

Predicting Survivorship and Mortality

Demographers gain insight into historical influences on birth and death rates by dividing populations into age and sex groups and calculating mortality rates for each one. This allows ecologists to make predictions for future population growth and to better understand the ecology and evolution of life expectancies.

By constructing life tables from local data, insightful judgments can be made about local population trends. The cemetery is an interesting data source for studying such trends. It provides a rich source of information for determining the birth dates, sexes, and death rates over different periods of local history.

In this lab, you will collect data from a local cemetery to construct survivorship curves and mortality rate-vs.-age graphs for each period. Then, you will correlate your findings to historical data to explain the differences among the periods and make predictions about future survivorship and mortality.

OBJECTIVES

Collect local data about gender, date of birth, and age at death for four time periods.

Calculate survivorship totals and mortality rates for each period.

Graph survivorship curves and mortality rate-vs.-age graphs for each period.

MATERIALS

- graph paper, sheet (2)
- map, cemetery
- notebook, four-theme
- pencils, colored, assorted (5)
- pencil, graphite



Procedure

PART I—PREPARE TO COLLECT DATA

1. Prepare your four-theme notebook for use as a field logbook. Label the four sections of the field logbook for groupings of people born in four different time periods: prior to 1850, between 1850 and 1900, between 1900 and 1950, and after 1950. Mark off four data columns on the first few pages of each section. Label the columns sex, birth date, death date, and death age. In some cemeteries there could be little information for events prior to 1850. However, this is also valuable information to show how that particular population has changed through time.
2. Select a large local cemetery. Permission to conduct your study should be obtained beforehand by your teacher.

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3. Establish your sampling scheme. On the map of the cemetery, draw a boundary around the area in which you will collect data. Cemeteries are often arranged with the oldest graves located in one area, and progressively newer graves found farther out. Draw your boundary such that you are likely to get sufficient amounts of data for each time period. You will be gathering information on all grave sites within this boundary. Selecting your grave sites before you look at them will help prevent your data from being skewed on particular birth years, since you are forced to gather data from all grave sites in the boundary, rather than gathering data from grave sites in close proximity.

PART II—COLLECT DATA

4. Using your field logbook and map, collect data from every grave site within the boundary you previously selected.

EXAMPLE CALCULATION TABLE

| Age | # Died at Age | Mortality Rate | # Survived | % Survival |
|-----|---------------|----------------|------------|------------|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |
| 9 | | | | |
| 10 | | | | |
| -- | | | | |
| -- | | | | |
| -- | | | | |
| 90 | | | | |
| 91 | | | | |
| 92 | | | | |
| 94 | | | | |
| 95 | | | | |
| 96 | | | | |
| 97 | | | | |
| 98 | | | | |
| 99 | | | | |
| 100 | | | | |

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PART III—PREPARE FOR ANALYSIS

5. Prepare a calculation table similar to the Table on the previous page for each time-period group. Lay out the table for each time-period group on a separate sheet of graph paper. Label each table (for example, “Prior to 1850 Calculation Table”).

Analysis

1. **Describing Events** Recall occasions while collecting data when you came across close groupings of individuals that died in the same year and list those years. Review the data in your field logbook as necessary.

2. **Explaining Events** Explain how such close groupings of individuals that died in the same year could occur (whether you noted any in your collected data or not).

3. **Organizing Data** Write the # *died at age* for each *age* in each time-period on the calculation tables for each time-period group. Using the data in your field logbook, for each death age <1 through >100, sum up all individuals in the same time-period group with the same death age. Add up the total number of people in each time-period group and record that number as the *total for time period* on each calculation table.

4. **Organizing Data** Calculate the *mortality rate* for each *age* in each time-period group and record the calculations as percentages on the calculation tables. The *mortality rate* for each *age* is the # *died at age* divided by the *total for time period*.

5. **Organizing Data** Calculate the # *survived* for each *age* in each time-period group and record the calculations on the calculation tables. The # *survived* for each *age* is the # *survived* from the next earlier *age* minus the # *died at age* for the current *age* in question. Note, the # *survived* for the first *age* is the *total for time period* minus the # *died at age* for the first *age*.

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6. Organizing Data Calculate the % *survived* for each *age* in each time-period group and record the calculations as percentages on the calculation tables. The % *survived* for each *age* is the # *survived* divided by the *total for time period*.

7. Constructing Graphs Graph the mortality rate curves for each time-period group on the same graph. Using a sheet of graph paper, set up a graph of *mortality rate* on the *y*-axis versus *age* on the *x*-axis. The *y*-axis should have increments to 100%. The *x*-axis should have increments from <1 to >100. Title the sheet of graph paper, "Mortality Rate." Using a colored pencil, plot the data from your "Prior to 1850 Calculation Table." Label the curve "prior to 1850." On the same graph, plot the data from each of the other three calculation tables and label them accordingly. Use a different colored pencil for each curve.

8. Constructing Graphs Graph the survivorship curves for each time-period group on the same graph. Using a sheet of graph paper, set up a graph of % *survived* on the *y*-axis versus *age* on the *x*-axis. The *y*-axis should have increments to 100%. The *x*-axis should have increments from 1 to 100. Title the sheet of graph paper, "Survivorship." Using the same colored pencil as in Analysis question 7, plot the data from your "Prior to 1850 Calculation Table." Label the curve "prior to 1850." On the same graph, plot the data from each of the other three calculation tables and label them accordingly. Use the same colored pencil for each curve as you used in Analysis question 7.

Conclusions

9. Analyzing Graphs Relate the mortality rate and survivorship curves of each time period to historical data. How do the results from your local cemetery correlate to the region, the country, or the world?

10. Making Predictions Imagine that the trends indicated by the curves from the four time periods continue into the next 50 years. Using a different colored pencil, plot your predictions for mortality rate and survivorship for the time period between 2000 and 2050. Label the curves "between 2000 and 2050."

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Extension

- 1. Research and Communications** Reformulate results for Analysis questions 3 through 8 and Conclusions questions 9 and 10 separately for each gender. Prepare graph sheets containing separate tables and graphs for females and males.