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“Fate has allowed humanity such a pitifully meagre coverlet that in pulling it over one part of the world, another has to be left bare …”

Rabindranath Tagore  (May 10, 1893)
Maternal Mortality Ratio in 2011
(273,500 deaths)

Under-Five Mortality Rate in 2011
(7.2 million under 5 deaths)

Country variation in stillbirth rates at least ~ 2.65 million stillbirths

## Top 10 countries for numbers of stillbirths, neonatal and maternal deaths

<table>
<thead>
<tr>
<th></th>
<th>Ranking for neonatal deaths</th>
<th>Ranking for maternal deaths</th>
<th>Ranking for stillbirths</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Pakistan</td>
<td>3</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>China</td>
<td>4</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>DR Congo</td>
<td>5</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>7</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Indonesia</td>
<td>8</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Afghanistan</td>
<td>9</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Sudan</td>
<td>10</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

- **India**: 1.5 million neonatal deaths, 1.77 million stillbirths
- **Nigeria**: Approx 67% of global total neonatal deaths, Approx 63% of global total stillbirths
- **Pakistan**: 178,000 maternal deaths
- **DR Congo**: Approx 65% of global total maternal deaths

Timing of maternal & newborn deaths (PDHS 2007)

- Maternal deaths
- Newborn deaths

Time of death (days)
Where?
The countries with highest neonatal mortality rates

1. Somalia (52)
2. Mali (48)
3. DR Congo (46)
4. Sierra Leone (46)
5. Afghanistan (45)
6. Central African Republic (43)
7. Burundi (42)
8. Angola (41)
9. Pakistan (41)
10. Chad (41)

90% of the 20 highest NMR countries are in Africa.

Many have recent & ongoing conflict.

The need to focus on strategies for newborn care in emergencies & conflict zones.
2.6-3.0 million fewer under 5 child deaths annually!

Reduction in global U5MR by disease, 2000 to 2010
Deaths per 1,000 births

~50% of the reduction comes from pneumonia, diarrhea, and measles

Change in neonatal mortality (1990-2009)
Maternal mortality ratio = 4.2%
1-59 month mortality rate = 2.5%
Neonatal mortality rate = 1.8%
All 3 measures show increased progress since 2000

<table>
<thead>
<tr>
<th>REGION</th>
<th>Neonatal Average annual change</th>
<th>WHEN WILL ALL REGIONS REDUCE NMR TO THE CURRENT RATE OF HIGH INCOME COUNTRIES (3 per 1000)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>&lt; 1%</td>
<td>2165</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>1.5%</td>
<td>2115</td>
</tr>
<tr>
<td>Southeast Asia</td>
<td>2.2%</td>
<td>2085</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>3.3%</td>
<td>2040</td>
</tr>
<tr>
<td>Americas</td>
<td>3.4%</td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>3.5%</td>
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</table>

Global Progress to MDG 4 for child survival

3.1 million neonatal deaths, 40% of all under-five deaths
The causes?
Global causes of child death for 2000

Newborn deaths invisible in 2000

Estimates did not include specific neonatal causes, and were placed within the categories of perinatal causes and other causes.
Global causes of child death for 2010

Number 1: Pneumonia
Number 2: Preterm birth

- **Pneumonia**: 40%
- **Preterm birth complications**: 14%
- **Intrapartum-related events**: 9%
- **Sepsis/meningitis**: 5%
- **Other**: 2%
- **Congenital abnormalities**: 4%
- **Tetanus**: 1%
- **Diarrhoea**: 10%
- **Malaria**: 7%
- **Injury**: 5%
- **Measles**: 1%
- **AIDS**: 2%
- **Other conditions**: 18%

18% of living under-5 handicapped children in Hala & Matiari had a history suggestive of perinatal asphyxia.
The case for prematurity
PREGNANCY

First Trimester // Second Trimester // Third Trimester

<table>
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<tr>
<th>Months</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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TOTAL BURDEN OF PRETERM BIRTH

BORN ALIVE
Preterm birth (<37 weeks gestation)
- Extremely preterm (<28 weeks)
- Very preterm (28 - <32 weeks)
- Moderate or Late preterm (32 - <37 weeks)

Term (37 - <42 weeks)
Post-term (42 weeks or more)

Differing lower cut off for preterm birth definition from 20 to 28 weeks

Miscarriage

Stillbirths
- Early definition (ICD): Birthweight ≥ 500 gms or ≥ 22 weeks completed gestation
- Stillbirth international comparison definition (WHO): Birthweight ≥ 1000 gms or ≥ 28 weeks completed gestation

Differing lower cut off for stillbirth definition from 18 to 28 weeks

BORN TOO SOON

24 weeks: 50% chance of survival with neonatal intensive care (most HIC countries)

34 weeks: 50% chance of survival in many LMIC countries

Born Too Soon: The global action report on preterm birth, 2012
Global burden of prematurity

Number of preterm births, year 2010

- <5,000
- 5,000 - <10,000
- 10,000 - <50,000
- 50,000 - <100,000
- 100,000 - <250,000
- 250,000 or more

Data not available
Not applicable

0 1,500 2,500 5,000 kilometers
Preterm birth is a DIRECT cause of 35% of all neonatal deaths.

Moderate to late Preterm also increases risk of mortality.

Approx 50% of neonatal deaths, are preterm.

