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Review

An overview of the impact of COVID-19 on road traffic safety and travel behavior

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ABSTRACT

The COVID-19 epidemic caused global roads and highway networks to be disrupted to historic proportions. While the world is focused on combating COVID-19 pandemic, people are still dying and being injured as a result of traffic collisions on the highways owing to movement restrictions. Although the impact of shutdown mechanisms on traffic safety is still being studied, initial studies reveal a decrease in traffic flow and a rise in risky driving behaviors. On the other hand, it is important to investigate how the epidemic has influenced travel behavioral characteristics in order to design mobility regulations for the post-COVID-19 future. Considering the transport network has had a significant impact on the spread of infectious diseases (such as influenza A/H1N1, SARS, and Ebola) over the years [50,53]. The novel contagious coronavirus, also known as COVID-19, has recently spread rapidly around the globe, the World Health Organization (WHO) declared a pandemic in March 2020, following the discovery of the first verified case in the Chinese city of Wuhan in December 2019 [27,47]. As of September 29, 2021, the epidemic had spread to 223 countries and infected more than 233,569,801 people worldwide, resulting in more than 4779,109 deaths [45]. To prevent the spread of the COVID-19, most countries imposed strict restrictions and laws, including lockdowns, traffic limitations, employment, educational institutions, shopping, all religious services and, prohibitions on all social gatherings [3]. Several governments implemented these restrictions gradually, while others did so abruptly, resulting in partial or total lockdown [9]. At the very same time, road crashes continue to be one of the most serious transportation issues worldwide, leading in property damages, financial losses, and personal deaths and injuries [17,35]. Around 1.35 million people are dead on roads each year around the globe and, it is also the eighth major reason of deaths, with up to 50 million people injured each year [46]. The worldwide and local mobility restrictions imposed in response to the rapidly spreading COVID19 pandemic have resulted in significant changes in people’s travel behavior also [28]. However, Transport demand and travel behavior are, in reality, heavily linked to societal interaction. Because of this pandemic, travel and work two of the most basic aspects of daily life, have changed dramatically.

Because of the decreased traffic volume, road traffic accidents have dropped in most countries around the world. The reduction in traffic volume is thought to have contributed to an increase in speeding drivers. Lower traffic volume and congestion, especially during the start of the epidemic, combined with a decline in law enforcement created an environment where speeding was more likely [30,37,44]. Initial statistics indicates that, in addition to speeding, intoxicated driving is on the rise [49]. All public safety precautions implemented to counteract COVID-19 led to a reduction in traffic users (especially at peak weekday travel periods) also indicated an increase in unsafe road user activity, including speeding and driving while intoxicated. Moreover, initial road accident statistics indicate a reduction in both fatalities and non-fatal...
The effects of external COVID-19 isolation strategies on how movement attributes evolved after COVID-19 expanded has not been extensively researched. It might be stated that the introduction of social distancing policies had a substantial impact on individual travel both at local and global travel, based on initial study and data from various nations [29]. Travel demand has decreased in overall, and vehicular traffic and public transportation use have decreased dramatically throughout many countries in the world. People stayed away from public transportation because it was thought to be a breeding place for viruses and a location where it would be hard to prevent interaction with other travelers [40]. Bicycle riding increased at the outbreak of the epidemic as people are seeking a secure, dependable mode of transportation, and it has been a common mode of transportation, particularly for small or recreational excursions, ever since. The COVID-19 epidemic also has had a major impact on airline travel patterns. The number of flights as well as the number of passengers has considerably decreased [54]. The current study aims to provide an overview of the impact of the COVID-19 pandemic on road traffic crashes, deaths, and injuries. In reaction to the fast spreading COVID19 epidemic, global and regional movement limitations have resulted in substantial changes in people’s travel behavior.

3. Taxonomy of the reviewed systems

The effects of COVID-19 pandemic on travel patterns, congested roads, and road travel safety are generating a lot of discussions. Road traffic accidents are still one of the world’s top critical traffic problems, resulting in property damage, economic difficulties, and people deaths and injuries. In reaction to the fast spreading COVID19 epidemic, global and regional movement limitations have resulted in substantial changes in people’s travel behavior.

