

Epidemiology of Disaster The Donner Party (1846-1847)

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I examined the pattern of mortality in the Donner Party, a group of emigrants who became trapped with inadequate food stores in the winter snows of the Sierra Nevada mountains in 1846-1847. The party consisted of 90 persons; the median age was 19.5 years (range, 1 to 70), 55 (61%) were male, and 72 (80%) were traveling with family members. Of the 90 persons, 42 (47%) died. Multivariate regression analysis indicated that age was the most important mortality risk factor. The lowest mortality (10%) was seen in the 6- to 14-year age group, and the highest was for persons younger than 6 years (relative risk = 6.6; 95% confidence interval [CI], 2.3 to 9.6) and persons 35 years or older (relative risk = 8.4; 95% CI, 3.4 to 10.2). Persons traveling without other family members had a relative risk of 2.0 (95% CI, 1.0 to 2.5). Men and boys were also at increased risk (relative risk = 2.0; 95% CI, 1.0 to 2.9). These factors can identify persons at increased risk for mortality in nutritionally stressed populations, and efforts to maintain intact family structures may improve survival.

(McCurdy SA: Epidemiology of disaster—The Donner Party [1846-1847]. *West J Med* 1994; 160:338-342)

"Well, Ma, if you never see me again, do the best you can."

8-Year-old Martha (Patty) Reed, taking leave of her mother and rescuers to return to the cabin at Donner Lake to care for her 3-year-old brother.

Starvation is an enduring aspect of the human condition and reduces the capacity to withstand environmental stresses, including cold.¹ In the history of the American West, the experience of the Donner Party, a group of emigrants who became trapped with inadequate food stores in the Sierra Nevada mountains in the winter of 1846-1847, has fascinated generations with its tales of privation, cannibalism, and heroism. Despite the high level of interest in the Donner Party, little attention has been paid to epidemiologic aspects of the disaster and how factors such as age, sex, and social support affected survival. Although these events occurred nearly a century and a half ago, they hold contemporary relevance as political and natural upheavals cause starvation and forced migration in present-day populations.^{2,3}

I briefly review the historical events and the results of an epidemiologic analysis of the Donner Party mortality experience using data abstracted from accounts of the journey.^{4,9}

Historical Background

In the United States of the mid-1840s, population growth and economic instability led many to conclude that their futures lay farther west, in Oregon and California. Contributing to this view was the philosophy of

"manifest destiny" that held that the United States would ultimately encompass the rest of the North American continent west of the Mississippi River. California was of particular interest because of its fertile lands and the likelihood that it would soon pass from Mexican possession. Thousands began to pack up their belongings in prairie wagons and gather in Independence, Missouri, to embark on the Emigrant Road.

Travelers risking their lives and fortune to travel west had a relatively narrow window in which to make the journey. They would have to leave in the spring and traverse the Great Plains to cross the Rockies and the Sierra Nevada, a mountain range in eastern California, before the winter snows. They were encouraged in their journey by expansionist politicians, newspaper editors, and pamphleteers. One of these was Lansford W. Hastings, whose book, *The Emigrants' Guide to Oregon and California*, proved fatally influential for the Donner Party.

The usual route for California-bound emigrants entailed a northward journey into present-day Idaho before turning south and west to California (Figure 1). Hastings championed a new route—The Hastings Cutoff—that appeared to shave 350 to 400 miles from the journey. He proposed leaving the main Emigrant Road at Little Sandy Creek in present-day Wyoming, proceeding to Fort Bridger, traveling south of the Great Salt Lake and through the Salt Desert, and rejoining the main California Trail in Nevada.

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This work was supported by the National Institute of Environmental Health Sciences Environmental/Occupational Medicine Academic Award Program, grant No. K07-ES00250-02.

