volunteers to consistently visit eligible households to document all births and deaths, while high variability in birth rates and age-specific mortality rates may make reliable interpretations of under-five mortality rate estimates more difficult.

If you can answer yes to all of the above questions, then your program should be suitable for the implementation of a MAP system.

2.2: Managing stakeholder expectations

Once you have decided to implement a MAP system, it is time to meet with all of the program's key stakeholders to agree on expectations and to alleviate any concerns. These discussions are

critical to ensure that the community, government, and donors receive the same communication about the purpose and anticipated outcomes of mortality assessment activities. Possible expectations and concerns for each group of stakeholders are described below.

Possible community expectations and concerns

- **Expectations:**
 - Care Group Volunteers will collect and report information about pregnancies, births, and under-five deaths from all members of the community.
 - Under-five mortality trends in program area will be shared with the community on at least an annual basis at the time of community meetings.
 - Vital event data will be used to assess the program's effectiveness in reducing mortality in the community.
- **Concern:** Volunteers will collect information about sensitive issues and may share this information about other people.
 - Response: Volunteers will sign agreements keep all collected information confidential and will not share it with anyone outside the program.

Possible Care Group Volunteer expectations and concerns

- **Expectations:**
 - Volunteers will have new monitoring responsibilities to collect data on pregnancies, births, and deaths in addition to delivering health messages.
 - Volunteers will be regularly informed of the program's progress in the reducing under-five mortality in the project area.
- **Concerns:**

Volunteers may worry about being reprimanded for recording poor health outcomes, possibly causing them to under-report under-five deaths.

 - Response: It must be emphasized to Volunteers from the outset that they will not be punished for reporting deaths in their community. Rather, they will be commended for recording complete and valid mortality information.

Volunteers may be concerned about the workload associated with vital event monitoring responsibilities.

- Response: The additional responsibilities should not be overly burdensome, as identifying vital events should occur at the same time that health messages are delivered as part the Volunteer's routine household visits.

Possible government expectations and concerns

- **Expectations:**
 - Government officials will receive program mortality information on at least an annual basis to augment their national-level mortality data, assess the health program's effectiveness, and explore opportunities for further scale-up and health systems integration.
 - Possibilities for using the vital events data for official government vital events registration systems will be explored.
- **Concern:** Local government officials may fear looking poorly as a result of reported mortality rates.
 - Response: District and local level government officials will be informed at all stages of MAP system's implementation and receive regular summary reports of mortality data. Though data may indicate poor mortality statistics at the beginning of the project, officials will then be able to use this data to advocate for more resources to improve the health of their communities

Possible donor expectations and concerns

- **Expectations:**
 - A portion of donor program funding will go toward support of the MAP system, providing the necessary materials, training, and human resources to collect vital event data.
 - The donor will be provided with a report on at least an annual basis to demonstrate how the program may be contributing to excess mortality rate reductions in the program area.
- **Concern:** Donors may have questions about the quality of data collected by Care Group Volunteers.
 - Response: Donors should be provided with information on the quality assurance and supervision structures in place in order to ensure data validity.

Clearly defining the expectations of all stakeholders for the MAP system before its implementation will be crucial to obtaining the buy-in and ongoing support necessary to make the system successful.

SECTION THREE

Establishing and Managing a MAP System

3.1 Developing data collection tools

The first step in establishing a MAP system is to create a set of data collection tools to accurately record all pregnancies, births and under-five deaths in the community. These tools should be simple enough to be easily used by Promoters and Supervisors, but thorough enough to capture all data of interest for vital event registration. Three key data collection tools are needed to establish a MAP system: a Pregnancy and Birth Register, an Under-Five Death Register, and a Vital Events Database.

Task 1: Assess current data collection tools

Promoters, Supervisors, and the program's monitoring and evaluation coordinator should meet to take an inventory of any other data collection tools and forms that will be utilized by the program. This will help to determine what types of vital events information might already be collected by the program through other forms and records. Pregnancy and vital event information that will be utilized for the MAP system can also be consolidated from the aforementioned three tools into existing data collection tools prevent unnecessary duplicate data entry and reporting, if deemed more practical.

Task 2: Create a Pregnancy and Birth Register

The creation of a Pregnancy and Birth Register will allow Promoters to keep an ongoing record of all pregnant women in the community for tracking births. This tool should consist of a register book of paper pregnancy and birth forms. Each register page allows the Promoter to record information for about 20 pregnancies and births. Each Promoter will receive his/her own Pregnancy and Birth Register to record all new pregnancies and births across all the Care Groups he/she is working with. These vital events are verbally reported by Volunteers at each Care Group Meeting. On a monthly basis, the Promoters will report all identified pregnancies and live births, and other pregnancy outcomes to their respective Supervisors for entry into the MAP system's Vital Events Database.

When developing the Pregnancy and Birth Register, the following data elements should be included for each pregnancy at a minimum:

1. Administrative information

- a. **Year:** the current year in which pregnancy and birth information is being collected.

- b. **District (if applicable):** the name/number of the Promoter's district/municipality/local government unit, if program area covers multiple districts.
 - c. **Supervisor Number:** a unique ID number assigned to each Supervisor's area of supervision.
 - d. **Promoter Number:** a unique ID number assigned each Promoter's area of supervision.
- 2. Information to be recorded when a pregnancy is identified:**
- a. **Pregnancy ID Number:** an ordered, unique ID number assigned to each pregnancy in the Promoter's area of responsibility as it is reported by Care Group volunteers.
 - b. **Month Pregnancy Reported:** denotes the month the pregnancy was reported to the Promoter by a Care Group Volunteer.
 - c. **Care Group Number:** an ordered, unique ID number assigned to each Care Group.
 - d. **Name of Reporting Volunteer:** the name of the Care Group Volunteer reporting the pregnancy.
 - e. **Mother's Name:** the name of the identified pregnant woman.
 - f. **Expected Date of Delivery:** the expected month and year the identified pregnant women will give birth.
- 3. Indicators to be recorded after the pregnancy outcome:**
- a. **Pregnancy Outcome Code:** a numerical code that will indicate if the pregnancy resulted in a live birth, stillbirth, or another outcome.
 - b. **Date of pregnancy outcome:** the date when the pregnancy outcome occurred.

Further instructions for using this register will be provided in Section 3.3. A sample Pregnancy and Birth Register is included in **Appendix 1** to assist in the development of this form. It can also be accessed electronically at:

www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/Birth_Pregnancy_Register.pdf

Task 3: Create an Under-Five Death Register

The creation of an Under-Five Death Register will allow Promoters to document all under-five deaths occurring in their geographic areas of responsibility. This tool contains many pages bound together to create a register book (including at least one carbon copy per sheet, if available). Each register page allows the promoter to record information for about 20 deaths (one row per death). The columns provide space to record specific information about each death as described below. Each Promoter will receive his/her own Under-Five Death Register

to record all deaths across all Care Groups assigned to the Promoter. Under-five deaths will be verbally reported by Volunteers at each Care Group Meeting. The Promoters will then report all identified under-five deaths to their respective Supervisors on a monthly basis for entry into the MAP system's Vital Events Database.

When developing the Under-Five Death Register, the following data elements should be collected for each death at a minimum:

1. Administrative information

- a. **Year:** the current year in which the death information is being collected.
- b. **District (if applicable):** The name/number of the Promoter's district/municipality/local government unit, if program area covers multiple districts.
- c. **Supervisor Number:** a unique ID number assigned to each Supervisor's area of supervision.
- d. **Promoter Number:** a unique ID number assigned to each Promoter's area of supervision.

2. Indicators to be recorded after an under-five death has been identified

- a. **Death ID Number:** an ordered, unique ID number assigned to each death in the Promoter's area of responsibility as it is reported by a Care Group Volunteer.
- b. **Month in which Death Was Reported:** denotes the month the death was reported to the Promoter by a Care Group Volunteer.
- c. **Care Group Number:** an ordered, unique ID number assigned to each Care Group.
- d. **Name of Reporting Volunteer:** the name of the Care Group Volunteer reporting the death.
- e. **Name:** the name of the under-five child that died.
- f. **Date of Birth:** the birth date of the child.
- g. **Date of Death:** the date the child died.
- h. **Age at Death:** the age of the child at death. This age may be recorded in days, months, or years, depending on how long the child lived. The unit must be specified.
- i. **Pregnancy ID Number (if applicable):** If the child's birth was recorded in the Pregnancy and Birth Register, this indicator corresponds to the Pregnancy ID Number in the Register associated with his/her birth.

Further instructions for using this register will be provided in Section 3.3: Collecting Data on Pregnancies, Births, and Deaths. A sample Under-Five Death Register is included in **Appendix 2** to assist in the development of this form.

It can also be accessed electronically at:

http://www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/Under-Five_Death_Register.pdf

Task 4: Create a Vital Events Database

The creation of a Vital Events Database will allow program Supervisors to aggregate data collected from the Pregnancy and Birth Register and Under-Five Death Register into a single electronic record. The Supervisors and program monitoring and evaluation staff will then be able to use this database to analyze trends in mortality rates in the program area over time (Although there are many options for database software, in this manual we will use Microsoft Excel for examples. This program is relatively simple to operate and closely resembles the spreadsheet layout of both Registers. It also allows database responsibilities to be more highly transferable in the event of staffing changes as many people in the field of monitoring and evaluation are familiar with the program).

When creating a Vital Events Database in Excel, an attempt should be made to mirror the layout of both Registry forms. This will make transcribing information from these Registries into the Database as simple as possible for program monitoring and evaluation staff. Pregnancy and Birth data and Under-Five Death data should be placed on a separate tab for entry by each Supervisor, with a 'Statistics' tab for formulas to automatically calculate the total number of births and deaths from data entered into the Supervisor tabs. These totals can then be used to calculate monthly and yearly under-five mortality rates for trend analysis. **Further instructions for using this database to analyze changes in under-five mortality rates will be provided in Section 4: Analysis and Interpretation of Data.**

A Vital Events Database has been created in an Excel File as an attachment to this manual for your use. This database can also be accessed at:

www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/Vital_Events_Database_-_Mortality_Assessment_for_Health_Programs_MAP_System.zip

For screenshots of the Vital Events Database, please see **Appendix 3**.

Task 5: Pilot-test data collection tools

Once each data collection tool has been created (or existing tools adapted to the requirements above), the tools should be pilot-tested to ensure that they can be used correctly and effectively by the Promoters, Supervisors, and program monitoring and evaluation staff. The pilot-testing process should take place in two stages. In the first stage, an internal pilot-test of the tools with program staff should be conducted. This may be performed during the same time period as other program preparation activities outlined below, such as the community

mapping exercise. In the second stage, a field-based pilot-test should be conducted during the first month of data collection with all staff using real pregnancy, birth, and death data collected from the community. This will confirm that the tools will be effective and accurate when utilized at program-scale.

Step 1: For the first internal phase of the pilot test with program staff, select a sample group of Promoters, Supervisors, and monitoring and evaluation staff for preliminary training on the use of the data collection tools before the remainder of the staff are trained.

Step 2: Test the Pregnancy and Birth Register and Under-Five Death Register tools with the sample group of Promoters through a simulation exercise. Have one Promoter act out the role of a Care Group Volunteer reporting a series of ‘mock’ births and deaths while the other Promoters record this information in their registers. Several of these ‘mock’ births and deaths should be ‘reported’ with missing or vague information, and encourage the Promoters to ask questions if they would like further clarifications on a particular birth or death. At the end of the simulation, any inconsistencies or missing data in the Promoters’ registers should be noted. Where appropriate, the Monitoring and Evaluation Coordinator should seek to re-educate Promoters on how to avoid in the future any of the mistakes that they had made. The Promoters should also have the opportunity to provide feedback on anything that they found confusing about the data collection tools, as well as suggest ways that they might be improved.

Step 3: Test the Vital Events Database with a sample group of Supervisors and/or monitoring and evaluation staff members that will be responsible for maintaining the database. Develop a sample set of completed Pregnancy and Birth Registers and Under-Five Death Registers, and have these staff enter this information into the database. Several of these ‘mock’ births and deaths should be ‘reported’ with missing or vague information, and encourage the staff to ask questions if they would like further clarifications on a particular birth or death. At the end of the simulation, any inconsistencies or missing data in the Supervisor’s database should be noted. Where appropriate, the Monitoring and Evaluation Coordinator should seek to re-educate the staff on how to avoid in the future any similar mistakes. The staff should also have the opportunity to provide feedback on anything that they found confusing about entering the data into the database or ways the database might be improved.

Step 4: Using notes recorded on inconsistencies or errors in data in entry from the pilot-test and feedback from the sample groups as a guide, data collection tools may be modified if necessary to improve ease of use. Any resulting adjustments to the tools should be reported back to the sample groups so they are aware of these changes the next time they are required to use the tools, with appropriate re-training provided if necessary.

