



Vehicle related injury patterns during the COVID-19 pandemic: What has changed?



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ABSTRACT

Background: Following the emergence of the COVID-19 pandemic, normal daily life in the United States (US) has changed dramatically. As the US population shifts to practice social distancing, there are undoubtedly changes in the pattern of traumatic injuries presenting to Emergency Departments across the US. This analysis aims to analyze previously undocumented trends on how the COVID-19 pandemic has changed the pattern of vehicle related injuries in selected US states.

Methods: A retrospective analysis was performed utilizing public vehicle collision data gathered from the Department of Transportation of Florida, New York, and Massachusetts from October 1, 2019 to March 31, 2020 regarding 158,341 motor vehicle collisions. Descriptive statistical analysis and linear regression was performed to investigate the counts and trends of motor vehicle collisions and injuries during the study period in order to determine what effect, if any, COVID-19 has had on the incidence and pattern of these events.

Results: In Florida, New York, and Massachusetts, there was a general downward trend of vehicle collisions and vehicle related injuries over this time period, with statistically significant association between number of total vehicle collisions vs. date ($p < 0.001$), as well as number of vehicle related injuries vs. date ($p < 0.001$).

Conclusion: Incidence of vehicle collisions and vehicle related injuries have significantly decreased during the COVID-19 pandemic. The creation of improved public transport modalities and use of virtual/remote replacements for social activities could serve as long-term solutions to reduce vehicle collisions and vehicle related injuries.

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1. Introduction

1.1. Background

On March 11, 2020, the World Health Organization (WHO) officially declared COVID-19 a pandemic. This announcement has prompted the structure of normal daily life to change dramatically, with the temporary suspension of most in-person activities in favor of virtual and remote replacements in order to reduce the chances of contracting and spreading the virus. As an increasing number of official bodies such as the Centers for Disease Control (CDC) instruct the general population to stay at home and avoid in-person social contact, the incidence and trends of traumatic injuries is likely changing as well.

1.2. Context

Motor vehicle collisions are a leading cause of injury and death in the United States, with the economic burden of medical care and

productivity losses associated with occupant injuries/death exceeding \$75 billion dollars in 2017 [1]. Given the encouragement to practice social distancing from official organizations and some state-mandated stay-at-home orders, it is logical to assume that people will be minimizing their amount of driving only to essential activities, such as grocery stores and pharmacies. This should therefore reduce their risk of experiencing a vehicle related injury, as predicted by the following model: Traffic injury = Exposure × Risk × Injury probability [2].

1.3. Study aims

This analysis aims to identify and explain what trends, if any, are present in the incidence of motor vehicle collisions and vehicle related injuries from the onset of the COVID-19 pandemic until present. Additionally, we aim to discuss the implications of what these trends may have on future patterns of motor vehicle injury after the resolution of this pandemic and provide recommendations as to how this data can be utilized to reduce incidence of vehicle related injuries in the future.

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2. Methods

2.1. Data source and population

A retrospective analysis was performed utilizing public vehicle collision data gathered from the Department of Transportation of Florida, New York (NY), and Massachusetts (MA) from October 1, 2019 to March 31, 2020 [3-5]. These datasets include collision information submitted by law enforcement, fire departments and other organizations that are involved in resolving a vehicle collision incident. The states analyzed were chosen based on data availability, and priority was given to as densely populated states as possible in order to capture the largest number of vehicle collisions and Vehicle Collision injuries. The October 2019–March 2020 time frame was chosen to ensure that all collisions and Vehicle Collision vehicle injuries since the emergence of COVID-19 were captured. Information regarding a total of 158,341 motor vehicle collisions was gathered by searching these public databases for All Vehicle Collisions and Vehicle Collision Injuries, which includes Alcohol/Drug related collisions.

