

**Maternal Mortality:
The
Epidemiological
Perspective**

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Every minute of every day, somewhere in the world, a woman dies as a result of complications arising during pregnancy and childbirth. The majority of these deaths are avoidable.

For every woman who dies, 20 more are injured.

Maternal death is a tragedy for individual women, for families, and for their communities.

From: *Reduction of Maternal Mortality*. Geneva: WHO, 1999 and Kristof N. <http://www.nytimes.com>

What is a maternal death?
*If she had not been pregnant,
would she have died?*

From: Berg C, et al. (eds.) *Strategies to Reduce Pregnancy-Related Deaths*. Atlanta: CDC, 2001.

- Pregnancy related deaths are caused by:
 - Complications of the pregnancy itself
 - A chain of events initiated by the pregnancy
 - The aggravation of an unrelated condition or event by the physiologic effects of pregnancy
- Cases must be considered individually and are usually (but not always!) straightforward

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- Three questions must be answered:
 - Is the condition or procedure that caused death unique to pregnancy?
 - Is the condition that caused death more likely to occur during or to be exacerbated by pregnancy?
 - What is the temporal relationship between the pregnancy, the condition and death?

What is a maternal or “pregnancy-associated” death?

From: Berg C, et al. (eds.) *Strategies to Reduce Pregnancy-Related Deaths*. Atlanta: CDC, 2001.

- Death of a woman while pregnant or within 1 year (42 days for the WHO/NCHS definition) of termination of pregnancy, irrespective of cause
 - Pregnancy-related (cause related to or aggravated by pregnancy, but not from accidental or incidental causes)
 - Pregnancy-associated-but-not-pregnancy-related (cause unrelated to pregnancy)
 - Undetermined if pregnancy-related

Case Study #1

A 20-year-old female G2P1 with sickle cell anemia has an acute sickle crisis at 28 weeks gestation and dies on the second postpartum day.

Is this death related to pregnancy?

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Case Study #2

A 20-year-old female G2P1 with sickle cell anemia has an acute sickle crisis at 28 weeks gestation and suffers a cardio-respiratory arrest during delivery. She is resuscitated and placed on life support. She survives for 4 months but eventually becomes septic and dies.

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Case Study #3

A 20-year-old female G2P1 with sickle cell anemia gives birth to a healthy baby girl at 37 weeks gestation. Eight months later she develops an acute sickle crisis and dies.

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Is this death related to pregnancy?

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Measures of pregnancy-related mortality: **Mortality ratio**

- Chance of dying due to complications of an individual pregnancy over a specific time period:

$$\frac{\text{Number of pregnancy-related deaths} \times 100,000}{\text{Number of live births}}$$

Measures of pregnancy-related mortality: **Mortality rate**

- Chance of a reproductive-age woman dying of pregnancy complications during a specific time period:

$$\frac{\text{Number of pregnancy-related deaths}}{\text{Number of women of reproductive age}} \times 100,000$$

Measures of pregnancy-related mortality: **Proportional mortality rate**

- The extent to which pregnancy-related deaths contribute to mortality among women of reproductive age (15-49 years old) over a specific time period:

$$\frac{\text{Number of pregnancy-related deaths}}{\text{Number of deaths to women of reproductive age}} \times 100$$

Measures of pregnancy-related mortality: **Lifetime risk of maternal death**

- Probability of maternal death during a woman's reproductive life, usually expressed in terms of odds

Maternal deaths are difficult to count

- Deciding whose death is “pregnancy-related” often involves a review committee—and such committees are a luxury not usually available in poor countries
- As a result, *accurate* statistics on such deaths are quite limited in poor countries (and aren't even complete in the US!)

