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# Ordeal by Hunger: An Introductory Statistical Analysis of the Donner Party Deaths

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## Abstract

This paper describes how we use demographic data from the Donner Party tragedy to illustrate descriptive statistics and two-way tables in an introductory statistics course.

## 1. Introduction

Ramsey and Schafer (2002) present a data set that lists the names, ages and genders of the adult survivors and non-survivors of the Donner Party tragedy. The data set was used as a case study in the application of logistic regression analysis. The goal was to determine if the odds of survival in the Donner Party were greater for women than for men.

In this paper, a modified, more complete version of the same data set is analyzed from the point of view of a first statistics course. Specifically, we discuss how we have students use an exploratory analysis based upon descriptive statistics and two-way tables to answer anthropological questions concerning the Donner Party incident.

## 2. Background

Noted anthropologist Donald Grayson presented a demographic assessment of the Donner Party Deaths in a 1990 article appearing in the *Journal of Anthropological Research*. We have adapted a discussion from Grayson's article to provide the reader with a detailed background on the Donner Party tragedy.

The Donner Party is the name given to a group of emigrants who became trapped in the Sierra Nevada mountains during the winter of 1846 to 1847. Grayson (1990) powerfully notes: "The history of the Donner Party is so deeply embedded in American lore that there can be few Americans who do not know something about it. At its most lurid level, the fate of the Donner Party provides popular American history with a tale of cannibalism, of fellow travelers eating one another to survive. At a deeper level, the Donner history juxtaposes an attempt to fulfill a common mid-nineteenth-century American dream – a better life to be found by going west – with one of the worst tragedies to befall overland emigrants in their attempts to pursue that dream." (p. 223)

The final composition of the Donner Party was not established until August 1846, but the heart of the group, 22 members of the Donner and Reed families, left Springfield, Illinois, for California in mid-April 1846. Several other families joined up with the Donners at Independence, Missouri, in May 1846.

According to Grayson (1990), with the exception of the death of Margaret Reed's elderly mother, Sarah Keyes, shortly after the journey had begun, the Donners and their traveling companions had a relatively uneventful trip as far as Fort Bridger on western Wyoming's Green River. After reaching Fort Bridger on July 27, the Donner Party made a decision to take a new and untested route to the Sacramento Valley. This new route had recently been touted by Lansford W. Hastings in a popular and influential guidebook.

Had the Donner Party decided to stay on established trails, they would have headed north from Fort Bridger to southern Idaho's Fort Hall. From there, they would follow the more-established California Trail. But, Grayson (1990) shares, "Hastings suggested that the emigrants should instead make their way south and west through the rugged Wasatch Range. Once in the valley of the Great Salt Lake, they were to pass south of the lake and then forge directly across the Great Salt Lake Desert to the headwaters of the Humboldt River. Here, on the Humboldt, they would then rejoin established paths. This more direct route, he asserted, would save both time and effort. It was this route, the Hastings Cutoff, that the Donner Party decided to follow." (p. 224) Figure 1 provides a map of wagon routes from Independence, Missouri to the Sacramento Valley, circa 1850.

Figure 1. 1850s Wagon Routes from Independence, Missouri to Sacramento Valley. From *The Plains Across: The Overland Emigrants and the Trans-Mississippi West, 1840-60*. Copyright 1979 by the Board of Trustees of the University of Illinois. Used with permission of the University of Illinois Press.



The table on the Background Sheet in Appendix A0 gives a list of the names of members of the Donner Party, along with their gender, age, survival status, and family group size (Grayson 1990). There are minor discrepancies between the Grayson data set and the Ramsey and Schafer data set; for consistency, we will use the Grayson data set throughout this paper.

Although Sarah Keyes died soon after the Reeds had left Springfield, the first death in the Donner Party as it was finally constituted occurred south of the Great Salt Lake, when Luke Halloran, who had been ill from the onset of the trip, died of “consumption.” By the time the party reached the foothills of the Sierra Nevada, 4 additional males had died, all as a result of passive or active violence. John Snyder was killed along the Humboldt River by James Reed, leading to Reed’s expulsion from the group. Hardkoop lacked a wagon or draft animal of his own and, when forcefully denied access to transportation, he also succumbed along the Humboldt. Wolfinger died in the Humboldt Sink, apparently murdered by Reinhardt and Spitzer. Slightly further along the trail, William Pike was accidentally shot and killed while passing a weapon to his brother-in-law, William Foster.

The remaining 35 deaths happened after the winter encampment was established near Donner Lake. Of these deaths, 22 occurred in the winter encampment itself, as members of the group awaited rescue. The remaining 13 deaths took place either while members of the party attempted to escape on their own or during a series of rescue attempts that were mounted from the Sacramento Valley. Of these 13 deaths, 12 occurred in the Sierra Nevada or on its western flank, while one infant (Elizabeth Graves) succumbed at Sutter’s Fort soon after she had been rescued. The exact causes of these deaths are unknown, but the general cause is quite clear - all or nearly all of the 35 died of some combination of starvation and exposure.

