Making it to the Millennium: A Study of the Death Dip, Death Rise Phenomenon Surrounding Holiday Periods in Specific Demographic Areas

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“Making it to the Millennium”
A Study of the Death Dip, Death Rise Phenomenon Surrounding Holiday Periods in Specific Demographic Areas

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Senior Honors Thesis
Boston College
Advisor: Professor Sara Moorman
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# Table of Contents

Acknowledgements................................................................................................. 3  
Abstract.................................................................................................................. 4  
Introduction ........................................................................................................... 5  
  Theoretical Context............................................................................................... 8  
  The Timing of Death and Community Ceremonies.............................................. 9  
  Community Celebrations Versus Anniversary Dates.......................................... 12  
  Evaluating Previous Research............................................................................ 13  
  Moving Research Forward................................................................................... 13  

Data and Methods.................................................................................................. 14  
  Data...................................................................................................................... 14  
  Methods................................................................................................................ 15  
  Data Analysis....................................................................................................... 18  
  Table 1.................................................................................................................. 20  

Results..................................................................................................................... 21  
  Table 2.................................................................................................................. 23  
  Figure 1................................................................................................................ 24  
  Table 3.................................................................................................................. 25  
  Table 4.................................................................................................................. 25  
  Figure 2................................................................................................................ 26  

Discussion.............................................................................................................. 27  
  How Results Compare to Other Studies.............................................................. 28  
  What This Means................................................................................................. 29  
  Implications of What This Means........................................................................ 31  
  Limitations........................................................................................................... 31  

Conclusion............................................................................................................. 33  

References............................................................................................................. 34
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Finally, I wish to thank my parents for their support and encouragement throughout this project.
Abstract

My grandfather passed away four years ago of cancer. Every family member made their way to Cape Cod during his last few days in order to say their good-byes. It was not until the day after the last grandchild said good-bye that my grandfather passed away. We all felt that he wanted to wait so he could say good-bye to all of us.

I have talked to many people who have had similar experiences with family members and friends. Some people have held on to see people one last time; others have wanted to make another birthday, while others have wanted to see another holiday that is special to them.

In the present study, I explored the death dip, death rise phenomenon. Specifically, I analyzed mortality rates around the New Year’s Day, Christmas, and Pioneer Day. I examined two days before and two days after the holiday within specific cities (Project 1: New York City, Los Angeles, Chicago; Project 2: Salt Lake City, Boise, Little Rock; Project 3: Atlanta, Oklahoma City, New Orleans) within a five-year period (1998-2002). The data observed found a death dip and death rise present for New Year’s in New York City and Chicago. There was not a death dip or death rise observed for Project 2, Project 3, or Los Angeles in Project 1.
To what extent is the timing of death a social event influenced not only by the condition of the body but also by a person’s relationship with others? Anecdotal evidence that people close to death may succeed in living long enough to celebrate a special family or community event has prompted investigation by sociologists as early as Emile Durkheim in 1912 (1965). More recent research has examined birthdays, Thanksgiving, New Year’s, Christmas, and numerous other holidays or events.

Findings in current research yielded varying and inconsistent results. Some studies found evidence that people delay their deaths (e.g., Pelham and Shimizu 2008). Others found inconclusive results (e.g., Byers and Zeller 1987), and still others found no effects at all (e.g., Hade and Young 2004). Such inconsistent findings could be due to limitations in these studies. Still, other analyses have examined the validity of these studies. Critics have pointed out issues with the methodological grouping of death data around specific events (Bazerman and Schulz 1980, Royer and Smith 1998). The possibility remains that these studies have not been systematic enough to clarify the question. For example, some studies have looked at religious association while others have looked at specific age groups or ethnic groups. Similarly, studies have ranged from looking at death rates in periods of years, months, and days. These inconsistencies could contribute to the lack of significant observed findings. In addition, there has been little attempt to link a holiday with a specific place. Yet, cities have specific cultural characteristics that might make particular holidays salient. The research presented here aims to connect specific holidays with certain cities to take into account that cities with
specific demographics may value an event more than other cities with a different demographic composition.

Durkheim suggests theoretical reasons to expect that dates held in high social esteem might prove important in shaping human lives. In his book, *On Morality and Society*, Durkheim explains that religious holidays and events are important to a group starting at the individual level and continuing through the community because of the personal meaning people in society give to them. An individual who feels a commitment to his or her community will give holidays and special community events personal high importance. Communities are created around ceremonial activities and people who are unified with their community will participate in these ceremonies (Durkheim 1961).

Can the death dip preceding the turn of the Millennium in New York City (Shimizu and Pelham 2008) be found in other cities where New Year's celebrations are traditionally observed with less gusto? Are the days before Christmas related to a death dip in notably Christian cities in the Bible Belt, but not in other cities of similar sizes? Are the days immediately preceding Pioneer Day—a lesser-known holiday enthusiastically observed by members of the Mormon faith—associated with a death dip in Salt Lake City, but not in cities where only a minority of the population has even heard of it? Are the days immediately postdating these holidays related to a death rise within any of these cities? If one could show that holidays are associated with patterns in death rates, particularly in urban populations in which the selected events have special salience, then one could argue more persuasively that people may time their deaths in relation to those events.
Using data from the Social Security Death Index (SSDI), I will examine mortality rates immediately before and after three days that are held in high regard by specific demographic segments of the American population: Christmas (December 25th), the turn of the last millennium (January 1st, 2000\(^1\)), and Pioneer Day (July 24th), over a five year period. For each holiday, I will examine death rates in a triad of cities that are similar in size but diversified by cultural characteristics that might make a particular holiday particularly salient.