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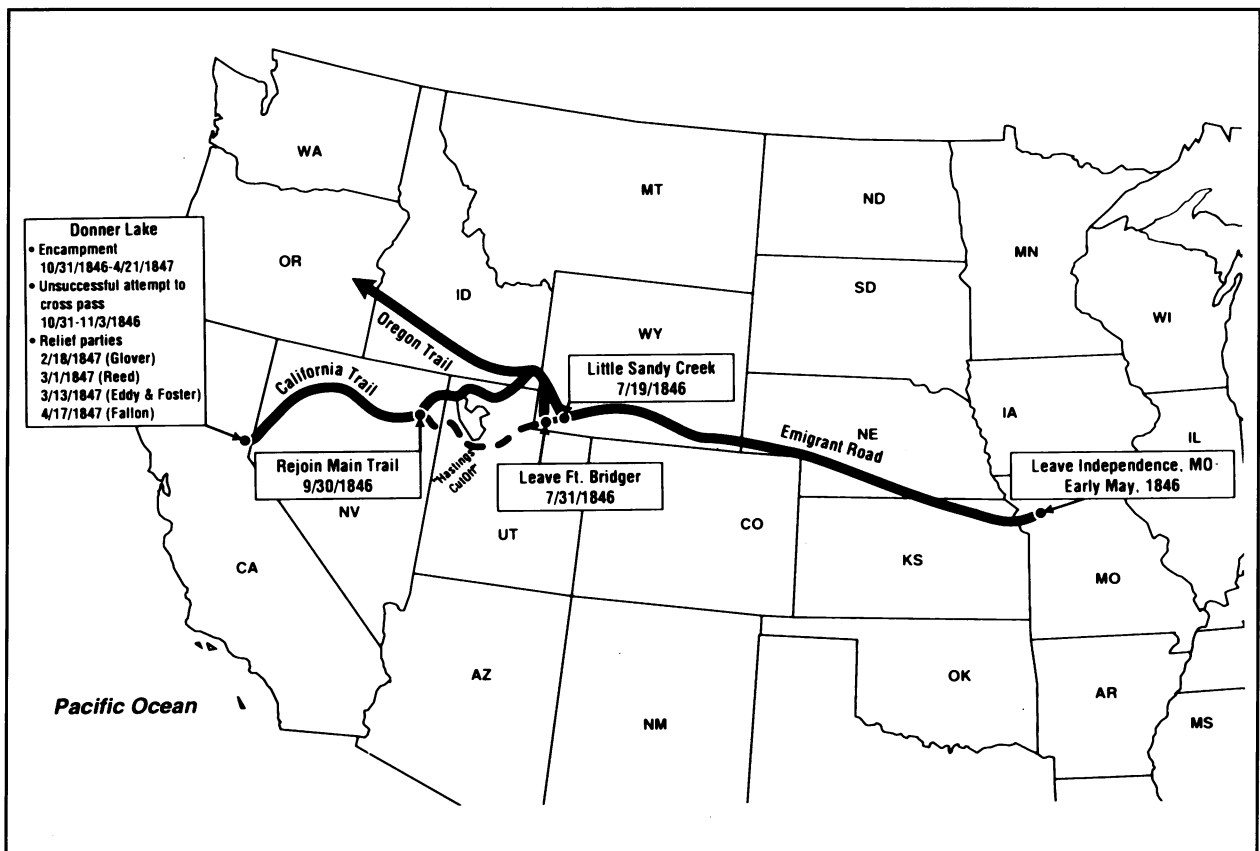


Figure 1.—The map shows the approximate route and dates of the Donner Party, 1846.

At Little Sandy Creek, a group of emigrants coalesced and made the decision to follow the Hastings Cutoff. Prominent among them was James Frazier Reed, a well-to-do businessman from Illinois. His mother-in-law, Sarah Keyes, had already become the first casualty of the group, having died of “consumption” (presumably tuberculosis) earlier on the journey. The company elected as their leader a prosperous farmer from Springfield, Illinois, Captain George Donner.

At Fort Bridger the emigrants stopped to rest in late July 1846. From there a connecting trail existed that represented their last chance to turn north and rejoin the main Emigrant Road. But many in the group had read Hastings’s pamphlet describing the shortcut and, eager to push on, ignored warnings to rejoin the main trail. On July 31, 1846, the Donner Party headed west on the Hastings Cutoff.

Almost immediately, the group experienced unanticipated hardships. They had to hack a road through the Wasatch mountains, a task that took them about three weeks. Crossing the Great Salt Desert, which Hastings had described as a two-day journey of 40 miles, was in reality an 80-mile journey requiring five days. Finally they meandered through the Ruby Mountains of eastern Nevada before rejoining the California Trail. The “shortcut” took nearly two months of precious time and was actually 125 miles longer than the original Emigrant Road.

