



**GUIDELINES FOR  
MATERNAL MORTALITY  
EPIDEMIOLOGICAL SURVEILLANCE**

*Editors: Cynthia Berg • Isabella Danel • Germán Mora*

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## Background

The death of a mother is a tragedy. It is the loss of a young life still full of promise. One of the most traumatic events that can befall a family, the loss of a mother has an immense impact on the well-being of the family members who survive her. The survival and development of her children, especially infants, may be adversely affected. Each mother's death diminishes society-at-large.

Reported maternal mortality underestimates the true magnitude of the problem by as much as 70% in some countries (Royston and Armstrong, 1989). It is estimated that in 1993, in the Region of the Americas, almost 20,000 women died from pregnancy and its complications.

Maternal mortality epidemiologic surveillance (MMES) has been defined as "a component of the health information system, which permits the identification, the notification, the quantification, and the determination of causes and of the avoidability of maternal deaths, for a defined time period and geographic [location], with the goal of orienting the measures necessary for its prevention." (PAHO-SMI, June 1991). MMES has two underlying rationales:

- **First**, MMES establishes an accurate assessment of the magnitude of women's deaths related to pregnancy. By having an accurate assessment of maternal mortality, policy makers and decision makers in other sectors in society may be more compelled to give the problem the attention it deserves. In addition, evaluators will have a more accurate baseline for assessing interventions to decrease mortality rates.
- **Second**, we can understand what actions need to be taken in the community level, within the formal health care system, and at the intersectoral level (i.e., in other governmental and social sectors) only by identifying and investigating all maternal deaths.

### A. Regional Plan for the Reduction of Maternal Mortality

Recognizing the importance of maternal health, in 1990 the XXIII Pan American Sanitary Conference (PAHO/WHO, 1990) passed a resolution endorsing the Regional Plan for the Reduction of Maternal Mortality. The Regional Plan had the following objectives:

- Improve the health conditions of women in the Region through increased coverage and improved quality of reproductive health services in order to reduce the current rates of maternal mortality by 50% or more by the year 2000.
- Increase the capacity and quality of institutional delivery care through strengthening of the first level of referral, expanding the number of hospital beds installed and providing birthing centers for low-risk deliveries.
- Increase knowledge of and social participation in the interest of safe motherhood and mobilize the community to identify pregnant women so that they will receive care in a timely and adequate manner.
- Establish a regional system of epidemiologic surveillance for maternal deaths.

- Increase the capacity of the countries to design, operate, and evaluate their programs aimed at reducing maternal deaths.
- Improve care in home delivery through the continuing education of traditional birth attendants and other personnel who may be involved in home delivery.

To achieve these objectives, the Plan proposed strategies including:

- Improving the system for the registration and capture of information of all health actions relating to pregnancy, delivery, postpartum and family planning, by extending registration, collection, and use of the information to the peripheral levels and the community.
- Ensuring the existence of a national system for the epidemiologic surveillance of mortality of women of reproductive age that provides data of sufficient quantity and quality to determine the real scope of the problem, the structure of its causes, and the social determinants of maternal mortality.
- Setting up maternal mortality committees on national, regional, and local levels and keeping them operative.

## **B. Guidelines for Maternal Mortality Epidemiological Surveillance**

In 1992, PAHO, the U.S. Centers for Disease Control and Prevention (CDC) and the Carter Center convened a meeting in Atlanta, Georgia, USA, at which experts in maternal mortality surveillance from nine countries in the Region met and discussed experiences in maternal death surveillance in their countries. Participants stressed the importance of understanding the social and medical factors that contribute to maternal death as essential to improving prevention strategies for reducing maternal mortality and morbidity.

The proceedings of the meeting were published in a document entitled "Reduction of Maternal Morbidity and Mortality in the Americas: Guidelines for Maternal Mortality Epidemiological Surveillance." (PAHO/WHO, 1992) These guidelines were meant to facilitate the development and implementation of surveillance systems or to reinforce those systems already in existence.

## **C. Updated Guidelines for Maternal Mortality Epidemiologic Surveillance**

Since the original document was published in 1992, a number of nations have made progress in developing and implementing maternal mortality epidemiologic surveillance. Additionally, more current information, as well as information from additional countries, is now available from the data collected by the Scientific and Technical Advisory Group (STAG) of PAHO as part of its Evaluation of Progress on the Regional Plan for the Americas (PAHO/WHO, 1995). (See Table 1.) Considering the newly available data and experience, PAHO, the WHO Collaborating Center in Perinatal Care at the Centers for Disease Control and Prevention (CDC) and MotherCare decided to update the Guidelines and sponsored a Maternal Mortality Epidemiologic Surveillance Guidelines meeting in Atlanta, Georgia, USA, on April 18-19, 1995. There representatives from 12 countries presented their countries' experiences with maternal mortality surveillance, advances made and obstacles encountered, and discussed a draft-in-progress of the updated Guidelines.

Resources used in compiling this document include data collected by the STAG Evaluation of the Progress on the Regional Plan, site visits to countries, reports and comments made by participants at the 1995 PAHO Maternal Mortality Epidemiologic Surveillance Guidelines meeting, and both published and unpublished literature. Explicitly highlighted in these updated Guidelines are the experiences various countries have had in developing

MMES, meeting implementation goals, and overcoming problems in operating the system. The current document expands the discussion of data analysis, dissemination, and interventions.

The authors of the document recognize the variety of governmental structures in which nations operate MMES programs. For the sake of clarity, three levels of governmental structure are referred to using the following terms:

- **Local** — Some nations call this the municipal or county level.
- **Regional** — Some nations call this the departmental, state, or provincial level.
- **National** — In general, the Ministry of Health fulfills this role.

These updated Guidelines will present the objectives of MMES, discuss methods to identify and investigate maternal deaths, describe ways these data can be analyzed to produce useful information, and suggest some actions that may help reduce maternal mortality. (See Figure 1.) Because each country is unique in terms of the development of its surveillance system and resources, the Guidelines are meant to be adapted to local conditions.



**Table 1: Status of Maternal Mortality Epidemiologic Surveillance in the Americas, 1995**

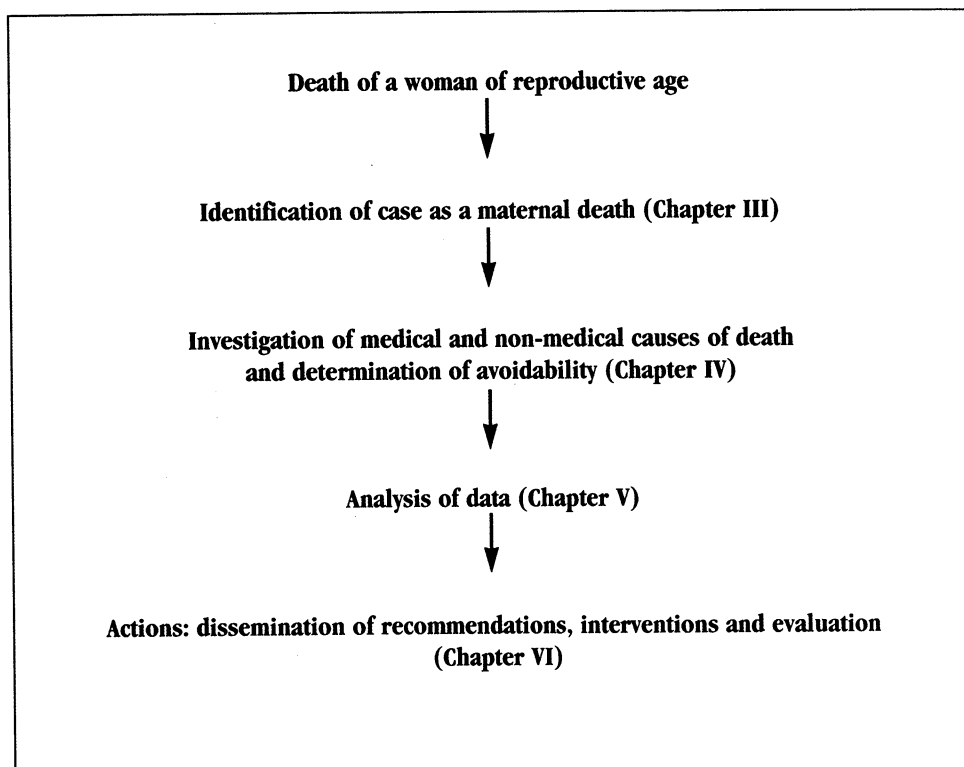
Country	Death Certificate Has Check Box	National Maternal Mortality Committees	Regional Maternal Mortality Committees	Local Maternal Mortality Committees
Argentina***	Proposed	In the process of formation	Some jurisdictions	Some hospitals
Barbados **				
Bolivia	Approved	Yes	Planned	Planned
Brazil	Yes	Yes	Yes	Some municipalities
Canada ***	Yes (5 of 12 areas)	In planning stage	Yes (5 of 12 areas)	Most hospitals
Chile	-	Yes	No	Hospitals
Colombia	In revision	Yes	Yes (29 or 31 departments)	Yes
Costa Rica **				
Cuba	No	Yes	Yes	No
Dominican Republic	Proposed	Yes	Planned	Planned
Ecuador	Yes	Yes	Yes (13 of 21 provinces)	3 at area level
El Salvador	No	In the process of formation	No	26 planned for hospitals
Guatemala ***	No	Yes	Some=	No
Guyana **				
Haiti	No	No	No	No
Honduras	No	No	Yes (some)	Some hospitals
Jamaica	No	Yes (met once)	No	No
Martinique **				
Mexico	Yes	Yes	Yes	Yes-/Hospital; few at local level
Nicaragua	Yes	Yes	Yes (some)	Some hospitals
Panama	No	In the process of formation	Yes	Some
Paraguay	No	Yes	Some	Hospitals
Peru ***	No	Yes	One pilot region	One hospital
Puerto Rico ***	Yes	Reactivating	No	Some hospitals
Surinam **				
Trinidad and Tobago	No	Yes (being organized)	No	No
Uruguay	No	No	No	No
United States ***	No	No	Some states	Some hospitals
Venezuela	No			

\* Source: Each country's evaluation of the regional plan to reduce maternal mortality in the Americas, submitted to PAHO in Jan/Feb 1995.

\*\* No info available

\*\*\* Data from other sources

**Figure 1: MATERNAL MORTALITY SURVEILLANCE**





## Objectives of Maternal Mortality Epidemiologic Surveillance

### *Goal: To monitor and reduce maternal mortality*

The primary goal of maternal mortality surveillance is to obtain information to guide public health efforts in reducing maternal mortality. Collecting data is a mechanism for obtaining information but is not in itself the goal.

