Health Effects of Fertility Control

OUTLINE

1. Beneficial effects of oral contraceptives
2. Contraception and risks of STDs, PID, HIV, and infertility
3. Sterilization
4. Abortion
5. Maternal mortality and risks/benefits of contraception
### Beneficial effects of contraception

Well-established major protective effects of oral contraceptives by problem or condition (UK or US)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Relative Risk</th>
<th>Influenced by Duration of Use</th>
<th>Influenced by OC Formulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinal</td>
<td>Current Use</td>
<td>Past Use</td>
<td></td>
</tr>
<tr>
<td>Menstrual problems</td>
<td>0.75</td>
<td>1.0</td>
<td>No</td>
</tr>
<tr>
<td>Iron-deficiency anemia</td>
<td>0.75</td>
<td>1.0</td>
<td>No</td>
</tr>
<tr>
<td>Benign breast cysts</td>
<td>0.5</td>
<td>1.0</td>
<td>Yes - protection increases as duration increases</td>
</tr>
<tr>
<td>Pelvic inflammatory disease</td>
<td>0.5</td>
<td>1.0</td>
<td>Unknown</td>
</tr>
<tr>
<td>Functional ovarian cysts</td>
<td>0.25</td>
<td>1.0</td>
<td>No</td>
</tr>
<tr>
<td>Epithelial ovarian cancer</td>
<td>0.5</td>
<td>0.5</td>
<td>Yes - protection increases as duration increases</td>
</tr>
<tr>
<td>Endometrial cancer</td>
<td>0.5</td>
<td>0.5</td>
<td>Yes - protection increases as duration increases</td>
</tr>
</tbody>
</table>

Effects of Contraception on STDs

1. **Barrier Methods**
   - Mechanical and chemical barriers protect against cervical and upper genital tract infections

2. **Oral and injectable contraceptives**
   - Protect against ascending infections due to ↑ cervical mucus viscosity (e.g., gonorrhea RR~0.5).
   - Oral contraceptives may increase the risk of chlamydia, due to increase in ectopy. (Possible detection bias)
Effects of Contraception on STDs, PID, and Tubal Infertility

3. IUD
   - Increased risk of PID within first 3 months after insertion. Due to introduction of infection at time of IUD insertion, increased menstrual bleeding, IUD tail and possible foreign body reaction.

4. Female Sterilization
   - Partially protective against PID in distal tube and peritoneal cavity.
# Primary Tubal Infertility and Contraceptive Use

<table>
<thead>
<tr>
<th></th>
<th>Adj RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No History of PID</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IUD</td>
<td>1.7</td>
<td>1.2, 2.3</td>
</tr>
<tr>
<td>OC</td>
<td>1.1</td>
<td>0.8, 1.5</td>
</tr>
<tr>
<td>Barrier</td>
<td>0.7</td>
<td>0.5, 0.9</td>
</tr>
<tr>
<td><strong>PID History</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IUD</td>
<td>3.9</td>
<td>2.0, 7.5</td>
</tr>
<tr>
<td>OC</td>
<td>1.8</td>
<td>0.7, 4.5</td>
</tr>
<tr>
<td>Barrier</td>
<td>0.5</td>
<td>0.2, 0.9</td>
</tr>
</tbody>
</table>
Contraception and HIV

1. **Barrier Methods**

   • Male Condoms protect, dependent on consistency of use.

   • Female condom, no data

   • No clear evidence for effects of diaphragm or cervical cap (vaginal mucosa exposed).

   • Microbicides:
     – Nonoxynol 9, no effect or increased risk. Increased ulceration
     – Cellulose sulphate, trial stopped for harm 2007
<table>
<thead>
<tr>
<th>Condom use</th>
<th>Number of Couples</th>
<th>Cumulative HIV Seroconversion over Two Years (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistent</td>
<td>121</td>
<td>0</td>
</tr>
<tr>
<td>Inconsistent use</td>
<td>124</td>
<td>12.7 (5.9-19.5)</td>
</tr>
<tr>
<td>Inconsistent Users</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use in &lt;50% sex contacts</td>
<td>60</td>
<td>15.0 (9.7-20.3)</td>
</tr>
<tr>
<td>Use in ≥50% of contacts</td>
<td>60</td>
<td>10.3 (5.9-14.7)</td>
</tr>
</tbody>
</table>