Liu et al Lancet 2012
Outcomes related to low birth weight

Stillbirth

Factors during labour
Factors during pregnancy
Pre-pregnancy factors

Interventions to prevent Prematurity/SGA

Appropriate care of LBW infant

LBW infant
- Preterm
- Preterm/SGA
- Term SGA
- Term AGA

Complications of preterm birth

Complications of SGA

Neonatal death

Disability
Poor growth

Healthy development

Pre-pregnancy factors
Factors during pregnancy
Factors during labour

Prematurity
Prematurity AND growth retardation
Defining Preterm Birth: challenges

- Low Birth Weight: infant with birth weight less than 2500g regardless of gestational age
- Preterm: infant born before 37 weeks of gestational age
- Intrauterine Growth Restriction: infant small for gestational age (below 10th percentile)
The relationship of prematurity & IUGR

VLBW live births (AKUMC 1987-2000)
Weight vs Gestational age in 9 Asian datasets (n=90,978)

- Normal Birth Weight: N=5,711 (7%)
- Low Birth Weight: N=3,020 (4%)
- Preterm (37 wks): N=2,748 (4%)
- Full-term: N=38,297 (49%)
- N=16,656 (21%)
- N=11,616 (15%)

“Term Low birth weight”

%’s are of total 90,978 infants
Katz et al (CHERG unpublished. Do not cite)
Weight vs Gestational age in 9 African datasets (n=38,948)

- Normal Birth Weight
  - N=1949 (5%)
  - N=26,567 (68%)
  - N=6,230 (16%)
  - N=2610 (7%)

- Low Birth Weight
  - N=885 (2%)
  - N=707 (2%)
  - N=2610 (7%)
  - Full-term
  - Preterm 37 wks

%’s are of total 38,948 infants
Neonatal Mortality Relative Risk by Prematurity and Small-for-Gestational-Age categories

Katz et al (CHERG unpublished). Do not cite
Timing of cause-specific neonatal mortality

Population-based sample, Verbal autopsy, Uttar Pradesh, India (N=1048)

Over half of all preterm deaths are late, usually associated with infections!

“The facts are always less than what really happened!”

Nadine Gordimer
The causes of the causes?
The nature of poverty

“We think sometimes that poverty is only being hungry, naked and homeless. The poverty of being unwanted, unloved and uncared for is the greatest poverty ....”

Mother Teresa
Inequity in Birth preparedness

%  
Pregnancies Protected against Tetanus
Facility Births

Poorest  Second  Third  Fourth  Richest

PDHS 2007
Inequity in Birth Preparedness

- %
- Pregnancies Protected against Tetanus
- Discussed place of birth
- Made financial arrangements
- Facility Births

PDHS 2007
Underlying causes of newborn deaths
Hala (2000)

- Poverty: 41%
- Socio-cultural / Behavioral factors: 41%
- Health System Issues: 37%

- Unknown: 7%
- Lack of money: 15%
- Family unsure: 18%
- No problems noted: 15%
- Not referred by physician: 17%
- Delayed referral: 20%
- Husband absent: 8%
Resuscitation skills of staff (FATA & Swat)

- **FATA**:
  - LHV: 66.7
  - RMO's: 43.3

- **SAWAT**:
  - LHV: 44.9
  - RMO's: 23.4

- **Overall**:
  - LHV: 50.8
  - RMO's: 36.1
Referral Hospital

**Tertiary**
University Hospital

**Secondary**
District General Hospital
Sub-district Hospitals

35-40% - 5-10%

**Primary**
Rural Health Center

50-60%

Village Health Units
Care Seeking patterns Neonatal Deaths

- Prematurity
- Birth Asphyxia
- NN-infections

- First day of illness
- 2nd-3rd day of illness
- 4th-8th day of illness
- >8th day of illness
- Never sought care
Why can’t we implement what we know?
Average annual rate of change for causes of neonatal deaths 2000-2010

- Public health interventions
- Frontline workers, commodities and health system solutions

- Tetanus
- Diarrhoea
- Neonatal infections
- Intrapartum related
- Preterm birth complications
- Other neonatal causes
- Congenital abnormalities

67% of neonatal deaths

Mortality data from Li Liu et al Lancet 2012
Back to Preterm Births
Promoting Behavior Change
Demand Creation

Scaling up
Implementation Research

Integration as packages of care
Referral Systems

INNOVATIONS TO FACILITATE DELIVERY

Coverage gap

Coverage (%)

Facility-based births
Early initiation of breastfeeding
Thermal care
Hygienic care and skin care
Neonatal resuscitation
Kangaroo Mother Care
Case management of illness
Management of RDS including CPAP
Full neonatal intensive care

Essential newborn care
Extra care for preterm babies

Born Too Soon:
The global action report on preterm birth, 2012
Innovation pipeline

- 70% of the public sector linked projects on innovations were based on cell phones or digital platforms.

- Others largely included business, social marketing and franchise models.

- Few addressed neglected or orphan technologies.
More than half (58%, range across regions 17% to 74%) of births not weighed at birth and even less have reliable gestational age.
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### Preterm births & mortality

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<th>Morbidity &amp; Long term complications/disability</th>
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<td>CHX in Clean Birth Kits</td>
<td>No early screening system tested in LMICs</td>
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Anemia detection

Hypothermia prevention

LBW & prematurity risk assessment

Substitute to IV therapy

Low cost hand scrubs

Rapid detection & treatment of infection
“My greatest challenge has been to change the mindset of people. Mindsets play strange tricks on us. We see things the way our minds have instructed our eyes to see”