The surveillance system should provide information that can be used in the development of programs and interventions to improve maternal health, reduce maternal morbidity, and improve the quality of care of women during pregnancy, delivery, and the puerperium. Counting cases is not enough. The data must lead to information that can, in turn, lead to specific recommendations and actions, as well as to an evaluation of the interventions. The precise nature of this information will differ from country to country. These Guidelines include examples of how data are collected and used to provide information in various countries in the Americas.

The information obtained from MMES can also increase awareness of maternal mortality at the community, the health care system, and intersectoral (policy-making) levels. Increased awareness can lead to changes in practice among the public and among health practitioners, as well as lead to a reallocation of resources to activities for decreasing maternal mortality.

**Overall objectives** — To guide activities whose aim is to reduce maternal mortality by collecting, analyzing and interpreting data, reporting findings and making recommendations for actions based on information.

### **Specific objectives** —

1. To collect accurate data on all maternal deaths:
  - a. Number — identification of all maternal deaths
  - b. Cause — investigation (audit) of all maternal deaths
  
2. To analyze data collected through surveillance and maternal death investigations:
  - a. Trends in maternal mortality
  - b. Causes of death (both medical and non-medical)
  - c. Avoidability of the deaths
  - d. Cluster, risk factors and groups at increased risk
  
3. To make informed recommendations for action to decrease maternal mortality (such as decreasing unwanted pregnancies, decreasing the prevalence of complications and preventing complications from leading to death) by assessing needs and improving:
  - a. Community education
  - b. Timeliness of referrals

*Guidelines for Maternal Mortality  
Epidemiological Surveillance*

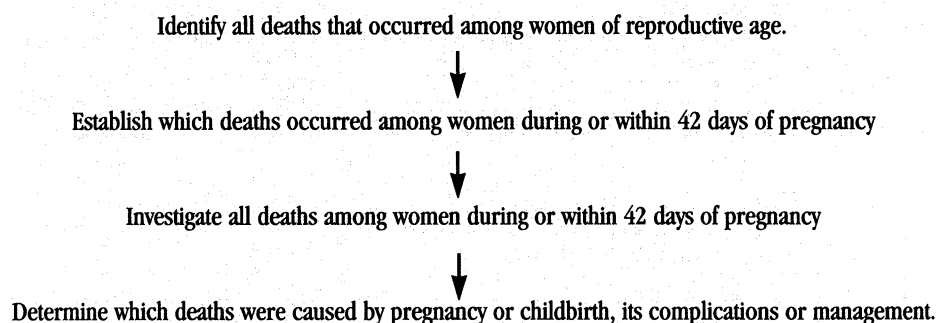
- c. Access to and delivery of services
  - d. Quality of care / training needs of health personnel /protocols
  - e. Legislation
  - f. Resource distribution
4. To disseminate the findings and recommendations to policy makers, health personnel and the community.
  5. To evaluate the impact of interventions.
  6. To increase awareness among policy makers, health personnel, and the community about the magnitude, social effects, and preventability of maternal mortality.
  7. To allow the comparability of maternal mortality statistics at a regional, national and international levels.
  8. To identify key areas requiring further research and to help establish priorities for that research.

## Identification of Cases of Maternal Death

A maternal death is defined as the death of a woman while pregnant or within 42 days of the termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes. (See the Glossary).

The system used to identify maternal deaths will vary according to the structure of the health care and health information systems and the resources available in a given country. Although each MMES system will operate differently, the objectives of each surveillance system should be the same — to identify and, subsequently, investigate all deaths caused by pregnancy, its complications and management. (See Figure 2.) Only when every maternal death is identified and investigated can the magnitude and causes of the problem be understood well enough to develop and evaluate interventions.

**Figure 2: Identifying Maternal Deaths**



In order to identify every maternal death, more than one source of information is required. Deaths occur in urban and in rural areas; in hospitals and at home; early and late in pregnancy; before, during and after labor; following different pregnancy outcomes (e.g., livebirth, stillbirth, ectopic pregnancy, abortion); and from direct and indirect causes (see the Glossary). Multiple data sources are required to find the most cases and the greatest amount of information about each death.

***Relying on vital statistics only leads to an underestimation of maternal mortality, even in developed countries such as the United States where 100% of deaths are registered. During 1987-19990, official vital statistics indicated a maternal mortality ratio (MMR) of 8/100,000 livebirths (LB). A surveillance system using multiple sources indicated an MMR of 10/100,000 LB— a 20% increase.***

***The ICD-10 (Who, 1993) includes a new category called “pregnancy-related” deaths, defined as all deaths during or within 42 days of pregnancy regardless of cause.***

***This classification is useful for two major reasons:***

- ***Cause of death can be difficult to determine.***
- ***In developing countries, a high percent of deaths that occur during pregnancy and the postpartum period are due to the pregnancy and its complications,***

***ICD-10 also includes the new category "late maternal death" for deaths due to pregnancy which occur 42 to 365 days after the end of pregnancy. However, these Guidelines focus on maternal deaths as defined by ICD-9 and ICD-10, \*i.e., those during or within 42 days of pregnancy.***

*\* The codes of ICD-10 were not published at the time these Guidelines were printed.*

In developed countries such as the United States, only about 1% of deaths among reproductive-aged women are found to be caused by pregnancy and its complications (Atrash et al., 1995). In contrast, 25% or more of all deaths to women of reproductive age in some developing countries are thought to be caused by pregnancy (Royston & Armstrong, 1989). The proportion of deaths caused by pregnancy is even greater among deaths temporally related to pregnancy. In Jamaica, for example, more than 95% of deaths that occurred during or within 42 days of pregnancy during the years 1981 to 1983 were causally related to the pregnancy (Walker et al, 1986).

***Investigators from Guatemala and Mexico report that the vast majority of deaths caused by pregnancy occurred within the initial 42-day period. In areas where resources are limited, it is more appropriate to focus on these maternal deaths; identification of late maternal deaths can be added when the system is more developed.***


## **A. Sources of Information**

### ***1. Death Certificates***

**Background** — Vital records serve as the foundation of any MMES. Part of the process of strengthening the MMES system includes strengthening vital registration. Theoretically, finding maternal deaths should be easy if every death is registered and has an accurate cause of death recorded on it. However, even in some large, well-developed countries, this system falls short of the ideal (Bouve-Collier et al., 1991).

**Use** — Vital records should be used as the initial source for finding maternal deaths. Death can be identified by ICD-9 codes from 630 through 676.9 which officially indicate pregnancy. However, even if death certificate data are computerized, a manual review of the certificates can frequently uncover additional cases through notes written in the margins.

Figure 3: México's death certificate



**SECRETARÍA DE SALUD**  
**CERTIFICADO DE DEFUNCIÓN**

MODELO 1994  
FOLIO DE CAPTURA  
**44242068**

<p>Antes de llenar el certificado, leer las instrucciones anotadas en el reverso</p> <p><b>1. NOMBRE DEL FALLECIDO:</b></p> <p>Nombre (s) _____</p> <p>Primer apellido _____ Segundo apellido _____</p>		<p><b>2. FECHA DE NACIMIENTO:</b></p> <p>_____ día _____ mes _____ año</p>	<p>D2 _____</p> <p>9 Día mes año 14</p>
<p><b>3. SEXO:</b></p> <p>Masculino <input type="radio"/> 1</p> <p>Femenino <input type="radio"/> 2</p> <p>Se ignora <input type="radio"/> 9</p>	<p><b>4. EDAD CUMPLIDA:</b></p> <p>_____ Años _____</p> <p>Si era menor de un año, escriba si se trata de:</p> <p>Meses _____ Días _____ Horas _____</p>	<p><b>5. NACIONALIDAD:</b></p> <p>Mexicana <input type="radio"/> 1</p> <p>Otra <input type="radio"/> 2</p> <p>Especifique _____</p>	<p>D3 _____</p> <p>15</p>
<p><b>6. ESTADO CIVIL:</b> Soltero <input type="radio"/> 1 Casado <input type="radio"/> 2 Unión libre <input type="radio"/> 3 Separado <input type="radio"/> 4 Divorciado <input type="radio"/> 5 Viudo <input type="radio"/> 6 Se ignora <input type="radio"/> 9</p>		<p><b>7. RESIDENCIA HABITUAL (ANOTE EL DOMICILIO PERMANENTE DONDE VIVIA EL FALLECIDO):</b></p> <p>_____ 7.1 _____</p> <p>Calle, número y colonia, _____ 7.2 _____</p> <p>Municipio o delegación, _____ 7.3 _____</p> <p>Entidad federativa, _____</p>	<p>D4 _____</p> <p>16</p> <p>D5 _____</p> <p>19</p> <p>D6 _____</p> <p>20</p> <p>21 _____</p> <p>24</p> <p>D7.2 _____</p> <p>25 _____</p> <p>27</p> <p>D7.3 _____</p> <p>28 _____</p> <p>29</p> <p>D8 _____</p> <p>30 _____</p> <p>31</p> <p>D9 _____</p> <p>32</p> <p>D10 _____</p> <p>33 _____</p> <p>34</p>
<p><b>8. OCUPACIÓN HABITUAL</b></p> <p>Ninguna <input type="radio"/> 1 Menos de 3 años <input type="radio"/> 2 3 a 5 años de primaria <input type="radio"/> 3 Primaria completa <input type="radio"/> 4</p> <p>Secundaria o preparatoria o equivalente <input type="radio"/> 5 Profesional <input type="radio"/> 7 Se ignora <input type="radio"/> 9</p> <p>Elem. abedal, mecánico de autos, etc. equivalente <input type="radio"/> 6</p>		<p><b>11. NOMBRES:</b></p> <p>Del padre, _____</p> <p>De la madre, _____</p> <p>Del conyugue, _____</p>	
<p><b>10. DERECHO HABIENTE:</b></p> <p>Ninguna <input type="radio"/> 1 MAS <input type="radio"/> 2 INSTE <input type="radio"/> 3 FEMES <input type="radio"/> 4</p> <p>Fuerzas armadas <input type="radio"/> 5 Otra <input type="radio"/> 6 Se ignora <input type="radio"/> 9</p>		<p><b>12. Si la defunción corresponde al sexo femenino y se encuentra en el grupo de edad de 10 a 54 años, anotar si estuvo embarazada durante los 42 días antes de la muerte:</b> SI <input type="radio"/> 1 NO <input type="radio"/> 2</p>	
		<p>D12 _____</p>	<p>35</p>



***In a manual review of death certificates in the United States, one certificate listed the cause-of-death and ICD-9 codes as follows:***

***cardiorespiratory arrest (427.5)***

***secondary to***

***hypovolemic shock (785.59)***

***secondary to***

***hemorrhage (459)***

***This death would not be classified as a maternal death based on the cause-of-death codes. However, uncoded but written in the margin of the certificate were the following words:***

***“ruptured right tubal pregnancy.”***

In some countries, the death certificates have a box that can be checked if the woman was or had been pregnant within a certain time period before her death. All death certificates with a marked check box should be investigated because in most developing countries the vast majority of pregnancy-related deaths are indeed caused by the pregnancy.

