

STUDENT VERSION

***Cases in Population-
Oriented
Prevention***

Maternal Mortality

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Recommended Reading:

Maine D, Chavkin W. Maternal Mortality: Global Similarities and Differences. JAMWA 2002;57:127-130.

Callaghan WM, Berg CJ. Maternal Mortality Surveillance in the United States: Moving Into the Twenty-First Century. JAMWA 2002;57:131-134

Objectives:

At the end of the case, the student will be able:

- To define maternal death (pregnancy-related and pregnancy associated maternal death).
- To accurately report “cause of death” using ICD-10 codes
- To describe limitations in data sources, using death certificates as an example
- To calculate maternal mortality rates to determine racial disparities
- To describe the health status of a population using these rates
- To develop intervention strategies to identify and prevent maternal deaths

Abstract:

Maternal mortality remains an important public health concern, even though it is a rare event. This teaching case introduces five case reports of maternal death to provide a clinical lead into discussions about data sources, such as death certificates, and their limitations. The students will also calculate maternal mortality rates and explore racial disparities in this health indicator. Finally, the students will develop intervention strategies to identify and prevent maternal mortality.

Introduction:

Maternal mortality – the death of a woman due to pregnancy related causes during or within one year following a pregnancy – is an extremely rare outcome of pregnancy in the US today, with an incidence of only 12 deaths per 100,000 live births. Because it represents the worst outcome of pregnancy and because there are significant racial disparities in maternal mortality rates, it remains an important public health concern. It also serves as a sentinel event: a rare adverse health outcome that can serve as a marker of a population’s overall health status and that can be studied to provide insights about factors that contribute to poor health. In resource-poor countries, maternal mortality is much more common than in the US, with rates of over 1,000 per 100,000 live births in some countries.

Section A: Cases of Maternal Death

The New York State Department of Health recently conducted a three year review of maternal deaths, in collaboration with the Centers for Disease Control and Prevention, the New York State chapter of the American College of Obstetricians and Gynecologists, and the New York City Health Department. Following are summaries of five of the cases reviewed.

[Note: Gravidity (G) indicates the order of a woman’s current pregnancy, i.e. G 2 indicates she is pregnant for the second time; Parity (P) summarizes the outcome of past pregnancies,

indicating the number of full-term deliveries, preterm deliveries, abortions (spontaneous and induced), and currently living children.]

Patient A was a 23-year-old single black, Haitian-born woman, G 3, P 1011, with systemic lupus erythematosus (SLE), which had led to significant complications: hypertension and lupus nephritis. She was obese (5'5" tall and 285 pounds) and had a history of asthma. She was insured by Medicaid, but did not have a regular doctor and had received only sporadic care for her SLE and asthma. During her final pregnancy, she received care at a city clinic. She took her sister to appointments whenever possible to help translate between English and Creole. The pregnancy was complicated by fetal demise at 21 weeks, requiring prostaglandin induction for delivery. Following delivery at a community hospital, she developed respiratory distress, pulmonary edema, and salmonella sepsis. Despite antibiotic therapy, her status deteriorated, and she died.

Patient B was a 36-year-old married white woman, G1, P0, with severe mitral valve disease secondary to rheumatic fever during childhood. She was enrolled in a managed care plan, where her primary care provider was an internist. She received prenatal care from a private obstetrician, starting at 10 weeks gestation. She had a long history of frequent shortness of breath attributed to asthma, and she was unable to sleep without several pillows. Her symptoms became worse during the pregnancy. Her obstetrician referred her to a prenatal diagnostic center for "assessment of fetal status", with no mention on the referral form of her cardiac disease. At the diagnostic center, she was told to lie down on an examining table. She soon became severely short of breath, self-administered her asthma medication, and went into cardiac arrest. Resuscitation efforts were unsuccessful.

Patient C was a 34-year-old married African American woman, G 8, P 0252. Her obstetric history included four spontaneous abortions (one at 20 weeks due to incompetent cervix), two preterm pregnancies complicated by preeclampsia, and one hydatidiform mole, which required dilatation and curettage and chemotherapy. She lived with her two children, her husband, and his mother and sister. She and her husband had both abused crack cocaine in the past, but she reported no use in over two years. She had no regular health insurance, but when she was pregnant she was able to enroll in Medicaid. She received prenatal care at a hospital clinic, starting at 15 weeks gestation. During the current pregnancy, at 28 weeks gestation (with cervical suture in place to prevent late spontaneous abortion), she developed preeclampsia and HELLP syndrome (hemolysis, elevated liver enzymes, and low platelets). The cervical suture was removed, and labor was induced with prostaglandin gel and intravenous oxytocin. Fetal bradycardia led to a vacuum assisted delivery. Her postpartum course was complicated by hypertension, encephalopathy, and death due to brainstem herniation. Patient was cared for at a level II hospital, and her obstetrician did not consult with a maternal-fetal medicine specialist.

