**Chapter 2: Population & Health**

**Introduction** More people are presently alive than at any other point in Earth’s history, with population growth mostly concentrated in developing countries. Can Earth sustain more than the 7 billion people that currently call it home, let alone the added billions in the future? Geographers have unique perspectives on the ability of people to live on Earth. Population growth in developing countries, such as Indonesia (the fourth most populous country in the world), will greatly affect the future population of the world as a whole.

**Key Issue 1: Where Are the World’s People Distributed?**

**Introducing Population and Health** Geographers examine population problems by first identifying where people are found across the Earth. The location of Earth’s 7 billion people forms a regular distribution. Chapter 2 explains the spatial variation in population growth rates. With the rate of world population growth slowing in the twenty-first century, geographers have turned their attention to the global differences in access to health-care. The study of population geography is especially important for three reasons:

* More people are alive at this time than at any other point in Earth’s long history.
* Virtually all global population growth is concentrated in developing countries.
* The world’s population increased at a faster rate during the second half of the twentieth century than ever before in history; the rate has slowed in the twenty-first century but is still high by historical standards.

**Overpopulation** occurs when the number of people in an area surpasses the ability of the environment to support life at an adequate standard of living. The capacity of the Earth to sustain appreciable population growth differs at varying scales; some regions may feature a favorable balance between people and resources, whereas others may not. The **census** is the data source most readily used for analysis in population geography. Despite its importance, two issues relating to the census have been identified:

* **Nonparticipation**. Homeless (unsheltered) people, ethnic minorities, and citizens of other countries who do not possess proper immigration documentation may be less likely to participate in the census.
* **Sampling**. Statistical sampling techniques can be used to get a more accurate count, as well as to identify detailed characteristics of people, housing, and businesses. People sympathetic to the needs of the homeless and immigrants have been in support of sampling in contrast to people from more rural areas.

**Distribution of the World’s People** The world’s population is not distributed uniformly; two properties may be employed by Geographers to understand this distribution: concentration and density. These concepts can be displayed cartographically many ways, such as looking at concentration using a cartogram.

**Population Concentrations** Two-thirds of the Earth’s population are clustered in four regions. These four regions are characterized by low-lying terrain, with fertile soil and temperate climate. Concentrations of people are found near oceans (or rivers with easy access to an ocean) rather than in the interior of major landmasses.

**Four Clusters** The four aforementioned population clusters – East Asia, South Asia, Europe, and Southeast Asia, exhibit differences in the pattern of the occupancy of the land.

**East Asia** Nearly a quarter of the Earth’s population is centered in East Asia. East Asia’s population is mostly concentrated in China, but also Japan, North and South Korea, and Taiwan. Population is clustered near fertile river valleys and the Pacific Coast. About half of China’s population reside in urban areas.

**South Asia** Roughly a quarter of the world population lives in South Asia, comprising the countries of India, Pakistan, Bangladesh, and Sri Lanka. Population is concentrated along the Indus and Ganges rivers, and also along the two coasts of India (the Arabian Sea to the west and the Bay of Bengal to the east).

**Europe** Four dozen countries constitute Europe, ranging from Monaco (with 1 square kilometer in land area) to Russia (the world’s largest country by land area, including its Asian part). People occupy mostly cities, with three-quarters of Europe’s inhabitants living in urban areas.

**Southeast Asia** Approximately 600 million people live in Southeast Asia, with population concentrated on a series of islands that lie between the Indian and Pacific oceans. This concentration is distinguished by a high percentage of people working as farmers in rural areas.

**Other Clusters** Africa’s two largest population clusters amount to roughly 300 million people, are located along the west coast between Senegal and Mogeroa and along the east coast between Eritrea and South Africa. Most Africans work as farmers. In the Western Hemisphere, northeastern United States, and southeastern Canada make up the largest population cluster, with 100 million people.

**Sparsely Populated Regions** The **ecumene** describes the areas of permanent human habitation. Examining the changes in ecumene reveal some areas where humans do not live in large numbers. The ecumenes that are sparsely populated are very dry areas, very wet areas, very cold areas, and mountains. There are large cities in the mountains of Mexico and along the Andes because the climate is more temperate in the mountains in Latin America than in the lowlands. Africa also has some populations living at higher altitudes.

