Before you begin this unit, please take the corresponding test at the end of the book to assess your knowledge of the subject matter. You should redo the test after you’ve worked through the unit, to evaluate what you have learned.

**Objectives**

When you have completed this unit you should be able to:
- Explain the importance of mortality rates.
- Describe the concept of a mortality audit.
- List the important steps of a mortality audit.
- Keep a detailed birth register.
- Describe information which can be obtained from a birth register.
- Understand the importance of the low birth weight rate.

## 1 Introduction to maternal and perinatal mortality

### MORTALITY

#### 1-1 What is mortality?

Mortality means death. The mortality in a given area is the number of people who die in that area. Mortality is the most important measurable outcome in a health service.

#### 1-2 What is a mortality rate?

This is the number of people who die, expressed as a proportion of all the people in that area. For example, if 10 people die in a community of 1500 people, the mortality rate is 10 per 1500.

The mortality rate is the proportion of people who have died.

#### 1-3 How is mortality rate expressed?

Mortality rates are usually expressed per 1000 or 100 000 individuals (i.e. as a proportion). For example, the mortality rate for newborn infants is usually given per 1000 infants delivered alive while the mortality rate for
pregnant women is usually given per 100 000 pregnant women who deliver.

1-4 How can mortality rate be applied to groups of people?
A mortality rate is usually given for a specific group of people, e.g. pregnant women or newborn infants, and for a specific area or service, e.g. a town or clinic. Mortality rates may also be applied to people falling in a specific age group such as children, teenagers or the elderly.

For example, the mortality rate could be calculated only for pregnant women between the age of 20 and 25 years of age who live in a certain town.

Mortality rates are often calculated for a specific section of the population only.

1-5 What is the annual mortality rate?
This is the mortality rate calculated over the period of one year. Mortality is usually expressed as an annual rate. Sometimes the mortality rate may be expressed over a longer period such as 10 years.

1-6 Should the mortality rate be calculated for a special area?
Yes. The mortality rate is usually calculated for a given health district or region. In order to determine the mortality rate for a health district or region, all the births and deaths in each part of that service (each clinic and hospital) must be added together. Sometimes the mortality rate is calculated for a whole province or country by combining the results of many regions.

1-7 Is the mortality rate the same for all health districts?
No. The mortality rate often differs markedly between health districts. Usually the rates are higher for poor than industrialised districts.

Similarly, rates are higher in developing than in industrialised countries.

1-8 Do mortality rates remain the same?
No. Mortality rates may also differ between different time periods. In most countries mortality rates have fallen over the past years. Unfortunately this is not always the case in some African countries.

1-9 Why is it often better to know the mortality rate rather than simply the number of people who die?
Knowing the rate if often more useful than simply knowing the number of individuals who die, as it allows you to compare the size of the problem between different areas or over different periods of time. A small hospital with only a few patients each year can then be compared to a large hospital with many patients.

For example, if 10 patients die out of the 1000 patients admitted to a small hospital, and 100 patients die out of the 10 000 patients admitted to the large hospital each year, then the annual mortality rate of both hospitals is the same (i.e. 10 per 1000), even though more patients died in the larger hospital. Therefore, the mortality rates of two very different sized hospitals can be fairly compared.

1-10 Why would one want to know the mortality rate?
Knowing the mortality rate helps to determine both the amount of illness in a community as well as the standard of the health care provided. A high mortality rate suggests either a poor standard of health or a poor standard of health care. Mortality rates are, therefore, very useful in assessing the needs of a community and the efficiency of the health service.
The mortality rate reflects both the amount of illness in a community as well as the standard of health care.

**NOTE** Under special circumstances such as revolution, widespread crime or war, the mortality rate may also be influenced by social and political factors leading to the violent deaths of healthy people.

1-11 Why would you want to compare the mortality rates between two areas?
This will tell you about the differences in living conditions and standards of health care in the two areas. The area with the higher mortality rate either has poorer living conditions or a less efficient health care service. The area with the higher rate may also have some specific illness such as malaria or a specific health problem such as famine.

