



# The Effect of Flooding on Water-borne and Vector-borne Illnesses in Historic Rochester, NY

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## Abstract

The connection between flooding and other extreme water-related weather events with water-borne illnesses is a well-documented issue. Rochester, NY, which lies in the Genesee River valley, receives a significant amount of precipitation due to its proximity to Lake Ontario. Flooding, due to melting snow in the spring and general thunderstorms in the summer, caused the Genesee river to flood often before the construction of the Mt. Morris dam in 1948. Utilizing cemetery records from Mt. Hope cemetery in Rochester, NY, this study explores whether Rochester's history of flooding had any effect on water-borne or vector-borne illness deaths. The years 1840 to 1915 accounts for 8 flooding and extreme rain events. Using the cemetery records, death rates from water or vector borne illnesses in the four weeks following these flood events will be calculated and comparisons made with similar periods that did not experience extensive rainfall or flooding. As climate change continues to increase rates of flooding and extreme weather events, historic Rochester and its rapid health infrastructure growth in the mid-late 19th century offers insight into how modern-day developing nations at risk for extreme weather events may benefit from social programs or infrastructure improvements. Also important is highlighting which diseases put communities most at risk following extreme water related events, and how to better prepare for these outbreaks.

## Objectives

The objective of this study was to determine whether Rochester's frequent flooding before the Mt. Morris dam had any effect on the spread of water-borne or vector-borne illnesses. Preliminary research of other hydrologic events found patterns of increased diarrheal diseases, mosquito and protozoa-borne illnesses, and respiratory illnesses spread by droplets following flooding events as people came into contact with contaminated water. 19th-century Rochester was defined by regularly contaminated well water, overcrowded tenements, high death rates for children under five, and rapid weather fluctuations that would periodically cause the river to spill over into food markets and housing. Contact with contaminated river water, such as through contaminated wells, stagnant water, or overflowing basements, could result in diarrheal diseases, which, at the time, could have been lethal, especially for young children. Respiratory illnesses such as pneumonia, the flu, and tuberculosis were easily spread in the cold, moist air, and aerosolized river water could have contributed to this. The underdeveloped health infrastructure and multiple accounts of flooding make historic Rochester a unique case study, as increased cases of these "mild" diseases were more deadly in the 19th century, and thus may be visible in the cemetery records. However, the development of social programs toward the end of the 19th century significantly improved mortality and morbidity, which may reflect in a decrease of deaths from gastrointestinal illnesses.

## Materials & Methods

From January 2020 to March 2020, I transcribed Mt. Hope cemeteries scanned records into an electronic format for the years 1907-1919. This data was combined with a master list of previous transcriptions done from the years 1837 to 1920. Utilizing newspapers and historical weather reports from Rochester between the years of 1840 and 1920 uncovered eight severe flooding events that fit the criteria of flooding lasting more than a day requiring cleanup, causing flooded basements and shops, and resulting in more than one street becoming flooded. I eliminated three events due to insufficient data. Other unordinary hydrologic events such as extreme rainfall, or high river levels, were noted and removed from the years of comparisons. Flooding events for which there was insufficient data were supplemented with death records posted in the newspaper. Using Excel and the transcribed cemetery records, comparisons were made to the two weeks before a flooding event with the four weeks following the flooding event for any patterns of deaths from gastrointestinal diseases, vector-borne illnesses, and respiratory illnesses that spread through contact with contaminated or stagnant water. The four weeks following a flooding event were then compared to the same four weeks of the following or previous year to account for seasonal variations of disease

OFFICE MOUNT HOPE CEMETERY.—The number of interments at Mount Hope during the week ending April 4th was thirteen (13) and the diseases were as follows:	
Asthma.....	1
Consumption.....	5
Chorea.....	1
Diarrhoea.....	1
Hydrophobia.....	1
Measles.....	1
Premature Birth.....	1
Typhoid Pneumonia.....	1

The number of interments at this cemetery during the corresponding week of last year was twenty (20).

Table 1: Democrat and Chronicle Record from April 1874

**The Weekly Record.**  
Twelve deaths were reported the registrar of vital statistics during the week. Four deaths were caused by consumption and one by typhoid fever. There were two deaths of children under five years of age and but one of an adult over seventy years of age.

