
# Friday the 13th, Full Moons, and Holiday Blues: Ontario Death Date Distributions

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**Editor's Note.** This study was approved by the University of Toronto Research Ethics Board (Protocol #43117).

Among society's many superstitions is fear of Friday the 13th ("paraskevidekatriaphobia"). It dates back to at least a 14th century French raid of the Knights Templar, if not to the thirteen attendees at the Last Supper, and coincides with various famous deaths and tragedies. Tens of millions of people fear these dates, leading to poor decisions and hundreds of millions of dollars of lost business. We have a personal interest in this topic. One of us (Rosenthal) was born on a Friday the 13th and has written about luck and superstition. The other (Dmetrichuk) is a coroner and forensic pathologist who has wondered about possible increased death rates on these special dates.

Scientists usually dismiss such superstitions, but the issue has received fairly limited careful scientific empirical study (see the Further Reading section). This is unfortunate since, if scientists believe that these superstitions are unscientific, we should be able to refute them using science—specifically, on the basis of statistical analysis. There is something of a gap between scientists' dismissal of commonly-held superstitious beliefs and their efforts to refute those beliefs scientifically.

This article attempts to close that gap and investigate whether Friday the 13th and other superstitions have any basis in observed fact. Specifically, we use data from the Ontario coroner records in the fifteen year period 2009–2023 to investigate the effect of Friday the

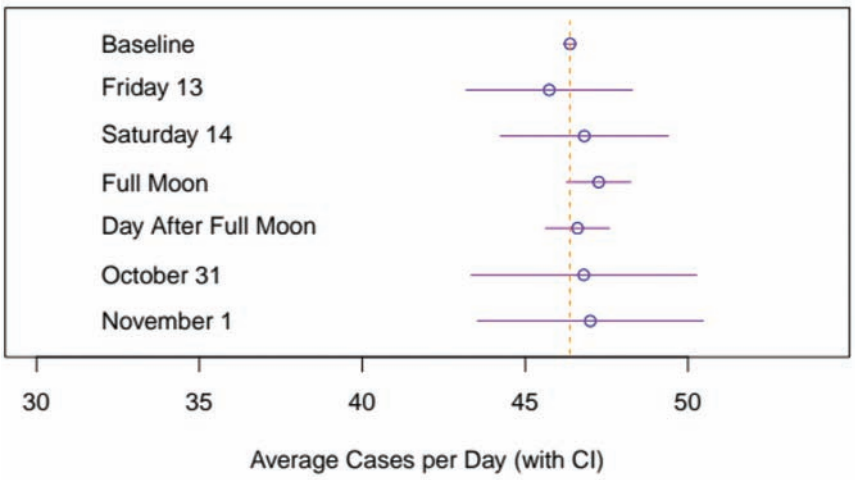


Figure 1. Friday 13th, Full Moons, and Halloween

13th and full moons and Halloween on death rates. We then also investigate some other statistical patterns in death dates, such as excessive deaths during the Christmas/New Year holiday period, monthly and seasonal effects, and whether Valentine's Day leads to more suicides.

## Data and Methods

Our data consists of the dates of pronouncement of all deaths investigated by the Ontario Coroner's Office during the inclusive fifteen-year period 2009–2023. This includes all deaths occurring within the province of Ontario that met criteria for a coroner's investigation under the Coroners Act, including homicides, suicides, accidents, and sudden and unexpected natural deaths.

There are a total of 262,742 deaths in this data. Of these, 722 (0.27 percent) were discovered as skeletal remains and are excluded due to uncertainty regarding the actual date of death. Another 7,962 (3.0 percent) have an undetermined manner of death and are thus excluded due to uncertainty regarding cause and/or manner of death (often due to decomposition changes). This leaves 254,058 death dates in our study over a total time period of 5,478 days, corresponding to a baseline average death rate of 46.38 deaths per day. (The complete list of dates is available for analysis at *probability.ca/DeathDates*).