From the time the Donner Party chose the Hastings

Cutoff, social cohesiveness unraveled as difficulties multiplied. One person was simply left behind to die when he became unable to walk and members were unwilling to carry him in a wagon. Arguments erupted. James Reed killed a man during an altercation. Initially threatened with hanging, he was banished from the party. He and a companion crossed the Sierra Nevada ahead of the company and before the winter snows. Ironically, his expulsion contributed to the party’s salvation because he organized relief efforts that later brought in survivors.

Aware of their peril should they fail to cross the Sierra Nevada mountains before the winter snows, the remaining emigrants pushed on with increasing desperation. They had been weakened by the delay and had lost numerous oxen and wagons. Struggling through the early snows, the party reached the crest of the Sierras near Truckee Lake (now Donner Lake) on November 3, 1846. Exhausted from their ordeal and unable to go farther, they halted, intending to make the final crossing, now within sight, in the morning. These plans were soon dashed by a storm, as through the night of November 3 it snowed continuously. When the emigrants looked around them the following morning, they were surrounded by 3-m-high drifts of new snow. Defeated, they turned back to Donner Lake to establish camp.

The party now consisted of 81 persons huddled in makeshift shelters near the lake. Of the 88 persons who left Independence in the spring, 6 had died (3 of trauma,

2 of “consumption,” and 1 abandoned in the wilderness), 3 had crossed the mountains in advance of the party, and the party had been joined by 2 Native American guides sent by Capt John Sutter.

As their situation grew increasingly desperate, a group of 15 members—10 men and 5 women—attempted to hike over the pass on snowshoes and on to Sutter’s Fort in Sacramento, California. Calling themselves the “Forlorn Hope,” the group left in mid-December, taking six days’ rations. Beset by snowstorms and losing their way, they wandered for 33 days before coming to a small settlement. Eight of the men and none of the women perished. Those who lived survived only because they resorted to cannibalism and were able to kill game en route. In addition, they were helped by members of a Native American village. Ironically, the two Native American guides from Fort Sutter were consumed after probably being murdered by a member of the group.

With the arrival of this group of survivors, efforts for rescue attained new urgency. On February 18, 1847, the first relief party reached the lake. The rescuers surveyed a scene of misery and destruction. Corpses lay piled in the snow, and the survivors were gaunt skeletons, barely subsisting on boiled animal hides. Over the next two months, several relief parties journeyed to the camp. Because of the difficulty in reaching the lake, they were unable to bring in large stores of food and brought out only small groups of the strongest survivors. Paradoxically, the situation for those remaining grew more desperate, and the group resorted to cannibalism to survive. On April 21, Lewis Keseberg, the last remaining member of the party, left Donner Lake.

Materials and Methods

Accounts of the Donner Party experience were re-

TABLE 1.—Demographic Characteristics and Mortality of Donner Party, 1846-1847

Characteristic	Frequency, n (%)	Mortality Rate, n/N (%)	Adjusted Mortality Ratio* (95% Confidence Interval)
Number in party	90 (100)	42/90 (47)	--
Age, years			
Unknown	2 (2)	2/2 (100)	--
≤5	19 (21)	11/19 (58)	6.6 (2.3-9.6)
6-14	21 (23)	2/21 (10)	1.0†
15-34	34 (38)	16/34 (47)	3.3 (0.7-7.8)
≥35	14 (16)	11/14 (79)	8.4 (3.4-10.2)
Sex			
Male	55 (61)	32/55 (58)	2.0 (1.0-2.9)
Female	35 (39)	10/35 (29)	1.0†
Traveling with family members			
Yes	72 (80)	27/72 (38)	1.0†
No	18 (20)	15/18 (83)	2.0 (1.0-2.5)

*Computed as relative risk for mortality in reference to the category (†) with lowest mortality rate, adjusted for simultaneous effects of age category, sex, and whether or not traveling with other family members.
†Reference category.