Some statistics

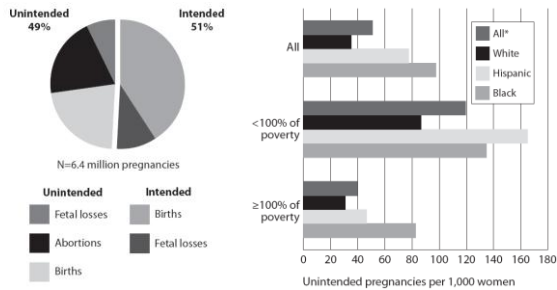
- **Maternal deaths**
 - 11-17% during childbirth itself
 - 50-71% during the postpartum period
- **Stillbirths and newborn deaths**
 - 98% occur in low- and middle-income countries
 - 58% result from obstetric complications

“The care that can reduce maternal deaths and improve women's health is also crucial of newborns' survival and health.”

From: Islam M. *Bull WHO* 2007;**85**:735.

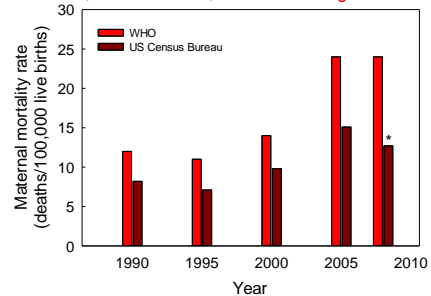
The situation in the US

Unintended pregnancy in the US, 2001: determinants and consequences

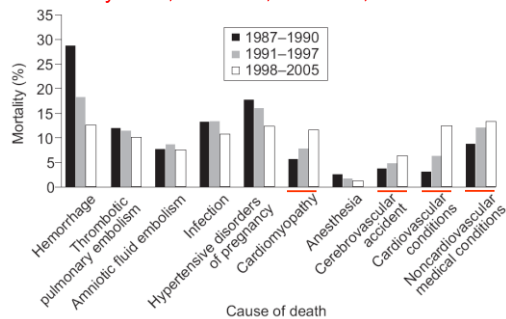


From: Finer LB, Henshaw SK. *Perspect Sex Reprod Health* 2006;38:90.

Estimates of the maternal mortality rate: US, 1990-2007-08, WHO and US government

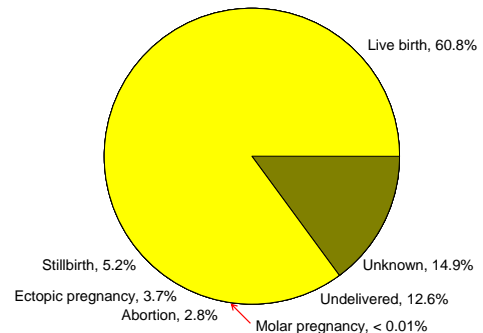


Cause-specific proportionate pregnancy-related mortality: US, 1987-90, 1991-97, 1998-2005



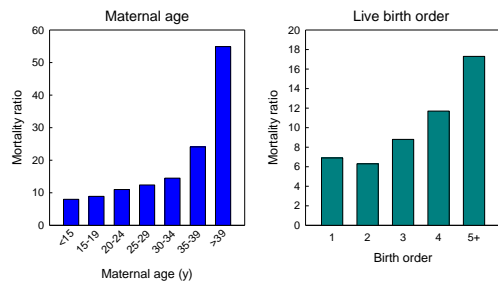
From: Berg CJ, et al. *Obstet Gynecol* 2010;116:1302.

Causes of pregnancy-related death by outcome of pregnancy: US, 1998-2005



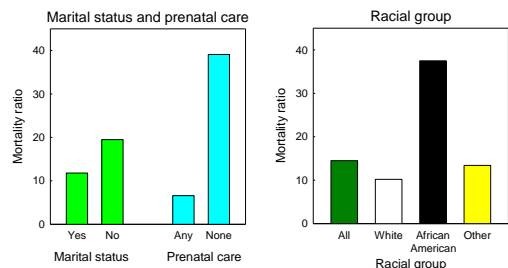
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Predictors of pregnancy-related mortality ratios: US, 1998-2005



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Lessons from the US data

- Maternal mortality is low, but. . .
 - It could be lower
 - It hasn't decreased in the last 30 years
- Maternal mortality rate varies by:
 - Age
 - Birth order
 - Marital status
 - Racial/ethnic group
 - Prenatal care



