Principles of Wildlife Management
Cemetery Demography
24 February 2009

Introduction

Constructing survivorship schedules and comparing them among groups of interest can elucidate interesting demographic patterns within and between populations. For example, we may be interested in discovering whether patterns of survivorship differ among men and women, or among people from different countries or geographic regions.

One way to explore this question is by constructing a life table. We can construct such a table using data from gravestones. For this exercise we will collect data at the Birch Hill cemetery, bring it back to the lab and analyze it in our spreadsheets. We will examine differences in survivorship with respect to gender, time periods (cohorts), and geographic regions. For this week's assignment you will produce a written lab report about your analysis and survivorship patterns (more on this later).

Methods

We will drive to Birch Hill cemetery, where you will split into sampling teams of 2 or 3. Each team will sample 100 headstones and record the following data:

1. Gender (if a name is gender-vague, take your best guess)
2. Year of Birth
3. Year of Death

Once you choose a headstone, you must include it in your sample unless one or more pieces of information are missing.

In the computer lab, we will have to enter our data into our spreadsheets for analysis. We will calculate survival probability and life expectancy for males and females separately over all years. Additionally, I have included some analyzed data from Massachusetts. To examine geographic variation in survival, you will compare these data with your data from Fairbanks.

Life Table Construction

Open the Lab_5_data.xls file available on the web page. On the first page you will see an example life table analysis that I have constructed. I will walk you through each column in the table and explain each statistic.

Column A

This column is an index of the age class intervals **(x)** that we will use in our analysis. We refer to each age class by the number in this column ($x = 1, 2, \ldots, x_{max}$).

Column B

These are ten-year age class intervals that encompass the majority of possible with human life spans.

Column C

This is the number of individuals that are alive at the beginning of age class x. We will refer to this number as $\mathbf{n_x}$ for the remainder of this exercise.

Column D

This column is the number of deaths that occur in age class **x.** We call this statistic $\mathbf{d_x}$.

Column E

This column is the probability of death in age class **x.** This is referred to as $\mathbf{q_x}$**.** It is calculated as $\mathbf{d_x / n_x}$**.**

Column F

This column is the survival probability for age class **x (i.e.,** $\mathbf{S_x}$). It is calculated as (1- $\mathbf{q_x}$).

Column G

This column is $\mathbf{l_x}$, the cumulative survival probability. It is calculated as $\mathbf{n_x / n_0}$.

Columns H and I

The values in these columns $\mathbf{L_x}$ and $\mathbf{T_x}$ are necessary for your calculations of life-expectancy, $\mathbf{e_x}$, and their interpretation is not necessarily straightforward. $\mathbf{L_x}$ is the mean number of years lived in that age interval per individual that enters that interval: $\mathbf{((l_x + l_{x+1}) / 2)*10}$. Why are we multiplying by ten? Ten is the number of years in our age classes… $\mathbf{T_x}$ is the total number of years to be lived from that interval onwards and is calculated as:

$$\mathbf{T_x} = \sum_{i=x}^{X_{max}} L_x$$

Column J

Life expectancy $\mathbf{e_x}$ measures the amount of time that an individual in the population can expect to live from that age forward. It is calculated as $\mathbf{T_x / l_x}$ (note the lowercase l). In essence, this is the total number of years to be lived from that point on ($\mathbf{T_x}$) adjusted by the proportion of the population that actually enters that age interval ($\mathbf{l_x}$). Think of this as the total numbers of years to be lived spread across some fraction of the total population that began the life table.

Columns K and L

This is the number of survivors standardized to a per 1000 basis. It is equal to the total number of individuals in the sample at time zero multiplied by 1000. Column L is the $\log_{10}$ of the per 1000 survival.

Survivorship Curves

You should build life tables and survivorship curves to compare males to females for both Fairbanks and Massachusetts (4 tables, 2 plots). Then, compare males from Fairbanks to males from Mass. Do the same with females (2 plots). Use the data from Massachusetts and the above equations to guide you. Enter the values and see if you can produce the same results. Then do the same for your Fairbanks data.

Construct survivorship curves by plotting the log 10 survival on the y-axis and the age class on the x-axis. It is useful for comparison analysis to plot two groups of interest (e.g., males and females on the same graph).

Homework (Due Tuesday, 3 March at beginning of lab)

Report your results in a document not to exceed two double-spaced typed pages -- less graphs). The report

1. A results section, which will summarize the findings from your analysis. Life expectancy for this group was… survivorship was lowest in this region…. Reference your graphs and tables in this section.

2. A discussion section, which develops and expands upon your results. Discuss the differences and similarities in patterns of survivorship within and between time periods, areas, and genders. Place your results in a broader context. Explain the patterns that you see.

You are welcome to corroborate with your cronies on the analysis part of this assignment. However, the words and thoughts in the final write-up should be your own.

Remember to attach graphs and figures to the back of your manuscript, after the literature cited section. Graph legends should go at the bottom of the figure. Table legends belong at the top of the table.