According to Grayson (1990), “modern analyses of human mortality provide a number of expectations concerning the distribution of deaths within the Donner Party. The expectations are straightforward:” (p. 232)

- “Analyses of age-specific mortality rates have shown that high death rates characterize both the youngest and oldest members of human societies...Mortality is generally very high between the ages of 1 and 5, after which it decreases. By the age of 35, mortality begins to increase again, becoming increasingly higher in older age classes.” (p. 232)

These patterns lead to the expectation that mortality rates in the Donner Party should have been high for the youngest and oldest members of the group.

- “Analyses of the relationship between sex and mortality have routinely shown that for most populations, male mortality is greater than female mortality across age classes.” (p. 233) “On average, women are smaller than men, have a greater proportion of subcutaneous fat, and have a lower basal metabolic rate...Under cold stress, inactive adult males suffer greater core temperature reduction than inactive adult females...For these and other reasons,...adult women...should fare better under conditions marked by famine and extreme cold than their male counterparts...It is also possible that tasks requiring short-term physical exertion, performed primarily by adult male members of the Donner Party, may have made those individuals even more vulnerable to cold and famine.” (p. 233)

These facts lead to the expectation that, unless females were excluded from important resources by males, mortality among the Donner Party should have been higher for males than it was for females.

- “Analyses of the relationship between mortality and the degree to which individuals participate in social networks have routinely shown an inverse relationship between these two variables: those individuals with larger social networks have reduced mortality rates.” (p. 233) “Accordingly, mortality in the Donner Party should have been inversely scaled to the number of social contacts, and in particular to the degree of social connectivity as measured by the size of the available kin groups.” (p. 324)

This information leads to the expectation that those persons with larger family sizes should have a lower mortality rate.

To begin the demographic analysis, Grayson presents death rates for male and female Donner Party members for various age classes (Table 1).

**Table 1.** Donner Party Members: Sex and Survivorship by Age Class. (Grayson (1990), Table 7, p. 234)

Age Class	<u>MALE</u> Survived?			<u>FEMALE</u> Survived?			Totals	% No
	Yes	No	% No	Yes	No	% No		
1 – 4	2	5	71.4	4	5	55.6	16	62.5
5 – 9	5	2	28.6	4	0	0.0	11	18.2
10 – 14	6	2	25.0	5	0	0.0	13	15.4
15 – 19	1	1	50.0	1	0	0.0	3	33.3
20 – 29	5	10	66.6	6	1	14.3	22	50.0
30 – 39	2	4	66.6	2	0	0.0	8	50.0
40 – 49	2	1	33.3	1	3	75.0	7	57.1
50 – 59	0	1	100.0	0	1	100.0	2	100.0
60 – 69	0	3	100.0	0	0	0.0	3	100.0
Age Unknown	0	1	100.0	1	0	0.0	2	50.0
Totals	23	30	56.6	24	10	29.4	87	45.0

Male mortality in the Donner Party was in fact higher than female mortality, confirming the second expectation. “Males succumbed at a rate approximately twice that of females (56.6 percent for males versus 29.4 percent for females)...Of the male deaths, 5 occurred prior to the Sierran encampment, and 4 of these were due either directly or indirectly to male aggression... Eliminating those deaths known to have been due to violence, the male death rate (53.1 percent) remains far higher than that for females.” (Grayson, 1990, p. 235)

The expectation that the greatest loss of life should have occurred in the oldest and youngest age classes was also met among the members of the Donner Party. Children beneath the age of 5 (62.5 percent mortality) and adults above the age of 49 (100 percent mortality) suffered the heaviest losses.

In general, it was better to be a younger member of the Donner Party than an older one. “For females, males, and the group as a whole, those who survived were younger on the average than those who did not. The males who survived were an average of 7.3 years younger than those who died, while surviving females averaged 6.3 years younger than those who died. For the entire group, survivors were on the average 7.5 years younger than non-survivors” (Grayson, 1990, p. 236 – 237) (Table 2).

**Table 2.** Average Ages, in Years, of Donner Party Members: Males and Females, Survivors and Non-Survivors. (Grayson, 1990, Table 10, p. 237)

	<b>Total Group</b>	<b>Survivors</b>	<b>Non-Survivors</b>
Females	17.5 (33)	15.6 (23)	21.9 (10)
Males	21.8 (52)	17.7 (23)	25.0 (29)
All Members Combined	20.1 (85)	16.7 (46)	24.2 (39)

Note: The total number of people involved is given in parentheses. The two members of the Donner Party whose ages are unknown are not included in this table.

According to Grayson (1990), the best contemporary mortality statistics available are likely those from Massachusetts (U.S. Bureau of the Census 1853). These statistics are presented in Table 3 and are used to provide a broad basis for comparison with the Donner Party data.