1-12 Why would you want to compare mortality rates at different times?
It is very useful to compare the mortality rates in a health care service between two periods of time. In some hospitals or health districts the mortality rate may be improving while in another it may be getting worse. An increasing mortality rate indicates a fall in living conditions or a fall on the standard of health care. Sometimes an increasing mortality rate may indicate the arrival of a specific disease such as AIDS or cholera.

1-13 Which mortality rates are usually recorded in a maternity service?
The maternal and perinatal mortality rates. The perinatal mortality rate includes both stillbirths and infant deaths in the first week of life. The following mortality rates should always be recorded:
1. Maternal mortality rate (women who die during or shortly after pregnancy).
2. Stillbirth rate (infants born dead).
3. Early neonatal death rate (infants that die soon after birth, i.e. in the first week of life).
4. Perinatal mortality rate (stillbirths plus early neonatal deaths).
Additional rates, which may be added, are:
6. Infant mortality rate (infants who die in the first year of life).

1-14 Why is it important to know why mothers and infants die?
It is very important to know, not only the mortality rates, but also why mothers and infants die in order that these deaths can be prevented by avoiding or correcting the causes of death.

1-15 What are primary causes of death?
The primary cause of maternal and early neonatal deaths as well as stillbirths is the obstetric factor or condition which resulted in the death, i.e. it is the reason why the death occurred. For example, if a pregnant woman has a placental abruption and the fetus dies, the primary cause of the stillbirth is antepartum haemorrhage. Similarly, a severe antepartum haemorrhage could also be the primary cause of death of the mother. Knowing the primary causes of death helps to identify important medical conditions that need to be prevented and bad clinical practices which need to be improved.

1-16 What are final causes of death?
The final cause of maternal or early neonatal death is the event which actually caused the death (a final complication of the disease process), i.e. how the patient died. For
example, if a woman has an induced abortion and dies of septic shock, the primary cause of the maternal death is the induced abortion but the final cause of death is septic shock. Similarly, if a newborn infant dies as a result of hypoxia (lack of oxygen) caused by eclampsia, the primary cause of death is eclampsia but the final cause of death is hypoxia. Knowing the final causes of death helps to identify facilities and resources, which need to be improved to prevent medical conditions resulting in death.

The final cause of death is the final event which actually resulted in the maternal or early neonatal death.

Note that a final cause of death is usually not recorded for stillbirths.

1-17 What is the value of knowing both the primary and final causes of death?

Because the correct diagnosis and management of the primary cause may prevent the complication which resulted in the death while diagnosing and treating the complication may prevent the final cause of death. For example, it would be best if placental abruption or eclampsia were prevented altogether or correctly diagnosed and treated as early as possible. If this was not possible, it is important that fetal hypoxia can be prevented or diagnosed early, and correctly managed. Every effort should be made to prevent both the primary and final causes of death.

AUDIT

1-18 What is an audit?

This is a systematic assessment (an examination or review). In a clinical service, it is a count of the number of patients and what happens to them. An audit helps one to understand the health related problems which patients have in a service and how effective the service is in managing these problems.

For example, in the audit of a maternity service, the total number of deliveries and the method of each delivery would be important.

1-19 What is a mortality audit?

This is a detailed assessment of all the patients that have died. Both a maternal and perinatal mortality audit is necessary in a maternity service.

A mortality audit is a detailed assessment of the patients who have died.

1-20 Why are mortality audits important?

Because they measure the size of the problem (the number of people who die) and indicate where the problem lies (what causes the deaths). By understanding the problem better (what errors might have been made) solutions can often be found to reduce the risk of similar deaths in future. By decreasing the number of patients who die, the standard of care will automatically improve for all patients.

1-21 What are the important steps of a mortality audit?

1. Documenting the number of people who have died.
2. Collecting the basic information on the people who have died.
3. Calculating the mortality rate.
4. Determining the causes of mortality (or morbidity).
5. Looking for avoidable factors and missed opportunities.
6. Planning ways in which these deaths can be avoided in future.
7. Write a mortality report.