Source: Vincenzi et al. NEJM 331: 341-6, 1984
<table>
<thead>
<tr>
<th></th>
<th>Inconsistent Use RR</th>
<th>Consistent Use RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>0.96 (0.5-1.7)</td>
<td>0.37 (0.2-0.9)</td>
</tr>
<tr>
<td>Syphilis</td>
<td>1.06 (0.9-1.2)</td>
<td>0.71 (0.5-0.9)</td>
</tr>
<tr>
<td>Gonorrhea/Chlamydia</td>
<td>1.44 (1.1-2.0)</td>
<td>0.50 (0.3-1.0)</td>
</tr>
<tr>
<td>BV</td>
<td>1.11 (1.0-1.30)</td>
<td>0.89 (0.7-1.1)</td>
</tr>
</tbody>
</table>

Ahmed et al *AIDS* 2001; 15: 2171
# Studies of Condom Breakage

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Population</th>
<th>Location</th>
<th>Recall Period</th>
<th>Breakage Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cross-sectional</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vanGriensven et al</td>
<td>1988</td>
<td>Gay men</td>
<td>Amsterdam</td>
<td>6 mos</td>
<td>2 to 4</td>
</tr>
<tr>
<td>Tindall et al.</td>
<td>1989</td>
<td>Gay and bisexual men</td>
<td>Sydney</td>
<td>6 mos</td>
<td>5 to 7 (anal)</td>
</tr>
<tr>
<td>Golombok et al</td>
<td>1989</td>
<td>Gay men</td>
<td>England</td>
<td>12 mos</td>
<td>3 to 5 (anal)</td>
</tr>
<tr>
<td>Consumers Union</td>
<td>1989</td>
<td>Men and women</td>
<td>US</td>
<td>12 mos</td>
<td>1 (anal), 0.6 (vaginal)</td>
</tr>
<tr>
<td>Albert et al</td>
<td>1991</td>
<td>Women</td>
<td>US</td>
<td>Lifetime</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Family planning clients</td>
<td></td>
<td>12 mos</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Cohort</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Richters et al</td>
<td>1988</td>
<td>Male prostitutes</td>
<td>Sydney</td>
<td>4 mos</td>
<td>0.5 (anal), 0.8 (vaginal)</td>
</tr>
<tr>
<td>Trussell et al</td>
<td>1992</td>
<td>Family planning clients</td>
<td>US</td>
<td>16 days</td>
<td>1.5 to 2.0</td>
</tr>
<tr>
<td>Trussell et al</td>
<td>1992</td>
<td>Family planning clients</td>
<td>US</td>
<td>21 days</td>
<td>1.2 to 1.3</td>
</tr>
</tbody>
</table>
Microbicides and HIV Acquisition

b. **Spermicides/Microbicides:**
Nonoxynol-9 (N-9) viricidal in vitro and protective in monkey experiments.

- No evidence of protective effects in humans. One trial showed increased HIV risk
- All trials in CSWs with high frequency of intercourse
- N-9 may increase transmission due to micro-ulceration of cervical and vaginal epithelium.
- Clinical trials confounded by concurrent condom use.
# Summary of randomized trials of N-9 versus placebo

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV</td>
<td>1.12</td>
<td>0.88-1.42</td>
</tr>
<tr>
<td>Gonorrhea</td>
<td>0.91</td>
<td>0.67-1.24</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>0.88</td>
<td>0.77-1.01</td>
</tr>
<tr>
<td>Cervical infection</td>
<td>1.01</td>
<td>0.84-1.22</td>
</tr>
<tr>
<td>Trichomoniasis</td>
<td>0.84</td>
<td>0.69-1.02</td>
</tr>
<tr>
<td>Bacterial vaginosos</td>
<td>0.88</td>
<td>0.74-1.04</td>
</tr>
<tr>
<td>Candidiasis</td>
<td>0.97</td>
<td>0.84-1.12</td>
</tr>
<tr>
<td>Genital ulcer</td>
<td>1.18</td>
<td>1.02-1.36</td>
</tr>
</tbody>
</table>

Oral and Injectable Contraceptives

- Monkey studies of vaginal inoculation with simian immunodeficiency virus (SIV) show higher rates of infection with progesterone (thinning of mucosa and endometrium).

- Human studies suggest higher viral shedding in genital tract secretions of women taking oral contraceptives.

