International Analysis On The Traffic Impact Of The Covid-19 Pandemic

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ABSTRACT

The purpose of this research was to assess, compare, and contrast the impact of COVID-19 activity restrictions on road-based transportation activity in regions of the US, Sweden, and China from January 1st to December 31st, 2020. Roadway traffic volumes were used to infer the progression of reported COVID-19 cases and government directives for social separation in three countries with diverse governmental responses. Among the contributions of this paper was the illustration of the timeline and level of public responses to closures, lockdowns, and reopening as represented through rapid traffic decreases and increases. Traffic was greatly impacted, showing that the pandemic influenced activity and travel. A Monday-Monday traffic trend showed that normal traffic levels occurred on weekdays and largest decreases on weekends. Urban roads showed a more rapid response to directives than rural roads. At the study period end, only China and Florida returned to pre-pandemic traffic levels, while China reported zero COVID-19 cases. Sweden experienced its largest COVID-19 curve as the US and had fewer cases-per-million than most states. The findings indicate that rapid traffic decrease was associated with delaying initial COVID-19 peak and a longer time to return to normal traffic, likely delayed the second peak.

This research provides insights for practitioners, researchers, and government entities developing and accessing plans for future pandemics. It is also expected that the findings of this study can be utilized by future researchers who continue to study various aspects of the COVID-19 pandemic and assess the public response to governmental actions.

INTRODUCTION

COVID-19 is a disease caused by the SARS-CoV-2 virus and was first identified in Wuhan, Hubei Province in China, in late 2019. COVID-19 spread throughout the world and has caused enormous global economic and social disruptions. In response to the virus, public officials issued directives to limit person to person contact to contain the rapid spread of the virus. The government restrictions and actions varied from country to country in terms of type, timing, and nature of the limitations for citizens. The United States (US), Sweden, and China, represent the most diverse virus responses taken. China provided an example of an authoritative, centrally planned response, while Sweden represented a classical liberal approach by limiting large public gatherings, but keeping public schools, restaurants, and other business open. The federalist system of the US allowed state governors to choose response measures that were regarded to be most appropriate by local authorities. This resulted in a mixed approach, with most states falling somewhere in between the measures taken by China and Sweden.

By January 2021, the COVID-19 pandemic was not over, and the assessment of significant and complex impacts will go on for years. There is a need for immediate and prompt assessment of outcomes and efforts as they continue to happen. Public acknowledgment and compliance with government recommendations for social distancing and separation is one of the most critical to assess. This can be only valuable insights for dealing with future pandemics. It is complicated to understand the impact of government mandated limitations on temporal and spatial responses of the public, given the near-infinite possibility for person-to-person interaction and the difficulty to systematically monitor the movement of individuals. This research assesses the COVID-19 infections and behavioral reactions using the same consistent measure of roadway traffic across three countries that represent the extreme range of pandemic response of any countries in the world. The impact of travel on decreases and increases of COVID-19 cases, as government mandated restrictions were executed and then reduced across US, China and Sweden is demonstrated by this paper.

The research includes four main sections. The first section is a brief review of similar efforts and reports to analyze the travel and health outcomes of governmental-imposed restrictions during the pandemic of COVID-19. This is followed by description of the data and methods that were used in this study, and the COVID-19 databases and traffic count data systems, and how they were used. The section that follows is a demonstration and discussion of the analytical testing that was performed on the data, together with the findings. Finally, the last section of the paper is a conclusion with a discussion of what the data and findings may be implying.

METHODOLOGY

This study compared 2020 daily traffic volumes to corresponding days in 2019 using a paired t-test in the US, China and Sweden, with a significance level of 0.05. There was no distinction between vehicle types, and the traffic counts were aggregated over 24-hour periods. The comparison period for US and Sweden was one year. This excluded the time of initial onset when government restrictions were first being implemented, reopening phases, and the actions taken at the end of the year. These dates were January 1st to December 31st 2020, and January 2nd to December 31st 2019. China experienced the COVID-19 pandemic much earlier than Sweden and the US. The comparison period for China was January 2nd to April 30th, 2019, and January 1st to April 28th, 2020. The traffic data for the rest of the year was not available.

FINDINGS

The health data has also been temporally offset from the traffic data. The reason for this was to associate the extent of cases to traffic conditions during the approximate time when the infection occurred. There are many other exposure possibilities that are not connected to vehicular travel and have been recognized by the authors.

To determine the number of days to offset reported new COVID cases for each individual state and country, a correlation analysis between number of daily cases and decrease in traffic from 2019 to 2020 was conducted. Correlation is measured by a value between +1 to -1, with +1 being the highest value of correlation. When the correlation is +1, it means the two sets of data have a positive correlation and both of the data sets increase at the same rate. Whereas, when the correlation is -1, it means the two sets of data have negative correlation and one variable decrease while the other increases. Traffic decreases preceded a drop in COVID-19 cases a few days to several months after the COVID/19 relation is offset in time. By moving the COVID case curve, a date can be found where it correlates more to the traffic decrease, and this relation can be shown more clearly. The difference between that date and the reported date of COVID cases, is the number of day offset.

CONCLUSION

Among the contributions of this paper was the illustration of the timeline and level of public responses to closures, lockdowns, and reopening as represented through rapid traffic decreases and increases.

By the end of the study period only China and Florida had returned to pre-pandemic traffic levels and only that reported zero COVID-19 cases. Florida, New York and Massachusetts show new record highs, and only Montana, Illinois and Ohio are showing a steady decrease. Sweden experienced a similar COVID-19 curve as the US, and even had fewer cases than the US states and lower COVID-19 peaks. Traffic was greatly impacted by lockdowns and re-openings, showing that government directives had an impact on activity and travel. Urban roads show a more significant response to directives than rural roads. Rural roads return to normal levels much earlier than urban areas. A Monday-Monday traffic trend during the study period show that more normal traffic levels were shown during weekdays, while the weekends had the largest decreases.

An indication that rapid traffic decrease delayed the initial COVID-19 peak and that a longer time for traffic to return to normal delayed the second COVID-19 peak.