**Dry Lands** Twenty percent of Earth’s land surface is covered by areas too dry for farming. While deserts cannot support agricultural activity due to insufficient water supplies, some populations have adapted to these circumstances, raising animals that are tolerant to the climate.

**Wet Lands** Poor soil conditions, caused by very high levels of precipitation and extreme heat, hinder human occupation near the equator.

**Cold Lands** Few humans live near the North and South poles, as much of the land is permanently frozen (permafrost) and few animals capable of domestication are tolerant to the extreme cold temperatures.

**High Lands** Many high elevation areas in the world are inhospitable to human settlement due to the mountains dominating these landscapes being steep and snow covered. Some plateau and mountain regions can support human settlement, especially those at low altitudes (near the equator) where agriculture is possible at high elevations.

**Population Density** The number of people occupying a defined area of land, previously described in Chapter 1 as density, reveal the distribution of people compared to available resources. Three measures of density are widely used by Geographers: arithmetic density, physiological density, and agricultural density.

**Arithmetic Density** In population geography **arithmetic density** refers to the total number of people divided by the total land area (usually square kilometers or square miles). Arithmetic density enables geographers to compare the number of people trying to live on a given piece of land in different regions of the world.

**Physiological Density** Land suitable for agriculture is called arable land. In a region, the number of people supported by a unit area of arable land is called the **physiological density**.Physiological density can be considered a rough measure of a country’s food security. A large difference between the physiological density and arithmetic density indicates that most of a country’s land is unsuitable for intensive agriculture.

**Agricultural Density** The number of farmers per area of arable land is the **agricultural density**. Agricultural density is used by geographers as a measure of development. Many more machines are used for agriculture in more developed countries. With more machines being used in agriculture, fewer farmers are needed. Also, more developed countries have the technology and capital to allow a few people to farm extensive land areas and feed many people. Physiological and agricultural densities may be used in concert to help geographers understand relationships between population and resources in a country.

**Key Issue 2: Why Is World Population Increasing?**

**Natural Increase** The **natural increase rate (NIR)** is the percentage by which a population grows in a year, excluding growth by migration.

**Population Growth in History** For the several hundred-thousand-year occupancy of Earth, the NIR was essentially zero. While the world NIR peaked in 1963 at a rate of 2.2 percent and has been in decline since the 1990s, the NIR during the second half of the twentieth century was considerably high by historical standards. The number of people added annually has decreased from a historic peak of 88 million in 1989 to the present level of 75 million people. This drop is less acute than the drop in NIR as the world population base is larger now than in the past. World population increased from 3 to 4 billion in 14 years, from 4 to 5 billion in 13 years, from 5 to 6 billion in 12 years, and from 6 to 7 billion in 12 years.

The NIR affects the **doubling time**, which is the number of years required to double a population, assuming a steady rate of natural increase. If the present rate of 1.2 percent per year holds, world population would double in approximately 54 years.

**Life expectancy** is the average number of years an individual can be anticipated to live, assuming current social, economic, and medical conditions remain in place. Life expectancy in developed countries is about 80 years, while in developing countries in sub-Saharan Africa is only 57 years.

**Regional Variations in NIR** More than 95 percent of the natural increase is concentrated in developing countries. In most countries of sub-Saharan Africa, the NIR is greater than 2.0 percent. In contrast to the relatively high NIR in developing countries, Europe’s NIR is negative, meaning that population is in decline (and has been in decline since 1980). Since 1980, 67 percent of the world’s population growth has been centered in Asia, 20 percent in Africa, and 9 percent in Latin America.

**Births and Deaths** Population increases rapidly in locations where more people are born than die, and it decreases in locations where more people die than are born.

**Fertility** The **crude birth rate (CBR)** is the total number of live births in a year for every thousand people alive in society.

**Mortality** The **crude death rate (CDR**) is the total number of deaths in a year for every thousand people in society.

**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.

**Stage 1: Low Growth** In stage 1, crude birth and death rates are both high, resulting in a low rate of natural increase. For most of this period, people depended on hunting and gathering for food. When food was easily obtained, a region’s population increased, but it declined when people were unable to locate enough animals or vegetation nearby. There are no countries presently in stage 1.

**Stage 2: High Growth** The move to stage 2 is caused by a rapid decline in crude death rates. Crude birth rates remain high, leading to rapid population growth. Developed regions such as Europe and North America entered stage 2 as a part of the **Industrial Revolution**. 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: Moderate Growth** Stage 3 is marked by a drop in fertility, which brings down the crude birth rate and decreases the natural increase rate. A society enters stage 3 when people have fewer children. The decision to have fewer children is partly a reaction to a decline in mortality. The crude death rate in stage 3 societies continues to fall but not as rapidly as the crude birth rate.

