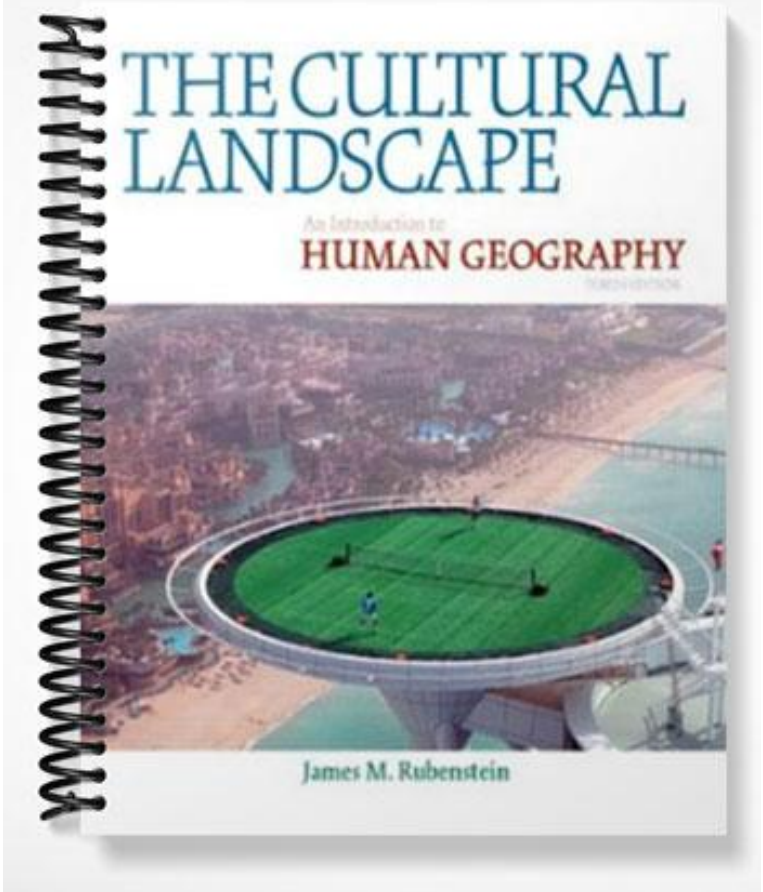
SOLUTIONS MANUAL



Chapter 2: Population

Chapter Outline

Introduction. Understanding the size, distribution and changes of Earth's human population is an important part of geography. Population growth is most rapid in less developed countries and geographers are concerned with population growth at the regional level. **Overpopulation** may be defined at the regional level as population relative to resources instead of absolute numbers of people.

Case Study: Population Growth in India. This case illustrates the role of family size on population growth, using a family as an example of the role that cultural preferences and development play in family size, health, and future economic considerations.

Key Issue 1: Where is the world's population distributed?

Population Concentrations. Population is clustered into four regions, all on the Eurasian landmass: East Asia, South Asia, Southeast Asia, and Europe.

East Asia holds 1/5th of the world's population, mostly in China but also Japan, North and South Korea, and Taiwan. Population is clustered near the large rivers and the ocean. China's population is only about ½ urban. South Asia's population is mostly in India but also Pakistan, Bangladesh, and Sri Lanka. Population is concentrated along the Indus and Ganges rivers, and also along the coasts. Three fourths of South Asia's population is rural. Southeast Asia's population is concentrated on the larger islands of Indonesia, the Philippines, Sumatra, Borneo, and Papua New Guinea. Other large populations are along the rivers of the Southeast Asian mainland. Again the population is largely rural. Europe holds about 1/9th of the world's population. People live mostly in cities (around 75% urban).

Smaller population clusters are found in the northeastern U.S. into southeastern Canada and the bight of Africa from Nigeria westward.

Sparsely Populated Regions. The **ecumene** describes the areas of human habitation. Examining changes to the ecumene reveals some types of areas where humans do not live in large numbers: extremely dry, wet, cold, and high lands. The last category has notable exceptions in Latin America, where large cities in Mexico and along the Andes are much higher than other population centers of the world; Africa also has some populations living at higher altitudes.