- Cross-sectional and prospective observational studies provide inconsistent evidence (problem of behavioral confounding due to increased sexual activity of OC and DMPA users?).
### Hormonal Contraception and HIV Acquisition, Rakai, Uganda

<table>
<thead>
<tr>
<th></th>
<th>Horm. Users HIV Incid per100 py</th>
<th>Non-Users HIV Incid Per 100 py</th>
<th>Adjusted RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>2.3</td>
<td>1.5</td>
<td>0.94 (0.5-1.6)</td>
</tr>
<tr>
<td>Pills</td>
<td>2.5</td>
<td>1.5</td>
<td>1.12 (0.5-2.6)</td>
</tr>
<tr>
<td>Injection</td>
<td>2.3</td>
<td>1.5</td>
<td>0.84 (0.4-1.7)</td>
</tr>
</tbody>
</table>

Kiddugavu et al *AIDS* 2003;17:233
Contraception and HIV/STD Prevention

• Condoms prevent HIV/STDs, but are not very effective for pregnancy prevention

• Hormonal methods do not protect against HIV/STDs, but are effective for prevention of unwanted pregnancy

• Women at high risk, ideally should use dual methods

- **Year**
  - 1991
  - 1995
  - 2001

- **Percent**
  - Condoms
  - Pill
  - Dual methods

- **Values**
  - 1991:
    - Condoms: 46.2%
    - Pill: 20.8%
    - Dual methods: 3.2%
  - 1995:
    - Condoms: 54.4%
    - Pill: 17.4%
    - Dual methods: 4.3%
  - 2001:
    - Condoms: 57.9%
    - Pill: 18.2%
    - Dual methods: 5.5%
Hormonal Contraception and HIV Shedding in HIV+ women

• 101 HIV+ Kenyan women observed before and after start of oral contraception (OC) or depot Provera

• Measured cervical HIV shedding

• All hormonal contraception, shedding increased from 42% to 52%

• No change in genital tract viral load (i.e., intensity of shedding)

  – Wang et al AIDS 2004;18:205
IUDs and HIV

– Theoretical risk with increased menstrual blood loss, foreign body inflammatory reaction, endometrial disruption.

– Cross-sectional studies suggest increased risk of prevalent HIV infection. (Behavioral confounding?)
Reproduction, hormones and Cardiovascular Disease (CVD)

- Hormones and CVD
- Effects of Hormonal Contraceptives
- Postmenopausal Hormone Supplementation
- Mechanisms
- Observational studies
- Randomized trials
Cardiovascular Disease (CVD) and Gender

• Male CVD mortality exceeds female mortality during the reproductive ages.

• The sex differential in CVD diminishes after menopause.

• Therefore, female hormones may be protective against CVD?
Effects of Estrogen on the Vascular System
(EPSTEIN FH NEJM 1999;340:1801)

- **Local Acute Effects:**
  - Estrogen causes vasodilatation and inhibit endothelial injury
  - mediated by estrogen receptors on endothelium
  - ↑ Nitric oxide (NO)

- **Systemic Effects:**
  - ↓ low density lipoprotein cholesterol (LDL)
  - ↑ high density lipoprotein cholesterol (HDL)
  - ↓ fibrinogen and ↓ anticoagulant proteins
    (increased clotting propensity)
Progestins Lipid Changes

• Progestins, particularly androgenic progestins such as norethisterone,
  – ↓ HDL and ↑ LDL.

• Second generation progestins may affect clotting mechanisms
Evidence of CVD and Oral Contraception 1960-1980


- **Relative Risks of CVD by age and smoking**

<table>
<thead>
<tr>
<th></th>
<th>Smokers</th>
<th>Non-Smokers</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-34</td>
<td>3.4</td>
<td>1.6</td>
</tr>
<tr>
<td>35-44</td>
<td>4.2</td>
<td>3.3</td>
</tr>
<tr>
<td>45+</td>
<td>7.4</td>
<td>4.6</td>
</tr>
</tbody>
</table>

- Prescribing practice changed to exclude use by women >35 and discourage use by smokers or persons with CVD risk factors
Cardiovascular Complications

• Venous Thromboembolism (VTE)
  – Deep vein thrombosis of the legs
  – Pulmonary embolism
  – Due to disturbance of clotting mechanisms associated with estrogen dose and new generation of progestins.
### Venous Thromboembolism: Case-control study

