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1 Populations in transition

01 Population change

KEY QUESTIONS

- How has the world's population changed over time?
- What is the global pattern of births, natural increase and mortality?
- What have been the major changes in these rates over time?
- How do fertility and life expectancy vary around the world?
- How do population pyramids show global variations in age and gender structure?
- What is population momentum and what impact does it have on population projections?

The grave of the poet W B Yeats, County Sligo, Ireland. The inscription reads: 'Cast a cold Eye/ On Life, on Death. / Horseman, pass by!'

Early humankind

The first hominids who were early ancestors of humans appeared in Africa around 5 million years ago, on a planet that is generally accepted to be 4600 million years old. They differed from their predecessors, the apes, in the fact that they walked on two legs and did not use their hands for weight-bearing. Other uses were soon found for these now liberated hands, with new skills acquired and charted in the evolutionary record as an increase in the size of the brain and the cranium (the hard bone case which gives the head its shape). After two million years cranial capacity (cc) had increased by 50% from the 600 cc of the earliest hominid, *Australopithecus*, to the 900 cc of the primitive man named *Homo erectus*. The final increase to *Homo sapiens*' current average of 1450 cc took place about 100 000 years ago.

The evolution of humankind was matched by its geographical **diffusion**. Whereas the locational evidence for *Australopithecus* is confined to Africa, remains of *Homo erectus* have been found stretching from Europe to South-east Asia. *Homo sapiens* roamed even further, making the first journeys into the cold environments of high latitudes.

During most of the period since *Homo sapiens* first appeared, global population was very small, reaching perhaps some 125 000 people a million years ago, although there is not enough evidence to be very precise about population in the distant past. It has been estimated that 10 000 years ago, when people first began to domesticate animals and grow crops, world population was no more than 5 million. Known as the Neolithic Revolution, this period of economic change significantly altered the relationship between people and their environments. But even then the average annual growth rate was less than 0.1% per year, extremely low compared with contemporary trends.

The pyramids at Giza, Egypt, build about 2000 BC when the world's population was only about 100 million.

However, as a result of technological advance the **carrying capacity** of the land improved and population increased. By 3500 BC the global population had reached 30 million and by AD 1 this had risen to about 250 million.

A Roman amphitheatre in Tunisia, built around AD 50 when the world's population was about 250 million.

Demographers estimate that world population had reached 500 million by about 1500. From this time population grew at an increasing rate. By 1800 the global population had doubled to reach almost one billion (Figure 1). Table 1 shows the time taken for each subsequent billion to be reached, with the global total reaching six billion in 1999. It had taken only 12 years for the world population to increase from five billion to six billion – less than the time required for the previous billion to be added. It is estimated that 7 billion will be reached in 2013 – a 14-year gap. Table 2 shows population change in 2009, with a global population increase of almost 82 million in that year. The vast majority of this increase is in developing countries.

Each billion	Year	Number of years to add each billion
1st	1804	All of human history
2nd	1927	123
3rd	1960	33
4th	1974	14
5th	1987	13
6th	1999	12
7th	2013	14
8th	2028	15
9th	2054	26

