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Fertility Measures

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Definition of Terms

- **Fertility** = Production of a live birth (natality)
- **Infertility** = Inability to produce a live birth
- **Parity** = Number of children born alive to a woman
- **Gravidity** = Number of pregnancies a woman has had whether or not they produce a live birth
- **Fecundity** = Physiological capacity to conceive (reproductive potential)
- **Infecundity (sterility)** = Inability of a woman to conceive a pregnancy

- Primary sterility = Never able to conceive a pregnancy

- Secondary sterility= Inability to conceive after one or more children have been born

- **Fecundability** = Probability that a woman will conceive during a menstrual cycle

Fertility Measurement: Sources of Data

- Censuses
- Vital registration systems
- Nationally representative sample surveys
- World Fertility Surveys (WFS),
- Demographic and Health Surveys (DHS),

CRUDE INDICATORS OF FERTILITY

Child- Woman Ratio (CWR)

- Number of children under age 5 per 1000 women of childbearing age in a given year.
- This measure can be calculated from national censuses or survey data, thereby providing fertility data where birth statistics may not otherwise be available.

$$\text{CWR} = \frac{\text{Number of children under age 5}}{\text{Number of women ages 15-49}} \times 1000$$

Crude Birth Rate (CBR)

This is the number of live births per 1,000 population in a given year.

$$\textbf{CBR} = \frac{\text{Number of births}}{\text{Total population}} \times 1000$$

Example

If the number of births in a community in 1960 was 18,247 and the mid-year population size was 985,210. What is the crude birth rate of this community?

Interpretation: There were **?** births per 1,000 in community X in year 1960.

Data Requirement and Limitations of CBR

- Need a complete and accurate vital registration system.
- Only a crude estimate of fertility.
- All the population included in the denominator is not exposed to the risk of pregnancy.
- Not good for comparing fertility across populations, as variations in age distribution of the populations being compared will affect the birth rate.

General Fertility Rate (GFR)

- The general fertility rate (also called the fertility rate) is the number of live births per 1,000 women ages 15-49 in a given year. The general fertility rate is a somewhat more refined measure than the birth rate because it relates births to the age-sex group at risk of giving birth (usually defined as women ages 15-49).

- This refinement helps eliminate distortions that might arise because of different age and sex distributions among populations. Thus, the general fertility rate is a better basis to compare fertility levels among populations than are changes in the crude birth rate.

$$\textbf{GFR} = \frac{\text{Number of births/year}}{\text{Number of women ages 15 to 49}} \times 1000$$

Data Sources

- Vital registration system for births
- May also be estimated from national censuses or survey data using the child-women ratio when birth statistics are not available
- Relates births to the age-sex group at risk of giving births (usually defined as women ages 15-49 years)
- More refined measure than crude birth rate to compare fertility across populations
- Approximately equals to 4 times the crude birth rate

AGE ADJUSTED INDICATORS OF FERTILITY

Age Specific Fertility Rate (ASFR)

- Number of births per 1000 women of a specific age (group) in a given year. Fertility rates is calculated for specific age groups to see differences in fertility behavior at different ages or for comparison over time.

$$\text{ASFR} = \frac{\text{Number of births to women age a}}{\text{Number of women age a}} \times 1000$$

Uganda calculation of ASFR, 1991

Age of women	(1) Number of women	(2) Number of births	(3) ASFR (2)÷(1)
15-19	936480	133,901	142.9
20-24	815627	250,361	306.9
25-29	673084	204,436	303.7
30-34	479915	122,778	255.8
35-39	353079	67,755	191.9
40-44	280223	24,275	86.6
45-49	233088	6,089	26.1

Age Specific Fertility Rates: Why do we need them?

- For comparisons in fertility behavior at different ages
- For comparison of fertility at different ages over time
- For comparison of fertility across countries/populations

Total Fertility Rates (TFR)

- The average number of children that would be born to a woman by the time she ended childbearing if she were to pass through all her childbearing years conforming to the age-specific fertility rates of a given year.

$$TFR = 5 \times \Sigma ASFR / 1{,}000$$

Calculating TFR: Uganda 1991

Age of women	(1) Number of women	(2) Number of births	(3) ASFR (2)÷(1)	(4) ASFR x 5/1000
15-19	936480	133,901	142.9	0.71
20-24	815627	250,361	306.9	1.53
25-29	673084	204,436	303.7	1.52
30-34	479915	122,778	255.8	1.28
35-39	353079	67,755	191.9	0.96
40-44	280223	24,275	86.6	0.43
45-49	233088	6,089	26.1	0.13
TFR				6.57

- TFR is a “synthetic” measure of fertility that is independent of age structure of a population
- Best single measure to compare fertility across populations
- Does not give a measure of actual number of births any woman will have all through her reproductive years

Children Ever Born (CEB)

- This is computed from censuses or sample surveys by asking women their age and number of live births they ever had (including those having died since birth)
- Provides one measure of population fertility
- Useful only if age group of women is considered
- Data can be used by demographers to indirectly estimate ASFR and TFR in a population.
- CEB for women over age 49 is called **Completed Fertility Rate**; it shows how many children on average a certain cohort of women who have completed childbearing actually produced during their childbearing years.