**Table 3.** Distribution of Mortality by Sex across Seventh Census Age Classes: Massachusetts, 1850. (Grayson, 1990, Table 8, p. 236)

<b>Age Class</b>	<b>% Males</b>	<b>% Females</b>
0 -- 4	7.11	6.05
5 -- 9	1.17	0.98
10 -- 14	0.45	0.57
15 -- 19	0.57	0.83
20 -- 29	1.00	1.17
30 -- 39	1.25	1.35
40 -- 49	1.51	1.33
50 -- 59	2.07	1.65
60 -- 69	3.48	2.96
70 -- 79	6.77	5.76
80 -- 89	15.00	13.47
90 -- 99	35.24	27.54

Grayson (1990) notes that there are some “oddities in the death rates for the Donner males. In particular, the death rate for males between 20 and 39 years of age was extremely high: 66.6 percent of the males of this age failed to survive” (p. 237) (see Table 1). Grayson goes on to state that, “whereas higher male than female mortality across all age categories is to be expected, male mortality in this particular age class needs to be explained, (compare, for instance, the rank orders of death rates for Massachusetts [Table 3] with those for the Donner Party males)” (p. 237) (Table 1). In an attempt to explain this abnormally high death rate, Grayson presents Table 4, which gives the fate, sex, and family group size for Donner Party members between 20 and 39 years of age who were in the Sierran encampment.

**Table 4.** Sex, Family Group Size, and Fate of Donner Party Members between 20 and 39 Years Old who Reached the Sierran Encampment. (Grayson, 1990, Table 11, p. 238)

<b>Name</b>	<b>Sex</b>	<b>Family Group Size</b>	<b>Fate</b>
Antoine	Male	1	Died walking out (snowshoe)
C. Burger	Male	1	Died in Sierra camp
J. Denton	Male	1	Died walking out (rescue)
E. Eddy	Female	4	Died in Sierra camp
M. Elliot	Male	1	Died in Sierra camp
J. Fosdick	Male	12	Died walking out (snowshoe)
J. Reinhardt	Male	1	Died in Sierra camp
S. Shoemaker	Male	1	Died in Sierra camp
J. Smith	Male	1	Died in Sierra camp
A. Spitzer	Male	1	Died in Sierra camp
C. Stanton	Male	1	Died walking out (snowshoe)
B. Williams	Male	2	Died in Sierra camp
W. Eddy	Male	4	Walked out (snowshoe)
S. Fosdick	Female	12	Walked out (snowshoe)
S. Foster	Female	13	Walked out (snowshoe)
W. Foster	Male	13	Walked out (snowshoe)
M. Graves	Female	12	Walked out (snowshoe)
N. James	Male	1	Walked out (rescue)
L. Keseberg	Male	4	Walked out (rescue)
P. Keseberg	Female	4	Walked out (rescue)
A. McCutcheon	Female	3	Walked out (snowshoe)
H. Pike	Female	13	Walked out (snowshoe)
M. Reed	Female	6	Walked out (rescue)
J. B. Trubode	Male	1	Walked out (rescue)
E. Williams	Female	2	Walked out (rescue)

“Those who are listed as ‘rescue’ [in Table 4] left the Sierran encampment with rescue parties sent from the Sacramento Valley. Of those leaving with rescue groups, 84.4 percent (38 of 45) survived, 5 of the 7 non-survivors being children 12 years old or younger. Those listed as

‘snowshoe’ [in Table 4] were among 15 people who attempted to walk from the Sierran encampment to the Sacramento Valley in late December...Of the 15 who made the attempt, 8 died. As in the Donner Party as a whole, losses among the show-shoers were differentially distributed across the sexes: 8 of 10 males died, but all 5 females survived.” (Grayson, 1990, p. 237-238)

Why was there such high mortality among males between 20 and 39 years of age? Grayson theorizes that “the extremely high mortality among Donner males between 20 and 39 years old is to be accounted for by the relatively small number of related individuals with whom they traveled.” (p. 239) Table 5 presents a summary of average kin group sizes for selected categories of Donner Party members who reached the Sierran encampment.

**Table 5.** Average Kin Group Sizes for Selected Categories of Survivors and Non-Survivors among Donner Party Members who Reached the Sierran Encampment. (Grayson, 1990, Table 12, p. 239)

Age Class	Survived?	Males	Females	Total
A. 20 -- 39	Yes	4.6 (N=5)	12.3 (N=8)	6.8 (N=13)
	No	2.1 (N=11)	4.0 (N=1)	2.3 (N=12)
B. 5 – 40	Yes	8.5 (N=20)	10.5 (N=19)	9.4 (N=39)
	No	5.5 (N=20)	4.0 (N=1)	5.4 (N=21)
C. 5 – 49	Yes	8.3 (N=21)	10.5 (N=19)	9.4 (N=40)
	No	5.5 (N=20)	12.0 (N=4)	6.5 (N=24)

Grayson (1990) shares that, “of the 25 individuals in the Sierran encampment between 20 and 39 years old, the average kin group size of the survivors was 6.8 individuals, whereas the average kin group size of the non-survivors was only 2.3 individuals...Surviving females between 20 and 39 years old had kin groups averaging 12.3 members, while the single female of this age who died had a kin group of only 4 members. Among males of this age, the survivors had kin groups averaging 4.6 members, whereas non-surviving males had kin groups averaging 2.1 individuals, less than half the size of the kin groups of the survivors.” (p. 239). Focusing on the 20 – 39 age group lends some support for the third expectation.