Table 1 *World population growth by each billion..*

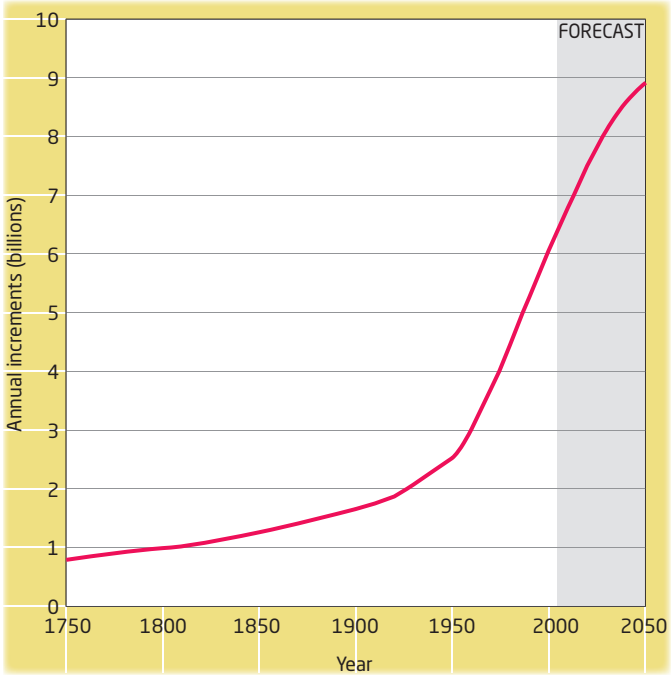

Figure 1 *World population growth, 1750–2050.*

Recent demographic change

Figure 2 shows that both total population and the rate of population growth are much higher in the developing world than in the more developed world. However, only since the Second World War has population growth in the developing countries overtaken that in the developed countries. The developed countries had their period of high population growth in the 19th and early 20th centuries, while for the developing countries high population growth has occurred since 1950.

The highest ever global population growth rate was reached in the early to mid-1960s when population growth in the developing world peaked at 2.4% a year. At this time the term 'population explosion' was widely used to describe this rapid population growth. By the late 1990s the rate of population growth was down to 1.8%. However, even though the rate of growth has been falling for three decades, **population momentum** meant that the numbers being added each year did not peak until the late 1980s (Figure 3).

The demographic transformation, which took a century to complete in the developed world, has occurred in a

		World	More developed countries	Less developed countries
Total population		6 809 972 000	1 232 100 000	5 577 872 000
Births per	Year	138 949 000	14 359 000	124 590 000
	Day	380 683	39 340	341 343
	Minute	264	27	237
Deaths per	Year	56 083 000	12 277 000	43 807 000
	Day	153 653	33 636	120 019
	Minute	107	23	83
Natural increase (births – deaths) per	Year	82 866 000	2 083 000	80 784 000
	Day	227 030	5 707	221 326
	Minute	158	4	154
Infant deaths per	Year	6 352 000	82 000	6 269 000
	Day	17 402	225	17 175
	Minute	12	0.2	12

Table 2 *World population clock, 2009.*

generation in some developing countries. Fertility has dropped further and faster than most demographers foresaw 20 or 30 years ago. The exceptions are in Africa and the Middle East, where in over 30 countries families of at least five children are the norm and population growth is still over 2.5%. Table 3 (page 4) shows the ten largest countries in the world in population size and their population projections for 2050.

