



CREATING AND INTERPRETING HISTOGRAMS – AGE DISTRIBUTION OF HOUSEHOLDERS IN THE UNITED STATES TEACHER VERSION

Subject Level:

Middle School Math

Grade Level:

6

Approx. Time Required:

45–60 minutes

Learning Objectives:

- Students will be able to create, compare, and interpret histograms.
- Students will be able to describe the shapes of data distributions.
- Students will be able to discuss factors that might explain the shapes of these data distributions.

Activity Description

Students will create, compare, and interpret histograms to answer the following statistical question: “How are the ages of householders distributed in various types of households in the United States?” They will also discuss factors that might explain the shapes of these data distributions.

Suggested Grade Level:

6

Approximate Time Required:

45–60 minutes

Learning Objectives:

- Students will be able to create, compare, and interpret histograms.
 - Students will be able to describe the shapes of data distributions.
 - Students will be able to discuss factors that might explain the shapes of these data distributions.
-

Topics:

- Histograms

Skills Taught:

- Creating a histogram
 - Comparing the shapes of data distributions
-

Materials Required

- The student version of this activity, 7 pages; it contains images that should be printed in color.
- Quarter-inch graph paper
- Red pens

A graphing calculator, graphing software (e.g., Microsoft Excel), or other graphing technology is optional.

Activity Items

The following items are part of this activity. The items and any sources appear at the end of this teacher version.

- Item 1: Households, by Type, Age of Members, Region of Residence, and Age of Householder, 2017
- Item 2: Histogram Templates

For more information to help you introduce your students to the U.S. Census Bureau, read "[Census Bureau 101 for Students](#)." This information sheet can be printed and passed out to your students as well.

Standards Addressed

See charts below. For more information, read

["Overview of Education Standards and Guidelines Addressed in Statistics in Schools Activities."](#)

Common Core State Standards for Mathematics

Standard	Domain	Cluster
CCSS.MATH.CONTENT.6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	6 SP – Statistics & Probability	Summarize and describe distributions.

Common Core State Standards for Mathematical Practice

Standard
CCSS.MATH.PRACTICE.MP4 Model with mathematics. Students will model the provided data with histograms.
CCSS.MATH.PRACTICE.MP5 Use appropriate tools strategically. Students will use graph paper or graphing technology to create histograms.

National Council of Teachers of Mathematics' Principles and Standards for School Mathematics

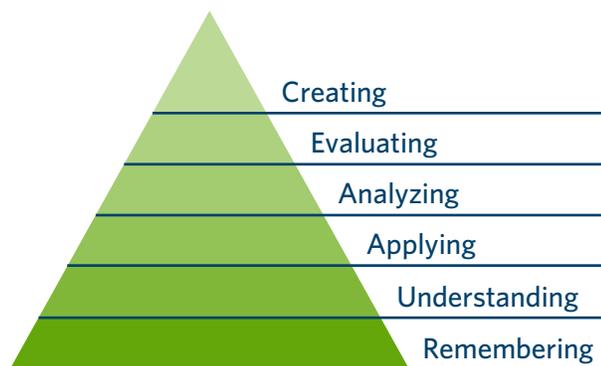
Content Standard	Students should be able to:	Expectation for Grade Band
Data Analysis and Probability	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	Select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots.
Data Analysis and Probability	Select and use appropriate statistical methods to analyze data.	Discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots.

Guidelines for Assessment and Instruction in Statistics Education

GAISE	Level A	Level B	Level C
Formulate Questions		X	
Collect Data			
Analyze Data		X	
Interpret Results		X	

Bloom's Taxonomy

Students will **apply** their skills to create histograms and **analyze** the data distribution apparent in those histograms.



Teacher Notes

Before the Activity

Students must understand the following key terms:

- **Family household** – a household of people related to each other by birth, marriage, or adoption
- **Frequency** – the number of times an item, number, or event occurs in a data set
- **Histogram** – a way of displaying numeric data on a graph using horizontal or vertical bars so that the height or the length of the bars indicates frequency
- **Household** – a housing unit containing any number of people; every person living in that housing unit makes up the household.
- **Householder** – the main person, at least 15 years old, who rents or owns the housing unit
- **Nonfamily household** – a household in which a person lives alone or a householder shares the unit with only nonrelatives (e.g., friends or acquaintances)

Teachers will discuss various types of households that appear in TV shows, movies, or books that are popular with students. Teachers will talk about who the “householder” is in each scenario based on the Census Bureau definition of “householder” (above). For example, Harry Potter’s household includes the Dursley parents; their son, Dudley; and their nephew, Harry Potter. This is a family household, as all the people are related to one another. Either Mr. or Mrs. Dursley could be considered the “householder.”

