

# POWER OF THE PYRAMIDS



People  
and the  
Planet

Lessons for a Sustainable Future

## INTRODUCTION

Many of the vast differences we see in societies across the globe can be related to the make-up of their respective populations. This is true on the local, state, and national level. So when exploring variations among countries, a good place to start is with their **population pyramids** – graphs that display the age and sex distribution of the country's population.

To help them make population projections for different countries, **demographers** look at the profile of the countries' residents. What are the ages of the people? How many are men? How many are women? Taking this information, they construct population pyramids that depict the configuration of a country's population as impacted by over 80 years of economic, political and natural events.

## MATERIALS

- Student Worksheet
- Pyramid Graph Paper
- Markers
- Calculators (optional)

## PROCEDURE

1. Display the world population pyramid and explain that this is a type of graph used by demographers to study the distribution of people across sex and age categories.
2. Explain to the students that the graph represents the entire world population, sorted by age and sex – with the youngest at the bottom and the oldest at the top and males on the left, females on the right. Each age/sex grouping is called a **cohort**. A cohort represents the percentage of people within that sex and age range within the population. So on the world population

### CONCEPT

The age and sex distribution of a regional or national population affects its growth rate.

### OBJECTIVES

Students will be able to:

- Calculate percentages using raw numbers for each age/sex group in a given population.
- Construct a population pyramid graph for for one of six different countries.
- Make connections between the shape of a graph and a country's population growth.
- Analyze countries' population pyramids to make inferences about past events, current trends, and future growth.

### SUBJECTS

Social studies (geography), math

### SKILLS:

Calculating percentages, graphing and analyzing data, interpreting bar graphs, comparing and evaluating

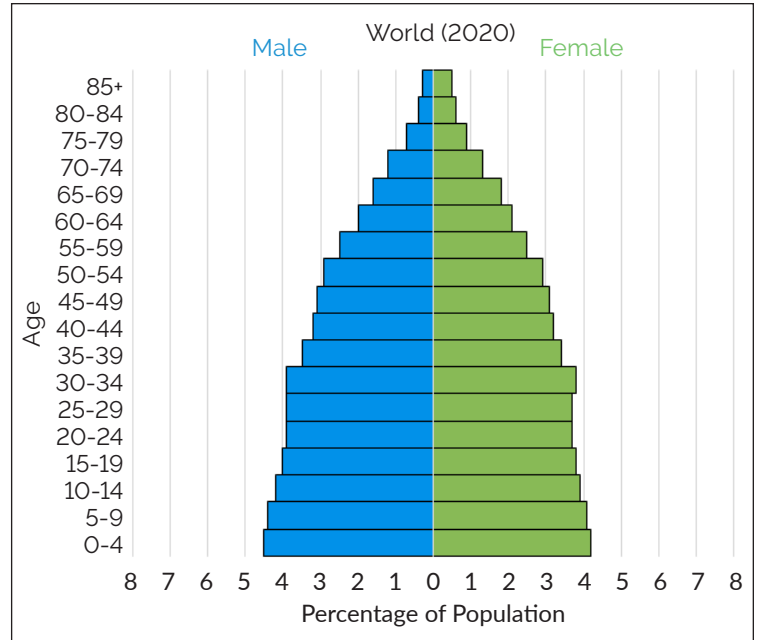
### METHOD

Students use real-world data to construct and interpret population pyramids and discuss differences in population growth rates among several different countries.

pyramid, we can see that 4.5 percent of the global population is made up of males aged 0-4.

3. Ask the students the following comprehension questions and allow them time to ask their own questions.

- Why do you think this type of graph is called a population pyramid? (*Because of its shape*)
- What is the largest age cohort and how can you tell? (*0 – 4 year old males; that bar extends furthest from the center axis*)
- What cohort makes up 4 percent of the global population? (*15 – 19 year old males*)



- Where are you represented on the pyramid?
- Are there currently more old people or young people living on the planet? How can you tell? (*More young people. The cohorts for young ages extend out further than the cohort bars for elderly people.*)
- Can we tell by looking at the pyramid how many people are on the planet? Explain. (*No, because percentages of the population are represented on the graph, not the actual number of people in each cohort.*)

g. Do you think different countries' population pyramids vary in shape?