In Section 4 and Section 5, we discuss how we have used some of the information provided in Section 2 and Section 3 to develop a worksheet for introductory statistics students. We use the Donner Party data set to give students an interesting applied problem to work on as homework. The homework assignment has two parts. The goal for each part is to have students determine if a Donner Party member’s likelihood of survival was related to his/her age, gender, or family group size. The first part has students use descriptive statistics and graphs. The second part has students use two-way tables and marginal and conditional distributions.

## 4. Descriptive Statistics

The first goal for students is to use measures of center and spread and comparative box plots to help determine if a Donner Party member’s likelihood of survival was related to his/her age.

Students complete the questions on the Descriptive Statistics Worksheet (Appendix A1). Descriptive statistics are calculated separately for the ages of those who perished and those who survived and comparative box plots are constructed. Figure 2 displays results for the descriptive calculations.

Figure 2. Descriptive Statistics for Survivors/Non-survivors

**Mean, Median, and Standard Deviation of Ages**

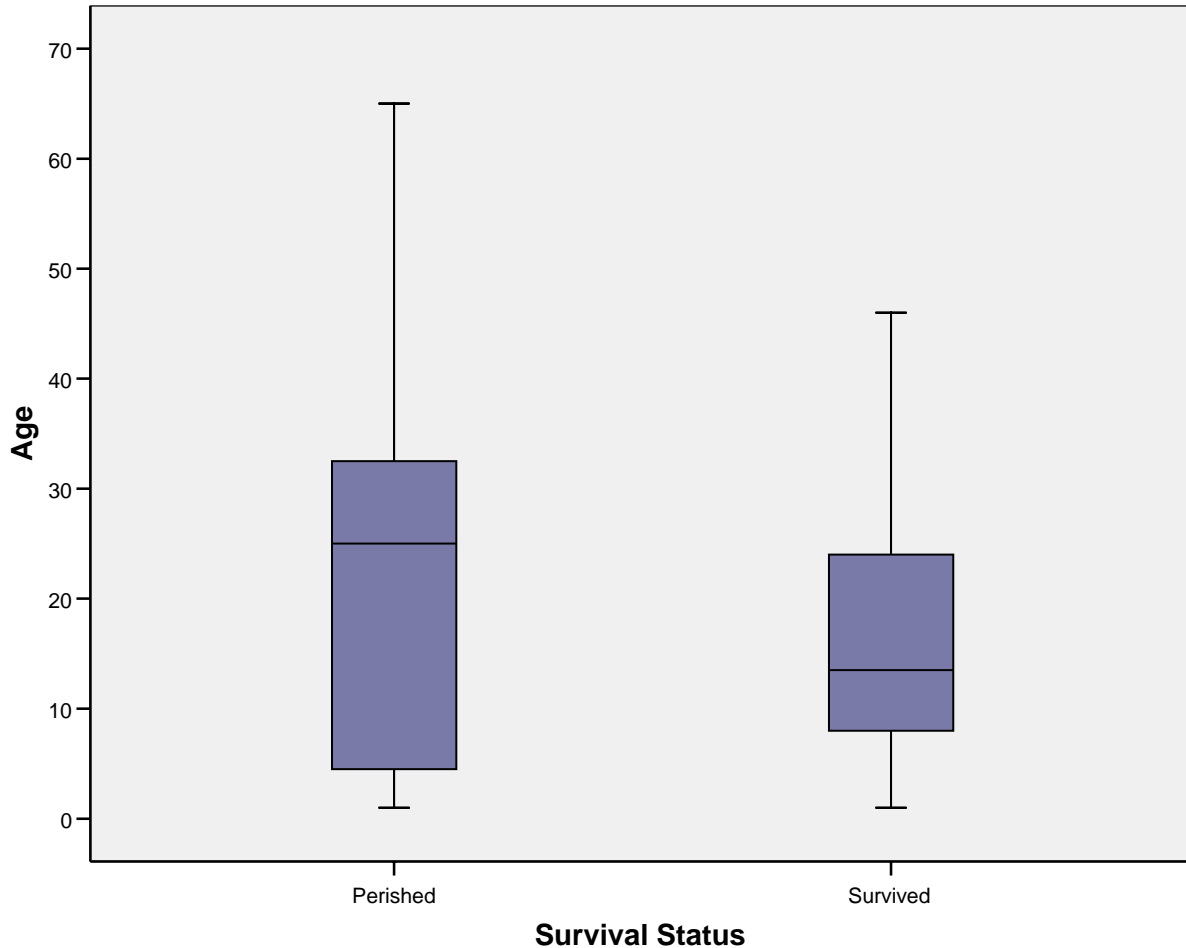
Status			Statistic
Age	Perished	Mean	24.18
		Median	25.00
		Std. Deviation	19.180
	Survived	Mean	16.65
		Median	13.50
		Std. Deviation	11.114

