Demographic Variables

and Measures

Plan of Action
6/2/04

Topic: Understanding Population Structure and Change

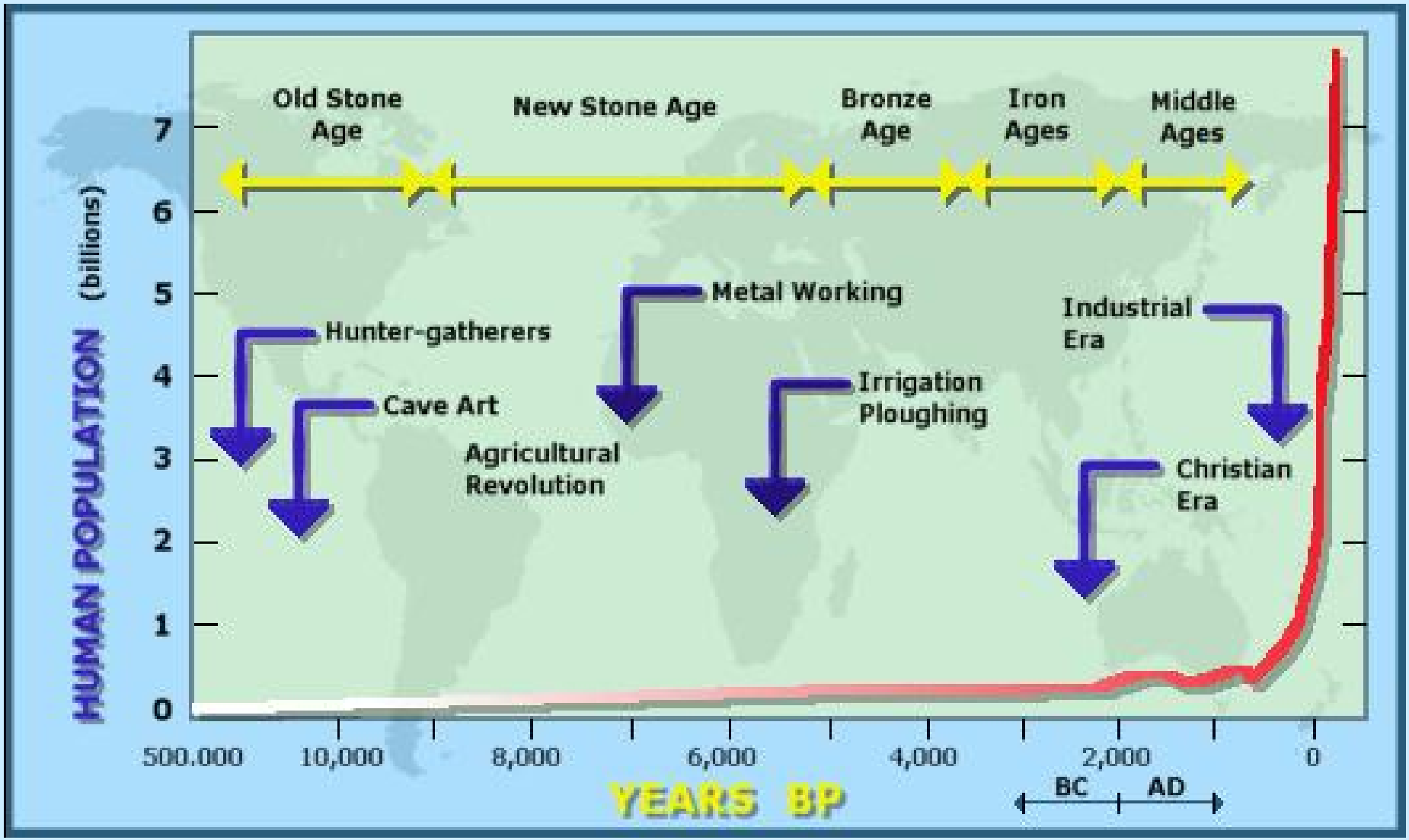
(1) Video: "World Population"

(2) Demographic Variables and Measures

(3) Fertility, Mortality and Migration

(4) Population Pyramids

Population Growth Through History



Source: http://www.globalchange.umich.edu/

Demographic Variables and Measures

Demography is the study of how human populations are *structured* and how human populations *change*.