Research goals are:

1) to calculate mortality rates around holiday periods and to identify death dips and rises associated with each holiday:

   \[
   \text{I hypothesize that pre- and post- holiday mortality rates will vary significantly in each city in comparison to the death rate in the city at midyear. Relative to midyear dates, pre- holiday dates will have a low death rate and the post- holiday dates will have a higher death rate. Further, I hypothesize that the death rates on holidays and in the days immediately following will be significantly higher than the death rates in the days immediately preceding the holiday.}
   \]

2) to compare differences across cities:

   \[
   \text{I hypothesize that pre- and post- holiday mortality rates will vary significantly in each city in comparison to the other cities when attached with a holiday. I expect that New York City will show more significant death rates around New Year’s than Los Angeles and}
   \]

\(^1\) The Millennium actually began January 1\(^{st}\), 2001, but January 1\(^{st}\), 2000 is the date that was significant to people so that is the date I examined in regards to the Millennium.
Chicago. I expect that Salt Lake City will show more significant death rates around Pioneer Day than Boise and Little Rock. I expect that Oklahoma City will show more significant death rates around Christmas than Atlanta and New Orleans.

3) to calculate mortality rates around New Year’s within each of three urban areas with distinctive demographic profiles by year:

I hypothesize that the year 2000 will see more significant variation in the death rate than the other years examined.

This research promises to reveal that social influences may be more far-reaching in people’s lives- up to and including their deaths- than anyone typically suspects. It may also tell us something about how the cultural characteristics of urban populations might translate into practical outcomes.

Theoretical Context

Durkheim theorized about influences societies have on individuals. In The Elementary Forms of the Religious Life, Durkheim discusses the rituals that are a large aspect of religious life. These rituals are an important component in what makes religions physically and socially feasible (Durkheim 1965). That is, beyond the moral standpoints of a religion, the physical ritual brings members together and allows them to experience their beliefs as a community.

Durkheim also discusses the ways in which these community and religious rituals are able to thrive in On Morality and Society. By attaching meaning to a material object and a ritual within religion, members are able to express their feelings physically. Having symbols and objects that a collective group will use with
the same meaning gives people a feeling of universality (Durkheim 1973). Religious and community ceremonies allow societies to come together under a feeling of collective unity. This gives people a sense of belonging and thus a feeling of obligation and dedication to the community. Communities use the observance of specific days as a way to express a collective ceremony. A specific day of the year can be dedicated to a special event within a community and by recognizing that day communities can participate in rituals either personal or universal to the group.

**The Timing of Death and Community Ceremonies**

Current research has found results that are consistent with Durkheim’s theories that community based ceremonies have an important influence on the individual. Researchers have suggested that a death dip will be observed before a special event or holiday because people who are sick and close to death will want to prolong his or her life in order to experience the event. Intuitively, a death rise would then be observed after the holiday or event has commenced because those who were holding off on death would subsequently have nothing left to wait for and thus would pass away. A study conducted on the United States population for Christmas and Thanksgiving observed a death dip before the holidays and a death rise after them (Pelham and Shimizu 2008). This study observed two days prior to the holiday and two days after the holiday over a 16-year period. The study’s findings suggest the importance people may attribute to these holidays. Another study conducted on the Jewish population in California during Passover similarly found a death dip in the week before and a death rise in the week after the Jewish holiday (King and Phillips 1988). Passover is a Jewish holiday that celebrates the
emancipation of the Jewish people from slavery in Egypt. A death dip and death rise phenomenon may have been observed due to the possibility that this population places great importance on this holiday and wants to hold onto life to experience one more Passover (King and Phillips 1988). Research conducted on the Chinese-American population during the Harvest Moon Festival also found a significant death dip and death rise phenomenon. The Harvest Moon Festival is a Chinese holiday that is of high importance to this population (Phillips and Smith 1990). Findings in another study show a rise on specific holidays such as New Year’s and birthdays, raising the possibility that people held on long enough to reach the holiday date even if it was not important to survive past that date (Pelham and Shimizu 2008). Other research supports the possibility that death rates are associated with meaning that people assign to specific days. For example, a study examined all Japanese and Chinese deaths in the United States in a 25-year period around the fourth of every month. The number four is considered an unlucky number for this population. This study showed an increase in death rates on the fourth of every month for this population compared to the other days of the month (Phillip, et al. 2001).

While such findings are consistent with the conclusion that people can postpone death slightly in order to experience a special event, other contemporary research has found results that are inconsistent with the death dip and death rise phenomenon. For example, a study conducted in Ohio observed mortality rates around Christmas. A death rise was observed after Christmas, but there was not a preceding death dip over the three-year period that was examined (Byers and Zeller
More research examined Christmas in North East England. This study did not observe a death dip or death rise immediately before or after one individual holiday, but observed mortality rates to increase leading up to and through Christmas. It was not until the New Year that a death dip occurred (Milne 2005). Further, a study conducted in New York City—a city with many Jewish residents—found a death rise after Yom Kippur, but no drop before (Feldman and Phillips 1973). This could mean the death rate is remaining regular before the holiday, but something about the holiday is correlated with an increase in the death rate afterwards.