1-22 How can it be determined why a patient has died?

All the information about the patient must be very careful reviewed. Only then can a likely cause of death be decided upon. This information consists of:
1. The history.
2. The examination of the patient.
3. Special investigations.
4. A post mortem examination, if this has been done.

1-23 What is a mortality meeting?
This is a meeting, attended by as many of the medical and nursing staff as possible, where the mortality audit is discussed, i.e. all the facts relating to the deaths are carefully examined. Mortality meetings are needed so that the management of patients who have died can be reviewed. At the mortality meeting a cause of each death must be looked for and possible avoidable factors identified for each person who has died.

1-24 What is a mortality report?
This is an important document, which reports on the mortality audit. It gives the details of the audit and should also summarise the main findings and make recommendations. It is best to write the report at the end of the mortality meeting when all the information is still available. Usually all the mortality reports over a year are used to prepare an annual mortality report.

1-25 Why is the mortality report so important?
The information in the mortality report is used to identify problems within a clinical service and plan interventions to reduce or remove the causes of those problems. An accurate mortality report is essential if the care provided to patients is to be improved.

1-26 What is morbidity?
Morbidity includes all the clinical problems or illnesses that patients suffer but have not died from, e.g. postpartum hemorrhage which did not kill the woman or severe pneumonia which did not kill an infant. Morbidity may result in temporary or permanent damage.

Note Unlike death, which is a definite end point, morbidity can sometimes be difficult to define accurately.

1-27 Why is it important to document morbidity?
While it is important to identify and prevent problems which kill patients, it is also important to address problems, which cause illness without death. To get a complete view of problems in a health service, both mortality and morbidity must be considered. Because morbidity is far commoner that mortality, deaths are only the 'tip of the iceberg'. By studying morbidity, it is possible to get a better idea of the pattern of disease or incorrect management which results in mortality. Where deaths are uncommon, it is particularly useful to study patterns of morbidity. The causes and avoidable factors of mortality and morbidity are usually the same.

1-28 Who is responsible for collecting and analysing mortality information?
Everyone in the service should be involved in keeping good notes and collecting mortality data. Usually one specific person is responsible for making sure that all the important data has been collected and is presented at the mortality meetings. That person usually also records and analyses the information from
the mortality meetings and then writes the mortality report.

1-29 What is a confidential enquiry?
This is an analysis of deaths where the names of the people involved with the care of the patient are kept confidential, i.e. their names are not made known. The names of the individuals who have died are also kept confidential. A confidential enquiry is an important method of collecting the true facts and of finding the cause of a death. Without a confidential enquiry, many people may be afraid of providing all the correct information for fear that they may be punished or embarrassed. A confidential enquiry is particularly useful in the investigation of maternal deaths.

**NOTE** In South Africa, the first confidential enquiry into maternal deaths was conducted in 1998.

### BIRTH REGISTER

1-30 What is a birth register?
This is a book in the labour ward where daily records of all deliveries are kept. The birth register is very important as it is the formal record of all deliveries. It is essential that every delivery is included in the register. Every labour ward must have its own register. Women who deliver in theatre must also be recorded in the labour ward birth register.

The birth register is a most important record of all deliveries.

1-31 What information should be recorded in the birth register?

1. The mother’s name, hospital or clinic number and age.
2. Whether the mother had antenatal care.
3. The mother’s VDRL status.
4. The method of delivery.
5. The Apgar scores.
6. The infant’s birth weight and gender.
7. Whether the infant was born alive or dead and whether live born infants died in the first week of life.
8. Any maternal deaths.

Additional information which is often recorded in a birth register is the mother’s address and contact phone number, her gravidity and parity, and whether she was referred from somewhere else.

**NOTE** The HIV positive rate is becoming a very important measure of the spread of the disease in each community and each woman’s HIV status may also be included in the register, provided that the result is kept strictly confidential.

1-32 What useful information can be calculated from information in a birth register?

