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JOHNS HOPKINS  
BLOOMBERG  
SCHOOL *of* PUBLIC HEALTH

# **Family Planning Policies and Programs**

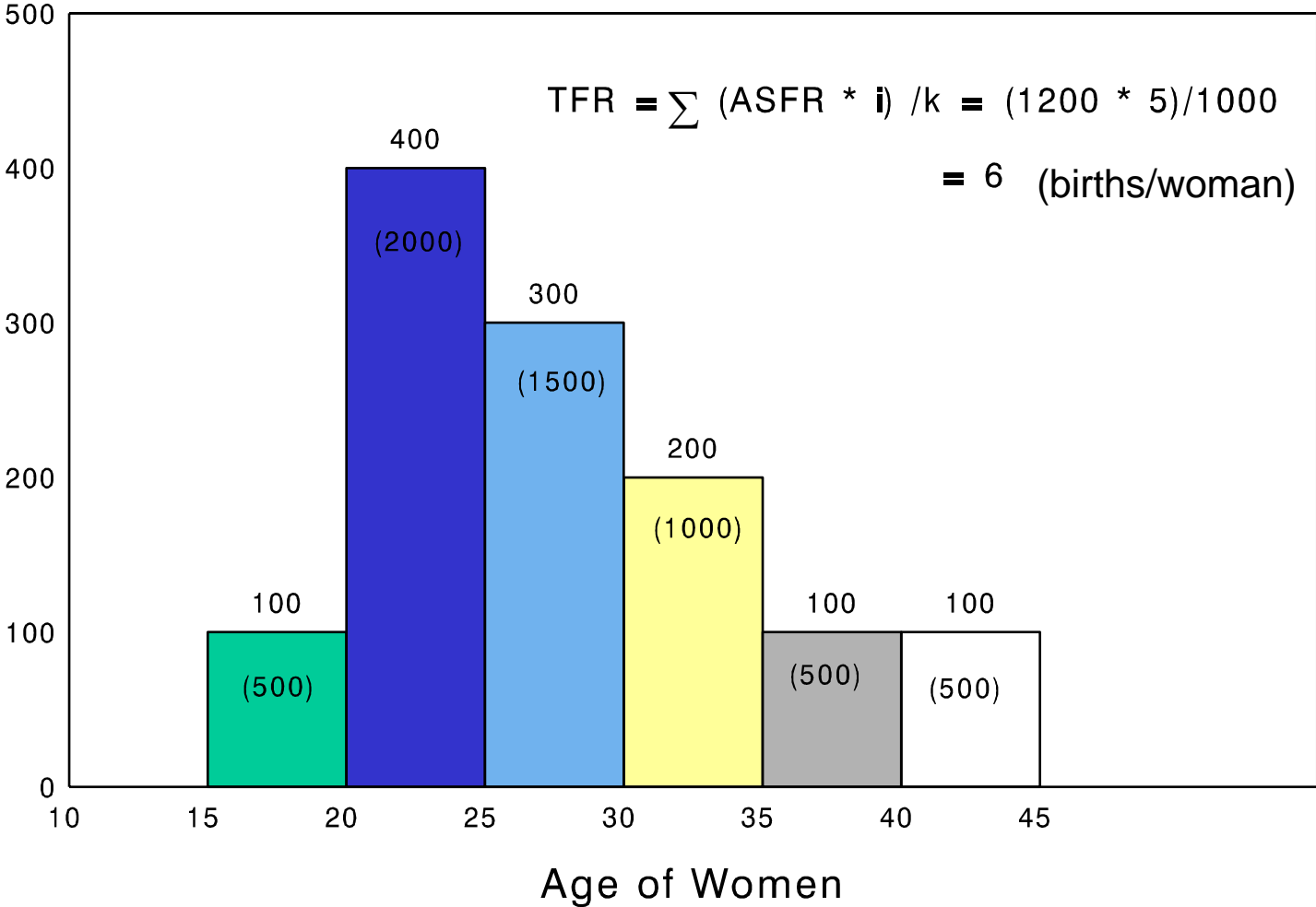
**Henry Mosley**

**Session 2 Slides**

**Fertility: Measurement,  
Trends, Proximate  
Determinants and  
Contraceptive Continuation  
and Failure**

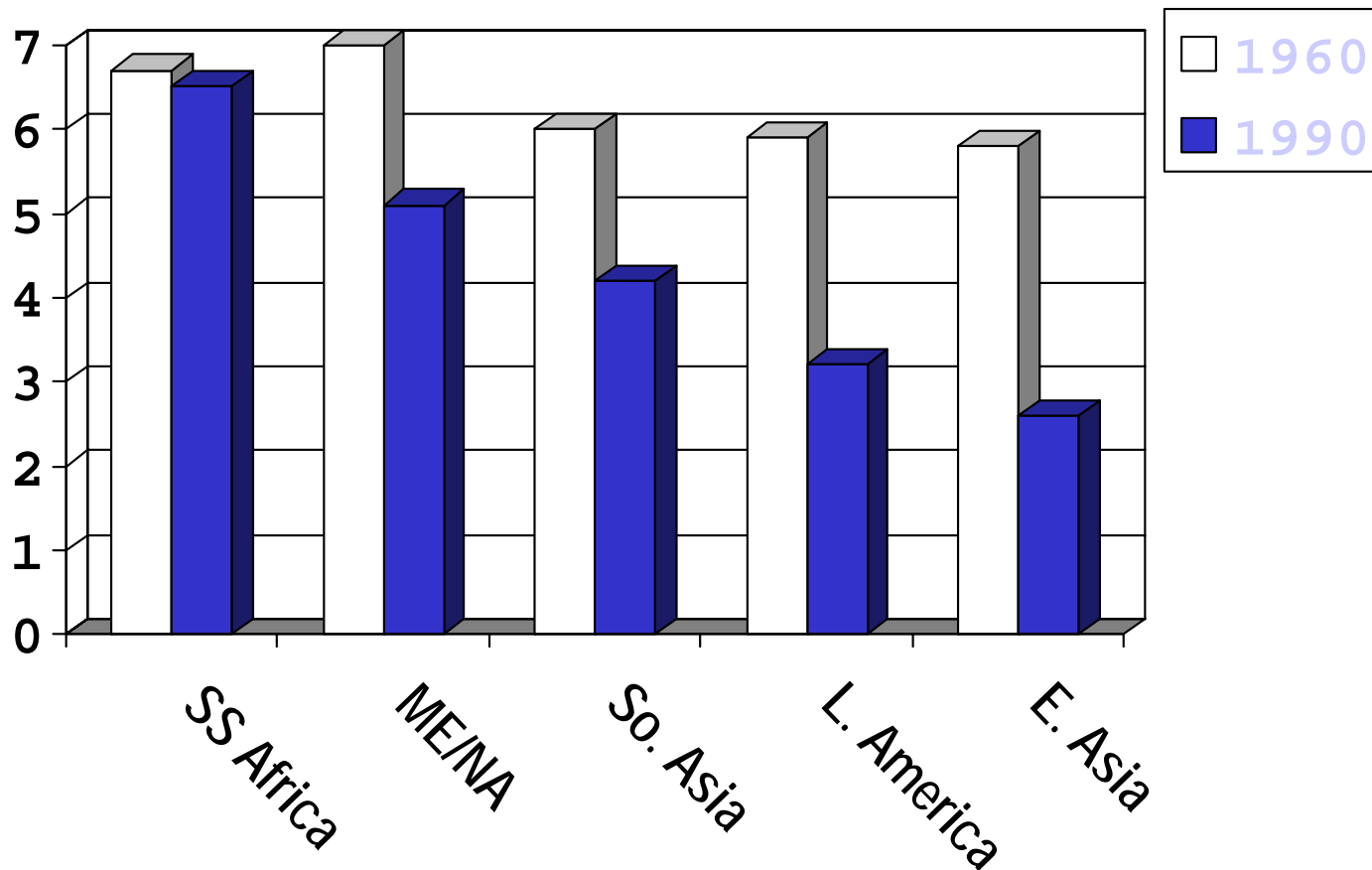
# Measurement of Total Fertility Rate (TFR)