***In 1989, Puerto Rico modified its death certificate to include a check box indicating that the decedent was or had been pregnant in the previous year. The number of maternal deaths identified increased by 69% (CDC, 1991a).***

***Other countries whose death certificates were recently modified to include some type of check box to identify pregnant or recently delivered women are Brazil, Ecuador, Mexico, Nicaragua and Puerto Rico.***

Placing a check box on the death certificate can greatly improve the identification of maternal deaths. However, the ability of check box to detect deaths in early pregnancy is limited by whether the family was aware of the pregnancy. This can be particularly problematic when the woman died after an induced abortion.

The ability to link deaths and births can substantially increase the number of maternal deaths that are identified. A sophisticated, computerized MMES system in which all births and deaths are universally registered can link the following information:

- Deaths among women of reproductive age
- Certificates of live births and fetal deaths within the previous year

***In several states in the United States linkage of death certificates to birth certificates and, in some cases, also to fetal death certificates, has resulted in a 30% to 153% increase in the reported maternal mortality ratio. (CDC, 1995; CDC, 1991b)***

**Pitfalls** — The ideal vital registration system registers every death and accurately records the cause of death in a timely fashion, making identification of maternal deaths easy. All systems, however, fall short of this ideal, even in developed countries with a sophisticated vital registry. Problems fall into three categories:

<sup>1</sup>The codes for ICD-10 were not available at the time these Guidelines were printed

- Deaths may not be registered (under-registration).
- Cause of death listed does not specifically identify the death as maternal (cause-of-death errors).
- Collection and processing of vital records data at a national level are often not timely.

In some countries, particularly in urban areas, almost 100% of deaths are registered with death certificates. In many developing countries, however, vital registration is incomplete, and many deaths are not registered. Registered deaths usually differ from those that are not registered. For example, deaths among women who live in an urban area or who have received better medical care are more likely to be registered than are deaths among women who live in a rural area or who have not received medical care.

***In Buenos Aires, almost all maternal deaths occur in hospitals and are registered on a death certificate. In 1985, a medical record review of deaths of reproductive-age women resulted in an 80% increase over the number of maternal deaths found by using death certificate coding only. The corrected MMR was 91/100,000 LB compared with the official MMR of 50.***

Even when a death is registered, the recorded cause of death may not indicate an association with pregnancy for several reasons. Sometimes the cause of death is unknown or difficult to determine, even when an autopsy is performed and sophisticated medical technology used. Many developing countries have a shortage of trained nosologists to assign appropriate cause-of-death codes. Sometimes codes may be technically accurate but still not reflect the impact of pregnancy on the death.

Although health care providers assign the cause of death, they are not the ones who code the causes on the death certificates. If the doctor does not specifically write that pregnancy is a factor in the cause of death, the coder may not assign a code that indicates an association with pregnancy.

Among reproductive-age women, certain non-pregnancy causes of death such as sepsis, hemorrhage, hypertension and stroke are more likely to be deaths due to pregnancy. These codes warrant a review of certificates and possibly further investigation. Deaths due to sepsis should be particularly suspect in areas with high rates of illegal abortion.

***In a review of registered deaths in Guatemala, 69% of maternal deaths registered by physicians contained cause-of-death errors (cause-of-death codes that did not indicate maternal death); in contrast, only 38% of maternal deaths registered by a TBA contained cause-of-death errors.***

Finally, the collection and processing of vital records data can take up to several years to reach the national level, where the data will be edited and compiled to produce statistics for the country. This time lag makes monitoring of trends difficult and evaluation of interventions problematic.

## 2. Hospital Records

**Background** — Maternal deaths that occur in a hospital are usually the easiest to identify. Generally, hospital records provide a good place to begin identifying maternal deaths. Hospital records often contain valuable information on the medical factors that contributed to the death. This information is particularly important for institutional maternal mortality review committees

**Use** — The way a hospital finds and reports its maternal deaths depends both on the size of the delivery service and on whether patient records and death records are kept manually or are computerized. A computerized system that tracks admissions or deaths along with reliable information on diagnoses can be used as an initial screening method to find maternal deaths. However, the computerized diagnoses may not capture all the known relevant information (see the discussion of “Death Certificates”). If the hospital maintains a listing of deaths, then a review of all records of deaths among reproductive-age women can be performed periodically. If the labor and delivery service keeps log books that include data on deaths, these should be reviewed as well. In facilities that have a limited number of beds, a manual review of all admissions can be conducted.

**Pitfalls** — Only the deaths that occur in the hospital are identified by a review of hospital records. The characteristics of maternal deaths occurring in hospitals can differ greatly from those deaths occurring outside the hospital, especially in areas where most women deliver at home. Furthermore, women with pregnancy outcomes other than live birth or stillbirth may be under-represented. For example, delivery room logs, which may be used to find deaths associated with childbirth, usually do not include deaths from abortion or ectopic pregnancy.

***In Puerto Rico, a woman developed serious postpartum complications of pregnancy. She was transferred to the intensive care unit of a tertiary referral hospital where she died several weeks later. By the time she had died, personnel had forgotten that the condition was associated with delivery and so the death certificate and discharge record made no mention of pregnancy.***

Women who die later in the postpartum period are less likely to be identified as maternal deaths. They may have been transferred to referral hospitals, and the relationship of their medical problems to the pregnancy may not be recorded in the records of hospitals where they died.

***A woman died while being transported to a health center in Nicaragua. Personnel at the health center never reported the death because it did not occur on the health center premises and the staff members did not want to be blamed for it.***

Most countries have more than one system of hospitals; in addition to Ministry of Health facilities, there may be hospital systems linked to a person's employment, such as Social Security hospitals, as well as private hospitals and clinics. Facilities that are not part of the Ministry of Health frequently are not included in maternal mortality surveillance. In some countries, personnel at private hospitals can refuse to participate and will not report their maternal deaths. Not only does exclusion of these facilities make estimates of maternal deaths less accurate, but it also prevents investigation of problems in attitude, knowledge or resources that led to these deaths. The desire to avoid being blamed for a death may discourage some health care facilities from reporting.

### ***3. Community Identification of Deaths***

**Background** — Maternal deaths that occur outside the hospital are the most difficult to identify and need the most creative approaches to surveillance. Nonetheless, it is important to identify these deaths and investigate them, particularly in areas where many deliveries occur at home. Women who die outside the health care system die for different reasons and from different causes than do women who die in hospitals.

**Use** — To find maternal deaths in the community, community members must be aware of the importance of reporting them. A person or persons, in some places referred to as “key informant(s),” may be responsible for transmitting information from the community to the health sector. As part of their regular tasks, health promoters or village health workers could be trained and encouraged to identify and report maternal deaths. Individuals who provide prenatal or delivery care have knowledge about women who are pregnant and are more likely to know if a death had occurred. Some countries have developed simplified reporting systems for maternal deaths which are used by traditional birth attendants (TBAs) and other community members. Other countries have explored innovative methods to identify deaths, including checking cemeteries and funeral homes for unregistered deaths.

In countries with a health care delivery system based on the WHO Primary Health Care model (WHO, 1988), the health center could collect information on maternal deaths reported from the communities it serves. Health centers usually have paid full-time staff, experience with keeping lists and records, and regular contact with the organized health care delivery system at higher levels. They may in some instances be the place where birth and death certificates are completed. In addition, health centers generally take care of pregnant or postpartum women who are seriously ill.

***Guatemala: A local MMES committee monitors funeral homes and cemetery registers to find deaths of women of reproductive age that may not have been officially reported.***

***Nicaragua: Some communities appoint an individual to investigate rumors of maternal deaths. The rumors that prove to be true are then reported officially.***

***Mexico: A Simplified Surveillance System designed for TBAs and others who cannot read is easy to use and contains pictures of signs and symptoms which are commonly associated with maternal deaths (Alvarez et al, 1994).***

**Pitfalls** — Maternal deaths that occur in the community are more easily overlooked than those that occur in hospitals. Not only must those who are aware of the death realize that the woman was or had recently been pregnant, but they must know that the event should be reported and to whom. A good relationship must exist with the health authorities, and the system must allow the inclusion of these officially unregistered deaths. The difficulties are so great that reports of maternal deaths in many countries are limited to hospital series.

#### *4. Formal Surveillance Systems*

***In both Peru and Nicaragua, a maternal death is a notifiable condition that must be reported through surveillance channels in a timely manner.***

**Background** — In some countries, the death of a woman of reproductive age or a death due to pregnancy or its complications is on the list of notifiable diseases (obligatory notification) that must be reported to the government-run surveillance system in a timely manner. If such a system functions as designed, it can resolve some of the pitfalls associated with other methods for identifying deaths.

*Guidelines for Maternal Mortality  
Epidemiological Surveillance*

**Use** - Surveillance of maternal deaths using obligatory notification is usually conducted by the epidemiology or surveillance division of the Ministry of Health, not by the maternal or family health unit. Surveillance personnel at the local Ministry of Health receive reports of deaths. They regularly report these deaths to the regional level and from the regional to the central level. In some systems, deaths occurring in hospitals may be directly reported to the regional or central level.

A formal surveillance system with obligatory notification can improve the timeliness of reporting and increase the visibility of maternal death as an important public health issue. Authorities and health personnel can use the information to develop interventions to decrease maternal deaths. Such practical usefulness encourages interest, accuracy, and enthusiasm.

**Pitfalls** - Formal surveillance is generally conducted by staff in administrative units outside of maternal or family health. Unless there exist strong relationships and communication with maternal health staff, information may not be communicated to those who need it to investigate the deaths (at the local or regional level) or those who need to develop interventions based on the data. (See Chapter VII. Issues, Section B. Interaction Between Identification and Investigation).

In addition, formal surveillance systems suffer similar pitfalls with respect to identification of deaths outside of an institutional setting as other methods. These still require notification by community members to the appropriate health authorities.

## Investigation of deaths

Every maternal death should be investigated. The investigation provides information about the problems which contributed to the death and guides the development of interventions to prevent such deaths in the future. Maternal death investigations are also known as confidential enquires or audits. However, the term 'investigation' will be used throughout these guidelines.