We wish to compare this baseline rate to the death rates for specific types of dates such as Friday the 13th, etc. To determine if the observed differences are statistically significant, we also need confidence intervals for these rates. We compute them by modeling the death counts as Poisson distributed, giving an approximate 95 percent CI for the expected count as "Count ± 1.96 √Count." The 95 percent CI for the corresponding death rate is then of the form "(Count ± 1.96 √Count)/NumDates," which we use to determine the statistical significance of various death rate comparisons. In particular, this gives a 95 percent CI for the baseline death rate of 46.20–46.56, which is quite narrow due to the large sample size.

The data also contains information about the manner and death factor classifications of the various deaths. In our initial analyses, we simply group all deaths together. However, when those dates show surprising patterns, we also make use of manner and death factor determination to delve deeper.

One limitation is that our data specifies the date when a medical professional officially assessed the body and pronounced death. So, if there is a delay in discovering the body, the observed date of death might differ from that on which death occurred physiologically. To somewhat account for this, we also consider the days right after the dates of interest (e.g. Saturday the 14th), to account for deaths which were not pronounced until the following day.

## Results—Friday 13th, Full Moons, and Halloween

So, with these data and methods in hand, can we provide a sound statistical analysis of the effects of these special dates on death rates?

We begin with Friday the 13th. We compute from our data that there were a total 1,235 deaths over 27 such days, for a rate of 45.74 (CI 43.19–48.29, which is wider than for the base rate due to the smaller sample size). This rate is very similar to (and in fact slightly less than) the

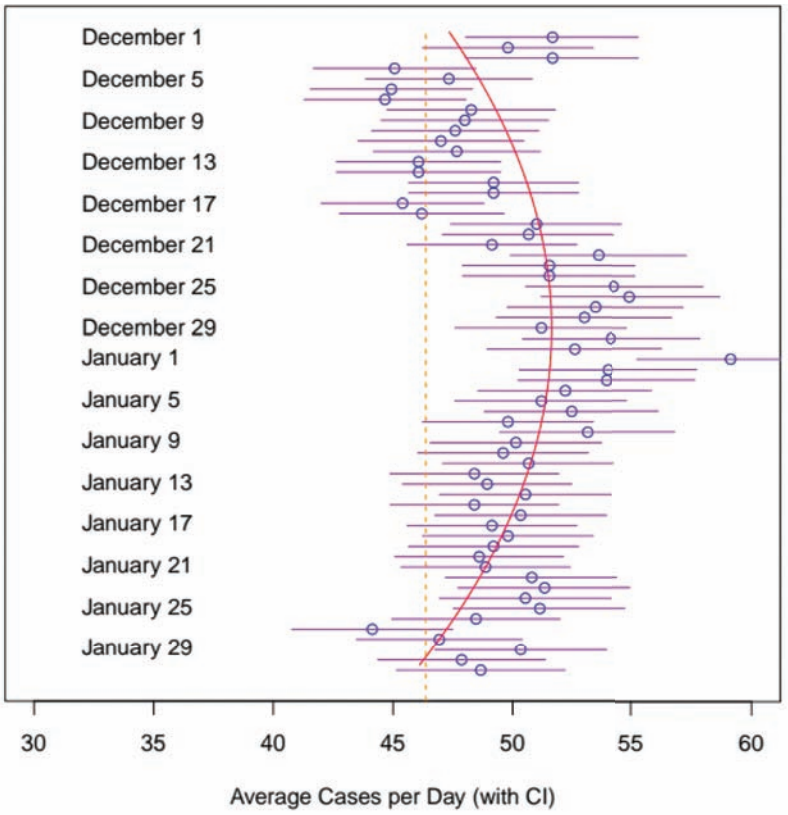


Figure 2. December–January, All Deaths

baseline rate, with overlapping CIs, indicating no evidence of any effect.

For Saturday the 14th (i.e., one day after Friday the 13th, to account for cases which were not pronounced until the next day), there were 1,264 deaths over 27 such days, for a rate of 46.81 (CI 44.23-49.40). This is again very similar to baseline rate, with overlapping CIs, again indicating no evidence of any effect. In short, despite all the fear, and with apologies to the millions of superstitious people around the world, there is absolutely no evidence in our data that Friday the 13th is any more dangerous than any other day in terms of suspicious or unexpected deaths. Sorry, superstitious friends everywhere!