Number of births/1000 women

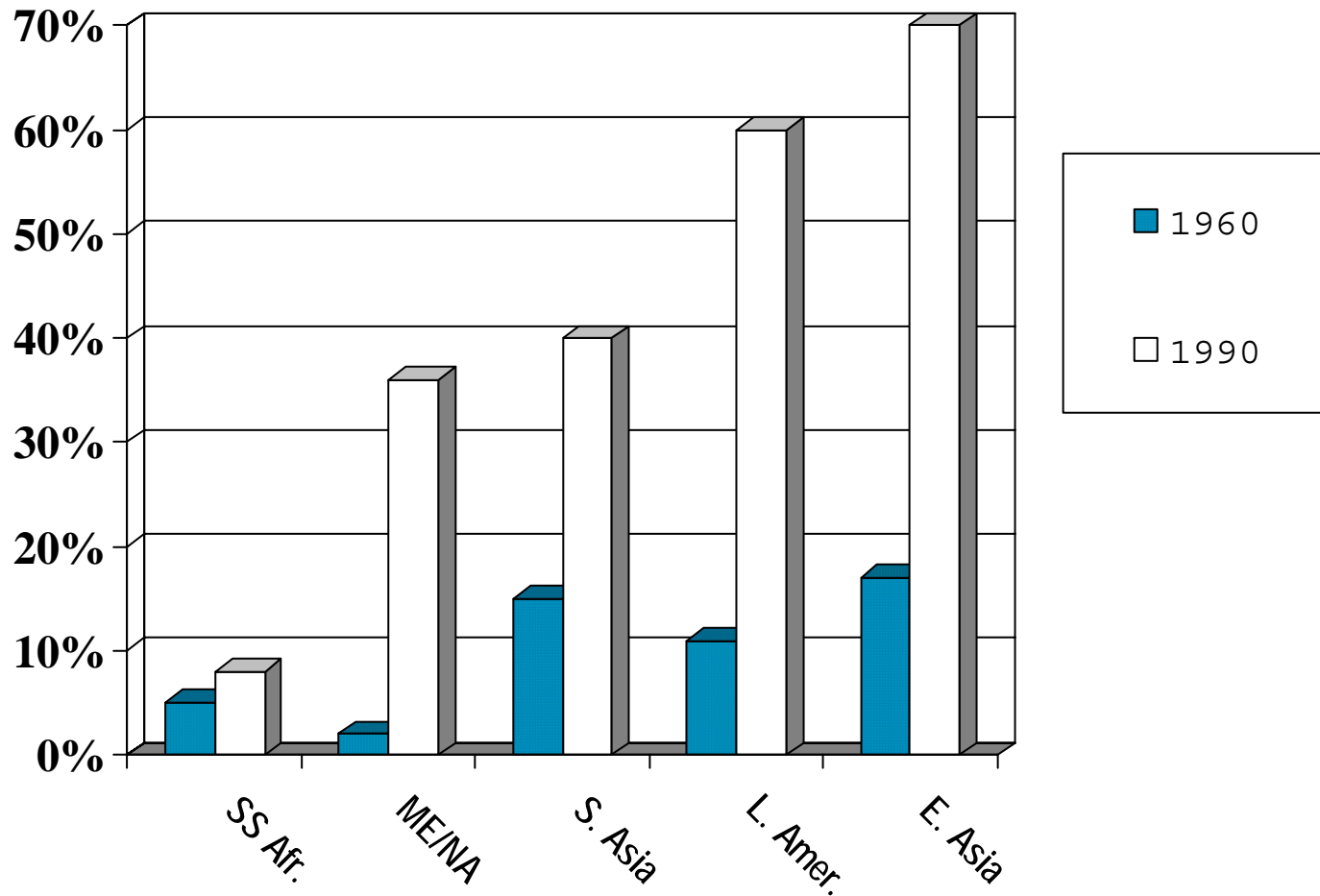


Where: **i** = age interval; **k** = multiplier (1000)