*WHO Lancet* 1995;346:1575-82

<table>
<thead>
<tr>
<th>Venous Thrombosis Embolism (VTE) Diagnosis</th>
<th>Europe OR (CI)</th>
<th>Developing Countries OR (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite</td>
<td>3.9 (2.7, 5.6)</td>
<td>4.8 (3.1, 7.3)</td>
</tr>
<tr>
<td>Probable</td>
<td>4.9 (2.8, 8.6)</td>
<td>3.1 (2.3, 4.3)</td>
</tr>
</tbody>
</table>
## VTE and Type of Progestin in OCs

*Jick Lancet 1995*

<table>
<thead>
<tr>
<th>Progestin</th>
<th>VTE Incidence/1000 py</th>
<th>RR (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levonorgestrel</td>
<td>16.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Desogestrel 2nd generation</td>
<td>29.3</td>
<td>2.2 (1.1-4.4)</td>
</tr>
<tr>
<td>Gestodene 2nd generation</td>
<td>28.1</td>
<td>2.1 (1.0-4.4)</td>
</tr>
</tbody>
</table>
Blood Pressure

• Increased Blood Pressure
  – Increase in mean diastolic and systolic blood pressure
  – Increased incidence of hypertension
  – Associated with progestin dose
Arterial Thrombosis

- Myocardial infarction (MI) and ischemic heart disease (IHD)
- Other arterial thromboses
- Increased risk of thrombotic, embolic, and hemorrhagic stroke
- Due to changes in lipid metabolism, clotting mechanisms and blood pressure, associated with estrogen and progestin dose
Coronary Heart Disease (CHD) / Myocardial Infarction (MI)

- Oral contraceptives increase the risk of MI and of fatal MI

- Risk increased with age, smoking and other CVD risk factors.

- Risk associated with current use and not related to duration of use.

- No residual risk with past use. (i.e., no “carry-over” effect)
Net CVD Effects of Combined Oral Contraceptives

• The effects of oral contraceptives depend on the ratio of estrogen to progestin dose, and the type of progestin.

• Estrogen dose decreased relative to progestins since 1980s
# Case control study of Cardiovascular Disease and OCs

**WHO Lancet 1997;349:1202-09**

<table>
<thead>
<tr>
<th>Region &amp; Type of Use</th>
<th>OR (CI) with OCs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Europe</strong></td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>5.01 (2.5, 9.9)</td>
</tr>
<tr>
<td>Past Users</td>
<td>1.2 (0.7, 2.3)</td>
</tr>
<tr>
<td><strong>Developing Countries</strong></td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td>4.78 (2.5, 9.1)</td>
</tr>
<tr>
<td>Past Users</td>
<td>1.48 (0.9, 2.5)</td>
</tr>
</tbody>
</table>
### Case-Control Study
Cardiovascular Disease
*Lancet* 1997;349:1202-09

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Europe OR (CI) with OCs</th>
<th>Developing Countries OR (CI) with OCs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 35 yrs</td>
<td>7.3 (2.2, 24.0)</td>
<td>4.1 (1.3, 13.2)</td>
</tr>
<tr>
<td>35+</td>
<td>3.5 (1.5, 8.2)</td>
<td>5.2 (2.5, 11.0)</td>
</tr>
<tr>
<td>CVD risk factors</td>
<td>37.3 (15.2, 91.7)</td>
<td>20.8 (9.1, 47.2)</td>
</tr>
<tr>
<td>Smokers</td>
<td>41.3 (12.5, 136)</td>
<td>21.0 (4.9, 89)</td>
</tr>
</tbody>
</table>
Stroke

• Types of stroke:
  – Ischemic due to occlusion of arterial flow
  – Venous due to thrombosis of veins
  – Hemorrhagic

• Stroke 11 per 100,000 in women of reproductive age, 15-44 years).
Summary of OC and Stroke


- US data suggest no significant increased risk (Pettiti, *NEJM* 1996;335:8-15)

- UK data suggest increased risk of fatal stroke.