**Stage 4: Low Growth** Stage 4 is marked by a nearly equal low crude birth and death rates, and roughly zero natural increase. This condition is called **zero population growth (ZPG)**,a term often applied to stage 4 countries. Stage 4 resembles stage 1 in terms of growth, but otherwise is very different. Total population of a country is much higher in stage 4 than in stage 1. Also, instead of high crude birth and death rates, both are low. Life expectancies are much longer in stage 4 and society is much different.

**Key Issue 3: Why Do Some Places Face Health Challenges?**

**Health and Gender** Females the world over are exposed to a host of challenging health risks that deeply affect the size and composition of the population of individual countries and the world as a whole.

**Baby Girls at Risk** Every year, around 700,000 female babies are “missing” in China and India, as a result of gender-based selection. Over the past several decades, it is estimated that 117 million females have gone “missing” over the past several decades. The number of males per 100 females in the population is the **sex ratio**. The standard biological level for humans at birth is approximately 105 male babies for 100 female babies. Developed countries have more females than males because on average women live seven years longer than men. The large number of male babies in countries like China and India has raised the possibility that a relatively large number of female fetuses are being aborted due to cultural preferences on the part of parents to have sons rather than daughters. In order to address the imbalance of male to female births, the “root cause” of this sex selection, gender inequality (as defined by the United Nations), must be recognized.

**Mothers at Risk** The **maternal mortality rate** is the annual number of female deaths per 100,000 live births from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes). The rate in many countries of Africa and Asia exceeds 100 deaths per 100,000 mothers, while fewer than 10 deaths per 100,000 mothers in most European countries.

**Health and Aging** A country’s stage of the demographic transition determines the proportion of people in different age groups. The varying number of people in different age groups reveals the specific health challenges a country faces.

**Population Pyramids** A **population pyramid** provides graphical insight into the age and sex composition of a locations’ population, with 5-year age cohorts and gender represented by bars. The youngest cohort is located at the base of the graph, while the oldest is at the top. We can tell by 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). Population pyramids help geographers identify which stage of the demographic transition a country occupies.

**Caring for Young and Old** One important way to compare age structure among countries is the **dependency ratio**, which shows the people who are too young and too old to work, compared to the number of people in their productive years. People who are 0–14 years of age or over 64 years old are normally classified as dependents. The large number of children in a poor country strains the ability of that country to be able to provide needed services such as schools, hospitals, and day care centers.

The **infant mortality rate (IMR)** is the annual number of deaths of infants under 1 year of age, compared with total live births, expressed as the number of deaths among infants per 1,000 births. IMR is an indicator of a country’s health-care system. Lower IMRs are found in countries with well-trained doctors and nurses, modern hospitals, and large supplies of medicine. Life expectancy is most favorable in wealthy countries in Europe and least favorable in the poor countries of sub-Saharan Africa.

The “graying” of a country’s population places a burden on the working population to meet the needs of older people for income and medical care after they retire from their job. This burden can be analyzed using the elderly support ratio. The **elderly support ratio** is the number of working-age people (ages 15-64) divided by the number of persons 65 and older.

**Medical Services** Health conditions differ from country to country, and each country possesses different resources for people in need of health care.

**Health Care** Developed countries devote resources to protect populations that are unable to work. Investment into health care comprise more than 15 percent of total government expenditures in
Europe and North America, in contrast to the less than 5 percent invested by sub-Saharan Africa and South Asia.

**Medical Facilities** The state of medical facilities in a developed country mirror the investment in health care. Most countries in Europe have more than 50 hospital beds per 10,000 people, compared to fewer than 5 in sub-Saharan Africa. Health care is available at little or no cost as a public service in most developed countries. The United States, however, is an outlier among developed countries in that private individuals are mandated to pay an average of 55 percent of health care expenses. While robust economic growth allowed for generous programs to be financed by developed countries in the past, sluggish economic growth has prevented these programs from sufficiently servicing populations in need of care.

