

**CrimRxiv**

# **A COVID-19 Public Health Silver Lining? Reductions in Driving Under the Influence Events and Crashes In Miami-Dade County**

**Justin Kurland<sup>1</sup>, Alex R. Piquero<sup>2</sup>, Nicole Leeper Piquero<sup>3</sup>,  
Stephen K. Talpins<sup>4</sup>**

<sup>1</sup>University of Southern Mississippi, <sup>2</sup>University of Miami; Monash University,

<sup>3</sup>University of Miami, <sup>4</sup>Office of the State Attorney for the Eleventh Circuit of Florida

**Published on:** May 09, 2021

**DOI:** 10.21428/cb6ab371.128b29bc

**License:** [Creative Commons Attribution 4.0 International License \(CC-BY 4.0\)](https://creativecommons.org/licenses/by/4.0/)

## **Abstract**

The health crisis that began in early 2020 has generated a large amount of interest in the effect of COVID-19 on public health. The majority of this work has centered around trying to better understand how the virus spreads, where it spreads, who is at risk and when, in order to provide evidence-based guidance to the public, and stop the pandemic. The Centers for Disease Control have continued to report the largely somber findings, however there are silver linings. The temporary reduction in daily global CO<sub>2</sub> emissions was one of these, but there are others. In this case study on Miami-Dade County, FL, a regression discontinuity model is used to highlight reductions in both drunk driving crashes and driving under the influence arrests. The impact of the March 2020 lockdown order was an immediate reduction of about 26 drunk-driving crashes, and a yearly decrease of nearly 810 drunk driving crashes in Miami-Dade County.

## **Introduction**

As of April 30, 2021, The New York Times COVID Tracker estimates over 32 million cases and almost 575,000 deaths as a result of the novel coronavirus ([Covid in the U.S.: Latest Map and Case Count - The New York Times \(nytimes.com\)](https://www.nytimes.com/interactive/2021/04/30/covid19/cases-deaths.html)), accessed April 30, 2021). Around the globe, the case and death tolls are exponentially higher. The spread of the novel virus, especially at the outset of the pandemic, resulted in public health and government officials ushering in a range of mitigation policies with the most restrictive being stay-at-home or lockdown orders in order to reduce cases and deaths (Piquero & Kurland, 2021), which resulted in the closing of most businesses (except for grocery stores and gas stations), alterations to the mode of education instruction to an online platforms, and cessation of most of the travel industry.

Not surprisingly, medical scholars have engaged in over a year's worth of research trying to understand the many health-related facets and outcomes of the virus, from spread, to treatment, to the development of vaccinations. Concurrently, social scientists have explored how persons have been dealing with the virus and associated lockdowns. Some of this early research showed increases in: stress, anxiety, and depression (Ettman et al., 2020; Salari et al., 2020), certain types of criminal activity such as domestic violence (Piquero et al., 2021) and aggravated assault and homicide (Rosenfeld et al., 2021), alcohol use (Pollard et al., 2020), and even reports of a large

number of excess deaths that were indirectly tied to COVID-19 but not a direct result of the virus itself (Woolf et al., 2020). In short, and unsurprisingly, the virus and some policy efforts have had a wide range of adverse effects on people and society more generally.

Is it possible however, that there may have been some potential ‘positive’ outcomes that may have been related to some policies? Initial research suggests that the numerous stringencies put in place to curb the spread of the virus have altered routine activity, and in turn changed the opportunity structure for particular forms of acquisitive crime thus leading to net reductions in numerous countries around the world (Borrion et al. 2020; Halford et al. 2020; Campedelli et al. 2021; Payne et al. 2021). Likewise, other early research has indicated that because fewer people were driving there were, in turn, fewer traffic crashes (Saladié et al., 2020; Shilling & Waetjen, 2020) while others reported large decreases in crashes involving injury, distracted drivers and ambulances (see Barnes et al., 2020). These findings are not entirely surprising as many businesses pivoted to work-from-home operations as a result of the forced lockdown orders keeping many people off the roadways. What remains unclear is whether these early reductions in automobile crashes was sustained—especially with respect to crashes involving alcohol as liquor sales reportedly increased and especially with the reopening of restaurants and bars during the latter half of 2020 and into early 2021.

