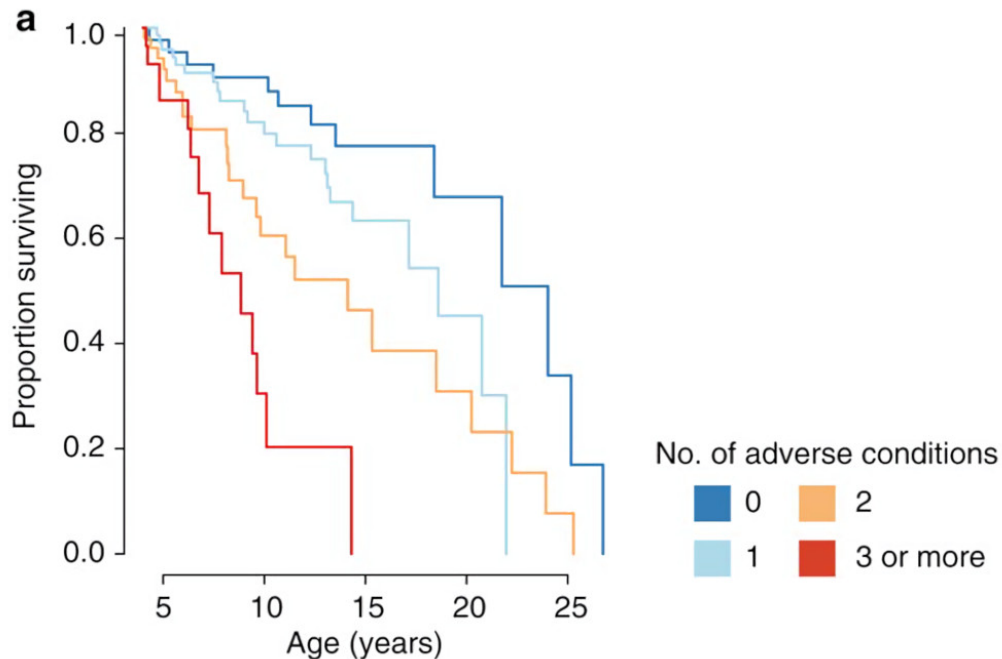




HOW TO USE THIS RESOURCE

Show the following figure and caption to your students. The accompanying Student Handout provides space below the image caption for Observations, Notes, and Questions and space next to the “Background Information” for Big Ideas, Notes, and Questions. The “Interpreting the Graph” and “Discussion Questions” sections provide additional information and suggested questions that you can use to prompt student thinking, increase engagement, or guide a class discussion about the characteristics of the graph and what it shows.



Caption: Survival curves for 196 adult female baboons from a population in Kenya. The baboons were grouped according to the number of adverse conditions that they had experienced early in life.

BACKGROUND INFORMATION

Studies have shown that people who experience major challenges such as poverty, war, famine, abuse, or disasters as children are more likely to suffer from health issues including heart disease, schizophrenia, and type II diabetes as adults. One hypothesis suggests that experiencing more of these adverse conditions early in life increases one's risk for later health issues and ultimately death. Although this hypothesis is difficult to evaluate in humans due to lack of data, scientists have studied similar conditions in other species.

In this study, scientists analyzed data from a baboon population in Kenya. These data were collected almost daily from 1983 to 2013 and contained detailed information about each of the 196 adult females in the population. The scientists compared how long each female lived with the number of adverse conditions that female had experienced early in life. The study considered six types of adverse conditions: drought, overcrowding, having a low-ranking mother, having a mother with fewer social connections, the death of a mother, and a competing younger sibling.

INTERPRETING THE GRAPH

This figure is a series of survival curves, which show the proportion of each group that was alive at a given age. The adult female baboons are grouped based on the number of adverse conditions they experienced before 4 years of age.

Each survival curve can be used to calculate multiple quantities, including:

- The probability of surviving past a given age. For example, about 80% of the baboons who experienced zero adverse conditions are alive at age 15. So, there is an 80% probability that a baboon from this group will survive past age 15. In contrast, there is a 0% probability that baboons who suffered three or more adverse conditions will survive past age 15.
- The median survival time, which is the age when only 50% of a group is still alive. This can be calculated by extending a horizontal line from 0.5 on the y-axis to the group's survival curve; the point where this line and the curve intersect is that group's median survival time. For example, baboons who suffered two adverse conditions have a median survival time of approximately 14 years.

In general, the figure shows that groups that experienced more adverse conditions early in life have both a lower probability of surviving past a given age as well as a lower median survival time. These results support the hypothesis that adverse conditions have a cumulative negative impact on the survival of adult female baboons.

Teacher Tip: Prompt your students to explain the parts of the graph as applicable:

- Graph type: Survival curve (Kaplan-Meier plot), shown as a "stairstep" graph. Note that this graph includes only adult baboons (baboons that had lived past age 4). This is because the study focused on how early life adversity affects adult survival (long-term effects) rather than childhood survival (immediate effects).
- X-axis: Baboon age (years), beginning at age 5. This was considered the earliest age of adulthood in the baboon population, because most females reached reproductive maturity between ages 4 and 5.
- Y-axis: Proportion of baboons surviving in each group. At age 5, the proportion surviving is 100% because the graph includes only baboons that had lived past age 4.
- Legend: Different colors represent different groups of baboons. Baboons are grouped based on the number of adverse conditions (0, 1, 2, 3 or more) that they experienced before age 4.

DISCUSSION QUESTIONS

- What are the probabilities that a baboon from each group will survive past 10, 20, and 25 years of age? How did you arrive at these numbers?
- What is the approximate median survival time for each group of baboons? How did you arrive at these numbers?
- How old was the oldest baboon in each group when it died? The youngest? How did you arrive at these numbers?
- Why are the survival curves shaped like jagged staircases instead of smooth lines?
- The x-axis on this graph starts at age 5, which is the age when the baboons became adults. Why do you think the graph doesn't include younger baboons?
- Was there anything that surprised you about this figure?
- This study considered six types of adverse conditions. Choose one of these conditions and explain why it would present a challenge for a young baboon.
- Which is likely to live longer: a baboon that experienced zero adverse conditions or a baboon that experienced three adverse conditions? Use evidence from the figure to support your claim.
- What is the relationship between the number of adverse conditions that a baboon experiences early in life and that baboon's longevity? Use evidence from the figure to support your claim.

- Why might adverse conditions early in life have negative impacts later in life?
- Scientists hypothesize that experiencing a greater number of adverse conditions early in life increases a person's risk for health issues later in life. Does this figure support that hypothesis? Why or why not? You may want to consider how these results would apply to other populations or species, as well as the relationship between health issues and survival probabilities.
- One of the adverse conditions that the scientists considered was having a mother with fewer social connections. The scientists also found that female baboons that experienced more adverse conditions early in life were socially isolated from other females later in life. How do you think social isolation impacts an individual's health and survival? How might it impact the health and survival of that individual's descendants?

KEY TERMS

adverse condition, lifespan, longevity, survival curve, survival probability, survivorship function

SOURCE

Figure 1a from:

Tung, Jenny, Elizabeth A. Archie, Jeanne Altmann, and Susan C. Alberts. "Cumulative early life adversity predicts longevity in wild baboons." *Nature Communications* 7 (2016): 11181. <https://doi.org/10.1038/ncomms11181>.

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