Maternal Mortality and Severe Morbidity
A Global Perspective

Professor James Walker,
Obstetrics and Gynaecology,
University of Leeds, UK
My Background

• Chairman of National Caesarean Section Audit
• National Professional Advisor (Maternity) – NPSA
• Chairman of CMACE (Confidential Enquiries)
• Senior Vice-President (Global Health – RCOG)
• National Professional Advisor (Maternity) – CQC

• No Conflict of Interests
In 1631, Shah Jahan, emperor of the Mughal Empire was grief-stricken when his third wife, Mumtaz Mahal, died during the birth
• In 1631, Shah Jahan, emperor of the Mughal Empire was grief-stricken when his third wife, Mumtaz Mahal, died during the birth of their 14th child.
• She was married at 14
• 7 of her children died
In 1631, Shah Jahan, emperor of the Mughal Empire was grief-stricken when his third wife, Mumtaz Mahal, died during the birth of their 14th child.

- She was married at 14
- 7 of her children died
- In a conflict area
- Teenage Bride
- Teenage pregnancy
- Grand Multiparity
- Conflict area
- Probable PPH
- Lack of skills
- Lack of transport
- Lack of resources
- Lack of medical care
- Lack of pregnancy spacing
# Global Maternal Deaths

<table>
<thead>
<tr>
<th>Cause</th>
<th>Incidence of complication (% of live births)</th>
<th>Number of cases (2000)</th>
<th>Case fatality rate</th>
<th>Maternal deaths (n)</th>
<th>Percentage of all Direct deaths (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemorrhage</td>
<td>10.5</td>
<td>13,795,000</td>
<td>1.0</td>
<td>132,000</td>
<td>28</td>
</tr>
<tr>
<td>Sepsis</td>
<td>4.4</td>
<td>5,768,000</td>
<td>1.3</td>
<td>79,000</td>
<td>16</td>
</tr>
<tr>
<td>Preeclampsia, Eclampsia</td>
<td>3.2</td>
<td>4,152,000</td>
<td>1.7</td>
<td>63,000</td>
<td>13</td>
</tr>
<tr>
<td>Obstructed labour</td>
<td>4.6</td>
<td>6,038,000</td>
<td>0.7</td>
<td>42,000</td>
<td>9</td>
</tr>
<tr>
<td>Abortion</td>
<td>14.8</td>
<td>19,340,000</td>
<td>0.3</td>
<td>69,000</td>
<td>15</td>
</tr>
</tbody>
</table>

* These estimates have been developed for WHO calculations of the global burden of disease and are based upon both literature review and expert consensus; the full results will be published in future issues of the World Health Report.
Map of Maternal Mortality, Worldwide

2000
Maternal deaths per 100,000 Live Births

## MMR, deaths and Lifetime Risk

<table>
<thead>
<tr>
<th>Region</th>
<th>MMR&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Range of MMR uncertainty</th>
<th>Number of maternal deaths&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Lifetime risk of maternal death&lt;sup&gt;a&lt;/sup&gt;: 1 in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>460</td>
<td>360 - 680</td>
<td>165,000</td>
<td>46</td>
</tr>
<tr>
<td>Sub-Saharan Africa</td>
<td>500</td>
<td>400 - 750</td>
<td>162,000</td>
<td>39</td>
</tr>
<tr>
<td>Eastern and Southern Africa</td>
<td>410</td>
<td>310 - 580</td>
<td>58,000</td>
<td>52</td>
</tr>
<tr>
<td>West and Central Africa</td>
<td>570</td>
<td>430 - 910</td>
<td>94,000</td>
<td>32</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>170</td>
<td>110 - 280</td>
<td>17,000</td>
<td>190</td>
</tr>
<tr>
<td>Asia</td>
<td>160</td>
<td>120 - 230</td>
<td>106,000</td>
<td>270</td>
</tr>
<tr>
<td>South Asia</td>
<td>220</td>
<td>160 - 320</td>
<td>83,000</td>
<td>150</td>
</tr>
<tr>
<td>East Asia and the Pacific</td>
<td>82</td>
<td>60 - 120</td>
<td>23,000</td>
<td>680</td>
</tr>
<tr>
<td>Latin America and Caribbean</td>
<td>81</td>
<td>68 - 99</td>
<td>8,800</td>
<td>520</td>
</tr>
<tr>
<td>Central and Eastern Europe and the Commonwealth of Independent States</td>
<td>32</td>
<td>28 - 39</td>
<td>1,800</td>
<td>1,700</td>
</tr>
<tr>
<td>Industrialized countries</td>
<td>12</td>
<td>11 - 14</td>
<td>1,400</td>
<td>4700</td>
</tr>
<tr>
<td>Developing countries</td>
<td>240</td>
<td>190 - 330</td>
<td>284,000</td>
<td>150</td>
</tr>
<tr>
<td>Least developed countries</td>
<td>430</td>
<td>340 - 620</td>
<td>121,000</td>
<td>52</td>
</tr>
<tr>
<td>World</td>
<td>210</td>
<td>170 - 300</td>
<td>287,000</td>
<td>180</td>
</tr>
</tbody>
</table>
Figure 3. Maternal mortality from 1870 to 1993 in Sweden, the USA and England & Wales
Figure 3. Maternal mortality from 1870 to 1993 in Sweden, the USA and England & Wales
Interventions: Antenatal Care