Accordingly, this paper uses data from Miami-Dade County, Florida, with a population of over 2.7 million residents, to examine changes in alcohol-related crashes and driving under the influence arrests from January 2016 through March 2021 in order to examine how the pandemic lockdown and the subsequent reopening potentially changed the course of this persistent pernicious infliction. According to the National Highway Traffic Safety Administration, in 2019 alone there were over 10,000 drinking-related deaths in the United States (“Drunk Driving | NHTSA,” n.d.).

## **Methods**

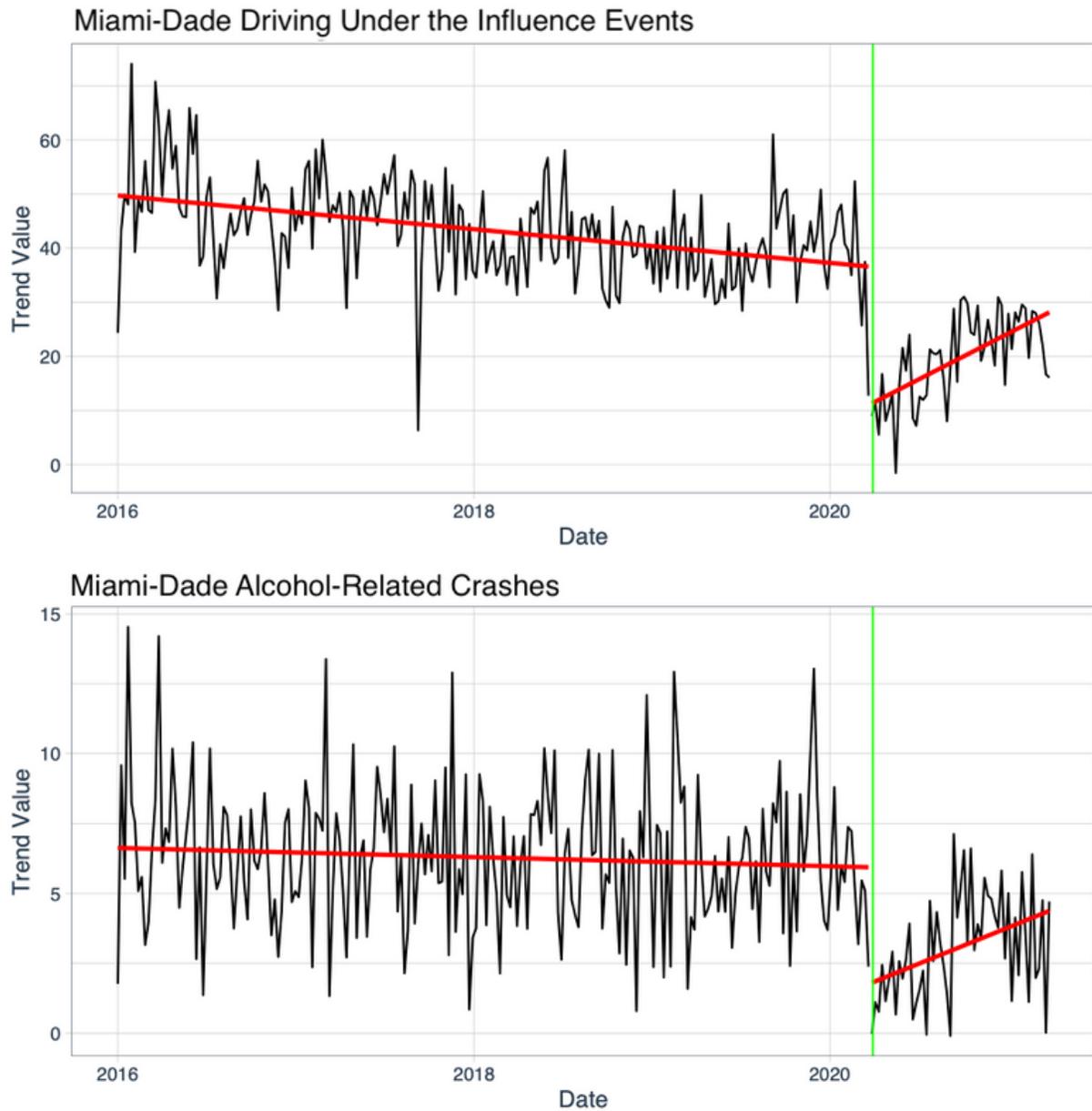
Weekly alcohol induced motor-vehicle accident counts as well driving under the influence arrest data for Miami-Dade County from January 2016 through March 2021 were utilized for a Regression Discontinuity in Time (RDiT) model. Interrupted time series (ITS) approaches, such as RDiT, are considered to be the strongest quasi-experimental design for evaluating the longitudinal effects of interventions, which in this case was the lockdown and associated stringencies (Cook & Campbell, 1979). This approach allows us to assess, in statistical terms, how the lockdown changed both

alcohol induced motor-vehicle crashes and driving under the influence arrests, immediately and over time and whether factors other than the intervention could explain the change (Wagner et al., 2002).