***In one country, the sole obstetrician practicing in a rural area also served on the area's maternal mortality review committee. One of the obstetrician's patients died as a result of pregnancy complications. The other committee members did not investigate the case thoroughly because they were afraid that the obstetrician would leave the area.***

Several factors may influence the success of a maternal death investigation. It must be made clear that —

- The purpose of an investigation is to find ways to reduce maternal mortality — not to find blame.
- The information obtained in the investigation will be confidential.
- Ideally, investigations are conducted by personnel who were not directly involved in the woman's care before her death.

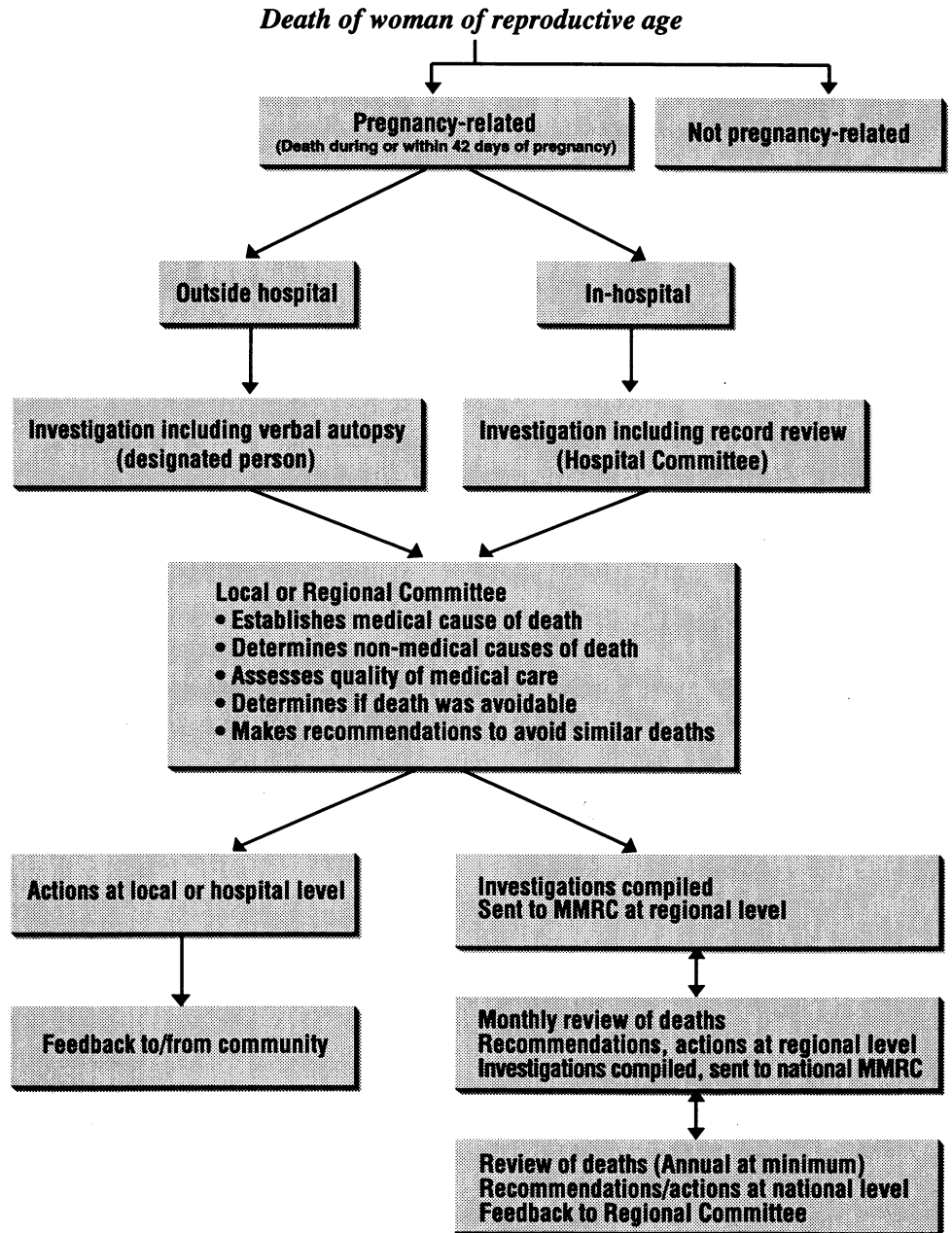
### A. What is Investigated?

When a death of a reproductive-age woman is identified and determined to be related to pregnancy, an investigation unfolds as shown in Figure 3. A maternal death investigation should establish the following:

1. Medical (pathologic) cause of death
2. Non-medical causes of death
  - a. Timeliness of problem recognition, decision making, and actions
  - b. Access to care and logistics of referrals
3. Quality of medical care (shortcomings of the health services)

It is vital that both medical and non-medical factors be considered during any given investigation, whether the death occurs in the hospital or at home. However, the focus of the investigation may differ depending on the circumstances in which the woman died. For instance, the investigation of a hospital death may focus on the quality of medical care and the availability of resources. Nevertheless, a home visit is still an important part of the investigation because it provides information for assessing the role of non-medical causes in the woman's death. For example, when a woman arrives at the hospital in a moribund condition and dies, it is important to investigate why. For a death that occurred outside the hospital, investigators may concentrate on why the woman did not receive medical care. Few maternal deaths can be prevented if medical attention is not sought in a timely manner. Factors that may affect the willingness of TBAs to refer women to hospitals may need to be investigated. Any medical care that the woman did receive, including prenatal care, should also be investigated. All the steps on the pathway to survival must be explored. (See Figure 4.)

**Figure 4: Investigation of Maternal Death**



**Figure 5: PATHWAY TO SURVIVAL – MATERNAL MORTALITY**

	Step 1	Step 2		Step 3	
Life-Threatening Illness	Recognition of Medical Problem	Timelines of Decision-Actions	Access to Care/Logistics of referral	Quality of Medical Care	Survival/Death

Adapted from "On the pathway to maternal health", *MotherCare Matters*, 1995.0

In most countries, maternal death investigations use a preprinted questionnaire to collect data. There is a tendency for such forms to focus almost exclusively on medical issues and neglect non-medical causes. Ideally, the questionnaire should ask about medical causes of death, nonmedical causes of death, and quality of care. It is recommended that in addition to a structured questionnaire, an open-ended interview be included to would allow family members to tell the story in their own words.

### 1. Establish the medical cause of death

The investigation should determine the medical, or pathophysiologic, causes of death as specifically as possible and categorize it as a direct obstetric, indirect obstetric or non-maternal death. (See the Glossary). Mechanisms for establishing the medical cause of death will depend on whether the woman was hospitalized or not.

***To classify causes of maternal death, CIESAR (Centro de Investigación Epidemiológica en Salud Reproductiva), the WHO Collaborating Center in Guatemala City, has adopted the coding manual for maternal mortality surveillance that is used by the U.S. Centers for Disease Control (Kestler, 1994). A primary cause of death is identified as well as any important associated conditions. The primary causes of death are hemorrhage, hypertensive disorders, infection, embolism, anesthesia-related deaths, and others. Associated conditions are those medical conditions that contributed to the death.***

#### a. Hospital Deaths

The medical cause of death can usually be established from the medical records. Interviews of hospital personnel involved in the care of the woman may provide additional information that can be used to corroborate facts in the hospital record. This is particularly important in situations where there are questions about the quality of medical care.

#### b. Deaths Occurring Outside of the Hospital

In some cases, a woman who dies outside the hospital may have had antenatal care or been hospitalized prior to her death. Medical records may be helpful but are sometimes not available in these situations. In these cases, a verbal autopsy is a tool that can be used to determine the medical



**Figure 6: A verbal autopsy scheme for classification of maternal death**

<b>Essential diagnoses</b>	<b>Specific diagnoses</b>
<b>1. Early pregnancy death</b>	<b>a. Ectopic</b>
	<b>b. Spontaneous abortion</b>
	<b>c. Induced abortion</b>
<b>2. Antepartum bleeding</b>	<b>a. Placenta previa</b>
	<b>b. Abruptio placenta</b>
<b>3. Postpartum bleeding</b>	<b>a. Retained placenta</b>
	<b>b. Atonic uterus</b>
	<b>c. Trauma</b>
	<b>d. Other</b>
<b>4. Obstructed labor</b>	<b>a. Ruptured uterus</b>
	<b>b. Other</b>
<b>5. Hypertensive disorders</b>	<b>a. Eclampsia</b>
	<b>b. Preeclampsia</b>
	<b>c. Chronic hypertension</b>
<b>6. Sepsis</b>	<b>a. Associated with prolonged rupture of membranes</b>
	<b>b. Prolonged labor</b>
	<b>c. Retained placental tissue</b>
	<b>d. Urinary tract</b>
	<b>e. Operative</b>
<b>7. Anesthetic</b>	
<b>8. Sudden death</b>	<b>a. Pulmonary embolism</b>
	<b>b. Amniotic fluid embolism</b>
	<b>c. Other</b>
<b>9. Unknown</b>	

cause of death. A verbal autopsy is an investigation in which a cause of death is established based on information obtained through interviews of people with knowledge about the woman's illness and death. Those interviewed would include family members, traditional birth attendants, and any others who assisted the woman during her illness. Several classification schemes are proposed in the report of a WHO workshop on verbal autopsy for maternal deaths. (WHO, in press) One of them has two levels of diagnosis for medical causes of death: essential and specific. (Figure 5.) The majority of maternal deaths can be categorized into one of the verbal autopsy's nine essential diagnoses. If more detailed information is provided, then the specific diagnoses may be assigned.

## ***2. Determine the Non-Medical Causes of Death***

The non-medical causes of death are often more important in determining whether a woman lives or dies than the medical condition itself. Therefore, it is important to investigate these if maternal mortality is to be reduced. Major examples of non-medical causes of death include the timeliness of problem recognition and decision making, access to care, and the logistics of the referral process.

### **a. Timeliness of problem recognition and decision making**

- Was the problem recognized promptly? If not, why not? Did the death occur so suddenly that the woman could not receive any care? Were any risk factors present that may have been missed because the woman did not seek prenatal care or because prenatal care was inadequate?
- If the problem was recognized, was a decision made to seek care? If not, why not? Again, did the death occur too suddenly? Did the woman refuse to seek care? Were there family obstacles to a referral? Was concern over access to care an obstacle to decision making?
- Did any beliefs or cultural practices create barriers to obtaining appropriate medical care? Did previous poor experiences with the health care system make the patient or TBA reluctant to seek care?

### **b. Access to care/logistics of referral**

- Was geography a factor? Were there problems with transportation? Or with the roads? Did the woman live far away from the necessary health care services?
- Were financial factors obstacles to obtaining care? Were actual costs a deterrent to the woman or her family? Did the health care delivery provider refuse appropriate care because the patient could not pay?
- Were there delays in transferring the patient to an appropriate level of care, such as from a clinic to a hospital? Was there a delay in her receiving care at the institution?

