# FRIDAY THE 13th, FULL MOONS, AND HOLIDAY BLUES:

## ONTARIO DEATH DATE DISTRIBUTIONS

by

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## INTRODUCTION:

Among society's many superstitions are fear of Friday the 13th (paraskevidekatriaphobia) and of Full Moons. We have a special interest in this topic. One of us (JSR) was *born* on a Friday the 13th, and has written about luck and superstition (Rosenthal, 2018). The other (JMD) is a Coroner and Forensic Pathologist, who has witnessed colleagues/death investigators wonder about increased death rates on these special dates. Although scientists may dismiss such superstitions, the issue has previously received rather limited careful scientific empirical study (see Further Reading, below).

In this paper, we use data from the Ontario Coroner records in the fifteen year period 2009-2023 to investigate the effect of Friday the 13th and Full Moons on various types of deaths. We also investigate other phenomena about death dates, including the nature of excessive dates during the Christmas / New Year holiday period.

## DATA AND METHODS:

Our data consists of the dates of pronouncement for all deaths investigated by the Ontario Coroner's Office during the fifteen-year period 2009-2023. These dates include deaths in the province of Ontario which met criteria for a Coroner's investigation under the Coroners Act, including homicides, suicides, accidental, and sudden and unexpected natural deaths.

There are a total of 262,742 deaths in the database during this fifteen-year period. Of these, 722 (0.27%) were discovered as skeletal remains many years later so are excluded due to uncertainty regarding physiological date of death and often manner of death. Further, 7,962 (3.0%) have an undetermined manner of death and are thus excluded due to potential competing manners or unknown cause of death (often due to decomposition changes which again yields uncertainty regarding physiological date of death). This leaves a total of 254,058 death dates for our study. (The dates data is available for analysis at: probability.ca/DeathDates)

We then compare those death dates to specific date types such as Friday the 13th, full moons, and holiday periods, to obtain death counts for various sets of days. Dividing these counts by the total number of such days gives us the death rate for those sets of days. Those rates can then be compared to the overall baseline rate for the entire period 2009-2023. We also compute 95% confidence intervals (CIs) for these rates by modeling the death counts as Poisson distributed, giving the approximate 95% CI of the form "(count ± 1.96 √count)/dates" in each case.

The data also contain information about the manner and death factor classifications of the various deaths. In our initial analyses we simply group all death dates

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 in our data, the date of death is when a medical professional officially assesses the body and pronounces death. So, if there is a delay in discovering the body, the date of death may not always be the same date that death occurred physiologically. For example, someone may pass away in their sleep the evening prior to their discovery, and be are pronounced dead the following morning. To somewhat account for this issue, in addition to considering the actual days of interest, we also consider the days right afterwards (e.g. Saturday the 14th), to account for deaths which were not pronounced until the following day.

RESULTS -- FRIDAY 13th AND FULL MOONS:

In total, our data for this fifteen year period includes 254,058 cases, over a total of 5,478 days, leading to an overall average rate of 46.38 cases per day (CI 46.20-46.56). We take this as our baseline rate.

Regarding Friday the 13th, there were 1,235 cases over 27 such days, for a rate of 45.74 (CI 43.19-48.29). This is very similar to (and in fact slightly *less* than) the baseline rate, with overlapping CIs, indicating no evidence of any effect.
[SEE FIGURE "Figure1.pdf". **All graphs available at probability.ca/F13graphs**.]

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 cases 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.
[SEE FIGURE "Figure1.pdf".]

By comparison Friday the 6th (one week earlier) had 1,246 cases over 27 days for a rate of 46.15 (CI 43.59-48.71), again very similar.
And Friday the 20th (one week later) had 1,271 cases over 27 days for a rate of 47.07 (CI 44.49-49.66), slightly higher but again with overlapping CIs indicating no effect.
[SEE FIGURE "Figure1.pdf".]

Regarding full moons, there were a total of 8,790 cases on the 186 days of the full moons, giving a rate of 47.26 (CI 46.27-48.25), which is *slightly* higher but still overlaps the baseline rate of 46.38.
And the 186 days right after those full moons had a total of 8669 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 effect.
[SEE FIGURE "Figure1.pdf".]

As a final special day, we considered 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 again had no significant effect on case rates.
[SEE FIGURE "Figure1.pdf".]

RESULTS -- HOLIDAY PERIOD:

In contrast to the above 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.
[SEE FIGURE "DecJan.pdf".]

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).

One hypothesis for the increased holiday rate could be due to elevated suicide rates over this period. To test for this, we looked at suicide cases specifically. There were a total of 21,509 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 Dec 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. January 1 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 alternative, we looked at cases where the death factor involved a motor vehicle due to potential increased travel. There were a total of 9,848 such cases over the 5,478 days of this study, giving a baseline average rate of 1.80 (CI 1.76-1.83). During the holiday periods Dec 24-31, 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 natural deaths, and in particular Myocardial Infarction (MI) deaths.
[SEE FIGURE "DecJanMI.pdf".]