- Risk of stroke with OC use higher with age, smoking, hypertension and in some studies, estrogen dose.
### WHO Case-Control Study
**Stroke**

*Lancet* 1996;348:505-10

<table>
<thead>
<tr>
<th>Type</th>
<th>Europe OR (CI)</th>
<th>Developing Countries OR (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ischaemic</td>
<td>2.7 (1.3, 5.5)</td>
<td>2.9 (2.1, 4.0)</td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td>1.4 (0.8, 2.3)</td>
<td>1.8 (1.3, 2.3)</td>
</tr>
</tbody>
</table>
Summary Oral Contraceptive and CVD

• Consistent evidence of increased risks of CVD with oral contraceptives

• Stroke effects variable

• No randomized trials
Postmenopausal Hormone Supplements and Cardiovascular Disease (CVD)

Trials trump observational studies
Postmenopausal Estrogen and Cardiovascular Disease (CVD)

- CVD is the major cause of death among postmenopausal women (aged 50-75)

- incidence of CVD is 700/100,000; case-fatality ratio of 0.60)
Hormonal Supplements and CVD

• **Observational studies** (case-control and cohort) suggest that use of postmenopausal estrogens reduce the risk of CVD and of death from CVD (RR ~ 0.5).
  - Risks lower with higher dose estrogens.
  - Risks reduced with current and recent estrogen use (< 3 years since last use), but not longer-term (no “carry-over” effect).
  - Addition of progestin does not appear to attenuate the estrogen effects.

• Stroke and deep vein thrombosis risks may be increased.
Problems of Interpretation in Observational Studies

- **Self-selection** (i.e. healthier women, higher SES or educational status adopt supplements).

- **Physician prescribing habits** (avoid high risk patients).

- **Duration** of observation and duration of estrogen use is often limited.

- **Age**: Women often relatively young (<60 years).
Clinical Trials of HRT

Clinical trial of women with established CVD

- Estrogen/medroxyprogesterone N=1380 vs Placebo N=1383
- Follow up 4.1 years
- No benefit observed

Effects on Lipids

Mean change in low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), and triglyceride levels during the first year of the study, expressed as percent change ± SEM.

Randomized trial (HERS Study)
Hulley JAMA 1998;280:605

• **Venous Thromboembolism**
  – Deep vein thrombosis: RR = 3.2 (1.4-7.0)
  – Pulmonary Embolism: RR = 2.8 (0.9-8.8)
  – Any thromboembolism: RR = 2.9 (1.5-5.6)

• **Stroke/Transient Ischemia**
  – RR = 1.13 (0.85-1.48)
Estrogen replacement and progression of coronary atherosclerosis

- RCT in women with established CVD
- Neither estrogen with or without progestin affected progression atherosclerosis
Estrogen replacement after ischaemic stroke

- RCT in women with ischaemic stroke 
estradiol vs placebo

- Recurrent stroke RR = 1.1 (0.8-1.4)
- Fatal recurrent stroke RR = 2.9 (0.9-9.0)

- Viscoli *NEJM* 2001;345:1243.
Women’s Health Initiative (WHIS) Study (*JAMA* 2002;288:321)

- 16,608 **healthy women** 50-75
- Randomized to conjugated estrogens + medroxyprogesterone acetate and placebo
- Follow up 5.2 years
- Trial stopped due to increased risk of breast cancer and lack of net benefit
### WHIS Study CVD Results

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RR (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD</td>
<td>1.29 (1.02-1.63)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.41 (1.07-1.85)</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>2.13 (1.39-3.25)</td>
</tr>
<tr>
<td>All CVD</td>
<td>1.22 (1.09-1.36)</td>
</tr>
</tbody>
</table>

Excess events per 10000py: CHD = 7, strokes = 8, PE= 8
Summary of HRT and CVD

- Observational Studies of women with long-term follow-up; suggest reduced risk, but inadequate control for confounding

- Metabolic studies, including randomized trials show estrogen reduced LDL (due to liver catabolism) and increased HDL.

- All clinical trials of supplementation in women shows no benefits and some show increased risk
When (if ever) should HRT be used?

- Short-term relief of menopausal syndrome (good efficacy)

- Prevention of osteoporosis

  No need to use HRT other effective treatments:
  - Raloxifene (estrogen antagonist in breast) but agonist in bones. Vertebral fracture RR = 0.70,
  - Alendronate (bisphosphonate) vertebral fracture RR = 0.53,

  - Delmas *Lancet* 2002;359:2018
Tubal ligation is the most common method of family planning in U.S. (> 10 million) and worldwide (> 100 million)

- Mortality 1.5/100,000 procedures (U.S., and U.K.), 12-21/100,000 in less developed countries

- Reversal of sterilization requested by 1-3%. Successful reversal varies with method of occlusion (approximately 25 - 70%).
Tubal Ligation and pregnancy.

