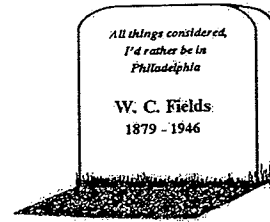


Human Population Ecology

Advanced Placement Biology

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(adapted from Dr. Bruce W. Grant, Widener University)

Synopsis of the Lab

You will visit a cemetery of your choosing and record dates of births and deaths etched on the headstones. You will create graphs of the data to help you interpret them. You will examine demographic parameters such as survivorship and mortality of males and females during two time intervals: deaths pre-1950 or post-1950. You will compare the data and suggest some causes for the results.

Objectives for the Lab

- (1) You will understand some of the basic concepts of population demography - survivorship and mortality.
 - (2) You will work with real data to learn how to graphically analyze the data.
 - (3) You will understand how factors such as advances in medicine and environmental protection may have affected human demography over the past 150 years.
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What Is Due from This Activity? (Neatly bound together, typed, with a table of contents using the order below, with page numbers, 3-hole punched!)

- (1) Abstract: Summarize your fieldwork and analysis in at least one page. Write a conclusion about the results. Interpret the data by incorporating demographics for your population with cultural issues of their time. Summarize what you have learned and its value to you. Suggest any improvements to this activity and provide your opinion of this activity.
- (2) Introduction: Explain where you went and what types of demographics are found in the cemetery (relative wealth of the population, other socio-economic/cultural information, etc.)
- (3) Graphs: 1) Survivorship Curve (best-fit line) showing the male/female survivorship by age interval for both time periods (4 lines) on the same page, and 2) a survivorship graph (best-fit line) of the human data in your textbook (p.808)
- (4) Typed *questions* and answers to all questions at the end of this handout (be sure to research your answers).

- (5) Your original data (Data Sheet # 1) with at least 200 data points (100 points for each time interval), which you collected at the cemetery. Feel free to collect more data points! (Copy blank data sheets.)
- (6) Your “Calculations of Survivorship” table of your data (Data Sheet # 2)
- (7) Resources cited (MLA or APA format) to support your ideas.

Introduction

Local cemeteries are an excellent place to study human demography. Etched in the gravestones are the dates of birth and death of the person below, at least in most cases. From these data, we can calculate death rates and draw survivorship curves. A survivorship curve is simply a graphical representation of the chance that an individual will survive from birth to any particular age. By comparing survivorship curves for different periods of time we may look for historical trends in demography over the decades. Also, different cemeteries may represent different socio-economic cross-sections of the population, and comparing data among cemeteries may reveal different patterns of mortality.

Over the last few centuries, advances in health care and large-scale global political conflict have left rather opposing marks on the demographics of the U.S. population. Two major time intervals stand out: before 1950 and from 1950 to the present. Firstly, the time interval before 1950 includes the industrial revolution, the ravaging effects of polio, the 1918 influenza pandemic, infections and other presently curable diseases, as well as World Wars I and II. Following 1950, numerous vaccines and antibiotics were widely used and, with the exception of the Korean, Vietnam, and Gulf Wars (not to mention a few other incidents...), this has been an era of relative peace in North America. However, new pandemics have emerged such as AIDS and SARS. What are your predictions about how the demographics of the United States population have changed during these two time periods?

In order to study the demography of a population, we would have to study all of the local cemeteries and assume that no one emigrated from the area and was buried elsewhere. Neither is likely. Thus for now, we will assume that the cemeteries you will visit are representative of all humans in the area, although we should be aware of these sorts of biases in the data.

Methods for the Lab

Study Sites: Choose a cemetery to visit. Be creative with your choice, consider using a cemetery where you vacation. Record its name and location on Data Sheet #1.

Data Collection: Collect data from headstones in the following categories: (200+ total)

Time Period 1: FEMALES WHO DIED BEFORE 1950 – 50 headstones

Time Period 1: MALES WHO DIED BEFORE 1950 – 50 headstones

Time Period 2: FEMALES WHO DIED AFTER Jan. 1, 1950 – 50 headstones

Time Period 2: MALES WHO DIED AFTER Jan 1, 1950 – 50 headstones

PLEASE DO NOT DUPLICATE DATA WITH ANY OTHER CLASS MEMBER. Also, if you visit a cemetery, at all times behave with respect and restraint when collecting these data. It is customary to avoid, where possible, walking on top of the graves. Most cemeteries do not allow picnics on the grounds.

Data Analysis

To estimate demographic characteristics of a population, we need to know the ages of people when they died for each sex and time interval. To get this, examine your field data sheets (Data Sheet #1), and count the number of people who died in 10 year intervals, 0-9, 10-19, etc.

Use Data Sheet #2 to guide you through the calculations to estimate the survivorship for each age interval. Plot the data on graph paper or on the computer (do NOT use plain, unlined paper). See attached instructions on how to properly construct a graph.