**First and Third Quartile of Ages**

			Percentiles	
			Quartile 1	Quartile 3
Weighted Average(Definition 1)	Age	Perished	4.00	35.00
		Survived	7.75	24.25
Tukey's Hinges	Age	Perished	4.50	32.50
		Survived	8.00	24.00

In Figure 3, we see comparative box plots for the ages of the survivors and non-survivors.

Figure 3. Comparative Box Plots for the Ages of Survivors vs. Non-Survivors



Students are asked to use the results of their descriptive calculations to write a statement giving their opinion about whether or not the ages of Donner Party members had an effect on likelihood of survival.

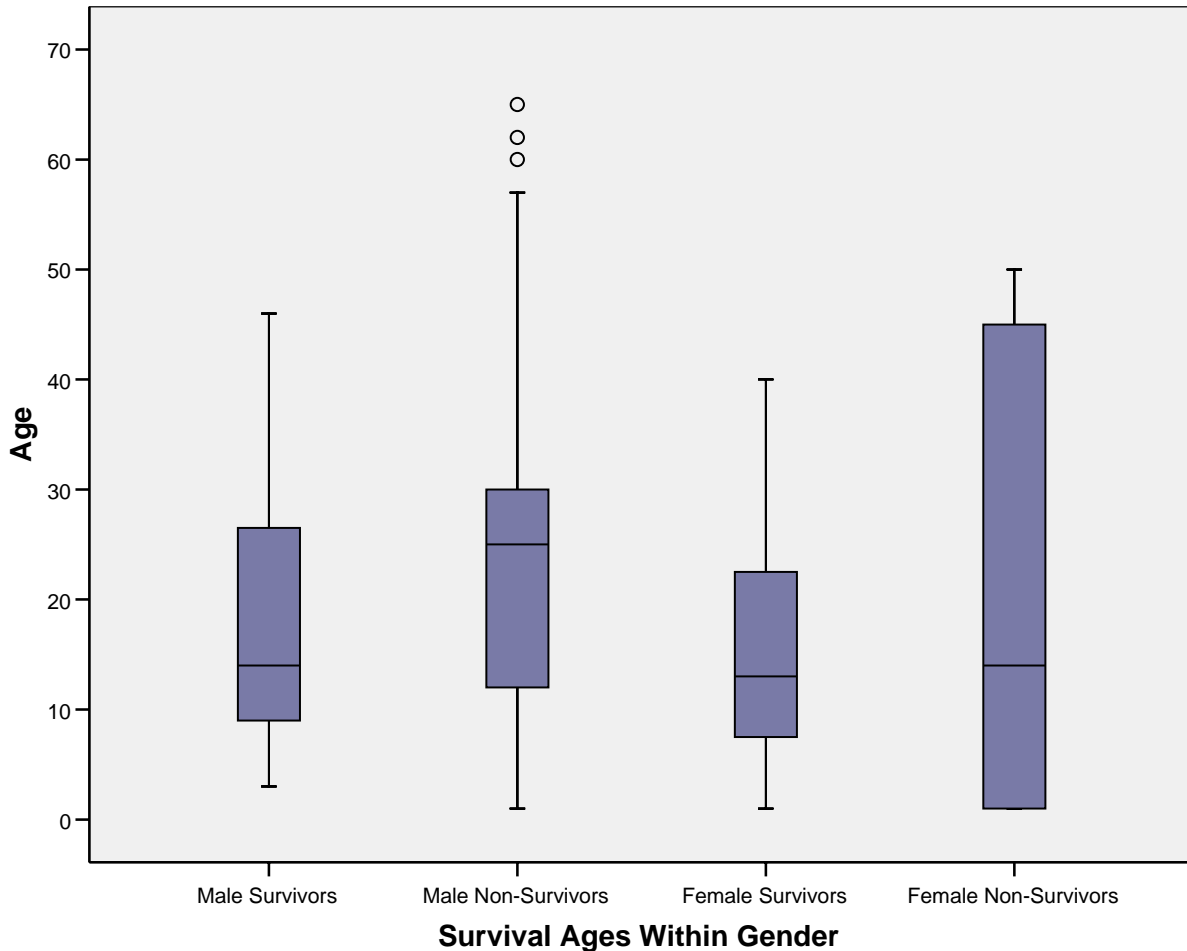
Notice that the mean and median ages for those who perished were 24.18 and 25 years, respectively. Compare these values to the mean and median ages for those who survived, which were 16.65 and 13.50 years, respectively. Thus, it seems that a ‘typical’ survivor was younger than a typical person who perished.