- Distribute the Pyramid Graph Paper and a copy of the Student Worksheet to each student and assign them one of the six countries. If you'd prefer, students can work in pairs.
- The figures on the Worksheet are the population of each age group within each sex for each particular country. In order to construct the country's pyramid, students must first calculate the percentage of the population of each sex in each age group.

Example: According to the Worksheet, the total population of the United States in 2020 was 332,639,102. The population of U.S. males aged 0-4 was 10,445,659.

$$10,445,659 / 332,639,102 = .031 \text{ or } 3.1\%$$

Students should complete these calculations for each cohort (age group).

- Model how to construct a population pyramid. Be sure students understand that the line drawn down the middle of the graph separates the male and female populations. The percentages of the population are plotted along the X-axis with females to the right, males to the left of the center line. The age groups are running up the Y-axis with the youngest at the bottom, oldest at the top.

7. Students construct a population pyramid for their assigned country by graphing the percentage data on the Pyramid Graph Paper. Using dark markers, they can shade in the two sides of their graph.
8. Choose one completed pyramid from each country to display for the class.
9. Go over the Discussion Questions.

### Answers to Student Worksheets

See Answer Key

## DISCUSSION QUESTIONS

1. Where are you represented on the Student Worksheet table and on the graphs?

*If you live in the United States and are between 10 and 15 years old you are represented on line three in the U.S. data under either male or female. On the graph, you and your cohorts make up the percentage represented by the third bar from the bottom, males on the left, females on the right.*

2. Can you tell from the graphs which country has the most people?

*No. The graphs represent 100% of the population of each country broken down by age groups.*

*Demographers typically use the percentage data instead of the raw data so that each graph fits on the same size paper and can be compared to the graphs of other countries.*

3. Can you tell from the data if there are more male babies or female babies in each country?

*Yes, there are more male babies. There is a slightly greater probability of giving birth to male children. For every 100 females born, there are about 105 males born.*

4. Are there more elderly females or males? Why might that be the case?

*There are more elderly females. Throughout the world, life expectancy for females is higher than for males, due to a number of genetic and social factors. In general, males are more predisposed to certain health risks than females. Also, males make up the vast majority of the military and are more likely to die during wars.*

5. In which country do children make up the largest percentage of the population?

*In Nigeria, children make up the largest percentage of the population; the bars at the bottom of the Nigerian pyramid extend the furthest. The percentages that you calculated show that Nigerian babies (males and female ages 0 – 4) make up over 15 percent (7.9% + 7.5%) of the population and the older children in the next two cohorts (ages 5 – 9 and 10 – 14) also make up a large percentage.*

6. Does a country have more potential for population growth when there are a lot of young people, or fewer young people? What is the shape of a graph that represents a population with more young people than old people?

More young people means a country has more potential for growth because these young people will soon reach their reproductive years. Those graphs are shaped like a triangle, or pyramid. The graphs have a wide base and a narrow top.

7. Of the six graphs, which one looks the most like a pyramid? What does that indicate about its population growth rate? Can you think of any other information we can infer from the triangular pyramid shape?