To implement the RDiT model the entire time series was first split into the pre-lockdown period, all weeks up and including the week of March 22, 2020 (168 weeks), and the after lockdown period that began the week of March 29, 2020 and lasted until the week of March 28, 2021 (53 weeks). This start of this latter period was selected because it was the first full week after the executive emergency order issued by the Miami-Dade County Mayor (on March 19) and Florida Governor (on March 30) in which all parks, beaches, recreational facilities, and all non-essential retail and commercial establishments were closed. After segmentation, each respective series for both the accident and arrest data was detrended and deseasonalized using Seasonal Decomposition and Trend using Loess, a procedure critical to the successful implementation of a RDiT (Cleveland et al., 1990; Svornos, 2016). Additional harmonic components, fixed effects (i.e., week of the year, month, and year) as well as weekly temperature and precipitation data from the National Oceanic and Atmospheric Administration (NOAA) to control for factors other than the lockdown that might explain some of the associated variance in both the alcohol-related vehicular crashes and driving under the influence arrests. A linear model was then created for both segments and the fitted values from each model was used for the RDiT.

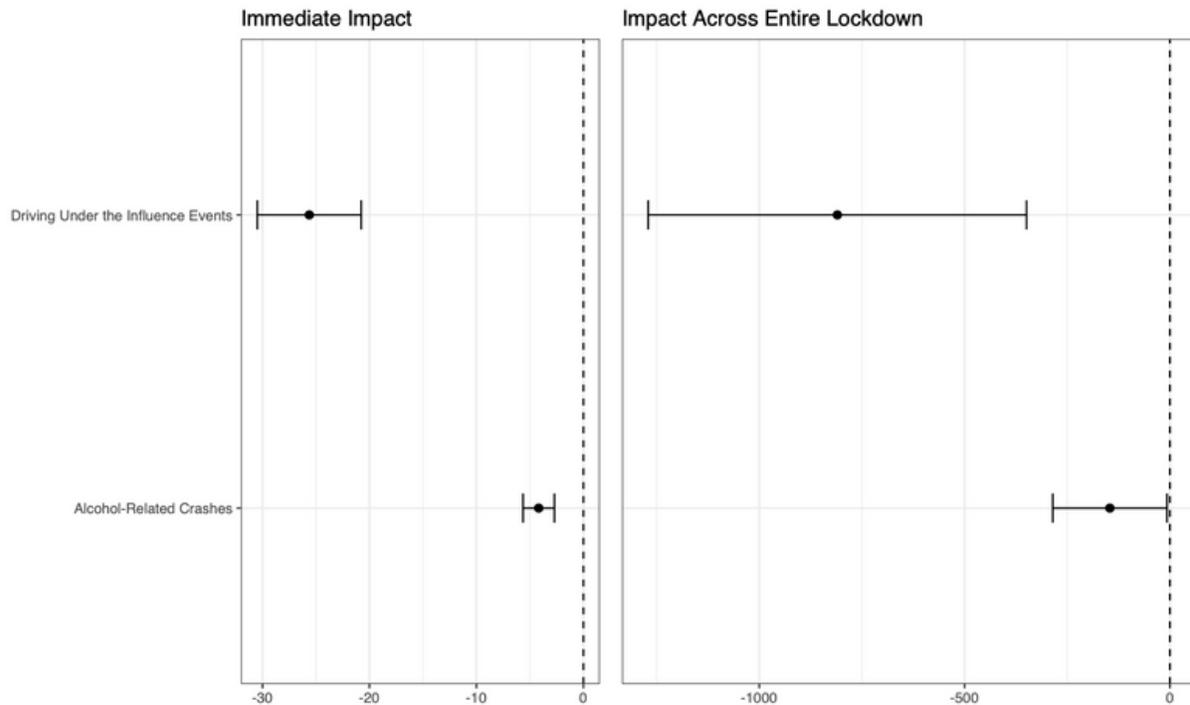
## **Results**

The results from the RDiT of both alcohol-related vehicular crashes as well as driving under the influence arrests suggest a significant impact immediately at the start of the lockdown period for both related categories, but also for the year following the start of the public health measures implemented in Miami-Dade County, Florida. Figure 1 below provides a clear illustration of the difference between the period before and after the lockdown and the fitted values and trends for both series.



