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Fertility Measures

Workshop on data analysis and report writing for civil registration based vital statistics

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Bloomberg
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DATA FOR
HEALTH INITIATIVE



Pacific
Community
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ESCAP

Economic and Social Commission for Asia and the Pacific

Overview

- ◆ Importance of measuring fertility
- ◆ Sex ratio at birth
- ◆ Crude birth rate



Importance of measuring fertility

- ◆ Fertility is one of the main drivers of population growth
- ◆ Helps us understand population change, and to develop and evaluate policies related to population change
- ◆ Analysis of fertility trends is useful for predicting needs for public services such as health facilities and schools



Data sources for fertility

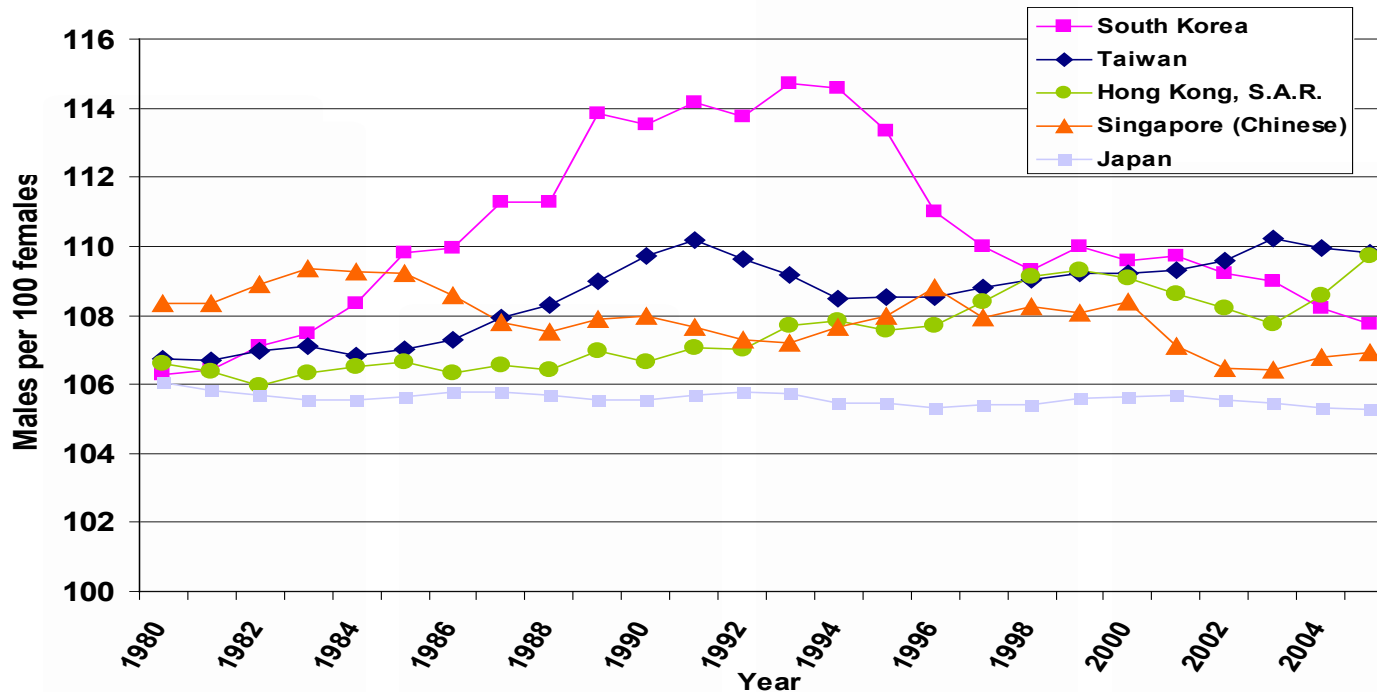
- ◆ CRVS systems are represent the gold standard for collecting data on fertility
- ◆ Censuses can also provide valuable information on fertility in countries where birth registration is incomplete
- ◆ Measures of fertility may also be estimated from household surveys (through birth history data)