This observation is consistent with more general results about monthly death patterns, which we consider next.

RESULTS -- MONTHLY:

Regarding months overall, the winter months of January [rate 50.28 (CI 49.64-50.92)] and February [48.18 (CI 47.52-48.85)] and 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.
[SEE FIGURE "AllMonths.pdf".]

One hypothesis for the increased winter rate could be due to elevated suicide rates at this time. To test for this, we looked at suicide cases specifically. (Note that we manually adjusted the manners in Medical Assistance in Dying (MAiD) deaths to ensure they were coded as per current practice, for coding consistency, as described in our previous work (Dmetrichuk et al 2022)). However, the suicide death dates do not appear to demonstrate any strong monthly or seasonal effects.

[SEE FIGURE "SuicideMonths.pdf".]

We also looked specifically at suicides in the month of February, due to possible effects of Valentine's Day, but did not see any significant daily variation (with the February 14 rate slightly on the high side, but with confidence interval still strongly overlapping with baseline).
[SEE FIGURE "FebSuicides.pdf".]

Similarly, homicide counts again do not appear to demonstrate any strong monthly or seasonal effects.
[SEE FIGURE "HomicideMonths.pdf".]

As an alternative, we looked at cases where the death factor involved a motor vehicle. However, these counts again do not appear to demonstrate any strong monthly or seasonal effects.
[SEE FIGURE "MotorMonths.pdf".]

More generally, accidental death counts again do not appear to demonstrate any strong monthly or seasonal effects.
[SEE FIGURE "AccidentMonths.pdf".]

This just leaves natural death counts, which do indeed show similar monthly effects.
[SEE FIGURE "NaturalMonths.pdf".]

To delve further, we find that Myocardial Infarction (MI) death counts do exhibit this monthly pattern to some extent, thus contributing to the overall pattern. Indeed, several studies have shown that 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, extra strain from shoveling snow, etc.
[SEE FIGURE "MIMonths.pdf".]

Pulmonary death counts also exhibit this same pattern,
Potentially due to the increased spread of respiratory illnesses and the impact of cold weather on the body's defenses
thus also contributing to the overall pattern.
[SEE FIGURE "pulMonths.pdf".]

On the flip side, unsurprisingly, accidental drownings are highest during the July/August summer months, which partially explains the increased accident deaths in summer.
[SEE FIGURE "drownMonths.pdf".]

However, accidental drug overdoses show very little monthly effect,
but rather remain quite consistent throughout the year.
[SEE FIGURE "drugMonths.pdf".]

RESULTS -- DAYS OF THE WEEK:

There was also a small effect from days of the week. Indeed, Saturdays and Sundays and Mondays are slightly above baseline, and Tuesdays and Wednesdays and Thursdays are slightly below baseline, outside of the CIs, so this may indicate a very small but significant day-of-the-week effect.
[SEE FIGURE "DaysOfWeek.pdf".]

Regarding day-of-week effects,
accidental drug overdoses show a *slight* increase on the Saturday

and Sunday weekend days.
[SEE FIGURE "DOWdrugs.pdf".]

Similarly, homicides also show a small increase on weekend days.
[SEE FIGURE "DOWhomicides.pdf".]

So, these two categories together seem to account for much of the (small) day-of-week affect.

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 case rates due to Friday the 13th or full moons (nor on the day after due to delayed reporting). However, there are some effects based on day-of-week and (especially) month/season. In particular, the winter months have a significantly higher rate of natural deaths including from Myocardial Infarction and Pulmonary Disease, consistent with previous medical studies.

In closing, we note that while Friday $13^{th}$ and full moons had no significant effect on death rates, the effects of breaking a mirror within 7 years has yet to be investigated!

DECLARATIONS: This study did not receive any funding. None of the authors declare any real or perceived conflicts of interest. All authors meet criteria for authorship per the ICMJE guidelines and all authors have approved the manuscript in its submitted form. This study adhered to scientific and medical standards of ethics and was approved by the University of Toronto Research Ethics Board (REB file #00043117).

FURTHER READING:

J.S. Rosenthal (2018), ``Knock on Wood: Luck, Chance, and the Meaning of Everything''. HarperCollins Canada.
General-interest book about luck and superstition in our lives.
(The original title of this book was ``Born on Friday the 13th'', which the author was.)

J.M.Dmetrichuk, J.S.Rosenthal, J.Man, M.Cullip, and R.A.Wells (May 2021), ``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.
(Previous analyses of the Ontario deaths, focusing on manners and factors by year rather than specific dates of deaths.)

T. Sheth, C. Nair, J. Muller, and S. Yusuf (June 1999), ``Increased winter mortality from acute myocardial infarction and stroke: the effect of age.''
J. Am. Coll. Cardiol. 1999 Jun; 33(7):1916-9.
(One of several studies showing that MI are more common in winter.)

J.S. Rosenthal (2025), Summary of all known previous scientific studies about the effects of Friday the 13th. Available at: probability.ca/F13list