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. $\dfrac{\text{\# births to women 15–19}}{\text{\# women ages 15–19}} \times 1{,}000 = \text{Age-Specific Fertility Rate}$

Puerto Rico

Live births per 1,000 women ages 20-34 by age group, 1965–1994

	Ages		
Year	20-24	25-29	30-34
1965	257.4	189.6	114.1
1975	154.9	146.1	91.2
1985	146.3	132.0	70.6
1994	133.8	113.5	69.0

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

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

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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)

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

Source: Barbara Downs, 2003, *Fertility of American Women: June 2002*, Current Population Reports P20-548, U.S. Census Bureau, Washington, DC.

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

$$\frac{\text{\# Deaths to People 45–49}}{\text{\# People 45–49}} \times 1{,}000 = \text{Age-Specific Mortality Rate}$$

Cause-Specific Death Rate

$$\frac{\text{Deaths from Cancer}}{\text{Total Population}} \times 100{,}000 = \text{Cause-Specific Mortality Rate}$$

Measures of Mortality

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

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

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.

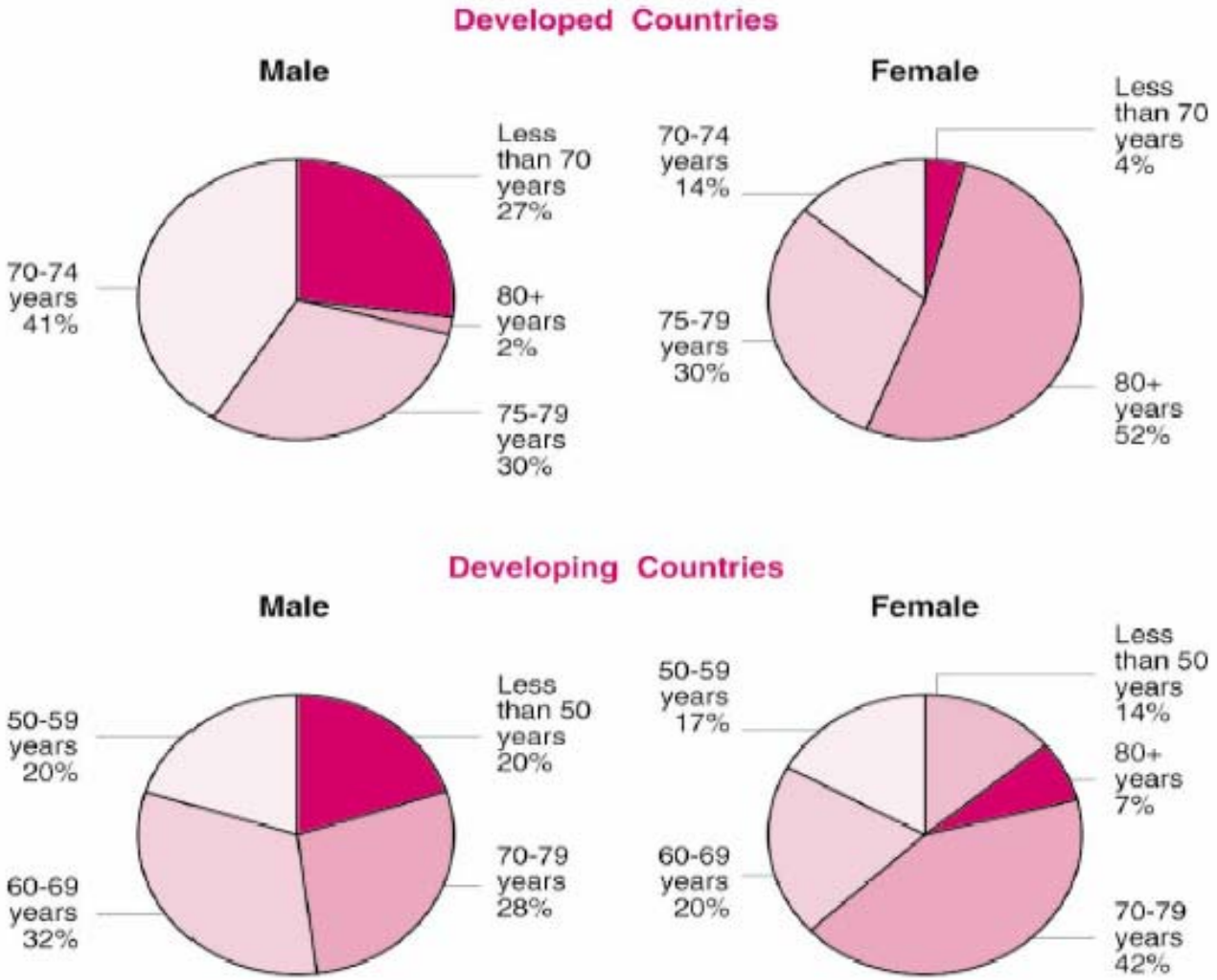
Life Expectancy at Birth = Average number of years a baby born this year can expect to live, if current age-specific death rates remain the same. A good indicator of health conditions.