Step 5: For the second field-based phase of the pilot-test, the Monitoring and Evaluation Coordinator should perform an evaluation at the end of the first month of data collection in the community to assess if there were any consistently missing or irregular data in the Promoters' registers. The Monitoring and Evaluation Coordinator should follow up on any discrepancies with the appropriate staff members to explore why these errors might have occurred. If any specific errors or irregularities are discovered to be systematic throughout the data collection process, the Monitoring and Evaluation Coordinator may modify the tools as needed to improve their reliability and/or clarity. Any resulting adjustments to the tools should be reported back to all staff members so they are aware of these changes the next time they are required to use the tools, with appropriate re-training provided if necessary.

3.2 Mapping the community

Another critical step in setting up a MAP system is mapping the program area in order to assign geographic areas of responsibility to Care Group Volunteers and register the beneficiary population for vital event monitoring. Most programs using the Care Group Model will conduct an initial registration of the community in which the households of all pregnant women and women with a child 0-23 months of age (or in some cases, 0-59 months of age) are identified and assigned to Care Group Volunteers for health messaging and monitoring (typically, a Care Group Volunteer lives adjacent to the other households in his/her catchment area.) However, women who are not initially identified in the baseline census may become pregnant, and women with young children may move into the area near a Volunteer's initially assigned households. Increasingly, child survival programming is targeted to children 0-23 months of age rather than children 0-59 month of age since in many settings the risk of death after the second birthday has become quite small. Even so, each Care Group Volunteer should have sufficient contact and awareness of any under-five deaths that occur in his/her geographically assigned area even if an under-five death occurs in a household that is not regularly being visited. These women and their children must also be identified to ensure that all pregnancies, births, and under-five deaths are captured by the MAP system. For this reason, it is necessary to engage in a community mapping exercise to assign Care Group volunteers to geographic areas rather than only to a set of assigned households so that all women of reproductive age in the community (including new entrants) can be visited on a routine basis.

Task: Create the map

The process of creating the community map should directly involve community members, local leaders, Supervisors, Promoters, and Care Group Volunteers. This should be initiated by Promoters, who will each be responsible for creating a map that will cover each of their Care Groups, or roughly 100-150 households. Below are some general guiding principles for creating the map, as well as a checklist of items for inclusion.

Principals for Creating the Map

- The Promoter should facilitate the drawing of a community map that includes the entire Care Group area, and divide this area into roughly equal geographical areas for assignment to each volunteer (with ideally 8-10 households per Volunteer).
- The Volunteers should identify all households in their assigned areas occupied by the different types of intended program beneficiaries [women of reproductive age (15-49 years), pregnant women, and/or children under-five years of age].
- The Promoter should work together with the Care Group Volunteers to draw individual maps of their assigned geographic areas, separately designating households occupied by different types of intended program beneficiaries.
- The Promoter should include all households occupied by intended program beneficiaries on the Care Group community map.

Map Checklist

- Important geographic landmarks are identified, including major structures, roads, and bodies of water.
- All beneficiary households and non-beneficiary are identified, with separate designations for each type of beneficiary [women of reproductive age (15-49 years), pregnant women, and/or children under-five years of age].
- Clearly defined boundary lines between each Care Group Volunteer's catchment area are included (such as roads, paths, fences, rivers, buildings, etc.)

Figure 2: An example of a community map with geographically assigned areas for each Care Group Volunteer (Shanklin and Sillan, 2005).



3.3 Collecting data on pregnancies, births and under-five deaths in the community

Once the Promoters and Care Group Volunteers have completed their community maps and finalized assignment areas, the Volunteers are ready to begin reporting vital events. The process for the routine gathering of this data is explained below by describing the responsibilities of Care Group Volunteers and Promoters in collecting, reporting, and recording data.

Care Group Volunteer responsibilities

The Care Group Volunteers' primary responsibilities for the MAP system are to identify and report to their supervising Promoters at each Care Group meeting all pregnant women in their assigned geographic areas, as well as all pregnancy outcomes (live births, stillbirths, miscarriages, or abortions) and under-five deaths. These responsibilities can be carried out during a Care Group Volunteer's routine visits to his/her assigned households to deliver health messages and collect other health status information. Each of these responsibilities is described in detail below.

Identifying pregnancies

Step 1: On at least a monthly basis, the Care Group Volunteer will visit all households (or at least have contact with each woman assigned to him/her to discuss program-related matters) in his/her assigned geographic area. During each visit, the Care Group Volunteer will ask if any women in the household believe that they have become pregnant. The Care Group Volunteer should also remain attentive to any signs or symptoms of pregnancy that a woman might describe during his/her visit, such as a missed period, frequent nausea, or enlargement of the abdomen that the woman may not automatically attribute to a pregnancy.

Step 2: If a woman believes that she has become pregnant or if the Care Group Volunteer suspects that the woman might be pregnant based on signs or symptoms that she describes, the Volunteer can ask the following questions:

- Have you missed your period? When did your last menstrual cycle begin?
- Have you experienced vomiting, loss of appetite, or a general feeling of nausea?
- Have you been urinating more than usual?
- Have you been having any feelings of heaviness, pain, or tingling in your breasts?

If the woman answers yes to most of these questions, it can be reasonably inferred that she is pregnant (Path et al., 2003).

Step 3: Once a Care Group Volunteer identifies that a woman is pregnant, he/she must next determine approximately *when* the woman became pregnant in order to estimate an expected month of delivery. This can usually be determined by asking the woman when she had her last period, as the woman likely will have become pregnant at some point in the subsequent month. If the woman does not remember when her last period occurred or is unable to describe the time that has passed since her last period in terms of days or months, the Care Group Volunteer can ask additional questions about signs and symptoms to attempt to determine what stage of pregnancy the woman is likely in. These signs and symptoms are listed below:

Early Stage or First Trimester (0-13 weeks)

- Menstruation ceases
- Nausea or vomiting commonly experienced when waking up in the morning, or during the evening
- Increased tiredness
- More frequent urination
- Noticeable growth of breasts and darkening of nipples

Mid-tem Stage or Second Trimester (14-27 weeks)

- Woman generally feels better during this period as nausea and vomiting become increasingly less common
- Enlargement of the abdomen and noticeable expansion of uterus
- Woman can begin to feel fetal movements

Late Stage (28-39 weeks)

- Uterus becomes very large in size causing abdominal enlargement
- Fetal movement is apparent to the mother
- Fetal body parts can be palpated by the mother
- Breasts are more prominently enlarged, with possible milk secretion
- More frequent urination
- Greater difficulty in sleeping and walking

Step 4: After the Care Group Volunteer determines the approximate month when the woman became pregnant, he/she will make mark the household on his/her personal map with a symbol to designate that the household now contains a pregnant woman. This will help the Volunteer to remember that he/she has a new pregnancy to report as well as a new woman to follow-up with pregnancy-related health messages.

Step 5: At the next scheduled Care Group meeting, the Care Group Volunteer will report all pregnancies identified since the last meeting he/she attended to the supervising Promoter. Specifically, the Volunteer will need to tell the Promoter the pregnant woman's name and the estimated month that the woman became pregnant and the estimated date of delivery. The Promoter will then record this information in his/her Pregnancy and Birth Register.

Identifying live births and other pregnancy outcomes

Step 1: On at least a monthly basis, the Care Group Volunteer will visit all households in his/her assigned geographic area to ask if any women have given birth to a child or experienced some other pregnancy outcome (such as a stillbirth, miscarriage, or spontaneous/induced abortion). In the majority of cases, the Care Group Volunteer will be following-up with all pregnant women in his/her assigned geographic area on at least a monthly basis and will already be aware of any births or other pregnancy outcomes taking place. However, it is important for a Volunteer to be attentive to any pregnant mothers from other areas of the community that may suddenly move in with relatives in his/her assigned geographic area to give birth to their child. Similarly, a Volunteer should pay attention to any pregnant women in his/her households that plan to move to other areas of the community that are not part of his/her assigned geographic area of responsibility. A Volunteer should report movements of pregnant mothers outside his/her assigned area and their destinations in the program area (if known) to his/her

supervising Promoter to make sure that births or other pregnancy outcomes are not double-counted.

Step 2: In most cases, identifying a live birth will be relatively simple for a Volunteer, who will make a note of the new child living in his/her geographic area by marking the household with the appropriate symbol on his/her map. However, this process may be more difficult if the woman experienced some other pregnancy outcome or if the child died during or shortly after delivery. Though communities may have varied cultural definitions for what constitutes a live birth, in order to ensure that all live births, stillbirths, and other outcomes are consistently classified, the following public health definitions should be used by Volunteers when reporting pregnancy results:

- **Live Birth:** occurs when a fetus, whatever its gestational age, exits the maternal body and subsequently **shows signs of life** (such as beating of the heart, breathing, voluntary movement of arms and legs, or crying). If the live-born infant subsequently dies **after** showing signs of life, this should be reported as an under-five death, **not** a stillbirth.
- **Stillbirth:** occurs when a **fetus** has died in the uterus (generally after six months of pregnancy) or during the birth process and was delivered **without showing signs of life**. Explained another way, if what is delivered can be generally identified as a fetus (that is, fetal parts such as the head or limbs were identified), but it did not show any signs of life upon delivery, it should be classified as a stillbirth.
- **Miscarriage:** occurs when a pregnancy spontaneously ends at a stage of pregnancy when the fetus is incapable of surviving independently, generally prior to five months of gestation. Explained another way, if what is delivered **cannot** generally be identified as a fetus, it should be classified as a miscarriage.
- **Abortion:** Occurs when a pregnancy is terminated (either spontaneous or induced). A spontaneous abortion and a miscarriage are identical terms for the same event.

As part of their training, Volunteers and Promoters should be able to consistently and accurately classify pregnancy outcomes from a variety of outcome examples.

Step 3: At the next scheduled Care Group meeting, the Care Group Volunteer will report all pregnancy outcomes identified since the last meeting he/she attended to the supervising Promoter. Only outcomes for women that have resided in the program area for longer than six months should be recorded (see below). The Volunteer will need to tell the Promoter the pregnant woman's name, the pregnancy outcome, and the date of the pregnancy outcome. The Promoter will then record this information in the Pregnancy and Birth Register.

Why only report vital events for women who have resided in the program area for longer than six months?

Women who have not resided in the program area for six months are unlikely to have benefited from the program's health promotion activities enough to attribute a pregnancy outcome or child death to the program's overall statistics. Additionally, the short duration of a woman's residence in the community may be indicative of her transitory presence in the program area, also signifying that a pregnancy outcome or child death will not be associated with the health conditions in the community.

Note: A volunteer may still report the *pregnancy* of a woman who has not resided in the program area for six months (as the woman may have remained in the program for six months by the time a pregnancy outcome occurs).

Identifying under-five deaths

Step 1: On at least a monthly basis, the Care Group Volunteer will visit all households with under-five children and/or pregnant women in his/her assigned geographic area to ask if any child deaths have occurred.

Step 2: If a child death is reported, the Volunteer will seek to verify as confidently as possible that the child was younger than five years of age at the time of death. This can be determined by asking for both the child's date of birth and date of death. While the date of death should be recent enough for the mother to remember accurately (as it will likely have occurred sometime in the 2-4 week period after to the Volunteer's last visit), the mother may have difficulty providing an exact date of birth for the child. In this case, the mother may be asked how old the child was in days, months, or years (depending on how long the child was alive). If the mother cannot provide this information (e.g., in some cultures, a Western calendar is not followed), the Volunteer can still attempt to verify that the child was under-five years of age in the following ways:

- If the child's birth was reported by the Volunteer, the Volunteer's supervising Promoter will have a record of the child's birth date in his/her Pregnancy and Birth Register. The Promoter can then use this information to verify that the child was younger than five years of age at the time of death (this will become more likely over time once the Pregnancy and Birth Register has been implemented for months/years).
- The Volunteer can choose a regularly occurring event in the community, such as a religious holiday, local celebration, season/time of year, or agricultural harvest time. The Volunteer can then ask the mother how many times this event has occurred since she gave birth to the child. By using the time interval between when each event regularly occurs as a guide, the Volunteer can work with his/her supervising Promoter to make an estimate of the child's age at death.

- If any significant event in the community's history occurred five years prior to when the death of the child was reported (e.g. a major flood, influx/outflow of people, construction of a community building, etc.), the Volunteer can ask the mother if the child was born before or after this event. If the child was born after the event occurred, the Volunteer can be reasonably confident that the child was less than five years of age.

Step 3: At the next scheduled Care Group meeting, the Care Group Volunteer will report any under-five deaths identified since the last meeting he/she attended to the supervising Promoter. Only deaths for children of mothers who have resided in the program area for longer than six months should be recorded (per rationale provided above). The Volunteer will need to report to the Promoter the child's name, date of birth (if it can be determined), the date of death, and the age at death in days (if the child was less than one month old), in months (if the child was between one month and one year of age) or years (if the child was between 1 and 5 years of age at the time of death). The Volunteer should also report to the Promoter if the child's birth had been previously reported to them and recorded in the Pregnancy and Birth Register. This will prompt the Promoter to find the child's pregnancy number in the Pregnancy and Birth Register in order to link the birth and death for record-keeping purposes. The Promoter will then record all of this information in his/her Under-Five Death Register.

