Demographic Variables

and Measures
Plan of Action
5/31/04

Topic: Understanding Population Structure and Change

(1) Demographic Variables and Measures

(2) U.S. Population

Yesterday: Introduction to Demography

Tomorrow: Continue with Demographic Variables & Measures
Population Growth Through History

Source: http://www.globalchange.umich.edu/
Demographic Variables and Measures

Demography is the study of how human populations are \textit{structured} and how human populations \textit{change}. 
Changes in Fertility

Figure 1
U.S. Birth Rates by Age of Mother, Selected Age Groups, 1955–2002

Births per 1,000 women

Ages 20-24

Ages 25-29

Ages 30-34

Ages 34-39

Ages 15-19

Ages 40-44


Source: J.A. McFalls (2003)
Population: A Lively Introduction.
Population Reference Bureau

Demographic Measures

Types of Measures:

Count = The *absolute number* of a population or demographic event (e.g. a birth), for a specified time and place.

Rate = The *frequency* of a demographic event in a population for a given time period divided by the population “at risk” for the same time period.

Ratio = The *relation* of one population subgroup to the total population or to another subgroup.
**Demographic Measures**

*Demographic characteristics* help us understand *population structure*:

- Age
- Sex
- Race
- Place of Residence
- Income
- Education

*Demographic events* help us understand *population change*:

- Fertility
- Mortality
- Migration
Fertility

Fertility = The incidence of childbearing in a country’s population.

Fecundity = The maximum possible number of children a woman can have in a lifetime.

From menarche to menopause, a woman can have more than twenty children; this total is limited by various factors: cultural norms, finances, environmental conditions, public health and personal preferences.
Measures of Fertility

**Crude Birth Rate** = The number of live births in a year per thousand people in the population.

To calculate, take the total number of births in a year for a region and divide by the mid-year population, then multiply by 1,000.

\[
\frac{\text{# of Births}}{\text{Total Population}} \times 1,000 = \text{Crude Birth Rate}
\]

U.S. Crude Birth Rate (2003) = 14/1,000
World Crude Birth Rate (2003) = 22/1,000
Measures of Fertility

General Fertility Rate = Number of live births per 1,000 women aged 15 – 49 (the typical childbearing years).

To calculate, take the total number of births in a year for a region and divide by the total number of women age 15-49 (i.e. those “at risk” of giving birth), then multiply by 1,000.

\[
\frac{\text{# of Births}}{\text{# of Women Age 15-49}} \times 1,000 = \text{General Fertility Rate}
\]
Measures of Fertility

Age-Specific Birth Rates = The number of live births to women in a given age class (e.g. teenagers).

To calculate, take the total number of births to women in a particular age group, and divide by the total number of women in that age group.

e.g. # births to women 15–19 \[\frac{\text{# women ages 15–19}}{\text{# women ages 15–19}} \times 1,000 = \text{Age-Specific Fertility Rate}\]
Puerto Rico

<table>
<thead>
<tr>
<th>Year</th>
<th>20-24</th>
<th>25-29</th>
<th>30-34</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>257.4</td>
<td>189.6</td>
<td>114.1</td>
</tr>
<tr>
<td>1975</td>
<td>154.9</td>
<td>146.1</td>
<td>91.2</td>
</tr>
<tr>
<td>1985</td>
<td>146.3</td>
<td>132.0</td>
<td>70.6</td>
</tr>
<tr>
<td>1994</td>
<td>133.8</td>
<td>113.5</td>
<td>69.0</td>
</tr>
</tbody>
</table>

In Puerto Rico in 1994, there were 134 live births to women ages 20-24 per 1,000 women in that age group.

In 1994, the fertility rate for women ages 20-24 was about one-half as high as it was in 1965. In 1985 and 1994, the rates for women ages 30-34 were nearly equal.

Source: Population Reference Bureau, 2004
Measures of Fertility

Total Fertility Rate = The average total number of children a woman will have when she completes childbearing, assuming she follows the dominant age-specific birth patterns for her time and place.

This is an artificial measure, as it does not apply to any individual woman. It is a way to assess the childbearing habits of a typical woman using the dominant childbearing habits of all women in a society at a given time.
### Calculating the Total Fertility Rate

**Israel’s TFR, 1994**

<table>
<thead>
<tr>
<th>Age of women</th>
<th>(1) Number of women</th>
<th>(2) Number of births to that age group</th>
<th>(3) Birth rate (2)/(1)</th>
<th>(4) Age-specific birth rate(3)x5</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-19</td>
<td>244,000</td>
<td>4,474</td>
<td>.018</td>
<td>.090</td>
</tr>
<tr>
<td>20-24</td>
<td>225,800</td>
<td>28,013</td>
<td>.124</td>
<td>.620</td>
</tr>
<tr>
<td>25-29</td>
<td>194,200</td>
<td>36,440</td>
<td>.188</td>
<td>.940</td>
</tr>
<tr>
<td>30-34</td>
<td>182,300</td>
<td>27,402</td>
<td>.150</td>
<td>.750</td>
</tr>
<tr>
<td>35-39</td>
<td>181,400</td>
<td>14,044</td>
<td>.077</td>
<td>.385</td>
</tr>
<tr>
<td>40-44</td>
<td>177,600</td>
<td>3,176</td>
<td>.018</td>
<td>.090</td>
</tr>
<tr>
<td>45-49</td>
<td>151,100</td>
<td>182</td>
<td>.001</td>
<td>.005</td>
</tr>
</tbody>
</table>

**Sum = 2.88**

The rates in column (3) simulate the likelihood of a woman giving birth during each year of her childbearing years—that is, they approximate the “risk” of having a birth. Multiplying each of these rates by five provides the number of children she would have for each five-year period. Each woman is subject to the annual “risk” of a birth five times in each age group; for example, 0.124 when she is 20, 0.124 when she is 21, and so on. Summing the rates for all age categories results in the number of children she would have by age 49—the total fertility rate.