In the discussion, teachers should be aware that household type may be a sensitive topic for students of this age, given the wide variety of household types that exist. Teachers may want to limit the conversation to types of households in general, *not* asking students to talk about their own households.

Teachers should review with students how to create a histogram. Teachers should remind students that the height of each bar represents the frequency (or count) in the data and that the bars should all be the same width to represent the same range of data (e.g., five years). Teacher may wish to model creating a histogram using the tools that students will use in the activity (either graph paper or graphing technology). Tips for creating histograms in Microsoft Excel and on graphing calculators appear within the sample answers of this teacher version.

Teachers may want to review errors that students commonly make when creating histograms:

- Drawing an axis or gridline *between* the lines on the graph paper, instead of *on* a line
- Creating a vertical axis scale that uses the exact numbers in the data (e.g., gridlines at 1, 2, 6, 13, 45) instead of using even divisions (e.g., gridlines at every interval of 5 or 10)
- Drawing bars that are not all the same width
- Leaving out a bar for a data range with no data, instead of creating a bar for that data range with a height of zero

- Failing to provide labels for the horizontal and vertical axes
- Failing to provide a brief descriptive title for the graph

During the Activity

Teachers will monitor students as they work to ensure that they are setting up their axes and drawing their histograms correctly.

If teachers find that this activity is too difficult, they could consider simplifying it by:

- Having students work in pairs, with each partner creating a histogram and then working together to compare and analyze the two
- Having students create and analyze only one histogram
- Replacing part 3 of the activity with a group discussion

After the Activity

Teachers will direct students to share their news articles from part 3 and to compare their histograms and analyses with those of other students.

Extension Ideas

- Teachers could ask students to create a graph comparing the numbers of various types of households within two age groups. This could be a bar graph, but not a histogram.
- Teachers could adapt this activity for other GAISE levels (read "[*Overview of Education Standards and Guidelines Addressed in Statistics in Schools Activities*](#)" for more information):
 - Level A - Formulate a specific question for students to answer related to the whole set of data or to only one row of the data, rather than multiple rows (e.g., "How are the ages of householders distributed in the United States overall?"), or have students make just one histogram and discuss the whole set of data or only one row of the data.
 - Level C - Use measures of variability (not just the histograms) to compare subsets of data.

Student Activity

Click [here](#) to download a printable version for students.

Activity Items

The following items are part of this activity and appear at the end of this student version.

- Item 1: Households, by Type, Age of Members, Region of Residence, and Age of Householder, 2017
- Item 2: Histogram Templates

Student Learning Objectives

- I will be able to create, compare, and interpret histograms.
- I will be able to describe the shapes of data distributions.
- I will be able to discuss factors that might explain the shapes of these data distributions.

In a given year, how old do you think most householders are? Do you think there is the same number of householders in their 20s as there is of those in their 50s? Are there more men, women, or married couples who are householders?

We can answer all of these questions using data from the U.S. Census Bureau that show the age distribution of householders according to household type.

In **Item 1: Households by Type, Age of Members, Region of Residence, and Age of Householder, 2017**, the blue rows show “all households,” the pink rows show “family households,” and the green rows show “nonfamily households.” The table provides the age distribution for just those householders ages 20 through 54, although there were both older and younger householders in the United States in 2017. Note that all numbers in **Item 1** are in thousands.

Part 1 - Examine the Data and Create Histograms

1. Were there more family or nonfamily households in the United States in 2017? Include the data that support your answer.

There were more family households (82,827,000) than nonfamily households (43,396,000) in 2017.

2. What is the definition of a family household?

A family household is a housing unit where all people in it are related to each other.