• Antenatal care clinics started in US, Australia, Scotland between 1910–1915
• New concept - screening healthy women for signs of disease
• By 1930’s large number (1200) ANC clinics opened in UK
• No reduction in maternal mortality
Figure 3. Maternal mortality from 1870 to 1993 in Sweden, the USA and England & Wales
1940 - UK

- Maternal death rate 2.9 per 1000
  - Puerperal fever
  - Haemorrhage
  - Convulsion

- Then came
  - Ergometrine
  - Sulphonamides
  - Blood
  - Anaesthetics
  - Better surgery
Maternal mortality by cause (E&W) 1935-78

Deaths per 100,000 total births

- Abortion and miscarriage
- Prolonged labour, trauma and other causes
- Toxaemia
- Haemorrhage
- Puerperal sepsis
- Puerperal phlebitis, thrombosis and embolism

Source: General Register Office and OPCS, Reproduced in Birth counts, Table A10.1.3.
Graph by Alison Macfarlane
The Global Health Research/Care Cycle

1. Identify problems
2. Collect information
3. Analyse the results
4. Recommendations for action
5. Implement, Evaluate and refine
Maternal Mortality in the UK

1952-54
- 90 per 100,000 maternities

2006-08
- 8.5 per 100,000 maternities

2012-14
- 11 per 100,000 maternities
The Global Health Research/Care Cycle

1. Identify problems
2. Collect information
3. Analyse the results
4. Recommendations for action
5. Implement
   - Evaluate and refine
Maternal Mortality

• Lessons the same the world over
• Learn from our (and others) mistakes
• Learn from our (and others) successes
• We have been there, we can all improve
• Develop solutions
• Solutions cannot be achieved in isolation
Maternal Mortality and Morbidity

• Risk assessment
  – Antenatal Care

• Prevention
  – Ergometrine/caesarean section

• Management
  – Sulphonamides/antibiotics/antihypertensive drugs

• Rescue
  – Blood/Aнаesthesetics/Skilled Doctors
UK Mortality 2000-2002

- Anaes: 6%
- Sepsis: 10%
- Early: 14%
- AFE: 5%
- PPH: 16%
- PET: 13%
- Other: 8%
- VTE: 28%

1/10000

Scotland Morbidity 2003-2005

- Other: 18%
- PET: 6%
- VTE: 2%
- Sepsis: 3%
- Anaes: 2%
- AFE: 0%
- Early: 0%
- PPH: 69%
Trends in Maternal Mortality: 1990 to 2010

WHO, UNICEF, UNFPA and The World Bank estimates
Changes in Maternal Mortality by World Region, 1990 and 2005

Maternal Deaths per 100,000 Births

Causes of Maternal Mortality

Pregnancy and Childbirth-Related Deaths to Women, by Cause

- Severe Bleeding: 25%
- Infections: 15%
- Unsafe Abortion: 13%
- Eclampsia: 12%
- Obstructed Labor: 8%
- Other Direct Causes: 8%
- Indirect Causes: 20%

Note: Total exceeds 100 percent due to rounding.
• Over three-quarters of maternal deaths are due to direct complications of pregnancy and childbirth,
  • such as severe bleeding, infection, unsafe abortion, hypertensive disorders (eclampsia), and obstructed labor.

• Women also die of indirect causes aggravated by pregnancy,
  • such as malaria, diabetes, hepatitis, and anemia.
Maternal Mortality morbidity - under resourced world

MMR 1:150
Estimation of mortality from the main obstetric complications worldwide and impact of possibly preventable deaths. -WHO-1994

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Number of Death</th>
<th>% of Deaths</th>
<th>Possible preventable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>127 000</td>
<td>25%</td>
<td>55%</td>
</tr>
<tr>
<td>Sepsis</td>
<td>76 000</td>
<td>15%</td>
<td>75%</td>
</tr>
<tr>
<td>Preeclampsia/eclampsia</td>
<td>64 000</td>
<td>12%</td>
<td>65%</td>
</tr>
<tr>
<td>Obstructed labour</td>
<td>38 000</td>
<td>8%</td>
<td>80%</td>
</tr>
<tr>
<td>Unsafe abortion</td>
<td>67 000</td>
<td>13%</td>
<td>75%</td>
</tr>
<tr>
<td>Other direct causes</td>
<td>39 000</td>
<td>8%</td>
<td>---</td>
</tr>
<tr>
<td>Indirect cause</td>
<td>100 000</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>510 000</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
The Global Health Research/Care Cycle

1. Identify problems
2. Collect information
3. Analyse the results
4. Recommendations for action
5. Implement
6. Evaluate and refine
The flawed assumption:
Most life-threatening obstetric complications
    can be predicted or prevented
There needs to be rescue services
Reason’s ‘swiss cheese’ model

- Environment
- Defences, barriers and safeguards
- Lack of care and facilities
- Lack of transport and drugs
- Lack education and empowerment
- Problem
- Death
Do women die immediately after developing complications in delivery?