*The graph for Nigeria looks most like a pyramid. This shape indicates a high growth rate. Population growth occurs when the segment of the population currently in its childbearing years (ages 15 – 44; bars 4 – 10 on the graphs) has produced a generation larger than itself (bars 1 – 3). The pyramid shape also indicates that a relatively small proportion of the population is elderly – the bars at the top of the graph are very small – and could mean that life expectancy is low.*

8. Which other graphs have a wide base and narrow top? Do you think these countries are growing as fast as Nigeria?

*The graphs for India and Guatemala each have a wide base and narrow top. However, unlike Nigeria, the bottom bars of the graph representing the youngest cohorts, are more rectangular. This is especially evident in India's graph where the bottom five bars are almost the same size (4.6 and 4.7 percent for males and 4.1 percent for females, ages 0 – 25). If this trend continues unchanged, the "pyramid" might gradually become more rectangular.*

9. What factors would change the shape of the pyramids in the future?

*A decrease in the birth rate. The people in their childbearing years would be having fewer children, and therefore, be producing a generation more similar in size to itself. This would change the shape of the graph over time from a pyramid to more of a rectangle, indicating a more stable population. Additionally, as life expectancy increases and the proportion of older people increases, the top bars will expand.*

10. Looking at the pyramids, which countries appear to have the slowest rates of population growth? How can you tell?

*Germany has the slowest population growth with over half of the country's population past their childbearing years. The pyramid has a wide top and thin base showing that 53 percent of the population is over the age of 45 (bars 10 – 18 on the graphs). The United States is also growing slowly. The graph is closer to a rectangle than a pyramid, showing more similar population size across the age groups and therefore a more stable population.*

11. Imagine you are a business owner in the United States, and you are deciding what to sell based on the information you have about the population. What would you sell and why?

*Answers should include any products for people between 25 – 34 or 55 – 64 because they make up the largest percentages of people.*

12. Imagine you are a business owner in Nigeria, and you are deciding what to sell based on the information you have about the population. What would you sell and why?

*Answers should include any products for children and infants.*

# ASSESSMENT

Students complete an exit ticket indicating if the following statements are true or false. If the statement is false, why?

1. A population pyramid displays a country's population in terms of age and shoe size.
2. By looking at the world's population pyramid, we can tell that the global population is 7.8 billion.
3. When a population pyramid's shape is closer to a rectangle than a pyramid, that country's population growth rate is slow.
4. If a country is growing, bars at the bottom of the graph (representing younger people) extend further out than bars at the top of the graph (representing older people).

## **Answers**

1. *False – pyramids display age and sex.*
2. *False – the pyramid shows the age/sex distribution of the population as a percentage, not the actual number of people.*
3. *True*
4. *True*

Data source: United State Census Bureau, International Data Base.

# POWER OF THE PYRAMIDS

## STUDENT WORKSHEET

Name: \_\_\_\_\_

Date: \_\_\_\_\_

UNITED STATES (2020)					CHINA (2020)					NIGERIA (2020)				
AGE GROUP	MALES	MALES %	FEMALES	FEMALES %	AGE GROUP	MALES	MALES %	FEMALES	FEMALES %	AGE GROUP	MALES	MALES %	FEMALES	FEMALES %
0-4	10,445,659		9,992,880		0-4	43,933,770		38,898,766		0-4	16,813,967		16,053,449	
5-9	10,325,131		9,875,278		5-9	43,303,522		37,227,422		5-9	15,044,440		14,423,094	
10-14	10,603,765		10,166,213		10-14	42,059,047		35,656,239		10-14	13,713,331		13,198,226	
15-19	10,732,423		10,305,932		15-19	40,312,118		34,191,682		15-19	12,130,595		11,720,651	
20-24	11,198,945		10,700,531		20-24	45,817,723		39,684,466		20-24	9,892,065		9,638,102	
25-29	12,029,149		11,482,838		25-29	53,218,977		48,128,777		25-29	7,850,577		7,734,216	
30-34	11,649,087		11,330,329		30-34	64,173,087		62,018,343		30-34	6,751,995		6,718,188	
35-39	10,990,413		10,931,596		35-39	50,883,009		48,596,175		35-39	5,944,240		5,948,352	
40-44	10,168,231		10,261,555		40-44	47,096,321		45,387,943		40-44	5,013,838		5,014,734	
45-49	9,947,289		10,157,342		45-49	58,099,063		56,128,753		45-49	4,044,321		4,037,313	
50-54	10,109,501		10,400,905		50-54	60,319,274		58,451,566		50-54	3,203,942		3,233,671	
55-59	10,598,811		11,172,941		55-59	48,010,856		47,409,493		55-59	2,475,859		2,552,575	
60-64	10,091,925		10,918,867		60-64	36,816,789		36,148,014		60-64	1,851,988		1,961,689	
65-69	8,491,889		9,538,282		65-69	34,411,322		35,544,771		65-69	1,374,968		1,501,109	
70-74	6,836,985		7,922,281		70-74	22,080,119		23,360,749		70-74	979,963		1,085,776	
75-79	4,502,437		5,550,601		75-79	13,084,854		14,835,509		75-79	593,642		672,316	
80-84	2,764,750		3,743,461		80-84	7,738,618		9,800,033		80-84	274,821		331,556	
85+	2,418,086		4,282,794		85+	4,271,577		6,917,230		85+	105,689		143,044	
Total	332,639,102				Total	1,394,015,977				Total	214,028,302			