We next turn to full moons. By accessing an official list of full moon dates, and coordinating that with our death data, we determined that there were a total of 8,790 deaths on the 186 days of full moons over our fifteen-year period. This gives a death rate of 47.26 (CI 46.27–48.25), which is slightly higher but still overlaps the baseline rate of 46.38. And to accommodate for delayed pronouncements, the 186 days right after those full moons had a total of 8,669 cases, for a rate 46.61 (CI 45.63–47.59). So both CIs overlap with the baseline CI, again indicating no evidence of any adverse effect from full moons, either. Sorry, werewolves everywhere!

As a final special day, we consider October 31 (Halloween). Those 15 days had a total of 702 cases, for a rate 46.80 (CI 43.34-50.26). This again overlaps with baseline, as does the day after (November 1) with rate 47.00 (CI 43.53-50.47). So, those evil Halloween spirits also had no significant effect on case rates. Sorry, horror fans everywhere!

These various death rates and CIs are summarized in Figure 1, which shows the lack of statistically significant effect on death rate from any of these special days.

So no statistical effects from any of these special days. Oh well. Does that mean our data analysis is useless? No. We can still investigate other temporal effects on death rates to try to understand them better, as we do next.

## Results—Holiday Period

The above conclusion is something of a negative one: There are no effects on death rates from superstitious dates like Friday the 13th or full moons. However, before

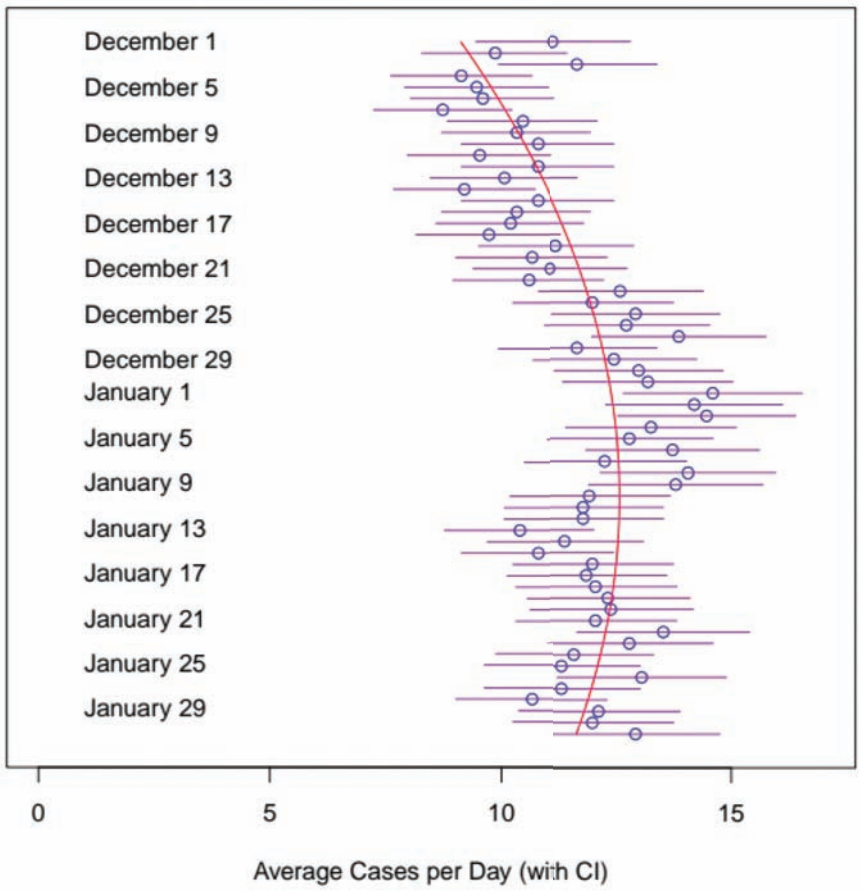


Figure 3. December–January, Myocardial infarction deaths only

abandoning our data, this leads to another question: Are there any other special date ranges, besides these superstitious ones, which do affect death rates? Why yes, it turns out there are!

As shown in Figure 2, in contrast to the previous special days, there do seem to be elevated death counts around the December–January holiday period, in a roughly quadratic curve "bulge" around the holiday period.