Average Complications to death interval

- Hemorrhage
  - PPH: 2 Hours (5.7 hrs*)
  - APH: 12 Hours (11.5 hrs)
- Ruptured uterus: 1 Day
- Eclampsia: 2 Day (1.7 Days)
- Obstructed Labour: 3 Days
- Infection: 6 Days (2.4 Days)

The 3 Delays Model

• Delay in decision to seek health care
• Delay in reaching health care
• Delay in receiving health care
Why does this happen?

Three Delays Model

• Delay in decision to seek care
  – Acceptance of maternal death
  – Low status of women
  – Socio-cultural barriers to seeking care
  – Lack of understanding of complications
  – Blocks/Slow/non-referral

• Delay in reaching care
  – Mountains, islands, rivers — poor organization
  – Lack of escalation pathway/fear

• Delay in receiving care
  – Supplies, personnel
  – Poorly trained personnel with punitive attitude
  – Finances both personal and institutional
Percentage of births in facilities by region: Ethiopia

- Addis Ababa: 63%
- Harari: 48%
- Dire Dawa: 34%
- Gambela: 17%
- Tigray: 9%
- National: 7%
- Benishangul-Gumuz: 6%
- Amhara: 5%
- Oromiya: 5%
- SNNP: 4%
- Afar: 2%
- Somali: 2%
Maternal Transport
Maternal Transport

‘Ambulance taxi’ service in Tanzania

Rehema Sanane, age 30, three weeks ago (10 February 2016) gave birth to a healthy boy called Setu. However, her situation could have been very different if she had not been able to travel to the district hospital at short notice. On 10 February, 2016, she experienced labour pains and sudden bleeding. She visited the nearest health facility, one kilometre from her home, where she was assessed and told that she and her newborn child were in danger as she was experiencing ante-partum haemorrhaging. She
Maternal Transport
The Global Health Research/Care Cycle

1. Identify problems
2. Collect information
3. Analyse the results
4. Recommendations for action
5. Implement
   - Evaluate and refine
Interventions to Reduce Maternal Mortality

Historical Review
• Traditional Birth Attendants
• Antenatal Care
• Risk Screening

Current Approach
• Education
• Reduce Unwanted Fertility
• Skilled Attendant at Delivery
• Emergency Obst. Care
• Referral Services
• Escalation and Transport
Interventions: Traditional Birth Attendants

Advantages
- Community-based
- Sought out by women
- Low tech
- Can perform clean delivery

Disadvantages
- Technical skills limited
- May keep women away from life-saving interventions due to false reassurance

Current Approach to Reduction of Maternal Mortality
What proportion of maternal deaths can these strategies can prevent?

- TBA training 03%
- ANC 11%
- Family Planning 26%
- Health Centers (BEmOC) 25%
- HC & Urban Hospitals (C) 60%
- HC & rural Hospitals 67%
Women centered care
Getting care to the community

If there are any problems or complications during a delivery I am able to manage it, refer it to the hospital and save a life.
Projects in Uganda

Maternal Health Partnership Hub

Sustainable Capacity Building
Taking action to improve care

• Improve clinical knowledge and skills
  – Identify very sick women
• Identification and management of higher risk women
• Improve referrals
• Better communications
  – Lack of communication
  – Lack of communication skills
  – Telephone conversations
• Improve senior support
• Contraceptive advice (Family Spacing)
  – Pre-pregnancy counselling
Malago, Uganda
Mulago Maternity Ward
Malago, Uganda
HDU development
Mulago HDU first 4 weeks

- 12 Ruptured Uteri
- 7 eclamptic fits
- 8 severe PET
- 2 Cardiac Failures
- 1 severe anaemia
- 1 pericarditis
- 5 Caesarean Hysterectomies
Hoima, Uganda
Hoima, Uganda
Hoima, Uganda
In Country Collaboration

• Help to improve access and quality of reproductive health services
• Build capacity of health systems
• Improve quality of training and education
• Promote progressive change and sustainability
Conflict/disaster areas
First do no harm: the impact of recent armed conflict on maternal and child health in Sub-Saharan Africa

Bernadette A M O'Hare¹ and David P Southall²

Author information » Copyright and License information »
Conflict or Disaster

• Additional problems
  – Lack of contraception
    • Sex as a weapon of war
  – Lack of family support
  – Lack of midwifery support
  – Lack of hygiene
  – Lack of medical support
  – Lack of transport
Maternal Mortality in Iraq

Figure 2: Maternal mortality rate.

Maternal mortality rate

per 100,000 life births

year
Maternal Mortality in Iraq

- Massive Obstetric Haemorrhage 28%
- Post Abortion 19%
- Eclampsia 17%
- Infection 15%
- Post Anaesthetic and Other 14%
- Obstructed Labour/Ruptured Uterus 7%
Is it all hopeless?