Patient D was a 24-year-old married white female, Gravida 2, Para 1001 with poorly controlled Type I diabetes mellitus, complicated by hypertension, nephropathy, and neuropathy. Prior to this pregnancy, she had been hospitalized five times for ketoacidosis. She had sporadic health insurance and her primary source of care was a community health center, where the providers reported poor compliance with medications and with diet and exercise recommendations. Her diabetes worsened during the pregnancy, and at 19 weeks,

her condition became life threatening. There was no practitioner readily available with significant experience in second trimester abortions. Her obstetrician had done saline abortions in the distant past and attempted one in this case. Hypertonic saline entered the patient's circulation, and she became comatose following the abortion and died.

Patient E was a 15-year-old black primigravida (G1, P0) who started prenatal care at 22 weeks, when her mother confronted her about the pregnancy. She lived with her mother and two younger siblings. During prenatal care she reported a long history of verbal abuse by her mother. The pregnancy was medically uncomplicated, and she presented to the hospital at 35 weeks in active labor. She developed severe fetal bradycardia and was delivered by cesarean section. During the operation, she developed pulseless electrical activity (electro-mechanical dissociation) and was resuscitated. Over the course of the next three days, two additional operations were necessary because of a ruptured uterine wall that was not identified during the delivery. The uterine rupture led to significant intraperitoneal hemorrhage. Her postoperative course was complicated by tachyarrhythmias, cardiomyopathy, and multiple organ system failure.

Teaching Note: Divide the class into small groups. Have each group choose one of the cases above and discuss the following questions:

Question 1. Was this death preventable?

Question 2. If so, what could have been done differently to prevent it?

Question 3. When the class reconvenes, have each group present prevention opportunities they identified.

Question 4. Discuss recurring issues and strategies for preventing future maternal deaths.

Section B: Classifying Maternal Deaths

Maternal deaths are grouped into several categories, based on the relationship between the death and the pregnancy. Deaths that would not have occurred if the woman had not been pregnant are termed pregnancy-related deaths. Pregnancy-related deaths are often subdivided into two groups: those that are due to complications of the pregnancy itself are referred to as direct maternal deaths, and those that are due to an underlying illness that was exacerbated by the pregnancy are referred to as indirect maternal deaths. Deaths that occur during or within a year after pregnancy, but whose cause is unrelated to the pregnancy itself are termed pregnancy-associated deaths.

Question 1. How would you categorize the following deaths?

- a. 27 y.o. P6016 – postpartum hemorrhage unresponsive to medical intervention
- b. 25 y.o. G3 P2002, 22 weeks pregnant – multiple injuries following motor vehicle crash
- c. 42 y.o. woman – end-stage metastatic breast cancer, found to be 7 weeks pregnant at autopsy
- d. 19 y.o. P1 – 1 week postpartum, antibiotic-resistant wound infection following cesarean delivery

- e. 33 y.o. G2 P0010 – long-standing ulcerative colitis, in remission until 38 weeks gestation, developed fever, abdominal pain, bloody diarrhea, DIC

Question 2. How would you categorize the cases you reviewed in Section A?

Question 3. If you were filling out the death certificate for that patient, what would you list as the immediate and underlying causes of death and as other significant conditions?
(Teaching Note: Obtain blank copies of the death certificate of your state for this exercise.)

Question 4. If you were coding the cause of death, which ICD-10 codes would you assign? (Refer to ICD-10 codes listed in Handout.)

Question 5. Discuss how and where death certificates are filled out, the validity of death certificate data for assessing cause-specific mortality rates, and approaches to improving data quality.

Section C: Maternal Mortality Statistics

The maternal mortality ratio is the number of pregnancy-related deaths (death certificate cause of death in the ICD10 range O00-O99) divided by the total number of live births. Below are statistics for New York State during the period from 1995 through 1997.

