

What Do Suicides, Fatal Heart Attacks and COVID-19 Deaths Have in Common?

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Abstract

In this paper, we examine U.S. COVID-19 deaths by day of the week. Using data from the two large US. States (Florida and Texas) that report deaths by “day of actual death,” and controlling for time trends, we show that deaths during the Monday to Friday period (the week) are 7-8 percent higher than the weekend (Saturday and Sunday) in these states.

The weekend effect does not obtain in New York City, which also reports deaths by “day of actual death.” We provide some preliminary thoughts as to why this “weekend” effect obtains for COVID-19 deaths in Florida and Texas, but not in New York City.

COVID-19, coronavirus, COVID-19 Deaths, New York City Deaths, Florida Deaths, Texas Deaths.

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1. Introduction:

In this paper, we examine U.S. COVID-19 deaths by day of the week. Using data from the two large US. States (Florida and Texas) that report deaths by “day of actual death,” and controlling for time the time trends of the pandemic, we show that deaths during the Monday to Friday period (the week) are 7-8 percent higher than the weekend (Saturday and Sunday) in these states.

The weekend effect does not obtain in New York City, which also reports deaths by “day of actual death.” We provide some preliminary thoughts as to why this obtains in the case of COVID-19 deaths in the U.S., but not those in New York City.

With the exception of suicides, there is very little research on how the day of the week affects deaths.² In the case of suicide, it is well documented that deaths are much higher on Mondays than other days of the week. In the literature, this is referred to as the “Blue Monday” effect. See Eunkyon (2019) and the sources cited within.

Table 1 shows U.S. data on suicides for 1999 and 2007. Suicide deaths on Mondays are approximately 20 percent higher than they are on Sunday. But it is more than just a Monday effect. The table also shows that such deaths are relatively high on Monday through Wednesday and come down as the weekend approaches, reaching a low on Saturday. From Table 1, the week (Monday-Friday) had 8.3 (8.5) percent more suicides than the weekend (Saturday-Sunday) in 1999 (2007).

² There is a large literature on how the day of admission to a hospital affects mortality, but this is a completely different issue.

Year	Deaths 1999	Deaths 2007	% above Sat (1999)	% above Sat (2007)
Monday	4,522	5,487	19.4	21.4
Tuesday	4,492	5,150	18.6	14.0
Wednesday	4,242	4,988	12.0	10.4
Thursday	4,092	4,898	8.1	8.4
Friday	4,018	4,821	6.1	6.7
Saturday	3,786	4,518	0.0	0.0
Sunday	4,108	4,828	8.5	6.9

Table 1. U.S. Suicide Deaths by Day of the Week.³

To the best of our knowledge, the only pre-COVID-19 research that finds day of the week effects and does not focus on suicide or heart attacks is Freemantle et al (2012). The distinguishing mortality factor they focus on is not cause but place of death. Using data from UK National Health Care Service (NHS), they find, controlling for disease, that for every 100 deaths among patients in a hospital on Wednesday, there are 92 deaths among patients in the hospital on a Sunday. Thus there are eight percent fewer deaths in hospitals on Sunday than there are Wednesday. Perhaps because this is a secondary finding, they do not speculate as to why this is the case.⁴

³ Source: Centers for Disease Control (CDC), National Center for Health Statistics (NCHS). Data for 2007 available at https://www.cdc.gov/nchs/data/dvs/MortFinal2007_Worktable14.pdf. Data for 1999 available at https://www.cdc.gov/nchs/data/dvs/table14_99.pdf. According to the CDC, such annual tables were no longer produced beginning in 2008. See https://www.cdc.gov/nchs/nvss/mortality_tables.htm. But it is unlikely that suicide patterns by day of the week have changed much since 2007.

⁴ Official mortality data from Israel from the Israel Central Bureau of Statistics shows, that controlling for other factors, deaths during the weekend (which is Friday and Saturday in Israel) are three percent lower than during the week for the period from January 1, 2000 through the end of May 2020. This result comes from Steinberg (work in progress 2020).