How much progress can be made?
Implementation Research

• Not just train more birth attendants
  – How to train and support
• Introduce care frameworks designed for the area
• Communication and transport
• Pregnancy Spacing
• EmOC, guidelines, skill drills, empowering
Maternal Mortality Reduction
Sri Lanka 1940–1985

Health system improvements:
• Introduction of system of health facilities
• Expansion of midwifery skills
• Decreased use of home delivery and delivery by untrained birth attendants
• Spread of family planning
Maternal Mortality Reduction
Sri Lanka 1940–1985

85% births attended by trained personnel
Interventions: Skilled Attendant at Childbirth

• Proven effective
  – Malaysia: basic maternity services 320 □157
  – Cuba: national priority 118 □31
  – China: facility based childbirth 1500 □$0
• Malaysia (41) vs. Indonesia (230):
  – Trained community midwives (2 years) vs. untrained midwives (4 years)
Severe maternal morbidity

Mantel et al. BJOG 1998; 105:985
14 categories of severe morbidity

- Major haemorrhage
- Eclampsia
- Renal/liver dysfunction
- Cardiac arrest
- Pulmonary oedema
- Respiratory dysfunction
- Coma
- Cerebrovascular event
- Status epilepticus
- Anaphylaxis
- Septicaemic shock
- Anaesthetic problem
- Pulmonary embolism
- ITU admission

## Dublin maternity hospitals 2006-2010

<table>
<thead>
<tr>
<th>Total 3 hospitals</th>
<th>Events</th>
<th>Rate per 1000</th>
<th>UK data 2006-2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfusion &gt; 5 units</td>
<td>151</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Peripartum hysterectomy</td>
<td>52</td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Transfer to ICU</td>
<td>54</td>
<td>0.38</td>
<td>1.46</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>38</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Uterine rupture</td>
<td>25</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>HDU admissions in maternity hospital</td>
<td>2034</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>14</td>
<td>10 per 100,000</td>
<td>11.4</td>
</tr>
</tbody>
</table>
Most severe morbidity event per patient (Dublin)

<table>
<thead>
<tr>
<th>Cause of morbidity</th>
<th>Worst event (n=158)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular dysfunction</td>
<td>57</td>
</tr>
<tr>
<td>Coag dysfunction</td>
<td>16</td>
</tr>
<tr>
<td>Cardiac dysfunction</td>
<td>7</td>
</tr>
<tr>
<td>Metabolic dysfunction</td>
<td>2</td>
</tr>
<tr>
<td><strong>Cerebral dysfunction (eclampsia)</strong></td>
<td><strong>26</strong></td>
</tr>
<tr>
<td>Acute renal dysfunction</td>
<td>1</td>
</tr>
<tr>
<td>Acute liver dysfunction</td>
<td>1</td>
</tr>
<tr>
<td>Resp dysfunction</td>
<td>11</td>
</tr>
<tr>
<td>Immunological dysfunction</td>
<td>2</td>
</tr>
<tr>
<td>ICU</td>
<td>17</td>
</tr>
<tr>
<td>CCU</td>
<td>3</td>
</tr>
<tr>
<td>Anaes</td>
<td>1</td>
</tr>
<tr>
<td>Peripartum hysterectomy</td>
<td>4</td>
</tr>
</tbody>
</table>

Murphy et al Eur J Obstet Gynecol 2009
Causes of Maternal Mortality

Pregnancy and Childbirth-Related Deaths to Women, by Cause

- **Severe Bleeding**: 25%
- **Infections**: 15%
- **Unsafe Abortion**: 13%
- **Eclampsia**: 12%
- **Obstructed Labor**: 8%
- **Other Direct Causes**: 8%
- **Indirect Causes**: 20%

Note: Total exceeds 100 percent due to rounding.
Post Partum Haemorrhage

“Haemorrhagic Shock
a rude unhinging of the machinery of life”

Samuel Gross, 1862
Postpartum Haemorrhage - England

Percentage of deliveries with PPH coded

Year

Source – Hospital Episode Statistics
### Causes of Haemorrhage

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of women (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uterine atony</td>
<td>167 (53)</td>
</tr>
<tr>
<td>Placenta accreta/increta/percreta</td>
<td>121 (39)</td>
</tr>
<tr>
<td>Uterine rupture</td>
<td>26 (8)</td>
</tr>
<tr>
<td>Extension of uterine incision at delivery</td>
<td>20 (6)</td>
</tr>
<tr>
<td>Uterine infection</td>
<td>16 (5)</td>
</tr>
</tbody>
</table>

*100 women (32%) with 2 or more causes of haemorrhage. Excludes 3 women undergoing hysterectomy for malignancy

Knight (2007). BJOG 114:1380-1387
Scottish Data – Haemorrhage and Mode of delivery per 1000 Births

- SVD
- Instr Del
- EI CS
- Em CS

Year:
- 2003
- 2004
- 2005
- 2006
- 2007
Management of PPH
Problems associated with haemorrhage