Data source: United State Census Bureau, International Data Base.

# POWER OF THE PYRAMIDS

## STUDENT WORKSHEET - PAGE 2

GERMANY (2020)					INDIA (2020)					GUATEMALA (2020)				
AGE GROUP	MALES	MALES %	FEMALES	FEMALES %	AGE GROUP	MALES	MALES %	FEMALES	FEMALES %	AGE GROUP	MALES	MALES %	FEMALES	FEMALES %
0-4	1,776,761		1,684,135		0-4	61,476,291		54,844,472		0-4	1,010,695		968,598	
5-9	1,761,223		1,669,702		5-9	61,662,844		54,471,426		5-9	996,756		959,055	
10-14	1,764,866		1,672,026		10-14	61,877,954		54,528,674		10-14	936,694		905,779	
15-19	1,884,828		1,792,996		15-19	62,153,754		54,704,937		15-19	869,188		852,395	
20-24	2,127,584		2,061,475		20-24	61,269,777		54,034,843		20-24	836,542		831,151	
25-29	2,298,179		2,253,770		25-29	57,794,800		51,429,767		25-29	762,843		767,087	
30-34	2,577,005		2,526,601		30-34	53,489,399		48,939,213		30-34	647,084		658,754	
35-39	2,455,944		2,450,154		35-39	49,987,699		46,481,566		35-39	537,577		553,941	
40-44	2,350,680		2,351,081		40-44	46,115,904		43,539,933		40-44	458,964		482,619	
45-49	2,521,809		2,501,884		45-49	41,980,723		40,396,572		45-49	378,759		407,606	
50-54	3,349,711		3,286,927		50-54	35,907,142		35,055,268		50-54	280,706		316,809	
55-59	3,433,935		3,390,809		55-59	29,320,623		29,052,650		55-59	238,627		272,111	
60-64	2,863,951		2,925,215		60-64	23,124,194		23,394,388		60-64	192,790		224,632	
65-69	2,384,833		2,582,179		65-69	17,324,501		18,037,720		65-69	149,151		174,219	
70-74	1,839,689		2,071,543		70-74	12,027,804		13,112,207		70-74	104,288		121,664	
75-79	1,649,406		2,033,966		75-79	7,415,100		8,646,670		75-79	63,790		78,431	
80-84	1,356,200		1,885,712		80-84	3,676,445		4,727,348		80-84	30,367		41,330	
85+	918,745		1,704,138		85+	1,610,609		2,480,030		85+	15,864		26,422	
Total	80,159,662				Total	1,326,093,247				Total	17,153,288			