3.1. Road traffic safety

Figs. 2 and 3 show taxonomy of different studies used in this study to analyze the impact of COVID-19 on road traffic safety and travel behavior. We investigated a total of 18 research papers for this study, all of which looked at the impact of COVID-19 on road traffic safety. For the purpose of assessing the influence of the COVID-19 pandemic on road safety, 9 publications (50% of total evaluated articles) employed statistical analysis, while 9 papers (50% of total reviewed articles) used questionnaire surveys, machine learning, time series analysis, and other methods. Statistical analysis includes poisson regression, negative binomial model, logistic regression, and chi square test, etc.

3.2. Travel behavior

COVID-19 pandemic results in extreme changes in travel behavior in

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**Fig. 1.** Flowchart of PRISMA-based article search strategy.
To investigate this travel behavior change, we looked at a total of 23 scientific papers and a taxonomy have been presented in Fig. 2. Depending on the methodology, these 23 articles can be exposed in three categories such as (i) statistical analysis; (ii) descriptive analysis; (iii) Both statistical & descriptive analysis. Among these, 13 papers (56.5% of total reviewed articles) are on statistical analysis, 6 papers (26.1% of total reviewed articles) are on descriptive analysis and 4 papers (17.4% of total reviewed articles) are on both statistical and descriptive analysis on travel behavior during COVID-19 epidemic. Statistical analysis includes paired t-test, chi square test, negative binomial model, two binary logit models, least-squares regression models, Mann Whitney U test; Wilcoxon signed-rank test, Gini index; Inclusive Development Index; Human Development etc. From the analysis of travel behavior, one of the most important observations is that people have inclined in private transport from public transport in large.

4. Literature on developed systems

In terms of traffic safety and travel behavior, recent literature studies have provided important insights and information to govern how future lockdowns are managed. This research reviews a number of articles, examining the causes of crashes, data sources, methodology, and important findings. Sections 4.2 and 4.3 go through the important findings of the previous studies, which are summarized in Tables 1 and 2, as well as taxonomy.
involved in car accidents. Even throughout COVID-19 pandemic, safety of business trips taken, have a beneficial impact on the number of people situation of road security and public opinion of highway safety during entering three separate data sets in Qatar, Alhajyaseen et al. [3] studied the consciousness, mobility, and mobility patterns are all tightly linked, and preventive strategies. They observed that the overall people miles traveled reduced as a result of the required social shutdown rules due to COVID-19, not including incidents leading to severe or fatal injuries. Following accidents, injuries and deaths that result from them. The majority of participants stated that overall activity had continuing tinctions. The majority of participants stated that overall activity had

\[ \text{Table 1} \]

| Author                | Study Area | Accident Increase/Decrease Causes of crashes | Method | Data Collection Sources |
|-----------------------|------------|-----------------------------------------------|--------|-------------------------|
| Yao et al. [51]       | USA        | Angle crashes have increased significantly Driver behavior has shifted in a negative way, with more carelessness and speed | Statistical analysis | Michigan State Police (MSP) Traffic Crash Reporting System (TCRS) |
| Sekadakis et al. [35] | Greece     | The total number of traffic collisions fell, the number of fatalities and minor injuries increased dramatically | The volume of traffic has dropped dramatically | Seasonal Autoregressive Integrated Moving Average (ARIMA) | Hellenic Statistical Authority |
| Muley et al. [22]     | Qatar      | Fewer fatalities | Lockdown in every way | Measuring the cumulative effect of small changes | Public Works Authority (ASHGHAL) |
| Salădăie et al. [33]  | Spain      | The number of road accidents is increasing | Unwillingness to use public transit, more private vehicles are being driven | Chi-square test | Directorate-General of Fire Prevention, Extension and Rescue (DGFEIS) |
| Vanlaar et al. [48]   | USA, Canada | Increase high-risk driver behavior | Most of the people said their behavior had not changed | Logistic regression | Traffic Injury Research Foundation (TIRF), Road Safety Monitor (RSM) surveys |
| Lin et al. [19]       | USA        | Non-fatal accident decreased but severe and fatal cases of traffic accidents remains the same | Traffic lock down | Difference-in-differences (DID) regression analyses | Los Angeles and New York City |
| Barnes et al. [5]     | USA        | Decrease in traffic accidents | Stay-at-home | Regression discontinuity design | COVID Tracking Project, Google Community Mobility reports |
| Michelmanaki et al. [21] | Greece, Saudi Arabia, Cyprus and Brazil | Road crashes decreased | Traffic lockdown | Fusion technology, machine learning algorithms and driver monitoring metrics | GPS, accelerometer data, and gyroscope data |
| Sedain and Pant [34]  | Nepal      | Reduced the amount of traffic collisions, injuries and deaths that result from them | Lockdown, Speeding | Excel spreadsheet analysis | Media reports |
| Gupta et al. [10]     | India      | Reduced crash fatality | Lockdown | Linear mixed model | Traffic police website or national road crash database |
| Huang et al. [12]     | China      | Electric bicycle related RTIs increased, total number of RTIs decreased | Lockdown | Retrospective study | Suzhou pre-hospital emergency center |
| Yan and Zhu [52]      | China      | E-bike fatal accidents are down | Lockdown | Multi-output regression models | Province-level and monthly socioeconomic data |
| Zhang et al. [54]     | USA        | Number of people involved in accident reduced | Lockdown | Negative Binomial (NB) | National Household Travel Survey and American Community Survey |
| Qureshi et al. [30]   | USA        | Reduction in road traffic accidents | Mandated societal lock down | Time series analysis | Statewide Traffic Accident Records System |
| Rapporto et al. [31]  | Canada     | Deaths and injuries among older drivers have decreased | Traffic lock down | Agresti-Coul method | Ontario Ministry of Transportation’s (MTO) Research and Evaluation Office |
| Alhajyaseen et al. [3] | Qatar      | Total number of crashes reduced, serious and fatal injuries increased | Traffic lock down | Questionnaire surveys | Questionnaire surveys |
| Oguzoglu [24]         | Turkey     | Decline in accidents | Traffic lock down | Poisson models | Ministry of Transport and Infrastructure (MTI), monthly city-level traffic accident reports |
| Shaik et al. [37]     | Bangladesh | Reduces deaths and injuries but continuing | Traffic lock down | General overview | Newspaper articles, WHO, Worldometer |