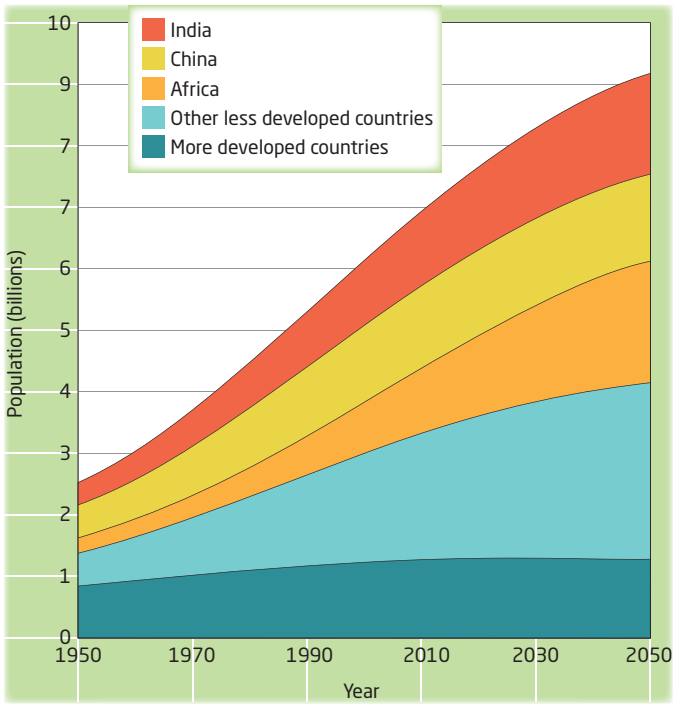

Figure 2 *Population growth in developed and developing countries, 1950–2050.*

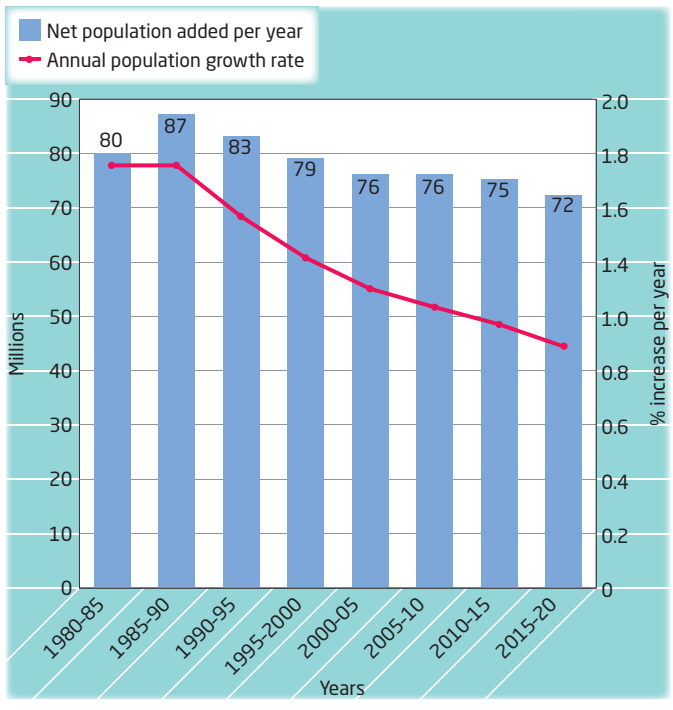

Figure 3 *Population increase and growth rate in five-year periods, 1980–2020.*

2009		2050	
Country	**Population (millions)**	**Country**	**Population (millions)**
China	1331	India	1748
India	1171	China	1437
USA	307	USA	439
Indonesia	243	Indonesia	343
Brazil	191	Pakistan	335
Pakistan	181	Nigeria	285
Bangladesh	162	Bangladesh	222
Nigeria	153	Brazil	215
Russia	142	Congo, Dem. Rep.	189
Japan	128	Philippines	150

Table 3 *The ten most populous countries in the world, 2009 and 2050.*

Theory of Knowledge

Patterns and processes can be examined at different time scales. The important thing is to choose the most appropriate time scale for your analysis.

The concept of time lag is important in various types of geographical analysis. For example in this chapter the time lag between fertility falling to population replacement level in a country and the total population actually beginning to decline is a significant factor in population change.

Bearing in mind what has been noted about demographers' problems with predicting fertility (page 3), how confident do you think we can be about population predictions 10, 20 or 50 years ahead?

Activities

1. With the help of Figure 1 and Table 1, briefly describe the growth of human population since 1750.
2. Produce a brief bullet point summary (8–10 points) of Table 2.
3. Look at Figure 2. Describe the differences in population growth and projected growth in developed and developing countries between 1950 and 2050.
4. Describe the trends in (a) population increase and (b) population growth rate shown in Figure 3.
5. Describe the changes in the world's most populous countries (Table 3) between 2009 and 2050.

Research idea

Find out in more detail about the advances in the Neolithic Revolution (page 1) which stimulated population growth.

Demographic transition

Although the populations of no two countries have changed in exactly the same way, some broad generalisations can be made about population growth since the middle of the 18th century. These generalisations are illustrated by the model of **demographic transition** (Figure 4) which is based on

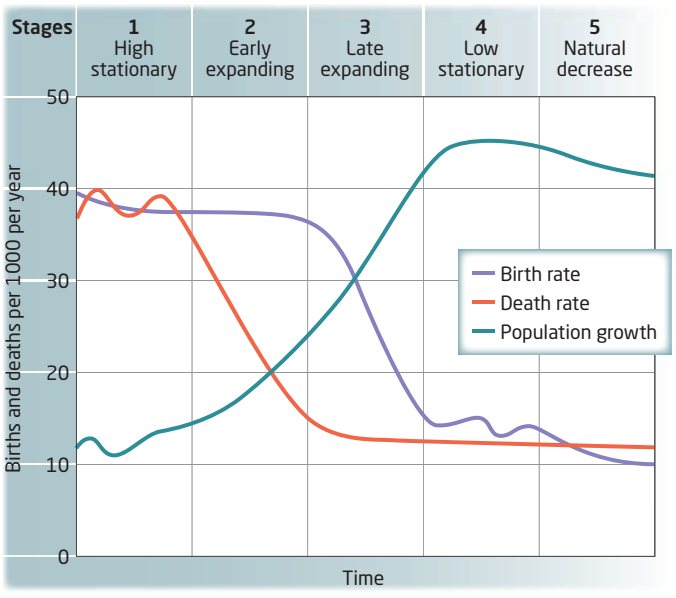

Figure 4 *Model of demographic transition.*

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the experience of north-west Europe, the first part of the world to undergo such changes as a result of the significant industrial and agrarian advances that took place during the 18th and 19th centuries.