Indeed, the holiday day range December 24–31 has a total of 6,377 cases over 120 days, leading to a rate 53.14 (CI 51.84–54.45), which is well above baseline, indicating a significant effect of the holiday period. And the specific date January 1 is even higher, with 887 cases over 15 such days, for a rate of 59.13 (CI 55.24–63.02).

This leads to a puzzle: Why should the death rate go up over the holidays? Perhaps there is an elevated suicide rate over this period, due to holiday depression, right? Wrong! There were a total of 21,509 suicides over the 5,478 days of this study, giving a baseline average rate of 3.93 per day (CI 3.87–3.98). During the holiday periods, December 24–31, there were 392 suicides over 120 days for a rate of 3.27 (CI 2.94–3.59). This rate is actually lower than the baseline rate, indicating that there were actually fewer suicides over the holiday period, not more. Even January 1 itself had 62 suicides over 15 such days, for a rate of 4.13 (CI 3.10–5.16) which strongly overlaps with baseline. Hence, suicides do not explain the increased number of death cases over the holiday period. (As an aside, note that we first adjusted the manners in Medical Assistance in Dying deaths, as described in our previous work, "Non-Natural Manners of Death in Ontario: Effects of the COVID-19 Pandemic and Related Public Health Measures.")

Perhaps there were more motor vehicle deaths due to increased travel? Wrong again! There were a

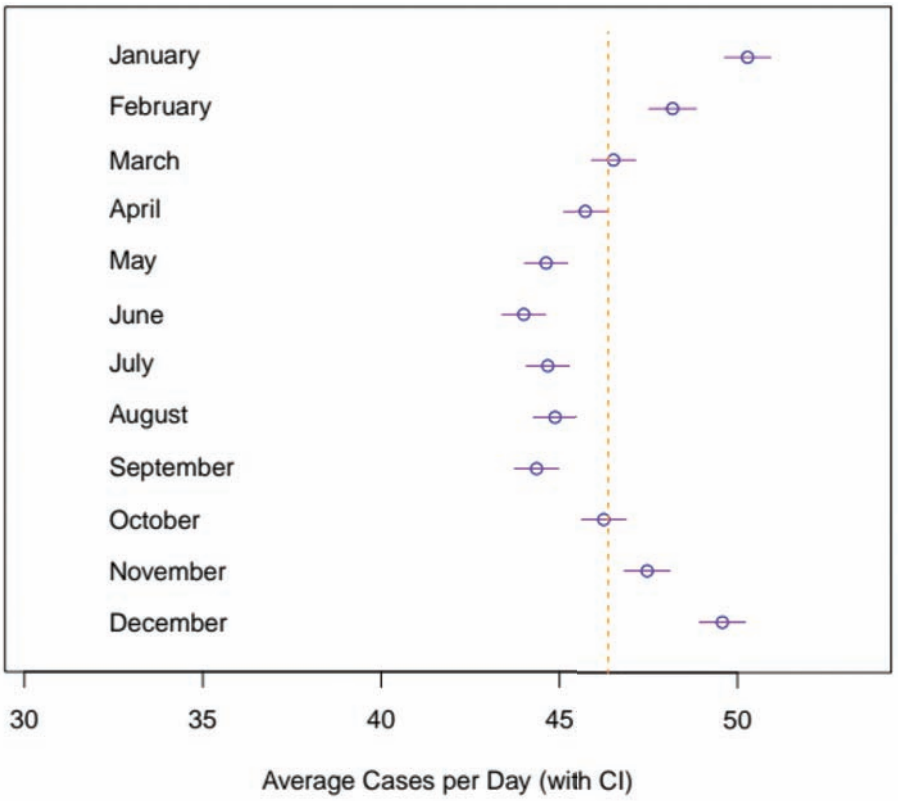


Figure 4. All Deaths, by Month

total of 9,848 such deaths over the 5,478 days of this study, giving a baseline rate of 1.80 (CI 1.76–1.83). During the holiday periods, there were 159 motor vehicle deaths over 120 days for a rate of 1.32 (CI 1.12–1.53), which is actually lower than the baseline CI. And for January 1, the rate is 1.60 (CI 0.96–2.24), very similar. So, motor vehicle deaths also do not explain the increased number of cases over the holiday period.