Promoter responsibilities

The Promoter's primary responsibility for the MAP system is to document the identification of all pregnant women, pregnancy outcomes, and under-five deaths reported in all assigned Care Groups in his/her Pregnancy and Birth Register and Under-Five Death Register. These responsibilities are to be carried out during the Promoter's meetings with each of his/her assigned Care Groups (approximately once a month). The Promoter will also be responsible for verifying and submitting this information to his/her Supervisor on a monthly basis. Each of these responsibilities is described in detail below.

Recording pregnancies in the Pregnancy and Birth Register

Step 1: At every meeting with each of his/her Care Groups, the Promoter will ask the Care Group Volunteers if any pregnancies have been identified since the previous Care Group meeting.

Step 2: If a new pregnancy has been identified by a Volunteer, the Promoter will begin a new entry in his/her Pregnancy and Birth Register, creating a new sequential Pregnancy Number following the entry. The Promoter will also record the month the pregnancy was reported, the Care Group number, the name of the Volunteer who identified the pregnancy, and the name of the pregnant woman.

Step 3: The Promoter will then work with the Volunteer to estimate the month of delivery. If the volunteer was able to determine the month that woman likely became pregnant, the Promoter will take the number of months (if any) that has elapsed between the current month and the month the women likely became pregnant, and subtract this number from the nine months that comprises the length of a normal, full-term pregnancy. This number of months will then be added to the current month to obtain the expected month of delivery.

Example: A Care Group Volunteer reports a pregnancy at a Care Group Meeting in **April**, but has determined from her discussions with the woman that her pregnancy likely began sometime in **February**. The Promoter will subtract the time that has elapsed from the approximate beginning of the pregnancy until it was reported (2 months) from 9 months, to estimate the remaining length of the pregnancy to be **7 months**. This number of months will be added to the current month of April to determine that the expected month of delivery is sometime during or near **November**.

If the Volunteer was unable to determine the specific month that the woman likely became pregnant, but was able to estimate the current trimester of the pregnancy, the Promoter may enter a 'best guess' for the expected month of delivery depending on the range of weeks that may remain in the pregnancy. For information on the range of weeks for each trimester, see **Care Group Volunteer Responsibilities: Identifying Pregnancies** above.

Important Note: It is not critical that the Promoter's expected month of delivery is exactly correct given the approximate nature of the pregnancy's start date provided by the Volunteer. It is only important that the Promoter record a **reasonable** estimate given the information available. The determination of an expected month of delivery is simply for Promoters to follow-up with Volunteers during or near this expected month to determine if a pregnancy outcome has taken place.

The Promoter has now completed his/her entry of the pregnancy into the Pregnancy and Birth Register.

Recording births and other pregnancy outcomes in the Pregnancy and Birth Register

Step 1: At every meeting with each of his/her Care Groups, the Promoter will ask the Care Group Volunteers if any births or other pregnancy outcomes have been identified since the previous Care Group meeting. Promoters should also inquire about any existing pregnancies in the Pregnancy and Birth Register with expected months of delivery near or during the current month to see if an outcome has occurred.

Step 2: If a new birth or pregnancy outcome has been identified by a Volunteer, the Promoter will check his/her Pregnancy and Birth Register using the Care Group number, Volunteer name, and mother's name to determine if the pregnancy had previously been recorded in the register. If the pregnancy has been recorded, and the woman has resided in the program area for longer than six months, the Promoter may proceed with the next step of recording information on the pregnancy outcome. If the pregnancy had not been previously recorded (e.g. due to a pregnant mother moving into the Care Group area from another community to give birth), the Promoter should follow the instructions below before proceeding.

Recording an outcome for a previously unidentified pregnancy: The Promoter should ask the reporting Volunteer if the woman moved from another Care Group area into his/her area to give birth, the area from which the woman arrived, and the name of the Care Group Volunteer that had been previously visiting the woman on a routine basis, if applicable (the Volunteer should be asked to investigate this and report back at the subsequent Care Group meeting if he/she had not yet inquired about this information). After obtaining this information, the Promoter may pursue the following actions:

- If the woman arrived from another Volunteer area or Care Group area under the Promoter's supervision, the Promoter will likely be able to find the woman in his/her own Pregnancy and Birth Registry using that Care Group's number, Volunteer name, the mother's name, and the expected month of delivery. If this is the case, the Promoter should make a note to inquire about this woman at the next Care Group meeting in this area. If the Volunteer listed as originally reporting the woman's pregnancy is able to confirm that the woman recently moved from his/her geographic area of responsibility, the pregnancy outcome information should be completed in the original pregnancy entry in the register.
- If the woman arrived from another Care Group area outside of the Promoter's supervision, the Promoter will make a note of this in his/her register in pencil and inform his/her Supervisor of the woman's name, previously responsible Volunteer, original area of residence, and pregnancy outcome information. Once the Supervisor has confirmed with the other Promoter in the woman's original area of residence that the woman had recently moved from this Promoter's area of responsibility, the woman's pregnancy outcome information should be recorded in the registry of the Promoter from the woman's original area of residence. The Promoter identifying the pregnancy outcome, once informed by his/her Supervisor, should erase and void the entry in his/her register.
- If it is determined that the woman arrived from outside the program area (and thus had not been living in the program area for at least six months previously), the pregnancy outcome should not be recorded.

Step 3: The Promoter will ask the Care Group Volunteer what he/she decided the pregnancy outcome was and his/her reason for that decision. Once the Promoter and Volunteer have agreed on the proper classification of the outcome according the public health definitions listed in the **Care Group Volunteer Responsibilities** section, the outcome will be recorded in the register numerically as follows:

- 1 – Live Birth
- 2 – Stillbirth
- 3 – Other: pregnancy terminated before six months of gestation without a live birth (includes miscarriages, spontaneous abortions, and induced abortions).

The Promoter will then record the date reported by the Volunteer that the outcome occurred.

Step 4: On the last day of each month, the Promoter will transcribe all new pregnancies and pregnancy outcomes that have been reported during that month into a new blank Pregnancy and Birth Register form separate from his/her own Pregnancy and Birth Register, which will be provided to the Promoter’s Supervisor for entry into the Vital Events Database. New pregnancies will be transcribed leaving the pregnancy outcome section of each entry line blank, and new pregnancy outcomes should be listed as completed entries (including pregnancy identification information). At this time the Promoter will also indicate in the report to the Supervisor any pregnancy outcomes identified that may have occurred elsewhere in the program area for follow up and verification.

Recording under-five deaths in the Under-Five Death Register

Step 1: At every meeting conducted by the Promoter their assigned Care Groups, the Promoter will ask the Care Group Volunteers if any under-five deaths have been identified since the previous Care Group meeting.

Step 2: If a new under-five death has been identified by a Volunteer and the child’s mother has resided in the program area for longer than six months, the Promoter will begin a new entry in the Under-Five Death Register, creating a new sequential Death Number following the previous entry (if using carbon copies, use a new page in the register at the beginning of each month). The Promoter will also record the month the death was reported, the Care Group number, the name of the Volunteer who identified the death, the name of the child, and the date of death.

Step 3: The Promoter will ask the Volunteer to explain how he/she verified that the child was younger than five years of age at the time of death. If the exact date of birth is provided by the Volunteer, the Promoter will be able to record this exact date and affirm an age at death, which may be recorded in days (if the child was less than one month of age at the time of death), months (if the child was between one month and one year of age at the time of death) or years

(if the child was between one and five years of age at the time of death). If the exact date of birth is not known by the Volunteer, but the child's birth was reported in the Pregnancy and Birth Register, the Promoter should be able to find information about this child in the register using the corresponding Care Group number, Volunteer name, and mother's name. The Promoter will then record the mother's 'pregnancy outcome date' as the child's date of birth in the Under-Five Death Register and calculate the corresponding age at death.

If the Promoter is unable to determine an exact date of birth, but the Care Group Volunteer is able to provide an estimated age at death from his/her interview with the mother, then the Promoter will record this age estimate, along with a corresponding estimated month/year of birth (writing "99" for the date) in the 'date of birth' field.

If for any reason it becomes clear that the child was not actually younger than five years of age at the time of death, the death should not be recorded in the Under-Five Death Register.

Step 4: If the child's birth was recorded in the Pregnancy and Birth Register, the mother's pregnancy number should be recorded in the child's entry in the Under-Five Death Register.

Step 5: On the last day of each month, the Promoter will transcribe all of the month's under-five deaths into a new blank Under-Five Death Register form separate from his/her own Under-Five Death Register, which will be provided to the Supervisor for entry into the Vital Events Database. If carbon copies are available, the Promoter will provide his/her Supervisor with a carbon copy of the reported under-five deaths for that (and begin entries for the next month on a new page).

Supervisor/Monitoring and Evaluation Coordinator responsibilities

After data on pregnancies, births, and deaths in the program area are submitted by Promoters, Supervisors and/or a Monitoring and Evaluation Coordinator (hereafter uniformly referred to as "Supervisors") will be responsible for entering this data in the Vital Events Database. As previously discussed in **Section 3.1: Establishing Data Collection Tools**, this Database should mirror the Pregnancy and Birth Register and Under-Five Death Register tools closely to make data entry as simple and efficient as possible. Sample screenshots of the Supervisor data entry tab in the Database have been provided in **Appendix 3**.

In order to limit inconsistencies in data entry and allow for all program data to be analyzed at once, all Supervisors will enter Promoter reports into a single Vital Events Database. If attempting to share a single Database is not practical due to a large number of Supervisors for the program (which may create conflicts in sharing/accessing a single Database file), Supervisors may be required to forward their reports to a Monitoring and Evaluation Coordinator for data management for merging into the Vital Events Database. In this case, the

Supervisors will still be responsible for examining Promoter reports for missing data and following up on pregnancies and births that may have been registered in other areas of the program, but they will not be responsible for manual data entry activities.

Entering pregnancies into the Vital Events Database

Step 1: The Supervisor will need to create a new unique Pregnancy Number for each entry provided by the Promoter (as a Promoter's own Pregnancy ID Numbers will overlap with those in other Promoters' Registers). It is suggested that for each new Pregnancy ID Number, the Supervisor begin with the two digits of the Promoter Number followed by a period and then the Promoter's own reported Pregnancy Number (with at least six numerical placeholders).

Example: The Supervisor receives a report of a new pregnancy from **Promoter 12**. The **Pregnancy Number** indicated in the Promoter's Register is **178**. The Supervisor would enter a new, unique pregnancy number in the Vital Events Database of **12.000178**.

Step 2: The Supervisor will copy the remaining fields in the Promoter's monthly Pregnancy and Birth Register report into the Database, including the following indicators: Year Reported, Month Reported, District, Supervisory Unit Number (SU #), Promoter Unit Number (PU #), Care Group Number (CG #), Volunteer Name, Mother's Name, and Expected Month of Delivery.

Step 3: The Supervisor should highlight any missing fields for follow-up with the Promoter.

Entering births and other pregnancy outcomes into the Vital Event Database

Step 1: Births and other pregnancies outcomes will be entered at the end of each month into the Vital Events Database to complete previously recorded pregnancy entries (if they were reported). This will require the Supervisor to find the pregnancy number associated with each reported pregnancy outcome, and then record the Pregnancy Outcome with the correct numerical code (1=Live Birth, 2=Stillbirth, 3=Other) and Pregnancy Outcome Date, Month, and Year.

Entering an outcome for a previously unidentified pregnancy: In some cases, a Promoter may report a pregnancy outcome, but has reason to believe that the pregnancy may have been initially registered in another Care Group area outside his/her own area due to information he/she has received from the reporting Volunteer as well as the absence of a pregnancy record in the Promoter's Pregnancy and Birth Register. In these instances, the Supervisor should record a new entry with a Pregnancy Number, Outcome, and Outcome Date in the Vital Event Database. The entry should then be highlighted (in a color such as yellow) for follow up with the appropriate Promoter in the other area. If the woman's pregnancy is found to have been registered in another Care Group area, the Outcome and Outcome Date should be completed in

the originally registered entry in the database, and the highlighted entry “voided” in the Database. To “void” the entry, it should be highlighted in a unique color used for all voided entries (such as red) and all fields should be cleared of data, but the Pregnancy Number should remain in the Database for record-keeping purposes and should not be duplicated by a subsequent entry.

Example: Pregnancy Number 08.000006 is voided in the Vital Events Database. The next Pregnancy Number assigned a pregnancy reported from Promoter Unit 8 would be 08.000007, and **would not** replace the voided entry for Pregnancy Number 08.000006.

If the pregnancy outcome is discovered to have been reported for a woman who has not resided in any part of the program area for at least six months, the entry should be voided in the same manner.

