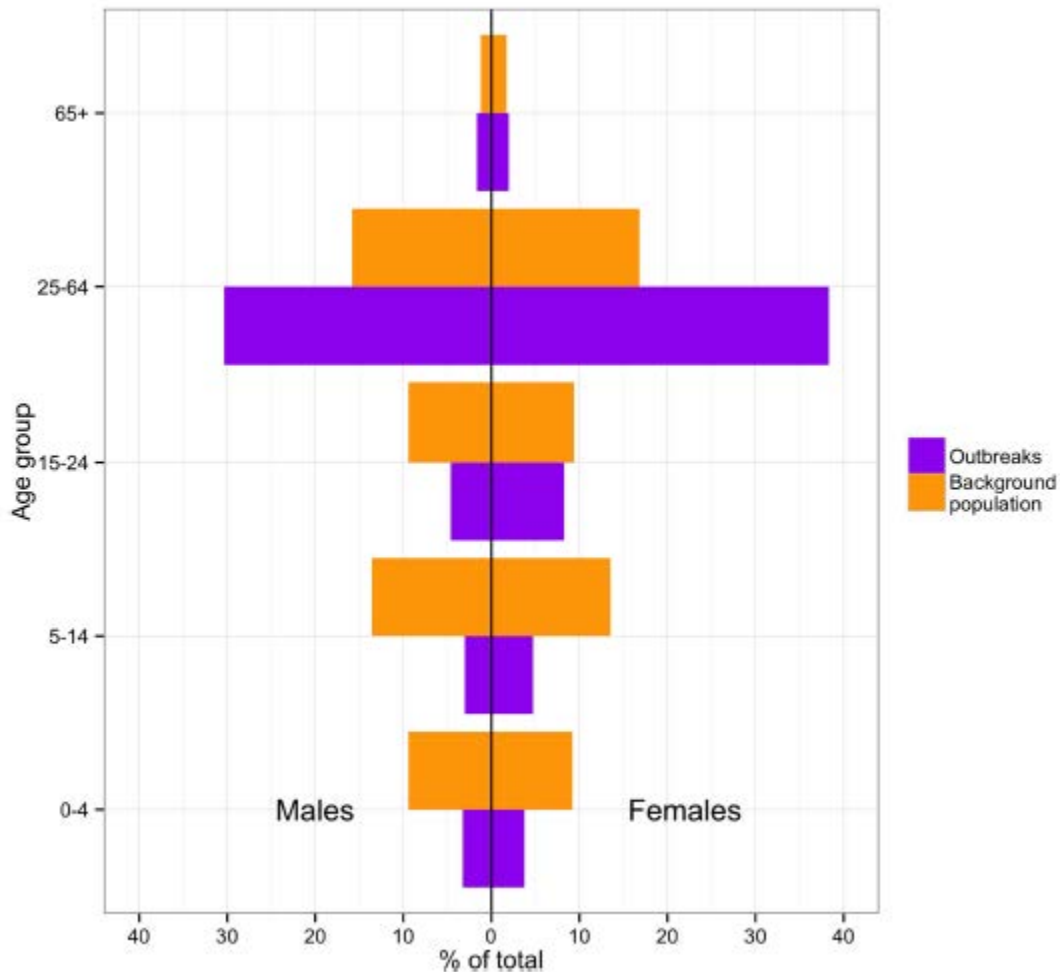## HOW TO USE THIS RESOURCE

Show the figure below to your students along with the caption and background information. The "Interpreting the Graph" and "Discussion Questions" sections provide additional information and suggested questions that you can use to guide a class discussion about the characteristics of the graph and what it shows.

Caption: Cases of Ebola virus disease (EVD) in the Democratic Republic of the Congo (purple bars) are grouped by age and sex and are compared to the demographics of the background population (orange bars). The data represent 996 suspected, probable, or confirmed cases of EVD documented during the seven Ebola outbreaks that occurred between 1975-2014 and the background population from 1976-2010.

BACKGROUND INFORMATION

Ebola virus disease (EVD) in humans is caused by four of five viruses belonging to the genus *Ebolavirus*. Although most new EVD infections in humans arise from direct contact with the blood or other body fluids of infected people, scientists suspect that transmission from animals to humans may occur through consumption of or contact with infected bats and monkeys living in nearby rainforests. Ebola virus is known to infect animals such as apes, monkeys, and bats in addition to humans, and is considered a zoonotic pathogen. Once a person is infected, they typically suffer from high fever, vomiting, diarrhea, and sometimes muscle pain, headaches, and bleeding, which often lead to death.