Further investigation indicates that this "bulge" is not caused by accidental deaths but rather by natural deaths, and in particular myocardial infarction or heart attack deaths (Figure 3).

Mystery solved! But why should MIs be particularly prevalent over the holidays?

To answer that question, we need to look at the bigger picture of monthly death patterns.

## Results—Monthly

Looking month-by-month shows that the winter months of January [rate 50.28 (CI 49.64–50.92)], February [48.18 (CI 47.52–48.85)], November [47.47 (CI 46.84–48.11)], and December [49.58 (CI 48.94–50.22)] are all above baseline, while May [44.62 (CI 44.02–45.23)], June [44.00 (CI 43.38–44.61)], July [44.67 (CI 44.06–45.28)], and August [44.88 (CI 44.27–45.48)] are all below baseline. In fact, the monthly rates have a clear and striking pattern of higher rates in the winter and lower rates in the summer (Figure 4).

Why would there be such a strong seasonal pattern? Perhaps it is suicides this time? Nope! The suicide monthly death dates are all very similar, with no clear monthly or seasonal effects. Even the rate for February 14 (Valentine's Day) itself is just slightly on the high side, with the CI still strongly overlapping with baseline. So that's not it. Similarly, neither homicide counts nor motor vehicle deaths nor accidental deaths nor drug overdoses demonstrate any strong monthly or seasonal effects. (And drownings actually go the other way, with more in the summer, but they are rare enough to have little impact on the total monthly rates.)

So what could be causing these higher winter death rates? Further investigation shows that it is actually the natural deaths that are significantly more common in the winter than summer (Figure 5).

Closer study shows that MI and pulmonary (breathing/respiratory) death counts are the primary

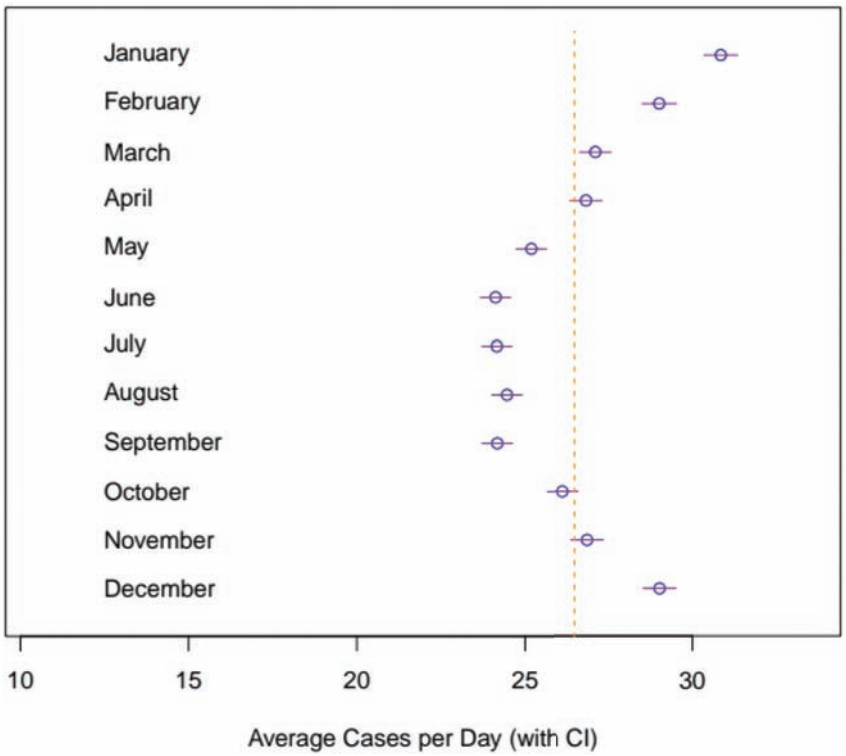


Figure 5. Natural Deaths, by Month

drivers of this natural death monthly pattern. Could that really be correct? Indeed, we discovered that several medical studies (by T. Sheth and colleagues, for example) have determined MI incidents are more common in winter months due to some combination of cold weather causing blood vessels to constrict, exacerbation of existing heart conditions such as angina, and extra strain from shoveling snow and trudging through slush, etc. Furthermore, pulmonary death counts also exhibit this same pattern, presumably due to the increased spread of respiratory illnesses and the impact of cold weather on the body's defenses.