**The Epidemiologic Transition** **Epidemiology** is the branch of medical science concerned with the incidence, distribution, and control of diseases that are prevalent among a population at a specific time and are produced by some special causes not generally present in the affected place. The **epidemiologic transition**,conceptualized by Abdel Omran in 1971,focuses on distinctive health threats in each stage of the demographic transition. Geographic concepts such as scale and connection are utilized by epidemiologists to understand the distribution and method of diffusion of possible epidemics, and to develop control and prevention strategies.

**Stage 1: Pestilence and Famine** In stage 1 of the epidemiologic transition, infectious and parasitic diseases were principal causes of human deaths. Accidents and attacks by animals and other humans were also prevalent causes of death at the time. History’s most violent stage 1 epidemic was the Black Plague (bubonic plague), which was probably transmitted to humans by fleas from migrating infected rats.

**Stage 2: Receding Pandemics** A **pandemic** is disease that occurs over a wide geographic area and affects a very high proportion of the population. Improved sanitation, nutrition, and medicine during the Industrial Revolution reduced the spread of infectious diseases. Death rates did not decline immediately and universally during the early years of the Industrial Revolution. Poor people crowded into rapidly growing industrial cities had especially high death rates. An early example of geographic tools used to study epidemiology is the GIS created by Dr. John Snow to determine the source of cholera in London in 1854. Dr. Snow overlaid maps of addresses of cholera victims and the location of water pumps over a map of the Soho neighborhood, displaying a cluster of victims around a single pump on Broad Street.

**Stage 3: Degenerative Diseases** Stage 3 of the epidemiologic transition is characterized by a decrease in deaths from infectious diseases and an increase in chronic disorders associated with aging. Chronic disorders associated with aging include heart attacks and various forms of cancer. Sub-Saharan Africa and South Asia have the lowest incidence of cancer, primarily because of the relatively low life expectancy in those regions.

**Stage 4: Delayed Degenerative Diseases** The major degenerative causes of death—cardiovascular disease and cancers—linger, but the life expectancy of older people is extended through medical advances. Medical operations and healthier lifestyles increase people’s life expectancy in stage 4 of the epidemiologic transition. On the other hand, consumption of non-nutritious food and sedentary behavior have resulted in increased obesity rates in stage 4 countries.

**Key Issue 4: Why Might Population Increase in the Future?**

**Population and Resources** English economistThomas Malthus was one of the first to predict that population increases would soon outpace the development of food resources, leading to a dramatic crisis as a result of the strain on resources. Malthus claimed that the populations grow geometrically, while food supply increase arithmetically. England entered stage 2 of the demographic transition several decades before Malthus stated these conclusions. Malthus posited that the only thing to prevent a “Malthusian” crisis would be a country’s population following “moral restraint,” lowering CBRs (unless disease, famine, war, or other disasters produced higher CDRs).

**Contemporary Neo-Malthusians and Critics** Malthus’s views remain influential today. Supporters of Malthus’s model suggest that characteristics of recent population growth pose even greater risks than when Malthus developed his thesis more than 200 years ago. However, criticism has been directed at both the population and resource depletion elements of Malthus’s equation. Evidence from the past fifty years suggest both Neo-Malthusians and their critics are correct in certain aspects their analyses.

**Population Futures** It is vital for geographers and other researchers to project the future world population to assess possible trends in epidemiology, food scarcity, and other issues. The United Nations estimates that the world population in 2100 could grow to 15.8 billion or decline to 6.2 billion, depending on the outcomes of variant projections.

**Demographic Transition Possible Stage 5: Decline** A possible stage 5 of the demographic transition is predicted by demographers for some developed countries. Stage 5 would be characterized by very low CBR, an increasing CDR, and therefore a negative NIR. The population of a country in stage 5 of the demographic transition would be much older.

**China and India** China and India together include more than one-third of the world’s total population. As the world’s two most populous countries, policies instituted in China and India will affect prospects for global overpopulation.

**China’s Population Policies** The core of the Chinese government’s family-planning program has been the One Child Policy, adopted in 1980. Couples in China receive financial subsidies, a long maternity leave, better housing, and (in rural areas) more land if they agreed to have just one child. The government prohibited marriage for men until they are age 22 and women until they are age 20. Rules have changed in the twenty-first century as China has moved toward a market-based economy and families are becoming wealthier. Since 2000, China has had a lower CBR than the United States. The number of people added to China’s population each year has dropped by one-half, from 14 million to 4 million, during the past twenty-five years. Despite China abandoning the One Child Policy in 2015, China’s CBR will likely not dramatically increase due to three decades of intensive educational programs (and coercion).