No country as a whole retains the characteristics of stage 1, which applies only to the most remote societies such as isolated tribes in New Guinea and the Amazon that have little or no contact at all with the outside world. All the developed countries of the world are now in stages 4 or 5, most having experienced all of the previous stages at different times. The poorest of the developing countries (e.g. Bangladesh, Niger, Bolivia) are in stage 2 but are joined in this stage by a number of oil-rich Middle East nations where increasing affluence has not been accompanied by a significant fall in fertility. Most developing countries that have registered significant social and economic advances are in stage 3 (e.g. Brazil, China, India), while some of the newly industrialised countries such as South Korea and Taiwan have entered stage 4. With the passage of time there can be little doubt that more countries will attain the demographic characteristics of the final stages of the model. The basic characteristics of each stage are as follows.

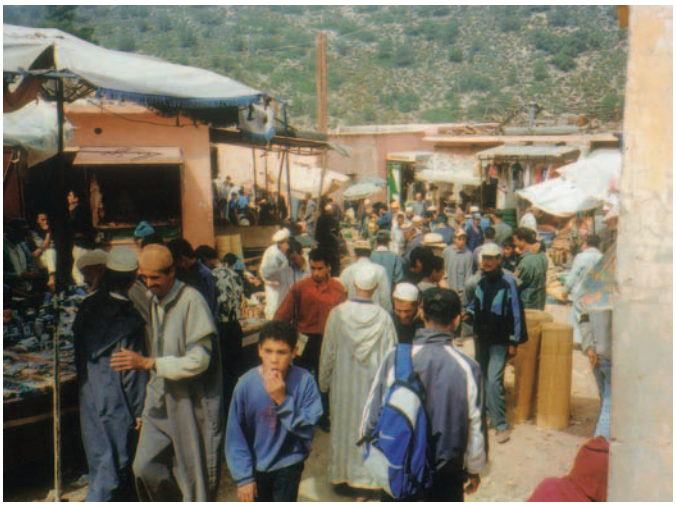
High stationary Stage 1

The **crude birth rate** is high and stable while the **crude death rate** is high and fluctuating due to the sporadic incidence of famine, disease and war. The use of the word 'crude' means that the birth and death rates are based on the total population and as such they are very generalised, with clear limitations. In this stage population growth is very slow and there may be periods of considerable decline. Infant mortality is high and life expectancy low. A high proportion of the population is under the age of 15. Society is pre-industrial with most people living in rural areas, dependent on subsistence agriculture.

Early expanding Stage 2

The death rate declines significantly. The birth rate remains at its previous level as the social norms governing fertility take time to change. As the gap between the two vital rates widens, the **rate of natural change** increases to a peak at the end of this stage. Infant mortality falls and life expectancy increases. The proportion of the population under 15 increases. Although the reasons for the decline in mortality vary in intensity and sequence from one country to another, the essential causal factors are: better nutrition; improved public health, particularly in terms of clean water supply and efficient sewerage systems; and medical advance. Considerable rural-to-urban migration occurs during this stage. However, in recent decades for developing countries urbanisation has often not been accompanied by the industrialisation that was characteristic of the developed nations during the 19th century.

Graveyard in France dating from the 18th century. Inscriptions show that life expectancy at that time was very low.



Market in Morocco – a country in stage 3 of the demographic transition.

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Case study

Demographic transition in England and Wales

In England and Wales in medieval times (stage 1) both the birth rate and the death rate hovered around 35/1000. The birth rate was generally a little higher, resulting in a slow rate of natural increase. While the birth rate tended to remain at a relatively stable level, the death rate varied considerably at times. For example, the 1348–49 epidemic of bubonic plague, known as the Black Death, killed something like a third of the population. These conditions of high fertility and high mortality persisted until about 1740 (Figure 5).

Stage 2, that lasted until about 1875, witnessed a period of rapid urbanisation which alerted both public officials and factory owners to the urgent need for improvements in public health. Factory owners soon realised that an unhealthy workforce had a huge impact on efficiency. The provision of clean piped water and the installation of sewerage systems, allied to better personal and domestic cleanliness, saw the incidence of the diarrhoeal diseases and typhus fall rapidly.