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)



Source: U.S. Census Bureau, 1998.

Figure 2.

Female Advantage in Life Expectancy at Birth: 1998

(Difference in years between females and males)

Source: U.S. Bureau of the Census, 1998.

Migration

Migration = the movement of people into or out of a specified territory.

Refers to movement across a territorial boundary for the purpose of changing one's usual place of residence.

Immigration = movement into a territory

Emigration = movement out of a territory

Migration

International Migration = Crossing a national border to change residence.

Internal Migration = Movement within a country; in the U.S. this refers to movement across a county line to change residence.

Urbanization is a common consequence of internal migration (rural-urban) in many areas.

Measures of Migration

In-migration Rate = the number of people moving into a specified territory per 1,000 people.

Out-migration Rate = the number of people moving out of a specified territory per 1,000 people.

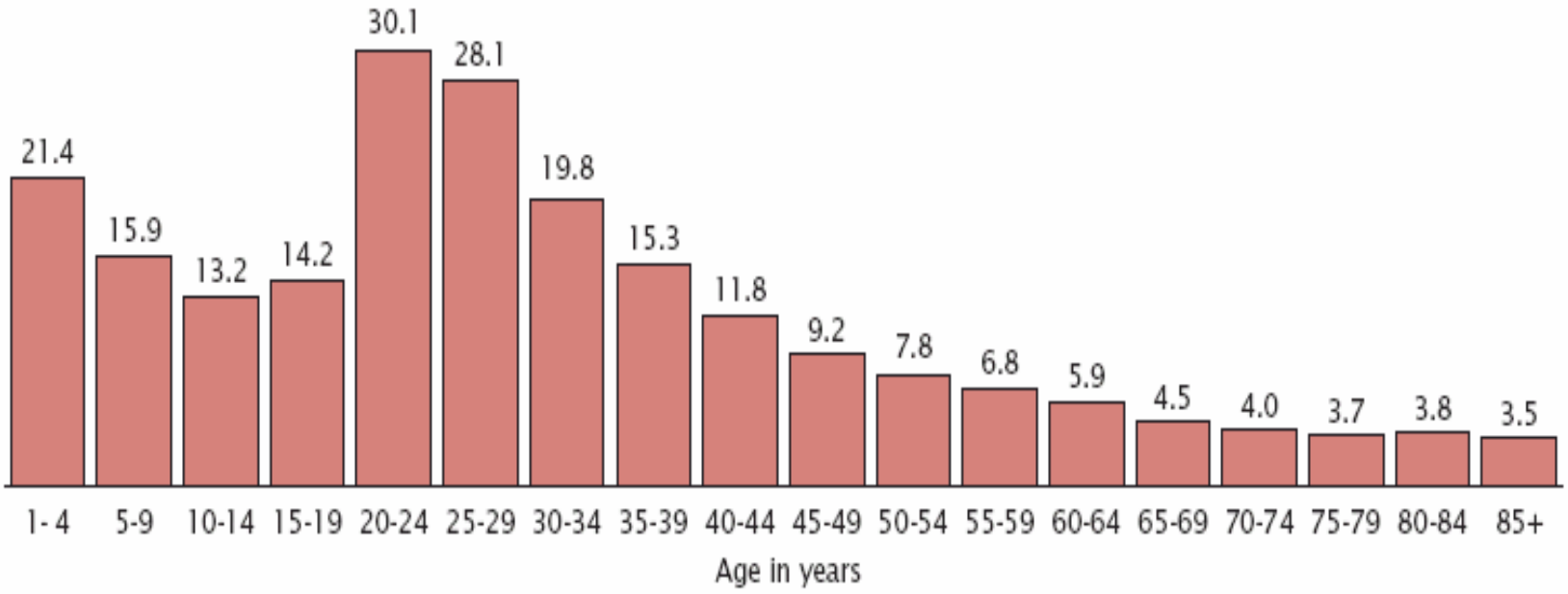
Net Migration = the difference between the number of people moving into a territory and the number moving out of the same territory in a given time frame (usually one year).