Overall, there is virtually no difference in the number of deaths, from all causes combined, by day of the week in the United States. According to Livescience,⁵ based on data from the U.S. Centers for Disease Control, overall, there was very little difference in deaths by day of the week in the United States. Based on the “CDC Wonder database,” which contains data on all deaths in the U.S. from 1999 to 2014, “Livescience” reports the following: Sunday, which was the “low day” of the week for deaths, had 5.6 million total deaths during the 1999-2014 period, while Saturday, the “high day,” had 5.7 million total deaths during the same period. This is a very small (1.7 percent) difference from the trough to the peak.⁶ However, interestingly, heart attack deaths were 4.3 percent higher on Mondays than on Sundays. There was virtually no difference in heart attack deaths between Sunday and the other days of the week.⁷

To the best of our knowledge, there is no research on day of the week effects for deaths that occur outside of hospitals. Public media reports that deaths due to COVID-19 among long-term care residents account for 42% of all COVID-19 deaths in the U.S.⁸ In many of these cases, nursing care residents died on site and not in hospitals.⁹ Thus many U.S. deaths from COVID-19 occurred outside of hospitals.¹⁰ Of course, suicide deaths also often occur outside of hospitals.

⁵ See LiveScience, “The Deadliest Day of the Week,” by Sara G. Miller April 18, 2016, available at: <https://www.livescience.com/54429-deadliest-day-of-the-week.html>

⁶ Ibid.

⁷ Ibid.

⁸ See <https://www.nytimes.com/interactive/2020/us/coronavirus-nursing-homes.html>

⁹ <https://www.washingtonpost.com/business/2020/06/16/nursing-home-deaths-coronavirus-hospital-transfers/?arc404=true>

¹⁰ Neil Gandal et al (2020) provide evidence that (controlling for other risk factors) long-term care facilities are a risk factor for death from COVID-19 both in the U.S. and Europe. The research does not examine, however, what features of such settings (communal living area, multiple residents in a room, care provided by multiple caregivers to multiple care recipients, etc.) increase the chances of death from COVID-19, and whether any of the features would affect death by day of the week.

2. Data and Analysis

Perhaps surprisingly, it is not easy to get definitive daily data on U.S. deaths from COVID-19 by date of actual death. The data on deaths are typically by “day of reported death” and not by “day of actual death.” These data show huge reporting effects as has been noted by Peter Walker of the “COVID Tracking project” as well as others.¹¹

Fortunately, as Walker reports, two large U.S. states -- Florida and Texas -- provide data on deaths by “day of actual death.” Additionally, the city of New York also reports deaths by day of actual death. Hence, we have data on “day of actual death” from three of the largest four states by population in the U.S.¹² Data Sources are in the Appendix. Table 2 shows summary data.

	Texas	Florida	NYC	% above Sunday Texas	% above Saturday Florida	% above Saturday NYC
Monday	72.8	70.6	120.6	4.4	7.6	3.6
Tuesday	76.0	70	116.6	9.0	6.7	0.2
Wednesday	77.3	70.7	113.4	10.9	7.8	-2.6
Thursday	76.8	71.5	112.3	10.2	9.0	-3.5
Friday	79.6	67.1	116.9	14.2	2.3	0.4
Saturday	75.0	65.6	116.4	7.6	0.0	0.0
Sunday	69.7	66	119	0.0	0.6	2.2

Table 2: Average COVID-19 Deaths per day of the week (actual day of death)

¹¹ See <https://covidtracking.com/blog/is-there-a-right-way-to-chart-covid-19-deaths-over-time> by Peter Walker, entitled “Is There a Right Way to Chart COVID-19 Deaths over Time?” In an earlier version of this paper, we used day of reported death data and tried to adjust for reporting issues. But this is not ideal, so it is fortunate that day of actual death data are available for Texas, Florida, and NYC.

¹² Such data are also available for Arizona, but the population of Arizona is much smaller (7.3 million) than either Florida (21.5 Million) or Texas (29.0 million).

In all three cases, we use the first day for which such data are available and stop on August 20, which is a week before the day we collected the data. Thus, Texas data are available from March 15-August 20, Florida data from March 17-August 20, and NYC data from March 11-August 20. In the case of NYC, there are 23-24 observations for each day of the week. In the case of Texas, there are 22-23 observations for each day. In the case of Florida, there are 22-23 observations for each day.