INDICATORS OF REPRODUCTION

Gross Reproduction Rate (GRR)

Average number of daughters that would be born to a woman during her lifetime if she passed through her child-bearing years conforming to the age specific fertility rates of a given year.

Note: GRR is exactly like TFR, except that it counts only daughters and literally measures "reproduction"– a woman reproducing herself in the next generation by having a daughter.

- Let B^f = Number of female births
- B^{m+f} = Number of male and female births i.e. all births

GRR Cont'd

$$GRR = \sum ASFR * \frac{B^f}{B^{m+f}}$$

- GRR = TFR ∗ (Proportion of female births)
- GRR, Uganda ,1991: Sex ratio at birth = 1.03M/F

$$= TFR \times \frac{\#\text{ of female births}}{\#\text{ of total births}} = 6.7 \times \frac{100}{100+103} = 3.3$$

GRR Cont'd

- GRR, like TFR, assumes that the hypothetical cohort of women pass from birth through their reproductive life without experiencing mortality.
- This assumption is satisfactory when one wants to compare levels of fertility and/or gross reproduction across populations and over time.
- But, for a more realistic assessment of the reproductive potential of a population, taking into account mortality, one needs to calculate the Net Reproduction Rate (NRR).

Net Reproduction Rate (NRR)

Definition

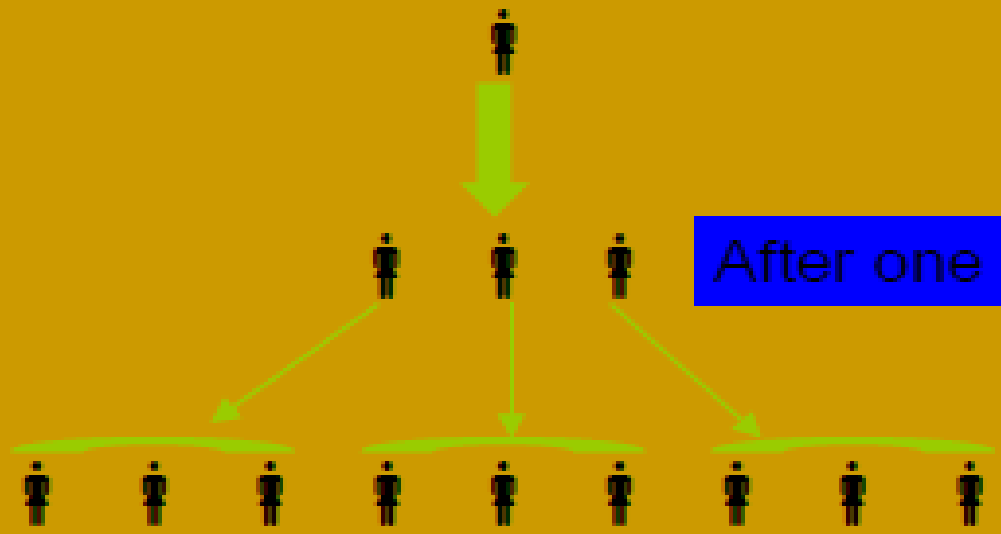
- Average number of daughters that would be born to a woman if she passed through her life-time from birth to the end of her reproductive years conforming to the age-specific fertility and mortality rates of a given year

Net Reproduction Rate: Relationship with GRR and TFR

- NRR is always lower than GRR, because it takes into account the fact that some women will die before entering and completing their child-bearing years.

- Correspondingly NRR will be less than half the magnitude of the TFR.

Reproduction of Population When NRR=3



Replacement Fertility

- Replacement Level Fertility is said to have been reached when NRR=1.0

– Surviving women in the hypothetical cohort have exactly enough daughters (on average) to replace themselves in the population

- At this time GRR>1 and TFR>2. (Roughly, this is when couple have an average of two children.)
- When NRR=1.00 it does not imply:

– CBR= CDR

– Population growth rate = 0

Relationship between Reproduction Measures and Population Growth

- Population momentum is the propensity for a population to grow for many years after fertility declines to reach the replacement level of the “two-child family”. (TFR ~2.2 and NRR=1.0).
- This population momentum during the fertility transition is a function of young age structure of the population due to high levels of fertility in the past.

Thank you

Terima Kasih