Population Density. Arithmetic density is a measure of the number of people per area of land, usually square kilometers or square miles. The number of people per area of land is the **physiological density**, which can be considered a rough measure of a country's food security. The number of farmers per area of arable land, the **agricultural density,** is a measure of development as machines are used in more developed countries.

Key Issue 2: Where has the world's population increased?

Natural Increase. Population growth is measured through the **natural increase rate** (NIR, also commonly referred to as the rate of natural increase). The NIR is calculated by subtracting the crude death rate from the crude birth rate. The NIR is given as a percent

change per year, while birth and death rates are usually given per 1,000 total population. World NIR has decreased from a 1963 peak of 2.2 to around 1.2 percent, lessening concerns about rapid population growth. Still, the average masks large regional differences: most growth is occurring in less developed countries while more developed countries have low or even slightly negative growth. These regional differences map out for a variety of demographic measures.

Fertility. The **total fertility rate** (TFR) is a measure of the average number of children a woman will have in her lifetime; it ranges from less than 2 to over 6.

Mortality. Other measures of mortality include the **infant mortality rate** (IMR, deaths before age 1 per 1,000 live births, ranging from under 10 to over 100) and **life expectancy** at birth, the average number of years a person born today can expect to live. Life expectancy ranges from around 40 years to around 80 years.

Note that the crude death rate does not follow the global distribution of other indicators. This is because crude death rates are relatively high in places with a large proportion of elderly people. Thus, the crude death rate is not an indicator of development.

Key Issue 3: Why is population increasing at different rates in different countries?

The Demographic Transition. The **demographic transition** is a model of population change where high birth rates and death rates transition to low birth rates and death rates. It is divided into four stages:

In stage 1, birth rates and death rates are both high, resulting in a low rate of growth. There are no countries presently in stage 1.

The move to stage 2 is caused by a decline in death rates. Birth rates remain high, leading to rapid population growth. The more developed countries entered stage 2 as a part of the Industrial Revolution, while many less developed countries entered stage 2 much later as a result of the diffusion of medical technologies and knowledge into the less developed world (the **medical revolution**).

Stage 3 is marked by a drop in fertility, which brings down the birth rate and decreases the natural increase rate. The death rate continues to fall but not as rapidly as the birth rate.

Stage 4 is marked by a low crude birth rate and crude death rate and nearly zero natural increase. Stage 4 resembles stage 1 in terms of growth but otherwise is very different: instead of high birth and death rates, both are low. Life expectancies are much longer in stage 4, and society is much different. Finally, once the demographic transition has reached stage 4, the population has swelled during stages 2 and 3.

Population Pyramids. Population pyramids give a “snapshot” of the age and sex composition of a population. We can tell at one look whether a population is growing rapidly (wide base), has a long or short life expectancy (tall or short pyramid), or is aging and stable (straight sides). Two measures are illustrated in the population pyramid: the dependency ratio and the sex ratio. The dependency ratio is the ratio of those too young or too old to work to those of working age. The sex ratio is the number of men per 100 women.

Countries in Different Stages of Demographic Transition. This section gives representative examples of countries in each stage of the demographic transition: Cape Verde (stage 2), Chile (stage 3), and Denmark (stage 4).

Demographic Transition and World Population Growth. Those concerned with the progress of the demographic transition in rapidly growing countries today are faced with a special challenge. It took European and North American populations 100 years or more to make the transition out of stage 2, which is caused by a cultural change to preferring smaller families. Not only are developing countries being asked to make the transition faster, the cause of their movement into stage 2 is fundamentally different from historic causes. In many cases it is unknown whether the move to stages 3 and 4 will happen soon or not.

Contemporary Geographic Tools: Spatial Analysis and the Census. This box briefly covers the decennial U.S. census and measurement issues associated with population counts in general.

Global Forces, Local Impacts: Japan's Population Decline. Japan has the somewhat unique combination of a negative natural increase rate coupled with a strict immigration policy. This means that Japan's population is aging with potential problems in the future because so few children are being born.

Key Issue 4: Why might the world face an overpopulation problem?

Malthus on Overpopulation. Thomas Malthus predicted that population increases would soon outpace the potential increases in food supply, leading to dramatic crises as a result of this strain on resources.