Although in many ways life in the expanding towns was little better than in the countryside, there was a greater opportunity for employment and a larger disposable income so that more food and a wider range of food products could be purchased. Contemporary studies in developing countries show a very strong relationship between infant nutrition and infant mortality. Infant mortality in England fell from 200/1000 in 1770 to just over 100/1000 in 1870.

The virulence of the common infectious diseases diminished markedly. For example, scarlet fever which caused many deaths in the 18th century had a much reduced impact in the 19th century. From about 1850 the mortality from tuberculosis also began to fall. A combination of better nutrition and the general improvements in health, brought about by legislation such as the Public Health Acts of 1848 and 1869, were the most likely causal factors.

The final factor to be considered in stage 2 is the role of medicine. Although some important milestones were reached, such as Jenner's discovery of a vaccination against smallpox, there was no widespread diffusion of medical benefits at this time. Of all the drugs available in 1850, fewer than ten had a specific action, so their impact on mortality was negligible. Surgery was no more advanced. Anaesthesia was unavailable until the last years of the century.

We can be much more sure about the accuracy of demographic data during this period. The first **census** of

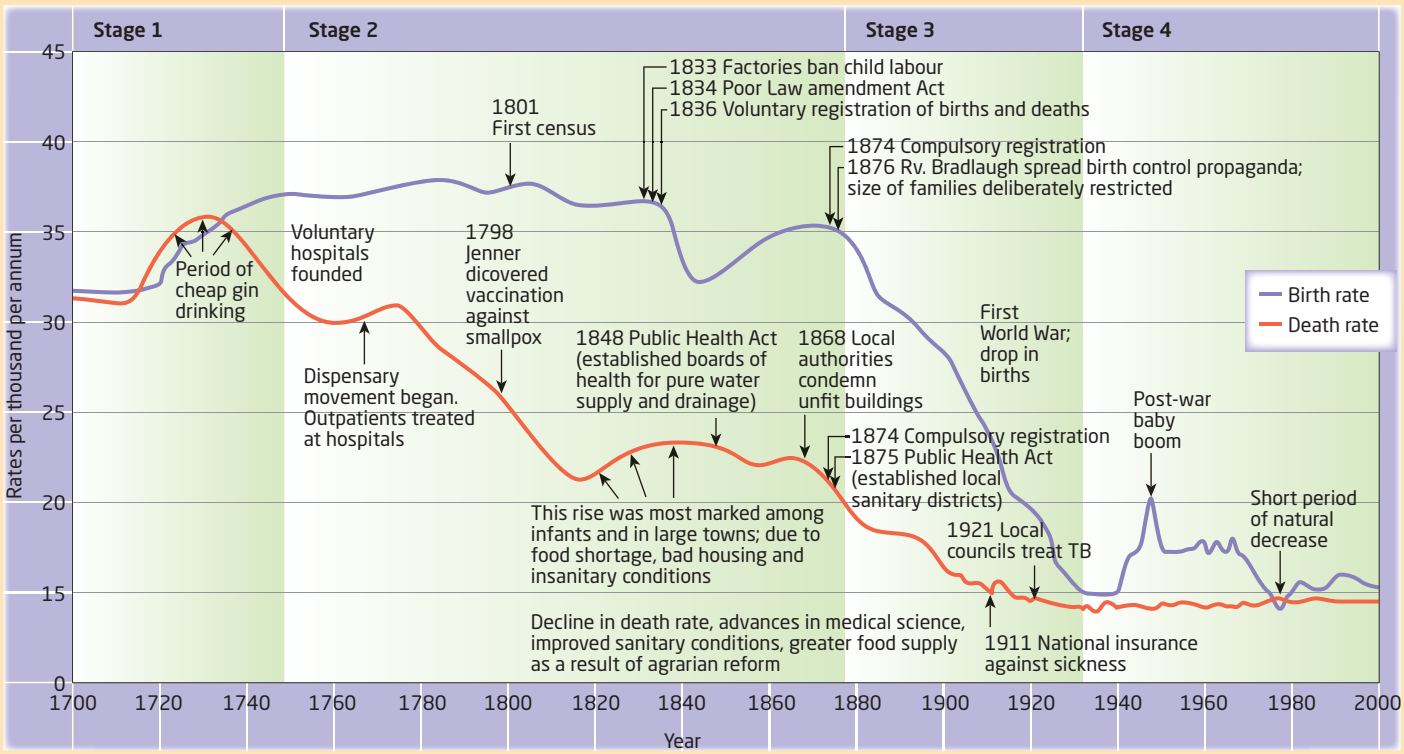

Figure 5 *Demographic transition in England and Wales.*

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England and Wales was taken in 1801 and every ten years thereafter, and from 1836 the registration of births and deaths was introduced on a voluntary basis. The latter became compulsory in 1874.