Some contemporary research has not observed either a death dip or a death rise. One study conducted with profoundly intellectually disabled patients in Texas attempted to examine this theory in regards to Christmas, Thanksgiving, date of institutionalization, and their birthdays (Cleland, Mason and Rago 1981). Another study was conducted with psychiatric patients in Houston, Texas surrounding Christmas, New Year’s Day, and their birthdays (Greiner and Pokorny 1989-1990). Neither of these studies observed a death dip or death rise. This could have been due to the fact that both of their research populations had individuals with some sort of mental disability, which could inhibit the population’s ability to observe the event or associate importance with the date. A study of cancer patients in Ohio over an 11-year period, which similarly did not observe a significant death dip or death rise around Christmas, Thanksgiving, or the patient’s birthday (Hade and Young 2004) cannot be dismissed for the same reason. However, it is possible that the negative findings might have reflected the impact that the patient’s serious disease
has had on the patient’s body, perhaps taking away the ability to postpone death. Another study tried to see if there was more of a will to live among famous people, assuming that because of public attention, famous people would hold their birthday to a higher standard than non-famous people. There were no significant death dips or death rises for this population (Angermeyer, Kuhn and Osterwald 1987).

Community Celebrations versus Anniversary Dates

Not all research on the timing of death assumes that people are attempting to live long enough to experience a celebration in the community. Other studies examine “anniversary events” such as birthdays or other significant milestones that people may wish simply to achieve rather than to observe together with others. These studies predict a death increase on the date of a special event. For example, one study conducted on the entire United States population saw a death increase on New Year’s and birthdays (Pelham and Shimizu 2008). Another study conducted on the Chinese-American population in California was likewise consistent with the idea of an anniversary date, but associated a death rise with a day with a negative connotation. The study found an increase in deaths on the fourth of the month, a number considered unlucky to many people in this population (Phillips at al. 2001). This study argues that this is due to the negative association this population holds to this number and the stress that occurs due to the association (Phillips et al. 2001). Both of these studies observed an increase in mortality rates on the special event date.
Evaluating Previous Research

Some of these studies have not held up well to critical examination. One re-examination looked at eighteen different studies that have attempted to observe a death dip and death rise phenomenon and suggested alternative interpretations of the data (Freedland and Skala 2004). For example, the study that examined the death dip and death rise phenomenon for Chinese-Americans during the Harvest Moon Festival could have been due to “differences in adherence to medication regimens or level of medical care” or “unspecified psychobiological processes” rather than the interpretation that the date is the influencing factor in the person’s death (Freedland and Skala 2004 p. 383). Critics also suggest that the study of the Jewish population in California during Passover could have observed a death dip and death rise because of “unspecified psychosomatic processes” (Freedland and Skala 2004 p. 383). Other re-examinations have suggested similar conclusions (Royer and Smith 1998, Bazerman and Schulz 1980).

Moving Research Forward

This study will be looking at holidays within specific cities with demographic profiles that have high salience for a particular holiday. This level of refinement is rare in past studies. The Passover study on Jewish Californians (King and Phillips, 1988), the Harvest Moon Festival study (Phillips and Smith 1990) and the number four study, both on Chinese-Americans (Phillips et al. 2001) have done this and have found significant death dips and rises. All of these studies examined a certain population with regard to a holiday or event that they hypothesized the population
would find more salient than other populations and have been able to find significant associations.

We should not yet give up the efforts to examine the extent to which the timing of death may reflect social influences. There are many explanations for why the results of previous research are inconsistent with one another. The methods used in this study will aim to establish a consistent basis for how this question should be examined in the future. In this study, the Millennium, Pioneer Day, and Christmas will be examined based on population demographics with the expectation that a death dip and death rise will be observed because specific populations will invest in these holidays with a higher salience than others.

Data and Methods

Data

This project used data from the Social Security Death Index (SSDI) in the years 1998-2002. The SSDI is a population-based dataset of the United States. It lists over 92 million United States citizens’ deaths starting from the year 1936 and continuing through today’s date. Specific information available from the SSDI includes the last name, first name, social security number, state issued, birth date, death date, and last residence. The death date was used in this study (“Ancestry.com: U.S., Social Security Death Index, 1935- Current” 2013). The Social Security Death Index is accessible through genealogy websites such as ancestry.com, genealogybank.com, and familysearch.org. This study used genealogybank.com.

Because no individuals were living and all data were publically accessible, under the 45 CFR 46, Institutional Review Board approval was not required.
Methods

I conducted three separate analyses, each of which examined death rates around a holiday in a triad of cities that are similar in size but diversified by cultural characteristics that might make a particular holiday especially salient.