1. Teenage pregnancy rate.
2. Rate of attending antenatal care (‘booking rate’).
3. Syphilis rate.
5. Caesarean section rate.
6. Asphyxia rate (low Apgar scores).
7. Low birth weight rate.
10. Referral rate.
12. Percentage of pregnant women aged 35 years or more.

1-33 What is a minimal data set?
This is the basic information which must be collected from the birth register at every clinic or hospital which delivers mothers:

1. The number of live born and stillborn (fresh and macerated) infants as well as the number of early neonatal deaths by weight category.
2. The number of women less than 18 years or older than 34 years.
3. Syphilis status of the mother (negative, positive or unknown). If possible, it is
also important to record the HIV status of each mother.

4. Method of delivery: normal vaginal, assisted (vacuum or forceps), breech or caesarean section.

5. The number of infants born before arrival at the clinic or hospital.

6. The number of women who have received no antenatal care.

7. The number of maternal deaths.

A summary of the minimal data set is usually presented and discussed at the start of each perinatal mortality meeting. The minimal data set reflects the activities of the health centre.

1-34 What is the value of knowing the number of young and older mothers?

The teenage pregnancy rate indicates the well being of a community. A high teenage pregnancy rate indicates many social problems in a community. These problems need to be addressed, especially in the schools.

Older mothers have a higher rate of twins and infants with congenital abnormalities.

1-35 Why measure the rate of women attending antenatal care?

Women who do not attend antenatal care have a much higher perinatal mortality rate. There are many reasons for not attending antenatal clinic, including ignorance, lack of transport, inability to get away from work, fear of revealing the pregnancy, denial of the pregnancy, lack of antenatal care services nearby, unfriendly service at the clinic, and laziness. All these factors need to be addressed to ensure that mothers come early in pregnancy for care.

1-36 Why is the number of women who are screened for syphilis important?

It is essential to screen all pregnant women for syphilis as this infection is a common cause of perinatal death in some communities. It is cheap and easy to screen for syphilis and treat the condition during pregnancy. In many parts of South Africa less than 50% of pregnant women are screened for syphilis. A low rate of syphilis screening indicates poor antenatal care.

A low rate of syphilis screening indicates poor antenatal care.

1-37 Why is the HIV rate determined?

The need for screening all women for HIV is becoming very important, as monitoring the HIV rate in pregnant women is one of the best ways of documenting the spread of HIV in a community. The use of antiretrovirals to reduce the risk of mother to child transmission of HIV must be encouraged while the management of pregnancy, labour and delivery, and the newborn infant may need to be changed in HIV positive women.

A high rate of HIV counselling and screening indicates a good antenatal care service.

1-38 Why is the use of documenting the caesarean section rate?

The caesarean section rate in a developing country should be about 15%. It will be much higher in a referral hospital. A low rate may indicate inadequate care in labour and can be associated with an increased number of intrapartum deaths due to labour complications. A very high rate usually indicates that many unnecessary caesarean sections are being done.

1-39 Why is it important to document whether the mother has been referred?

This information helps to establish the referral pattern. In turn this is important in planning good perinatal services.

A high rate of infants 'born before arrival' (BBA) indicates poor communications and transport services.
1-40 What is the use of knowing the rate of asphyxiated infants?

The percentage of infants with a low 1 minute Apgar score (i.e. neonatal asphyxia) is a useful index of care in labour. Many asphyxiated infants usually indicates poor labour care. The percentage of asphyxiated infants who die gives an idea of the standard of newborn resuscitation.

LOW BIRTH WEIGHT

1-41 How may infants be divided into groups by their birth weight?

It is very useful to divide infants into birth weight categories. This requires little extra effort. Usually 500 g categories are used. The commonly used birth weight categories are 500–999 g, 1000–1499 g, 1500–1999 g, 2000–2499 g and 2500 g or more.

Birth weight categories can be used to investigate stillbirths, neonatal deaths and perinatal deaths.

1-42 What is a low birth weight infant?

All infants weighing less than 2500 g at birth are called low birth weight (LBW) infants. This includes all live born and stillborn infants weighing between 500 and 2499 g. Both preterm delivery and slow intrauterine growth can result in a low birth weight infant.

