Family Planning Policies and Programs
Henry Mosley

Session 2 Slides
Fertility: Measurement, Trends, Proximate Determinants and Contraceptive Continuation and Failure
Measurement of Total Fertility Rate (TFR)

Number of births/1000 women

\[ TFR = \sum \frac{(ASFR * i)}{k} = \frac{(1200 * 5)}{1000} = 6 \text{ (births/woman)} \]

Where: \( i = \text{age interval}; k = \text{multiplier (1000)} \)
Trends in fertility in developing countries

![Bar graph showing trends in fertility in different regions from 1960 to 1990. Regions include SS Africa, ME/NA, So. Asia, L. America, and E. Asia. The x-axis represents the regions, and the y-axis represents the fertility rates. The bars are colored with shades from white to blue, indicating the fertility trends over time.]
Trends in Contraceptive Use in Developing Countries

[Bar chart showing trends in contraceptive use by region (SS Afr., MEINA, S. Asia, L. Amer., E. Asia) for the years 1960 and 1990.]
Relationship Between Fertility and Contraceptive Use

100 countries Surveyed in the 1990s
Fertility Determinants Model

- Underlying Determinants
- Intermediate (Proximate) Determinants
- Fertility
Bongaarts Proximate Determinants of Fertility Model
# Rating of Intermediate Fertility Variables

<table>
<thead>
<tr>
<th>Intermediate fertility variables</th>
<th>Sensitivity of fertility to intermediate variables</th>
<th>Variability among populations</th>
<th>Overall rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportions married</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Contraceptive use</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Prevelance of induced abortion</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Postpartum infecundability</td>
<td>++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Fecundability</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Spontaneous intrauterine mortality</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Permanent sterility</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

+++ = High  
++ = Medium  
+ = Low or absent
Potential Reproductive Life Span

~25 years or 300 months

Potential Reproductive Life Span

Reproductive potential

Age

15

50
Model of Reproduction

- Birth of woman
- Menarche
- Start of sexual union
- Birth 1
- Birth 2
- Birth 3
- Birth last
- End of exposure to risk
- Marriage
- Sterility
- Marriage dissolution
- Death of woman
- Effective reproductive span
- Postpartum infecundability
- Time to conception
- Pregnancy
- Conception
- Resumption of menses
- Birth 2
- Birth 3

* Effective increase in the average time to the next conception due to spontaneous fetal losses.
## A Model of Birth Interval Dynamics

<table>
<thead>
<tr>
<th>Birth Interval Model with:</th>
<th>Postpartum infecundity (months)</th>
<th>Time to next conception (months)</th>
<th>Gestation (months)</th>
<th>Total interval (months)</th>
<th>Total events in 300 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>1.5</td>
<td>9.5</td>
<td>9.0</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Breastfeeding</td>
<td>17.5</td>
<td>9.5</td>
<td>9.0</td>
<td>36</td>
<td>8.3</td>
</tr>
<tr>
<td>Contraception</td>
<td>1.5</td>
<td>95</td>
<td>9.0</td>
<td>105.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Abortion</td>
<td>1.5</td>
<td>7.5</td>
<td>1</td>
<td>10</td>
<td>30</td>
</tr>
</tbody>
</table>
Birth Interval Dynamics Model

Key Points

1. Breast feeding with lactational amenorrhea is a major determinant of lower fertility in developing countries.

2. Contraception prolongs the “waiting time to conception” by reducing the probability of conception in each ovulatory cycle.

3. Abortion actually shortens the inter-pregnancy interval. Therefore two to three abortions may be required to prevent one live birth.

4. While abortion alone is a very inefficient method of fertility control, abortion with contraceptive backup can be highly efficient.
Postpartum infecundability ($C_i$)

Contraception ($C_c$) and abortion ($C_a$)

Marriage ($C_m$)

\[ TFR = TF \times C_i \times C_c \times C_a \times C_m \]

*Note: the indices (C) have been developed so that all will have a value ranging from 1.0 signifying no effect of the factor, to 0.0 signifying 100% effect.
Index of Marriage

\[ TN \times C_m \]

\[ \text{Not married} \]

\[ \text{Married or in sexual union} \]

\[ C_m = \frac{TFR}{TMFR} \]

\[ = \sim \% \text{ Married} \]

TFR = Total Fertility Rate
TMFR = Total Marital Fertility Rate
Index of Contraception

\[ C_c = 1 - (1.08 \times u \times e) \]

- \( u = \) contraceptive prevalence
- \( e = \) contraceptive effectiveness
Index of Abortion

\[ C_a = \frac{TFR}{TFR + 0.4 \times TA (1+u)} \]

\( TN \times C_m \times C_c \times C_a \)

- Not married
- Effectively contracepting
- Fertility reduction by abortion

TA = Total Abortion Rate
**Index of Postpartum Infecundability**

\[ C_i = \frac{20}{18.5 + a} \]

- **TN**
  - \( x C_m \): Not married
  - \( x C_c \): Effectively contracepting
  - \( x C_a \): Fertility reduction by abortion
  - \( x C_i \): Fert. reduction by PP infecundability