Most maternal deaths occur in the peripartum period, and many are not associated with pre-existing risk factors. Thus, the ability to diagnose a problem and refer women to appropriate facilities in a timely fashion when emergencies arise is paramount. In what condition did the woman arrive at the hospital? Was the referral timely or too late? If too late, what contributed to its lateness? How long after her arrival did the woman die? Deaths that occur shortly after arrival at a hospital frequently cannot be prevented even in hospitals provide appropriate emergency obstetrical care. These deaths are often associated with a late referral due to factors such as those

outlined above, including delays in recognizing the problem, delays in making a decision to seek the appropriate level of medical care, and delays in reaching the appropriate level of medical care.

### ***3. Assess the quality of medical care***

The investigation should include information about the medical management of the woman's condition in order for the committee to determine if the recommendations and treatment were appropriate and the quality of care adequate. The quality of any prenatal care such as screening for risk factors or underlying conditions also needs to be assessed. For both hospital and out of hospital deaths, the quality of care evaluation should include that care given by traditional birth attendants, nurses, midwives, and physicians.

The first referral level of care should have the capacity to provide the essential obstetric functions as defined by WHO (WHO, 1991). The capacity to perform these includes having both the necessary resources and personnel with appropriate training. The investigation should determine whether a lack of resources or inadequate training contributed to the death. Many countries have written protocols or norms regarding the management of obstetric complications. A complete investigation includes an assessment of whether norms of care were available, were followed and were appropriate. Recommendations for changing or improving norms can be one result of maternal mortality surveillance.

## **B. Who Conducts the Investigation?**

The investigation of maternal deaths is carried out by maternal mortality committees whose primary responsibility is to establish the medical and non-medical causes of death, assess the quality of care delivered, determine if the death was avoidable, and identify interventions which could prevent similar deaths in the future. The structure for investigating maternal deaths recommended by PAHO includes maternal mortality committees at three levels of government: local, regional, and national. The functions and limitations of each level will vary and will depend on the country's size, needs, and established organization.

### ***1. Maternal Mortality Committees***

A review of the current status of maternal mortality investigation in the Americas revealed that the majority of countries have formed some type maternal mortality review committees, shown in Table 1, as recommended in the PAHO Regional Plan for the Reduction of Maternal Mortality in the Americas (PAHO/WHO, 1990). The identification of maternal deaths usually occurs at the local level or at the hospital. Investigation of the deaths occurs at the level that has the human resources to do so.

**Local Level Committees** — Local level committees are usually based in a municipality or county and have a health center or hospital at their core. In some countries, the local area will include the first referral hospital. (In other countries, the first referral hospital is a regional hospital and will be integrated with the Regional Committee.) Hospital deaths can either be investigated by a hospital maternal mortality committee or by an external local committee.

The more difficult question is "Who will investigate deaths that occur outside the hospital?" This decision depends on the development of the health care system and on the personnel resources that are available. In some countries, the deaths occurring outside the hospital are investigated by personnel from the local level, who then report their findings to the regional level. If personnel resources are scarce at the local level, the deaths may be investigat-

ed by personnel at the regional level, who then report to the regional maternal mortality committee. In some countries, members of a maternal mortality committee conduct the investigation themselves. In general, investigations should not be conducted by any one who was personally involved in the clinical care of the woman who died.

The composition of the local committee will depend on local resources but usually includes a mixture of health personnel (including specialists if they are available at that level), community members and representatives from pertinent organizations (such as women's groups) and government ministries (such as the Ministry of Education). A person designated to investigate the death completes a questionnaire and submits it to the committee. The local committee determines the cause of death and whether it was avoidable, and recommends interventions to prevent such deaths in the future.

***In Mexico, about 85% of deliveries occur in hospitals, most of which now have maternal mortality committees. However, hospital deliveries account for only 62% of the reported maternal deaths. The risk of maternal mortality is greater in home deliveries, which are more common in rural areas. To improve the registration and investigation of maternal deaths in rural areas, a pilot study was conducted in a rural area which established a local maternal mortality committee to conduct an intensive search for deaths of reproductive age women. The search uncovered 36% more maternal deaths than were officially reported, which were then all investigated (Secretaría de Salud, 1994)***

Personnel at the local level generally assure that the data is of adequate quality. The limited numbers of maternal deaths at this level usually make quantitative analysis unreliable. However, the critical value of local assessment is the delineation of local problems such as the following:

- The family's decision about when to bring the patient for medical care
- The traditional birth attendants decision about when to refer the patient for medical care
- Obstacles to getting the patient to medical care
- The adequacy of prenatal care
- The quality of medical attention the patient received — as perceived by the family and by the medical community

Although nearly all countries in the Region are contemplating some system to investigate deaths that take place outside of the hospital, and some countries are piloting systems in local areas, most countries currently do not have uniformly functioning systems for investigating non-hospital maternal deaths.

**Hospital Committees** — All hospitals that attend pregnant women should establish maternal mortality committees, including those operated by the Ministry of Health, Social Security and by the private sector. Most countries have already established hospital maternal mortality committees. This was the starting point for many maternal mortality surveillance systems in the Americas. The committees include specialists such as obstetricians, anesthesiologists, pathologists, and others involved in obstetric care. Committee members should meet regularly to discuss both the medical and the non-medical causes of death. In particular, they should evaluate the referral process, if relevant.

For problems to be resolved and maternal mortality reduced, recommendations require both a community and a medical perspective. Communication between the local/regional and hospital committees is important so each can provide their perspective about factors associated with maternal deaths.

**Regional Level Committees** — The local level maternal mortality committees and those hospital committees not integrated with a local committee report to the regional level committee. In some countries, this committee is located at the regional hospital, whereas in others it is located at the regional Ministry of Health. Ideally the regional committee should include obstetricians, anesthesiologists, other specialists, and members from other Ministries and community organizations such as women's groups that might be instrumental in reducing maternal mortality. Including persons from outside the health care sector is especially important to ensure that non-medical aspects of maternal mortality are not forgotten.

The maternal mortality committees at the regional level will make a final determination about the cause and avoidability of a maternal death. They are also responsible for tabulating and reviewing aggregate data. In most countries, the number of maternal deaths occurring at the regional level is large enough to allow an evaluation of patterns and trends.

The regional level frequently has control over decision-making about resource allocation and program development within its area. The regional committee can make recommendations about interventions to resolve problems it has delineated, especially those that require budget expenditures for implementation.

It is vital for the regional committee to provide feedback about its findings and recommendations to the local level and respond to requests for technical assistance and resources which have been made by the local level.

**National Level Committees** — National maternal mortality committees frequently include the director of vital statistics, the director of family or maternal and child health, obstetricians, epidemiologists, women's groups, and community members. They monitor national trends and evaluate the effectiveness of the country's programs to reduce maternal mortality. They promote legislation and health policies to reduce the number of maternal deaths. The national committee must take an active role in raising awareness about maternal mortality and convincing policy makers that problems of maternal health are a priority.

## ***2. Importance of Interaction Between Committees***

Communication and feedback are vital both to the reduction of maternal mortality and to the sustainability of maternal mortality surveillance activities. Feedback between the local and regional level needs to be bi-directional. Investigation of deaths at the local level will quickly diminish without response from the local government or the regional level that addresses the problems raised by the local committee. The local committee must make clear to the regional committee its concerns and proposals for solutions. The regional committee has the responsibility to respond to the problems raised by the local committee and also to make its own recommendations to the local level. The local level committee must frequently depend on the regional level committee to help it resolve its problems, because the reduction of maternal mortality usually requires increased resources and training. Periodic regional meetings with representatives from all the local committees can allow for an exchange of ideas and experiences with different strategies and interventions. Such meetings often revitalize local members to continue their work.

Communication and feedback between the regional and national level are also necessary. Recommendations made at the regional level frequently require some type of response from the national level and, vice versa, the national level may make recommendations to the regional level. Most countries have annual meetings involving members of the regional committees which are a forum where the problems, experiences, and solutions of the different regions can be shared.

**Figure 7: FUNCTIONS OF MATERNAL MORTALITY COMMITTEES IN COLOMBIA**

<b>Local Level (municipal)</b>	<b>Regional Level (departmental)</b>	<b>National Level (Ministry of Health)</b>
<ul style="list-style-type: none"> <li>• Collects data</li> <li>• Investigates maternal mortality cases</li> <li>• Analyzes information</li> <li>• Makes decisions regarding interventions</li> <li>• Reports to regional level</li> </ul>	<ul style="list-style-type: none"> <li>• Compiles data from investigations</li> <li>• Follows up interventions</li> <li>• Provides technical and scientific feedback to local level</li> <li>• Reports to the national level</li> </ul>	<ul style="list-style-type: none"> <li>• Analyzes and monitors flow of information</li> <li>• Studies causes of death and associated risk factors</li> <li>• Evaluates the impact of interventions</li> <li>• Gives technical and scientific feedback to regional level</li> <li>• Offers technical assistance and monitoring of interventions</li> <li>• Publishes national results</li> </ul>

### **C. How is Avoidability Determined?**

The purpose of every death investigation is to determine the causes of death, whether the death was avoidable and, if so, how it could have been prevented. For developing countries, this assessment should be based on the country's obstetric norms and available resources, not on standards used in more developed countries. The purpose of the investigation is not to blame a particular person or facility for the death. Rather, avoidability is a proactive concept to prevent future deaths from being caused by similar factors.

The following factors should be considered when assessing if a death was avoidable:

#### **1. Family/Community Level**

Patient / family factors — Did the woman and her family

- Recognize that a problem existed
- Seek medical care
- Seek prenatal care
- Comply with any medical advice given

TBA factors - Did the TBA

- Manage the labor and delivery correctly
- Recognize that a problem existed
- Refer the woman appropriately and without delay
- Consider herself part of the local health care system

## ***2. Formal Health Care Delivery System Level***

Antenatal care — Determine whether

- The woman received antenatal care
- Antenatal care followed country guidelines
- Risk factors and medical problems were correctly assessed and treated

Hospital factors — Determine whether

- Essential obstetric functions were available at the first referral level
- Resources were adequate to resolve the problem
- Protocols/norms were available and appropriate
- Care was available regardless of the ability to pay

Health care provider factors — Determine whether the health personnel

- Were trained to treat the problem correctly
- If so, treated the problem adequately
- Were sensitive to the social and cultural values of the patient and her family

## ***3. Intersectoral level***

Transportation factors — Assess if transfer was hindered by:

- Availability of transport
- Adequacy of roads
- Ability to travel at night
- Cost

Education factors

Communication factors

Status of women

Based on information obtained from the investigation, the committee will make recommendations to prevent such deaths in the future. As cases accumulate and patterns emerge, especially at the regional and national levels, interventions can be prioritized according to which will have the greatest impact. (See the Chapter VI. Actions — Use of the Information.)