**NOTE** Infants weighing less than 1500 g are classified as very low birth weight (VLBW) infants while infants weighing less than 1000 g are called extremely low birth weight (ELBW) infants.

1-43 Why is it important to identify all low birth weight infants?

Because they commonly have problems in the first weeks of life and, therefore, need to be assessed for additional care. They often need more than primary care and are transferred to a level 2 or 3 nursery.

1-44 What is the low birth weight rate?

The low birth weight rate is the percentage of infants with a birth weight less than 2500 g. The low birth weight rate is expressed per 100 births (as a percentage), unlike perinatal mortality rates, which are expressed per 1000 births. The low birth weight rate is calculated as follows:

\[
\text{Number of infants weighing less than 2500 g at birth} \times 100
\]

\[
\text{Total number of infants delivered}
\]

1-45 What is the importance of the low birth weight rate?

The low birth weight rate varies widely between different communities and is a very sensitive marker of the socioeconomic status of that community. In an industrialised country the low birth weight rate is usually around 7%. However, in a poor country the low birth weight rate is usually 15% or more (e.g. 30% in India). Knowing the low birth weight rate of different communities helps to identify those communities in greatest need of socioeconomic support.

The low birth weight rate reflects the socioeconomic status of the community.

1-46 What is the low birth weight rate in South Africa?

The average low birth weight rate for South Africa is about 15% which is typical for a poor country. In some very poor areas the low birth weight rate is as high as 25%.

In South Africa the low birth weight rate is about 15%.
1-47 How does the low birth weight rate influence the perinatal mortality rate?

The perinatal mortality rate is higher for infants who weigh less than 2500 g at birth.

CASE STUDY 1

All the perinatal deaths during a 2 year period in a small town are recorded. An attempt is also made to discover the cause of each death. There were 25 perinatal deaths out of a total of 500 deliveries in the 2 years. Ten years before, the perinatal mortality rate was reported to be 75.

1. What is the present mortality rate?

Twenty five deaths out of 500 deliveries, i.e. 25/500. As the perinatal mortality rate is usually expressed per 1000 births, the rate is 50 per 1000. Knowing the mortality rate is more helpful than simply knowing the number of perinatal deaths.

2. Should the rate be expressed over the two year period?

The number of deaths can be counted over any period of time but the rate is usually expressed per year. Therefore, the annual perinatal mortality rate in this small town is 50/1000. It is far better to know the annual mortality rate for the whole town than just in a clinic or hospital as it gives a more accurate indication of what is happening in the community.

3. What is the value of knowing the perinatal mortality rate ten years earlier?

As the perinatal mortality rate has fallen from 75 to 25 per 1000 over 10 years, either the health of pregnant women and their newborn infants has improved or the standard of health care is better. This is a most important way of documenting changes in a health care service. A comparison of the perinatal mortality rate with that of neighbouring towns would also be very useful in assessing whether the town’s rate was higher or lower than expected.

4. Why would it have been important to know if the perinatal mortality rate had increased over 10 years?

Because it would draw the attention of the health care authorities to a serious deterioration in health or health care services or both in the town over the past ten years.

5. Why is it also important to document the cause of perinatal deaths?

Only if the common causes of perinatal deaths are known can plans be made to prevent those deaths. It is very difficult to reduce the mortality rate if the causes of death are not known. Therefore, it is very important to establish the causes of perinatal death in each health district.

6. What is the difference between the primary and final cause of death?

The primary cause of death is the medical condition that lead to that death while the final cause is the complication which actually caused the death. For example, in a pregnant woman, hypertension may be the primary cause of death but a cerebral haemorrhage would be the final cause of death. Correct diagnosis and management of hypertension would prevent the primary cause of death. Failing this, the correct treatment of the haemorrhage may prevent the final cause of death.

CASE STUDY 2

At a regular monthly perinatal mortality meeting in a regional hospital, the information from the birth register is used to present an audit of maternal and perinatal care provided. Important items from the minimal data set are discussed.