After 1875 the continued decline of the death rate was accompanied by a marked downturn in the birth rate (stage 3). Medical science began to play an important role in controlling mortality and doctors were now able to offer potent, specifically effective drugs. From about 1906 increasing attention was paid to maternity and child welfare, and to school health. More measures to improve public health were introduced, while there were further gains in nutrition.

The beginning of the decline in fertility coincided with, and was partly the result of, much more widespread knowledge of contraception. However, perhaps the most important factor was the desire for smaller families now that people could be sure that the decline in mortality was permanent and because the monetary cost of children was higher in urban, compared with rural, areas.

Family size varied by social group, with the upper and professional middle classes leading the way in contraception. The birth rate, which had been 30.5/1000 in 1890, fell to 25/1000 in 1910 and was down to 17/1000 by 1930, at which time it is reasonable to assert that England and Wales was entering the final stage of demographic transition.

By 1940 the birth rate had fallen further to 14.5/1000 but this was undoubtedly influenced by the outbreak of war the previous year. The higher figures in the three decades following the end of the war are generally accounted for by the phenomenon known as the 'post-war baby boom'. However, by 1980 the birth rate was down again to 14/1000, remaining very close to that figure ever since. The introduction of the oral birth control pill in 1960 and improvements in other forms of contraceptive meant that the relationship between desired family size and achieved family size had never been stronger.

Geographical skill

Why can we be more certain about the accuracy of demographic data from the 19th century onwards than from the period before?

Late expanding Stage 3

After a period of time social norms adjust to the lower level of mortality and the birth rate begins to decline. Urbanisation generally slows and average age increases. Life expectancy continues to increase and infant mortality to decrease. Countries in this stage usually experience lower death rates than nations in the final stage due to their relatively young population structures.

Low stationary Stage 4

Both birth and death rates are low. The former is generally slightly higher, fluctuating somewhat due to changing economic conditions. Population growth is slow. Death rates rise slightly as the average age of the population increases. However, life expectancy still improves as age-specific mortality rates continue to fall.

Natural decrease Stage 5

In an increasing number of countries the birth rate has fallen below the death rate, resulting in **natural decrease**. In the absence of net migration inflows, these populations are declining. Most countries in this stage are in eastern or southern Europe.

Critics of the demographic transition model see it as too Euro-centric. They argue that many developing countries may not follow the sequence set out in the model. It has also been criticised for its failure to take into account changes due to migration.

Theory of Knowledge

A model is a simplification of reality. Concentrating only on major characteristics and omitting the detail, it makes understanding easier at the start of the learning process. However, once clear about the framework of a situation or process, it is then not too difficult to unravel the detail. A good model will be helpful in this respect from the start. If, however, the model has clear limitations, then it needs to be improved (refined). In geography, models are useful in many areas of the subject. The model of demographic transition is the first to be examined in this book.

Discussion point

What do you think are the main factors responsible for the UK's current relatively low birth rate of approximately 13/1000?

Demographic transition in the developing world

There are a number of important differences in the way that developing countries have undergone population change compared with the experiences of most developed nations. In the developing world:

- Birth rates in stages 1 and 2 were generally higher. About a dozen African countries currently have birth rates of 45/1000 or over. Twenty years ago many more African countries were in this situation.
- The death rate fell much more steeply and for different reasons. For example, the rapid introduction of Western medicine, particularly in the form of inoculation against major diseases, has had a huge impact on lowering mortality. However, AIDS has caused the death rate to rise significantly in some countries, particularly in sub-Saharan Africa.
- Some countries had a much larger base population and thus the impact of high growth in stage 2 and the early part of stage 3 has been far greater. No countries that are now classed as developed countries had populations anywhere near the size of India and China when they entered stage 2 of demographic transition.
- For those countries in stage 3 the fall in fertility has also been steeper. This has been due mainly to the relatively widespread availability of modern contraception with high levels of reliability.
- The relationship between population change and economic development has been much more tenuous.