3. Decide whether each of the following makes up a family or nonfamily household:
 - a. A grandmother owns a house, and her daughter and three grandchildren live with her. **Family**
 - b. Three single men rent an apartment together. **Nonfamily**
 - c. A woman rents an apartment and two of her nieces live with her. **Family**
 - d. A married couple rents a house, and they have two cousins who live with them. **Family**
 - e. A woman owns a condo, and her 25-year-old son lives with her. **Family**
 - f. A woman owns a condo and lives alone. **Nonfamily**

4. How many married couple householders were ages 25–29 in 2017?

3,205,000 householders

5. Which age group had the largest number of **female nonfamily** householders in 2017? Why do you think this was the largest group?

Ages 25–29 (1,750,000). Student answers for the second question will vary but could include: Women in this age group that may not be married or have any children yet. This could be why they would likely not have family members living with them.

6. Which age group had the largest number of **female family** householders in 2017? Why do you think this was the largest group?

Ages 40–44 (1,780,000). Student answers for the second question will vary but could include: This is the age range when most women have children living at home.

7. Choose two rows of data (other than “Total” rows) that you can compare, and write them below:

My two rows are _____ and _____.

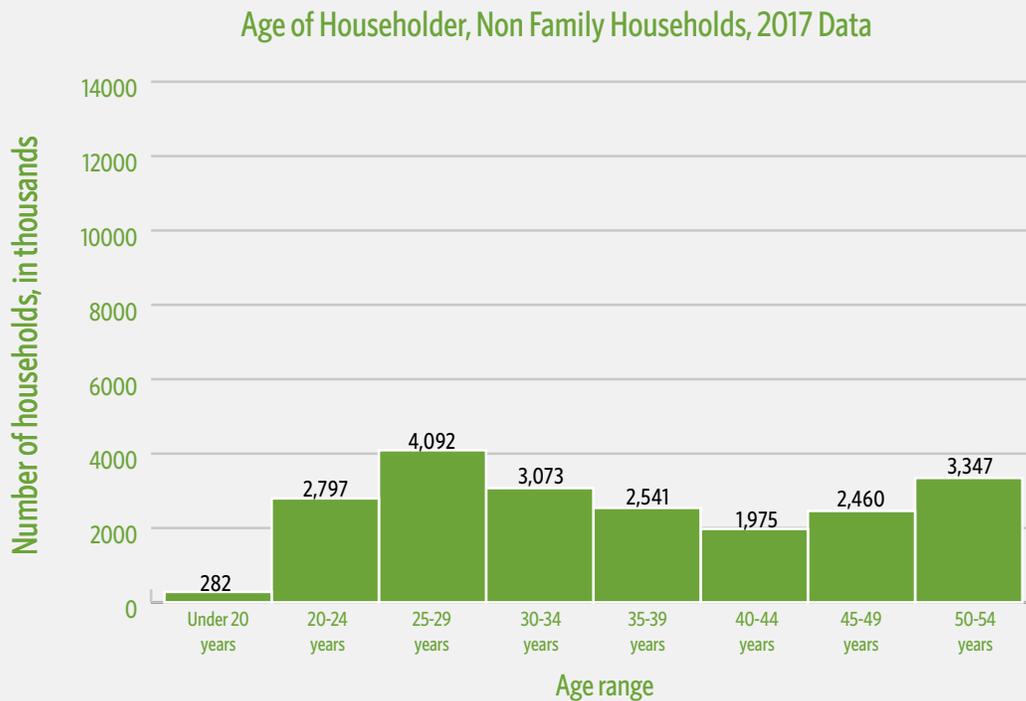
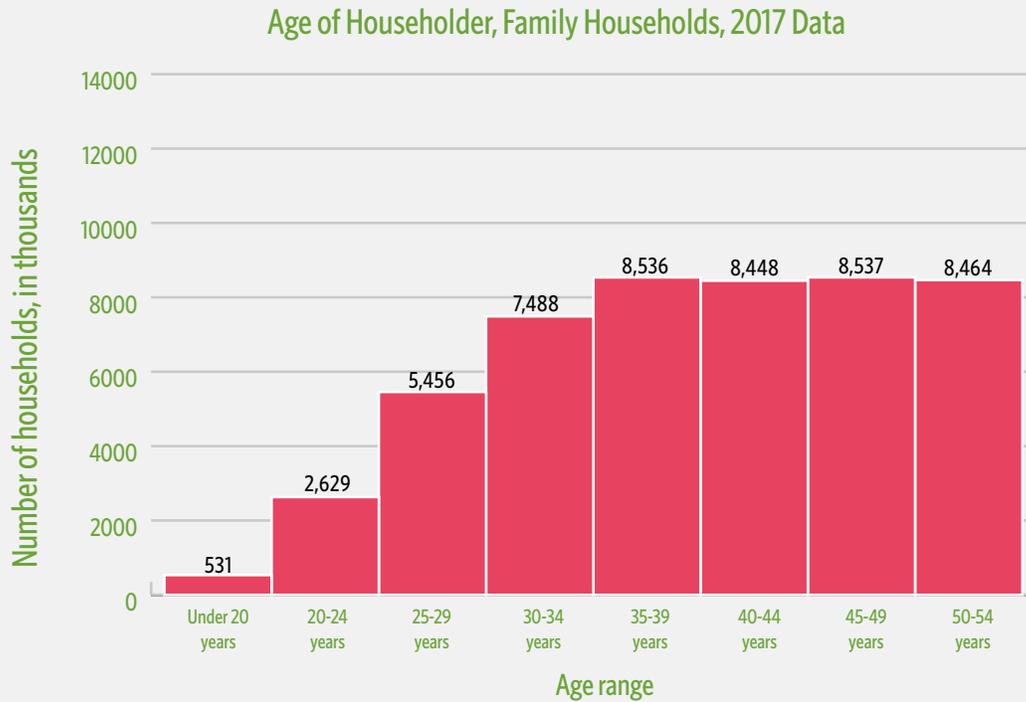
Student answers will vary. To make this part of the activity easier, teachers could have all students choose the same two rows, then work in pairs (with each student creating one of the two histograms).