Malthus was wrong for his time period but his thesis remains attractive to many today who point out that today's projected numbers may create a resource crisis for food supply or some other resources (like fresh water or energy). Critics of Malthus argue that population growth is not so large that human ingenuity or cooperation cannot overcome any resource hurdles which arise.

Declining birth rates. Birth rates have continued to decline across the world but especially in developing countries. Most of this decline has been to declining birth rates, attributable to economic development and increased use of contraceptives. Debate continues on the most effective means to lower birth rates.

World Health Threats. Unfortunately, increasing death rates have contributed to lower growth rates in some areas of the world, most notably portions of sub-Saharan Africa affected by the AIDS epidemic.

The **epidemiologic transition** roughly follows the demographic transition but instead of changes in birth rates it tracks changes in the leading causes of death.

In the epidemiologic transition stages 1 and 2, death from contagious disease is at first common and then gradually less so. By stage 3, contagious diseases are less common and chronic diseases like cardiovascular disease and cancer. In stage 4 lives are extended—for example, heart attacks and cancer become survivable through medical treatment. Some epidemiologists predict a stage 5, where death rates increase again as contagious

diseases return. AIDS has been the most deadly recent epidemic, having killed over 25 million.

Introducing the Chapter

Chapter 2 opens with a discussion of why the study of population is important. The reasons make a powerful opener to any discussion of the chapter's contents by emphasizing the "punch" of the fourth Key Issue: Why might the world face an overpopulation problem? The three reasons we should study population are given as:

More people are alive at this time—about 6.75 billion—than at any point in Earth's long history.

The world's population increased at a faster rate during the second half of the twentieth century than ever before in history.

Virtually all global population growth is concentrated in less developed countries.

Icebreakers

The "Village of 100"

Numerous examples on the web and in the text introduce the concept of the world's population as a "global village." The elementary concept of percentages is dramatized by imagining the world (or your state, county, or city) has a population of only 100. This concept is most frequently attributed to Donella Meadow's "State of the Village" (1990). Beware: while there are many versions of this "village" on the internet, not all are accurate! It is best to use reliably sourced data to construct your own village of 100.

With a large enough class you might consider having students play out the village on a virtual map. I have started a class by handing out 100 note cards to students in a large lecture class with different information on each card. The students then arranged themselves in an outside common area according to the categories on the cards (world regions, more developed/less developed, etc).

Family size

In a small class, have students fill out the number of children in their families, including themselves. Collect the slips and organize them in ascending order. Write the distribution on the board. Then ask the following questions:

What is the average family size? Mode? Median?

Is this representative of the average family size in the community? (Students may need to be reminded that not every couple has children, so the class sample is biased upward.)

When did most parents start having children?

Do most parents practice contraception?

How might these numbers vary elsewhere in the world?

The same exercise can be modified for a large-lecture class with a show of hands. Ask students who are only children to raise their hands, followed by those with only one brother or sister, continuing up to "5 or more brothers and sisters" until there are no more volunteers. It should be easy to estimate the average family size from this show of hands.

Population growth model

Population Connection publishes a seven-minute film on DVD and VHS (www.populationconnection.org) modeling population growth from AD 1 to 2030, with million-person dots added to a world map as the time progresses (about 5 years/second). Students are initially very bored by the slow progress of human population from AD 1 to around 1800. The rapid expansion of human populations in the last 30 seconds of the film stimulates discussion.

Challenges to Comprehension

Imagining billions

Students can have a very difficult time understanding the scale of world population size and growth. Here is an exercise that can be performed briefly in class (ask students with calculators to help with the calculation) or assigned as independent work:

Imagine the Equator was entirely land; that is, 40,000 kilometers of Earth's surface. If we gave every person on Earth one square meter of soil, how many times would the present human population (2009: 6.7 billion) circle the globe?

Answer: 40,000 km X 1 m/person = 40,000,000 people once around the equator.

6.7 billion ÷ 40,000,000 = **167.5 times**.