• Half the deaths occur within 7 hours

• Underestimation of blood loss

• Delay in action (or no facilities)
  – Transfusion
  – Calling the consultant
  – Treatment of coagulation abnormalities
Postpartum Haemorrhage

• 149 cases of obstetric haemorrhage
  – 126 cases 500-700 - all recovered
  – 64 cases 700-1000 - all recovered
  – 9 cases over 1000 - 6 died
  • Scott, Toronto 1943
Management of PPH
Obstetric Haemorrhage

• Incidence increasing
• Most can be saved
  – Team work
  – Blood transfusion
  – Early intervention
• Be prepared
  – Drills
  – Equipment
• Placenta Accreta
The LSTM – RCOG LSS – EOC and NC training package
Medical devices

Original article

PPH Butterfly: a novel device to treat postpartum haemorrhage through uterine compression

OPEN ACCESS

Caroline Cunningham¹, Peter Watt², Nasreen Aflaiefel¹, Simon Collins³, Dot Lambert¹, John Porter⁴, Tina Lavender⁵, Tony Fisher⁶, Andrew Weeks¹
Causes of Maternal Mortality

Pregnancy and Childbirth-Related Deaths to Women, by Cause

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- **Eclampsia**: 12%
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- **Other Direct Causes**: 8%
- **Indirect Causes**: 20%

Note: Total exceeds 100 percent due to rounding.
Unsafe Abortion

Unsafe abortions per 1000 women aged 15–44 years:
- 30 or more
- 20–29
- 10–19
- 1–9
- None/negligible
Deaths from sepsis in UK
Deaths from sepsis in the UK

Abortion Act 1967

[Bar graph showing yearly sepsis deaths with categories early, late, and surgical]
Causes of Maternal Mortality

Pregnancy and Childbirth-Related Deaths to Women, by Cause

- Severe Bleeding: 25%
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- Obstructed Labor: 8%
- Other Direct Causes: 8%
- Indirect Causes: 20%

Note: Total exceeds 100 percent due to rounding.
## Pregnancy Complications N=5628

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preeclampsia (PE)</strong></td>
<td>278</td>
<td>4.9</td>
</tr>
<tr>
<td>Term PE $\geq$37w</td>
<td>209</td>
<td>3.7</td>
</tr>
<tr>
<td>Preterm PE &lt;37w</td>
<td>69</td>
<td>1.2</td>
</tr>
<tr>
<td>Early onset PE &lt;34w</td>
<td>28</td>
<td>0.5</td>
</tr>
<tr>
<td>PE + SGA</td>
<td>66</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Gestational Hypertension (GH)</strong></td>
<td>470</td>
<td>8.4</td>
</tr>
<tr>
<td>Term GH $\geq$37w</td>
<td>446</td>
<td>7.9</td>
</tr>
<tr>
<td>Preterm GH &lt;37w</td>
<td>24</td>
<td>0.4</td>
</tr>
<tr>
<td>GH + SGA</td>
<td>96</td>
<td>1.7</td>
</tr>
</tbody>
</table>
Maternal death from pre-eclampsia by diagnosis – UK; 1952 – 1999

Data from CEMD, UK
Maternal death from pre-eclampsia by diagnosis – UK; 1952 – 1999

Data from CEMD, UK

UNIVERSITY OF LEEDS
Maternal death from pre-eclampsia by diagnosis – UK; 1952 – 1999

Data from CEMD, UK
UNIVERSITY OF LEEDS
Changing incidence of eclampsia

<table>
<thead>
<tr>
<th>Range</th>
<th>Eclampsia/10000</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-40</td>
<td>72</td>
</tr>
<tr>
<td>41-50</td>
<td>75</td>
</tr>
<tr>
<td>51-60</td>
<td>25</td>
</tr>
<tr>
<td>61-70</td>
<td>15</td>
</tr>
<tr>
<td>71-80</td>
<td>10</td>
</tr>
<tr>
<td>81-90</td>
<td>5</td>
</tr>
<tr>
<td>91-100</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Anticonvulsants and Eclampsia