Using Stata, I calculated the death rate for each city. First, for each of the five years (1998-2002), I found the number of deaths in each city on the holiday itself, as well as (a) two days before, (b) two days after, and (c) a midyear day opposite the holiday. Second, I found the city’s total population in July. Third, I calculated the death rate by conducting a simple ratio equation looking at the number of deaths in each day divided by the July population size. This ratio allowed me to compare deaths across cities that differed in size. The denominator, the July population, is a best estimate of the city’s population, but is imperfect because of births, deaths, migration, visitors, etc.

The people who died in the year 2000 consisted of 37,288 people for New York City, 14,245 people for Los Angeles, and 20,770 people for Chicago. There were 2,867 people that died in Salt Lake City, 1,222 people in Boise, and 2,470 people in Little Rock. There were 4,343 people that died in Oklahoma City, 5,435 people in Atlanta, and 4,223 people in New Orleans.

*The Turn of the Millennium:* New York City celebrates New Year’s unlike any other city in the United States. For over 100 years, New York City has hosted the turn of the New Year in Times Square. Now, people all over the world can tune into their televisions and watch the ball drop in Times Square from their homes, while an estimated one million people celebrate in Times Square itself (“Times Square”
The evening consists of celebrity musical performances and concludes with balloons and confetti as the ball drops to commemorate the beginning of a new year.

Project 1 explored deaths before and after the recent millennium change in 2000 and explored deaths before and after the New Year over a five-year period. Taking the whole population of each city, I compared the death rates two days prior and two days after the New Year and compared these findings by city and the average death rate during the year. I did this in New York City, Los Angeles, and Chicago. I expected New York City to see a more significant death dip and death rise phenomenon during the Millennium and other New Year’s compared to Los Angeles and Chicago.

*Pioneer Day*: Pioneer Day is an official holiday in Utah. Celebrated on July 24th, Pioneer Day commemorates the entry of the first Mormons into Salt Lake City. The followers of the Church of Jesus Christ of the Latter-day Saints commemorate this event with fireworks, parades, rodeos, re-enactments of the first Mormons entering Salt Lake City on the Mormon trail, and parties. Since it is an official holiday of the state, most businesses shut down on this day (“The Day of ’47” 2010).

Project 2 focused on deaths immediately preceding and following Pioneer Day. I took the whole population of each city and compared the death rates for the two days before and two days after Pioneer Day, also comparing findings to the average death rate per city annually. This was done in Salt Lake City, Boise, and Little Rock. I expected Salt Lake City to have a more significant death dip and death rise surrounding this holiday due to its large Mormon population compared to Boise or Little Rock. These three cities are of similar size and of similar general demographic
profiles but are different in their religious compositions: 56% of the population in Salt Lake County is Mormon, 15.1% of the population in Ada County (Boise) is Mormon, and 0.6% of the population in Pulaski County (Little Rock) is Mormon. Table 1 displays the religious demographics for each city. In short, Salt Lake City has a very large Mormon population, Boise has a slightly smaller Mormon population, and Little Rock has a very small Mormon population (“The Association of Religion Data Archives” 2010). This makes it likely that each city will assign differing salience to this Mormon holiday.

Christmas: Christmas is an important holiday for many Americans, but especially for Christians. Christmas celebrates the birth of the Christian messiah, Jesus Christ. It is celebrated on December 25th and is one of the most celebrated Christian holidays in the United States (“History: Christmas” 2013). Project 3 examined the number of deaths surrounding Christmas. I took the whole population of each city and compared the death rates for the two days before and two days after Christmas Day, also comparing these rates with the average death rates per city at midyear. Estimations were calculated for Oklahoma City, Atlanta, and New Orleans. All of these cities have similar population sizes, which range from about 400,000 to 500,000 people and are in a similar geographic area (i.e., the South). All of these cities have similar cultural characteristics, with the exception of their religious demographics. I expected Oklahoma City to show a more prominent death dip and death rise phenomenon compared to Atlanta and New Orleans. This is because Oklahoma City is a heavily Christian city. Oklahoma City County is 63.6% Christian, Fulton County (Atlanta) is 47.4% Christian, and Orleans County (New
Orleans) is 41% Christian ("The Association of Religion Data Archives" 2010). This makes it likely that each city will assign differing salience to this particular Christian holiday. Oklahoma City should place more salience upon Christmas than Atlanta or New Orleans.

Data Analysis

Aim 1:

First, I tested whether the daily death rate varied from day to day within each city in the specified time around the holiday. To test whether there was a significant change day to day during this five-day period, I used an analysis of variance. This showed me if a death dip and/or death rise phenomenon was present in each city for the specified holiday.

With approximately 690 deaths in the five-day period in New York City, I can be 95% certain of detecting fluctuations of 3.73% or more in the death rate. With approximately 219 deaths in the five-day period in Los Angeles, I can be 95% certain of detecting fluctuations of 6.57% or more in the death rate. With approximately 415 deaths in the five-day period in Chicago, I can be 95% certain of detecting fluctuations of 4.76% or more in the death rate.