From UNICEF. State of the World's Children 2009

Change in maternal mortality, 1980-2008: 181 countries

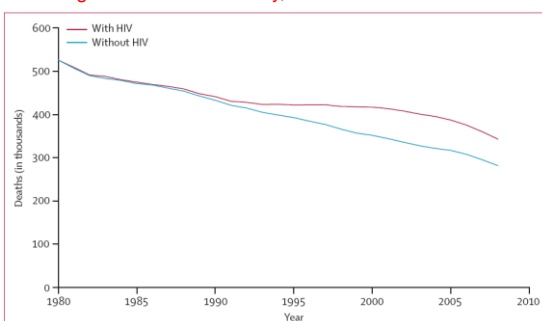
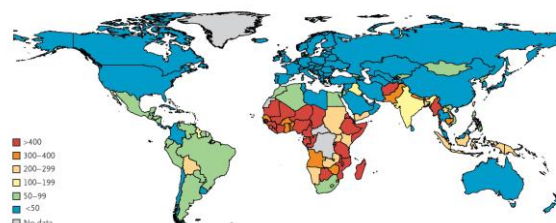


Figure 2: Global maternal deaths, 1980-2008

From: Hogan MC, et al. *Lancet* 2010;375:1609.

Maternal deaths per 100,000 live births in 2010



From: Bhutta Z, Black RE. *NEJM* 2013;369:2226.

Estimates of maternal death by UN MDG regions, 2010

Region	MMR	Number of maternal deaths	Lifetime risk of maternal death (1 in:)
World	210	287,000	180
Developed regions	16	2,200	3800
Developing regions	240	284,000	150
Northern Africa	78	2,800	470
Sub-Saharan Africa	500	162,000	39
Southern Asia	220	83,000	160
Southeastern Asia	150	17,000	290
Western Asia	71	3,500	430
Latin American and the Caribbean	80	8,800	520

From: WHO. *Trends in Maternal Mortality, 1990-2010*.
http://whqlibdoc.who.int/publications/2012/9789241503631_eng.pdf

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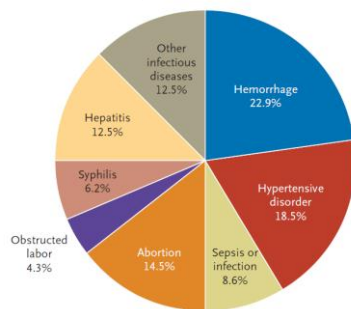
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This difference between developed and developing countries has long been cited as the “largest discrepancy of all public-health statistics”, and is substantially greater than that for child or neonatal mortality.

From: Hill K, et al. *Lancet* 2007;**370**:1311.

Causes of maternal death



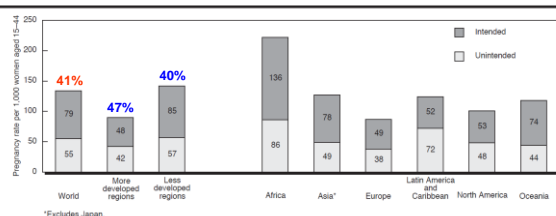
From: Bhutta Z, Black RE. *NEJM* 2013;**369**:2226; redrawn from Lorzano et al. *Lancet* 2012;**380**:2095.

Factors that contribute to maternal deaths in resource-poor countries

- Low status of women and some families
- Poverty at the family and/or community level
- Lack of access to modern family planning
- Child (young adolescent) marriages
- Polygamous (multi-wife) marriages
- Low community-level awareness of danger signs of pregnancy/labor
- Violence (homicide, suicide) in pregnancy
- Rural location (time/distance to health facilities)
- Unwillingness/inability to attend antenatal care
- Weak health systems

From: Nieburg P. *Improving Maternal Mortality and Other Aspects of Women's Health*. 2012.
<http://csis.org/publication/improving-maternal-mortality-and-other-aspects-womens-health>

Rates of unintended and intended pregnancy, worldwide and by region, 2008



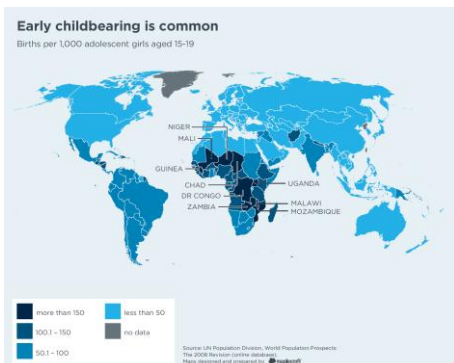
From: Singh S, Sedgh G, Hussain R. *Stud Fam Plan* 2010;**41**:241.