Sex ratio at birth

- ❖ The **sex ratio at birth** is the ratio of male to female babies born
- ❖ The normal sex ratio at birth is between 103-106 (there are biological reasons for this)
 - ❖ It refers to the number of boys born alive per 100 girls born alive
- ❖ Sex ratio can vary naturally between countries, cultures, and geographic locations
- ❖ In countries where there is clear son preference, the sex ratio at birth becomes increasingly skewed with birth order (the third or fourth born children are more likely to be boys than first or second children)

Sex ratio at birth

Figure 5. Sex ratios at birth reported in East Asia
(3-year averages 1980-2005*)



*Vital statistics used for 3-year averages extend from 1979 through 2006. Confidence interval above and below 3-year average in 2005 exceeds 1.0 per 100 for Hong Kong, 1.5 per 100 for Singapore Chinese.

Sources: National Statistical Office, 2008; Department of Statistics, 2008; Li, 18 September 2002, 07 September 2004, 16 January 2008; Department of Statistics National Institute of Population and Social Security Research, 2004; Ministry of Health, Labour and Welfare, 21 January 2008.

Slide figure from U.S. Census Bureau

Why is sex ratio at birth important?

- ❖ Useful for determining gender-biased sex selection
 - ❖ A high sex ratio at birth could indicate that sex selection is taking place
- ❖ Technology allows parents to know baby's sex from an early age, parents may selectively abort female fetuses.
- ❖ Aside from the ethical issues of sex selection, sociological problems can also result:
 - ❖ Shortage of eligible women (compared to men) – can impact on childbearing and therefore fertility
- ❖ It is estimated that there are over 130 million 'missing women' globally, as a result of selective abortion and excess female deaths
- ❖ Skewed sex ratios at birth may also indicate problems with birth registration itself



Sex ratio at birth estimation

- ❖ Sex ratio at birth is the number of male live births (for a country, for a specified period) divided by the number of female live births (for the same place and time period)

$$\frac{\text{Number of male live births}}{\text{Number of female live births}} \times 100$$

- ❖ **Example:**

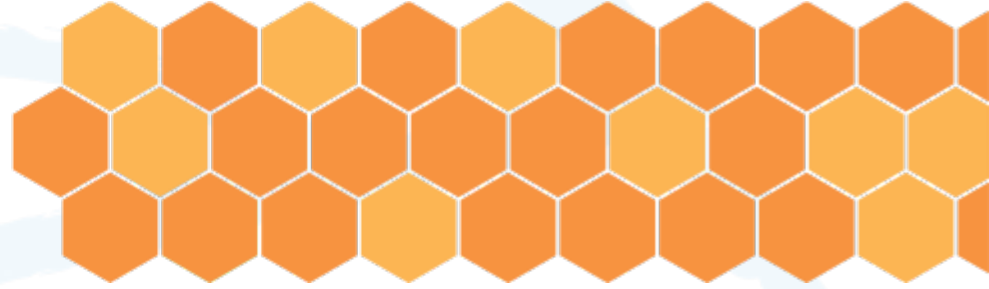
55,000 male births in 2021 in Country X

50,000 female live births in 2021 in Country X

(55,000/50,000) x 100 = 110 male births per female births in 2021



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Fertility Measures



Measures of fertility – Crude Birth Rate (CBR)

- ❖ Birth data are important
 - ❖ As data in their own right for planning & denominators for other rates
 - ❖ But recall: births alone do not tell us about fertility of the average woman, and a large number of births may just reflect a large population
- ❖ A common measure of fertility is the **crude birth rate (CBR)**:
 - ❖ the number of births per 1,000 population over a given period of time.