The use of magnesium sulphate

- Magnesium sulphate
- Diazepam
- Magnesium sulphate
- Phenytoin

UNIVERSITY OF LEEDS
Use of Magnesium Sulphate

<table>
<thead>
<tr>
<th>01 outcomes for the woman</th>
<th>magnesium sulphate (n/N)</th>
<th>control (n/N)</th>
<th>RR (fixed) 95% CI</th>
<th>No. of trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>maternal death</td>
<td>11/5400</td>
<td>21/5395</td>
<td>0.54 [0.26, 1.10]</td>
<td>2</td>
</tr>
<tr>
<td>eclampsia</td>
<td>43/5722</td>
<td>107/5722</td>
<td>0.41 [0.29, 0.58]</td>
<td>6</td>
</tr>
<tr>
<td>serious morbidity</td>
<td>196/5164</td>
<td>183/5168</td>
<td>1.08 [0.89, 1.32]</td>
<td>2</td>
</tr>
<tr>
<td>renal failure</td>
<td>49/5055</td>
<td>61/5055</td>
<td>0.80 [0.55, 1.17]</td>
<td>1</td>
</tr>
<tr>
<td>coagulopathy</td>
<td>73/5055</td>
<td>86/5055</td>
<td>0.85 [0.62, 1.16]</td>
<td>1</td>
</tr>
<tr>
<td>stroke</td>
<td>3/5055</td>
<td>6/5055</td>
<td>0.50 [0.13, 2.00]</td>
<td>1</td>
</tr>
<tr>
<td>antihypertensive</td>
<td>3964/5400</td>
<td>4080/5395</td>
<td>0.97 [0.95, 0.99]</td>
<td>2</td>
</tr>
<tr>
<td>resp depression</td>
<td>52/5344</td>
<td>26/5333</td>
<td>1.98 [1.24, 3.15]</td>
<td>2</td>
</tr>
<tr>
<td>any side effects</td>
<td>1201/4999</td>
<td>228/4993</td>
<td>5.26 [4.59, 6.03]</td>
<td>1</td>
</tr>
<tr>
<td>flushing</td>
<td>1032/5066</td>
<td>110/5061</td>
<td>9.38 [7.74, 11.37]</td>
<td>2</td>
</tr>
<tr>
<td>caesarean section</td>
<td>2528/5082</td>
<td>2370/5026</td>
<td>1.05 [1.01, 1.10]</td>
<td>6</td>
</tr>
<tr>
<td>blood loss &gt;500ml</td>
<td>7544/4482</td>
<td>775/4427</td>
<td>0.96 [0.88, 1.05]</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>02 outcomes for the baby</th>
<th>magnesium sulphate (n/N)</th>
<th>control (n/N)</th>
<th>RR (fixed) 95% CI</th>
<th>No. of trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>fetal/neonatal death</td>
<td>634/5003</td>
<td>611/4958</td>
<td>1.04 [0.93, 1.15]</td>
<td>3</td>
</tr>
<tr>
<td>death or SCBU &gt;7days</td>
<td>1330/4538</td>
<td>1302/4486</td>
<td>1.02 [0.95, 1.08]</td>
<td>1</td>
</tr>
<tr>
<td>intubated at birth</td>
<td>175/4162</td>
<td>171/4398</td>
<td>1.01 [0.82, 1.24]</td>
<td>1</td>
</tr>
<tr>
<td>admission to SCBU</td>
<td>1629/4162</td>
<td>1591/4398</td>
<td>1.01 [0.96, 1.06]</td>
<td>1</td>
</tr>
</tbody>
</table>
## Maternal Mortality from HBP

<table>
<thead>
<tr>
<th>Year</th>
<th>Cerebral</th>
<th>Pulmonary</th>
<th>Hepatic</th>
<th>Renal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>70-72</td>
<td>25</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>47</td>
</tr>
<tr>
<td>73-75</td>
<td>23</td>
<td>7</td>
<td>14</td>
<td>1</td>
<td>4</td>
<td>49</td>
</tr>
<tr>
<td>76-78</td>
<td>21</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>33</td>
</tr>
<tr>
<td>79-81</td>
<td>17</td>
<td>8</td>
<td>8</td>
<td>0</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>82-84</td>
<td>21</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>85-87</td>
<td>11</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>26</td>
</tr>
<tr>
<td>88-90</td>
<td>14</td>
<td>10</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>27</td>
</tr>
<tr>
<td>91-93</td>
<td>5</td>
<td>11</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>94-97</td>
<td>7</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>97-99</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>00-02</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>03-05</td>
<td>12</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>06-08</td>
<td>12</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>73</td>
<td>46</td>
<td>6</td>
<td>41</td>
<td>356</td>
</tr>
</tbody>
</table>
(Pre)Eclampsia

Good care makes a difference

Less than 1 woman in every million who gives birth now dies from pre-eclampsia, but to detect it blood pressure and urine must be checked at every antenatal visit.
Dr Nicola Vousden MD

Clinical Research Fellow,
King’s College London

Community Blood Pressure Measurement in Rural Africa and Asia: the Detection of Underlying Pre-eclampsia and Shock (CRADLE 3)
Causes of Maternal Mortality

Pregnancy and Childbirth-Related Deaths to Women, by Cause

- Severe Bleeding: 25%
- Infections: 15%
- Unsafe Abortion: 13%
- Eclampsia: 12%
- Obstructed Labor: 8%
- Other Direct Causes: 8%
- Indirect Causes: 20%

Note: Total exceeds 100 percent due to rounding.
Caesarean Section saves life
By the end of today our world will have another 25,000 child brides

Every year 1.5 million children married by age 15 years

Early pregnancy – tragic endings

MMR doubled in girls of 19 years and 5 times higher in girls of 15 years

70,000 teenagers die in childbirth

Most of 2 million fistula cases originated with teenage births

Combating child marriage through education - Gordon and Sarah Brown Foundation
Waiting outside the fistula hospital
CS Rates