The standard deviation of those who perished was 19.18 years vs. a much smaller standard deviation of 11.11 years for those who survived (however, with younger ages, we would expect a smaller standard deviation). So, there was less variability in the ages of those who survived.

The box plots show that those who survived tended to be younger than those who perished. The median age for survivors was much lower than for those who perished, and we can also see that the third quartile was much lower for those who survived, compared to those who perished. However, the first quartile for those who perished was lower than the first quartile for those who survived. But, overall, 75% of the ages of those who survived were younger than the age for which 50% of those who perished were below.

In order to examine the relationship between age, gender, and likelihood of survival, students are asked to construct comparative box plots to display four age distributions: Female Survivors, Female Non-Survivors, Male Survivors, and Male Non-Survivors. In Figure 4, we see comparative box plots for the four age distributions.

Figure 4. Comparative Box Plots for the Ages of Survivors vs. Non-Survivors within Gender



Students state their opinions about whether or not the age/gender of a person had an effect on their likelihood of survival. From the comparative box plots, we can see that the Male Non-Survivors had the highest median age. The median ages of the Male Survivors, Female Survivors, and Female Non-Survivors are all relatively close. The ages of the Female Survivors had the least variability, whereas the ages of the Female Non-Survivors had the most variability.

As Grayson (1990) notes, the death rate for males between 20 and 39 years of age was extremely high: 66.6 percent of the males of this age failed to survive (see Table 1). In order to examine the relationship between family group size and likelihood of survival, we ask students to consider only the Donner Party members between 20 and 39 years old who reached the Sierran

encampment (see Table 4). Table 4 is presented (on the Descriptive Statistics Worksheet) and students are asked to use the information in the table to determine if family group size was related to likelihood of survival. Students calculate the mean family group size for Male Survivors (4.6 people) and Non-Survivors (2.09 people), and Female Survivors (8.125 people) and Non-Survivors (4 people). Based upon the calculations, students state whether it can be concluded that survivors tended to have a larger family group size relative to non-survivors across genders.

## 5. Two-Way Tables

We ask students to perform calculations on two-way tables to help answer the following questions: Was a Donner Party member’s likelihood of survival related to his/her gender? Was a Donner Party member’s likelihood of survival related to whether or not a person was an adult? Students complete the questions on the Two-Way Tables Worksheet (Appendix A2) and see an illustration of the usefulness of two-way tables for summarizing the relationship between two categorical variables. Constructing appropriate conditional distributions illustrates how to informally determine if two categorical variables are associated.

We ask students to calculate the overall percentage of deaths of the Donner Party members; 46% of the Donner Party members perished.

Students then construct a two-way table to display the variables Gender and Survival Status:

### Mortality by Gender

	Died	Survived
Male	30	23
Female	10	24

Students calculate the percentage of deaths within each gender obtaining the *conditional distribution of Survival Status given Gender*:

### Mortality by Gender

	Died	Survived
Male	57%	43%
Female	29%	71%

We ask students to use the conditional distribution to determine whether they believe that a Donner Party member’s likelihood of survival was related to his/her gender. As we can see from the conditional distribution, the death rate was considerably higher for Males (57%) than for Females (29%), so it appears that Gender and Survival Status are related.

Students construct a two-way table to display the variables Age and Survival Status, where a Donner Party member is considered to have been an Adult if he/she was 18 years old or older; the analysis assumes that Mr. and Mrs. Wolfinger should be included in the Adult category:

**Mortality by Age Group**

	Died	Survived
Adults	25	20
Children	15	27

Students calculate the percentage of deaths within each age category obtaining the *conditional distribution of Survival Status given Age*:

**Mortality by Age Group**

	Died	Survived
Adults	56%	44%
Children	36%	64%

We ask students to use the conditional distribution to determine whether they believe that a Donner Party member’s likelihood of survival was related to his/her age. As we can see from the conditional distribution, the death rate was considerably higher for Adults (56%) than for Children (36%), so it appears that Age Category and Survival Status are related.

**6. Conclusions**

The Donner Party data set is a real data set that many students will find intrinsically interesting. Asking students to analyze the data set helps with illustrating the usefulness of descriptive statistics such as measures of center and spread and boxplots to answer data-based questions. In addition, two-way tables can be constructed and conditional distributions calculated in order to examine the relationship between two categorical variables.

## Appendix A0: Background

### Survival in the Donner Party (Background adapted from Ramsey and Schafer 2002)

#### Background

In April 1846 the Donner and Reed families left Springfield, Illinois, for California by covered wagon. In July, 1846, the Donner Party, as it became known, reached Fort Bridger, Wyoming. There, its leaders decided to attempt a new and untested route to the Sacramento Valley. Having reached its full size of 87 people and 20 wagons, the party was delayed by a difficult crossing of the Wasatch Range and again in the crossing of the desert west of the Great Salt Lake. The group became stranded in the eastern Sierra Nevada mountains when the region was hit by heavy snows in late October. By the time the last survivor was rescued in April, 1847, 40 of the 87 members had died from famine and exposure to extreme cold.