Who's Moving?

Figure 2.

Moving Rates by Age: 2002 to 2003

(Percent moved for the population 1 year and older)



Source: U.S. Census Bureau, Current Population Survey, 2003 Annual Social and Economic Supplement.

Age and Sex Ratios

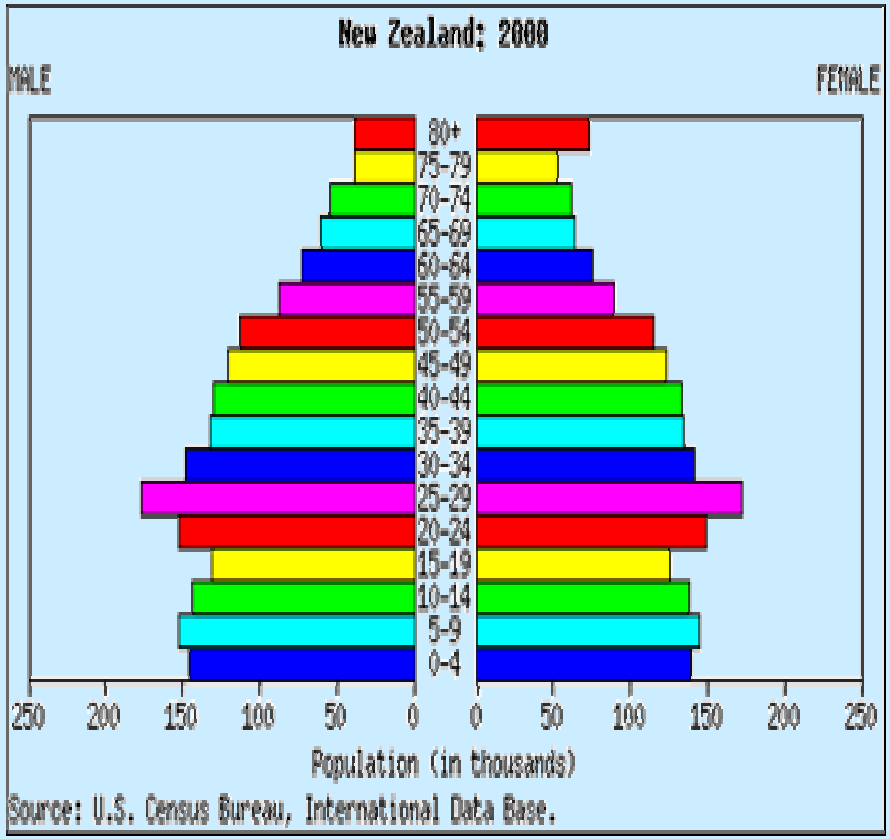
Age and Sex are two important variables to consider in a population's structure.

Both affect fertility, mortality and migration.