Cumulative ten year pregnancy rates 1.9/100 women years.

Pregnancy increased in younger women

Method of occlusion. Lowest with unipolar or postpartum salpingectomy (~ 0.8/100 wy), highest with bipolar or clip (~ 2.5-3.7/100 wy).

• 33% of failures ectopic. Rates of ectopic pregnancy are 0.73/100 women over 10 years
Induced Abortion

• **Measuring Rates of Abortion**
  - Abortion rate per 1,000 women
  - Abortion ratio per 1,000 births
  - Total abortion rate: Average number of abortions per women during the childbearing years

• Measurement difficult due to underreporting, particularly of illegal procedures

• 26-31 million legal and 10-22 million illegal abortions (e.g. 36-53 million total)
Induced Abortion, cont.

• Rates vary by country.
  – Historic reasons (e.g., lack of contraception in ex-Communist block)
  – Cultural acceptance (religion?)
  – Contraception

• Legal status

• (% of women living in different countries):
  – 40% abortion on demand,
  – 23% social grounds,
  – 12% broad medical grounds,
  – 25% life-endangerment.
<table>
<thead>
<tr>
<th>Country</th>
<th>Abortion Rate/1000</th>
<th>15-49 in Developed Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Former USSR</td>
<td>110/1000</td>
<td></td>
</tr>
<tr>
<td>Hungary</td>
<td>40/1000</td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>23/1000</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>20/1000</td>
<td></td>
</tr>
<tr>
<td>UK</td>
<td>17/1000</td>
<td></td>
</tr>
<tr>
<td>Holland</td>
<td>7/1000</td>
<td></td>
</tr>
</tbody>
</table>
Methods of Induced Abortion
Vary with length of gestation

**Surgical**

- Menstrual regulation < 3 weeks
- Vacuum curettage < 13 weeks
- Dilatation and curettage (D & C) < 13 weeks
- Dilatation & Evacuation (D & E) 13 - 20 weeks
- Hysterotomy / hysterectomy > 20 weeks
- Dilatation and Extraction > 20 weeks
- (Partial birth abortion)
Medical Induced Abortion

- Antiprogestins (RU486) and prostaglandin (<7 weeks, can be up to 20 weeks)

- Instillation < 20 weeks (saline, urea)
## Clinical Trials of Medical Induced Abortion

<table>
<thead>
<tr>
<th></th>
<th>RU 486, Oral Misoprostol  &lt; 49 days (rates)(^1)</th>
<th>RU 486, Oral Misoprostol  &lt; 63 days (rates)(^2)</th>
<th>Methotrexate and Misoprostol &lt; 56 days (rates)(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>505</td>
<td>133</td>
<td>31</td>
</tr>
<tr>
<td>Complete Abortion</td>
<td>96.9%</td>
<td>95.0%</td>
<td>90.3%</td>
</tr>
<tr>
<td><strong>Failures</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Persistent pregnancy</td>
<td>0.8%</td>
<td>1.0%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Incomplete expulsion</td>
<td>1.8%</td>
<td>4.0%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Excess bleeding</td>
<td>0.4%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Women < 49 days pregnant. RU 486 600 mg orally followed in 48 hours by Misoprostol 400 ug orally (Peyron. NEJM 1993;328:1509)

\(^2\) Women < 63 days pregnant. RU 486 600 mg, vaginal misoprostol 800 ug orally (El Refaey. NEJM 1995;332:963)

\(^3\) Women < 56 days pregnant. Methotrexate injection followed 3 days later by 800 ug of misoprostol vaginal suppository (Creinin 1994;272:1190)
Mortality from Induced Abortions

**Mortality**
- Abortion related deaths approximately 60-120,000 per year (10 to 20% of maternal deaths)

**Measurement**
- Abortion mortality ratio per 100,000 live births and abortions
- Abortion mortality rate per 100,000 women between the ages of 15 - 45 years
- Abortion case-fatality ratio per 100,000 procedures
Mortality from Induced Abortions

- **Mortality Rates vary by:**
  - Legal status (increased if illegal)
  - Type of procedure
  - Length of gestation
  - Facilities and training of personnel ("unsafe abortion" WHO classification based on anesthesia, back up emergency care, skill and experience of personnel)
  - Estimate 20,000,000 “unsafe abortions”/year, approximately 78,000 deaths
## US. Abortion case-fatality ratios