Steps for Data Analysis (see sample table for help)

1. On top of each Data Sheet #2, record the type of data for each page (MALES or FEMALES, DIED BEFORE or AFTER 1950).
2. **Column A:** Record the number of people who died for each 10-year age interval listed (0-9, 10-19, etc.) from your data set from Data Sheet #1.
3. At the bottom of the table, write down the total number of people who died in this data set (i.e., add all of the numbers in the column = N_1).
4. **Column B:** Determine the number of people living at the start of each interval (people who survived the previous age interval). Age interval 0-9 will be the N_1 number. To determine the numbers below it, take the number above and subtract the deaths from the same row (above).
5. **Column C:** Determine the cumulative number of survivors at the end of each interval by subtracting the number who died from the survivors in that interval. ($N-D$). This number will be the same as those in column B but off by one line.
6. **Column D:** The chance of surviving each time interval is determined by dividing the survivors (column C) by the number of living in the time interval (column B). [*Example from Sample Sheet: if you survive to age 50, there is a 100% chance of reaching age 59.*]
7. **Column E:** To determine cumulative SURVIVORSHIP (chance of surviving from birth to age 109), divide the number in column C by the total that you found at the bottom of column A (N_1).
8. Use graph paper or the computer (NOT plain paper) to plot the SURVIVORSHIP in column E as a function of age interval from your data for each group. Be sure to read the attached guidelines for making graphs. Your graph will be graded on the accuracy, neatness, and conforming to the rules for making graphs.
9. Make a graph of the "Life Table for the U.S. Population in 2001" in your textbook (p.808). You will need to calculate the cumulative survivorship for this table before making the graph of survivorship.

Questions to Answer after You Have Collected and Graphed Your Data (be sure to type *questions* as well) -

I. Data Interpretation:

Q # 1: Which *time interval's* individuals had the best chance of surviving to the age of:

- a) 0-10 years b) 11-20 years c) 31-40 years d) 71-80 years

Q# 2: Which *sex* had the greater chance of surviving to the age of:

- a) 0-10 years b) 11-20 years c) 31-40 years d) 71-80 years

Q # 3: Research and reference at least 2 sources to explain the change in survivorship trends you noticed above.

Q # 4: Using your data, estimate (and *sketch* with your answer) what an age structure diagram would look like (see text, p. 815) for the two time intervals. Describe any differences you would expect to see. What do you think the most recent diagram predicts about the future population growth of the U.S.?

If your data are from outside the U.S., how do your graphs/age structure diagrams compare to that of the U.S. (from your text)? Research and reference at least 2 sources to explain any differences you notice between the two countries. What do you think the most recent diagram predicts about the future population growth for the country of your data?

II. Analysis and Conclusions

Q # 5: Why might data that you have collected be useful to an insurance company? Many people carry recessive and hidden genetic defects that sometimes pre-dispose the carrier population to a curve of higher disease incidence and mortality. Even though carriers of such defects may have no physical symptoms, what do you think would happen to his or her health insurance premium if his or her insurance company found out about the hidden genetic defect? Do you believe that this is fair to the individual? to the insurance company?

Q# 6: What types of information do human survivorship curves and age structure diagrams reveal? Itemize and discuss why is this type of data collection and analyses are valuable to a culture in the long term.

Q# 7: Discuss the value to humans of this type of analysis for different species.

DATA SHEET 1: RAW DATA

HEADSTONES YOU NEED TO FIND: _____

(above write MALES or FEMALES, DIED BEFORE or AFTER 1950)

Range of Death years:

death year - birth year _____ = age at death	death year - birth year _____ = age at death	death year - birth year _____ = age at death
death year - birth year _____ = age at death	death year - birth year _____ = age at death	death year - birth year _____ = age at death
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DATA SHEET 2: Calculations of Survivorship

Type of Headstones You Found: _____

(above write: MALES or FEMALES, DIED BEFORE or AFTER 1950)

	A	B	C	D	E
Age Interval (in years)	Number of Deaths per Age Interval	Number Living at Start of Interval	Cumulative Survivors at End of Interval	Chance of Surviving Each Time Interval	Cumulative Chance of Surviving to End of Interval
	(D)	(N)	(N - D)	(N-D)/N	(N-D)/N ₁ *
0-9					
10-19					
20-29					
30-39					
40-49					
50-59					
60-69					
70-79					
80-89					
90-99					
100-109					

*N₁ = total data points on this table (number of headstones you found in this category)

SAMPLE

DATA SHEET 2: Calculations of Survivorship

Type of Headstones You Found: _____

(above write: MALES or FEMALES, DIED BEFORE or AFTER 1950)

	A	B	C	D	E
Age Interval (in years) (of death)	Number of Deaths per Age Interval	Number Living at Start of Interval	Cumulative Survivors at End of Interval	Chance of Surviving Each Time Interval	Cumulative Chance of Surviving to End of Interval
	(D)	(N)	(N-D)	(N-D)/N	(N-D)/N _i *
0-9	5	24	19	$\frac{19}{24} = 79\%$	$\frac{19}{24} = 79\%$
10-19	1	19	18	$\frac{18}{19} = 95\%$	$\frac{18}{24} = 75\%$
20-29	3	18	15	$\frac{15}{18} = 83\%$	$\frac{15}{24} = 63\%$
30-39	1	15	14	$\frac{14}{15} = 93\%$	$\frac{14}{24} = 58\%$
40-49	1	14	13	93%	54%
50-59	0	13	13	100%	54%
60-69	0	13	13	100%	54%
70-79	2	13	11	85%	46%
80-89	4	11	7	64%	29%
90-99	3	7	4	57%	17%
100-109	4	4	0	0%	0%

*N₁ = total data points on this table (number of headstones you found in this category) = 24 for this sample