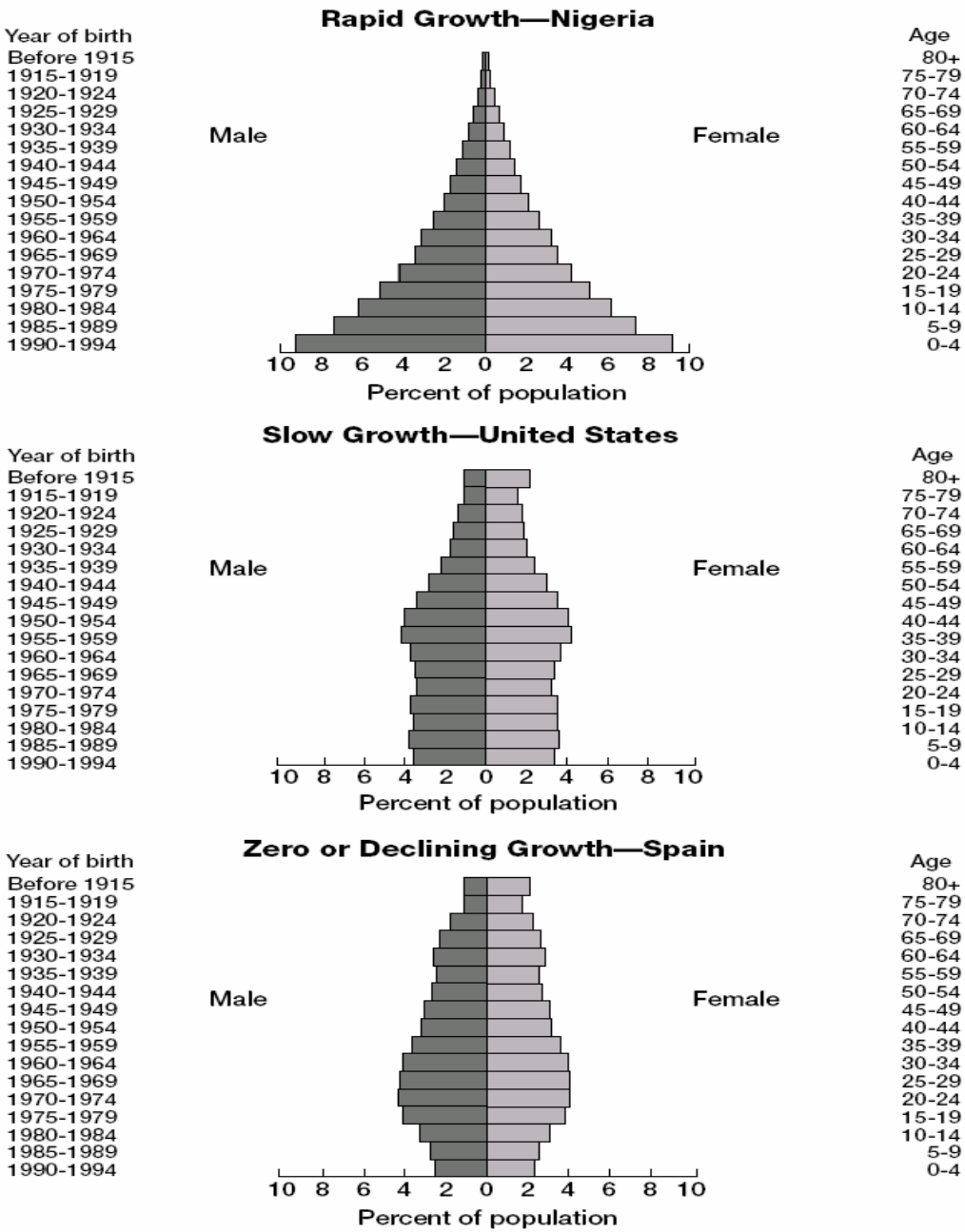
Population Pyramids

Population pyramids are a tool we can use to summarize and visualize a population's structure quickly and easily.

A population pyramid shows the age and sex structure of a given population at a given time.



