



## 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 need to 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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## Measures of pregnancy-related mortality: **Mortality ratio**

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

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

### 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

### 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

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

### Some statistics

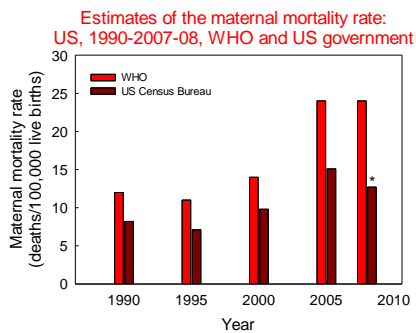
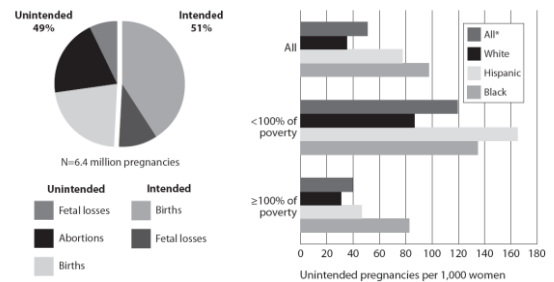
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“The care that can reduce maternal deaths and improve women's health is also crucial of newborns' survival and health.”

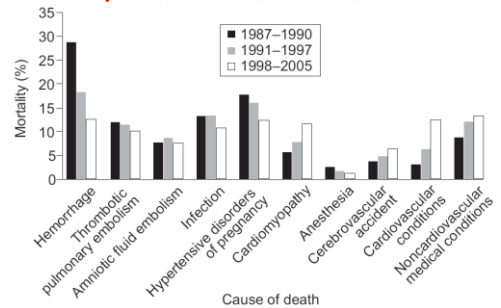
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## The situation in the US

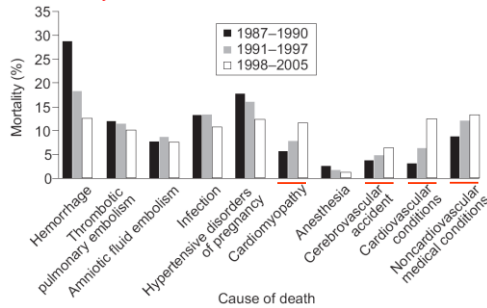
### Unintended pregnancy in the US, 2001: determinants and consequences



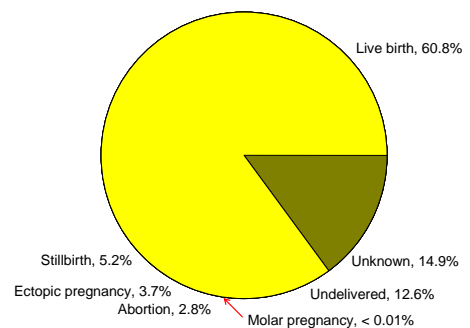
### Cause-specific proportionate pregnancy-related mortality: US, 1987-90, 1991-97, 1998-2005



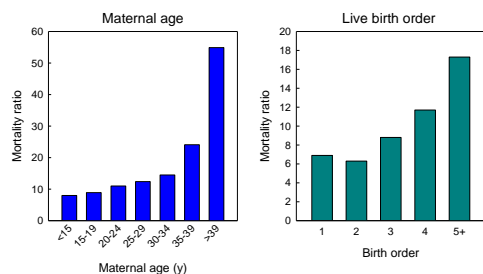
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### Causes of pregnancy-related death by outcome of pregnancy: US, 1998-2005

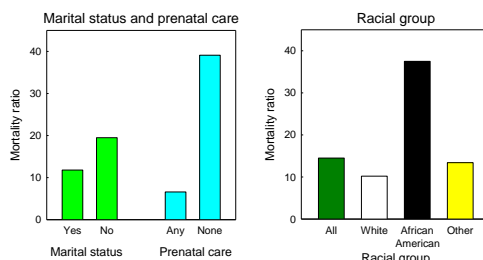


### Predictors of pregnancy-related mortality ratios: US, 1998-2005



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

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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