# Trends in fertility in developing countries

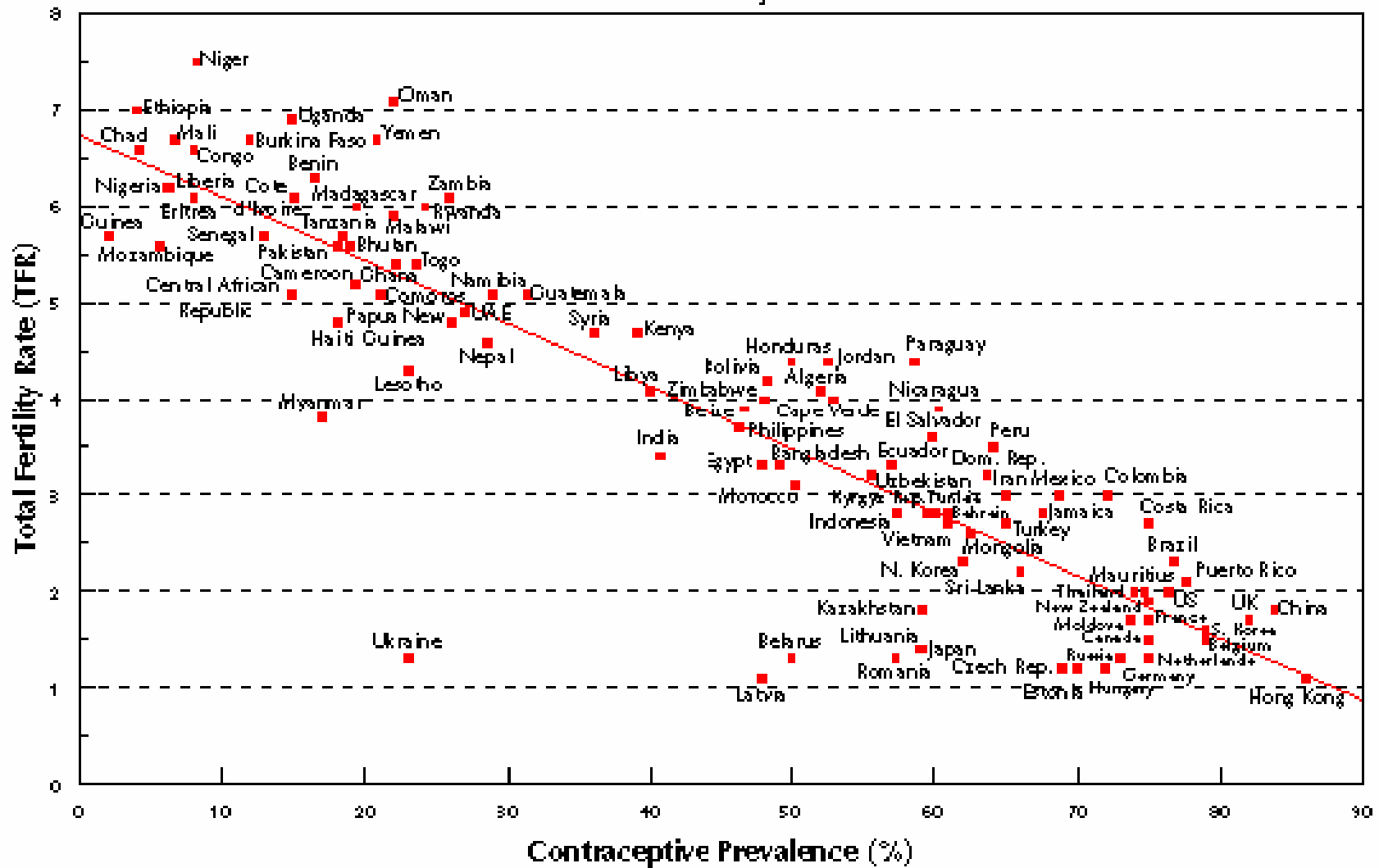


# Trends in Contraceptive Use in Developing Countries



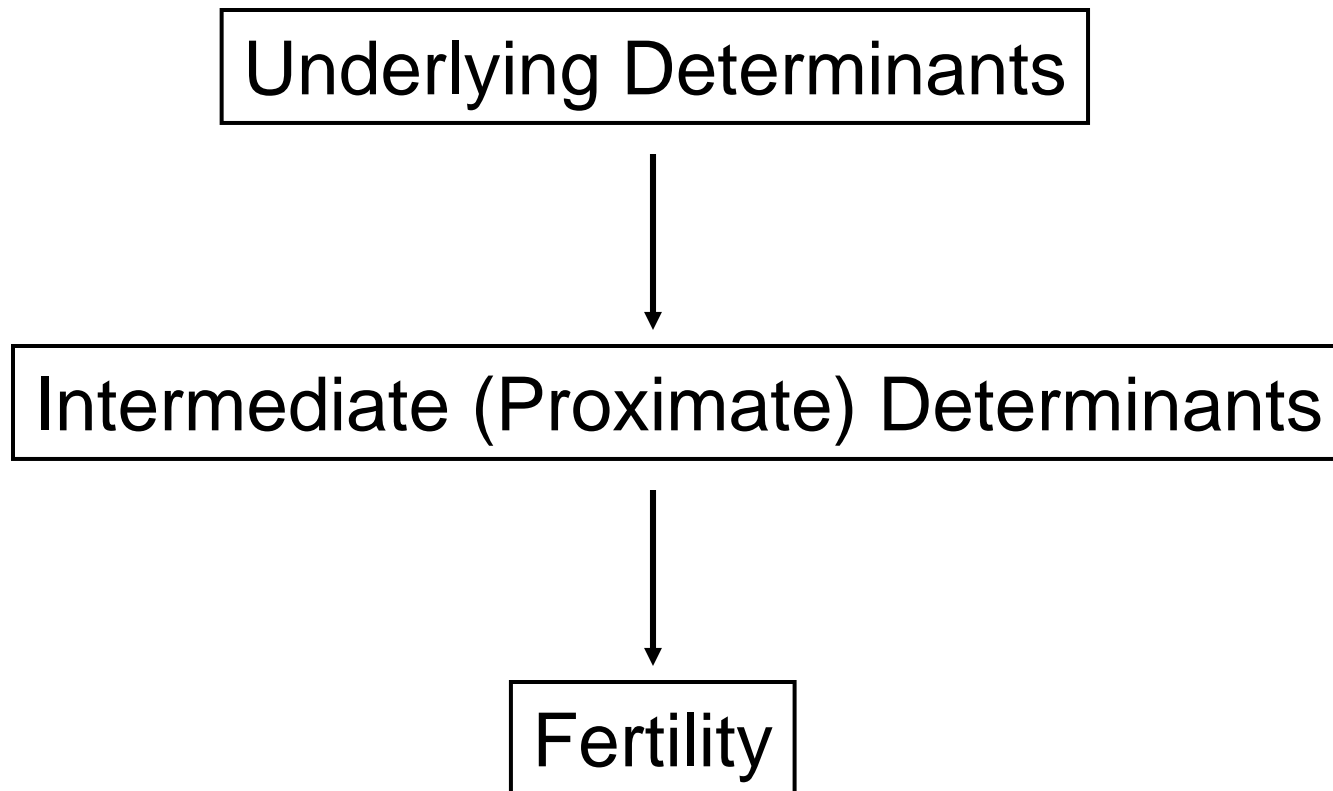
# Relationship Between Fertility and Contraceptive Use

100 countries Surveyed in the 1990s



Population Reports

# Fertility Determinants Model





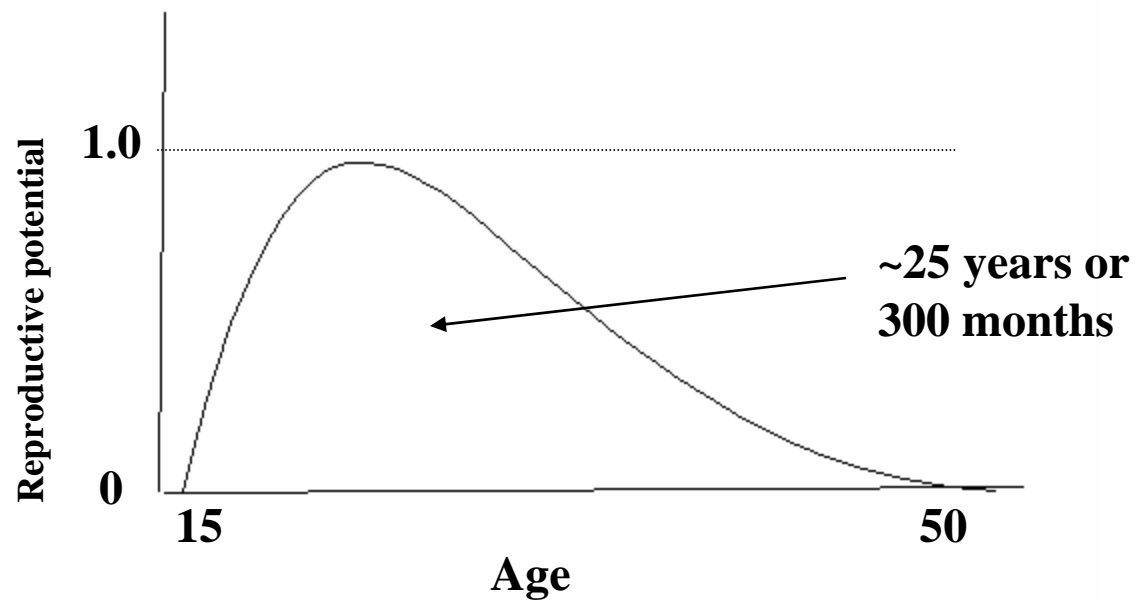
# Bongaarts Proximate Determinants of Fertility Model