Figure 2: Democrat and Chronicle death record from April 1888

## Results

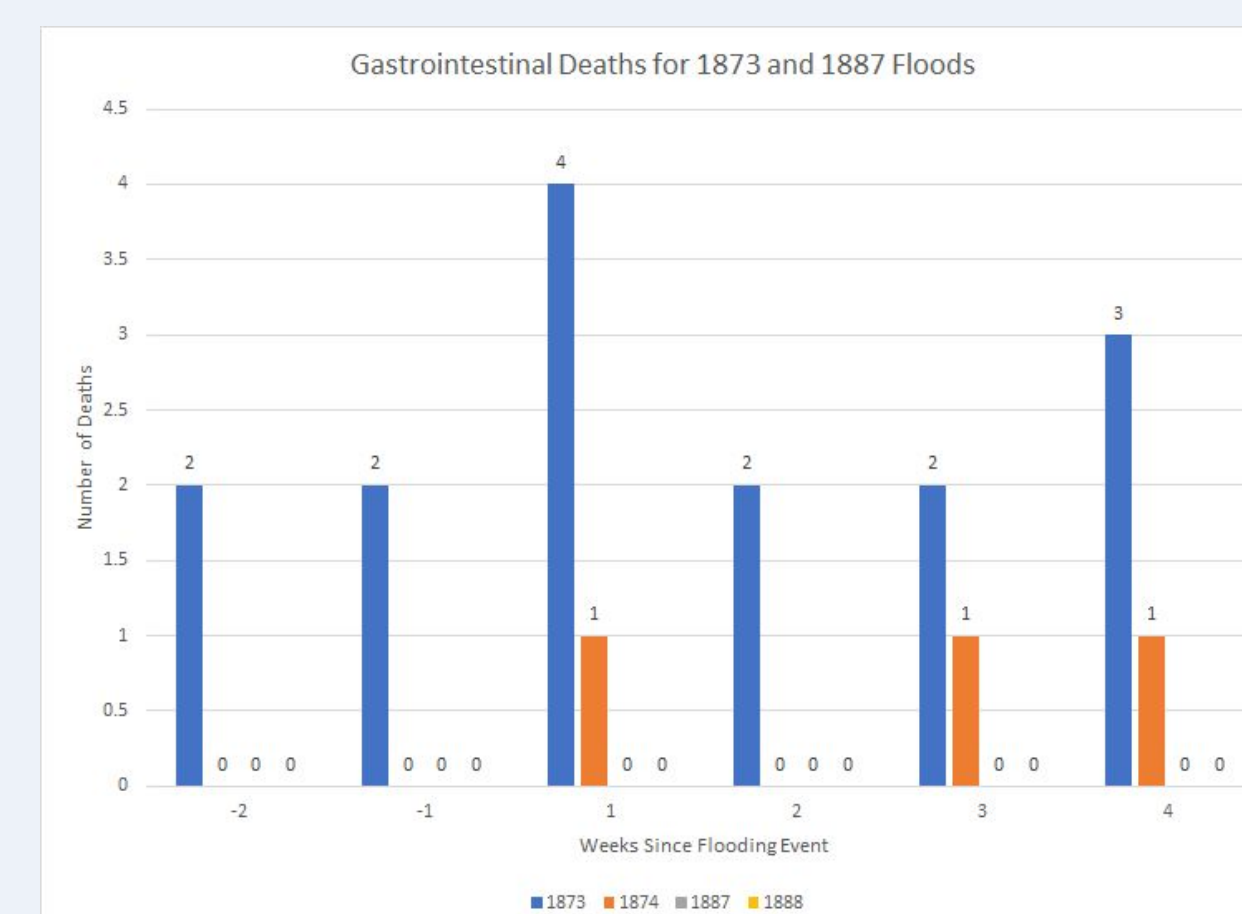


Table 1: Deaths from gastrointestinal illnesses for the flooding events in 1873 and 1887 with their comparison years of 1874 and 1888 respectively.