Now that your students are imagining a line of people long enough to circle the globe 167 times, have them calculate the speed at which the line would grow at the current population growth rate:

6.7 billion X .012 = ~80 million new people every year

80,000,000 m / year = 80,000 km / year

80,000 km / year = 9 km/hr (Google can do the unit conversion very quickly)

9 km/hr = a steady jog with no breaks, just to keep up with world population for one year!

Crude death rates

Although it is addressed in the first paragraph after the measure is defined, students struggle with understanding how developed countries can have higher death rates than developing ones. It is helpful to take some time to discuss the age structure of a population and how older populations can have a moderately high death rate even though the population is healthy.

Blaming the victims

Students can be challenged to appreciate how different life in other places can be. Students frequently misapprehend:

a) Women in less developed countries often do not have the same reproductive choices as in the more developed world; and

b) HIV/AIDS affects many innocent people (some are unforgiving of HIV/AIDS cases over the implied immorality of transmission).

To address (a), consider a discussion of what life is like in an underdeveloped country. A series of questions can help lead the discussion to a better understanding:

In a less developed country, how many years of school would a typical girl or boy experience?

Would the answer be different if he or she grew up on a farm or in a city?

If a young woman didn't want to get married and have children, what choices might she have in a rural community in a less developed country?

What pressures might there be for the same woman to marry and reproduce?

To address (b), have the class consider whether everyone with HIV/AIDS is responsible for their illness. Students will volunteer several examples, e.g. mother-to-child transmission.

Assignments

Review/Reflection Questions

- Refer to Table 2-1 on page 51 of your textbook. In terms of food supply, which measure of density is most important when considering whether a country's population is too large? Why?
- Describe the change brought about by the industrial and medical revolutions in terms of population growth. What effect did both revolutions have?
- List several differences between the industrial and medical revolutions. Why did both cause a move from stage 1 to stage 2? What is preventing countries now in stage 2 from moving to stage 3?
- What did Thomas Malthus predict about population growth? Was he right? Give an example of a neo-Malthusian argument from your own experience (some resource you think might become rare because of population growth).
- How is the epidemiologic transition like the demographic transition? How is it different? What does the epidemiologic transition mean when comparing the lives of people in the developed world with the lives of people in less developed countries?

Demographic Data Collection and Analysis

Purpose: students will look up demographic data for a variety of countries to become more familiar with demographic measures.

Choose or have the students choose six to ten countries for analysis. You may wish to give students a representative sample of countries from around the world; if your teaching includes specific international examples it might be useful to include those countries.

Data selection: choose widely available data for the students to look up. Have the students assemble the data in a table.

Analysis: you may wish to have students perform regression analysis on two or more points of data, or simply to write a reflection on what they learned.

Here is an example:

Use the following countries in your analysis:
Afghanistan
Bolivia
Cambodia
China
France
Lithuania
Tanzania
Turkey
United States

Look up the following information for each county on www.prb.org and assemble it into a table. Your table should be easy to read and fit onto one page. If you cannot fit it onto one page, please make sure that all column and row labels are present on the second page.