Step 2: The Supervisor should highlight any missing fields for follow-up with the Promoter.

Entering under-five deaths into the Vital Events Database

Step 1: The Supervisor will need to create a new unique Death Number for each entry provided by the Promoter (as a Promoter’s own Death Numbers will overlap with those in other Promoters’ Registers). It is suggested that for each new Death Number, the Supervisor begin with the two digits of the Promoter’s Unit Number (PU#), followed by a period and then the Promoter’s own reported Death Number (with at least six numerical placeholders).

Step 2: The Supervisor will copy the fields in the Promoter’s monthly Under-Five Death Register report into the Database, including the following indicators: Year Reported, Month Reported, District, Supervisory Unit Number (SU #), Promoter Unit Number (PU #), Care Group Number (CG #), Volunteer Name, Child’s Name, and Date of Death. The Date of Birth may be entered as a precise date (e.g. “DD/MM/YY”) if this was obtained. If the exact date has not been determined, “15” should be entered for the date to approximate the middle of the month (so the estimate has an equal likelihood of error whether the true date is before or after). Similarly, “06” should be entered for the month if a precise estimate has not been determined.

Example 1: The Promoter’s recorded date of birth for a reported death is December 2014. The Supervisor should enter this into the Date of Birth field as “15/12/14”.

Example 2: The Promoter’s recorded date of birth for a reported death is 2012. The Supervisor should enter this into the Date of Birth field as “15/06/12”.

Step 3: The Age at Death should be recorded as reported by the Promoter in months. If the child was less than one month old (less than 30 days old), the age should be entered as “00”.

Example: The Promoter’s recorded age at death is reported as 3 years. The Age at Death should be entered as “36” (3 years is 36 months).

Step 4: If the Promoter has linked the death to a Pregnancy Number in his/her Pregnancy and Birth Register, the unique Pregnancy Number created for this pregnancy **in the Database** (not the number in his/her register) should be completed in the Pregnancy Number field for the death entry in the Database.

Step 5: The Supervisor should highlight any missing fields for follow-up with the Promoter. If any deaths are later discovered to have occurred for children who were older than five years of age at the time of death or for children whose mothers had not resided in the program area for at least six months previously, these entries should be voided in the Database.

SECTION FOUR

Analysis and Interpretation of Under-Five Mortality Data

4.1 When to use under-five mortality rates to assess a health program

Examining initial monthly trends in under-five mortality data over time can be useful to attempt to assess if a program moving in the right direction in preventing child deaths. However, in many cases, an individual month's total number of births and under-five deaths will not allow for a sufficiently precise understanding of a program's under-five mortality situation due to the very small number of events recorded. For this reason, as previously stated, it is recommended that **at least 50 under-five deaths are registered at baseline in order to calculate a reasonably accurate under-five mortality rate (with a 95% confidence interval of roughly $\pm 30\%$ of the calculated rate, depending on the number of births)**. Going forward, a program can then calculate a reasonably accurate under-five mortality rate **on an annual basis** to assess program progress. The **minimum baseline of 50 under-five deaths per year** ensures that if the program's interventions have a positive effect in reducing mortality in the program area over the course of the project, **annual mortality rates calculated in subsequent years from the baseline will still be reasonably accurate down to 25 under-five deaths per year (as long as the 95% confidence interval for the rate remains below $\pm 40\%$, which will depend on the number of births)**. Further instructions for calculating the 95% confidence interval of an under-five mortality rate will be explained later in this section.

Expected Number of Under-Five Deaths Per Year							
			Expected Number of U5 Deaths by Program Pop. Size				
Country	U5MR*	CBR*	20,000	40,000	60,000	80,000	100,000
Honduras	24	27	13	26	39	52	65
Cambodia	51	22	22	45	67	90	112
Pakistan	87	27	47	94	141	188	235
Ethiopia	106	31	66	131	197	263	329
Sierra Leone	174	39	136	271	407	543	679

*Source: World Bank, 2011

Using the above **Table 1** from **Section 2.1**, it can be observed that a program in Honduras serving 80,000 beneficiaries would be able to record the 50 under-five deaths necessary to calculate a reasonably precise under-five mortality rate to assess the health program after roughly the end of the first year of the program (assuming approximately 52 under-five deaths per year). This would allow an NGO working in this setting to evaluate the program's potential contributions in reducing under-five mortality on an annual basis. Using a different example, a program in Honduras serving 40,000 beneficiaries might be able to record over 25 under-five

deaths to calculate a reasonably precise under-five mortality rate to assess a health program after the first year (assuming approximately 26 under-five deaths per year), but if the under-five mortality rate declines over the course of the project, the subsequent annual mortality rates may be too imprecise to assess correlations between program activities and mortality reductions.

It should be noted that under-five deaths may sharply rise for the first several months after the MAP system is established. This should not be cause for alarm, as it usually signifies that the system is steadily becoming more effective in capturing all under-five deaths in the program area than during the first phases of its implementation. If the health program's interventions are working effectively, the under-five mortality rate should begin to decline after this initial increase.

To provide a real example of this phenomenon, under-five mortality data from the first year of a World Relief Care Group program in Cambodia are provided below.

Example Data: Summary Information for Births and Under-Five Deaths in Ponhea Kriek & Dombe Health Districts, 2000. (World Relief, 2008).

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Births	189	155	136	141	130	118	130	166	178	129	1472
Deaths	19	22	20	29	18	15	25	16	16	10	190

As can be observed from the table above, the number of under-five deaths rose overall from March until June, presumably as the Care Group Volunteers became more effective at capturing all deaths in the community. By the end of the first year, in December, the number of under-five deaths had fallen to 10. For this reason, **we recommend discounting the first three months of data towards calculating a baseline rate.** This will allow time for the MAP system to realize its full surveillance capabilities before using the data to analyze under-five mortality rate trends.

Seasonality may also play a role in large month-to-month fluctuations, as births and deaths may be more frequent during certain times of the year. By ensuring that under-five mortality rates are calculated on an annual basis, the high variability associated with small numbers (such as the number of vital events that occur from one month the next) can be avoided, resulting in much more precise under-five mortality rates to assess possible trends.

Calculating an under-five mortality rate

The World Health Organization defines an under-five mortality rate as “the probability that a child born in a specific year or period will die before reaching the age of five, if subject to the

age-specific mortality rates of that period” (World Health Statistics, 2012). This definition requires that the probability of death is obtained for eight period subintervals (0 months, 1-2 months, 3-5 months, 6-11 months, 12-23 months, 24-25 months, 36-47 months, 48-59 months), with the “probability of death for a cohort in a given period the result of dividing the number of deaths for that period occurring between the limits of the subinterval to children who were exposed to death in the period, by the number of children exposed (children entering the subinterval alive)” (Rutstein and Rojas, 2006). Though this method of calculation produces a precise under-five mortality rate as utilized by demographers, the complexity of the calculation and the insufficient availability of reliable age-specific mortality rate derived from a prospective cohort analysis in low-resource areas limits the utility of this method for NGOs monitoring programs in these settings.

However, a strong estimate of an under-five mortality rate can be calculated by taking the total number of under-five deaths that have occurred in a period of interest and dividing this number by the total number of births in that period and multiplying by 1,000. While this calculation is not robust enough for high-level scientific research, it can provide a very reliable under-five mortality rate estimate for program monitoring as long as there are not large fluctuations in the number of births and age-specific risks of death from year to year (as described in assumptions for MAP system implementation in Section 1.3). More importantly, since the rate is calculated consistently using the same methodology, it should provide a good measure of changes in under-five mortality in the program area assuming that no major non-programmatic disruptions (as mentioned previously) are present.

Example data from Year 1 of a World Relief Care Group project in Cambodia will be used below to demonstrate how to perform this calculation.

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Births	189	155	136	141	130	118	130	166	178	129	1472
Deaths	19	22	20	29	18	15	25	16	16	10	190

From the table above, it can be observed that after discounting the first three months of data collection, the 50 cumulative under-five deaths necessary to calculate the first mortality rate for the project (also known as the ‘baseline’ rate) are recorded by the conclusion of August. A baseline under-five mortality rate can now be calculated for June-August by adding the vital event data for each month together. This calculation is demonstrated below.

Deaths for June-August: $29+18+15= 62$ deaths

Births for June-August: $141+130+118= 389$ births

$$\frac{62 \text{ deaths}}{389 \text{ births}} \times 1,000 = 159.4 \text{ under-five deaths per 1,000 live births}$$

The same calculation can be completed to calculate an annual under-five mortality rate by taking total number of under-five deaths that occurred in the year of interest and dividing this number by the total number of births in that year and multiplying the result by 1,000. Example data from Year 2 of a World Relief Care Group project in Cambodia (the first full year of the project) will be used below to demonstrate how to perform this calculation.

Example Data: Summary Information for Births and Under-Five Deaths in Ponhea Kriek & Dombe Health Districts, 2001. (World Relief, 2008).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Births	153	159	146	118	160	121	110	114	113	100	145	146	1585
Deaths	13	16	10	8	21	17	16	9	12	19	19	10	170

$$\frac{170 \text{ deaths}}{1585 \text{ births}} \times 1,000 = 107.3 \text{ under-five deaths per 1,000 live births}$$

Calculating a confidence interval for an under-five mortality rate

After calculating an under-five mortality rate, it is crucial to know how precise the rate is based on the rate's calculated 95% confidence interval (CI). A confidence interval is composed of two figures or a range of numbers - an upper and lower limit - computed specifically for a given rate. That range then has a 95 percent chance of containing the "true" rate or a rate unaffected by chance events (Pennsylvania Department of Health, 2012). When births and under-five deaths are being reported for everyone in the population of interest, the following formula can be used to calculate a 95% confidence interval for an under-five mortality rate*, where *D* is the number of under-five deaths, and *B* is the number of births in the same time period (Breslow & Day, 1987; Selvin, 1991):

$$\frac{[D \pm 1.96 \times (\sqrt{D})]}{(B)} \times 1,000$$

*The " $\sqrt{}$ " symbol stands for 'square root'. A square root is a number that produces a specified quantity when multiplied by itself. For example, 4 is a square root of 16 ($\sqrt{16} = 4$).

When example data is used from the month of August in the 2000 World Relief data presented above (15 under-five deaths, 118 births) and entered into the equation, it looks like this:

$$\frac{[15 \pm 1.96 \times (\sqrt{15})]}{(118)} \times 1,000$$

When this is simplified, it gives us a 95% confidence interval of **62.8 – 191.4** under-five deaths per 1,000 live births for the calculated under-five mortality rate of **127.1**, meaning that we can be 95% certain that the true rate (unaffected by chance events) falls between 61.5 and 192.8 under-five deaths per 1,000 for that month. At first glance, this appears to be a very large range, so it would be wise to assess the rate's precision based on its calculated 95% confidence interval. A simple method for assessing precision of a rate is to divide the upper limit of the 95% confidence interval by the calculated under-five mortality rate, subtract 1, and multiply by 100 to obtain percentage by which the upper limit of the 95% confidence interval exceeds the calculated rate (this percentage will be the same for the extent to which the lower limit of the 95% confidence interval is less than the calculated rate, as the interval is evenly centered around the rate). When the data from above are entered into the equation it looks like this:

$$\left(\frac{191.4}{127.1} - 1 \right) \times 100 = 50.6$$

The confidence interval is roughly **±51%** of the calculated under-five mortality rate and thus not very precise.

This calculation demonstrates why we recommend that mortality rates are calculated to assess health programs **only on an annual basis**. Using monthly data with small numbers of vital events is likely to result in imprecise under-five mortality rate calculations with 95% confidence intervals greater than **±40%** of the calculated rate. By contrast, annual data produces much more precise under-five mortality rates due to the higher number of vital events included. Using the 2001 World Relief annual data presented above as an example (170 under-five deaths, 1585 births), the equation to determine a 95% confidence interval looks like this:

$$\frac{[170 \pm 1.96 \times (\sqrt{170})]}{(1585)} \times 1,000$$

When this is simplified, it gives us a 95% confidence interval of **91.1-123.4** deaths per 1,000 live births for the calculated under-five mortality rate of **107.3**. This confidence interval is roughly **±15%** of the calculated under-five mortality rate, and thus much more precise.

It is very important to always calculate the 95% CI for each calculated under-five mortality rate to be certain how precise the rate is. If the rate is not precise (**with a 95% CI greater than ±40% of the rate**), then more vital events need to be recorded before a rate can be reliably calculated. Once several reliable annual under-five mortality rates and their corresponding 95%

CIs have been established for the program area, basic inferences about trends in mortality rates can be made.