With approximately 35 deaths in the five-day period in Salt Lake City, I can be 95% certain of detecting fluctuations of 16.47% or more in the death rate. With approximately 20 deaths in the five-day period in Boise, I can be 95% certain of detecting fluctuations of 21.74% or more in the death rate. With approximately 24 deaths in the five-day period in Little Rock, I can be 95% certain of detecting fluctuations of 18.76% or more in the death rate.
With approximately 65 deaths in the five-day period in Oklahoma City, I can be 95% certain of detecting fluctuations of 12.07% or more in the death rate. With approximately 91 deaths in the five-day period in Atlanta, I can be 95% certain of detecting fluctuations of 10.19% or more in the death rate. With approximately 65 deaths in the five-day period in New Orleans, I can be 95% certain of detecting fluctuations of 12.06% or more in the death rate.

Aim 2:

Then, to compare the different cities over the five-day period, another analysis of variance was conducted. I hypothesized that there would be a significantly statistically greater death dip and death rise for each holiday in one of the cities specified with the holiday. For example, I expected to see a significantly statistically greater death dip and death rise in Salt Lake City during Pioneer Day than in Boise or Little Rock.

Aim 3:

Then, to compare the years surrounding the Millennium, another analysis of variance was conducted. I hypothesized that there would be a statistically significant difference for the year 2000 compared to the other years that were examined.
Table 1

**Year 2000 Demographic Statistics**

<table>
<thead>
<tr>
<th></th>
<th>New York City % (N)</th>
<th>Los Angeles % (N)</th>
<th>Chicago % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Population</strong></td>
<td>100 (8,008,278)</td>
<td>100 (3,694,820)</td>
<td>100 (2,896,016)</td>
</tr>
<tr>
<td><strong>Religious Affiliation</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roman Catholic</td>
<td>36.7 (2,939,038)</td>
<td>39.9 (1,474,233)</td>
<td>39.9 (1,155,510)</td>
</tr>
<tr>
<td>Mainline Protestant Denominations</td>
<td>6.9 (552,571)</td>
<td>3.5 (129,319)</td>
<td>5.3 (153,489)</td>
</tr>
<tr>
<td>Evangelical Protestant Denominations</td>
<td>2 (160,166)</td>
<td>6.1 (225,384)</td>
<td>5 (144,801)</td>
</tr>
<tr>
<td>Church of Jesus Christ of Latter-Day Saints</td>
<td>0.2 (16,017)</td>
<td>1 (36,948)</td>
<td>0.1 (2,896)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Salt Lake City % (N)</th>
<th>Boise % (N)</th>
<th>Little Rock % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Population</strong></td>
<td>100 (181,743)</td>
<td>100 (185,787)</td>
<td>100 (183,133)</td>
</tr>
<tr>
<td><strong>Religious Affiliation</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roman Catholic</td>
<td>5.9 (10,723)</td>
<td>12.2 (22,666)</td>
<td>8.1 (14,834)</td>
</tr>
<tr>
<td>Mainline Protestant Denominations</td>
<td>2 (3,635)</td>
<td>6 (11,147)</td>
<td>12.4 (22,709)</td>
</tr>
<tr>
<td>Evangelical Protestant Denominations</td>
<td>2 (3,635)</td>
<td>10.4 (19,322)</td>
<td>37 (67,759)</td>
</tr>
<tr>
<td>Church of Jesus Christ of Latter-Day Saints</td>
<td>56 (101,776)</td>
<td>15.1 (28,054)</td>
<td>0.6 (1,099)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Oklahoma City % (N)</th>
<th>Atlanta % (N)</th>
<th>New Orleans % (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Population</strong></td>
<td>100 (506,132)</td>
<td>100 (416,474)</td>
<td>100 (484,674)</td>
</tr>
<tr>
<td><strong>Religious Affiliation</strong>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roman Catholic</td>
<td>6.4 (32,393)</td>
<td>8.8 (36,650)</td>
<td>28.1 (136,193)</td>
</tr>
<tr>
<td>Mainline Protestant Denominations</td>
<td>14.9 (75,414)</td>
<td>17.6 (73,299)</td>
<td>4.8 (23,264)</td>
</tr>
<tr>
<td>Evangelical Protestant Denominations</td>
<td>42.3 (214,094)</td>
<td>21 (87,460)</td>
<td>8.1 (39,259)</td>
</tr>
<tr>
<td>Church of Jesus Christ of Latter-Day Saints</td>
<td>0.6 (3,037)</td>
<td>0.3 (1,249)</td>
<td>0.06 (291)</td>
</tr>
</tbody>
</table>

*Note. Percentages do not sum to 100 because the categories are not exhaustive of religious affiliations.*

* Religious affiliation was calculated by county.
Results

Aim 1:

In Project 1, there were no significant differences in death rates found for Los Angeles in the days surrounding New Year’s. However, in New York City and Chicago there were significant differences. In New York City there was a medium difference in death rates between December 31st and January 1st. There was a small, but still significant, difference in death rates between December 30th and January 1st, January 1st and January 2nd, and January 1st and January 3rd. A large difference is one that is 1.5 and greater, a medium difference is between 1.0 and 1.49, and a small difference is less than 1.0. All differences were significant at the level of $p < .05$. In Chicago there was a large difference in death rates by day between December 30th and January 1st. There were medium differences in death rates by day between December 31st and January 1st and between January 1st and January 2nd. All differences were significant at the level of $p < .05$. January 1st always had the largest of the death rates in both cities. This identifies a death dip prior to the New Year and death rise on the holiday, meaning that the New Year is a milestone date. Results are presented in Table 2 and Figure 1.