## Analysis — Turning Data into Information

One of the major purposes of MMES is to turn data into useful information in order to understand the pathways that lead to maternal death and to develop interventions to prevent them. Data, both in terms of the number of deaths and the information from the investigations, must be analyzed both qualitatively and quantitatively.

### A. Qualitative Analysis

Qualitative analysis of maternal mortality data can and should be done at the local and regional levels. The committee responsible for investigating deaths should perform the initial qualitative analysis. The collected information is used to determine the events that led to the death. The committee, group, or individual analyzing the data needs to identify possible problems in all the areas described in Figure 7, as well as assess the avoidability of the death. Even if only a few deaths have occurred, local committees should be able to get an idea of some specific problems occurring in their communities and the measures needed to correct them.

***While the medical cause of many maternal deaths may be the same, the reasons for the death will vary, as will the solutions. For example, a woman can die from a retained placenta for many reasons. She may be delivered at home by a traditional birth attendant who may not be aware that a problem exists or may refer her too late. The woman may refuse to seek medical care or go to the hospital. She may be unable to reach the hospital because of a lack of transport or roads. If she is taken to a health care facility, the health care worker may not be skilled in manual removal of the placenta, or there may be no staff available to perform the procedure.***

WHO has developed a structure to identify problems and to develop and evaluate interventions (Backett et al., 1984). It provides several helpful paradigms that incorporate both medical and non-medical factors in defining problems and developing interventions. The structure defines the health care delivery system very broadly, in three levels:

- **Community level** — the individual, her family and community
- **Formal health care system level**— health posts, health centers, hospital and associated staff
- **Intersectoral level** — education, transportation, communication, agriculture

**Figure 8: LEVELS OF THE HEALTH CARE DELIVERY SYSTEM**

	Community	Formal	Intersectoral
Attitude			
Knowledge/Skill			
Resources			



In addition, the structure also considers possible problems at each level of the health care delivery system:

- Attitude
- Skill and knowledge
- Resources (money, materials, manpower, management skills)

When investigating maternal deaths, the MMES committee members must consider possible problems and solutions in all these nine areas.

Local MMES committee members must transmit the results of the qualitative analysis to the regional level. It is often the regional level committee that makes decisions about management and resource allocation. The regional level committee also generally makes decisions about the need for training, health education, improved treatment protocols, or improved transportation.

## **B. Quantitative Analysis**

Quantitative data analysis will vary somewhat depending upon the level at which it is being performed. Although maternal deaths occur far too frequently, they are still relatively uncommon events compared with perinatal or infant deaths. In local areas with few births, only one or two maternal deaths may occur in a year. This is one of the reasons why a surveillance system is important: to collect information from different areas so the number of cases is sufficient to look for trends and patterns.

### **1. Data tabulation**

Initial data analysis will include tabulation of cases by basic characteristics such as:

- Person — age, race/ethnicity, education, socioeconomic status
- Place — place of residence/delivery/death
- Time — year, season, day of week, time of day

In addition, the analysis can tabulate deaths by reproductive characteristics:

- Parity
- Pregnancy outcome (live birth, stillbirth, induced or spontaneous abortion, ectopic pregnancy)
- Gestational duration
- Type of delivery (vaginal versus cesarean)
- Antepartum/intrapartum/postpartum status
- Delivery-to-death interval
- Medical cause of death

***It is helpful to classify a maternal death by both the outcome of pregnancy and the cause of death. For example, this type of classification allows deaths due to abortion-associated sepsis to be distinguished from deaths due to sepsis associated with live birth, which may require different interventions***

Many schemes exist for classifying cause of death, including those described in "Verbal Autopsy for Maternal Deaths - Report of a WHO Workshop" (WHO, in press), the ICD-9 (WHO, 1991), and the CDC's Pregnancy-Related

Mortality Surveillance System (CDC, 1992) and its adaptation by CIESAR (Centro de Investigación Epidemiológica en Salud Reproductiva). The same cause-of-death coding scheme should be used throughout a country's MMES program, so that codes will be compatible and data from different areas can be combined.

The analysis at the regional level compiles data from the local level so that there are adequate numbers to analyze. In general, data are tabulated at regular intervals such as monthly, quarterly, or annually.

## 2. Data analysis

After tabulating the data by the relevant characteristics, additional comparisons can be made that lead to greater insights into factors associated with maternal death. These analysis can:

- Examine trends in maternal mortality over time in a given area.
- Compare the risk of maternal death between areas (see map).
- Compare data among different groups in the population, defined by characteristics such as age, ethnicity, parity, residence, etc.

***In Caldas, a department in Colombia, maternal mortality ratios for each municipality were calculated. Those areas with a high MMR were identified and were priority areas for receiving intervention programs***

The simplest way to analyze maternal mortality data is to look at the number of maternal deaths. If programs to reduce maternal mortality are functioning as designed, the number of deaths from an area should decrease over time. However, as the system for identifying deaths improves, the number of deaths reported will increase even if the true number of deaths is decreasing. (This improvement in case finding should be applauded.) In addition, if the number of births increases significantly, the number of deaths can also increase, even if the risk of death is the same or decreasing. Conversely, a decrease in the number of births would mean a decrease in the number of deaths even if there had been no improvement in the risk of death. Thus, it is usually preferable to use measures that include both a numerator and a denominator rather than a simple measurement of numerator only.

***In 1986, the U.S. Centers for Disease Control and Prevention started a Pregnancy-Related Mortality Surveillance System and encouraged all the states to improve their surveillance of maternal deaths. With this improved surveillance system, the annual number of maternal deaths reported to the surveillance system increased from 275 in 1987 to 415 in 1990, with an increase in the maternal mortality ratio from 7.2/100,000 live births to 10.1000,000. (Berg et al, 1996)***

The most common indicator used to describe the risk of death from pregnancy is the maternal mortality ratio or MMR (see the Glossary). Defined as the number of maternal deaths per 100,000 live births, the MMR requires information on both the numerator (number of maternal deaths) and the denominator (number of live births in the population) for each group or time period being compared. However, because the small number of births and maternal deaths at the local level lead to unstable estimates of the MMR, it is most reliably calculated for fairly large areas, such as a region or nation.

**Figure 9: Maternal mortality ratios for Caldas, Colombia. 1989-1993**



Municipalities	No.	Live Births 1989-1993	Maternal Deaths 1989-1993	MMR 1989-1993*
Critical	8	53.359	51	95.6
Intermediate	8	13.828	9	65.1
Healthy	9	24.204	6	24.8
<b>Total</b>	<b>25</b>	<b>91.391</b>	<b>66</b>	<b>72.2</b>

\* Per 100,000 live births

Source: Sección Información, Dirección Seccional de Salud de Caldas. Estudio de Mortalidad Materna, Caldas 1989-1993

The MMR can be compared between different time periods and between different geographic areas, as long as the data for both the numerator and denominator are available. The MMR for women of different age groups, ethnicities, and parities can help in identifying groups at increased risk. The MMR by place of residence (urban or rural) and place of delivery (home, health center, or hospital) can be helpful in understanding possible problems in the health care system. However, maternal mortality ratios calculated using hospital-based data should be used with caution. If the sickest women are referred into the hospital, the ratio of deaths to live births may be deceptively high, whatever the quality of care provided. On the other hand, if women with complications do not reach the hospital, the ratio may be deceptively low.

In many developing countries, birth registration is a major problem, and obtaining an accurate number of live births (the denominator) can also be difficult. Both under- and over-registration of live births have been reported. Where births are under-registered, the maternal mortality ratio will be falsely high. In other countries, where births are over-reported, the maternal mortality ratio will be falsely low.

Obtaining the number of live births for sub-groups, such as geographic areas, age, parity or ethnicity groups, can be particularly difficult. If available, census or special studies, such as Demographic Health Surveys, Reproductive Health Surveys or other surveys, can be used to estimate births over time and in subgroups in the population.

Indicators such as the maternal mortality rate and the life-time risk of death from pregnancy (see the Glossary) take into account both the risk of death from each pregnancy (MMR) and the total number of pregnancies women in the population experience. These indicators are helpful in making the population and policy makers aware of the impact of pregnancy on society. The proportionate mortality and cause-specific proportionate mortality can be helpful in monitoring the impact of maternal deaths in a population and also the relative impact of the different causes of maternal death (see the Glossary). The more pregnancies women have, the greater the maternal mortality rate and lifetime risk.



## Actions — Use of the Information

One of the primary objectives of MMES is to use the collected information to design, implement and evaluate intervention strategies to promote maternal health and reduce maternal mortality and morbidity. First, surveillance data help identify and prioritize problems at all levels of the health care delivery system. This information can be used to develop interventions to improve maternal health and decrease maternal mortality and morbidity. Using the data, health personnel can prioritize the factors that most influence maternal health and that are potentially preventable. While few countries have sufficient experience in developing data-based interventions, hopefully work in the Region over the next several years will provide more examples of successful interventions.

### A. Dissemination of the Findings and Recommendations

#### 1. Dissemination to Maternal Mortality Committees at all Levels

Committees at the different levels should first establish communication and feedback mechanisms with each other. Findings at the local level may include a need for training or resources which can only be obtained from the regional level. Conversely, the regional level may make recommendations for actions at the local level. These must be adapted to fit the local needs.

Health personnel are more likely to continue the sometimes frustrating or arduous job of collecting information if they know the information is being used and acted on. This same type of two-way feedback is important between the regional and national levels. One way to assure effective communication between the different levels of maternal mortality surveillance is periodic, at least annual, meetings at the regional and national levels.

Communication and exchange between committees at the same level can also be helpful in improving MMES. Periodic meeting between the local and/or hospital committees in a region can allow members to exchange of ideas and experiences between the different areas and regions. They promote the discussion of surveillance methods as well as of interventions which have been successful in reducing maternal mortality. Such exchange also helps maintain momentum and vitality in the activity. Meetings of representatives of regional committees with national level personnel can, likewise, be helpful.

#### 2. Dissemination to Other Groups

Communicating with other audiences outside the surveillance system to stimulate actions is the goal of MMES. Reaching these difference audiences requires communications that take a variety of forms: community level meetings or health promotion messages to the community conveyed through a variety of media; publications, presentations or reports to health care providers; recommendations of professional societies; and government reports and intersectoral communications. One tool found effective for the dissemination of findings and rec-

ommendations is the epidemiologic bulletin or newsletter. Many countries in the Americas now have such bulletins, some at the regional level. It is important that the findings of maternal mortality committees be included in such epidemiologic bulletins.