# Rating of Intermediate Fertility Variables

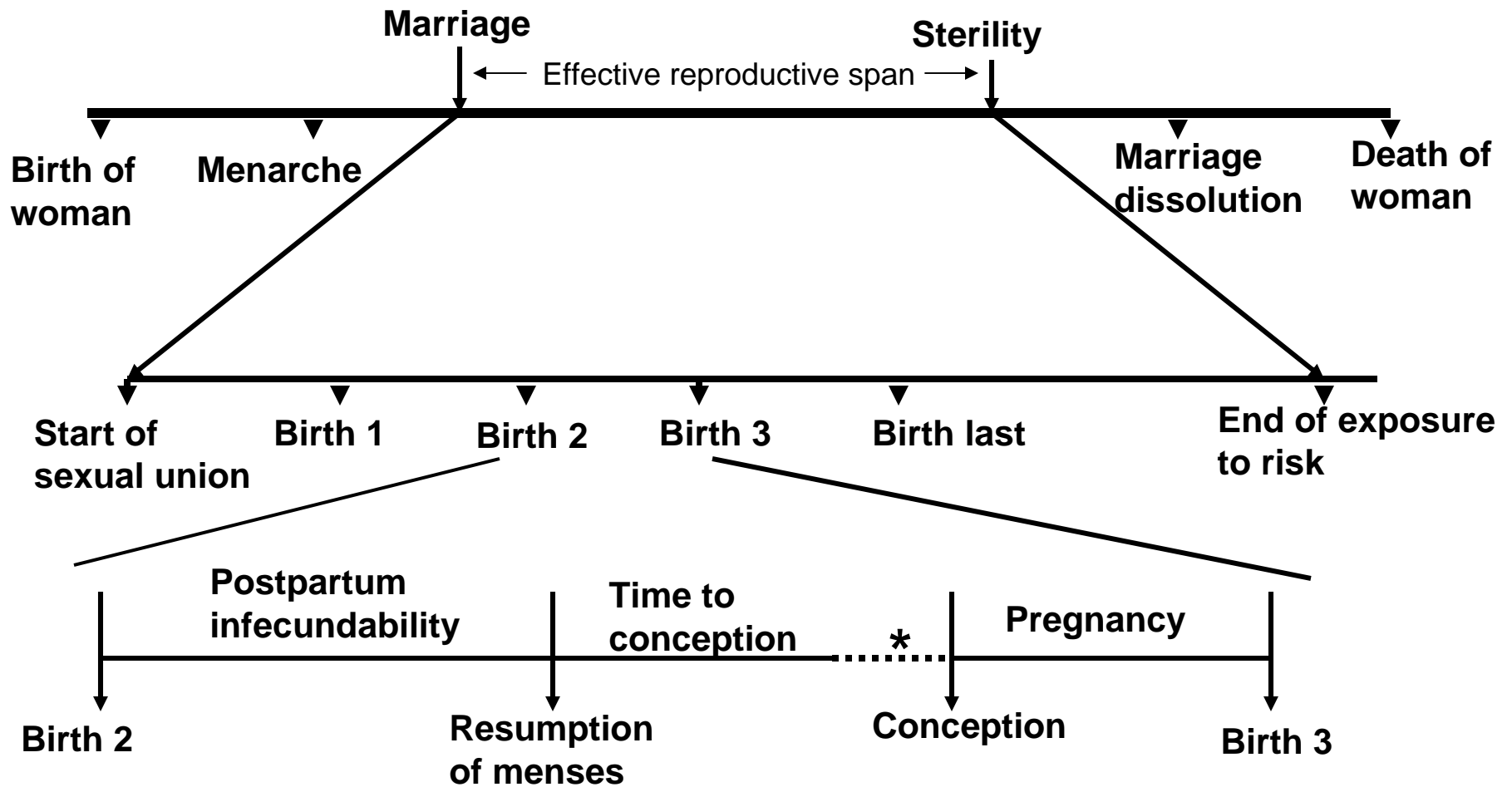
<b>Intermediate fertility variables</b>	<b>Sensitivity of fertility to intermediate Variables</b>	<b>Variability among Populations</b>	<b>Overall Rating</b>
Proportions married	+++	+++	+++
Contraceptive use	+++	+++	+++
Prevalence of induced abortion	++	+++	+++
Postpartum infecundability	++	+++	+++
Fecundability	++	++	++
Spontaneous intrauterine mortality	+	+	+
Permanent sterility	++	+	+

+++ = High      ++ = Medium      + = Low or absent

# Potential Reproductive Life Span

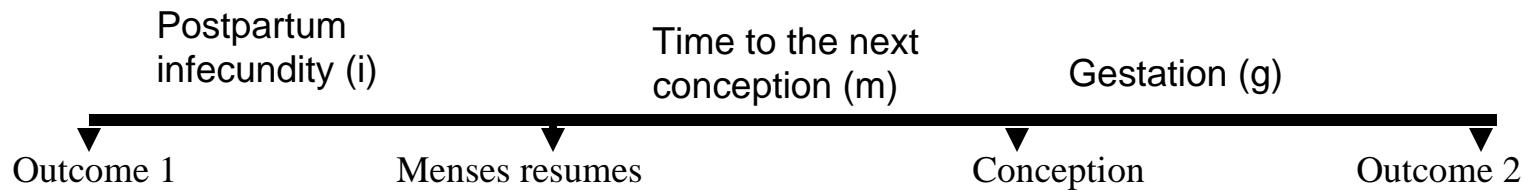


# Model of Reproduction



\* Effective increase in the average time to the next conception due to spontaneous fetal losses.

# A Model of Birth Interval Dynamics



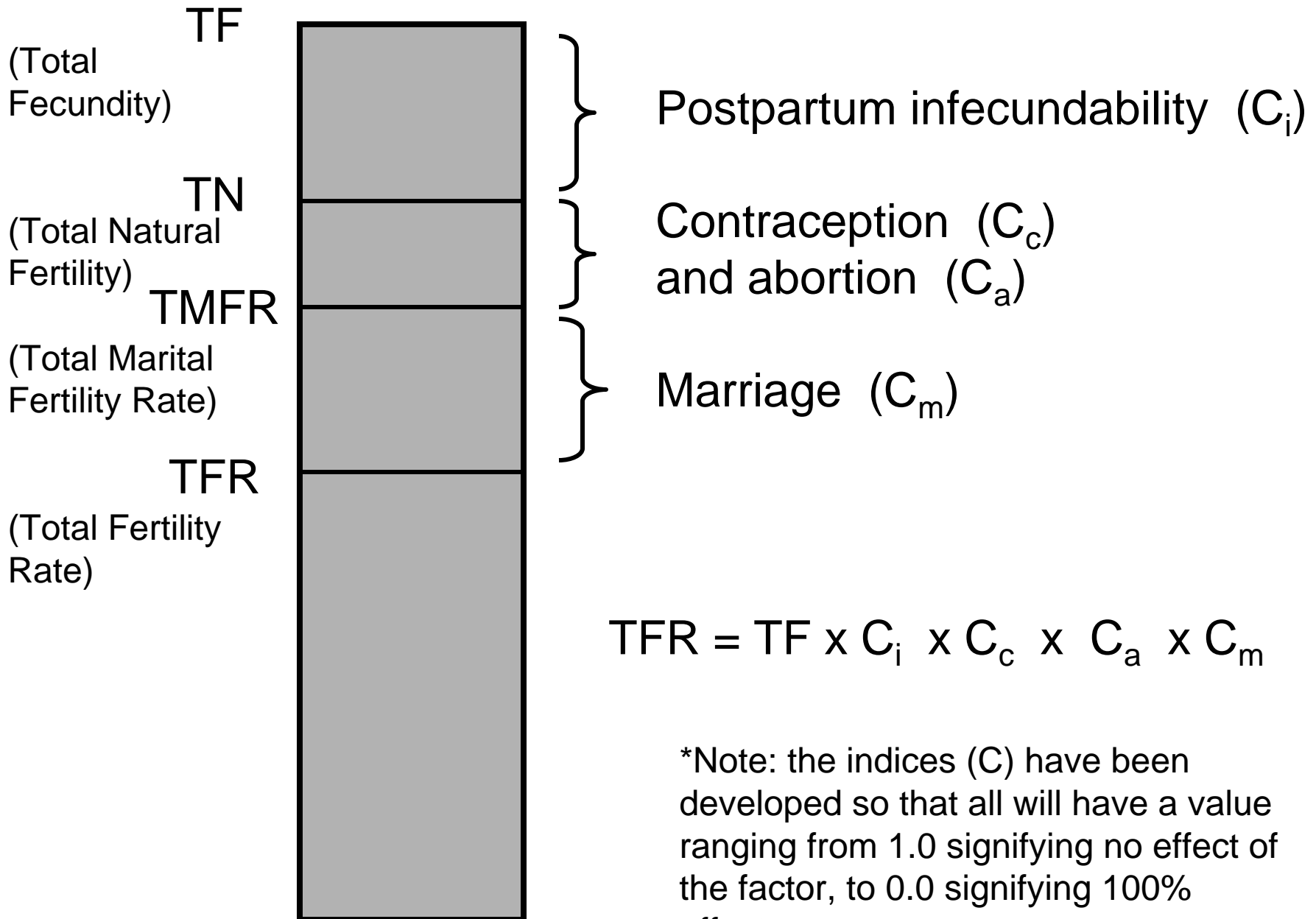
<b>Birth Interval Model with:</b>	<b>Postpartum infecundity (months)</b>	<b>Time to next conception (months)</b>	<b>Gestation (months)</b>	<b>Total interval (months)</b>	<b>Total events in 300 months</b>
<b>Maximum</b>	1.5	9.5	9.0	20	15
<b>Breastfeeding</b>	17.5	9.5	9.0	36	8.3
<b>Contraception</b>	1.5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