Different models of demographic transition

Although most countries followed the classical model of demographic transition illustrated in the last section, some countries did not. The Czech demographer Pavlik recognised two alternative types of population change (Figure 6). In France the birth rate fell at about the same time as the death rate and there was no intermediate period of high natural increase. In Japan and Mexico the birth rate actually increased in stage 2 due mainly to the improved health of women in the reproductive age range.

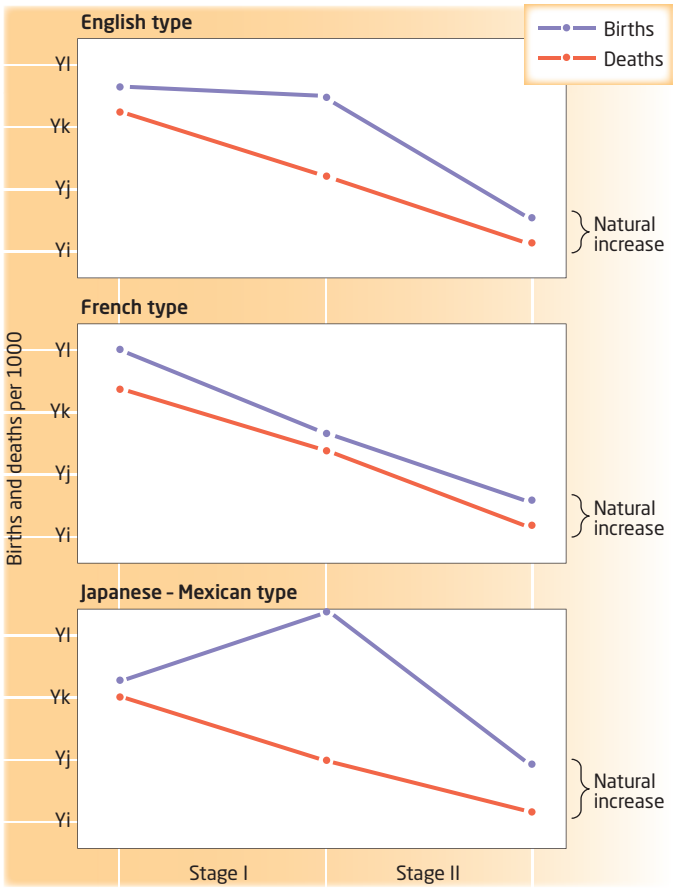

Figure 6 *Types of demographic transition.*

Activities

1. What is a geographical model (such as the model of demographic transition)?
2. Explain the reasons for declining mortality in stage 2 of demographic transition.
3. Why does it take some time before fertility follows the fall in mortality (stage 3)?
4. Suggest why the birth rate is lower than the death rate in some countries (stage 5).
5. Discuss the merits and limitations of the model of demographic transition.
6. Why has the death rate in developing countries fallen much more steeply over the last 50 years, compared with the fall in the death rate in earlier times in developed nations?

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Research idea

Look at the latest World Population Data Sheet on the Population Reference Bureau's website (www.prb.org). Select three countries which you feel reasonably fit each of stages 2, 3, 4 and 5 of the model of demographic transition.

The components of population change

The relationship between births and deaths (natural change) is not the only factor in population change. The balance between **immigration** and **emigration** – that is, **net migration** – must also be taken into account as the input-output model of population change shows (Figure 7). The corrugated divide in Figure 7 indicates that the relative contributions of natural change and net migration can vary over time within a particular country as well as between countries at any one point in time. The model is a simple graphical alternative to the population equation P = (B – D) +/– M, the letters standing for population, births, deaths and migration respectively.