**India’s Population Policies** India became the first country to embark on a national family-planning program. The government spends several hundred million dollars annually on various family-planning programs including the distribution of birth-control devices and abortions. India’s most controversial family-planning program was the establishment of sterilization camps. A sterilized person was entitled to payment which was roughly equivalent to a person’s monthly income. People were opposed to the sterilization camps because they thought that eventually sterilization would be forced.

**Epidemiologic Futures** While the possible stage 5 of the demographic transition is introduced by an increased elderly population, a theoretical stage 5 of the epidemiologic transition could be brought about by a reemergence of infectious and parasitic diseases. Three reasons help explain the possible emergence of a stage 5 of the epidemiologic transition: evolution, poverty, and increased connections.

**Possible Stage 5 Cause: Evolution** In a possible stage 5, infectious diseases thought to have been eradicated or controlled return, and new ones emerge. Infectious disease microbes have continually evolved and changed in response to environmental pressures by developing resistance to drugs and insecticides. Antibiotics and genetic engineering contribute to the emergence of new strains of viruses and bacteria.

**Possible Stage 5 Cause: Poverty** Infectious diseases are more prevalent in poor areas than other places because unsanitary conditions may persist, and most people can’t afford drugs needed for treatment. Tuberculosis is an example of an infectious disease that has largely been controlled in developed countries but remains a major cause of death in developing countries. Tuberculosis is more prevalent in poor areas because the long, expensive treatment poses a significant economic burden.

**Possible Stage 5 Cause: Connections** As they travel, people carry diseases with them and are exposed to the diseases of others.

**AIDS** The most lethal pandemic in recent years has been AIDS (acquired immunodeficiency syndrome). 39 million people have died worldwide since the beginning of the epidemic through 2014, and 37 million people currently have HIV (human immunodeficiency virus, the cause of AIDS). 26 million of the world’s 37 million HIV sufferers live in sub-Saharan Africa.

**Ebola** Ebola, named for the river in the Democratic Republic of Congo, is a relatively “new” pandemic. The first known victim of Ebola in West Africa was a 2-year old boy in the village of Meliandou, Guinea, who died in December 2013. The virus rapidly spread in early 2014 to isolated villages in Guinea and the neighboring countries Sierra Leone and Liberia, areas among the poorest in the world. While the disease was spread by health care workers who traveled to other places while unknowingly infected, their destinations and homes possessed health-care systems able to treat patients.

**Family Futures** The world CBR steeply declined between 1990 and 2015, from 27 to 20. In developing countries during the same time period, CBR dropped from 31 to 22. Two strategies have been successful in lowering birth rates.

**Lowering CBR through Education and Health Care** Improving local economic conditions is one approach to decreasing crude birth rates. A community with more economic resources can increase expenditures on education and health-care programs that promote lower birth rates. According to this approach, women’s educational opportunities are encouraged, making them more likely to gain employment skills and take economic control over their lives. Women would also have been knowledge of their reproductive rights, letting them make more informed reproductive choices, and increase awareness of available methods of contraception. Improved health-care programs, such as prenatal care, counseling about sexually transmitted diseases, and child immunization, lead IMRs to decline. With the survival of more infants ensured, women would be more likely to choose to make more effective use of contraceptives to limit the number of children.

**Lowering CBR through Contraception** Short-term solutions included in family-planning programs, such as contraception, can reduce crude birth rates much more quickly than prolonged economic shifts. Demand outstrips supply for contraceptives where they are needed most – in developing countries. Places where people have limited access to education and modern communication are susceptible to the acceptance of family-planning concepts; for example, in Bangladesh, 6 percent of married women used contraceptives in 1980 – in 2014, the number rose to 62 percent. Similar trends have been examined in Columbia, Morocco, and Thailand. Contraceptive usage is very low in sub-Saharan Africa, with only 30 percent of married women using them. Cheap and rapid distribution of contraceptives in
sub-Saharan Africa could have a relatively large impact on lowering CBR in the region.

**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 population increase in the future? The three reasons we should study population are given as:

* More people are alive at this time—about 7 billion—than at any point in Earth’s long history.
* Virtually all global population growth is concentrated in less developed countries.
* The word’s population increased at a faster rate during the second half of the twentieth century than ever before in history.