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Rate Per 100,000</th>
<th>Relative Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curettage</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Evacuation</td>
<td>3.7</td>
<td>6.8</td>
</tr>
<tr>
<td>Instillation</td>
<td>7.1</td>
<td>13.0</td>
</tr>
<tr>
<td>Hysterectomy/hysterotomy</td>
<td>51.6</td>
<td>95.0</td>
</tr>
</tbody>
</table>

Unsafe abortion incidence, worldwide

Fig. 4 Incidence of and mortality from unsafe abortion

Maternal mortality in legal status of abortion in Romania

“We cannot ban abortion, we can only ban safe Abortion”

Figure 4.4: World Development Report 1993. World Bank and Oxford University Press. All Rights Reserved.
Parental notification law and abortions in Texas (Joyce et al NEJM 2006;354:1031)

- Compared abortions and births per 1000 population in teens before (1998-9) and after (2000-02) parental notification.

- Assessed ratio of changes in rates 15-17 to changes in 18 year olds (not affected by notification).

- Conclusion: decline in abortion ages 15-17, and increased second trimester abortions in minors 17.50-17.74 years (i.e., caught be change in law).
If abortions and pregnancies decreased in 15-17, is this due to change in law or a decline in adolescent pregnancy? The denominator should be pregnancies.
Risk-Benefit Assessment of Fertility Control

• Compare mortality associated with fertility (i.e., maternal mortality and mortality associated with fertility control (contraception and abortion).

• Data from North America and Europe. Extrapolation to developing countries speculative.
Risk-Benefit Assessment of Fertility Control, cont.

- Mortality associated with fertility control:
  - Deaths due to complications of birth control methods.
  - Deaths due to complications of accidental pregnancies from method failures (including induced abortion)
  - Deaths due to induced abortion at varying stages of gestation
## ESTIMATES of MATERNAL MORTALITY
### 1990

<table>
<thead>
<tr>
<th>Region</th>
<th>Maternal Mortality Ratio per 100,000 Live Births</th>
<th>Estimated Number of Maternal Deaths</th>
<th>Estimated Lifetime Risk of Maternal Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>430</td>
<td>585,000</td>
<td></td>
</tr>
<tr>
<td>Developed Countries</td>
<td>27</td>
<td>4,000</td>
<td>0.05%</td>
</tr>
<tr>
<td>Developing Countries</td>
<td>480</td>
<td>582,000</td>
<td>2.1%</td>
</tr>
<tr>
<td>Africa</td>
<td>870</td>
<td>235,000</td>
<td></td>
</tr>
<tr>
<td>South Asia</td>
<td>560</td>
<td>227,000</td>
<td></td>
</tr>
<tr>
<td>East Asia</td>
<td>95</td>
<td>24,000</td>
<td>0.2%</td>
</tr>
<tr>
<td>Latin America</td>
<td>190</td>
<td>23,000</td>
<td></td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>62</td>
<td>2,500</td>
<td></td>
</tr>
<tr>
<td>North America</td>
<td>11</td>
<td>500</td>
<td>0.03%</td>
</tr>
</tbody>
</table>

Comparison of mortality due to contraception & abortion versus no birth control

Estimated Deaths Per 100,000 US Women Age 15-44

- No method/birth
- No method-abortion
- Spermicides
- Oral contraceptives
- Sponge
- Female sterilization
- Periodic abstinence
- Withdrawal
- Diaphragm/cap
- Condom
- Long-acting hormonal
- IUD
- Male sterilization

Deaths associated with pregnancy or abortion
Deaths associated with pregnancy (resulting from method failure)
Deaths associated with contraceptive use

## Lifetime Risk of Maternal Deaths

<table>
<thead>
<tr>
<th>Region</th>
<th>Lifetime Risk/100,000 births</th>
</tr>
</thead>
<tbody>
<tr>
<td>More developed countries</td>
<td>48</td>
</tr>
<tr>
<td>Less developed countries</td>
<td>1,800</td>
</tr>
</tbody>
</table>

*Based on risk per pregnancy and total number of pregnancies per woman (UNICEF)*
Safety of Contraception Summary

• All methods of contraception are safer than child bearing

• Risk/benefit ratio is greatest where maternal mortality is highest or abortion is illegal or unsafe