In Project 2 there were no significant differences within Salt Lake City, Boise, or Little Rock in the days surrounding Pioneer Day. In Project 3 there were no significant differences found within New Orleans, Atlanta, or Oklahoma City in the days surrounding Christmas. Upon discovering these findings, I chose to analyze data from four additional dates, two at either end of the five-day period. For example, in Project 2, July 20th, July 21st, July 27th, and July 28th were added to the
data. Adding these dates did not alter the results; there were still no significant differences. I did not go on to test the later hypotheses for Project 2 and Project 3 because those hypotheses are predicated on finding significant differences in hypothesis 1, which did not occur for these projects.

Aim 2:

In Project 1, there was a difference found between New York City and Chicago during the New Year. Chicago had a larger death rise than New York City. Results are presented in Table 3.

Aim 3:

In Project 1, there were no significant differences found for Los Angeles in the years surrounding the Millennium. However, in New York City and Chicago, there were significant differences at the level of $p < .05$. In New York City there was a medium difference in death rates between the years 2000 and 2002. There was a small difference in death rates between the years 1998 and 2000, 1999 and 2001, 2000 and 2001, 1998 and 2002, and 1999 and 2002. In Chicago there was a large difference in death rates between the years 1999 and 2000 and between 2000 and 2001. There was a medium difference in death rates between the years 1998 and 2000 and between 2000 and 2002. This identifies a gradual death rise through the year 2000 and a dip in deaths after the year 2000, showing the year 2000 had the most deaths, making it the most important year for people to live to. Results are presented in Table 4 and Figure 2.
Table 2  
*Differences in Death Rate within Cities by Day*

<table>
<thead>
<tr>
<th>New Year's</th>
<th>Dec. 30(^a)</th>
<th>Dec. 31(^b)</th>
<th>Jan. 1(^c)</th>
<th>Jan. 2(^d)</th>
<th>Jan. 3(^e)</th>
<th>July 1(^f)</th>
<th>(F)</th>
<th>Significant subgroup differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York City</td>
<td>1.32 (0.11)</td>
<td>1.15 (0.44)</td>
<td>2.31 (0.42)</td>
<td>1.39 (0.23)</td>
<td>1.40 (0.14)</td>
<td>1.71 (0.22)</td>
<td>10.39</td>
<td>ac, bc, cd, ce</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>1.20 (0.15)</td>
<td>2.73 (3.32)</td>
<td>1.59 (0.30)</td>
<td>4.43 (4.03)</td>
<td>4.30 (4.35)</td>
<td>1.20 (0.14)</td>
<td>1.45</td>
<td>none</td>
</tr>
<tr>
<td>Chicago</td>
<td>1.78 (0.47)</td>
<td>2.09 (0.27)</td>
<td>3.48 (0.73)</td>
<td>2.01 (0.62)</td>
<td>2.37 (0.24)</td>
<td>2.73 (0.47)</td>
<td>7.75</td>
<td>ac, bc, cd</td>
</tr>
<tr>
<td>Pioneer Day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July 22(^a)</td>
<td>3.85 (1.60)</td>
<td>5.06 (1.53)</td>
<td>3.96 (1.06)</td>
<td>3.63 (2.39)</td>
<td>4.62 (2.29)</td>
<td>3.41 (1.18)</td>
<td>0.65</td>
<td>none</td>
</tr>
<tr>
<td>Salt Lake City</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boise</td>
<td>1.51 (0.70)</td>
<td>1.83 (0.87)</td>
<td>1.72 (0.59)</td>
<td>3.01 (1.40)</td>
<td>2.05 (0.70)</td>
<td>1.94 (0.98)</td>
<td>1.68</td>
<td>none</td>
</tr>
<tr>
<td>Little Rock</td>
<td>3.50 (1.31)</td>
<td>4.48 (1.05)</td>
<td>3.39 (1.36)</td>
<td>2.51 (0.91)</td>
<td>3.71 (1.52)</td>
<td>3.06 (0.91)</td>
<td>1.50</td>
<td>none</td>
</tr>
<tr>
<td>Christmas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dec. 23(^a)</td>
<td>2.73 (1.11)</td>
<td>1.98 (0.58)</td>
<td>2.57 (0.67)</td>
<td>2.61 (0.91)</td>
<td>2.60 (0.71)</td>
<td>1.79 (0.60)</td>
<td>1.25</td>
<td>none</td>
</tr>
<tr>
<td>Oklahoma City</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atlanta</td>
<td>3.36 (0.24)</td>
<td>4.71 (1.57)</td>
<td>4.18 (1.04)</td>
<td>3.51 (0.36)</td>
<td>3.12 (1.03)</td>
<td>2.88 (1.00)</td>
<td>2.44</td>
<td>none</td>
</tr>
<tr>
<td>New Orleans</td>
<td>2.35 (0.37)</td>
<td>2.76 (0.74)</td>
<td>2.27 (0.86)</td>
<td>2.15 (0.37)</td>
<td>2.48 (0.74)</td>
<td>1.82 (0.49)</td>
<td>1.29</td>
<td>none</td>
</tr>
</tbody>
</table>