2.2. Statistical methods

Descriptive statistical analysis was performed to investigate the counts and trends of motor vehicle collisions and injuries during this time frame in order to determine what effect, if any, COVID-19 has had on the incidence and pattern of these events. In addition, linear regression was performed to investigate if there was any

significant association between the number of vehicle collisions and Vehicle Collision injuries and date. IBM SPSS statistics software version 26 was used for data analysis. Statistical significance was defined as $p < 0.05$.

3. Results

3.1. Results for New York

NY experienced an average of 494.39 collisions per day (SD = 131.92, maximum = 782, minimum = 138, median = 505, Interquartile range = 158) with a steady decline in the number of vehicle collisions as there is progression through the date range as evidenced in Fig. 1 with a sharp point of inflection in early March 2020. Subsequent linear regression analysis revealed a moderate negative correlation between total number of vehicle collisions and date (Table 1). In regards to trends in vehicle related injuries, NY experienced an average of 145.3 vehicle traumas per day (SD = 41.55, median = 147, maximum = 260, minimum = 30, IQR = 49) with a steady decline in number of vehicle related injuries as there is progression through the date range (Table 1). Subsequent linear regression analysis revealed a moderate negative correlation between number of vehicle injuries and date (Table 1). Additionally, evaluation of the incidence and trends of vehicle collisions for the same October 1–March 29 time frame in the 2016–2017, 2017–2018, 2018–2019, and 2019–2020 was performed to determine if the trends observed due to normal seasonal changes. As demonstrated in Fig. 2, it appears that there is a dramatic difference