Since EVD was first identified during a 1976 outbreak in Zaire (now the Democratic Republic of the Congo, DRC), deadly outbreaks have repeatedly occurred in certain regions of Africa. Person-to-person transmission of the virus is rapid. This, combined with the frequency of ground travel, remoteness of outbreaks leading to slow detection and response, and healthcare and funeral practices that lead to transmission, can make containing an outbreak extremely challenging. For example, during a 2014-2016 outbreak, which began in West Africa and is currently the largest Ebola outbreak in history, individuals living in Europe and the United States also became infected. Ultimately, the outbreak infected 28,652 people in at least 10 countries, killing 11,325 people.

These outbreaks are devastating to the communities in which they occur, including the DRC, which has suffered the most outbreaks since 1976. While containment has been the primary method of controlling EVD outbreaks, the scale and duration of the 2014-2016 outbreak caused scientists to ramp up their efforts to develop vaccines, leading to the development of at least one potential candidate vaccine in 2017.

While communities await an effective vaccine, epidemiologists continue to pursue other strategies for the prevention or control of future EVD outbreaks. In this study, researchers analyzed patterns of disease spread, such as the frequency of EVD infection in people of different ages or sex. In the above figure, scientists compiled data on 996 suspected, probable, or confirmed cases of EVD in the DRC between 1975 and 2014. The cases span all seven outbreaks that occurred in the country during that time period.

INTERPRETING THE GRAPH

In an age structure diagram, adding the horizontal bars of a given color together represents 100% of the population. In this case, the orange bars represent the total population of the DRC between the years 1975 and 2010 (referred to as the background population). The purple bars represent the total number of EVD cases across the seven outbreaks between 1975 and 2014.

The figure shows that more females than males in the DRC became infected with EVD in every age group. Using the 25-64 age group as an example, we can see that a nearly equal percentage of the background population is female (about 17% of total) and male (about 16% of total). However, when you look at the purple bars, which represent the subset of the population diagnosed with EVD, we see that about 38% of all EVD cases in this same age group were in females, compared to only 30% in males. In addition, the number of EVD cases was disproportionately higher in the 25-64 age group than in the other age groups, compared to the background population. The authors speculate that this may be due to the fact that more women than men tend to be care-givers and that care-givers (either in the home or by profession) are more likely to fall in the 25-64 age range. This increased exposure of women in this age range to individuals infected with EVD makes them more likely to contract the disease themselves. The authors note that these findings could inform which age groups should be targeted first for interventions such as vaccines.

Teacher Tip: Prompt your students to explain the parts of the graph as applicable:
- Graph Type: Age Structure or Population Diagram
- Bars: Orange bars represent the percentage of the population of the DRC from 1975 to 2010 in each age group. Purple bars represent the percentage of individuals infected with the Ebola virus in the DRC from 1975 to 2014 (seven outbreaks) in each age group.
- *X*-axis: % of total population (orange) or % of total EVD cases (purple) in males (left) or in females (right) in each age group
- *Y*-axis: Age group

DISCUSSION QUESTIONS

- What patterns do you notice in this figure? Does any particular pattern surprise you? Why or why not?
- Describe the groups of people most and least likely to contract EVD. Use evidence from the figure to support your claim.
- Explain how the purple bar can be bigger than the orange bar for the 25-64 and 65+ age groups.
- Approximately what percentage of the general population is aged 0-4? What percentage of this age group was infected with EVD?
- Sketch a population pyramid for a population that you'd expect to grow in the future and one that you'd expect to decline. What are the key differences between these pyramids?
- Do you think the general population of the DRC would be expected to grow, shrink, or stay about the same in number? Provide evidence from the figure.
- Of the EVD cases shown in the figure, 79% were fatal. Would you expect the incidence of EVD infection to affect population growth? How might a major EVD outbreak affect the population of the DRC in the future?
- What factors do you think make one group more likely to contract EVD than another?
- Why is it important to examine infection rates in people based on sex and age group?
- Why do you think the authors selected these age categories? How might a different age categorization provide different results?
- If an effective EVD vaccine were available, which age group would you suggest giving it to first? Why?
- How could the results of this study be used to prevent or manage future EVD outbreaks?

KEY TERMS

age structure, background population, Ebola, epidemiology, outbreak, virus, zoonotic disease

SOURCE

Figure 2 from:

A. Rosello, *et al*. (2015). Ebola virus disease in the Democratic Republic of the Congo, 1976-2014. *eLife*. [DOI: 10.7554/eLife.09015] https://elifesciences.org/articles/09015

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