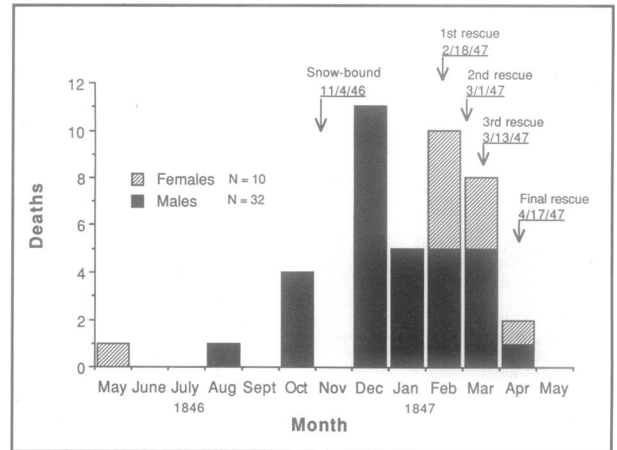


Figure 2.—The graph shows the mortality distribution, deaths by month and sex.

viewed to determine sex, age, and whether or not traveling with other family members in the party.^{4,6,9} Families traveling with married children and grandchildren were considered one family unit. The senior Donner brothers were each married with children and were considered separate family units. Data were entered into a VAX 3100 computer and analyzed using procedures available in the SAS software system.¹⁰ Age was categorized as 5 years or younger, 6 to 14, 15 to 34, and 35 or older. Group comparisons for age were made using the Wilcoxon test; group comparisons for categorical variables were made using the χ^2 test.¹¹ Subsequent stratified analysis revealed no evidence of interactions, and logistic regression using a main effects model was employed to examine the association between mortality and possible risk factors.¹¹ Data were complete for all but two subjects for whom age was unavailable; these subjects were excluded from the final multivariate analysis. The adjusted odds ratio estimates were converted to adjusted relative risk for mortality (mortality ratio), using as reference the category with the lowest mortality rate for each variable.

Results

There were 90 subjects (Table 1), including James Reed’s mother-in-law, who died crossing the plains, and two Native American guides (Luís and Salvador) sent to the Donner camp by Capt John Sutter. There were 11 family groups ranging in size from 2 to 13 persons (median 7) and consisting of 72 persons. The other 18 persons (20%) traveled without family members; all were adult men. The median age was 19.5 years (range, 1 to 70). Survivors were younger than those who perished (16.4 years versus 26.0 years; $P < .05$), and persons traveling with family members were younger than those traveling alone (18.8 years versus 29.5 years, $P < .001$). Female members were younger than male members, but the difference was not significant (mean, 18.8 versus 22.0 years).

Of the entire party, 42 died (Figure 2). Survival rates were higher for women, the 6- to 14-year age group, and persons traveling with other family members. Among

subjects who died, female members survived longer than male members, and their deaths were more likely to occur in the latter half of the mortality distribution ($P < .01$). Multiple logistic regression analysis (Table 1) indicated that age exerted the strongest effect, with the highest mortality for those younger than 6 years and persons 35 years or older. Male sex was also independently associated with a twofold increased risk for mortality. The increased risk for men and boys persisted even after removing the group of men traveling without family members. Although persons traveling without other family members also showed a twofold increased risk for mortality, this reflects the experience of adult men because all women and children were traveling with a family member. In comparison with women in the two older age categories, men traveling without family members had a relative risk of 2.6 (95% confidence interval 1.7 to 2.8). Among those traveling with family, there were no significant differences in survival between the family groups, and family group size did not exert a clear effect.

Discussion

This report examines the mortality experience of a well-known historical disaster involving a group of 90 persons traveling to California in 1846. The most important risk factor from the multivariate analysis was age. Traveling without other family members and male sex were also important, and each carried a twofold increased risk. The analysis reflects the experience of the entire party, although not all members participated in the complete journey. Physical hardship and nutritional deficiency exerted a winnowing effect throughout the entire travail of nearly a year. A number escaped the most harrowing experiences at Donner Lake through early death or good fortune, whereas the two Native American guides joined the group late and perished in its fatal denouement. Because survival was affected by the exposures and tribulations associated with the journey, I have included all members in the analysis. Limiting analysis to the 81 members entrapped at the lake yielded substantively similar results.

The immediate cause of death cannot be ascertained for most of the subjects. Although several deaths were related to trauma, most were due to complications of starvation and hypothermia or other rigors associated with their ordeal. Starvation causes a reduction in the basal metabolic rate and a loss of body mass, reducing the ability to maintain body temperature in cold environments.¹² Starvation also increases susceptibility to infection,¹² and this was a known or likely factor in several deaths. A vitamin deficiency disorder, such as scurvy, may also have contributed, although I found no mention or suggestion of this in historical accounts.