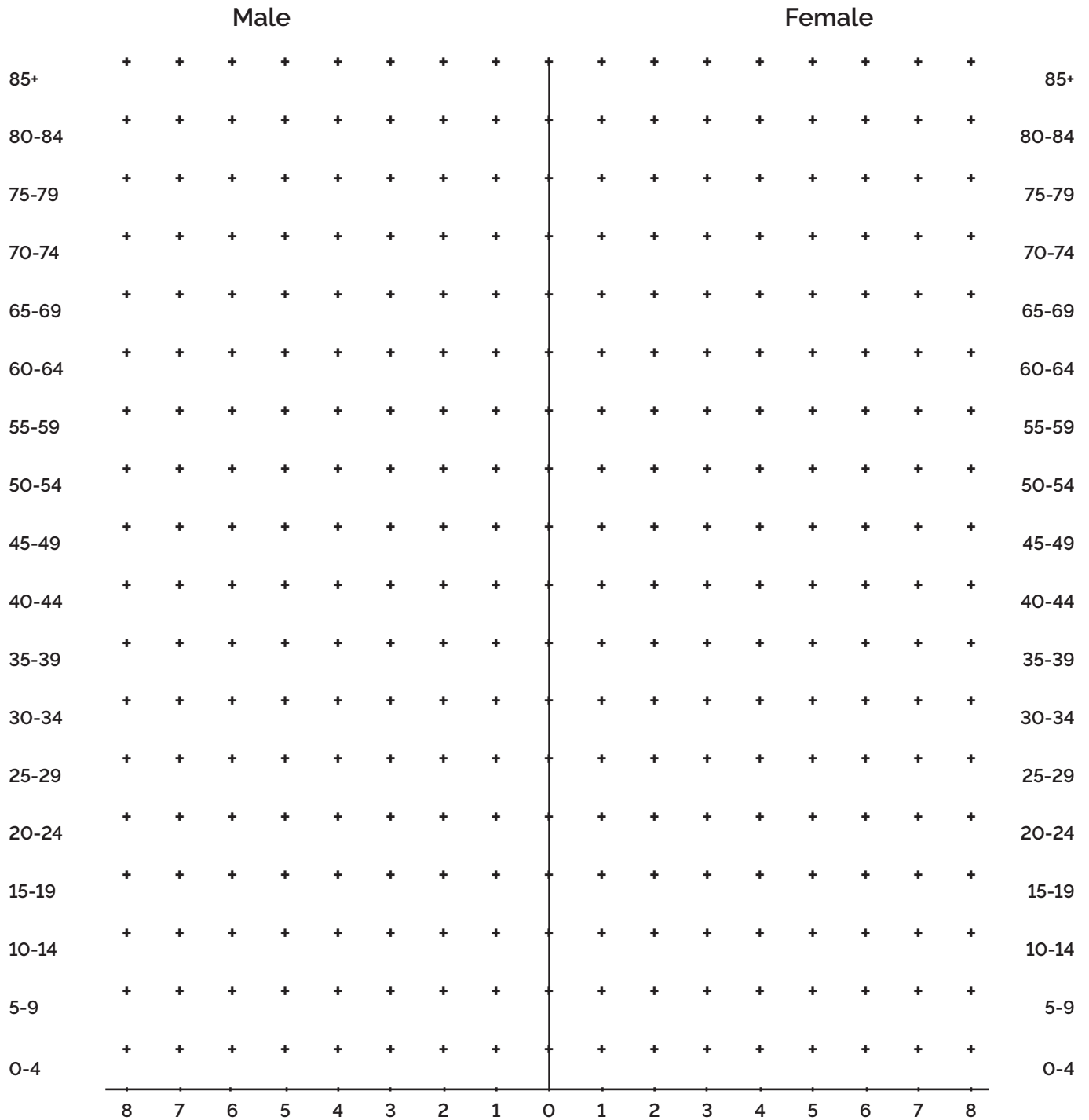
Data source: United State Census Bureau, International Data Base.