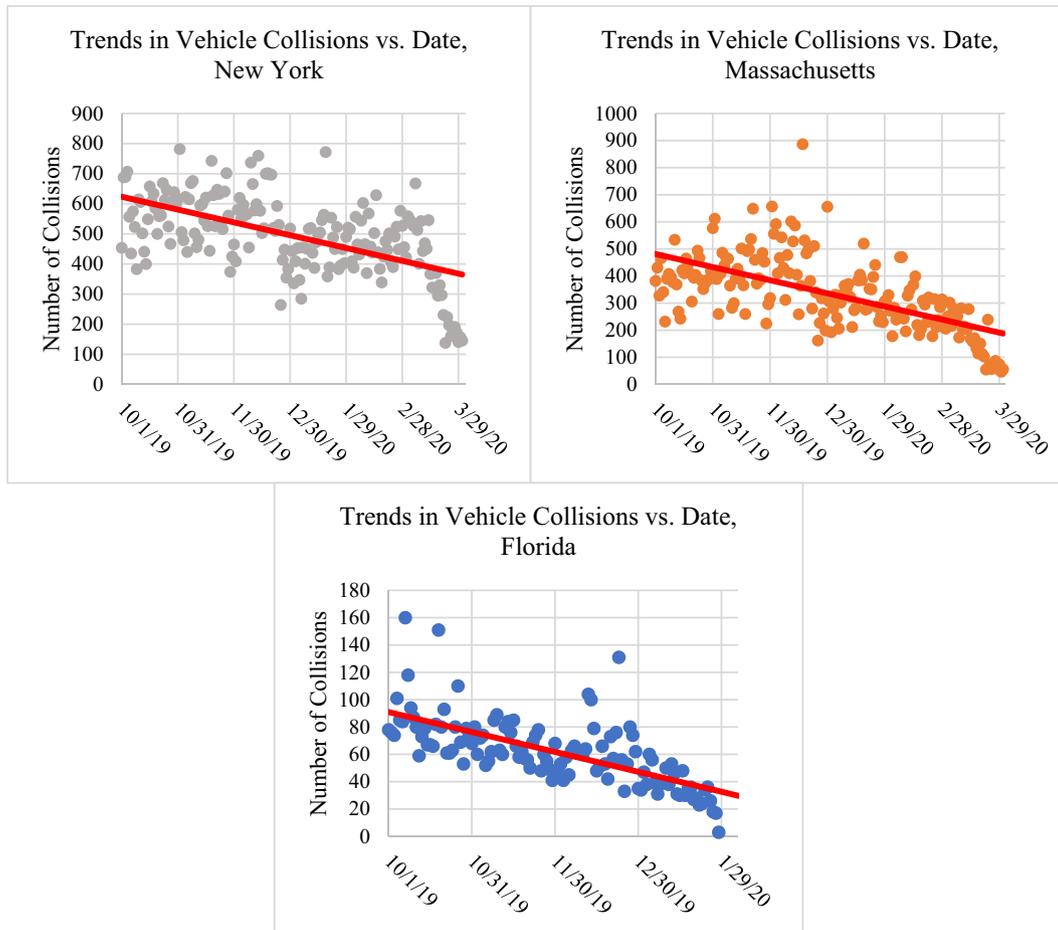


Fig. 1. Trends in vehicle collisions vs. Date in New York, Massachusetts, and Florida. A moderately negative correlation between the incidence of vehicle collisions and date can be observed for the three states analyzed with a sharp inflection after March 1, 2020 for New York and Massachusetts. Trendline equations, Pearson correlations, and p-values corresponding to each state can be found in Table 1.

Table 1
Linear trendline and regression equations for vehicle collisions and injuries. The linear trendlines, Pearson correlation values, and subsequent p-values can be observed for the categories of vehicle collisions and vehicle injuries in New York, Massachusetts, and Florida. Abbreviations: CI = confidence intervals.

State	Category	Pearson correlation	95% CI	P-value
New York	Vehicle collisions	-0.570	298,263.351, 379,457.154	<0.001
	Vehicle injuries	-0.545	86,204.677, 111,413.277	<0.001
Massachusetts	Vehicle collisions	-0.605	216,358.492, 286,073.089	<0.001
	Vehicle injuries	-0.567	4028.115, 13,230.507	<0.001
Florida	Vehicle collisions	-0.677	62,272.214, 93,050.879	<0.001
	Vehicle injuries	-0.633	23,103.787, 33,954.232	<0.001

between the trends observed during COVID-19 (2019–2020) compared to this time period in previous years.

3.2. Results for Florida

Florida experienced an average of 62.06 total vehicle collisions per day (SD = 24.98, median = 61, minimum = 3, maximum = 160, IQR = 29) with a steady decline in the number of vehicle collisions as there is progression through the date range as evidenced in Fig. 1 and Table 1. Subsequent linear regression analysis revealed a moderately

negative correlation between number of vehicle collisions and date (Table 1). In regards to total vehicle related injuries during this time period, Florida experienced an average of 41.99 injuries per day (SD = 13.31, median = 42, minimum = 5, maximum = 89, IQR = 15) with a steady decline in number of vehicle injuries as there is progression through the date range. Linear regression analysis revealed a moderately negative correlation between number of vehicle injuries and date (Table 1). Evaluation of seasonal trends (Fig. 2) revealed a dramatic reduction in vehicle collisions during the 2019–2020 COVID time period compared to previous years.