8. Draw a star next to each of your two rows in the table, using a red pen.
9. Create two histograms — one for each of your selected rows of data. Be sure to include all of the row data in your histogram except for the data in the “Total” column. You can use your own graph paper, **Item 2: Histogram Templates**, or graphing technology (if provided). Label one histogram as “Histogram A” and the other as “Histogram B.”

Then add a more descriptive title to each graph and label your axes, making sure that the label for the y-axis includes “in thousands.” The horizontal axis for both histograms should have the same scale: five years. The vertical axis for both histograms should also have the same scale, which you will determine.

Remember, histograms have bars that represent equal ranges of data, and there are no gaps between the bars. Once you have created all of your bars, include the exact number of households for each type on top of each bar.

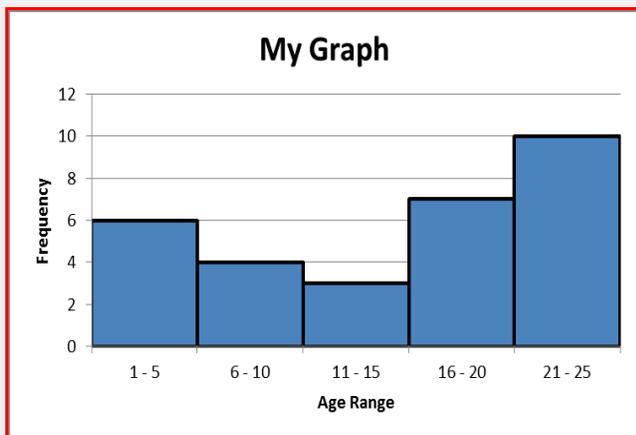
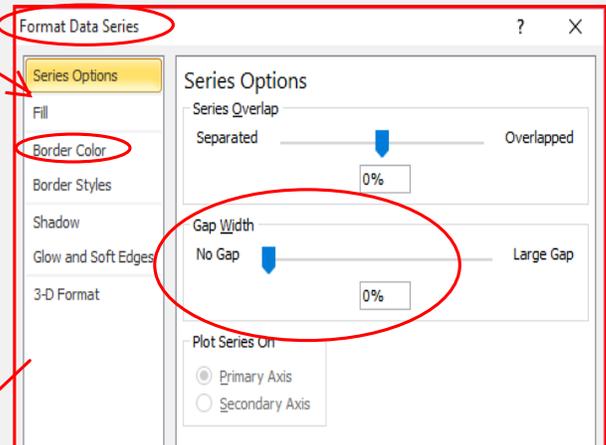
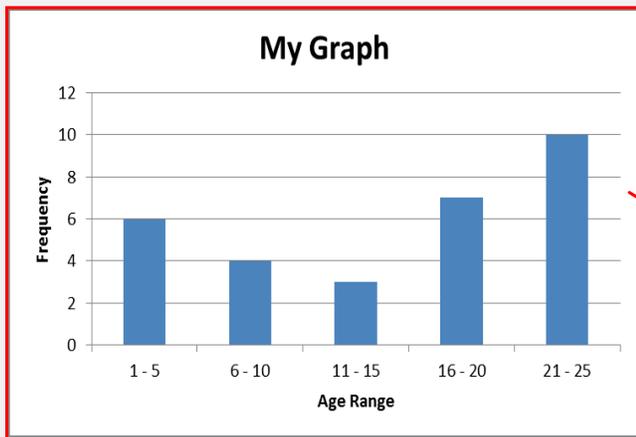
Student histograms should look like the ones below:



If students use Microsoft Excel, they can easily turn a bar graph into a histogram. To do this, they must first create a 2-D Column Chart and then locate the Format Data Series option. (In Excel 2010 for Windows, right-click on any column, then choose Format Data Series.) They should set the Gap Width to 0 percent to eliminate gaps between the columns. Students can also create borders for each histogram bar by choosing Border Color and Border Styles from this same menu.

A tutorial for creating a histogram with a TI graphing calculator is available [here](#), at the sixth link under D. Data & Statistics. More tutorials for using TI graphing technology are available [here](#).

Here are some sample histograms, made with Excel 2010, using identical scales (minimum = 0, maximum = 14,000) for the vertical axes: **Part 2 - Analyze and Compare Your Histograms**



Part 2 - Analyze and Compare Your Histograms

Student answers will vary depending on the data selected.

1. In your Histogram A, which age range had the most households? _____
2. In your Histogram B, which age range had the most households? _____
3. In your Histogram A, which age range had the fewest households? _____
4. In your Histogram B, which age range had the fewest households? _____
5. Do your histograms have the same shape? Describe the shape of each histogram.

Student answers will vary. Most of the histograms will not have the same shape. Looking at the samples above, the nonfamily (green) histogram has two peaks, one at ages 25-29 and another at ages 50-54. The bars in the family (red) histogram rise and then practically plateau for three almost-equal bars, at ages 40-44, 45-49, and 50-54.

6. If your histograms have the same shape, or different shapes, why do you think that is?

Student answers will vary. In the family (red) histogram, there is likely a plateau at ages 40-44, 45-49, and 50-54 because a lot of householders within those age ranges may have children living at home, meaning everyone in their household is related.

Part 3 - Write a News Article

Write a three-paragraph news article — with a headline — that discusses what you learned about the ages of householders in different types of households in the United States in 2017. In the first paragraph, answer this question: “How are the ages of householders distributed in various types of households in the United States?” Be sure to cite specific examples from the data and from your histograms.

In the second paragraph, talk about what happens in families as people get older and about groups of people who live together. In the third paragraph, explain why it is important that the Census Bureau collect these data and how other government agencies, schools, businesses, charities, and individuals might use them.

Student answers will vary. A sample headline might be: “Most U.S. householders are in their 50s.”

Item 1: Households, by Type, Age of Members, Region of Residence,
and Age of Householder, 2017

Note that all numbers in the table are in thousands.

Type of household, all numbers in thousands, 2017 data	Total, including those < 20 years and > 54 years	Under 20 years	20-24 years	25-29 years	30-34 years	35-39 years	40-44 years	45-49 years	50-54 years
All Households									
Total	126,224	813	5,426	9,548	10,560	11,077	10,423	10,998	11,810
Married Couple	60,804	43	925	3,205	5,137	6,092	6,041	6,290	6,493
Male Householder	26,990	365	2,177	3,033	2,524	2,268	1,822	2,051	2,318
Female Householder	38,429	405	2,324	3,311	2,900	2,717	2,561	2,657	3,000
Family Households									
Total	82,827	531	2,629	5,456	7,488	8,536	8,448	8,537	8,464
Married Couple	60,804	43	925	3,205	5,137	6,092	6,041	6,290	6,493
Male Householder	6,452	238	706	690	683	688	627	622	560
Female Householder	15,572	250	997	1,561	1,668	1,756	1,780	1,625	1,411
Nonfamily Households									
Total	43,396	282	2,797	4,092	3,073	2,541	1,975	2,460	3,347
Male Householder	20,539	127	1,471	2,343	1,840	1,580	1,194	1,429	1,758
Female Householder	22,858	154	1,326	1,750	1,232	961	781	1,032	1,589

