

DEMOGRAPHIC FACTS OF LIFE

introduction

The **birth rate** and **death rate** are demographic statistics that serve as building blocks for understanding more complex population concepts like growth rate, **doubling time**, and more. Birth and death rates determine the rate of population growth. If the birth and death rates are similar, a population experiences little or no growth. When the birth rate far exceeds the death rate, the population soars. Doubling time is the amount of time it takes a quantity to double and is used in demography to project future changes in population size.

Vocabulary: birth rate, death rate, doubling time, rate of natural increase

materials

Part 1

- Student Worksheet
- Calculator (optional)

Part 2

- None

Part 1: On the Double

procedure

1. Go over the following definitions with your students:

Birth rate: Annual births per 1,000 people.

Death rate: Annual deaths per 1,000 people.

2. Ask students to hypothesize how a country's birth rate and death rate impact its population growth. Specifically, how does the difference between these numbers determine population growth? At this point, do not correct misconceptions – students will discover these relationships on their own through the calculations.



Studies For Our Global Future

concept

The difference between a population's birth and death rates determines rate of growth and a wide array of factors impact these rates.

objectives

Students will be able to:

- Calculate rates of population growth given birth and death rates.
- Calculate doubling time given the rate of increase.
- Explain how birth and death rates affect population growth.
- Draw connections between population growth and social/political and economic conditions.
- Summarize factors that influence fertility and mortality within one specific country and provide statistical evidence.

subjects

AP Human Geography, Geography, Algebra, Statistics, English Language Arts

skills

Calculating doubling time and half-life, researching, writing, synthesizing research

method

Students calculate the rate of natural increase and corresponding doubling time or half-life for several countries and explore factors that influence a country's birth and death rates.

3. Write the following formulas on the board and explain that they can be used to determine a population's annual growth rate and the number of years it will take the population to double if the growth rate remains constant.

$$\frac{\text{birth rate} - \text{death rate}}{10} = \text{rate of natural increase (\%)}$$

$$\frac{70}{\% \text{ natural increase}} = \text{doubling time (in years)}$$

Note: Students might wonder where the number 70 comes from. It is 100 times the natural logarithm of 2 which is used when solving the equation $ar^x = 2a$ where "a" is the initial population and "r" is the growth factor.

4. Calculate the **rate of natural increase** and doubling time for the world population.

Currently, the global birth rate is 19 and the global death rate is 7.

$$\frac{19 - 7}{10} = 1.2\%$$

At the current growth rate of 1.2%, the world's population will double in 58 years.

$$\frac{70}{1.2} = 58 \text{ years}$$

5. Distribute copies of the Student Worksheet and allow time for students to complete the calculations.

Answers to Student Worksheet

Country	Birth Rate (2020)	Death Rate (2020)	Annual Natural Increase (%)	Doubling or Halving Time (in years)
Bulgaria	9	16	-0.7	100 (halving)
China	10	7	0.3	233 (doubling)
Germany	10	12	-0.2	350 (halving)
Guatemala	22	5	1.7	41 (doubling)
India	20	6	1.4	50 (doubling)
Japan	7	11	-0.4	175 (halving)
Nigeria	37	12	2.5	28 (doubling)
South Africa	20	9	1.1	67 (doubling)
South Korea	6	6	0	n/a
United States	12	9	0.3	233 (doubling)

discussion questions

1. What are some observations you can make from this data? What patterns do you see?

Answers may include: when a country's birth rate is higher than its death rate, the population increases; when the death rate is higher than the birth rate, the population decreases; when the birth rate and death rate are the same, the population size does not change; when the rate of growth is higher, the doubling time is shorter and vice versa.

2. Which countries from the Worksheet are growing the fastest? What similarities do you see in these countries' statistics?

Guatemala, Nigeria, India, and South Africa are growing the fastest. The growth rate is higher and the doubling time is shorter. These countries have the largest difference between the birth rate and the death rate.

3. Which figures differ most among countries, the birth rates or the death rates? How would you explain this?

Birth rates differ more because there is more variability in family size. The birth rate is higher when the average family size is larger. For example, Nigeria (with a birth rate of 37/1,000) averages 5.3 children per family while Germany (with a birth rate of 10/1,000) averages 1.6 children per family. Death rates used to have more variability depending on a person's access to medicine, clean water, and other necessities. Though millions of people across the world struggle to get their basic needs met, the overall rising health of people worldwide has eliminated large variations among death rates.

4. What do you think accounts for variations in death rates among countries? Why do you think the death rate in the U.S. is higher than in Guatemala?