The following table shows the names, sex, ages, and family group sizes of the survivors and non-survivors of the party. These data were used by noted anthropologist Donald Grayson to study the theory that females are better able to withstand harsh conditions than are males.

#### Donner Party Roster

Name	Sex	Age	P=Perished S=Survived	Family Group Size
Antonio	Male	23	P	1
Breen, Edward	Male	13	S	9
Breen, Isabella	Female	1	S	9
Breen, James	Male	4	S	9
Breen, John	Male	14	S	9
Breen, Mary	Female	40	S	9
Breen, Patrick	Male	40	S	9
Breen, Patrick, Jr.	Male	11	S	9
Breen, Peter	Male	7	S	9
Breen, Simon	Male	9	S	9
Burger, Charles	Male	30	P	1
Denton, John	Male	28	P	1
Dolan, Patrick	Male	40	P	1

Donner, Elitha	Female	14	S	16
Donner, Elizabeth	Female	45	P	16
Donner, Eliza	Female	3	S	16
Donner, Frances	Female	6	S	16
Donner, George	Male	62	P	16
Donner, George	Male	9	S	16
Donner, Georgia	Female	4	S	16
Donner, Isaac	Male	5	P	16
Donner, Jacob	Male	65	P	16
Donner, Leanna	Female	12	S	16
Donner, Lewis	Male	3	P	16
Donner, Mary	Female	7	S	16
Donner, Samuel	Male	4	P	16
Donner, Tamsen	Female	45	P	16
Eddy, Eleanor	Female	25	P	4
Eddy, James	Male	3	P	4
Eddy, Margaret	Female	1	P	4
Eddy, William	Male	28	S	4
Elliott, Milton	Male	28	P	1
Fosdick, Jay	Male	23	P	12
Fosdick, Sarah	Female	22	S	12
Foster, George	Male	4	P	13
Foster, Sarah	Female	23	S	13
Foster, William	Male	28	S	13
Graves, Eleanor	Female	15	S	12
Graves, Elizabeth	Female	47	P	12

Graves, Elizabeth	Female	1	S	12
Graves, Franklin, Jr.	Male	5	P	12
Graves, Franklin.	Male	57	P	12
Graves, Jonathan	Male	7	S	12
Graves, Lavina	Female	13	S	12
Graves, Mary	Female	20	S	12
Graves, Nancy	Female	9	S	12
Graves, William	Male	18	S	12
Halloran, Luke	Male	25	P	1
Hardkoop, Mr.	Male	60	P	1
Herron, William	Male	25	S	1
Hook, Solomon	Male	14	S	16
Hook, William	Male	12	P	16
James, Noah	Male	20	S	1
Keseberg, Ada	Female	3	P	4
Keseberg, Lewis	Male	32	S	4
Keseberg, Lewis, Jr.	Male	1	P	4
Keseberg, Philippine	Female	32	S	4
McCutchen, Amanda	Female	24	S	3
McCutchen, Harriet	Female	1	P	3
McCutchen, William	Male	30	S	3
Murphy, John	Male	15	P	13
Murphy, Lavina	Female	50	P	13
Murphy, Lemuel	Male	12	P	13
Murphy, Mary	Female	13	S	13
Murphy, Simon	Male	10	S	13

Murphy, William	Male	11	S	13
Pike, Catherine	Female	1	P	13
Pike, Harriet	Female	21	S	13
Pike, Naomi	Female	3	S	13
Pike, William	Male	25	P	13
Reed, James	Male	46	S	6
Reed, James Jr.	Male	5	S	6
Reed, Margret	Female	32	S	6
Reed, Patty	Female	8	S	6
Reed, Thomas	Male	3	S	6
Reed, Virginia	Female	12	S	6
Reinhardt, Joseph	Male	30	P	1
Shoemaker, Samuel	Male	25	P	1
Smith, James	Male	25	P	1
Snyder, John	Male	25	P	1
Spitzer, Augustus	Male	30	P	1
Stanton, Charles	Male	35	P	1
Trubode, J. B.	Male	23	S	1
Williams, Baylis	Male	24	P	2
Williams, Eliza	Female	25	S	2
Wolfinger, Mr.	Male	?	P	2
Wolfinger, Mrs.	Female	?	S	2

## Appendix A1: Descriptive Statistics Worksheet

### Instructions:

Your goal is to answer the following question: Was a Donner Party member's likelihood of survival related to his/her age? To help answer this question, complete the following.

1. Calculate descriptive statistics for the ages of the Donner Party members. Obtain the calculations separately for those who Perished and those who Survived.