*Notes.* The death rate is the ratio of deaths to the whole population of each city during the specified dates. Means and standard deviations are shown. One-way analysis of variance (ANOVA) tests with post-hoc Scheffe tests were used to evaluate significant differences (at \(p < .05\)) across the dates within each city. All tests had 5 degrees of freedom.
Figure 1

*Differences in Death Rate within Cities by Day*
Table 3

Differences in the Death Rise between Cities

<table>
<thead>
<tr>
<th>New Year's</th>
<th>New York City$^a$</th>
<th>Chicago$^b$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean rise in death rate</td>
<td>0.99 (0.46)</td>
<td>1.41 (0.70)</td>
<td>10.35</td>
</tr>
</tbody>
</table>

Notes. The death rate is the ratio of deaths to the whole population of each city during the specified dates. Means and standard deviations are shown. A one-way analysis of variance (ANOVA) test was used to evaluate significant differences (at $p < .05$) between the cities. The test had 30 degrees of freedom.

Table 4

Differences in the Rise in Death Rates within Cities by Year

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New York City</td>
<td>1.07 (0.16)</td>
<td>1.33 (0.15)</td>
<td>1.47 (0.38)</td>
<td>0.72 (0.17)</td>
<td>0.35 (0.16)</td>
<td>33.42</td>
<td>ac, bd, cd, ae, be, ce, de</td>
</tr>
<tr>
<td>Chicago</td>
<td>1.21 (0.22)</td>
<td>1.37 (0.39)</td>
<td>2.52 (0.43)</td>
<td>0.86 (0.27)</td>
<td>1.10 (0.61)</td>
<td>20.46</td>
<td>ac, bc, cd, ce</td>
</tr>
</tbody>
</table>

Notes. The death rate is the ratio of deaths to the whole population of each city during the specified dates. Means and standard deviations are shown. One-way analysis of variance (ANOVA) tests with post-hoc Scheffe tests were used to evaluate significant differences (at $p < .05$) across the years within each city. All tests had 8 degrees of freedom.
Figure 2

*Differences in the Rise in Death Rates within Cities by Year*
Discussion

Aim 1:

I had hypothesized that there would be a significant difference in death rates per day when examining the days around each holiday period. This was only true for New Year’s in New York City and Chicago. The mid-year death rates were average compared to the fluctuations seen in the holiday periods examined for New York City and Chicago.

Aim 2:

I had hypothesized that pre- and post-holiday mortality rates would vary significantly in each city in comparison to other cities when the city is attached with a holiday. I hypothesized that the differences would be largest in each city for the holiday corresponding to a city’s collective characteristics. This was not true for any of the projects. I was expecting to see a more significant death rate difference in New York City than Chicago because New Year’s is associated with Times Square. I saw a more significant death rise in Chicago during the New Year and the Millennium than in New York City.

Aim 3:

I hypothesized that the year 2000 would have a more significant rise in death rates than the other years. A large death rise was seen in 2000 in Chicago compared to the death rises in 1999 and 2001. There was a medium death rise seen in 2000 compared to the death rises in 1998 and 2002. In New York City, there was only a small death rise for the year 2000 compared to the death rises in other years.
How Results Compare to Other Studies:

Previous studies that have looked at New Year’s have found a significant rise in deaths on January 1st (Pelham and Shimizu 2008). This is because this type of holiday is considered an anniversary or milestone date and people want to survive to this date but do not have a motivation to celebrate the entire day. Consistent with prior research, this study found an increase in deaths on New Year’s in New York City and Chicago. Also, the year 2000 saw more deaths on the date of January 1st in New York City and Chicago than the other years observed in this study.

Unlike the present study, previous studies that have looked at Christmas have found significant differences. A death dip and death rise were observed around Christmas in a study that examined two days prior and two days after the holiday occurred (Pelham and Shimizu 2008). Another study observed a death rise after Christmas but there was no death dip prior to the holiday (Byers and Zeller 1987). Consistent with the present study, two other studies did not observe a death dip or death rise. One examined patients with profound intellectual disabilities and the other examined psychiatric patients (Cleland, Mason, and Rago 1981 and Greiner and Pokorny 1989-1990). Another study that examined cancer patients also did not observe a death dip or a death rise surrounding Christmas (Hade and Young 2004). A study conducted in England that examined Christmas did not see a death dip until the New Year where mortality rates kept increasing through Christmas (Milne 2005).

The present study is the first to examine Pioneer Day. I expected to see a prominent death dip and death rise around Pioneer Day in Salt Lake City because a
large percentage of the population is Mormon. I believed that because this population is largely Mormon, Pioneer Day would have more meaning than in any other place examined. Although this seemed like it could have interesting findings, there were no significant differences. Another study that used a very specific population was one conducted in California. The Harvest Moon Festival is a Chinese holiday that is very important to this Chinese-American population. This study examined death rates around this holiday for the Chinese-American population and found a significant death dip and death rise phenomenon (Phillips and Smith 1990).