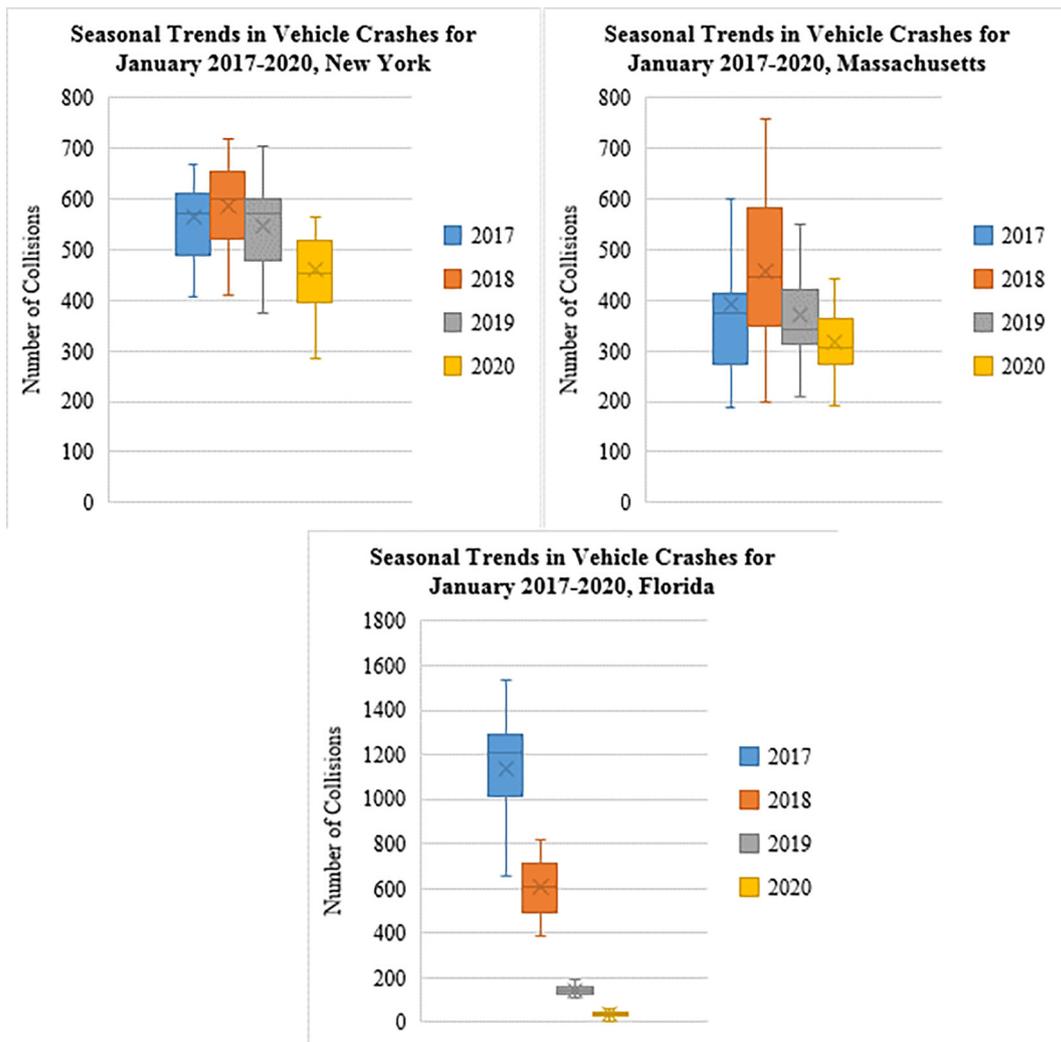


Fig. 2. Seasonal trends in vehicle collisions from 2016 to 2020 in New York, Massachusetts and Florida. These plots show the number of vehicle collisions which occurred during January 2017, 2018, 2019, and 2020. It can be observed that in each state, there is a downward trend and reduced numbers of vehicle collisions during the in 2020 compared to the same time period in previous years.

3.3. Results for Massachusetts

MA experienced an average of 330.97 total vehicle collisions per day (SD = 134.663, median = 324, minimum = 47, maximum = 885, IQR = 170) with a steady decline in the number of vehicle collisions as there is progression through the date range as evidenced in Fig. 1 and Table 1 with a sharp point of inflection in early March 2020. Linear regression analysis revealed a moderate negative correlation between number of vehicle collisions and date (Table 1). In regards to total vehicle injuries during this time period, MA experienced an average of 16.1 vehicle injuries per day (SD = 8.75, median = 15, minimum = 0, maximum = 44, IQR = 12) with a steady decline in number of vehicle injuries as there is progression through the date range (Table 1). Linear regression analysis revealed a moderate negative correlation between number of vehicle injuries and date (Table 1). Evaluation of seasonal trends (Fig. 2) revealed a dramatic reduction in vehicle collisions during the 2019–2020 COVID time period compared to previous years.