# POWER OF THE PYRAMIDS

## GRAPH PAPER

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Country \_\_\_\_\_



Percentage of Population



# POWER OF THE PYRAMIDS

## ANSWER KEY (STUDENT WORKSHEET)

UNITED STATES (2020)					CHINA (2020)					NIGERIA (2020)				
AGE GROUP	MALES	MALES %	FEMALES	FEMALES %	AGE GROUP	MALES	MALES %	FEMALES	FEMALES %	AGE GROUP	MALES	MALES %	FEMALES	FEMALES %
0-4	10,445,659	3.1%	9,992,880	3.0%	0-4	43,933,770	3.2%	38,898,766	2.8%	0-4	16,813,967	7.9%	16,053,449	7.5%
5-9	10,325,131	3.1%	9,875,278	3.0%	5-9	43,303,522	3.1%	37,227,422	2.7%	5-9	15,044,440	7.0%	14,423,094	6.7%
10-14	10,603,765	3.2%	10,166,213	3.1%	10-14	42,059,047	3.0%	35,656,239	2.6%	10-14	13,713,331	6.4%	13,198,226	6.2%
15-19	10,732,423	3.2%	10,305,932	3.1%	15-19	40,312,118	2.9%	34,191,682	2.5%	15-19	12,130,595	5.7%	11,720,651	5.5%
20-24	11,198,945	3.4%	10,700,531	3.2%	20-24	45,817,723	3.3%	39,684,466	2.8%	20-24	9,892,065	4.6%	9,638,102	4.5%
25-29	12,029,149	3.6%	11,482,838	3.5%	25-29	53,218,977	3.8%	48,128,777	3.5%	25-29	7,850,577	3.7%	7,734,216	3.6%
30-34	11,649,087	3.5%	11,330,329	3.4%	30-34	64,173,087	4.6%	62,018,343	4.4%	30-34	6,751,995	3.2%	6,718,188	3.1%
35-39	10,990,413	3.3%	10,931,596	3.3%	35-39	50,883,009	3.7%	48,596,175	3.5%	35-39	5,944,240	2.8%	5,948,352	2.8%
40-44	10,168,231	3.1%	10,261,555	3.1%	40-44	47,096,321	3.4%	45,387,943	3.3%	40-44	5,013,838	2.3%	5,014,734	2.3%
45-49	9,947,289	3.0%	10,157,342	3.1%	45-49	58,099,063	4.2%	56,128,753	4.0%	45-49	4,044,321	1.9%	4,037,313	1.9%
50-54	10,109,501	3.0%	10,400,905	3.1%	50-54	60,319,274	4.3%	58,451,566	4.2%	50-54	3,203,942	1.5%	3,233,671	1.5%
55-59	10,598,811	3.2%	11,172,941	3.4%	55-59	48,010,856	3.4%	47,409,493	3.4%	55-59	2,475,859	1.2%	2,552,575	1.2%
60-64	10,091,925	3.0%	10,918,867	3.3%	60-64	36,816,789	2.6%	36,148,014	2.6%	60-64	1,851,988	0.9%	1,961,689	0.9%
65-69	8,491,889	2.6%	9,538,282	2.9%	65-69	34,411,322	2.5%	35,544,771	2.5%	65-69	1,374,968	0.6%	1,501,109	0.7%
70-74	6,836,985	2.1%	7,922,281	2.4%	70-74	22,080,119	1.6%	23,360,749	1.7%	70-74	979,963	0.5%	1,085,776	0.5%
75-79	4,502,437	1.4%	5,550,601	1.7%	75-79	13,084,854	0.9%	14,835,509	1.1%	75-79	593,642	0.3%	672,316	0.3%
80-84	2,764,750	0.8%	3,743,461	1.1%	80-84	7,738,618	0.6%	9,800,033	0.7%	80-84	274,821	0.1%	331,556	0.2%
85+	2,418,086	0.7%	4,282,794	1.3%	85+	4,271,577	0.3%	6,917,230	0.5%	85+	105,689	0.0%	143,044	0.1%
Total	332,639,102				Total	1,394,015,977				Total	214,028,302			

Data source: United State Census Bureau, International Data Base.