Whatever the message, it is important that it be written for a specific audience, focusing on the issues and using language appropriate to the reader. It is also important, particularly for things such as reports and guidelines, that once written, they be distributed and used.

***Nicaragua and Guatemala are among some of the countries that now publish official monthly or quarterly epidemiologic bulletins. These bulletins have been used to publish information about maternal mortality.***

## **B. Interventions: From Data to Action**

***A maternal mortality survey in Jamaica identified eclampsia as the leading cause of maternal death. An intervention was developed in one parish which included establishing more high-risk clinics, training health personnel in how to accurately measure blood pressure, and conducting home follow-up of high-risk women who failed to return for clinic visits. With these targeted interventions, the rate of antepartum eclampsia decreased 38%, and no deaths due to eclampsia occurred in the intervention area. Because this was the most common cause of maternal death, the overall maternal death ratio also fell.***

Interventions can take place at all levels of the health care system — community, formal health care system and intersectoral — and include changes in the attitude, knowledge/skill and resources of the system. Interventions need to address primary, secondary, and tertiary prevention strategies, not just the acute treatment of specific conditions. The Mother-Baby Package (WHO, 1994), developed by WHO, describes areas in which activities can prevent maternal death. Non-medical interventions such as training of professionals, health promotion campaigns, changes in public health policy, reorganization of services, community participation, and broad-scale communications are key components.

- ***Primary prevention (preventing the occurrence of the condition) – Reduce the number of high-risk and unwanted pregnancies through family planning.***
- ***Secondary prevention (early detection and treatment of disease) – Reduce the number and severity of obstetric complications through prepregnancy and antenatal care to prevent problems and detect complications early; clean and safe delivery; postpartum care.***
- ***Tertiary prevention (reducing mortality from complications) – Reduce case fatality rates in women with complications through access to essential obstetric care.***

Interventions can focus on preventing maternal death through any of the following strategies:

Prevent unwanted pregnancies — Provide information and services for family planning, both before and during pregnancy and in the post-partum period.

Decrease the number and severity of pregnancy complications — Increase coverage and improve the quality of care: *Antenatal care* including advice on diet and nutrition, iron and foliate supplementation, tetanus toxoid, STD/HIV prevention. *Delivery care*, clean and safe (atraumatic) delivery. *Postpartum care* including the promotion and support of breast-feeding.

Improve the timeliness of treating complications — Improve problem recognition and referral. Establish a set of protocols based on symptoms and signs of emergency complications. Prevent delays in deciding to seek care. Match provider skills to patient risks. Train health personnel at all levels. Establish protocols for emergency management to signal when an ill woman should be referred. Plan communications systems to alert the referral site to prepare for the woman's arrival. Improve referral. Reorganize services to create a triage system to identify where women with specific complications should be sent. Make sure transportation systems are in working order.

Improve the treatment of complications - Detect early and manage any preexisting condition (e.g., STD/HIV, malaria, anemia, hookworm), antenatal complications (e.g., abortion, toxemia, bleeding, anemia), intra-partum complications (e.g., hemorrhage, eclampsia, prolonged/obstructed labor), and post-partum complications (e.g., hemorrhage, sepsis, eclampsia). Train personnel. Establish protocols and treatment norms. Increase availability of blood transfusion. Make sure drug dispensaries are adequately stocked.

### C. Evaluation

Ideally, when a measure to reduce maternal mortality is begun, those implementing the measure will include plans to evaluate the impact. This should be done by those who implement the action. While a decrease in maternal mortality is the final goal, other indicators should be included in evaluating programs because a maternal death is such a rare event at the local level.

A discussion of evaluation is not in the scope of this document. However, evaluation is discussed in other publications (WHO, 1994; Koblinsky et al., 1995) and include structural, process and outcome indicators. In its evaluation of progress on the Regional Plan for the Reduction of Maternal Mortality in the Americas, PAHO collected annual data from 24 countries for the measures shown in Table 2 for the years 1988 to 1993. These indicators can provide help in evaluating problems and monitoring interventions.



Table 2: Maternal Health Indicators

INDICATORS OF IMPACT					
INDICATOR	1996	1997	1998	1999	2000
Overall Fertility					
Fertility of Adolescents (15-19)					
Maternal Mortality Ratio					
Percent of maternal deaths due to:					
Hemorrhage					
Sepsis					
Hypertension					
Abortion					
Percentage of Low Birth Weight					
Percentage of Maternal Deaths of total deaths to Women 15-49 Years Old					
Number of Cases of Neonatal Tetanus					

INDICATORS OF PROCESS					
INDICATOR	1996	1997	1998	1999	2000
Contraceptive prevalence among women in union 15-49 Years					
Percent of Women Married or Living With Partner					
Percentage of Prenatal Coverage					
Average number of prenatal visits					
Percent seen in first trimester					
Percentage of Institutional Delivery					

INDICATORS OF ACCESS					
INDICATOR	1996	1997	1998	1999	2000
Distance in Time Between the Residences of Pregnant Women and the Nearest First Level and Referral Institutions					

INDICATORS OF QUALITY					
INDICATOR	1996	1997	1998	1999	2000
Percent of C-Section					
Percent of Pregnant Women Vaccinated with Tetanus Toxoid					
Percent of Pregnant Women With VDRL Test					
Number of hospitals with all seven essential obstetrical functions					
Number of maternity waiting homes					
Hospital Lethality Due to Maternal Deaths					

## Issues in Maternal Mortality Surveillance

At the Guidelines meeting held in 1995, participants identified and discussed several additional issues of concern which spanned the entire MMES process.

### A. The Scope of Surveillance

Views about the appropriate scope for surveillance of maternal health cover a broad range. Some feel that maternal deaths are too infrequent to provide adequate numbers for meaningful analysis. Others feel that the identification and investigation of all maternal deaths require too much work and that such activities divert resources that otherwise could be used for interventions.

PAHO strongly recommends that in order to find all maternal deaths, it is necessary to identify all deaths of women of reproductive age and determine the temporal and causal relationship to pregnancy. Finding all deaths will greatly increase the number of pregnancy-related deaths identified; however, it requires additional resources that may not be available. Some countries do not currently have the ability to conduct national surveillance for all maternal deaths. In these cases, a stepwise development of surveillance is advisable. PAHO recommends that, as an initial step, maternal deaths occurring in hospitals be identified and investigated. Surveillance of all maternal deaths could be initiated in a pilot area, chosen either because it was an area of particularly high maternal mortality or because it was an area in which interventions can be easily implemented.

Several participants suggested methods for expanding the scope of MMES beyond the identification and investigation of all maternal deaths. Some countries have expanded maternal mortality surveillance to include late maternal deaths, i.e., deaths up to one year post delivery. The Centro Latino Americano de Perinatología (CLAP) developed and is pilot testing a Perinatal Health Information System, designed to identify all pregnant women who register for antenatal care and monitor their pregnancies prospectively. Some countries with few maternal deaths are exploring ways to identify "near misses," i.e., pregnant or postpartum women with severe morbidity that could have led to death. Others are expanding their activities to look at the potential impact of pregnancy on "non-maternal" causes of death such as intentional (suicide and homicide) and unintentional injuries and infections such as HIV.

### B. Interaction between Identification (Vital Statistics) and Investigation (Maternal Mortality Committees)

#### 1. Providing committees with a list of deaths

Unless vital statistics personnel who register maternal deaths communicate with the personnel conducting maternal mortality surveillance, the death may never be investigated. This communication can be active or passive. Personnel responsible for the investigation can either wait to be informed of a death or else can actively review vital records on a weekly or monthly basis. Many Ministries of Health receive only a single copy of the death certificate for their mortality records.

## 2. Using MMES data to improve vital records based statistics

Another reason it is important for surveillance system personnel to interact with those in charge of vital statistics is so that the official vital statistics are as accurate as possible. Maternal deaths are frequently misclassified as non-maternal, even in developed countries. If an investigation reveals that a death originally classified as non-maternal is, in fact, due to pregnancy, the information on both the death certificate and in vital records ideally should be corrected to reflect this change. Because cause-of-death coding errors undermines accurate assessment of maternal mortality, PAHO strongly encourages the development of correction schemes such as that used in Mexico (see box). There, when a misclassified death is discovered by the surveillance system, it is reported to the vital registration system at the local and regional level, where the correct information is added. Unfortunately, once data reach the national level, the data can no longer be corrected.

A key purpose of surveillance is to make the maternal mortality data that is published is as accurate as possible. Ideally, the same data should be used by the vital statistics unit and the Ministry of Health. An effective surveillance system incorporates information not only from death certificates, but also from other sources for identifying death. Every effort should be made to include these additional maternal deaths in the official reports as well.

***In Mexico, personnel at the local and state levels of the Ministry of Health give regular feedback to personnel in charge of vital statistics at both the local and the national (Instituto Nacional de Estadística, Geográfica e Informática) levels about any errors that they detect in classifying maternal deaths. These are then corrected by vital statistics so that the most accurate information about the cause of death is published.***

## C. Sustainability

Simply sustaining an MMES program requires attention, ongoing activity, and creativity. At the local level, sustaining a program has special challenges. The MMES structure is more likely to be sustainable and acceptable if it is integrated with an existing operating structure. Most countries in the Region already have surveillance systems or mechanisms for investigating some reportable illnesses or deaths, particularly infant mortality, cholera, polio, and measles. One strategy is to build on these successes and incorporate maternal mortality.

Just as there are different views on the appropriate scope of MMES, there are also different views on the appropriate workload for a maternal mortality committee. Too much work, either in terms of the number of cases or the amount of work needed to investigate each case, can lead to poor quality work or even the demise of the maternal mortality committee due to burn-out. The local health unit should not be overwhelmed with “busy work” or tasks that require resources that are unavailable. All activities should be realistic and of value.

On the other hand, several participants at the Guidelines meeting affirmed that committees need a minimum number cases to investigate in order to remain vital. If too few maternal deaths occur at local levels, interest in the problem may fade, and people may turn their attention to other issues that may be less serious but that are more common. In such situations activities may include surveillance of specific risk factors or maternal morbidity.

Few people will continue the often difficult and time-consuming task of investigating a maternal death if they sense that their work is being ignored. Equally important to sustaining activity at the local level is the knowledge that the investigations and recommendations will have an impact and will result in some kind of action at the regional and national levels. Written and verbal feedback are important, but local activities are more likely to continue if it is clear that the reports are being read and that there is a response to the concerns they raise.