# 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.

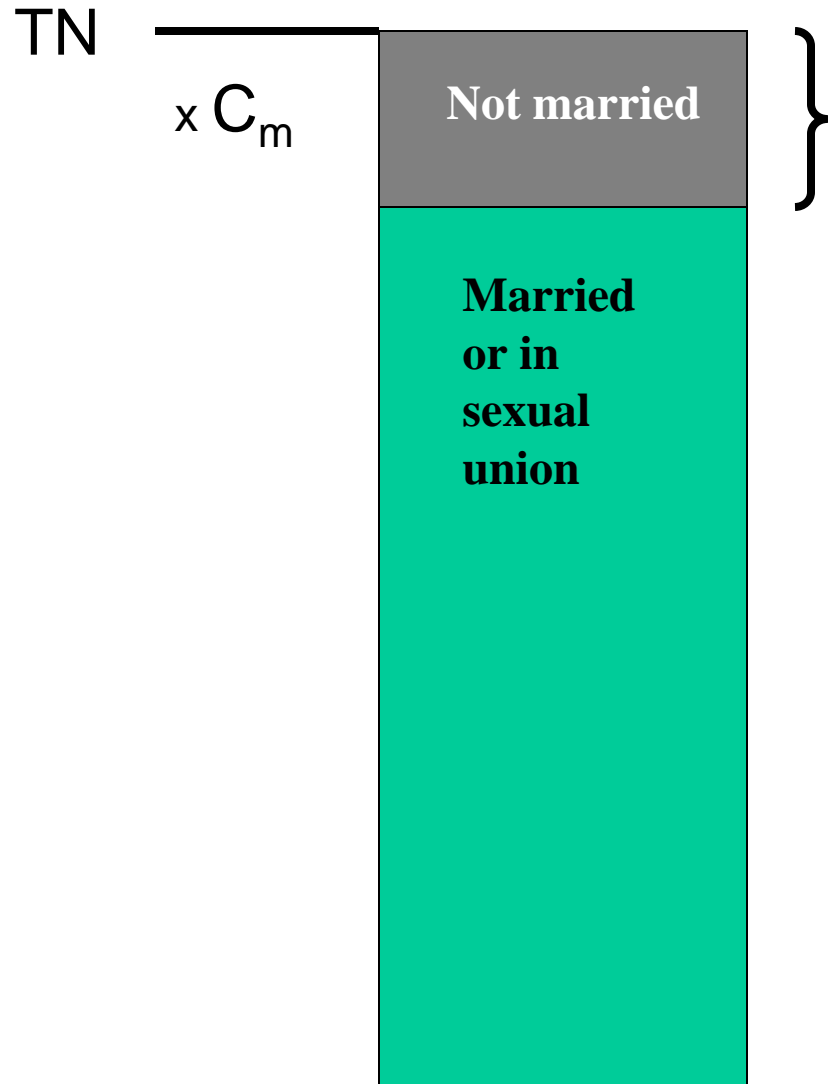
# Bongaarts Indices\*



$$TFR = TF \times C_i \times C_c \times C_a \times C_m$$

\*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



$$C_m = \frac{\text{TFR}}{\text{TMFR}}$$

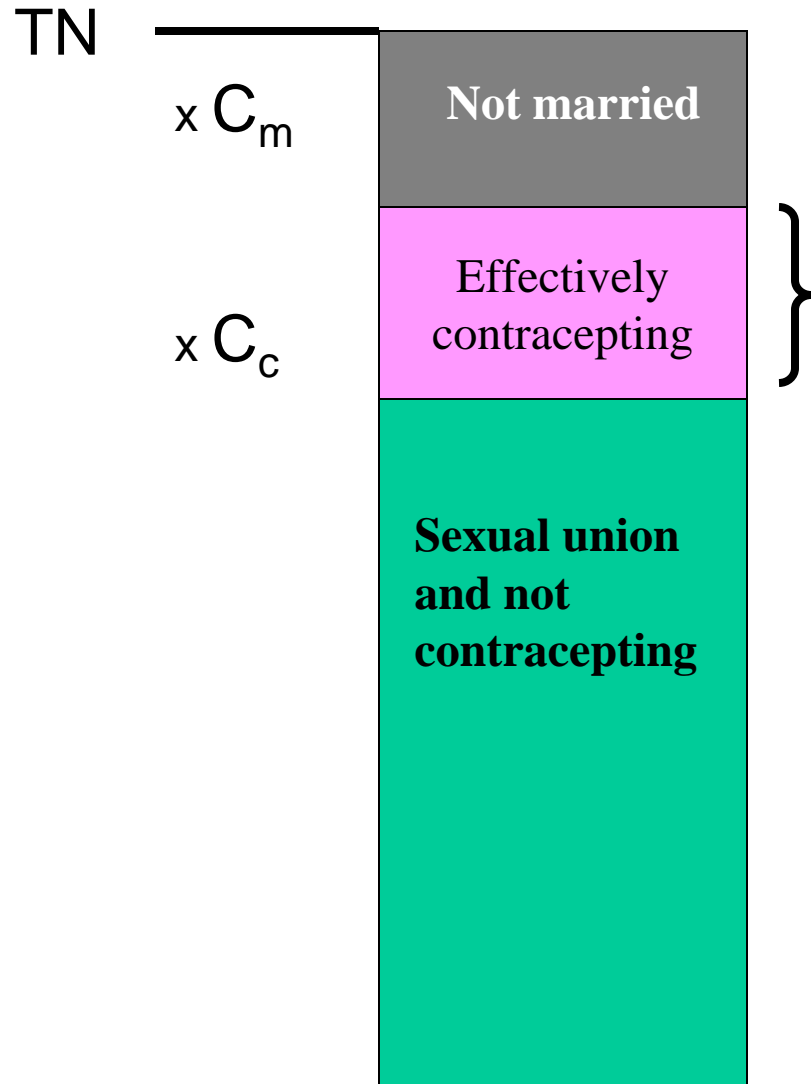
= ~ % Married

TFR = Total Fertility Rate

TMFR = Total Marital Fertility Rate



# Index of Contraception

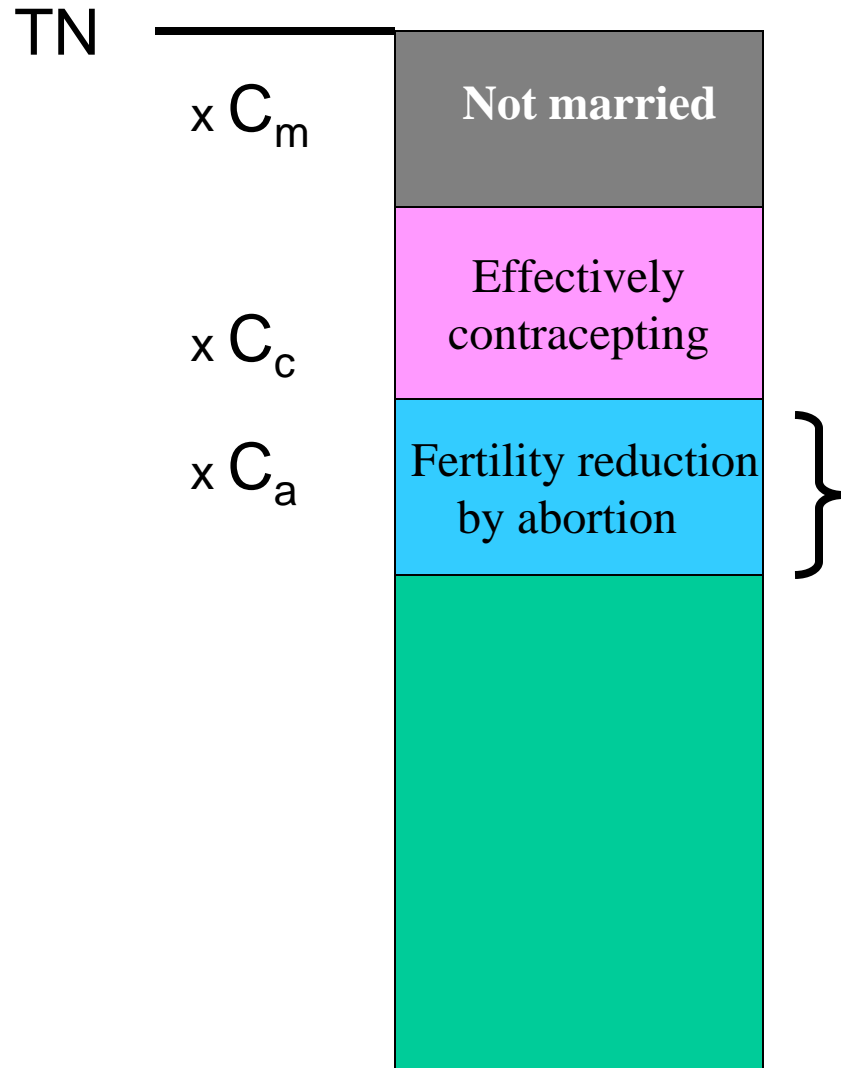


$$C_c = 1 - (1.08 \times u \times e)$$

$u$  = contraceptive prevalence

$e$  = contraceptive effectiveness

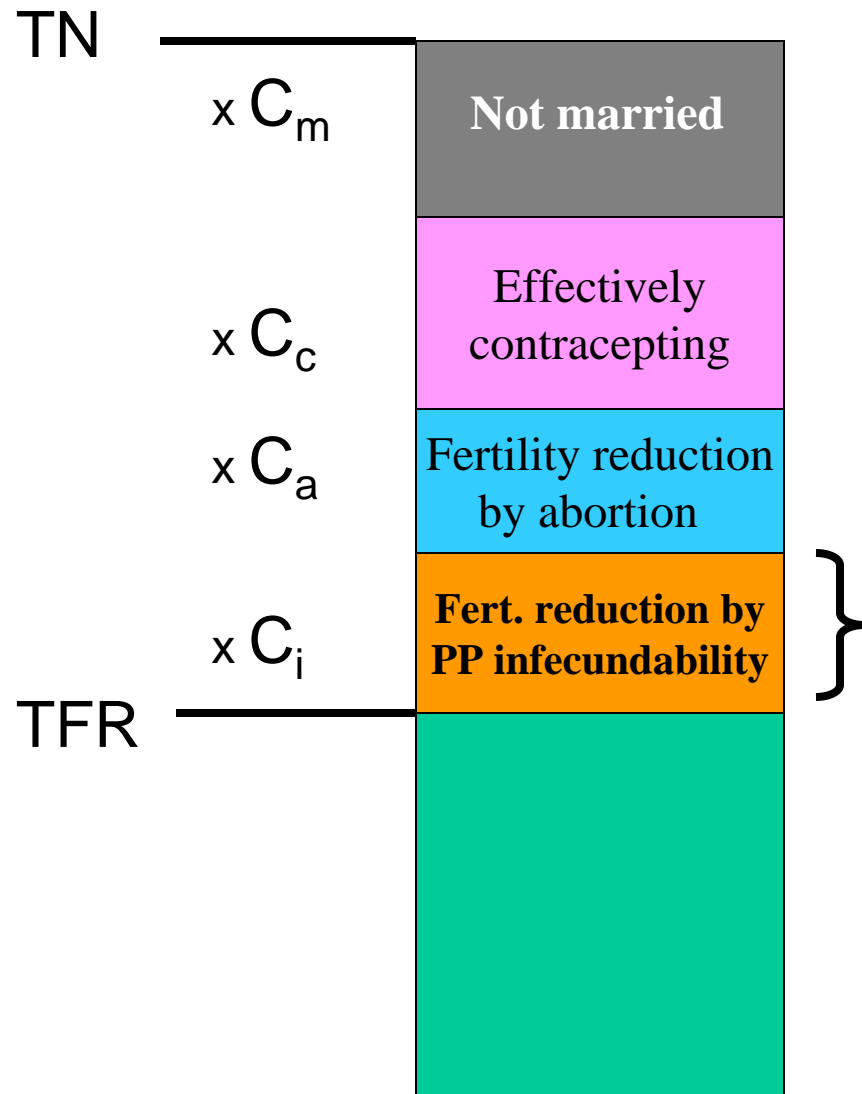