#### Perished

mean = \_\_\_\_\_

standard deviation = \_\_\_\_\_

first quartile = \_\_\_\_\_

median = \_\_\_\_\_

third quartile = \_\_\_\_\_

#### Survived

mean = \_\_\_\_\_

standard deviation = \_\_\_\_\_

first quartile = \_\_\_\_\_

median = \_\_\_\_\_

third quartile = \_\_\_\_\_

2. Construct comparative box plots for the ages of those who Perished and those who Survived.

3. Write a statement, using complete sentences, giving your opinion about whether or not a person's age had an effect on their likelihood of survival. You must refer to your descriptive statistics and your comparative box plots. Your statement must be thorough.

4. In order to examine the relationship between age, gender, and likelihood of survival, construct comparative box plots to display four age distributions: Female Survivors, Female Non-Survivors, Male Survivors, and Male Non-Survivors. Write a paragraph stating your opinion about whether or not a person's age/gender had an effect on their likelihood of survival. You must refer to your comparative box plots. Your statement must be thorough.

5. The death rate for males between 20 and 39 years of age was extremely high: 66.6 percent of the males of this age failed to survive. Why was there such high mortality among males of this age? Age-related differences in male basal metabolic rates cannot account for this pattern. Perhaps the extremely high mortality among Donner males of this age is to be accounted for by the relatively small number of related individuals with whom they traveled. Analyses of the relationship between mortality and the degree to which individuals participate in social networks have routinely shown an inverse relationship between these two variables: those individuals with larger social networks have reduced mortality rates.

The following table gives the sex, family group size, and fate of Donner Party Members between 20 and 39 years old who reached the Sierran Encampment.

<b>Name</b>	<b>Sex</b>	<b>Family Group Size</b>	<b>Fate</b>
Antoine	Male	1	Died walking out (snowshoe)
C. Burger	Male	1	Died in Sierra camp
J. Denton	Male	1	Died walking out (rescue)
E. Eddy	Female	4	Died in Sierra camp
M. Elliot	Male	1	Died in Sierra camp
J. Fosdick	Male	12	Died walking out (snowshoe)
J. Reinhardt	Male	1	Died in Sierra camp
S. Shoemaker	Male	1	Died in Sierra camp
J. Smith	Male	1	Died in Sierra camp
A. Spitzer	Male	1	Died in Sierra camp
C. Stanton	Male	1	Died walking out (snowshoe)
B. Williams	Male	2	Died in Sierra camp
W. Eddy	Male	4	Walked out (snowshoe)
S. Fosdick	Female	12	Walked out (snowshoe)
S. Foster	Female	13	Walked out (snowshoe)
W. Foster	Male	13	Walked out (snowshoe)
M. Graves	Female	12	Walked out (snowshoe)
N. James	Male	1	Walked out (rescue)
L. Keseberg	Male	4	Walked out (rescue)
P. Keseberg	Female	4	Walked out (rescue)
A. McCutcheon	Female	3	Walked out (snowshoe)
H. Pike	Female	13	Walked out (snowshoe)
M. Reed	Female	6	Walked out (rescue)
J. B. Trubode	Male	1	Walked out (rescue)
E. Williams	Female	2	Walked out (rescue)

Use the information in the table above to determine if family group size was related to likelihood of survival. Perform the following calculations:

Male Survivors mean family group size: \_\_\_\_\_

Male Non-Survivors mean family group size: \_\_\_\_\_

Female Survivors mean family group size: \_\_\_\_\_

Female Non-Survivors mean family group size: \_\_\_\_\_

Based upon the calculations, would you conclude that family group size was related to likelihood of survival? Explain.

## Appendix A2: Two-Way Tables Worksheet

### Instructions:

Your goal is to answer the following questions: Was a Donner Party member's likelihood of survival related to his/her gender? Was a Donner Party member's likelihood of survival related to his/her age? To help answer these questions, complete the following.

1.

(a) Calculate the overall percentage of deaths: \_\_\_\_\_% of the Donner Party members died.

(b) Calculate the percentage of the *overall* deaths that were male and female:

Male	Female

2. Construct a two-way table to display the variables Gender and Survival Status:

Mortality by Gender

	Died	Survived
Male		
Female		

3. Calculate the percentage of deaths within each gender. You have calculated the *conditional distribution of Survival Status given Gender*.

Mortality by Gender

	Died	Survived
Male		
Female		

4. Do you think that a Donner Party member's likelihood of survival was related to his/her gender? Explain.

5. Construct a two-way table to display the variables Age and Survival Status:

**Notes:**

- Consider a Donner Party member to be an Adult if he/she was 18 years old or older.
- Include Mr. and Mrs. Wolfinger in the Adult category.

Mortality by Age Group

	Died	Survived
Adults		
Children		

6. Calculate the percentage of deaths within each age category. You have calculated the *conditional distribution of Survival Status given Age*.

Mortality by Age Group

	Died	Survived
Adults		
Children		

7. Do you think that a Donner Party member's likelihood of survival was related to his/her age? Explain.

## References

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