Table 2 shows that in the case of Texas the fewest COVID-19 deaths take place on Sunday. In Texas, Tuesday through Friday have many more deaths than Sunday. The greatest difference is on Friday, which has 14.2 percent more deaths than on Sunday.

Table 2 shows that in the case of Florida, the fewest COVID-19 deaths occur on Saturday, but Sunday has virtually the same number. In the case of Florida, Monday through Thursday have many more deaths than Friday through Sunday. In Florida, the greatest difference between deaths by day of the week is between Thursday and Saturday. Thursday has 9.0 percent more deaths than Sunday.

In the case of NYC, Table 2 shows that there is no such pattern. Tuesdays, Fridays, Saturdays, and Sundays have virtually the same number of deaths. Monday has more deaths than any day, and the fewest deaths are on Wednesday and Thursday.

We then conduct regression analysis for the three regions separately. The dependent variable is the natural logarithm of the number of daily deaths. The right-hand-side (independent) variables include controls for time trends of the pandemic by using a fifth degree polynomial.¹³ The key right-hand-side variable is a dummy variable for week, which takes on the value one for Monday through Fridays and zero for Saturday and Sunday. The coefficient on this variable is the estimate for the

¹³ All three regions were well beyond their peak by August 20, which is the end of the data.

percentage by which deaths during the week exceed those on the weekend. This is our key parameter. Regression results are in Table 3 in the Appendix.

We find that, controlling for time trends, deaths during the week are 8.2 percent higher than on the weekend in Texas and 7.7 percent higher than on the weekend in Florida. Both of these effects are statistically significant, with a p-value of 0.065 in the case of Texas and 0.044 in Florida.¹⁴

In the case of NYC, running the same regression, we find that deaths during the week are only 1.5 percent higher than on the weekend and that this effect is not significant (p value of 0.723).¹⁵

Why is New York City different from Florida and Texas? Possibly because in NYC, between mid-March and the end of May, every day seemed the same, as in the movie “Groundhog Day.” Except it was Coronavirus Day. Each day, you woke up to disbelief, dread, even horror, and soon enough, you heard the wail of ambulances.¹⁶ White hospital tents dotted the East Meadow in Central Park; the scene was like something out of a Civil War photograph. Everyday at 7 p.m., residents all over the city came out on their landings or opened their windows to cheer, for a few minutes, the efforts of front-line workers. During that two-month period, the electronic kiosks on the streets, which usually present a variety of ads, headlines, drawings, photographs, and fun facts about NYC, ran COVID-19-related information 24 hours a day, 7 days a week. The familiar rhythms of the American week were simply wiped

¹⁴ In the case of Florida, if we include “Friday” as part of the weekend, deaths are 9.5 percent higher during the week than on the weekend and this effect is significant at the 99 percent level of confidence (p-value of 0.01). In the case of Texas, if we include “Monday” as part of the weekend, deaths are 10.4 percent higher during the week than on the weekend and this effect is significant at the 99 percent level of confidence (p-value of 0.01). In the case of New York, the results are unchanged if we include either “Friday” or “Monday” as part of the weekend.

¹⁵ In the case of NYC, we used confirmed COVID-19 deaths. There are also probable COVID-19 deaths as well. In the case of NYC, running the same regression using both confirmed and probable deaths from COVID-19, we find that deaths during the week are 2.9 percent higher than on the weekend and again we find that this effect is not significant (p value of 0.516).

¹⁶ I (Keith Gandall) was in NYC on a weekly work schedule during this period (working remotely), but I nonetheless had trouble knowing what day it was. Other people observed this phenomenon too.

away. There was no time off and no weekends in the sense that there were no bars, restaurants, or theaters to go to. No sports to watch. People did not get together with family and friends that they weren't living with. Almost no one was on the streets. Even Times Square was empty. The sirens didn't stop at night. For almost everyone in NYC, it was impossible to avoid worrying, to stop seeing the news, to relax.