**Figure 1.** Regression Discontinuity in Time (RDiT) results for each of the trends (black) for the driving under the influence arrest events and the alcohol-induced crashes in Miami-Dade County, Florida from January 2016 to March 2021 with the associated linear fit (red) for the pre-lockdown period and the period after the lockdown after controlling for trend, seasonality, and numerous meteorological time-varying covariates.

There was an immediate reduction in weekly arrests for driving under the influence of alcohol of  $\sim 26$  ( $-25.62$ , 95% CI:  $[-3.39, -0.09]$ ). Similarly,  $\sim 4$  ( $-4.17$ , 95% CI:  $[-2.71, -5.64]$ ) fewer alcohol-induced motor-vehicle crashes occurred in Miami-Dade County. Over the duration of the year since the lockdown a staggering reduction of approximately 810 fewer driving under the influence arrest events occurred ( $-809.75$ , 95% CI:  $[-349.09, -1270.48]$ ), while approximately 147 alcohol-related motor-vehicle crashes were averted ( $-146.26$ , 95% CI:  $[-7.16, -285.37]$ ).



**Figure 2.** Regression Discontinuity in Time (RDiT) coefficients and associated 95% CIs for the immediate impact (left panel) and the impact across the entire lockdown period (right panel) for both driving under the influence arrest events and alcohol-related vehicular crashes.

## Discussion

The novel coronavirus has been a daily feature in the lives of every citizen since the early part of 2020. And while many adverse effects associated with the pandemic and its lockdowns have been well documented, one could also attempt to grasp for some potential silver lining(s). Some regard the reduction of carbon emissions generated from the reduced use of trains, planes, and automobiles, as one such silver lining. As

people began to work remotely from home, and for many still are, most forms of public travel shut down or became severely constrained thus reducing carbon emissions. In this study, we examined the extent to which reductions in alcohol-related motor vehicle crashes could also potentially qualify as a silver lining.

Using data from Miami-Dade County, Florida, we conducted a regression discontinuity design model and found that the impact of the March 2020 lockdown was associated with an immediate reduction of about 26 weekly drunk-driving crashes and a yearly decrease of nearly 810 drunk-driving crashes in the county. The many crashes, hospitalizations, and deaths that were potentially saved as a result of the lockdown reducing overall automobile travel in the county certainly helped to keep some people safe, some families intact, and some innocent drivers from being injured.

This is an altogether more important finding when situated within the broader context of public health outcomes for this past year given the fact that historically alcohol-related motor vehicle crashes represent approximately 35% of the total number of crashes that occur in the United States (Taylor et al. 2002). Further, and relatedly, traffic collisions and road fatalities represent a major component of contemporary policing and a leading source of police demand (Ratcliffe, 2021). Indeed the large number of drink driving-related police interventions available in the 'What Works' crime reduction toolkit is a testament to the activity in this area (College of Policing, n.d.). Taken together this represents a potential reduction of the hundreds of billions of dollars borne on the public in the form of monetary costs and quality of life losses a net reduction in alcohol-related crashes, which are both deadlier and more serious than other crashes, additional effort should be made to estimate the extent to which such a reduction was found across different cities and counties across the nation.

Whether these 'averted deaths' will continue to increase, of course, remains an open question. While our results are constrained to one large county in the United States and do not include data from adjacent counties nor data from other forms of transportation (such as bicycle crashes), it still represents an important 'win' for public health amid a year-long battle with the world's most deadliest virus.

## References

Barnes, S.R., Beland, L-P., Huh, J., & Kim, D. (2020). The effect of COVID-19 lockdown on mobility and traffic accidents: Evidence from Louisiana.

<https://www.econstor.eu/handle/10419/222470> (accessed April 30, 2021).

Borrion, H., Kurland, J., Tilley, N., & Chen, P. (2020). Measuring the resilience of criminogenic ecosystems to global disruption: A case-study of COVID-19 in China. *Plos one*, 15(10), e0240077.

Campedelli, G. M., Favarin, S., Aziani, A., & Piquero, A. R. (2020). Disentangling community-level changes in crime trends during the COVID-19 pandemic in Chicago. *Crime Science*, 9(1), 1-18.

Cleveland, R. B., Cleveland, W. S., McRae, J. E., & Terpenning, I. (1990). STL: A seasonal-trend decomposition. *Journal of official statistics*, 6(1), 3-73.