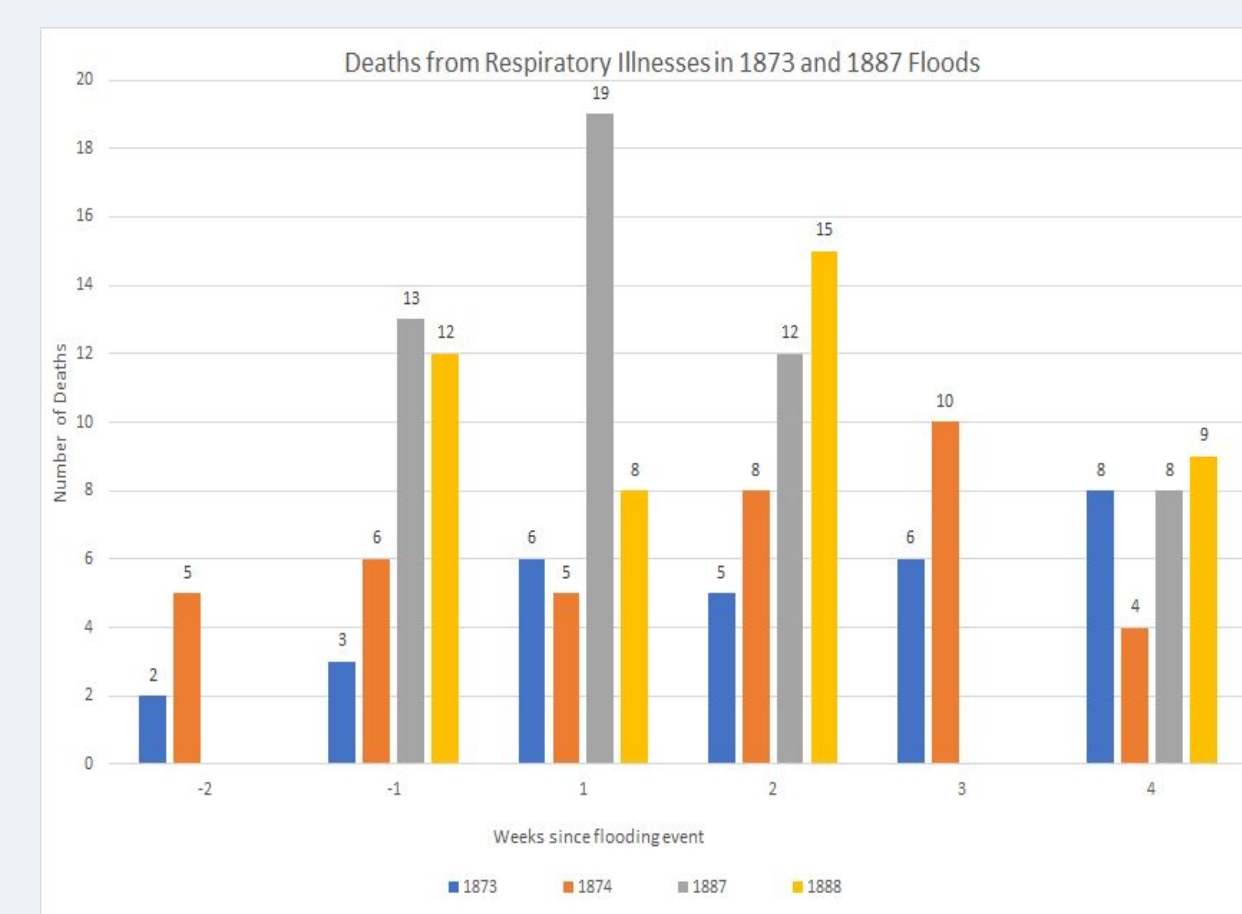


Table 2: Deaths from respiratory illnesses around the 1873 and 1887 flooding events with their comparison years of 1874 and 1888 respectively.

Data on the number of deaths for three weeks after flooding event and two weeks before flooding event for the years of 1887 and 1888 were unavailable. However, no gastrointestinal illness deaths were reported for any of the weeks studied in 1887 or 1888. Vector-borne illness deaths were also not present in any of the studied years. In 1873 the total deaths for the weeks presented were 16,20,26,25,20, and 29. In 1874 the total number of deaths was 13, 13, 15, 22, 22, and 10. In 1887 the total deaths were higher, hence the uptake in deaths overall at 35 for 1 week before followed by 49 1 week after, 35 two weeks after, and 31 the fourth week after the flooding event. In 1888 these values were 44, 25, 32, and 29.

## Conclusion

The data presented suggests an increase of gastrointestinal illness the week following a flooding event, and dropping the week after, and an increase in respiratory illness deaths the first week into the second. Further analysis should be done to understand whether these results were significant or not. The flooding events of April 8th, 1873 and February 11th, 1887 are shown solely here due to them being the only dates with the numbers of weekly deaths over 10.

More historic research may highlight an increased number of deaths, but factors such as switching the cities water source from wells to hemlock lake, sanitizing milk for young children, and an increase in social programs by the end of the 19th century may explain why deaths were not significant. This is not to say that citizens did not experience outbreaks of water-borne or vector-borne illnesses following a flood, only that they did not die from it; which may explain the results for 1887 and 1888. Monthly reports posted in the Democrat and Chronicle also highlight that deaths from gastrointestinal illnesses began to drop dramatically after 1880 while respiratory illnesses remained high but also dropped, due to various factors.

### Future Directions

Preliminary research on hydrologic events highlighted an increase in gastrointestinal diseases the week following a flooding event for up to two weeks, and an increase in respiratory diseases 10 to 14 following a flooding event (Liang and Messenger, 2018). More complete death records for Rochester around these flooding periods may show these trends more thoroughly. However, flooding events past 1900 will unlikely show these trends as Rochester's rapid health infrastructure growth toward the end of the 19th century greatly decreased deaths from diarrhea, flu, and other mild gastrointestinal and respiratory diseases. Flooding events in March of 1852 and 1865 may be the most reliable once the data exists, as this was before the social programs targeted toward improving children's health, before the acceptance of germ theory, a time when the city mostly relied on unprotected well water, and when the city was least prepared for responding to a severe flooding event.

## References

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