Source: Population Reference Bureau, 2004
TFR for Israel

The total fertility rate in 2002 in Israel was 2.9 births per woman (or 2,900 births per 1,000 women). That is, if 2002 age-specific rates continued unchanged, women in Israel would average 2.9 children each during their childbearing years.

In some developing countries, the TFR is more than five children per woman. In most developed countries, it is below two.

Source: Population Reference Bureau, 2004
# U.S. Fertility Indicators

Table 1. **Fertility Indicators for Women 15 to 44 Years Old by Age, Race, and Hispanic Origin: June 2002**  
(Numbers in thousands)  

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number of women</th>
<th>Percent childless</th>
<th>Number with a birth</th>
<th>Births per 1,000 women</th>
<th>90-percent confidence interval</th>
<th>First births per 1,000 women</th>
<th>Children ever born per 1,000 women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>61,361</td>
<td>43.5</td>
<td>3,766</td>
<td>61.4</td>
<td>59.4 - 63.4</td>
<td>23.1</td>
<td>1,211</td>
</tr>
<tr>
<td>15 to 19 years</td>
<td>9,809</td>
<td>91.2</td>
<td>549</td>
<td>55.9</td>
<td>50.9 - 60.9</td>
<td>27.7</td>
<td>140</td>
</tr>
<tr>
<td>20 to 24 years</td>
<td>9,683</td>
<td>67.0</td>
<td>872</td>
<td>90.0</td>
<td>83.0 - 97.0</td>
<td>45.3</td>
<td>525</td>
</tr>
<tr>
<td>25 to 29 years</td>
<td>9,221</td>
<td>45.2</td>
<td>897</td>
<td>97.2</td>
<td>90.2 - 104.2</td>
<td>33.2</td>
<td>1,050</td>
</tr>
<tr>
<td>30 to 34 years</td>
<td>10,284</td>
<td>27.6</td>
<td>859</td>
<td>83.6</td>
<td>77.6 - 89.6</td>
<td>26.4</td>
<td>1,543</td>
</tr>
<tr>
<td>35 to 39 years</td>
<td>10,803</td>
<td>20.2</td>
<td>452</td>
<td>41.9</td>
<td>36.9 - 46.9</td>
<td>7.9</td>
<td>1,849</td>
</tr>
<tr>
<td>40 to 44 years</td>
<td>11,561</td>
<td>17.9</td>
<td>137</td>
<td>11.9</td>
<td>9.9 - 13.9</td>
<td>3.6</td>
<td>1,930</td>
</tr>
</tbody>
</table>

Mortality

Mortality = The incidence of death in a country’s population.

Aspects of interest:

• Age at Death
• Cause of Death
• Life Expectancy
**Measures of Mortality**

**Crude Death Rate** = The number of deaths in a year per thousand people in the population.

To calculate, take the total number of deaths in a year for a region and divide by the mid-year population, then multiply by 1,000.

\[
\frac{\text{# of Deaths}}{\text{Total Population}} \times 1,000 = \text{Crude Death Rate}
\]

**Age structure** affects the crude death rate; older populations may have higher crude death rates, but these reflect the age structure, not the health conditions or other factors.
Measures of Mortality

Age-Specific Death Rate

\[
\text{Age-Specific Death Rate} = \left( \frac{\text{# Deaths to People 45–49}}{\text{# People 45–49}} \right) \times 1,000
\]

Cause-Specific Death Rate

\[
\text{Cause-Specific Death Rate} = \left( \frac{\text{Deaths from Cancer}}{\text{Total Population}} \right) \times 100,000
\]
Measures of Mortality

Infant Mortality = The number of deaths of infants under age 1 per 1,000 live births in a given year.

\[
\frac{\text{No. of Deaths of Infants Under Age 1}}{\text{Total Live Births}} \times 1,000 = \text{Mortality Rate}
\]
Measures of Mortality

Life Expectancy = The average number of additional years one could expect to live if the current age-specific death rates remained the same for the rest of his/her life.

Life Expectancy at Birth = Average number of years a baby born this year can expect to live, if current age-specific death rates remain the same. A good indicator of health conditions.

Life Expectancy varies by gender (and other factors); it is usually cited separately for males and females.
Figure 1.
Global Distribution of Life Expectancy at Birth: 1998
(Percent of countries in each category)

Developed Countries

Male
- Less than 70 years: 27%
- 70-74 years: 41%
- 80+ years: 2%
- 75-79 years: 30%

Female
- Less than 70 years: 4%
- 70-74 years: 14%
- 80+ years: 52%
- 75-79 years: 30%

Developing Countries

Male
- 50-59 years: 20%
- 60-69 years: 32%
- 70-79 years: 28%
- Less than 50 years: 20%

Female
- 50-59 years: 17%
- 70-79 years: 42%
- 60-69 years: 20%
- Less than 50 years: 14%
- 80+ years: 7%

Figure 2.
Female Advantage in Life Expectancy at Birth: 1998

(Difference in years between females and males)

- France: 8.0
- Russia: 13.0
- Japan: 6.3
- United States: 6.7
- Bangladesh: -0.1
- Brazil: 10.2
- Cuba: 4.9
- Morocco: 4.2