**What This Means:**

Project 1 shows there were significant differences in the death rates in New York City and Chicago in the days surrounding the New Year. This could mean that New Yorkers and Chicagoans view the celebration of New Year’s as an important event, one that is important enough to experience one more time before dying. This could be due to the celebrations that surround New Year’s such as the dropping of the ball in Times Square. In New York City and Chicago there were also significant findings in the years surrounding the Millennium, which could show that the Millennium was more important to live through to people than most other New Year’s. There was a larger death dip and death rise seen in Chicago than seen in New York City. At this time I cannot speculate as to why Chicago had a more significant death dip and death rise than New York City had. Further research should investigate why this happened. The results found in Project 1 in New York City and Chicago show that people could have the ability to delay death for a short period of time in order to experience something important. The turning of a new
year is an event that many people value, especially if it is a new millennium. There were no significant differences in death rates in Los Angeles in the days surrounding New Years and the years surrounding the Millennium. This could mean that the population of Los Angeles does not view New Year’s to be as important as the populations of New York City or Chicago do. It is also possible that the weather has an effect on these results. In New York City and Chicago, the New Year occurs at a time when it is typically very cold. Having a holiday to celebrate is something to look forward to and enjoy when the weather is not enjoyable for most people. In Los Angeles, it is warm and sunny year round so winter holidays feel the same as summer holidays. Also, deaths are probably more likely in the cold because the weather is more demanding on the body.

Project 2 shows no significant differences in death rates in the days surrounding Pioneer Day. This could mean that this holiday is not as important to the Mormon population as I had assumed. It is possible that the Mormon population holds more significance to other events in their religion and this holiday is not the most important.

Project 3 shows no significant differences in death rates in the days surrounding Christmas. This could mean that this holiday is not as important to the Christian population as I had assumed. It is possible that because of the commercialism of the holiday, Christmas has lost the emotional importance that it used to have. For some people, Christmas is about celebrating the birth of their savior. For other people, Christmas is about gifts and marketable goods. Due to this, Christmas may no longer be as meaningful to people.
Implications of What This Means:

The results in Project 1 show that people in New York City and Chicago do have the will to live for this special event. This new information could be valuable for hospital and funeral industries. They could prepare better for after New Year's, and be ready for an influx of people to take care of in hospitals and for mortuary services.

The results found in Project 2 and 3 show that the people of these populations either do not have the ability to push off death or do not value the holidays studied enough to. In Project 2, it was assumed that Pioneer Day was a very important holiday for the Mormon population and this may not be true. In Project 3, it was assumed these very Christian populations valued Christmas enough to push off death and this may not be true. Also, it is possible my study is not specific enough. I am able to find results for New Year's, which is important to everyone. It could be that I would find results for Christmas if the entire population studied was Christian, and for Pioneer Day if the entire population studied was Mormon. Perhaps the people who are not Mormon or Christian in the cities examined sufficiently dilute the data so there are no significant results.

Limitations:

Project 1 focused on the Millennium that, due to its proximity to Christmas, could bias the results. For example, the study that examined Christmas in England did not see a death dip until after the New Year and a death rise continued uninterrupted through Christmas (Milne 2005). This could have been due to how close Christmas and New Year’s are on the calendar. Project 2 focused on relatively
small cities as samples and it is possible these populations were too small. This could limit the generalizability of this study. Project 3 focused on Christmas and similarly to what was previously stated, due to its proximity to the New Year, the results could be biased.

This study was also cross-sectional, not longitudinal, meaning that one can only assume causality. Another limitation is that it is possible that the observed associations are due to unmeasured variables. These could be, for example, the causes of death. The SSDI does not allow one to see the cause of death, which means the data included outliers such as people who died due to accidents, suicides, and homicides.

Certain causal mechanisms can influence this data. For example, during Christmas and the New Year, some of the cities examined for these tests are located in a cold climate when these holidays occur. Cold climates have dangers including ice and snow that can cause accidents. These holidays also include dangerous activities like decorating one's house, which could include having to go on the roof of a house or working with electrical lights. The New Year and Christmas are also holidays associated with drinking alcohol. Drinking accidents are more likely to occur during these two holidays than during Pioneer Day because Pioneer Day is a Mormon holiday and drinking is not allowed in the Mormon tradition. Another causal mechanism is health care. Some people who are dying may be under the care of doctors who have their patients on life prolonging devices such as respirators and feeding tubes. Doctors might be more likely to wait until after a holiday has taken place to take these patients off of these devices.
A methodological issue is ecological fallacy because in this study I am making an individual level argument but looking at group level data. I am arguing that individuals postpone their deaths in order to survive until a meaningful holiday or event has occurred. The data I examined is not on individuals but on cities. I am assuming that the data from the cities reflects what individuals would do. It is possible that this is not true. For example, although I am seeing a significant death rise around the Millennium in New York City, this does not mean that all of the people that die on that day are dying because of the holiday.

Conclusion:

In the present study, I explored the death dip, death rise phenomenon and analyzed mortality rates around the New Year, Christmas, and Pioneer Day. I examined two days before and two days after the specified holidays and found significant findings for the New Year, specifically the Millennium. My findings showed that the populations of New York City and Chicago experience a death dip and death rise surrounding the New Year for the years 1998-2002. These findings reveal that people in these cities may view the New Year as a holiday that is important enough to experience just one more time before death.
References