***Peru: A pilot project funded by PAHO in an urban sub-region was very successful in investigating maternal death. Resulting recommendations led to improved quality of care in hospitals. Unfortunately, other regions with high rates of maternal mortality did not have adequate funding to conduct similar surveillance.***

***Nicaragua: Community organizations and women's NGO's enthusiastically participated in a newly created maternal mortality committee in one department. Over the next few years, some of the NGOs requested financial assistance for projects to reduce maternal mortality. The Ministry of Health could not provide the funding, so their participation in the committee gradually diminished.***

#### **D. Stability of Surveillance Personnel**

The high turnover of health personnel, especially at the local, rural level, can also interfere with the ability to sustain MMES. Local health units are frequently staffed by physicians and nurses who are required to practice in a rural area for one to two years as part of a 'social service' requirement. When they have completed their social service or move into positions of greater responsibility, they often move back to urban areas. Thus, in some areas, new personnel must be trained in MMES every year. In areas where maternal death is not a common event at the local level, it is difficult to provide adequate training experience for new personnel.

***Honduras: During a 12-month period between 1989 and 1990, a prospective study captured nearly 100% of deaths of women of reproductive age. These deaths were ascertained and investigated by 2 interns, 2 postgraduate students, and 46 physicians fulfilling social service commitments. They identified 381 maternal deaths and 1,361 nonmaternal deaths. (Castellanos et al., 1990) At the end of their service, however, these individuals left for other positions. By 1993, very few provinces continued investigating all the deaths of reproductive-age women, and the number of reported maternal deaths decreased more than 75%.***

#### **E. Funding**

Maternal health programs compete with many other programs for funds, often from shrinking health budgets. Nevertheless, if the reduction of maternal mortality is considered a priority, the necessary funds must be allocated. The most expensive components of maternal mortality surveillance are personnel training and investigation, which requires time and, sometimes, transportation. If MMES can be integrated with other surveillance activities, the incremental increase in cost is minimized. On the other hand, effective interventions to reduce maternal mortality can be expensive. The funding of these interventions requires political will and the decision to make maternal health a priority.



## Closing

Maternal mortality is an important public health problem that affects the individual, the family, and the society. Unfortunately, maternal health programs frequently are forced to operate with meager budgets. Often, the budget for maternal health programs is combined with the budget for infant health, with infant health programs generally allocated the greater share of financial resources. For example, in Colombia only 50 cents (U.S.) are spent on maternal health for every \$10.00 (U.S.) spent on infant health programs. The high profile infant mortality received in the last 15 years has produced excellent results with substantial decreases in most countries. When maternal mortality is addressed with the same vigor, similar progress can be expected. Maternal mortality can be reduced only if it becomes enough of a priority to receive an adequate share of resources.

Surveillance is an important part of any program aimed at reducing maternal mortality. Surveillance data provides vital information to design interventions to impact on maternal health. It also provides critical information about the impact that programs are having on maternal mortality. The risk of dying during any given pregnancy - the maternal mortality ratio - is really the outcome we seek to decrease. While process indicators are helpful, changes in them do not necessarily mean that maternal mortality is being affected. In order to measure whether or not interventions are reducing maternal mortality, ultimately we must measure the number of maternal deaths in the population. This is not to say that interventions must await the development of maternal mortality surveillance. Surveillance systems take time to become operational, so it is important to implement programs which may impact on maternal health. However, simultaneously effort should go into improving the ability to measure the maternal mortality ratio, and the only way to get an accurate assessment of the current maternal mortality ratio is through maternal mortality surveillance.

Maternal mortality surveillance may also be an effective intervention in and of itself. Anecdotes from several countries suggest that the mere practices of focusing on maternal mortality and carefully reviewing all maternal deaths may lead to more careful patient management and a reduction in maternal deaths, even before any formal recommendations are implemented.

Hopefully, these guidelines will be useful to persons developing maternal mortality surveillance, particularly at the local level. Progress has been made in the identification and investigation of maternal deaths. The next step is to analyze the data to provide information for guiding public health policy. There is still very little information about which interventions are successful and which are not. Hopefully, the next edition of these guidelines will include the experiences of PAHO member countries in using maternal mortality information for developing interventions and evaluating the impact on maternal mortality.

### Recommendations from the Workshop

Instituting these broad recommendations can dramatically improve an MMES system:

1. Improve death registration by adding to death certificates a check box indicating whether the death occurred during or within 42 days of pregnancy.
2. Routinely schedule training of new surveillance personnel, particularly in areas with high personnel turnover, such as local level.

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2. Improve the identification of out-of-hospital maternal deaths. Most countries now have hospital maternal mortality committees, but non-hospital deaths are still not uniformly identified and investigated
3. Continue to develop the regional and local maternal mortality committee. (Most countries already have national committees.)
4. Focus more attention on the non-medical causes of death, which often determine whether a woman will live or die. Currently, most investigations of maternal deaths focus almost exclusively on the medical cause of death.
5. Continue to develop interventions for reducing maternal mortality and measuring their impact.
6. Invest in the system. Allocate money for conducting maternal mortality epidemiologic surveillance.

## Glossary

(Adapted from Campbell & Graham, 1991)

**Women of reproductive age** - Definition varies, with the youngest age ranging from 10 to 15 and the older ranging from 45 to 50. PAHO generally includes women ages 15 through 49. All deaths to women of reproductive age must be found before all maternal deaths can be found. In addition, the maternal mortality rate uses the total number of reproductive-aged women as the denominator.

**Maternal death** - According to ICD-9 and ICD-10, a maternal death is the death of a woman while pregnant or within 42 days of the termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Maternal deaths are subdivided into:

**Direct obstetric deaths** - Maternal death resulting from complications of the pregnancy, labor or puerperium or from interventions, omissions or incorrect treatment.

**Indirect obstetric deaths** - Maternal death resulting from previously existing disease that was aggravated by the physiologic effects of pregnancy.

In ICD-10, two new measures of mortality temporally associated with pregnancy were added:

**Late maternal death** - Maternal death resulting from direct or indirect obstetric causes more than 42 days but less than one year after termination of pregnancy. (ICD-10)

**Pregnancy-related death** - Maternal death occurring during pregnancy or within 42 days of termination of pregnancy, irrespective of the cause.

*Pregnancy-related death is a useful measure when the cause of death is difficult to determine and when most maternal deaths in the area are caused by pregnancy.*

**Maternal mortality ratio (MMR)** - One of the most widely used measures of maternal death, the maternal mortality ratio is defined as

$$\frac{\# \text{ maternal deaths}}{\# \text{ live births}} \times 1000$$

Maternal mortality ratio is one of the most widely used measures of the risk of death due to pregnancy. The MMR is a ratio because some of the deaths in the numerator, such as those due to



ectopic pregnancy or abortion, will not be represented by the pregnancies in the denominator. The ideal measure would divide the number of maternal deaths by the total number of pregnancies. However, the total number of pregnancies is impossible to document, even in developed countries.

**Maternal mortality rate** - Not as commonly used an indicator as the maternal mortality ratio, the maternal mortality rate is a true rate, as all women in the numerator (maternal deaths) are included in the denominator (women of reproductive age). The maternal mortality rate is defined as

$$\frac{\# \text{ maternal deaths}}{\# \text{ women of reproductive age}}$$

The maternal mortality rate is affected both by the number of pregnancies experienced by women in the population (i.e., the fertility rate) as well as by the risk of death due to occurrence of pregnancy (MMR). In a population with declining fertility rates, fewer pregnancies will occur; even if the risk of death from each pregnancy is unchanged, fewer women will die due to pregnancy. While the maternal mortality rate will be unchanged, the total number of maternal deaths and the maternal mortality rate will decrease.

**Lifetime risk of death from pregnancy** - A measure related to maternal mortality rate, lifetime risk estimates the chance that a woman will die from pregnancy related causes over her reproductive lifetime, usually given as 30-35 years. It is determined both by the chance of becoming pregnant (fertility) and the risk of death once pregnant (MMR). It is calculated as

$$35 \text{ (years)} \times \frac{\# \text{ maternal deaths}}{\# \text{ to women of reproductive age}}$$

**Proportionate mortality (Percent of deaths due to pregnancy)** - This measure can help establish the importance of pregnancy as a cause of death for women, as the percent of all deaths among women of reproductive age that are due to pregnancy can range from 1% to almost 60% (Campbell and Graham). The proportionate mortality ratio is calculated as

$$\frac{\# \text{ maternal deaths}}{\# \text{ deaths to women of reproductive age}} \times 100$$

**Cause-specific proportionate mortality** - This indicator can provide information on the relative importance of a cause of maternal death compared to other causes of death. It is defined as

$$\frac{\# \text{ maternal deaths due to a specific cause}}{\text{total \# maternal deaths due to all causes}} \times 100$$

Both the cause-specific proportionate mortality and the proportionate mortality work best when data on cause of death are relatively accurate. However, as long as identification and classification of deaths remain consistent, these indicators can be used to monitor trends in causes of mortality.

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## Agenda

Northlake Holiday Inn; Atlanta, Ga ; 18-19 April 1995

- 9:00 Welcome
- 9:15 Introduction to Guidelines Ascertainment
- 9:30 Issues in maternal death ascertainment
- 9:45 Country report on ascertainment #1
- 10:00 Country report on ascertainment #2
- 10:15 Country report on ascertainment #3
- 10:30 Country report on ascertainment #4
- 10:45 — Break
- 11:15 Small group discussion
- 12:45 — Lunch
- 2:00 General group discussion of ascertainment issues
- 3:15 — Break

### ***Investigation***

- 3:45 Issues in maternal death investigation
- 4:00 Country report on investigation #1
- 4:15 Country report on investigation #2
- 4:30 Country report on investigation #3
- 4:45 Country report on investigation #4
- 5:00 — Adjourn

### **19 April 1995**

- 8:30 Small group discussion
- 10:00 — Break
- 10:30 General group discussion of investigation issues

### ***Analysis/dissemination***

- 11:30 Issues in data analysis and dissemination
- 11:45 Country report on analysis/dissemination #1
- 12:00 Country report on analysis/dissemination #2
- 12:15 Country report on analysis/dissemination #3
- 12:30 — Lunch
- 1:30 Small group discussion - Ascertainment
- 2:30 General group discussion of ascertainment issues
- 3:30 — Break
- 4:00 Plenary: uses and dissemination of the Practical Guidelines
- 5:00 — Adjourn

**Country reports** (10 minutes each with 5 minutes for discussion)

***Ascertainment:*** Nicaragua, USA, Colombia, and Bolivia

***Investigation:*** Jamaica, Canada, Mexico, and Argentina

***Data Analysis/Dissemination:*** Guatemala, Brazil, and Puerto Rico

**Atlanta, Ga  
18-19 April 1995  
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