Example

- Which country has higher fertility?
 - Country A had 164,000 births in 2011
 - Country B had 3,000 births in 2011

Answer: we don't know

- ◆ The number of births alone does not tell us anything about the fertility of the average woman
- ◆ A large number of births may simply reflect a large population

	Country A	Country B
Country	Papua New Guinea	Tonga
Population 2011	6,188,000	106,000
Births	164,000	3,000
CBR	26.5	28.3

Crude Birth Rate (CBR)

ADVANTAGES

- ❖ Easy to understand
- ❖ Requires the least amount of information
- ❖ Helps data users to understand fertility's contribution to population growth

DISADVANTAGES

- ❖ Can be misleading due to the composition of its denominator:
 - ❖ It includes children, men, and women outside of childbearing age
 - ❖ It can be affected by the proportion of the population who cannot have children
 - ❖ A very young or very old population or one that has many more males than females would affect the CBR
 - ❖ Even when the freq. of having children among women of reproductive ages is the same in two countries, each country may have different crude birth rates

Crude birth rate in small populations

❖ Generally, CBR is estimated as follows:

$$CBR = \frac{\text{Number of births occurring in a year}}{\text{Total mid – year population}} \times 1000$$

❖ If we aggregate over 3 or 5 years, divide the average number of births over this period by the population size at the midpoint of these 3/5 years:

$$\frac{\text{Average number of births occurring over a 5 – year period}}{\text{Total population at mid – point of 5 year period}} \times 1000$$

Patterns of child-bearing vary by age

- These patterns have many drivers:
 - Availability of family planning
 - Cultural & Societal norms
 - Costs of raising children
 - Value of education



Distribution of births by age of mother

Example from Fiji Vital Statistics report 2012-2017:

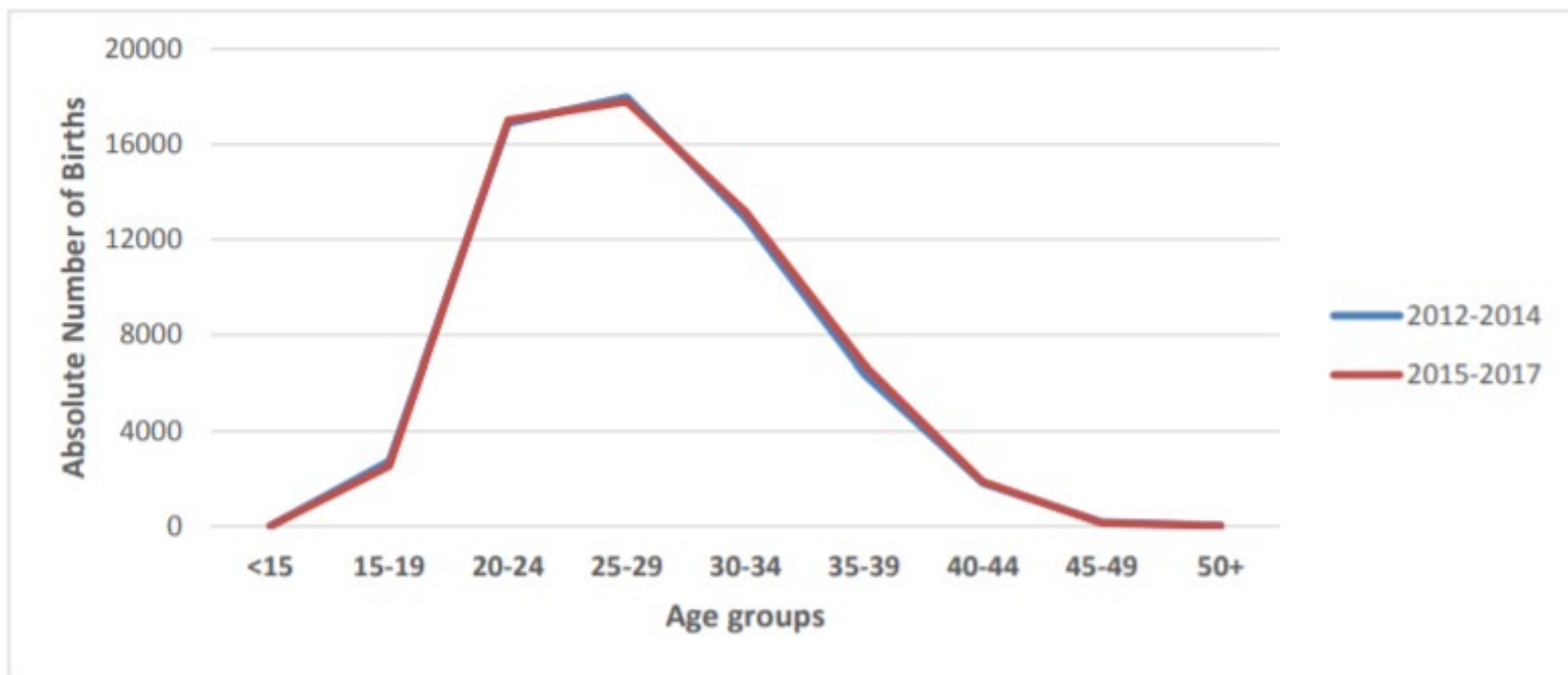


Figure 4: Births by age of mother

Age-specific fertility rates

- **Age-specific fertility rates (ASFRs)** are the number of births occurring to mothers of a certain age group per 1,000 women in that age group over a given period of time
- ASFR's are usually calculated for women aged 15-49 in each 5-year age group
- The advantage of ASFRs is that they are not affected by differences in the age distribution among women of childbearing ages

Age-specific fertility rates: estimation



Age-Specific Fertility Rates

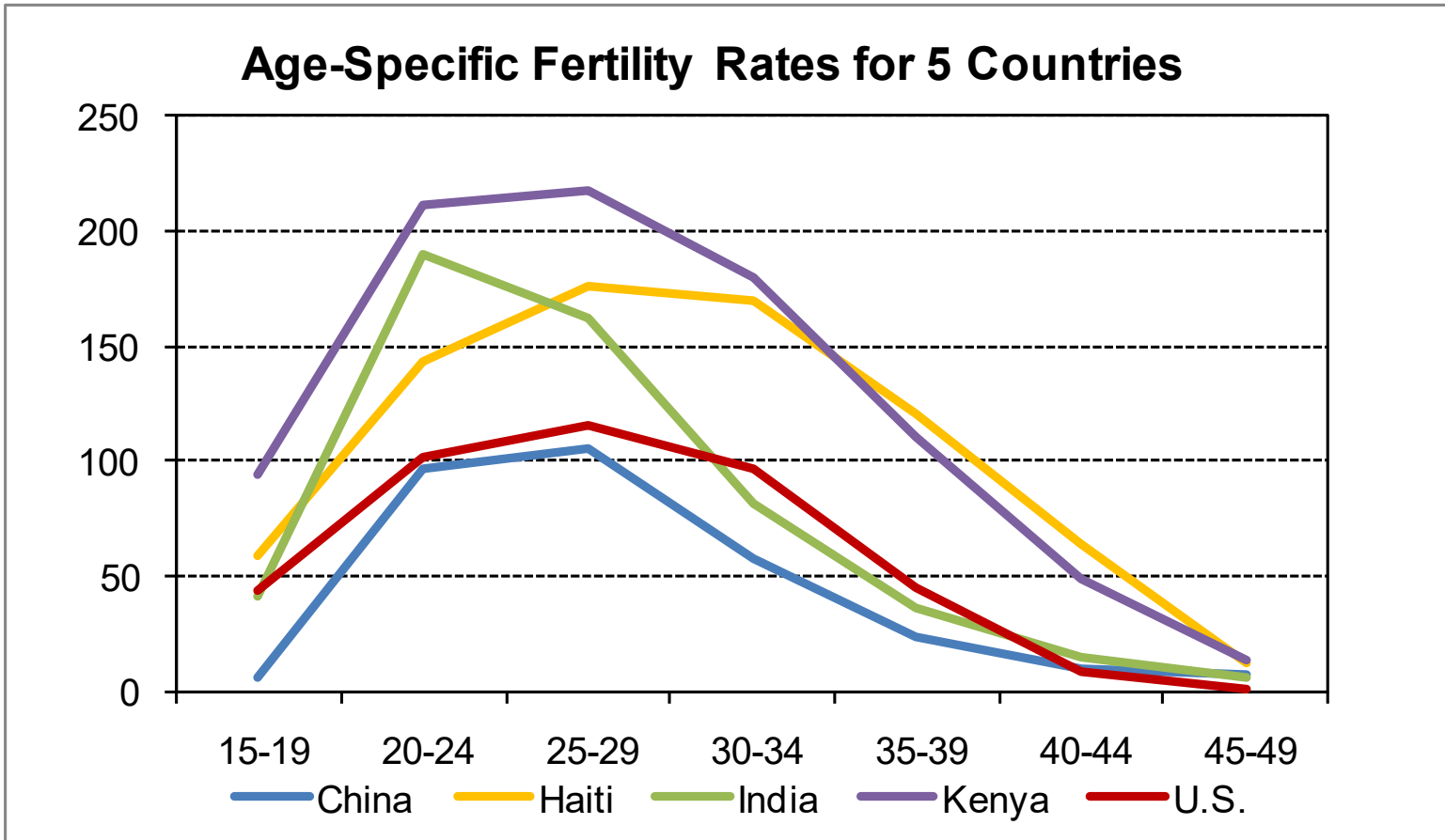
Age of Women (1)	Female Pop (2)	Number of Births (3)	Fertility Rate (4) = (3)/(2) x 1,000
15-19	593,262	36,784	62.0
20-24	587,076	81,233	138.3
25-29	505,362	65,236	129.1
30-34	424,186	37,506	88.4
35-39	385,749	17,532	45.4
40-44	325,105	4,929	15.2
45-49	266,575	512	1.9