College of Policing (n.d.). *Crime Reduction Toolkit*. Retrieved May 9, 2021, from <https://whatworks.college.police.uk/toolkit/Pages/Toolkit.aspx>

Cook, T.D., Campbell, D.T. (1979) Quasi-experimentation. Design & analysis issues for field

settings. Boston, MA: Houghton Mifflin Company

Ettman, C. K., Abdalla, S. M., Cohen, G. H., Sampson, L., Vivier, P. M., & Galea, S. (2020). Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Network Open*, 3(9), e2019686-e2019686.

Halford, E., Dixon, A., Farrell, G., Malleson, N., & Tilley, N. (2020). Crime and coronavirus: social distancing, lockdown, and the mobility elasticity of crime. *Crime science*, 9(1), 1-12.

Le Quéré, C., Jackson, R.B., Jones, M.W. *et al.* Temporary reduction in daily global CO<sub>2</sub> emissions during the COVID-19 forced confinement. *Nat. Clim. Chang.* **10**, 647-653 (2020). <https://doi.org/10.1038/s41558-020-0797-x>

Payne, J. L., Morgan, A., & Piquero, A. R. (2021). Exploring regional variability in the short-term impact of COVID-19 on property crime in Queensland, Australia. *Crime Science*, 10(1), 1-20.

Piquero, A.R., & Kurland, J. (2021). More stringent measures against COVID-19 are associated with lower cases and deaths in Florida and Miami-Dade. *The American*

Journal of Emergency Medicine. <https://doi.org/10.1016/j.ajem.2021.04.066>

Piquero, A. R., Jennings, W. G., Jemison, E., Kaukinen, C., & Knaul, F. M. (2021). Evidence from a systematic review and meta-analysis: Domestic Violence during the COVID-19 Pandemic. *Journal of Criminal Justice*, <https://doi.org/10.1016/j.jcrimjus.2021.101806>.

Pollard, M.S., Tucker, J.S., & Green, H.D. (2020). Changes in adult alcohol use and consequences during the COVID-19 pandemic in the US. *JAMA Netw Open*. 2020;3(9):e2022942. doi:10.1001/jamanetworkopen.2020.22942

Ratcliffe, J.H. Policing and public health calls for service in Philadelphia. *Crime Sci* **10**, 5 (2021). <https://doi.org/10.1186/s40163-021-00141-0>

Rosenfeld, R., Abt, T., & Lopez, E. (2021). Pandemic, Social Unrest, and Crime in U.S. Cities: 2020 Year-End Update. Washington, D.C.: Council on Criminal Justice.

Saladié, O., Bustamante, E., & Gutiérrez, A. (2020). COVID-19 lockdown and reduction of traffic accidents in Tarragona province, Spain. *Transportation Research Interdisciplinary Perspectives*, 8, <https://www.sciencedirect.com/science/article/pii/S2590198220301299>

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., ... & Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis. *Globalization and health*, 16(1), 1-11.

Shilling, F., & Waetjen, D. (2020). Social report (update): Impact of COVID19 mitigation on numbers and costs of California traffic crashes. Davis, CA: University of California Davis Road Ecology Center. [https://roadecology.ucdavis.edu/files/content/projects/COVID\\_CHIPs\\_Impacts.pdf](https://roadecology.ucdavis.edu/files/content/projects/COVID_CHIPs_Impacts.pdf) (accessed April 30, 2021).

Svoronos, T. 2016. Evaluating Health Interventions Over Time: Empirical Tests of the Validity of the Single Interrupted Time Series Design. Doctoral dissertation, Harvard University, Graduate School of Arts & Sciences.

Taylor, D., Miller, T. R., & Cox, K. L. (2002). *Impaired driving in the United States: State cost fact sheets*. Research Report No. DTNH22-98-D-35079, Task Order 7, Calverton, MD: Pacific Institute for Research and Evaluation.

Wagner, A. K., Soumerai, S. B., Zhang, F., & Ross-Degnan, D. (2002). Segmented regression analysis of interrupted time series studies in medication use research. *Journal of clinical pharmacy and therapeutics*, 27(4), 299-309.

Woolf, S.H., Chapman, D.A., Sabo, R.T., Weinberger, D.M., & Hill, L. (2020). Excess deaths from COVID-19 and other causes, March-April 2020. *JAMA*. 2020;324(5):510-513. doi:10.1001/jama.2020.11787