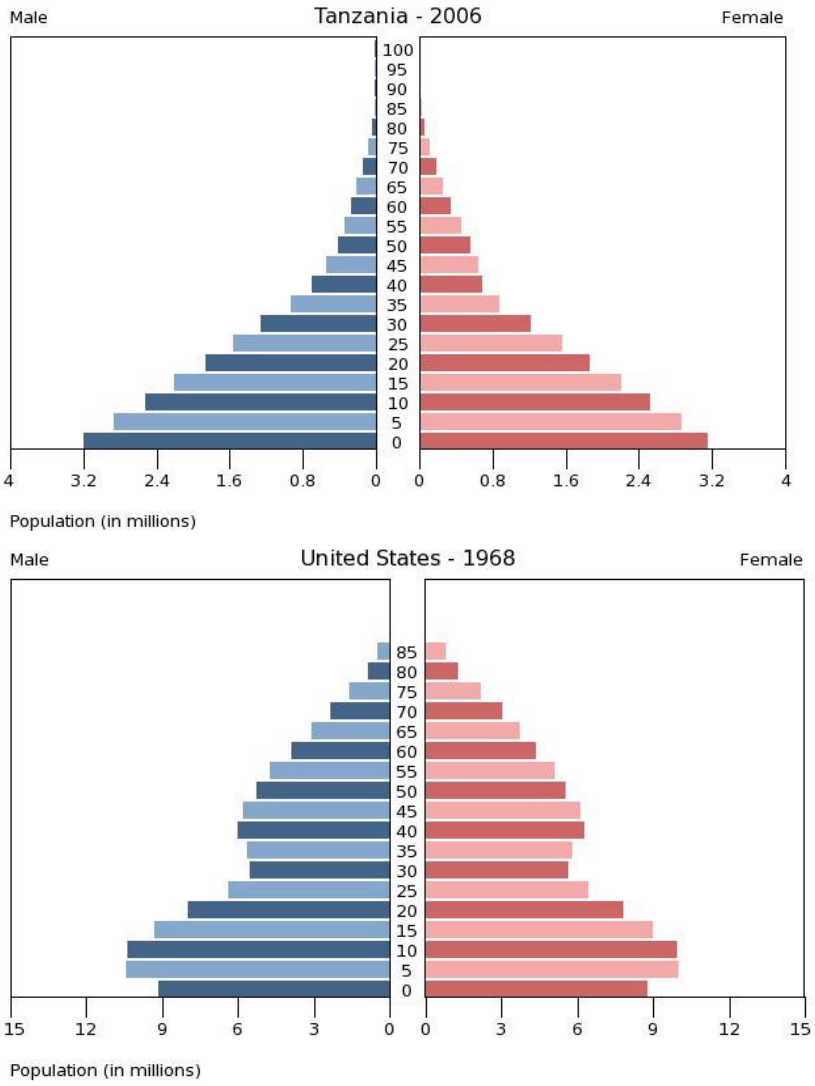
Crude Birth Rate (Births per 1,000 population)
Crude Death Rate
Rate of Natural Increase
Infant Mortality Rate (Infant deaths per 1,000 live births)
Life Expectancy
GNI PPP per capita
…and any other data you find personally interesting.

Include a column or row in your table in which you identify which stage of the demographic transition you believe each country to be in.

Once you have assembled your table, write a two- to three-page paper (500 to 750 words) on what you have learned from assembling this information: Do there appear to be any trends or relationships between the data? Is there any data that surprise you?

Resources

Interactive population pyramids



Images courtesy U.S. Census Bureau

The U.S. Census Bureau's International Data Base has an interactive population pyramid application at:

http://www.census.gov/ipc/www/idb/informationGateway.php

"From the Data Access page, select the "Country" tab, then the country and year(s) of interest and press the "Submit" button. Go to the "Population Pyramids" tab and you will see the dynamic pyramid followed by the pyramid(s) for the years you selected. You can select a different country and/or year(s) and click the "Submit" button to see the resulting pyramids."

This application illustrates how a population pyramid can display demographic data in an easily-understood format. The "dynamic" model, where the pyramid grows through a progression of past demographic data and into a forecast for 2050, helps students understand how each generation's reproductive choices affect a country's population structure.

Population Reference Bureau

The Population Reference Bureau (http://www.prb.org/) has a wealth of demographic data, as well as data on education, employment, health, and environment. It features data on the United States and most countries around the world. One section of the website ("Educators") focuses on using demographic data in teaching.

World Health Organization Statistical Information System (WHOSIS)

The WHO is the authoritative source of health data for the world, especially valuable as a resource for further investigation into this chapter's section on the epidemiological transition.

http://www.who.int/whosis/en/

Gapminder

Gapminder features an easy-to-use interactive chart tool and map. The chart allows users to select variables on each axis and watch trends unfold through time.

http://www.gapminder.org/

U.S. Census

The U.S. Census features a wealth of demographic and economic data on the U.S. population. (http://www.census.gov/)

Connections between Chapters

Back to Chapter 1

Page 46 underlines the key geographic concepts associated with the study of population, reinforcing the geographic nature of population distribution and change. This introduction also helps students understand the types of questions asked in the Key Issues.

Forward to Chapter 3

Chapter 3, Migration, forms a natural step from Chapter 2, as those countries experiencing rapid population growth frequently are source regions for international migration, while countries in stage 4 of the demographic transition often experience net in-migration.