4.2 Determining if an under-five mortality trend exists

Once multiple annual under-five mortality rates have been calculated, these mortality rates can be analyzed to determine if a statistically significant mortality trend exists. An Extended Mantel-Haenszel Chi square test is recommended for this type of trend analysis, as the test calculates the probability that a linear mortality rate trend is horizontal (i.e., no trend is present). If the resulting p value from this test is less than .05, there is at least a 95% probability that a mortality trend truly exists in the program population (depending on the p value). As this calculation can be time-consuming if performed by hand, it is recommended that staff use the **StatCalc, Chi Square for Trend** function within the free open source software package **EPI Info 7**, available for free on the Centers for Disease Control website: <http://wwwn.cdc.gov/epiinfo/7/index.htm>

Below are step-by-step instructions for determining if a statistically significant mortality trend exists in the program area using **EPI Info 7**. For further information on the Extended Mantel-Haenszel Chi square test, please consult the following reference:

Schlesselman, JJ. (1982). *Case-Control Studies: Design, Conduct, Analysis* (pp. 200–206). New York: Oxford University Press.

Step 1: Obtain multiple under-five mortality rates for the program area over time to use for trend analysis. Only under-five mortality rates for time intervals including at least 50 deaths should be used in this calculation to ensure adequate precision.

Step 2: Open **EPI Info 7**. In the Menu toolbar, select the **StatCalc** tool, then choose **Chi Square for Trend**. This should lead you to the screen below.

StatCalc - Chi Square for Trend

Analysis For Linear Trends In Proportions

Exposure Score	Cases	Controls	Odds Ratio

Add Row

Chi Square for linear trend (Extended Mantel-Haenszel)	...
p value	...

Step 3: Enter each time interval's vital event data for the following fields in each row:

- **Exposure score:** The number assigned to each entry in the formula. The entries can be numbered simply as 1,2,3,4,5 etc. to correspond to each annual mortality rate.
- **Cases:** The number of deaths occurring in the time interval.
- **Controls:** The number of births occurring in the time interval, **minus** the number of deaths occurring in the same interval.
- **Odds ratio:** This field will automatically calculate a comparative odds ratio for each successive rate after the first entry (this calculation is beyond the scope of this manual, as we are only interested in the resulting p value of the trend calculation).

Step 4: The program will automatically calculate the chi square value and corresponding p value. If the p value is less than .05, there is at least a 95% probability that a mortality trend truly exists in the program population (depending on the p value).

Three example trend analysis calculations and their interpretations are explained below using the example data from a dataset of annual under-five mortality rates taken from the previously cited Care Group program in Cambodia.

Example data

Year	Number of Births	Number of Deaths	U5MR
Jun.-Aug. 2000 (baseline)	389	62	159.4
2000 Year Total (Year 1)	1472	190	129.1
2001 Year Total (Year 2)	1585	170	107.3
2002 Year Total (Year 3)	1546	119	77.0
2003 Year Total (Year 4)	1429	93	65.1

2004 Year Total (Year 5)	1530	45	29.4
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Source: World Relief, 2008.

Example 1: Does a trend exist from the baseline rate to the end of Year 1 rate?

The baseline and end of Year 1 vital event data are entered into to the program as shown below.

StatCalc - Chi Square for Trend			
Analysis For Linear Trends In Proportions			
Exposure Score	Cases	Controls	Odds Ratio
1	62	327	1.000
2	190	1282	0.782
Add Row			
Chi Square for linear trend (Extended Mantel-Haenszel)		2.67834	
p value		0.10175	

The resulting p value (0.10175) indicates that the observed rising trend in the program mortality rate from the baseline measurement to the end of Year 1 is not statistically significant from zero (no trend) at the .05 level. This is not altogether surprising given the relatively short time frame that has elapsed from the baseline measurement (only around 4 months), the fact that the annual rate includes data from the baseline rate and thus is less dissimilar, and the fact that mortality rates usually rise after the baseline measurement in the first year as the data collection system becomes more effective at recording all deaths in the program area.

Example 2: Does a trend exist from the end of Year 1 rate to the end of Year 2 rate?

First, the Year 1 and Year 2 vital event data are entered into to the program as shown below. The original baseline rate is omitted in this case, as it is encompassed by the total end of Year 1 rate.

StatCalc - Chi Square for Trend			
Analysis For Linear Trends In Proportions			
Exposure Score	Cases	Controls	Odds Ratio
1	190	1282	1.000
2	170	1415	0.811

Chi Square for linear trend (Extended Mantel-Haenszel)	3.70965
p value	0.05410

The resulting p value (0.05410) indicates that the observed mortality rate reduction trend in the program area from the end of Year 1 to the end of Year 2 is not statistically significant from zero (no trend) at the .05 level. This would be interpreted to mean that there was a not a statistically significant reduction in under-five mortality between the end of Year 1 and the end of Year 2. This indicates that further mortality trend data is needed to more confidently confirm a change in mortality.

Example 3: Does a trend exist from the end of Year 1 rate to the end of Year 3 rate?

The Year 1, Year 2, and Year 3 vital event data are entered into the program as shown on the following page.

StatCalc - Chi Square for Trend			
Analysis For Linear Trends In Proportions			
Exposure Score	Cases	Controls	Odds Ratio
1	190	1282	1.000
2	170	1415	0.811
3	119	1427	0.563

Add Row

Chi Square for linear trend (Extended Mantel-Haenszel)	22.29681
p value	0.00000

The resulting p value (0.00000) indicates that the observed mortality rate reduction trend in the program area from the end of Year 1 to the end of Year 3 is strongly statistically significant from zero (no trend) at the .05 level. This would be interpreted to mean that there was a significant reduction in under-five mortality between the end of Year 1 and the end of Year 3.

These examples demonstrate why it is recommended that a mortality measurement system should only be implemented for programs with a minimum duration three of years, as it may take this long to obtain a complete enough representation of the trends in under-five mortality rates in the program area to make a confident evaluation. This example was chosen owing to the fact the mortality trends it exhibits are illustrative of common developments that often occur during the first three years after the establishment of a MAP system:

Year 1: The Year 1 mortality rate is established.

Year 2: If the program's health initiatives are effective, there will likely be considerable reduction in the number of under-five deaths between the end of Year 1 and the end of Year 2. However, due to the fact that the amount of time that has elapsed from the start of the program until the end of Year 2 is still relatively short, this decrease may not yet represent a statistically significant reduction in the mortality rate.

Year 3: Assuming that the program's health initiatives continue to reduce mortality rates considerably from Year 2 to Year 3, the Year 3 mortality rate will likely represent a statistically significant reduction from the end of Year 1 rate, showing a correlation between the program's activities and mortality rate reductions.

By regularly assessing trends in under-five mortality over the duration of the program, program staff can make interpretations about the changing rates of child deaths in the community. These trends can then be compared with national and regional trends (if data are available) to provide further context for the program's accomplishments. A reduction in under-five mortality can be generally attributed to a program if the following conditions are satisfied:

- A statistically significant reduction in under-five mortality has been observed in the program area.
- Service coverage and acceptance is high in the program area (this should be verified through household surveys).
- Reductions in under-five mortality have not occurred to the same extent in non-program areas or in the sub-national area where the program is located.
- The program area is similar to other non-program areas for the basis of comparison with regard to contextual factors, such as demographic characteristics, geographic and cultural factors, and level of development.
- Other factors that might cause changes in the under-five mortality rate in a short period of time, such as a rapid in- or out-migration, have not been present.

It is important to re-emphasize that, in the absence of an experimental randomized control trial and true 'control' community for comparison, trend test calculations cannot definitively prove that a program's interventions alone directly *caused* a decline in under-five mortality in a community; rather, trend analysis can prove evidence that the program's intervention's were *strongly correlated* with the under-five mortality declines in program area if all of the above conditions are met.

If one or more conditions are *not* met, while the program may have *contributed* to reducing under-five mortality in the project area, it is more difficult to attribute the mortality decline to the program's interventions. This is because there may have been *confounding* factors present that could have also influenced the mortality decline in addition to the program's activities (e.g. the concurrent initiation of a government initiative to improve healthcare access, similar levels of decline in mortality at the national level, etc.).

4.3 Presentation of under-five mortality trend data

After the MAP system has been established and is regularly collecting data on under-five mortality rates in the program area, program staff may be asked to analyze the data to evaluate the progress of the program in reducing child deaths and present the findings to various program stakeholders including the program's leadership, community members, government officials, and donors. Several options for the presentation of mortality trend data are described below.

A table of under-five mortality rates with confidence limits

A table is a useful tool to display trends in under-five mortality rates while showing the audience the exact data points for each time period of interest. These rates can also be displayed with confidence intervals to give the audience an understanding of the precision of each mortality rate estimate. An example of an annual data table with confidence intervals using data from the World Relief Care Group program from Cambodia is provided below.

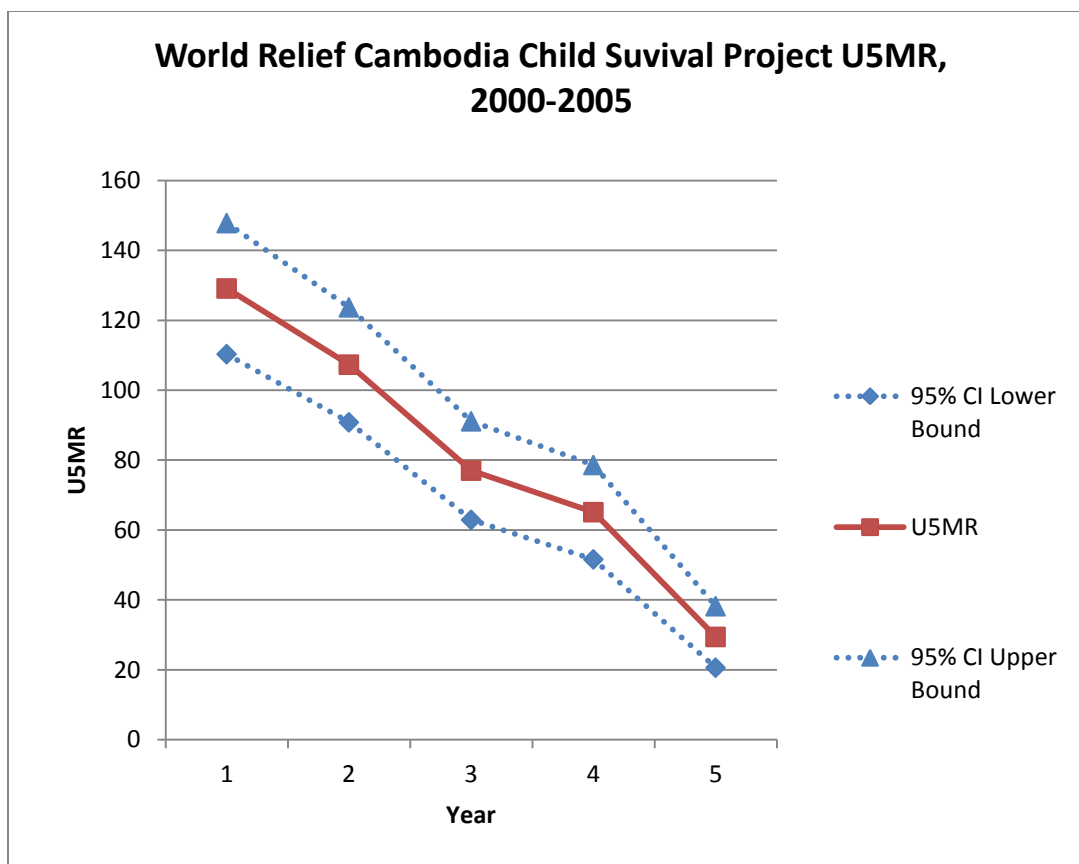
Year	Number of Births	Number of Deaths	U5MR	95% CI
Jun.-Aug. 2000 (baseline)	389	62	159.4	119.7-199.1
2000 Year Total (Year 1)	1472	190	129.1	110.7-147.4
2001 Year Total (Year 2)	1585	170	107.3	91.1-123.4
2002 Year Total (Year 3)	1546	119	77.0	63.1-90.8
2003 Year Total (Year 4)	1429	93	65.1	51.9-78.3
2004 Year Total (Year 5)	1530	45	29.4	20.8-38.0

A graph displaying plots of observed under-five mortality rate data over time

A graph is useful at providing a visual depiction of how mortality trends are changing in the program area over time. Graphs will be generally most effective when displaying annual trends in mortality rates over several years, as the significant fluctuations in mortality rates that may occur from month to month may make accurate interpretation of single-year graph difficult. An example of an annual under-five mortality rate trend graph with upper and lower bounds of the 95% confidence intervals for each data point using the World Relief data above is provided below. An under-five mortality trend graph generator has also been created and can be accessed at:

www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/U5MR_Trend_Chart_Creator.zip

When using the U5MR Trend Graph Generator, simply input the U5MRs and Lower/Upper 95% CI bounds for each period of interest (replacing the example data), and the trend graph will be automatically generated. Be sure to rename the periods accordingly (i.e. “Year 1” or “Year 2, June-August”).