	<u>TOTAL</u>	<u>WHITE</u>	<u>BLACK</u>	<u>OTHER</u>
Maternal Deaths	83	32	45	6
Births	791629	568947	165423	57259

Maternal Mortality Ratio
(for Question 1 below)

Question 1. Calculate the maternal mortality ratio for the total population and for each subgroup.

Question 2. Discuss the difference among these ratios, and possible reasons for the difference.

Question 3. Would race-specific maternal mortality ratios be good health indicators for a county to use in its community health assessment? Why or why not?

Studies indicate that counting only deaths where the cause of death on the death certificate is in the ICD-10 range of O00 to O99 seriously underestimates the maternal mortality ratio. This is due to problems in reporting and coding the cause of death. Many maternal causes (e.g. insulin-dependent diabetes mellitus in pregnancy – ICD-10 code O24.0) are miscoded under a similar non-maternal cause (i.e. insulin-dependent diabetes mellitus – ICD-10 code E10).

Question 4. How could we improve death certificate reporting of maternal deaths?

To improve completeness of maternal mortality counts, statisticians use a variety of data sources. In addition to the cause of death, in many states the death certificate includes a

question about whether the person had been pregnant within the past six months. This checkbox can help identify additional maternal deaths. The National Center for Health Statistics reviews all death certificates and generates a “multiple causes of death” file, using all the information available on the certificate, not simply the conditions listed under Cause of Death. Many maternal deaths are found in the multiple-cause file that were not originally reported as maternal deaths, for example deaths originally reported as being due to surgical complications, where the surgery in question was cesarean section. A third approach to finding potential maternal deaths involves linking death certificates to birth, fetal death, and abortion certificates in the previous year to identify women who died within a year following pregnancy. In addition, many states have hospital discharge databases that can be used to improve completeness of maternal death counts.

Question 5. What are the strengths of each approach?

Question 6. What are their weaknesses?

Question 7. What variables would you use to link birth and death certificates to maximize the number and accuracy of matches?

New York State’s hospital discharge database includes the following variables:

- dates of hospital admission and discharge
- patient’s date of birth, gender, address
- discharge status (discharged to home, to long-term care facility, or dead)
- principal diagnosis and up to 14 other diagnoses
- procedures performed during hospitalization

Question 8. Using any of these variables, how would you identify potential maternal deaths?

Handout 1 – Selected ICD-10 Codes (for Question B-4 above)

<u>CODE</u>	<u>DEFINITION</u>
A01	Typhoid and paratyphoid fevers
A02	Other salmonella infections (A02.1 = Salmonella septicemia)
A42	Other septicemia
B20	HIV disease resulting in infectious and parasitic diseases
B16	Acute hepatitis B
E10	Insulin-dependent diabetes mellitus (<i>excludes</i> diabetes mellitus complicating pregnancy)
E66	Obesity
E87	Disorders of fluid, electrolyte and acid-base balance
I05	Rheumatic mitral valve disease
I10	Essential (primary) hypertension
I12	Hypertensive renal disease
I21	Acute myocardial infarction
I42	Cardiomyopathy
I45	Cardiac conduction disorders
I50	Heart failure
I61	Intracerebral hemorrhage
J45	Asthma
L93	Lupus erythematosus
N00	Acute nephritic syndrome
O00	Ectopic pregnancy
O01	Hydatidiform mole
O04	Medical abortion (i.e. any legally induced abortion – surgical or medical)
O10	Pre-existing hypertension complicating pregnancy, childbirth and the puerperium
O14	Gestational hypertension with significant proteinuria (O14.1 = severe pre-eclampsia)
O24	Diabetes mellitus in pregnancy (O24.0 = pre-existing, insulin-dependent)
O35	Maternal care for known or suspected fetal abnormality and damage
O66	Obstructed labor, unspecified
O70	Perineal laceration during delivery
O71	Other obstetric trauma
O72	Postpartum hemorrhage
O74	Complications of anesthesia during labor and delivery
O75	Other complications of labor and delivery
O85	Puerperal sepsis
O87	Venous complications in the puerperium
O88	Obstetrical embolism (O88.1 = amniotic fluid embolism)
O90	Complications of the puerperium, not elsewhere classified
O95	Obstetric death of unspecified cause
O96	Death from any obstetric cause >42 days, but <1 year following delivery
O97	Death from sequelae of direct obstetric causes
O98	Maternal infections & parasitic diseases classifiable elsewhere but complicating pregnancy