A variety of factors can influence death rates including wars, disease, famines, and poor health care. The difference in death rates between Guatemala and the U.S. can be attributed to the U.S. having a larger proportion of elderly citizens. Death rates are relatively low in many of the countries with high birth rates because the majority of the population is young. In Nigeria, for instance, 44 percent of the population is under age 15, and only 3 percent is age 65 or older.

5. If you were a national leader in Nigeria or Guatemala, would you be concerned about the rapid population growth? Why or why not?

Answers will vary but many students will say yes, they would be concerned. Leaders of quickly growing countries are responsible for the needs of the expanding population which requires more food, water, shelter, education, transportation and energy infrastructure, healthcare, employment, and more. You would most likely find it difficult for your country to prosper in the global market if it cannot meet the needs of its own people.

6. Would national leaders have concerns if their country was losing population? Why or why not?

Answers will vary. They may fear labor shortages or a growing proportion of elderly who require more health care and home services. On the other hand, a decreasing population could alleviate crowding, unemployment, or strains on land and water resources.

7. The population of the United States actually grew at a rate of about 0.35 percent from 2019 to 2020, and Germany's population remained the same (0 percent growth).¹ These actual rates are both greater than the rates of natural increase calculated from birth and death rates. Why is this the case?

The rate of natural increase does not account for migration – people moving into or out of a country. Net migration accounts for roughly half of population growth in the United States. In 2020, the most common origin countries of people moving into the U.S. were Mexico, China, India, the Philippines, and El Salvador.² The most common origin countries of people moving into Germany were Romania, Poland, Bulgaria, Italy, and Croatia.³

Part 2: Fertility and Mortality Trends

procedure

1. Ask students to brainstorm what factors might impact the fertility and mortality in a country. Record their answers on the board.
2. Assign each student one country from the Worksheet, or allow them to select a different country. Students should conduct research to determine two factors, and an associated statistic for each, that influence fertility in the country and two factors, with statistics, that influence mortality in the country. For example, Guatemala has one of the higher birth rates. Two influential factors are that only 49 percent of females are using a form of modern contraception⁴ and the average woman gives birth to her first child when she's 21 years old.⁵
3. Have students write two paragraphs that summarize and synthesize their findings. The first paragraph should focus on the two fertility factors; the second paragraph should focus on the mortality factors. Each paragraph should include the two factors and their supporting statistics, if the factor has a direct or indirect relationship to fertility/mortality, and an explanation of the link between the factor and the country's fertility/mortality.

assessment

Monitor students' participation in the Part 1 discussion and evaluate their two paragraphs from Part 2.

follow-up activity

Focusing on the same country from Part 2, students research if and how the government has made a policy to address population growth. They should note if these strategies are working and what they would recommend to better that country's situation, using evidence to support their claims.

¹ Statistisches Bundesamt, Federal Office of Statistics. (2021). *Current population*. Retrieved July 22, 2021 from https://www.destatis.de/EN/Themes/Society-Environment/Population/Current-Population/_node.html; U.S. Census Bureau. (2021). *Population and Housing Unit Estimates*. Retrieved July 22, 2021 from <https://www.census.gov/programs-surveys/popest/data.html>

² Budiman, A. (2020, August 8). *Key findings about U.S. immigrants*. Pew Research Center. Retrieved from <https://www.pewresearch.org/fact-tank/2020/08/20/key-findings-about-u-s-immigrants/>

³ Statistisches Bundesamt, Federal Statistics Office. (2019). *Migration by the 10 most frequent citizenships of immigrants, 2019*. Retrieved from https://www.destatis.de/EN/Themes/Society-Environment/Population/_Graphic/_Interactive/migration-2019.html

⁴ Population Reference Bureau. (2019). 2019 Family Planning Data. Retrieved from <https://www.prb.org/fpdata>

⁵ CIA World Fact Book. (2021). *Mother's mean age at first birth*. [Data set]. Retrieved July 20, 2021 from <https://www.cia.gov/the-world-factbook/field/mothers-mean-age-at-first-birth>

DEMOGRAPHIC FACTS OF LIFE | student worksheet

Name: _____ Date: _____

Use the formulas below to calculate the annual rates of natural increase and the doubling or halving times for the populations of the countries listed on the chart.

$$\frac{\text{birth rate} - \text{death rate}}{10} = \text{rate of natural increase (\%)} \qquad \frac{70}{\% \text{ natural increase}} = \text{doubling time (in years)}$$

Country	Birth Rate (2020)	Death Rate (2020)	Annual Natural Increase (%)	Doubling or Halving Time (in years)
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Germany	10	12		
Guatemala	22	5		
India	20	6		
Japan	7	11		
Nigeria	37	12		
South Africa	20	9		
South Korea	6	6		
United States	12	9		

Source: Population Reference Bureau. (2020). *World Population Data Sheet*.