ASFRs follow a standard pattern

- ASFRs start from zero at very young ages where women are not yet able to bear children
- Rise until they peak sometime in women's twenties
- Decline back to zero somewhere around 50 years of age
- Variations in the pattern occur, due to factors such as age at marriage, the prevalence of contraceptive use, etc.



ASFR comparisons across 5 countries



Source:
U.S.
Census
Bureau's
Internatio
nal Data
Base

Total fertility rate (TFR)

- ASFRs are good for representing fertility by age group, but difficult to use if:
 - Comparing two different populations
 - Examining a given population over time
- Furthermore, they are not an easily understood measure of fertility. We therefore usually talk about the total fertility rate (TFR), when discussing fertility.
- The TFR is the average number of children a woman would give birth to during her lifetime if she were to pass through her childbearing years experiencing the present-day age-specific fertility rates
- The TFR (for 5 year ASFRs) is calculated by adding up the age-specific fertility rates, multiplying this sum by 5 and dividing by 1,000

$$\text{TFR} = (\text{Sum of ASFR} \times 5) / 1,000$$

Calculating TFR - EXAMPLE

Calculation of Total Fertility Rate

Age of Women (1)	Female Pop (2)	Number of Births (3)	Fertility Rate (4) = (3)/(2) x 1,000
15-19	593,262	36,784	62.0
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35-39	385,749	17,532	45.4
40-44	325,105	4,929	15.2
45-49	266,575	512	1.9
		Sum of ASFRs	480.4
		TFR	2.4

ASFRs with aggregated data

$$= \frac{\text{Average number of births to women of age } x}{\text{Total women of age } x \text{ at midpoint}} \times 1000$$

Example

- Average number of births from 2007-2011 was 55 for women aged 20-24
- Midpoint is July 1, 2009. There were 300 women aged 20-24 on this date.
- ASFR of 20-24 year olds
 $= (55/300) * 1000 = 183.3$ for the period 2007-2011



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Q&A