“The world we want: an end to child marriage”

Machal G, et al. (editorial), *Lancet* 2013;**382**:1005.

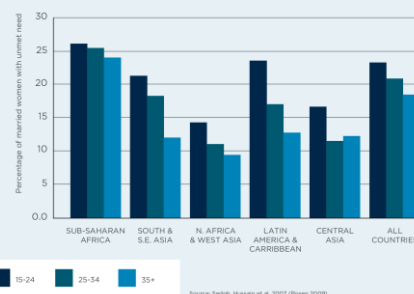


Tahani, 8, is seen with her husband Majed, 27, and her former classmate Ghada, 8, and her husband outside their home in Hajjah, Yemen, July 26, 2010 [see: tooyoungtowed.org]

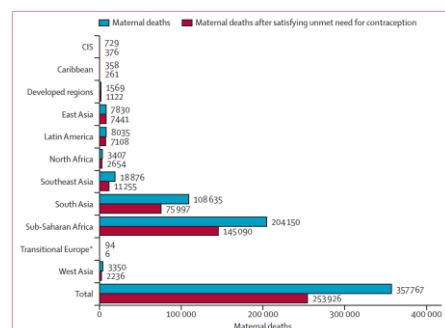


From: Temin M, Levine R. *Start With a Girl: A New Agenda for Global Health*. Washington, DC: Center for Global Development, 2009.

Unmet need for contraception among married women by age and region

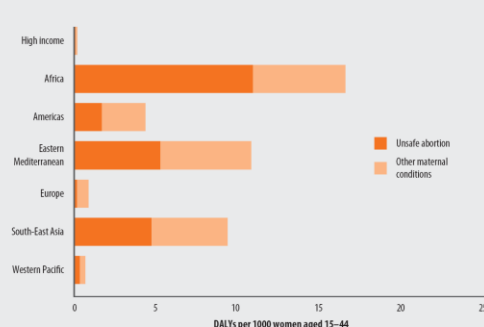


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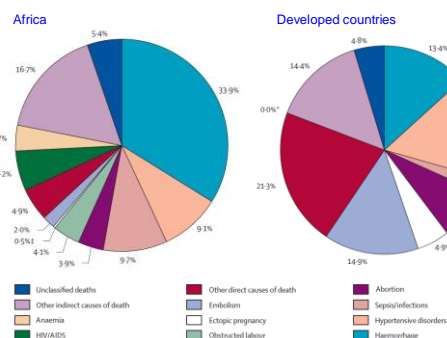
From: Ahmed S, et al. *Lancet* 2012;**380**:111.

Figure 10: Burden of disease attributable to lack of contraception, by WHO region, 2004.



From: WHO. *Global Health Risks: Mortality and Burden of Disease Attributable to Certain Major Risks*. WHO: Geneva, 2009.

Geographical distribution of causes of maternal death

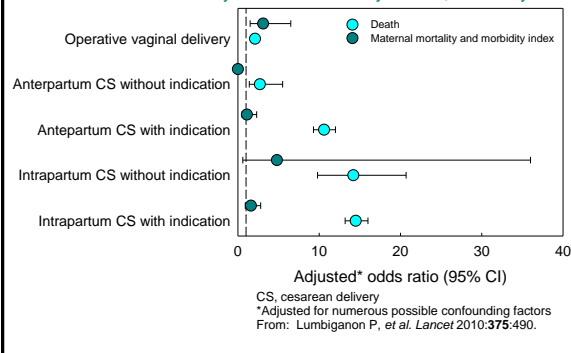


From: Glasier A, et al. *Lancet* 2006;**368**:1585.