### Change in maternal mortality, 1980-2008: 181 countries

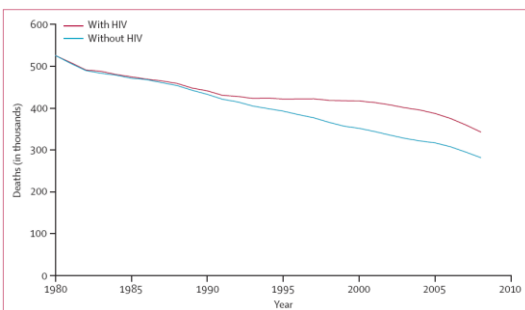
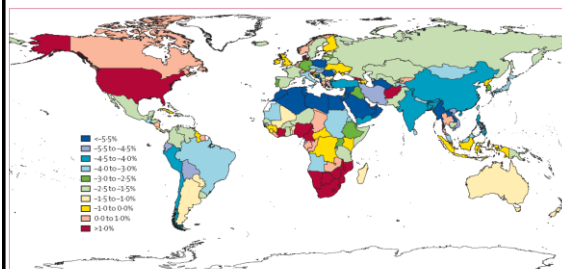


Figure 2: Global maternal deaths, 1980-2008

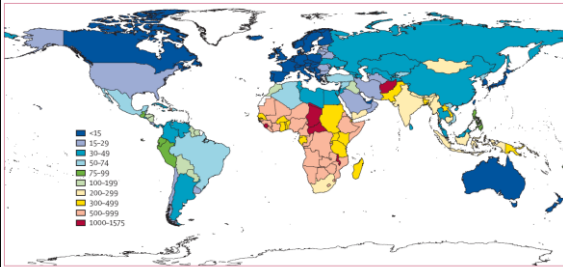
From: Hogan MC, et al. *Lancet* 2010;375:1609.

### Change in maternal mortality ratio: 1990-2008



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

### Maternal mortality ratio per 100,000 live births: 2008



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

### 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](http://whqlibdoc.who.int/publications/2012/9789241503631_eng.pdf)

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### Estimates of maternal death by UN MDG regions, 2010

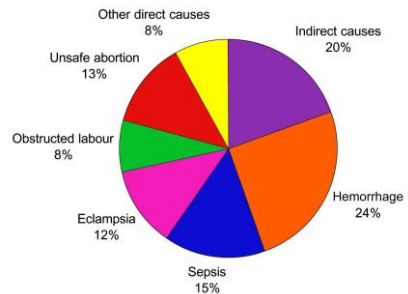
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This difference between developed and developing countries has long been cited as the "largest discrepancy of all public-health statistics", and is substantially greater than that for child or neonatal mortality.

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

### Causes of maternal deaths

Global estimates, which vary in different settings



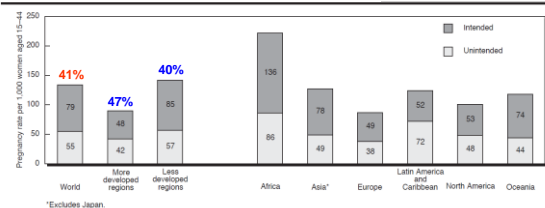
From: WHO. *Reduction of Maternal Mortality, 1999*.

## 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>

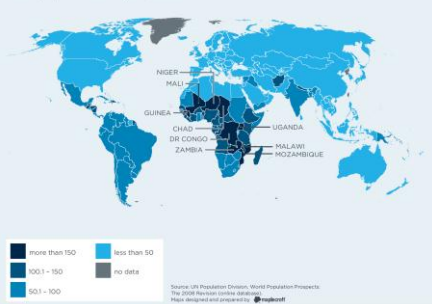
## Rates of unintended and intended pregnancy, worldwide and by region, 2008



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

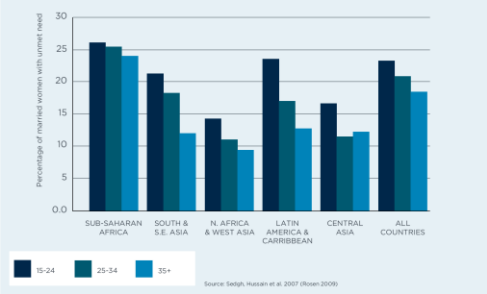
## Early childbearing is common

Births per 1,000 adolescent girls aged 15-19

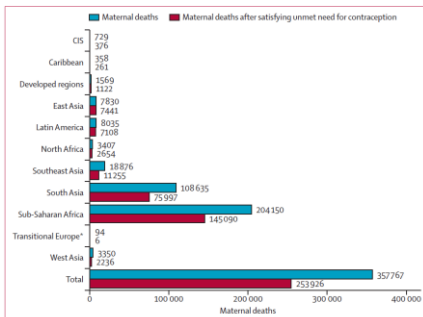


From: Temin M, Levine R. *Start With a Girl: A New Agenda for Global Health*. Washington, DC: Center for Global Development, 2009.