A narrative explaining under-five mortality rate changes over time in the context of the program's activities

A narrative providing the context in which under-five mortality rates have changed over time will be essential for the interpretation of any data that is presented. This narrative may include how trends in mortality rates coincided with the initiation of various program activities, and how this information provides some evidence that the program's activities are helping to achieve objectives for improving the health status of children in the community. The narrative may also provide contextual information to aid in the interpretation of mortality rate fluctuations (such as seasonality, flooding or droughts, etc.) and how under-five mortality rates in the program area compare to under-five mortality rates at the national or regional level. Making the case for the attribution of the program to a portion of the declines in under-five mortality will be bolstered by additional evidence in this area regarding the increase in coverage of key child survival interventions in the program communities (relative to a comparison area or the region in which the program is located) or relative to the decline in under-five mortality in the region or country. If it is of relevance to the audience, the narrative

may also include an explanation of the statistical basis for assessing the significance of mortality trends.

Making use of under-five mortality rate data is essential to assessing the effectiveness of an child health program. If there has been a significant reduction in the rate of child deaths, part of this task is already completed. All that is left is present the data in a way that is relevant, informative, and understandable to various program stakeholders to tell the story about how your program has been successful.

SECTION FIVE

Quality Assurance

Establishing a quality assurance process for data gathering at all levels of the MAP system is of fundamental importance to ensure that all pregnancies, births, and deaths in the program area are identified, accurately reported, and recorded. The strong system of supervision inherent in the Care Group Model is essential to this process, making it possible for all vital events to be systematically reviewed by each tier of program personnel. The constant validation of data by successive tiers of supervision along with other proactive quality assurance activities will make it difficult for inconsistent or missing data to escape detection, thereby ensuring the accuracy of the calculated under-five mortality rates that are reported. The quality assurance responsibilities for each tier of program personnel and the suggested frequency of their execution are described below.

Care Group Volunteer responsibilities

During each household visit:

- For all births, other pregnancy outcomes, and under-five deaths reported:
 - Ensure that the woman/mother has resided in the program area for at least six months before reporting an event (with no extended absences of longer than four months in the past year). Women who have not resided in the program area for six months are unlikely to have benefited from the program's health promotion activities enough to attribute a pregnancy outcome or child death to the program's overall statistics. Additionally, the short duration of a woman's residence in the community may be indicative of her transitory presence in the program area, also signifying that a pregnancy outcome or child death will not be associated with the health conditions in the community.

Note: A volunteer may still report the pregnancy of a woman who has not resided in the program area for six months (as the woman may have remained in the program for six months by the time a pregnancy outcome occurs).

During every Care Group meeting:

- Notify Promoter of any new women of reproductive age moving into the volunteer's geographic area of responsibility.
- Alert the Promoter if a pregnant woman is moving outside of his/her Care Group area to give birth. This is especially important in contexts where women traditionally move in with relatives to give birth, such as India and Pakistan (Rahman et al., 2003).

- Inform the Promoter if he/she has upcoming plans to be absent from the program area for more than one month. This will allow the Promoter to plan for another Volunteer to visit his/her households to ensure that all pregnancies and vital events are recorded.

Every month:

- Visit all households in the geographic area of responsibility to ensure all women of reproductive age are accounted for and registered and to identify new pregnancies in women who might not currently be in a Care Group.

Promoter responsibilities

During every Care Group meeting:

- Ask each Care Group Volunteer if he/she was able to visit all households and meet with all women of reproductive age in his/her assigned geographic areas. If there were any women that they were unable to contact, the Promoter should note these households on his/her community map (including date of last contact) and ask the Care Group Volunteer to attempt to follow-up with these women before the next Care Group meeting. The Promoter should ensure that the Care Group Volunteer has inquired at the next contact with the women about any births, other pregnancy outcomes, or deaths that have occurred since last contact (not just in the previous month).
- Examine the Pregnancy and Birth Register for any pregnancies with expected dates of delivery in the previous, current, and upcoming month with outcomes that have not yet been recorded. Inquire with the responsible Care Group Volunteers if outcomes have yet occurred.
- For all reported pregnancies:
 - Ask the Care Group Volunteer to explain how he/she determined the expected month of delivery (including what questions he/she asked and the signs and symptoms of pregnancy that the woman exhibited). If it becomes clear that the Care Group Volunteer is not confident in his/her estimation or provides an unusual explanation, assign a more experienced Care Group Volunteer to accompany him/her to verify this estimate and report back at the next Care Group meeting.
- For all reported births and other pregnancy outcomes:
 - Ask the Volunteer to explain how he/she determined the pregnancy outcome (including giving details on how the outcome should be designated using one of the standard public health definitions provided in this manual). If it becomes clear that the Care Group Volunteer is not confident in how he/she has determined the reported outcome or provides an unconventional (or non-

standard) explanation, assign a more experienced Care Group Volunteer to accompany him/her to verify this estimate and report back at the next Care Group meeting.

- For all reported under-five deaths:
 - Ask the Care Group Volunteer to explain how he/she ascertained that the child was under five years of age by determining the age at death (including if the age reported is a rough estimate or exact). If it becomes clear that the Care Group Volunteer is not confident in how he/she has determined the reported age at death or provides an unconventional explanation, assign a more experienced Care Group Volunteer to accompany him/her to verify this estimate and report back at the next Care Group meeting.
 - If a Care Group Volunteer reports that a child died shortly after birth, make sure that both the birth and death are recorded in their appropriate registers. Also have the Care Group Volunteer describe how he/she determined that the child was a live birth and not a stillbirth.

When turning in Pregnancy and Birth Register and Under-Five Birth Register reports to the Supervisor at the end of each month:

- Make sure all reported entries in each register report are complete and legible (if a carbon copy system is utilized, this includes checking that any carbon copies of reports have clearly replicated the original form). If any data are missing from an entry because the Promoter is waiting for additional follow-up and verification from the responsible Care Group Volunteer, the Promoter should make a note next to these entries in the reports.

Every six months:

- Personally verify all births, other pregnancy outcomes, and under-five deaths that have occurred amongst all Care Groups under the Promoter's supervision in the previous six months. This will involve directly contacting all women with recorded births, pregnancy outcomes, or under-five deaths in the past six months to validate all recorded entries in both the Pregnancy and Birth Register and Under-Five Death Register. Any resulting discrepancies should be amended with the correct information and reported to the Supervisor for rectification in the Vital Events Database, as well as followed up with the reporting Care Group Volunteer to determine the cause of the error and to provide refresher training if necessary. If the Promoter is unable to reach any of the women during this verification exercise, the Promoter will inform the woman's responsible Care Group Volunteer to notify the Promoter when she is available for a follow-up appointment.

- Interview 5-10 non-Volunteer key informants in each Care Group community (such as community leaders, traditional healers, religious leaders, traditional birth attendants, etc.) to ask about any births or under five deaths they are aware of that took place during the previous six months and cross check this with the vital events registered by the Care Group's Volunteers. The Promoter should then personally verify and add any missing births or under-five deaths that have been identified to their Registers and report them to their Supervisor for inclusion in the Vital Events Database. The Promoter should also identify the Care Group Volunteer(s) who was/were responsible for the areas where the missing vital event(s) was/were found for follow-up and refresher training if necessary. Any patterns in missing data over time (i.e. consistent omissions during rainy seasons, for most remote households, etc.) should also be investigated.
Note: Care Group Volunteers should not be involved in the selection of key informants to avoid potential biases.
- Hold a small Volunteer Recognition Meeting every six months for each Care Group and award a prize to the Volunteer who has the highest rate of matching reported and verified vital events to encourage high diligence in capturing all births and under-five deaths in their geographic areas (and thus attempt to address potential issues in under-reporting. Over-reporting of vital events will also be discouraged through this approach, as all vital events will be personally verified by the Promoter.)
- Redraw geographic boundaries on the community map for each Care Group Volunteer as necessary to ensure that any newly present households/women of reproductive age in the area are accounted for and registered to be visited on at least a monthly basis.

Ongoing:

- Remain alert for any consistently occurring errors, irregularities, or missing data reported by Care Group Volunteers. If these occurrences are concentrated in a specific Care Group Volunteer, refresher training should be provided. In the event that individual errors continue to persist, the Promoter or another experienced Care Group Volunteer should accompany the Care Group Volunteer on field visits to observe his/her work and build capacity to effectively perform his/her responsibilities. If consistently detected errors, irregularities, or missing data prove to be systematic across many Care Group Volunteers (or across Care Groups), this should be reported to the Supervisor as soon as possible for investigation and resolution.

Supervisor/Monitoring and Evaluation Coordinator responsibilities

Upon receipt of Promoter reports at the end of each month:

- Examine all entries in each Pregnancy and Birth Register report and each Under-Five Death Register report for legibility, as well as missing or irregular data (e.g. an estimated date of birth unaligned with a child's age at death, a culturally-defined pregnancy outcome provided rather than a public health definition with accompanying code, etc.). Any irregularities or missing data should be followed up with the appropriate Promoter within two weeks of his/her monthly report to determine the cause of the error and to provide refresher training if necessary.
- Investigate any pregnancy outcomes reported by a Promoter that are suspected to have been initially registered elsewhere in the program area at a woman's permanent area of residence. Confirm these reports with the Promoter in the area of the woman's permanent residence (through his/her Supervisor, if necessary), and update the Vital Events Database accordingly so the outcome is not recorded twice. The Promoter reporting the outcome should also be notified of this issue's resolution so his/her Pregnancy and Birth Register can be updated.

On an annual basis:

- Re-enter all submitted Pregnancy and Birth Register and Under-Five Death Register entries into a new, separate database to check that the routine database produces the same U5MR results. Investigate and correct any discrepancies or omissions.
- Prepare and provide each Promoter with a Vital Event Monitoring Report Card for the year. Include the following areas of interest:
 - **Timeliness of reports:** Include information on the number of Pregnancy and Birth Register and Under-Five Death Register reports submitted on time and the number of reports submitted late/not at all.
 - **Clarity of reports:** Include the number of reports that were submitted with no errors, the number of errors that required minor corrections by the Supervisor/Monitoring and Evaluation Coordinator, and the number of problems that required follow-up by the Supervisor for correction.
 - **Accuracy of reports:** Compare the number of births and under-five deaths reported by a Promoter over the course of the year with the average for each of the other Promoters (calculated by dividing the total number of births/under-five deaths reported in the project area by the number of Promoters). Provide comment on whether the numbers seem normal and follow-up if necessary.

- **NOTE:** This is an imprecise assessment of accuracy that is only meant to identify very irregular reporting patterns from Promoters. The number of Care Groups/ Volunteers/ households for each Promoter should be similar, so the project population covered by each Promoter should be similar as well. This means that the number of births and under-five deaths should be roughly similar on average for each Promoter. While deviations from the average are expected, any exceptional differences should be identified for follow-up and investigation.
- **Feedback information:** Include a section on the report card for the Promoter to respond to the following questions:
 - “What are my reporting strengths and weaknesses?”
 - “What will I do to improve reporting over the next three months?”
 - “How can my Supervisor help me?”
 - “How can I better support the Volunteers I am supervising?”
- ❖ Additional suggestion: Hold a Promoter Recognition Meeting at the end of each year. Award small prizes to Promoters who submit 100% of their reports on time and Promoters who had the least amount of reporting errors.

A sample template for a Promoter Vital Event Monitoring Report Card can be found in **Appendix 4** (this report card is adapted from Rapid Results Tracking Project, Institute for International Programs, Johns Hopkins Bloomberg School of Public Health). An Excel spreadsheet has been created to automatically generate individualized charts for each Promoter’s Timeliness, Clarity, and Accuracy of reports, which can be accessed at: www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/Promoter_Vital_Event_Monitoring_Report_Card_-_Chart_Creator.xls

Simply replace the sample numbers in each field with your own statistics for each Promoter, and each chart will be automatically generated.

Ongoing:

- Investigate any suspected systematic occurrences of errors, irregularities, or missing data in the MAP system as quickly as possible. Supervisors should pay especially close attention to sudden, large changes in the monthly number of births or deaths reported, as this may indicate a problem in the surveillance system. Depending on the results of this investigation, the Supervisor may recommend the re-development of data collection tools or the re-training of Care Group Volunteers or Promoters to improve the system’s validity.
- Ensure that Care Group Volunteers are promptly recruited and replaced when there is turnover.

SECTION SIX

Appendices

Index

Appendix 1: Pregnancy & Birth Register

Appendix 2: Under-Five Death Register

Appendix 3: Vital Events Database Screenshots

Appendix 4: Promoter Vital Event Monitoring Report Card

Appendix 5: Creating Formulas for the 'Statistics' tab of the Vital Events Database

Sample form

DISTRICT: 1
SUPERVISORY UNIT: 3
PROMOTER UNIT: 2

YEAR: 2013

†Pregnancy outcome codes: 1=Live birth; 2=Stillbirth; 3=Pregnancy terminated before 6 months of pregnancy without a live birth (inc. miscarriages, spontaneous abortions, and induced abortions).