# Index of Abortion



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

TA = Total Abortion Rate

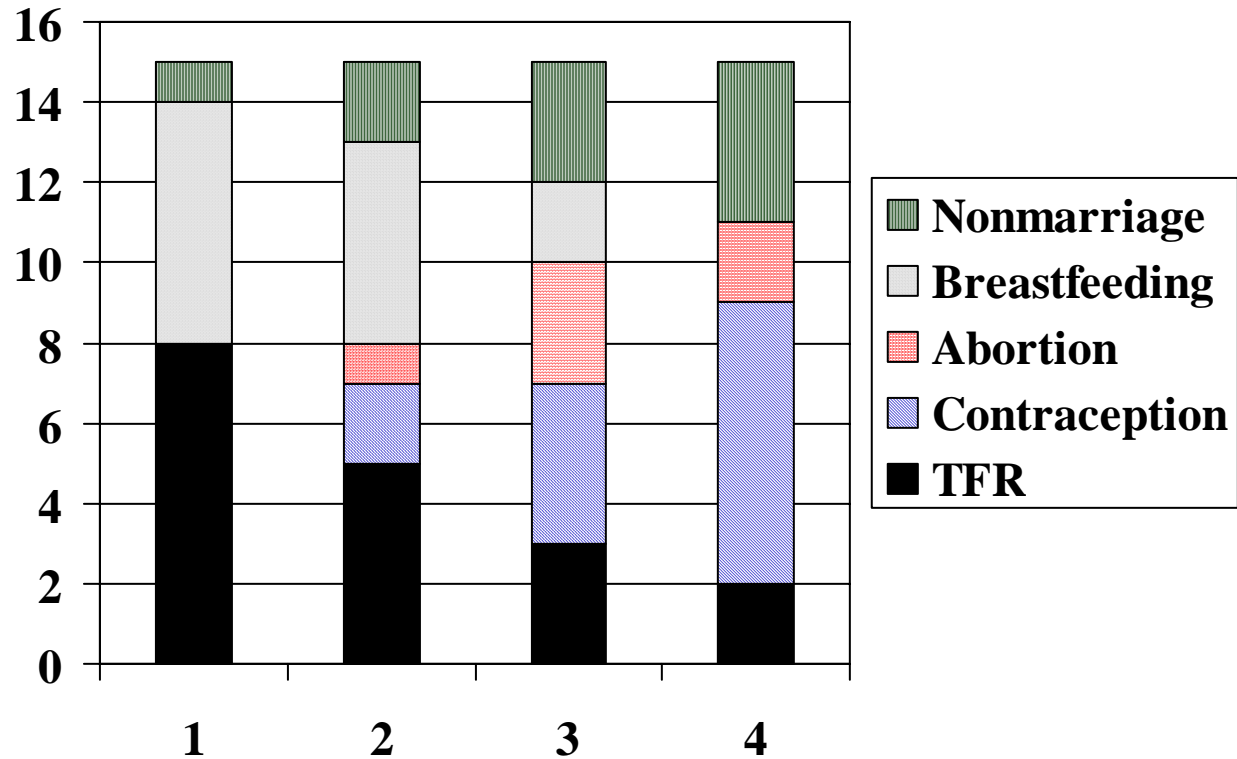
# Index of Postpartum Infecundability



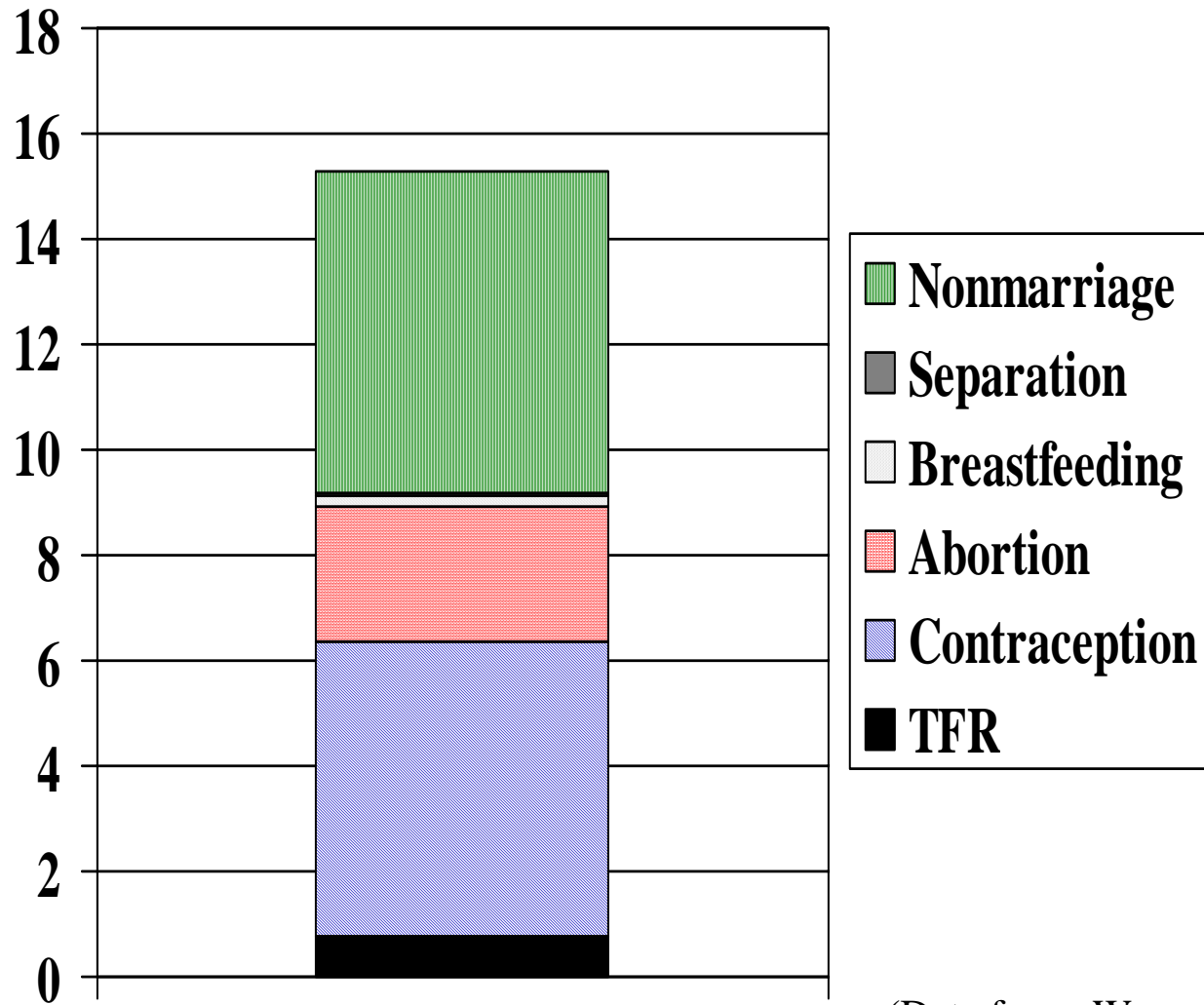
$$C_i = \frac{20}{18.5 + a}$$

$a$  = 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

- Bongaarts, J., The fertility inhibiting effects of the intermediate fertility variables. *Studies in Family Planning* 13: 170-189, 1982.
- Wang, S-X., et al., Proximate determinants of fertility and policy implications in Beijing. *Studies in Family Planning* 18: 222-228, 1987.

# Contraceptive Technologies

Continuation

And

Failure Rates

# Relationship of Contraceptive Prevalence to Acceptance and Continuation

- From epidemiology

$$\underline{\text{Prevalence} = \text{Incidence} \times \text{Duration}}$$

- For contraceptives

$$\underline{\text{Contraceptive prevalence} = \text{acceptance rate} \times \text{duration of use}}$$

- 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

<u>METHOD</u>	<u>DISCONTINUATION</u> (Range in percent/year)
IUD	– 10-30%
Orals	– 20-40%
Condoms	– 25-60%
Injectables	– 30-40%
Norplant	– 15-20%

# Relationship of Discontinuation Rate to Duration of Use

(Duration of use = 1/Discontinuation rate)

Discontinuation rate/year

Duration of use

5% (or 0.05)

– 20 years

10% (or 0.10)