The elevated death rates for persons at the extremes of the age distribution have been observed in other studies of nutritionally stressed populations.^{12,13} Famine in cold climates occurred during World War II in several locations, including Leningrad and parts of Holland,^{12,13} and younger and older age groups were disproportionately affected.



Figure 3.—A statue was erected to commemorate the Donner Party at Donner Lake. The pedestal shows the height of the snow (6.7 m, or 22 ft) in the winter of 1846-1847.

Recent experience in refugee camps in Somalia during an eight-month period of the 1992 famine documents a death rate of 74% for children 5 years and younger, a twofold to threefold increase over that of persons older than 5 years.¹⁴ The increased risk for early childhood and older age groups is probably due to a reduced ability to provide for oneself and to adapt to nutritional, physical, and infectious stresses.

Improved survival was seen for persons traveling with family members, and the basis for this is unclear. It appeared that members of family groups formed strong support networks, saving food and other provisions for their members rather than sharing them with the group. Persons traveling alone did not have the benefit of these networks, and the cohesiveness and support provided by the Donner Party as a whole was weak. Selection bias may also have been present, in that persons traveling alone may have been less fit physically or psychologically than persons traveling with family members.

Men had an increased risk for mortality after adjusting for the effects of age and traveling with family members. The gender effect was most striking in the group attempting to snowshoe out in mid-December; all five women and only two of ten men survived. Survival advantage for starvation-affected women has been reported in other population groups¹² and in studies of animals.¹⁵ The basis for this is unclear, but may relate to an increased loss of protein and lean body mass in nutritionally stressed men.¹⁵ In addition, women have lower daily caloric needs and maintain a higher percentage of body

fat,¹² which may help them to survive in conditions of cold and starvation. Sex-related behavioral differences—that is, performance of high-risk or strenuous tasks—may also play a role.

Cannibalism is one of the best-known aspects of the disaster, but its effect on survival is difficult to ascertain based on these data. Because of the strong social stigma attached to it, information may not be reliable. In addition, the likelihood of engaging in cannibalism is related to the extremity of the situation. Persons dying early would not have had the same opportunity to engage in cannibalism because of the time needed to break down social taboos against it. Cannibalism clearly provided a source of nutrition, and it is obvious that the members of the “Forlorn Hope,” who wandered for 33 days, having taken only 6 days’ rations, would not have survived had they not consumed those who died. On the other hand, the two family groups with the highest survival rates (the Breens and the Reeds, all of whose snowbound members survived) are considered not to have engaged in cannibalism.

Although the Donner Party disaster occurred nearly 150 years ago, it retains contemporary relevance because the factors associated with increased mortality likely have a biologic basis or are due to enduring behavioral characteristics. Two risk factors for mortality observed in this study—age and male sex—cannot be altered or mitigated, but they may be used to identify high-risk groups in starvation-affected populations. The observation that family structure was an important independent determinant of mortality also suggests intervention strategies for similar disasters. Specifically, measures to keep family groups intact so they may draw on their internal support network may improve survival.

Epilogue

Nearly a century and a half have elapsed since the Donner Party disaster, yet the story possesses an enduring power and immediacy. The last members of the original party survived into the 1930s, well within the scope of living memory. These events have left many visible threads in the fabric of the West. Truckee Lake was renamed Donner Lake. A museum and memorial statue showing the depth of the snow (6.7 m) in that winter of 1846-1847 (Figure 3) have been established near the encampment. No winter of similar severity has occurred since.

Several members of the party went on to become prominent figures in California. Patrick Breen kept a diary that provides an invaluable firsthand account of the disaster; this document is kept at the Bancroft Library at the University of California, Berkeley. James Reed became a leading citizen in San Jose. His daughter, Martha (Patty), had weakened during an initial rescue attempt and had to return to Donner Lake, subsequently to be rescued by her father. Throughout her journey she carried a doll, which is now on display at Sutter’s Fort in Sacramento.

An interesting historical footnote is that the last person to be rescued from the site, Lewis Keseberg, was vilified by a public deeply offended, in part, by his uninhibited and lurid descriptions of his cannibalism during the ordeal. He settled in Sacramento and opened a restaurant—an ironic career choice, considering the basis for his notoriety. He died in 1895, at the age of 81, at the Sacramento County Hospital, which later became the University of California, Davis, Medical Center.

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