4. Discussion

In the three states analyzed, there is a common statistically significant trend of reduced total vehicle collisions and vehicle related injuries during the COVID-19 pandemic. One of the most important factors likely contributing to these trends is the nationwide practice of social distancing in combination with state mandated stay-at-home orders, which are critical to reducing the transmission of COVID-19 [6]. As people stay at home and reduce their amount of driving, virtual replacements such as social media are critical to maintaining social connectedness and decreasing not only vehicle collisions, but depression and anxiety as well [7]. Therefore, the practice of reducing the number of in-person activities in favor of remote replacements may be one longitudinal practice that can reduce the incidence of vehicle collisions and injury following the resolution of the COVID-19 pandemic.

Relatedly, with less drivers on the road, there is a decreased chance of suffering a traffic injury according to the model of traffic injury by Hakkert and Braimaister [2]. Our study supports this notion by demonstrating that during early March 2020, there was a sharp reduction in the number of vehicle collisions in NY and MA which is likely caused by the WHO declaration of the pandemic on March 11, 2020 and rapid subsequent promotion of stay-at-home orders. Previous studies have indicated that the development and implementation of public transport has reduced traffic congestion and improved cost effectiveness for consumers in large cities compared to private vehicle use [8]. An additional long-term solution to reducing vehicle related injuries after COVID-19 could be the development and encouragement of public transport options in order to reduce the number of drivers and therefore the risk of experiencing a vehicle collision and Vehicle Collision injury.

Another important contributing factor to decreased number of vehicle collisions and Vehicle Collision injuries may be the reduction of alcohol impaired driving. The consumption of alcohol prior to driving is a well-known risk factor for traffic collisions as previous studies have shown that both driving speed and speed of detection of potentially hazardous events correlate positively with collision rates while under the influence of alcohol [9]. As states order the closure of non-essential businesses, the prevalence of drinking alcohol at bars/nightclubs and restaurants is decreasing and may prompt individuals to consume alcohol at home instead, possibly contributing to a reduced incidence of alcohol related vehicle collisions and Vehicle Collision injury. Previous studies have indicated that drinking at home is associated with a feeling of increased safety, convenience, stress relief, autonomy, and lower cost than drinking at an establishment [10]. Therefore, long-term reduction of in-person drinking at bars, nightclubs and restaurants in favor of alcohol consumption at home and “virtual happy hours” may be a solution to reducing the incidence of alcohol related

vehicle collisions and Vehicle Collision injury following the resolution of the current pandemic.

There are several limitations to our study. First, the Department of Transportation data utilized for this analysis is based on submission by law enforcement and other organizations involved in resolving a vehicle collision incident, so therefore our data only represents submitted incidents and does not include collisions that were not submitted to Department of Transportation of each respective state. Second, Florida data was not available for the month of March 2020, which if present may have changed the strength of trends observed. Third, there is not a clear definition for what is classified as a vehicle injury for each state; seemingly, minor afflictions such as bruising or soreness may be classified as an injury, which could falsely increase the incidence of injuries for each state and explain variability in number of injuries reported.

5. Conclusions

The implication of these results is that driving to in-person activities increase the chance of suffering a vehicle collision and vehicle related injury. As the COVID-19 pandemic resolves and restrictions on in-person social activity are lifted, careful monitoring of vehicle collision and Vehicle Collision injury rates should be performed to determine whether COVID-19 has had any longitudinal impact on people substituting in-person social activity for remote replacements at home. Additionally, we recommend for the creation of solutions, which can serve to reduce the incidence of vehicle collisions and Vehicle Collision injury, such as the development of more robust public transport systems and virtual replacements for activities. We hope that careful implementation of these solutions will reduce the incidence of vehicle related injuries and will contribute to a more healthy and happy population after COVID-19.

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CRedit authorship contribution statement

Mason Sutherland: Conceptualization, Investigation, Formal analysis, Writing – original draft, Writing – review & editing. **Mark McKenney:** Investigation, Formal analysis, Writing – review & editing. **Adel Elkbuli:** Conceptualization, Investigation, Formal analysis, Writing – original draft, Writing – review & editing.

Declaration of competing interest

Authors declare no competing interests.

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