– 10 years

20%

– 5 years

30%

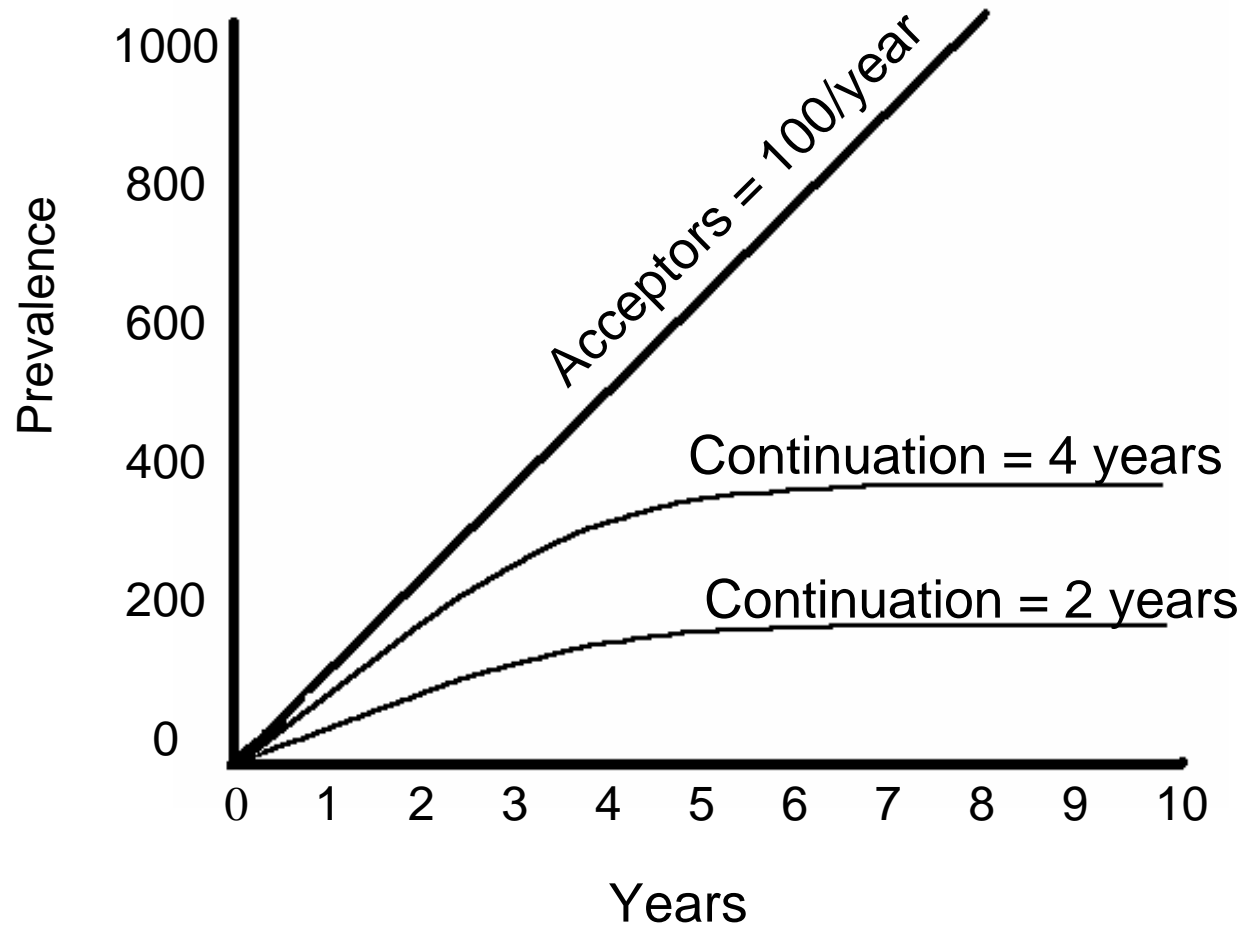
– 3.3 years

40%

– 2.5 years

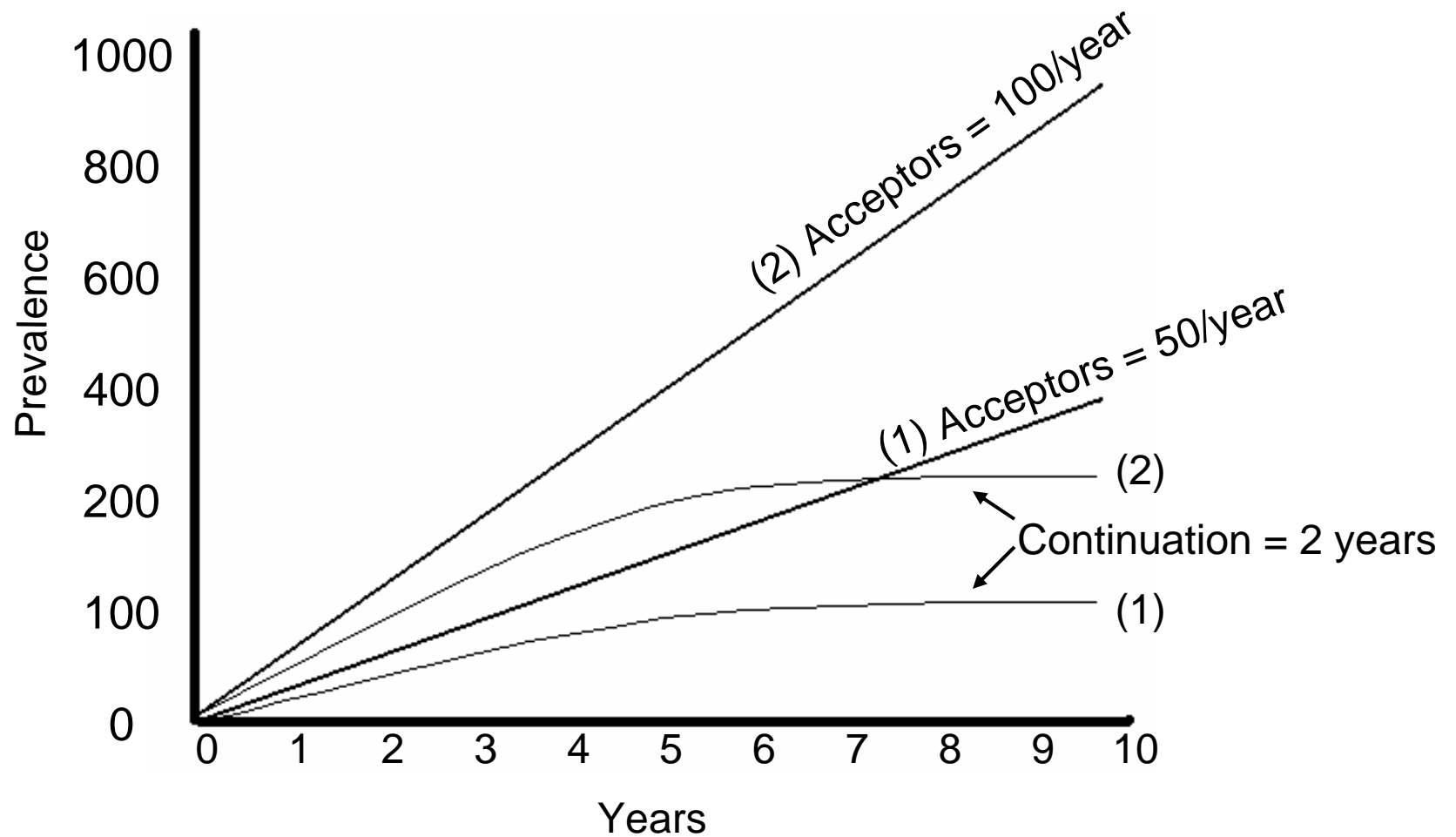
# Relationship of Contraceptive Prevalence to Variations in Continuation Rates

(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

<u>Contraceptive Effectiveness (e)</u>	<u><math>P_n</math></u>	<u>Probability of pregnancy (%) in 10 years = <math>1 - P_n</math></u>
.96	.66	33%
.90	.35	65%
.85	.20	80%



# 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

<b><u>METHOD</u></b>	<b><u>UNITS PER CYP</u></b>
• Oral contraceptives	• 15 cycles per CYP
• CuT 380-A IUD	• 3.5 CYP per IUD
• Norplant (implant)	• 3.5 CYP per implant
• Depo-Provera (inject.)	• 4 doses per CYP
• Noristerat (inject.)	• 6 doses per CYP
• Sterilization	• 10 CYP per procedure
• Condoms	• 150 condoms per CYP