# POWER OF THE PYRAMIDS

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0-4	1,776,761	2.2%	1,684,135	2.1%	0-4	61,476,291	4.6%	54,844,472	4.1%	0-4	1,010,695	5.9%	968,598	5.6%
5-9	1,761,223	2.2%	1,669,702	2.1%	5-9	61,662,844	4.6%	54,471,426	4.1%	5-9	996,756	5.8%	959,055	5.6%
10-14	1,764,866	2.2%	1,672,026	2.1%	10-14	61,877,954	4.7%	54,528,674	4.1%	10-14	936,694	5.5%	905,779	5.3%
15-19	1,884,828	2.4%	1,792,996	2.2%	15-19	62,153,754	4.7%	54,704,937	4.1%	15-19	869,188	5.1%	852,395	5.0%
20-24	2,127,584	2.7%	2,061,475	2.6%	20-24	61,269,777	4.6%	54,034,843	4.1%	20-24	836,542	4.9%	831,151	4.8%
25-29	2,298,179	2.9%	2,253,770	2.8%	25-29	57,794,800	4.4%	51,429,767	3.9%	25-29	762,843	4.4%	767,087	4.5%
30-34	2,577,005	3.2%	2,526,601	3.2%	30-34	53,489,399	4.0%	48,939,213	3.7%	30-34	647,084	3.8%	658,754	3.8%
35-39	2,455,944	3.1%	2,450,154	3.1%	35-39	49,987,699	3.8%	46,481,566	3.5%	35-39	537,577	3.1%	553,941	3.2%
40-44	2,350,680	2.9%	2,351,081	2.9%	40-44	46,115,904	3.5%	43,539,933	3.3%	40-44	458,964	2.7%	482,619	2.8%
45-49	2,521,809	3.1%	2,501,884	3.1%	45-49	41,980,723	3.2%	40,396,572	3.0%	45-49	378,759	2.2%	407,606	2.4%
50-54	3,349,711	4.2%	3,286,927	4.1%	50-54	35,907,142	2.7%	35,055,268	2.6%	50-54	280,706	1.6%	316,809	1.8%
55-59	3,433,935	4.3%	3,390,809	4.2%	55-59	29,320,623	2.2%	29,052,650	2.2%	55-59	238,627	1.4%	272,111	1.6%
60-64	2,863,951	3.6%	2,925,215	3.6%	60-64	23,124,194	1.7%	23,394,388	1.8%	60-64	192,790	1.1%	224,632	1.3%
65-69	2,384,833	3.0%	2,582,179	3.2%	65-69	17,324,501	1.3%	18,037,720	1.4%	65-69	149,151	0.9%	174,219	1.0%
70-74	1,839,689	2.3%	2,071,543	2.6%	70-74	12,027,804	0.9%	13,112,207	1.0%	70-74	104,288	0.6%	121,664	0.7%
75-79	1,649,406	2.1%	2,033,966	2.5%	75-79	7,415,100	0.6%	8,646,670	0.7%	75-79	63,790	0.4%	78,431	0.5%
80-84	1,356,200	1.7%	1,885,712	2.4%	80-84	3,676,445	0.3%	4,727,348	0.4%	80-84	30,367	0.2%	41,330	0.2%
85+	918,745	1.1%	1,704,138	2.1%	85+	1,610,609	0.1%	2,480,030	0.2%	85+	15,864	0.1%	26,422	0.2%
Total	80,159,662				Total	1,326,093,247				Total	17,153,288			

Data source: United State Census Bureau, International Data Base.

# POWER OF THE PYRAMIDS

## ANSWER KEY (COUNTRY PYRAMIDS)