Types of birth

- Vaginal
 - Spontaneous
 - Assisted (e.g. forceps)
- Cesarean
 - Without labor
 - After a prior cesarean birth
 - Not after a prior cesarean birth
 - During labor

Risk of maternal mortality and morbidity by method of delivery: WHO, 9-country survey



Maternal mortality ratio varies by income

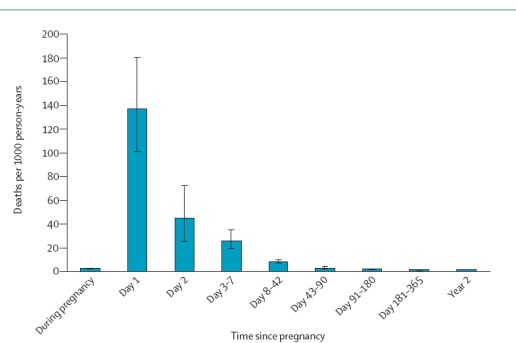
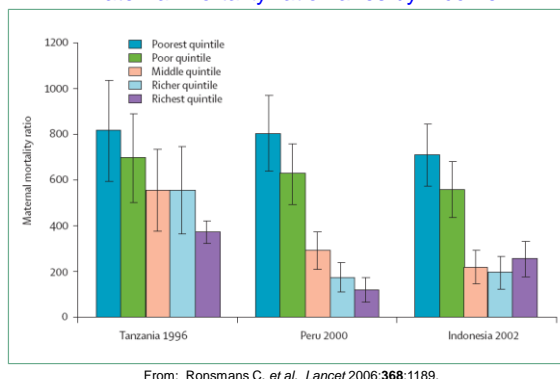


Figure 4: Mortality during pregnancy and by time since end of pregnancy in Matlab, Bangladesh
From: Ronsmans C, et al. *Lancet* 2006;**368**:1189.

Where pregnancy-related deaths occur

- Often in the hospital (receives the sickest women and has more accurate statistics)
- Types of cases:
 - Women who arrive too sick and late to benefit from emergency care
 - Women who could have been saved if they had received timely and effective interventions
 - Women admitted for normal delivery who subsequently developed serious complications and died with or without receiving emergency care

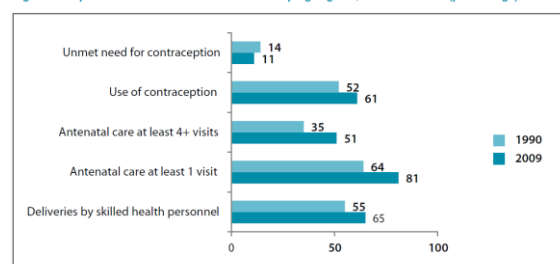
Such cases indicate substandard care and may represent 1/3 of maternal deaths.

MDG 5:

To improve maternal health

- 5A: To reduce maternal mortality rate by 75% between 1990 and 2015**
 - ↓ maternal mortality ratio
 - ↑ proportion of births attended by a skilled attendant
- 5B: To achieve universal access to reproductive health**
 - ↑ use of modern contraceptives
 - ↓ births to women <20 y old
 - ↑ improve antenatal coverage and ↑ number of visits

Figure 2. Reproductive health indicators in developing regions, 1990 and 2009 (percentage)



For contraception, data were available for 1990–2008.
Source: United Nations. *The Millennium Development Goals report 2011*, (46).

From: WHO. *Trends in Maternal Mortality, 1990–2010*.
http://whqlibdoc.who.int/publications/2012/9789241503631_eng.pdf

If this condition [maternal mortality] affected men, governments would take action. Women are considered as machines, machines to produce babies.

A portrait of a woman with dark skin, looking slightly to her left. She is wearing a headwrap and a top with a bold, geometric pattern in green, yellow, and blue. The top has a black lace trim along the neckline and sleeves. The background is a plain, light-colored wall.

Photo: WHO/Chris topher Black
From: http://www.who.int/mcnh/Topic5/pa1_publications/essential_interventions_18_01_2012.pdf