Table 1. Distribution of countries and number of cesarean sections and births according to the cesarean section rate categories

<table>
<thead>
<tr>
<th>Cesarean Rates</th>
<th>Section</th>
<th>Countries</th>
<th>Annual cesarean (thousands)</th>
<th>Number of sections</th>
<th>Annual births (year 2006) (thousands)</th>
<th>Number of births</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10%</td>
<td></td>
<td>54</td>
<td>4,556</td>
<td>24.7</td>
<td>77,417</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td>Between 10 and 15%</td>
<td></td>
<td>14</td>
<td>414</td>
<td>2.2</td>
<td>3,177</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>&gt;15%</td>
<td></td>
<td>69</td>
<td>13,479</td>
<td>73.1</td>
<td>48,390</td>
<td>37.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>137</td>
<td>18,449</td>
<td>100.0</td>
<td>128,984</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>
Requirements for CS services

- **Training**
  - Operators
  - Anaesthetists
  - Scrub nurses/assistants
  - Theatre support staff
  - Recovery staff

- **Development**
  - Theatre facilities
  - Sterilisation equipment
  - Maintenance of equipment and supplies
  - Blood transfusion services
  - Pharmacy services

- **Planning**
  - Transport services
  - Postpartum contraception
  - Management of labour with previous CS
Table 2. Cesarean section rates, number of needed cesarean sections and estimated cost for year 2008 for those countries showing cesarean section rates below 10% sorted according the contribution on number of needed cesarean section

<table>
<thead>
<tr>
<th>Country</th>
<th>Cesarean section rate (%)</th>
<th>Cesarean sections needed for year 2008</th>
<th>Estimated cost per year (US dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>1.8</td>
<td>494,296</td>
<td>68,411,688</td>
</tr>
<tr>
<td>India</td>
<td>8.5</td>
<td>403,695</td>
<td>42,213,047</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>1.0</td>
<td>278,370</td>
<td>36,940,008</td>
</tr>
<tr>
<td>Congo Democratic Republic</td>
<td>4.0</td>
<td>173,160</td>
<td>22,755,622</td>
</tr>
<tr>
<td>Pakistan</td>
<td>7.3</td>
<td>144,099</td>
<td>22,179,934</td>
</tr>
<tr>
<td>Indonesia</td>
<td>6.8</td>
<td>135,040</td>
<td>19,532,824</td>
</tr>
<tr>
<td>United Republic of Tanzania</td>
<td>3.2</td>
<td>120,428</td>
<td>16,790,318</td>
</tr>
<tr>
<td>Uganda</td>
<td>3.1</td>
<td>101,154</td>
<td>14,225,390</td>
</tr>
<tr>
<td>Kenya</td>
<td>4.0</td>
<td>90,360</td>
<td>12,563,130</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>7.5</td>
<td>85,750</td>
<td>8,411,331</td>
</tr>
<tr>
<td>Sudan</td>
<td>3.7</td>
<td>81,648</td>
<td>12,771,298</td>
</tr>
<tr>
<td>Yemen</td>
<td>1.4</td>
<td>72,756</td>
<td>11,345,196</td>
</tr>
<tr>
<td>Niger</td>
<td>1.0</td>
<td>71,190</td>
<td>9,032,588</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>3,185,492</strong></td>
<td><strong>431,578,091</strong></td>
</tr>
</tbody>
</table>
Table 3. Cesarean section rates, number of unnecessary cesarean sections and estimated cost for year 2008 for those countries showing cesarean section rates above 15% sorted according the contribution on number of unnecessary cesarean section

<table>
<thead>
<tr>
<th>Country</th>
<th>Cesarean section rate (%)</th>
<th>Unnecessary cesarean sections for year 2008</th>
<th>Estimated cost per year (US dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>China</td>
<td>25.9</td>
<td>1,976,606</td>
<td>31.8</td>
</tr>
<tr>
<td>Brazil</td>
<td>45.9</td>
<td>960,687</td>
<td>15.4</td>
</tr>
<tr>
<td>United States</td>
<td>30.3</td>
<td>673,047</td>
<td>10.8</td>
</tr>
<tr>
<td>Mexico</td>
<td>37.8</td>
<td>467,172</td>
<td>7.5</td>
</tr>
<tr>
<td>Iran</td>
<td>41.9</td>
<td>373,372</td>
<td>6.0</td>
</tr>
<tr>
<td>Egypt</td>
<td>27.6</td>
<td>253,890</td>
<td>4.1</td>
</tr>
<tr>
<td>Argentina</td>
<td>35.2</td>
<td>139,178</td>
<td>2.2</td>
</tr>
<tr>
<td>Italy</td>
<td>38.2</td>
<td>126,672</td>
<td>2.0</td>
</tr>
<tr>
<td>Iceland</td>
<td>15.6</td>
<td>30</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>6,220,844</td>
<td>100.0</td>
</tr>
</tbody>
</table>
## Maternal Death From CS