## Unmet need for contraception among married women by age and region

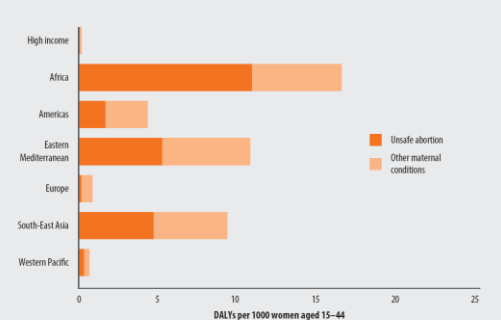


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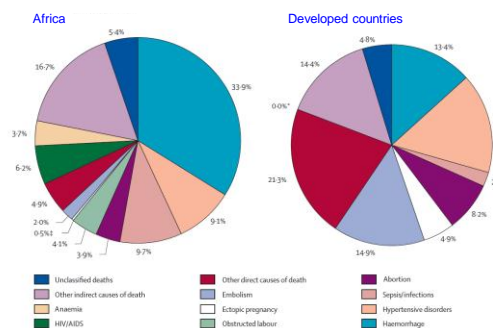
From: Ahmed S, et al. *Lancet* 2012;380:111.

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

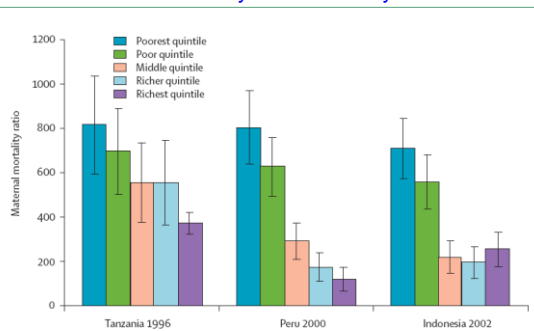


From: Glasier A, et al. *Lancet* 2006;368:1595.

## 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

## Maternal mortality ratio varies by income



From: Ronsmans C, et al. *Lancet* 2006;368:1189.

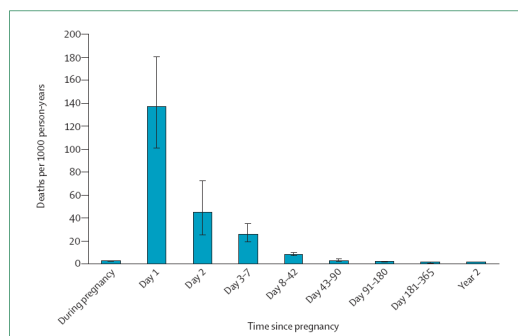


Figure 4: Mortality during pregnancy and by time since end of pregnancy in Matlab, Bangladesh

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

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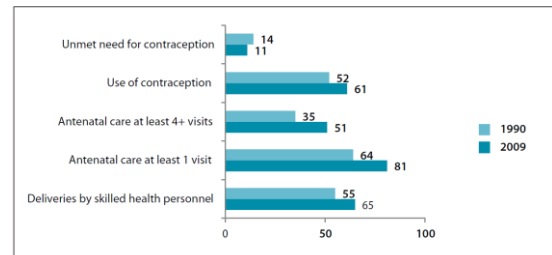
Such cases indicate substandard care and may represent 1/3 of maternal deaths.



## 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](http://whqlibdoc.who.int/publications/2012/9789241503631_eng.pdf)

Poor countries don't care and neither do we, so the rate [of maternal mortality] isn't going to go down.



Photo: WHO Creative Commons Attribution-NonCommercial-ShareAlike license. Source: [http://www.who.int/pmnch/working\\_group/publications/mmaternal\\_interventions\\_18\\_01\\_2012.pdf](http://www.who.int/pmnch/working_group/publications/mmaternal_interventions_18_01_2012.pdf)

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

--Nicholas Kristof, *New York Times*



Photo: WHO Creative Commons Attribution-NonCommercial-ShareAlike license. Source: [http://www.who.int/pmnch/working\\_group/publications/mmaternal\\_interventions\\_18\\_01\\_2012.pdf](http://www.who.int/pmnch/working_group/publications/mmaternal_interventions_18_01_2012.pdf)