- **TFR**

\( a = \) duration of postpartum amenorrhea in months (minimum is 1.5 months)
Hypothetical Model of Bongaarts Indices with the Fertility Transition
Proximate Determinants of Fertility
Beijing, 1982

(Data from: Wang, et al., 1987)
Examples of Applications of Bongaarts Indices


Contraceptive Technologies

Continuation
And
Failure Rates
Relationship of Contraceptive Prevalence to Acceptance and Continuation

- From epidemiology
  \[ \text{Prevalence} = \text{Incidence} \times \text{Duration} \]

- For contraceptives
  \[ \text{Contraceptive prevalence} = \text{acceptance rate} \times \text{duration of use} \]

- The critical issues in contraceptive programs are:
  1. Recruiting acceptors
  2. Dropouts by users of “temporary” methods (pills, IUDs, etc.)
  3. Failures by all methods, especially user-dependent methods
## Method Discontinuation Rates

<table>
<thead>
<tr>
<th>METHOD</th>
<th>DISCONTINUATION (Range in percent/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IUD</td>
<td>– 10-30%</td>
</tr>
<tr>
<td>Orals</td>
<td>– 20-40%</td>
</tr>
<tr>
<td>Condoms</td>
<td>– 25-60%</td>
</tr>
<tr>
<td>Injectables</td>
<td>– 30-40%</td>
</tr>
<tr>
<td>Norplant</td>
<td>– 15-20%</td>
</tr>
</tbody>
</table>
Relationship of Discontinuation Rate to Duration of Use

(Duration of use = 1/Discontinuation rate)

<table>
<thead>
<tr>
<th>Discontinuation rate/year</th>
<th>Duration of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>5% (or 0.05)</td>
<td>– 20 years</td>
</tr>
<tr>
<td>10% (or 0.10)</td>
<td>– 10 years</td>
</tr>
<tr>
<td>20%</td>
<td>– 5 years</td>
</tr>
<tr>
<td>30%</td>
<td>– 3.3 years</td>
</tr>
<tr>
<td>40%</td>
<td>– 2.5 years</td>
</tr>
</tbody>
</table>
Relationship of Contraceptive Prevalence to Variations in Continuation Rates

(Prevalence = Acceptance rate x Continuation)
Relationship of Contraceptive Prevalence to Variations in Contraceptive Acceptance Rates and Continuation

(Prevalence = Acceptance Rate x Continuation)
Contraceptive Failure

**Definition** – contraceptive failure (F) is a measure of the proportion of women conceiving in a given time period (usually one year) while using a method.

In general, one can consider the annual failure rate (F) as roughly equal to \((1 - e)\) where \((e)\) is contraceptive effectiveness. For example of 100 women using a contraceptive that is 95% effective, 5 (5%) will experience a pregnancy in a year.
Contraceptive Failure (Continued)

Reported contraceptive failure rates vary widely according to:

• **Method** – all methods have an intrinsic failure rate, for example, <0.1% for sterilizations, 0.1% for combined orals, 0.8% for CuT 380A, 2% for condoms, 4% for withdrawal, etc.

• **Characteristics of users** - User-dependent methods like condoms, withdrawal and pills, however, can show wide variations in “use-effectiveness” depending on the motivation, education, cultural background, etc., of the users. For example, pill failures generally range from 3% to 6% and condom failures from 5% to 15%.
Contraceptive Failure (continued)

Because of the need for extended periods of contraceptive use (i.e. 10 years or more), women using contraceptives of relatively high effectiveness (<90%) will actually have a high risk of an unintended pregnancy in their reproductive lifetime.

This is because the probability of remaining non-pregnant \( (P) \) for \( (n) \) years with a contraceptive of effectiveness \( (e) \) is an exponential function: \( P_n = e^n \).
Contraceptive Failure (continued)

Example: $P_n = e^n$.
where: $n = 10$ years

<table>
<thead>
<tr>
<th>Contraceptive Effectiveness (e)</th>
<th>$P_n$</th>
<th>Probability of pregnancy (%) in 10 years = 1 - $P_n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>.96</td>
<td>.66</td>
<td>33%</td>
</tr>
<tr>
<td>.90</td>
<td>.35</td>
<td>65%</td>
</tr>
<tr>
<td>.85</td>
<td>.20</td>
<td>80%</td>
</tr>
</tbody>
</table>
Couple Years of Protection (CYP)

• **Question** – how can one “add up” all of the different types of contraceptive services provided by various service delivery points to get a comparable indicator of performance?

• **Answer** – Use the measure of CYP.

**Definition** – CYP is “a composite person-time measure of the total amount of protection conferred by all methods to all acceptors practicing for any length of time.”
# Standard Values of Units Per CYP

## METHOD
- Oral contraceptives
- CuT 380-A IUD
- Norplant (implant)
- Depo-Provera (inject.)
- Noristerat (inject.)
- Sterilization
- Condoms

## UNITS PER CYP
- 15 cycles per CYP
- 3.5 CYP per IUD
- 3.5 CYP per implant
- 4 doses per CYP
- 6 doses per CYP
- 10 CYP per procedure
- 150 condoms per CYP