Sample form

FIRST EDITION, JAN 2013

Appendix 3: Vital Events Database

Supervisor Tab, Screenshot 1: Pregnancy & Birth Register

[illegible]

Supervisor Tab, Screenshot 2: Under-Five Death Register



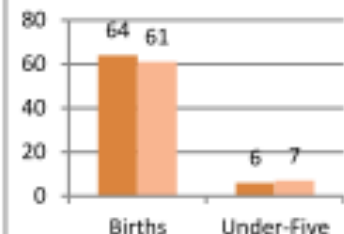
[illegible]

Database Statistics Tab Screenshot

	A	B	C	D	E	F
1	Database Statistics					
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate	
3	20XX	Jan	0	0	#DIV/0!	
4	20XX	Feb	0	0	#DIV/0!	
5	20XX	Mar	0	0	#DIV/0!	
6	20XX	Apr	0	0	#DIV/0!	
7	20XX	May	0	0	#DIV/0!	
8	20XX	Jun	0	0	#DIV/0!	
9	20XX	Jul	0	0	#DIV/0!	
10	20XX	Aug	0	0	#DIV/0!	
11	20XX	Sep	0	0	#DIV/0!	
12	20XX	Oct	0	0	#DIV/0!	
13	20XX	Nov	0	0	#DIV/0!	
14	20XX	Dec	0	0	#DIV/0!	
15	Year Total		0	0	#DIV/0!	
16						
17	20XY	Jan	0	0	#DIV/0!	
18	20XY	Feb	0	0	#DIV/0!	
19	20XY	Mar	0	0	#DIV/0!	
20	20XY	Apr	0	0	#DIV/0!	
21	20XY	May	0	0	#DIV/0!	
22	20XY	Jun	0	0	#DIV/0!	
23	20XY	Jul	0	0	#DIV/0!	
24	20XY	Aug	0	0	#DIV/0!	
25	20XY	Sep	0	0	#DIV/0!	
<div> ◀ ▶ ↺ Pregnancy & Birth Register Under-Five Death Register Statistics (DO NOT EDIT) </div>						
Ready						

Appendix 4: Promoter Vital Event Monitoring Report Card

Adapted from JHSPH IIP's *Real Time Results Tracking: CHW Report Card* (2012).

Sample Promoter Vital Event Monitoring Report Card Template																											
(Promoter Name)																											
Date: _____	District: _____	Supervisor: _____																									
<div style="text-align: center;">Timeliness</div>  <table border="1" style="margin: 10px auto; font-size: small;"><thead><tr><th>Category</th><th>Count</th></tr></thead><tbody><tr><td>On Time</td><td>10</td></tr><tr><td>1 Month Late</td><td>1</td></tr><tr><td>2+ Months Late/Missing</td><td>1</td></tr></tbody></table>	Category	Count	On Time	10	1 Month Late	1	2+ Months Late/Missing	1	<div style="text-align: center;">Clarity</div>  <table border="1" style="margin: 10px auto; font-size: small;"><thead><tr><th>Category</th><th>Count</th></tr></thead><tbody><tr><td>Error-free Report</td><td>7</td></tr><tr><td>Minor Error</td><td>3</td></tr><tr><td>Problem</td><td>2</td></tr></tbody></table>	Category	Count	Error-free Report	7	Minor Error	3	Problem	2	<div style="text-align: center;">Accuracy</div>  <table border="1" style="margin: 10px auto; font-size: small;"><thead><tr><th>Event Type</th><th>Reported by You</th><th>Promoter Average</th></tr></thead><tbody><tr><td>Births</td><td>64</td><td>61</td></tr><tr><td>Under-Five Deaths</td><td>6</td><td>7</td></tr></tbody></table>	Event Type	Reported by You	Promoter Average	Births	64	61	Under-Five Deaths	6	7
Category	Count																										
On Time	10																										
1 Month Late	1																										
2+ Months Late/Missing	1																										
Category	Count																										
Error-free Report	7																										
Minor Error	3																										
Problem	2																										
Event Type	Reported by You	Promoter Average																									
Births	64	61																									
Under-Five Deaths	6	7																									
<p>Timeliness:</p> <p>Over the past 12 months, 10 reports were submitted on time, 1 was received one month late, and 1 was two or more months late or is missing.</p> <p>Most of your reports were submitted on time, and I appreciate your hard work.</p> <p>Clarity:</p> <p>Your reports were submitted with no errors 7 times, with minor errors that were corrected by the database administrator 3 times, and there were problems requiring my follow-up for correction in 1 report.</p> <p>Please review your reporting and quality assurance responsibilities to ensure that your reports are accurate to avoid errors in the future. Thank you!</p> <p>Accuracy:</p> <p>In the previous twelve months of reporting, you reported 64 births and 6 under-five deaths. This number of births and under-five deaths seems normal. Thank you for your efforts!</p>																											
<p>Please discuss this report with your Supervisor and respond to the following questions (use the back of the page):</p> <ol style="list-style-type: none">1. What are my reporting strengths and weaknesses?2. What I will do to improve reporting over the next three months?3. How can my Supervisor help me?4. How can I better support the Volunteers I am supervising?																											

Appendix 5: Creating formulas for the ‘Statistics’ Tab of the Vital Events Database

Why use formulas?

In order to make calculating under-five mortality rates in the Vital Events Database as efficient and accurate as possible, it is useful to use formulas in Excel to automatically perform these calculations as data are entered into the two registry tabs of the Database. These formulas, if constructed correctly, minimize errors that can occur when calculating totals of births and deaths manually. Though a Vital Event Database with pre-established formulas can be accessed online([www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/Vital_Events_Data base - Mortality Assessment for Health Programs MAP System.zip](http://www.coregroup.org/storage/Monitoring_Evaluation/Mortality_Assessment/Vital_Events_Data_base_-_Mortality_Assessment_for_Health_Programs_MAP_System.zip)), below is a set of instructions for setting up a ‘Statistics’ tab in the Vital Events Database in Excel on your own, with formulas to automatically calculate under-five mortality rates as birth and death data is entered into the Database.

Setting up the ‘Statistics’ Tab

1. Insert a new spreadsheet tab at the bottom of the Excel workbook by clicking the ‘Insert Worksheet’ button. Name this spreadsheet tab ‘Statistics’. You may also want to insert a warning in the tab name such as ‘Do Not Edit’ to remind other users of the spreadsheet that this tab contains formulas and should not be edited manually. Instructions for how to protect this tab to prevent editing will be discussed later in these instructions.
2. Name the column headers of your new ‘Statistics’ spreadsheet with the following titles (from left to right): **Year; Month; Total Number of Births; Total Number of Under-Five Deaths; Under-Five Mortality Rate.**
3. Under the **Month** column header, enter the first month you will be collecting birth and death data. Fill in the remaining months of the same year below, and the corresponding year number to the left of each month in the **Year** column.
4. Below the row for the last month of the year, create a row with the title of **Year Total**. This row will be used to calculate the sums of all monthly birth and death data to determine yearly under-five mortality rates.

You have now completed setting up the Statistics tab. A visual depiction of the layout of the Statistics tab can be found in Appendix 3.

Constructing Formulas

Formula 1: Monthly total number of births

This formula will be used to automatically calculate the total number of births for each month from data entered in the Pregnancy and Birth Register tab of the Database.

C3		=COUNTIFS('Pregnancy & Birth Register'!N:N, 'Statistics (DO NOT EDIT)'!A3, 'Pregnancy & Birth Register'!M:M, 'Statistics (DO NOT EDIT)'!B3, 'Pregnancy & Birth Register'!K:K,												
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Database Statistics													
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate									
3	20XX	Jan	0	0	#DIV/0!									
4	20XX	Feb	0	0	#DIV/0!									
5	20XX	Mar	0	0	#DIV/0!									
6	20XX	Apr	0	0	#DIV/0!									
7	20XX	May	0	0	#DIV/0!									
8	20XX	Jun	0	0	#DIV/0!									
9	20XX	Jul	0	0	#DIV/0!									
10	20XX	Aug	0	0	#DIV/0!									
11	20XX	Sep	0	0	#DIV/0!									
12	20XX	Oct	0	0	#DIV/0!									
13	20XX	Nov	0	0	#DIV/0!									
14	20XX	Dec	0	0	#DIV/0!									
15	Year Total		0	0	#DIV/0!									

1. First, select the first field under the **Total Number of Births** column header. In the example above, this field represents the total number of births for the month of January, Year 20XX. Enter an “=” to begin typing the formula.
2. Enter “COUNTIFS”, the function you will be using for this formula. This function counts the number of cells that meet a predetermined set of criteria. In this case, it will be counting how many live births on each Supervisor’s data entry tab meet this field’s criteria for month and year. Enter an open parenthesis “(” to begin entering the range and criteria for this formula.
3. Next, return to the Supervisor tab. Select the entire column for **Pregnancy Outcome Date, Year** as the formula’s first ‘criteria range’. This will automatically populate the formula you began on the Statistics tab with the ‘Pregnancy Outcome Date, Year’ column location on the Supervisor tab.

SUM													X ✓ f_x =COUNTIFS('Pregnancy & Birth Register'!N:N																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			

- Enter a comma “,” after this range, then return to the Statistics tab. Select the year in the **Year** column to the left of the month field you are writing the formula in. In this case, the year is “20XX”. You have now ensured that only births occurring in this year will be counted towards the monthly total. Enter another comma “,” to complete this

SUM =COUNTIFS('Pregnancy & Birth Register'!N:N, 'Statistics (DO NOT EDIT)'!A3						
	A	B	C	COUNTIFS(criteria_range1, criteria1, [criteria_range2, ...])		E
1	Database Statistics					
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate	
3	20XX	Jan	(DO NOT EDIT)!A3	0	#DIV/0!	
4	20XX	Feb	0	0	#DIV/0!	

first condition.

- Next, you need to set another condition to make sure that only births that are in the month for the field you have selected are counted. Set this second criteria's range by returning to the Pregnancy and Birth Register tab and selecting the entire column for **Pregnancy Outcome Date, Month**.

SUM X ✓ f_x =COUNTIFS('Pregnancy & Birth Register'!N:N, 'Statistics (DO NOT EDIT)'!A3, 'Pregnancy & Birth Register'!M:M														
	A	B	C	COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2], ...)				I	J	K	L	M	N	
1	Pregnancy and Birth Register													
2												Pregnancy Outcome Date		
3	Preg. #	Year Rep.	Month Rep.	District	SU #	PU#	CG #	Volunteer Name	Mother's Name	Exp. Month of Deliv.	Preg. Outcome	Day	Month	Year
4														
5														
6														
7														
8														
9														
10														

- Enter a comma “,” after this range, and then return to the Statistics tab. Select the month in the **Month** column to the left of the month field you are writing the formula in. In this case, the month is “Jan”. You have now ensured that only births occurring in this month and year will be counted towards the monthly total. Enter another comma “,” to complete this second condition.

SUM		=COUNTIFS('Pregnancy & Birth Register'!N:N, 'Statistics (DO NOT EDIT)'!A3, 'Pregnancy & Birth Register'!M:M, 'Statistics (DO NOT EDIT)'!B3)																		
	A	B	C	COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2], [criteria_range3, ...])											F	G	H	I	J	K
1	Database Statistics																			
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate															
3	20XX	Jan	(DO NOT EDIT)!B3	0	#DIV/0!															
4	20XX	Feb	0	0	#DIV/0!															

- Lastly, you need to set another condition to make sure that only *live* births that are in the month for the field you have selected are counted. Set this second criteria’s range by returning to the Pregnancy and Birth Register tab and selecting the entire column for **Pregnancy Outcome**.

SUM		=COUNTIFS('Pregnancy & Birth Register'!N:N,'Statistics (DO NOT EDIT)'!A3,'Pregnancy & Birth Register'!M:M,'Statistics (DO NOT EDIT)'!B3,'Pregnancy & Birth Register'!K:K)													
	A	B	C	COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2], [criteria_range3, criteria3], ...)							J	K	L	M	N
1	Pregnancy and Birth Register														
2													Pregnancy Outcome Date		
3	Preg. #	Year Rep.	Month Rep.	District	SU #	PU#	CG #	Volunteer Name	Mother's Name	Exp. Month of Deliv.	Preg. Outcome	Day	Month	Year	
4															
5															
6															
7															
8															
9															
10															

- Enter a comma “,” after this range, then enter “1”. This is because live births are coded in the database with the number ‘1’. You have now ensured that only *live* births occurring in this month and year will be counted towards the monthly total. Enter a closed parenthesis “)” , add a “+” then return to Step 2 to complete this process for every Supervisor tab in the formula.
- Now you can copy this formula for to the remaining months of the year. Select the field where you just entered the formula and move your cursor over the bottom right corner until a bolded “+” appears. You can then click and drag this formula down to the

remaining months of the year below. Excel will automatically adjust the formula accordingly for each month.