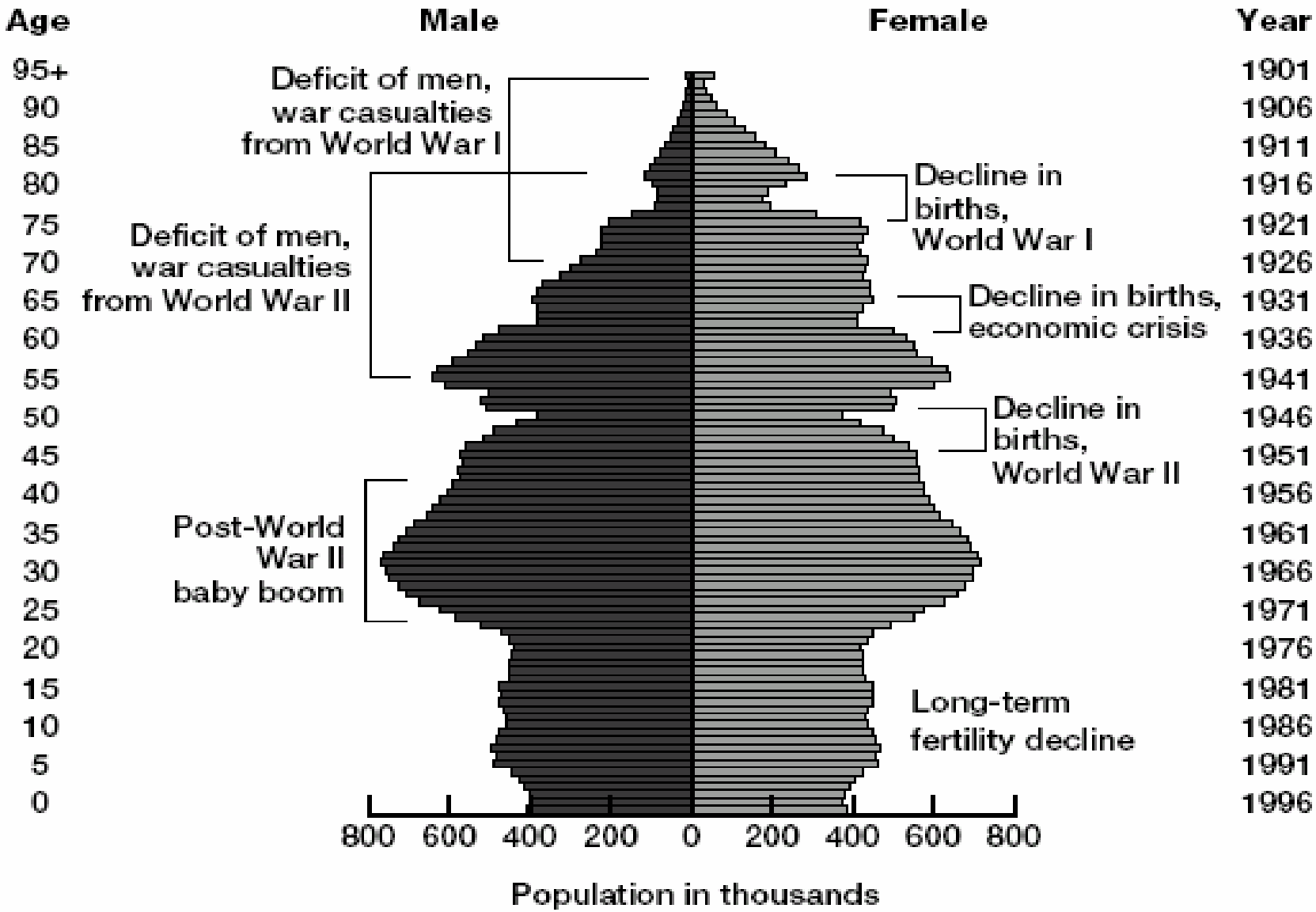
Age Patterns of Population: Nigeria, United States, and Spain, 1995



Sources: U.S. Census Bureau and the United Nations Population Division.

Figure 7

Germany's Population by Age and Sex, 1996



Source: Germany, Federal Statistical Office, unpublished tables.

Population Pyramid of Japan, 1995

Source: Japan's 1995 Census.