1. What is a monthly perinatal mortality audit?

It is an assessment of all the stillbirths and early neonatal deaths which have occurred
during the past month. It is important that regular audits of both maternal and perinatal deaths be conducted in all health facilities.

2. What is a birth register?

This is a book which is kept in each labour ward where daily records of all births are kept. The birth register is very important, as it is the formal record of what happens to all mothers and their infants who are cared for in that service.

3. What is the minimum data set?

This is the most important information which must be recorded in the birth register. It includes the number of maternal deaths, live births, stillbirths and early neonatal deaths, together with the method of delivery and important details of each woman, such as her age and VDRL status. The birth register also includes other less important information, which is usually not given in the minimum data set, such as the gender (sex) and Apgar score of each infant.

4. What useful information can be calculated from the birth register?

The information from the birth register can be used to calculate important rates, such as the maternal, stillbirth, early neonatal death and perinatal mortality rates. Other analyses include the caesarean section, low birth weight and teenage pregnancy rates.

5. What is the value of knowing the rate of women who attend for antenatal care?

Good antenatal care is most important as it lowers both the maternal and perinatal mortality and morbidity rates. If many women are not attending antenatal care, every effort must be made to find out why they are not attending and make plans to increase the attendance rate.

6. What does morbidity mean?

While mortality means death, morbidity means illness and clinical problems which are still important problems but are not severe enough to cause death. Morbidity would include problems such as antepartum and postpartum haemorrhage where the mother does not die. The causes of mortality and morbidity are the same. Therefore, high rates for morbidity are of great concern as they suggest that problems, which could be fatal, are occurring frequently.

CASE STUDY 3

In a health service consisting of one hospital and five clinics, the results of each monthly mortality audit are used to write an annual mortality report. As there were a number of maternal deaths during the year, a confidential enquiry is requested.

1. When are the monthly mortality reports written?

After all the deaths are discussed at the monthly mortality meeting. At the meeting the number and causes of the deaths are discussed. The mortality report is a summary of the mortality meeting.

2. What is an annual mortality report?

It is a report which is written each year and is based on the monthly mortality reports. The annual mortality report summarises the causes of death and indicates which factors associated with the deaths that they could have been avoided. For example, improving the attendance at antenatal clinics may have reduced the deaths due to syphilis. The annual mortality report is useful in planning ways to improve the perinatal care provided by the service.
3. What are the steps of a mortality audit?
The information about each death has to be collected and the important mortality indices calculated. Then the cause and possible avoidable factors for each death must be looked for. Finally, ways of avoiding similar deaths are discussed.

4. How can the cause of death be determined?
By documenting and discussing the results of the history, examination and special investigations, together with the result of the and postmortem examination, if this has been done.

5. What is a confidential enquiry into a maternal death?
This is a detailed investigation into the cause and possible avoidable factors in a maternal death. It is confidential as the names of the staff who cared for the patient are kept secret. By keeping the personal details of the investigation and the staff involved confidential, it is more likely that the true findings will be uncovered.

CASE STUDY 4

The birth weight of each infant is recorded in the labour ward register. At the monthly perinatal mortality meeting, the number of low birth weight infants delivered are counted and the low birth weight rate calculated.

1. What is a low birth weight infant?
Any infant that weighs less than 2500 g at birth.

2. What is the low birth weight rate?
The percentage of all infants born who have a low birth weight.

3. Why is it important to know the low birth weight rate?
Low birth weight infants have a high risk of morbidity and mortality and, therefore, often need more than just primary care. The low birth weight rate is increased in poor communities and is a sensitive marker of the socioeconomic status of that community. The low birth weight rate often varies widely between different communities, regions and countries.

4. What are the low birth weight rates in poor and industrialised countries?
Most poor countries have a low birth weight rate of 15% or more while the rate is usually about 7% in industrialised countries.

5. What is the low birth weight rate in South Africa?
South Africa has a low birth weight rate of 15%. This suggests that most of the communities in the country are poor.