3. Further Discussion and Concluding Thoughts

Could rhythms at hospitals explain some of weekend effect? Hospitals tend to be less staffed during the weekend, or staffed with less senior doctors, and there tends to be less availability of diagnostics.¹⁷ Since this is generally the case,¹⁸ one might think that hospital deaths would then go up on the weekends because less experienced doctors are running things with less diagnostic assistance. But Freemantle et al (2012) show that deaths from all causes actually go down on the weekends in hospitals.

It seems to us that it is likely that something *social* or *cultural* is going on with COVID-19 deaths, as with suicides, corresponding, in America, to differing behaviors and attitudes tied to different parts of the week. We do not have the answers, but we throw out some possibilities here:

Perhaps people tend to relax more on the weekends, even in hospitals or long-term care facilities, even when they are not allowed visitors (as has usually been the case during the U.S. COVID-19 pandemic). Fewer senior doctors and less diagnostic activity on weekends -- a weekend slowdown missing in NYC -- may mean a more relaxed atmosphere inside hospitals.

¹⁷ Freemantle et al (2012) also makes this point.

¹⁸ That was not true in NYC and other places as well during the height of the COVID-19 death toll, as doctors across the country heroically worked incredibly long shifts day after day in an attempt to minimize deaths.

Outside of hospitals, people socialize with family and friends. What don't they do on weekends that they do during the week? They probably don't work as much, or, if unemployed, they likely don't tend to worry as much about it. And perhaps they don't watch as much news as during the week. In any case, in American life, most importantly, weekends are *supposed to be* for fun, relaxation, and religious spirituality. The weekend is a deeply-rooted and powerful social practice shared from coast to coast.

In the case of suicides, the difference between the lowest weekend day and the highest day of the week (Monday) is approximately 20.4 when we average over the 1999 and 2007 data. Weekend "social exchanges" likely have a large mitigating effect on suicides. Given this, it makes sense that the weekend effect would be significant in the case of death by suicide. It also makes sense that heart attacks, which we also think of as having a psychosocial component, should be 4.3 percent higher on Monday than on Sunday.

But COVID-19 deaths also show a marked weekend effect that, while not quite as strong as suicide mortalities, is much stronger than heart attack fatalities. In the case of COVID-19, the largest difference in deaths comparing a particular "weekend day" to a particular "weekday" was 14.2 percent for Texas and 9.0 percent for Florida.

In terms of overall averages, the weekend effect in the case of suicides is 8.4 percent (averaged over 1999 and 2007), while the average COVID-19 weekend effect for Texas and Florida is 7.9 percent (the average of 8.2 percent and 7.7 percent) -- a differential almost as large as with suicides.

Do COVID-19 deaths have a psychosocial component that has not been recognized? Could worrying, watching the frightening news coverage of the pandemic, and

ultimately panicking about being sick with COVID-19 be increasing the death toll?
We leave this for future research.

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Appendix

Data Sources:

New York City (NYC) daily death data by actual date of death are available from the NYC government site at <https://www1.nyc.gov/site/doh/covid/covid-19-data.page>. These data are by day of actual death; they are continuously updated and are preliminary until confirmed (usually after a week). 2) In the case of Texas, the death data by actual date of death are available at the Texas Department of State and Health Services at: <https://dshs.texas.gov/coronavirus/additionaldata.aspx>. Courtesy of Peter Walker, Florida death data by actual date of death are available <https://usf.app.box.com/s/ru7dxth2hadozcuuksyg5iesuj5lvuz3>.

Regression Analysis:

	Week vs. Weekend 5 th order polynomial time-trend		
	Texas Data Coefficients (Std. Errors)	Florida Data Coefficients (Std. Errors)	NYC Data Coefficients (Std. Errors)
Week	0.082* (0.044)	0.077* (0.040)	0.015 (0.043)
Adjusted R ²	0.96	0.94	0.98
N	158	157	161

Table 3: Regression Analysis: Dependent Variable: Natural Logarithm of daily deaths

Independent Variables:

- Time trend based on Days from the beginning of the data for relevant region. Day 1 = 1, Day 2 =2, etc. (Coefficients omitted for ease of presentation)
- Binary “Dummy” variable for week (Monday-Friday)

(* Significant at 95% level of confidence)