Data adapted from: www.census.gov/data/tables/2017/demo/families/cps-2017.html

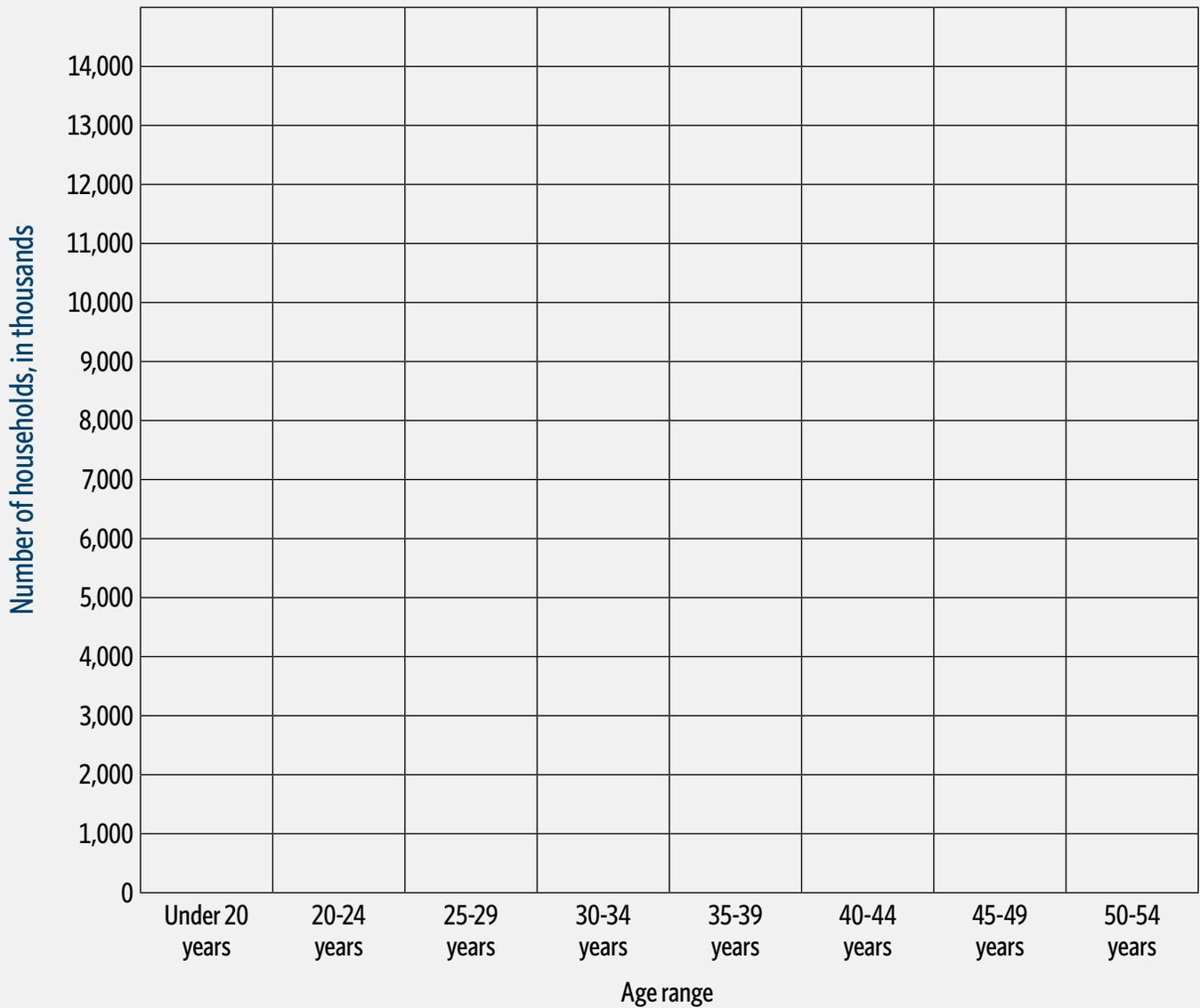
To view the data, go to the link above and click on the XLS link for Table H2.

Rounding was used in calculating these estimates; some of the table totals may appear off by one.

Item 2: Histogram Templates

Histogram A

Chart title: _____



Item 2: Histogram Templates (Continued)

Histogram B

Chart title: _____