Formula 2: Monthly total of under-five deaths

This formula will be used to automatically calculate the total number of deaths for each month from data entered in each of the Supervisor tabs in the Database.

D3		=COUNTIFS('Under-Five Death Register'!L:L,'Statistics (DO NOT EDIT)'!B3,'Under-Five Death Register'!M:M,'Statistics (DO NOT EDIT)'!A3)									
	A	B	C	D	E	F	G	H	I	J	K
1	Database Statistics										
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate						
3	20XX	Jan	0	0	#DIV/0!						
4	20XX	Feb	0	0	#DIV/0!						
5	20XX	Mar	0	0	#DIV/0!						
6	20XX	Apr	0	0	#DIV/0!						
7	20XX	May	0	0	#DIV/0!						
8	20XX	Jun	0	0	#DIV/0!						
9	20XX	Jul	0	0	#DIV/0!						
10	20XX	Aug	0	0	#DIV/0!						
11	20XX	Sep	0	0	#DIV/0!						
12	20XX	Oct	0	0	#DIV/0!						
13	20XX	Nov	0	0	#DIV/0!						
14	20XX	Dec	0	0	#DIV/0!						
15	Year Total		0	0	#DIV/0!						

1. First, select the first field under the **Total Number of Under Five Deaths** column header. In the example above, this field represents the total number of deaths for the month of January, Year 20XX. Enter an “=” to begin typing the formula.
2. As with the previous formula, enter “COUNTIFS”. In this case, it will be counting how many deaths in the Supervisor tabs meet this field’s criteria for month and year. Enter an open parenthesis “(” to begin entering the range and criteria for this formula.
3. Next, return to the Supervisor tab. Select the entire column for **Date of Death, Year** as the formula’s first ‘criteria range’.

SUM		X ✓ fx		=COUNTIFS('Under-Five Death Register'!M:M													
	A	B	C	COUNTIFS(criteria_range1, criteria1, ...)		H	I	J	K	L	M	N	O	P	Q		
1	Under-Five Death Register																
2											Date of Death			Age at Death			
3	Death #	Year Rep.	Month Rep.	District	SU #	PU#	CG #	Volunteer Name	Child Name	Date of Birth	Day	Month	Year	Days	Months	Years	Preg. # (if appl.
4																	
5																	
6																	
7																	
8																	
9																	
10																	

4. Enter a comma “,” after this range, then return to the Statistics tab. Select the year in the **Year** column to the left of the month field you are writing the formula in. In this case, the year is “20XX”. You have now ensured that only deaths occurring in this year

will be counted towards the monthly total. Enter another comma “,” to complete this first condition.

SUM X ✓ fx =COUNTIFS('Under-Five Death Register'!M:M, 'Statistics (DO NOT EDIT)'!A3				
	A	B	C	E
1	Database Statistics			
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths
3	20XX	Jan	0	#DIV/0!
4	20XX	Feb	0	#DIV/0!

- Next, you need to set another condition to make sure that only deaths that are in the month for the field you have selected are counted. Set this second criteria's range by returning to the Supervisor tab and selecting the entire column for **Date of Death, Month**.

SUM X ✓ fx =COUNTIFS('Under-Five Death Register'!M:M, 'Statistics (DO NOT EDIT)'!A3, 'Under-Five Death Register'!L:L																	
	A	B	C	COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2], ...)					I	J	K	L	M	N	O	P	Q
1	Under-Five Death Register																
2											Date of Death			Age at Death			
3	Death #	Year Rep.	Month Rep.	District	SU #	PU#	CG #	Volunteer Name	Child Name	Date of Birth	Day	Month	Year	Days	Months	Years	Preg. # (if appl.)
4																	
5																	
6																	
7																	
8																	
9																	
10																	

- Enter a comma “,” after this range, then return to the Statistics tab. Select the month in the **Month** column to the left of the month field you are writing the formula in. In this case, the month is “Jan”. You have now ensured that only deaths occurring in this month and year will be counted towards the monthly total. Enter a closed parenthesis “)”, add a “+”, then return to Step 2 to complete this process for all Supervisor tabs in the formula.

SUM X ✓ fx =COUNTIFS('Under-Five Death Register'!M:M, 'Statistics (DO NOT EDIT)'!A3, 'Under-Five Death Register'!L:L, 'Statistics (DO NOT EDIT)'!B3)												
	A	B	C	COUNTIFS(criteria_range1, criteria1, [criteria_range2, criteria2], [criteria_range3, ...])			F	G	H	I	J	K
1	Database Statistics											
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate							
3	20XX	Jan	0	L 'Statistics (DO NOT EDIT)'!B3	#DIV/0!							
4	20XX	Feb	0	0	#DIV/0!							

- Now you can copy this formula for to the remaining months of the year. Select the field where you just entered the formula and move your cursor over the bottom right corner until a bolded “+” appears. You can then click and drag this formula down to the remaining months of the year below. Excel will automatically adjust the formula accordingly for each month.

Formula 3: Monthly under-five mortality rate

This formula will be used to automatically calculate the under-five mortality rate for each month from monthly birth and death totals.

NOTE: Monthly under-five mortality rates can allow for basic observations to be made to see if mortality rates are headed in the right direction. As previously related, it is recommended that only mortality rates for periods that contain **at least 50 deaths** are used to more accurately assess mortality trends

E3		fx		=D3/(C3/1000)	
	A	B	C	D	E
1	Database Statistics				
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate
3	20XX	Jan	0	0	#DIV/0!
4	20XX	Feb	0	0	#DIV/0!
5	20XX	Mar	0	0	#DIV/0!
6	20XX	Apr	0	0	#DIV/0!
7	20XX	May	0	0	#DIV/0!
8	20XX	Jun	0	0	#DIV/0!
9	20XX	Jul	0	0	#DIV/0!
10	20XX	Aug	0	0	#DIV/0!
11	20XX	Sep	0	0	#DIV/0!
12	20XX	Oct	0	0	#DIV/0!
13	20XX	Nov	0	0	#DIV/0!
14	20XX	Dec	0	0	#DIV/0!
15	Year Total		0	0	#DIV/0!

- First, select the first field under the **Under-Five Mortality Rate** column header. In the example above, this field represents the under-five mortality rate for the month of January, Year 20XX. Enter an “=” to begin the formula.
- Select the ‘total number of under-five deaths’ field for the first month, then enter a divide sign “/”.
- Insert an open parenthesis “(“ and select the ‘total number of births’ field for the first month, then divide “/” this number by 1,000 (since the calculation of the under-five mortality rate is based on the number of deaths per 1,000 live births). Complete the equation with a closed parenthesis “)”. You now have a formula that will calculate the under-five mortality rate for this first month.

NOTE: Do not be concerned that the cell returns a “#DIV/0!” error. This error will be resolved once actual birth and death data is entered into the register tabs and the formula is no longer dividing by zero births.

- Now you can copy this formula for the remaining months of the year. Select the field where you just entered the formula and move your cursor over the bottom right corner until a bolded “+” appears. You can then click and drag this formula down to the remaining months of the year below. Excel will automatically adjust the formula accordingly for each month.

Formula 4: Yearly total number of births

This formula will be used to automatically calculate the total number of births for a single year from monthly birth totals.

- First, select the field corresponding to ‘Year Total’ under the **Total Number of Births** column header. In the example above, this field represents the total number of births for year 20XX. Enter an “=” to begin the formula.
- Enter “SUM”. This formula adds all the numbers in a range of cells. We will be using this formula to calculate the yearly total for number of births. Enter an open parenthesis “(” to start the range.
- Select all of the cells in the **Total Number of Births** column for the year you are trying to calculate. Enter a closed parenthesis “)” to complete the formula. You now have a formula that will automatically calculate the total number of births for the year you selected.

C15		=SUM(C3:C14)			
	A	B	C	D	E
1	Database Statistics				
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate
3	20XX	Jan	0	0	#DIV/0!
4	20XX	Feb	0	0	#DIV/0!
5	20XX	Mar	0	0	#DIV/0!
6	20XX	Apr	0	0	#DIV/0!
7	20XX	May	0	0	#DIV/0!
8	20XX	Jun	0	0	#DIV/0!
9	20XX	Jul	0	0	#DIV/0!
10	20XX	Aug	0	0	#DIV/0!
11	20XX	Sep	0	0	#DIV/0!
12	20XX	Oct	0	0	#DIV/0!
13	20XX	Nov	0	0	#DIV/0!
14	20XX	Dec	0	0	#DIV/0!
15	Year Total		0	0	#DIV/0!

Formula 5: Yearly total number of deaths

This formula will be used to automatically calculate the total number of deaths for a single year from monthly birth totals.

D15		fx		=SUM(D3:D14)	
	A	B	C	D	E
1	Database Statistics				
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate
3	20XX	Jan	0	0	#DIV/0!
4	20XX	Feb	0	0	#DIV/0!
5	20XX	Mar	0	0	#DIV/0!
6	20XX	Apr	0	0	#DIV/0!
7	20XX	May	0	0	#DIV/0!
8	20XX	Jun	0	0	#DIV/0!
9	20XX	Jul	0	0	#DIV/0!
10	20XX	Aug	0	0	#DIV/0!
11	20XX	Sep	0	0	#DIV/0!
12	20XX	Oct	0	0	#DIV/0!
13	20XX	Nov	0	0	#DIV/0!
14	20XX	Dec	0	0	#DIV/0!
15	Year Total		0	0	#DIV/0!

1. First, select the field corresponding to 'Year Total' under the **Total Number of Under-Five Deaths** column header. In the example above, this field represents the total number of deaths for year 20XX. Enter an "=" to begin the formula.
2. Enter "SUM". This formula adds all the numbers in a range of cells. We will be using this formula to calculate the yearly total for number of deaths. Enter an open parenthesis "(" to start the range.

SUM		X ✓ fx		=SUM(D3:D14	
	A	B	C	D	E
1	Database Statistics				
2	Year	Month	Total Number of Births	Total Number of Under-Five Deaths	Under-Five Mortality Rate
3	20XX	Jan	0	0	#DIV/0!
4	20XX	Feb	0	0	#DIV/0!
5	20XX	Mar	0	0	#DIV/0!
6	20XX	Apr	0	0	#DIV/0!
7	20XX	May	0	0	#DIV/0!
8	20XX	Jun	0	0	#DIV/0!
9	20XX	Jul	0	0	#DIV/0!
10	20XX	Aug	0	0	#DIV/0!
11	20XX	Sep	0	0	#DIV/0!
12	20XX	Oct	0	0	#DIV/0!
13	20XX	Nov	0	0	#DIV/0!
14	20XX	Dec	0	0	#DIV/0!
15	Year Total		0	=SUM(D3:D14	#DIV/0!

3. Select all of the cells in the **Total Number of Deaths** column for the year you are trying to calculate. Enter a closed parenthesis ")" to complete the formula. You now have a formula that will automatically calculate the total number of deaths for the year you selected.

Formula 6: Yearly under-five mortality rate

This formula will be used to automatically calculate the under-five mortality rate for each month from monthly birth and death totals. For this formula, you can copy the same formula that was used for monthly under-five mortality rate. Select the field for the monthly under-five mortality rate immediately above the yearly total field, and move your cursor over the bottom right corner until a bolded “+” appears. You can then click and drag this formula down to the yearly total field below. Excel will automatically adjust the formula to draw from the yearly total number of births field and yearly total number of deaths field to calculate the yearly under-five mortality rate.

Adding ‘Months’ and ‘Years’

Adding additional months and years to the Statistics tab is simple and does not require you to re-write any of the formulas you have previously entered. To add additional years, simply copy the preceding **month’s** row of formulas (**not** the year total formulas), and enter the new Year and Month information in the appropriate columns. Excel will automatically adjust the formula to draw birth and death data from the registries for the new month and years you have entered.

Locking the Statistics tab

You may wish to lock (or ‘protect’) the Statistics tab from editing so that the formulas are not mistakenly replaced during manual data entry. To do this, simply right-click the Statistics tab and select ‘Protect Sheet’. You will then be prompted to enter a password for the tab, and once it is locked, it cannot be edited unless the password is re-entered (though it may still be viewed). Make sure to store your password in a separate document or in another safe place so you can access this tab if you have to make any changes, such as adding additional years as the project progresses.

A note of caution

The formulas in the Statistics tab will only work to automatically calculate total numbers of births and deaths and under-five mortality rates correctly if Months, Years, and Pregnancy Outcomes are correctly coded in the register tabs. This means, for example, that if the name of a month is abbreviated to “3” (i.e. for March) in the Statistics tab, it must be entered exactly as “3” in the register tabs or the formulas will not capture it. Similarly, if a year is signified as ‘2012” in the Statistics tab, but only noted as “12” in an entry in one of the registries, this birth or death will not be captured by the formulas. This emphasizes the importance of quality assurance in all data entry and regular audits of data to ensure that all month, year, and pregnancy outcome codes are correctly entered.

SECTION SEVEN

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