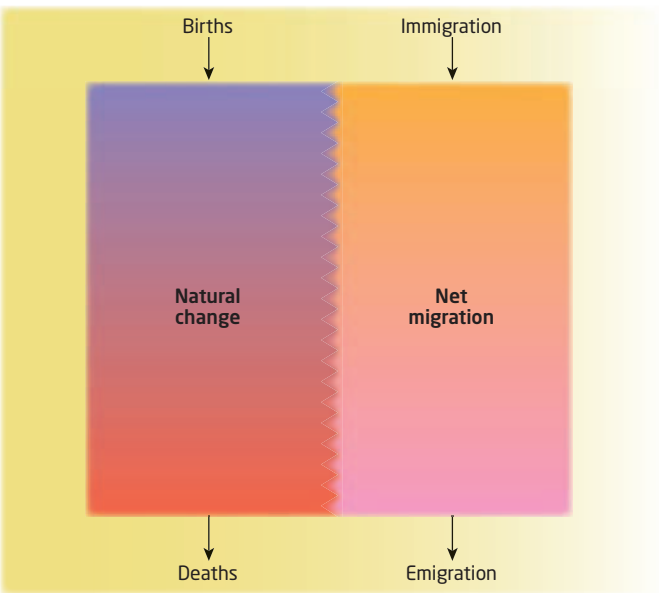

Figure 7 *Input-output model of population change.*

Fertility varies widely around the world. According to the 2009 World Population Data Sheet the crude birth rate – the most basic measure of fertility – varied from a high of 53/1000 in Niger to a low of 7/1000 in Monaco. The word 'crude' means that the birth rate applies to the total population, taking no account of gender and age. The crude birth rate is heavily influenced by the age structure of a population. The crucial factor is the percentage of young women of reproductive age, as these women produce most children.

For more accurate measures of fertility, the **fertility rate** and the **total fertility rate** are used. The total fertility rate varies from a high of 7.4 in Niger to a low of 1.0 in China, Macao. Table 4 (page 10) shows the variations in birth rate and total fertility rate by world region alongside data for the percentage of women using contraception in each region. Contraception is a major factor influencing fertility. Figure 8 (page 11) shows in detail how the fertility rate varies by country around the world.

Factors affecting fertility

The factors affecting fertility can be grouped into four main categories:

Demographic

Other population factors, particularly mortality rates, influence fertility. Where infant mortality is high, it is usual for many children to die before reaching adult life. In such societies, parents often have many children to compensate for these expected deaths.

Nigerian woman and children.

Fertility and natural change

Region	Birth rate	Rate of natural change	Total fertility rate	Women aged 15–49 using contraception (%)
World	20	1.2	2.6	62
More developed world	12	0.2	1.7	68
Less developed world	22	1.4	2.7	61
Africa	36	2.4	4.8	28
Asia	19	1.2	2.3	67
Latin America/ Caribbean	20	1.4	2.3	71
North America	14	0.6	2.0	73
Oceania	18	1.1	2.5	59
Europe	11	0.0	1.5	68

Table 4 *Variations in birth rate, natural change, total fertility rate and percentage of women using contraception, by world region in 2009.*

Traditional marriage ceremony, Paraguay.

Social/Cultural

In some societies, particularly in Africa, tradition demands a high rate of reproduction. Here the opinion of women in the reproductive years may have little influence weighed against intense cultural expectations. Education, especially female literacy, is the key to lower fertility. With education comes a knowledge of birth control, greater social awareness, more opportunity for employment and a wider choice of action generally. In some countries religion is an important factor. For example, the Muslim and Roman Catholic religions oppose artificial birth control. Most countries that have population policies have been trying to reduce their fertility by investing in birth control programmes. Within developing countries it is usually the poorest neighbourhoods that have the highest fertility, due mainly to a combination of high infant mortality and low educational opportunities for women.

Economic

In many of the least developed countries children are seen as an economic asset because of the work they do and also because of the support they are expected to give their parents in old age. In the more developed world the general perception is reversed, and the cost of the child dependency years is a major factor in the decision to begin or extend a family. Economic growth allows greater spending on health, housing, nutrition and education which is important in lowering mortality and in turn reducing fertility. Also, the nature of employment can have an impact on fertility. Many companies, particularly in developed countries, do not want to lose valuable female workers and therefore may provide workplace childcare and offer the opportunity of flexible working time.

Political

There are many examples in the past century of governments attempting to change the rate of population growth for economic and strategic reasons. During the late 1930s Germany, Italy and Japan all offered inducements and concessions to those with large families. In more recent years Malaysia has adopted a similar policy. However, today, most governments that are interventionist in terms of fertility still want to reduce population growth.

The above factors do not affect fertility directly; they influence another set of variables that determine the rate and level of childbearing. Figure 9 shows these 'intermediate variables' that affect fertility. These factors operate in every country, but their relative importance can vary greatly.