<table>
<thead>
<tr>
<th>Year</th>
<th>Place</th>
<th>Rate/1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966-1974</td>
<td>Lagos, Nigeria (21)</td>
<td>11</td>
</tr>
<tr>
<td>1979-1984</td>
<td>Enugu, Nigeria (22)</td>
<td>8</td>
</tr>
<tr>
<td>1988-1990</td>
<td>UK (23)</td>
<td>0.2</td>
</tr>
<tr>
<td>1998-2000</td>
<td>Malawi (24)</td>
<td>10.5</td>
</tr>
<tr>
<td>2010-2011</td>
<td>Sub-Saharan Africa (25)</td>
<td>5</td>
</tr>
</tbody>
</table>

- pre-existing morbidity
- lack of blood transfusion
- sepsis.
Causes of Maternal Mortality

Pregnancy and Childbirth-Related Deaths to Women, by Cause

- Severe Bleeding: 25%
- Infections: 15%
- Unsafe Abortion: 13%
- Eclampsia: 12%
- Obstructed Labor: 8%
- Other Direct Causes: 8%
- Indirect Causes: 20%

Note: Total exceeds 100 percent due to rounding.
Causes of Maternal Mortality

• Over three-quarters of maternal deaths are due to direct complications of pregnancy and childbirth,
  • such as severe bleeding, infection, unsafe abortion, hypertensive disorders (eclampsia), and obstructed labor.

• Women also die of indirect causes aggravated by pregnancy,
  • such as malaria, HIV, diabetes, hepatitis, and anemia.
Maternal Mortality – UK

Figure 2.4: Maternal mortality by cause 2012–14

- Cardiac disease
- Sepsis
- Neurological
- Other Indirect
- Thrombosis & thromboembolism
- Psychiatric
- Amniotic fluid embolism
- Haemorrhage
- Early pregnancy deaths
- Indirect malignancies
- Anaesthesia
- Pre-eclampsia
Maternal Mortality - UK

Figure 2.2: Direct and Indirect maternal mortality rates per 100,000 maternities; UK: 2003-2014 (using ICD-MM)

- Overall maternal death rate: P-value for trend over time = 0.018
- Indirect maternal death rate: P-value for trend over time = 0.220
- Direct maternal death rate: P-value for trend over time = 0.031

Test for trend over period 2003-2014: P = 0.001

Sources: CMACE, MBRRACE-UK
Percentage of MD related to HIV

% of MD

- Djibouti
- Russia
- Kenya
- Equatorial Guinea
- Thailand
- Uganda
- Gabon
- Bahamas
- Mozambique
- Malawi
- Zambia
- Ukraine
- Zimbabwe
- Lesotho
- Botswana
- Namibia
- South Africa
- Swaziland

% of MD
Way Forward

we know...

...who is at risk...

...where they live...

...what we must do...

...and how to do it.
Implementation Research

• Research tends to ask/answer single questions
  – It goes where it is easy, results assumed
  – Not where it is difficult and value unknown

• Funders tend to tackle a single problem
  – Aim to do something
  – Assuming benefit
  – Imbalances health care

• Three year cycles, ? Sustainability

• But we know what to do -
Taking action to improve care

• Improve clinical knowledge and skills
  – Identify very sick women
• Identification and management of higher risk women
• Improve referrals
• Better communications
  – Lack of communication
  – Lack of communication skills
  – Telephone conversations
• Improve senior support
• Contraceptive advice (Family Spacing)
  – Pre-pregnancy counselling
Fertility Rate
Figure 2.1. Trends in Total Fertility Rate by Region, 1950 -2005

Source: UN 2004 as cited in World Bank 2007
Trend in Early Childbearing, 1994 and 2006

Percent of Females Ages 15–19 Who Are Mothers or Became Pregnant Before Age 18

Source: ICF Macro, Demographic and Health Surveys; India, Sample Registration System. Surveys are from around 1994 and 2006.
Determinants of Maternal Mortality

- Clinical
- Cultural
- Economic
- Gender status
- Literacy
- Access to health care
- Quality of health care
- Political will
Lack of basic rights

• Right to time and space pregnancy
  – Contraception
  – Safe abortion

• Right to safe motherhood
  – Basic maternity care

• Right to safe sex
  – Prevention of HIV
  – Prevention of Cervical cancer

• Right to life and for her children to live
Trend in Early Childbearing, 1994 and 2006

Percent of Females Ages 15–19 Who Are Mothers or Became Pregnant Before Age 18

Source: ICF Macro, Demographic and Health Surveys; India, Sample Registration System. Surveys are from around 1994 and 2006.
Education
Reproductive Health

• Basic Hygiene
• Girls miss school during their period
• Simple reusable cloth protection can make a big difference
The Audit cycle

Guidelines
- Implement
- Evaluate and refine

Audit
- Identify cases
- Collect information
- Analyse the results

RCA/review
- Recommendations for action
We need to work together and share the learning from our mistakes to try and stop them happening again ….
Keeping the mother and baby safe