So suddenly the higher winter death rates start to make more sense! Those cold Ontario winters lead to extra strains, which put more pressure on cardiovascular and respiratory systems, leading to more MI and pulmonary deaths. Nothing magical or superstitious about it, but a statistically significant effect nonetheless. Mystery solved, again.

## Results—Days of the Week

Finally, we mention that there was also a small effect from days of the week. Indeed, Saturdays, Sundays, and Mondays are slightly but significantly above baseline, and Tuesdays, Wednesdays, Thursdays are slightly but significantly below baseline (Figure 6).

What could cause these day-of-week effects? Closer investigation indicates that accidental drug overdoses and homicides both show a slight increase on Saturdays and Sundays, i.e., on weekends when many people are off work. Not a huge difference but just enough to account for the (small) observed day-of-week effect. Another mystery solved!

## Summary

Our study of Ontario death dates over a fifteen-year period indicates that, contrary to the claims of superstitions, there is no significant effect on death rates due to Friday the 13th, full moons, or Halloween (nor on the day after to account for delayed reporting). While our data is specific to Ontario, other studies have shown similar results in other jurisdictions (see Further Reading), and there is no reason to think these superstitions hold in some locations but not others.

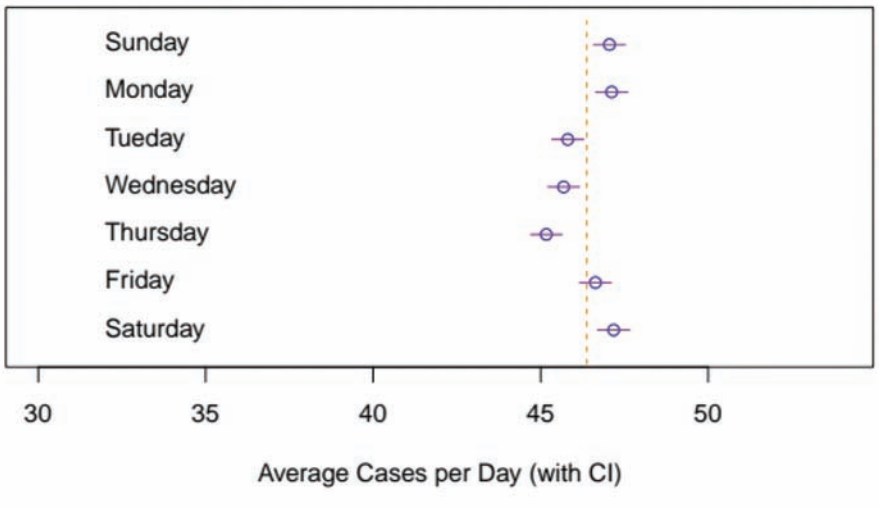


Figure 6. Days of the Week

## About the Authors

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However, there are indeed certain temporal effects on death rates, not from superstition but rather from day-of-week and (especially) month and season. In particular, the winter months have significantly higher rates of natural deaths, especially from MI and pulmonary disease, consistent with previous medical studies. So, the next time someone complains that misfortune befell them on a Friday the 13th, ask them if it was due to a cold winter month instead!

In closing, we note that although Friday 13th and full moons have no significant effect on death rates, the effects of breaking a mirror within seven years have yet to be investigated.

## Further Reading

Dmetrichuk, J.M, Rosenthal, J.S., Man, J., Cullip, M., Wells, R.A. 2022. Non-natural manners of death in Ontario: Effects of the COVID-19 pandemic and related public health measures. *The Lancet Regional Health–Americas* 7(March 2022):100130.

List of studies about the effects of Friday the 13th, *probability.ca/F13list*.

Rosenthal, J.S. 2018. *Knock on wood: Luck, chance, and the meaning of everything*. Toronto, ON: HarperCollins Canada.

Sheth, T., Nair, C., Muller, J., Yusuf, S. 1999. Increased winter mortality from acute myocardial infarction and stroke: the effect of age. *Journal of the American College of Cardiology* 33(7):1,916–9.