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## How COVID changed transportation landscape of NYC

The COVID-19 pandemic forever changed the landscape of not just New York, or just the United States, but of the entire world. One of the many ways that this change manifested was through changes in transportation patterns, especially in urban environments that had previously been jam packed with traffic, pedestrians, and as a result, many fatalities. During the lockdowns, traffic levels in NYC fell sharply, while the number of people who were walking and cycling rose. These shifts in transportation preferences brought with them emerging trends in car accidents and pedestrian fatalities that continue to this day, suggesting that the pandemic's influence on traffic behavior continues to persist.

While there has been significant research on road safety and accident trends prior to the pandemic, there has been less attention to how these trends have evolved in the post-pandemic era. This research paper will aim to fill that gap by leveraging data science techniques to analyze crash and fatality data in New York City. Understanding how car accidents and pedestrian deaths have changed in the wake of COVID-19 will provide crucial insights for urban planners, policymakers, and public safety officials, who are tasked with designing safer streets for a post-pandemic world that will hopefully be useful not just to the city of New York, but any urbanized space. With an increasing occupancy of urban spaces, people choosing to get around the cities via biking and walking increases (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7964246/). It’s more important than ever to understand and identify weak points in urban transportation systems to mitigate crashes and help make the city a safe and enjoyable place for everyone.

One of the primary questions guiding this study is how the patterns of car accidents and pedestrian fatalities have shifted compared to pre-pandemic levels. The analysis will focus on identifying changes in modes of transportation, as well as in the frequency, severity, and nature of these incidents before, during, and after the pandemic. Another important aspect of the research is examining the factors influencing these trends, such as traffic volume, commuting behaviors, risk factors, and infrastructure modifications. By understanding these drivers, the study seeks to uncover what has contributed to any observed shifts in accident rates and fatalities. Furthermore, the research will explore whether specific areas, demographics, or times of day have experienced significant changes in accident or fatality rates in the post-COVID landscape. Lastly, the findings will be used to consider the implications for future urban planning, road safety policies, and traffic management strategies in New York City, providing a framework for improving road safety and protecting both drivers and pedestrians.

The literature on road safety and traffic accidents in New York City is extensive, particularly concerning trends before the COVID-19 pandemic. Many studies have examined the dynamics of traffic incidents in urban settings, highlighting factors such as road design, traffic volume, pedestrian behavior, and the implementation of safety measures like *Vision Zero*. A notable study by Hu & Cicchino (2018) evaluated the early impact of Vision Zero on traffic fatalities in New York City and found mixed results; while traffic deaths overall had decreased, pedestrian fatalities remained a significant issue, especially in the densely populated areas. Similarly, research by Mueller et al. (2020) analyzed the interactions between urban infrastructure and safety outcomes, focusing on cycling and pedestrian crashes, showing the importance of proper urban design and traffic calming measures in reducing injuries. However, much of this pre-pandemic research did not account for a disruptor like COVID-19, which profoundly altered urban mobility patterns.

During the pandemic, initial studies explored the effects of lockdown measures on transportation behavior and traffic incidents. Shilling and Waetjen (2020) found that overall traffic volume plummeted during the lockdown, leading to fewer accidents, but paradoxically, the severity of crashes increased; likely because as traffic volume reduced, people were more able to drive recklessly. Similarly, research by Dumbaugh et al. (2021) documented how COVID-19 altered the transportation landscape, noting that more people turned to walking and cycling as safer alternatives to public transportation. These studies highlight early pandemic trends, but much of this research is limited to the first year of COVID-19 and has not yet delved into the long-term post-pandemic impacts on traffic safety.

There is a notable gap in the literature when it comes to post-pandemic trends in crash and fatality data in New York City. While Vision Zero initiatives were examined pre-pandemic, research into how the pandemic permanently altered traffic behaviors, road safety, and accident severity is sparse. For example, Sharifi et al. (2022) focused on pandemic-era shifts in traffic safety across multiple cities but lacked a deep dive into how these shifts have played out in a city like New York post-lockdown. Studies have yet to explore whether new behaviors; such as increased walking and biking or changes in driver habits have persisted into the post-pandemic period and what that means for road safety. Moreover, the role of law enforcement and traffic monitoring has shifted, as highlighted by reports from the New York City Department of Transportation, which show that changes in traffic enforcement during COVID-19 impacted how traffic laws were adhered to (NYC DOT, 2021).

This research aims to fill the gap in the literature by utilizing data science methods to analyze post-COVID crash and fatality trends in New York City. Building on previous work that has examined pre-pandemic traffic patterns, this study will apply machine learning models, statistical analysis, and geospatial tools to address the unique conditions created by the pandemic. In doing so, it will contribute to the growing body of knowledge on the post-pandemic safety landscape and offer insights to inform future urban planning and road safety policies in New York City.

The methodology for this study will involve a comprehensive data-driven analysis of crash and fatality data in New York City, focusing specifically on the post-COVID-19 period. The primary data will be sourced from the publicly available dataset, the New York City Open Data Portal (https://data.cityofnewyork.us/browse?q=VZV), which provides detailed records of motor vehicle collisions maintained by the NYPD. Additional data will be drawn from NYC Department of Transportation (DOT) reports, which offer insights into traffic fatalities, serious injuries, and Vision Zero progress. These datasets will cover the period from 2014 to 2023, enabling an analysis of crash and fatality trends across pre-pandemic, during-pandemic, and post-pandemic timeframes.

The data analysis will include several key approaches. Descriptive statistics will first be used to summarize the data, providing a broad overview of crash rates, fatalities, and injury patterns over time. Time-series analysis will then be employed to identify trends and shifts in crash and fatality rates, particularly around key moments such as the onset of lockdowns and the city’s reopening. A geospatial analysis using GIS tools will be conducted to identify accident "hotspots" and observe any changes in the geographic distribution of crashes or fatalities. To further understand the predictors of crashes and fatalities, machine learning models such as logistic regression and random forests will be applied. These models will help identify which factors (e.g., traffic volume, driver behaviors, and infrastructure) have had the most significant influence on crash severity and pedestrian deaths, both before and after the pandemic. Hypothesis testing will also be used to statistically evaluate changes in accident rates across different periods.

For this study, Python and R will be used for data cleaning, statistical analysis, and machine learning. Libraries such as Pandas, Scikit-learn, and Stats models will facilitate data manipulation and predictive modeling. GIS software, such as QGIS or ArcGIS, will be used to conduct geospatial analysis and create visual representations of accident data, while tools like Tableau or Matplotlib will help visualize the trends and results in easily interpretable formats. To ensure the validity of the findings, techniques such as cross-validation will be employed to evaluate the performance of the machine learning models, and sensitivity analyses will be conducted to assess the robustness of the results across different data assumptions. Ethical considerations will also be maintained throughout the study, ensuring that any sensitive information is anonymized, although the data being used is publicly available and free from personally identifiable information. This multi-faceted approach will provide a thorough and robust analysis of how traffic accidents and pedestrian fatalities have evolved in New York City post-COVID, offering critical insights for urban planning and public safety policy.

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