4.1. Road traffic safety

Road traffic accidents particularly in non or even no injuries were reduced as a result of the required social shutdown rules due to COVID-19, not including incidents leading to severe or fatal injuries. Following the first month of the COVID-19 epidemic [31], investigated at the variation in accidents and fatalities among different age motorists and pedestrians. Adults aged 80 and up would experience a correspondingly bigger decline than other motorists and pedestrians, according to these researchers. Zhang et al. [55] have been using the Negative Binomial (NB) approach to determine the impact of COVID-19 on the people engaged in collisions while controlling for the severity of various preventive strategies. They observed that the overall people miles traveled on the major traffic mode per person per day, as well as the percentage of business trips taken, have a beneficial impact on the number of people involved in car accidents. Even throughout COVID-19 pandemic, safety consciousness, mobility, and mobility patterns are all tightly linked, and hence have an indirectly impact on the number of accidents. Considering three separate data sets in Qatar, Alhajyaseen et al. [3] studied the situation of road security and public opinion of highway safety during the COVID-19 epidemic. The overall rate of accidents in Qatar throughout COVID-19 was much lower than in the past five years, but the rates of severe and fatal casualties climbed substantially. Gupta et al. [10] investigated the effect of shutdown strategies used to combat COVID-19 on-road casualties, using a generalized linear mixed method for analyses in fifteen nations due to the seriousness of the pandemic. The results of this model also showed that strict shutdown restrictions as well as a high level of residential movement decreased the Accident Fatalities and injuries Ratio. During the period of total lockdown in Nepal, Sedain and Pant [34] summed it up of road accident and fatalities. There seemed to be a decrease in the number of vehicle accidents, damages, and deaths, the decrease was not as significant as expected due to the severe limits on moving vehicles enforced during the shutdown. Saladié et al. [33] investigated the impact of the Spanish government’s COVID-19 restriction on road traffic fatalities in the region of Tarragona (Spain). Throughout the COVID-19 shutdown, total movement in Tarragona state decreased by 62.9%, whereas road fatalities decreased by 74.3%. Their results add to the growing body of information that the COVID-19 epidemic is wreaking havoc on transportation safety. Vanlaar et al. [48] examined self-reported unsafe driving behaviors in Canada and the United States during the epidemic to see if there are any distinctions. The majority of participants stated that overall activity had
Table 2
Summary of previous researches that analyzes the impact of COVID-19 on travel behavior.

| Author et al. | Data Sources | Methodology | Key findings | Study Region |
|---------------|--------------|-------------|--------------|--------------|
| Parr et al. [26] | Florida Department of Transportation (FDOT) | Paired t-test, SPSS | Overall traffic volume of statewide dropped by 47.5 percent; impact of COVID-19 on freeway traffic appears to start earlier than on arterial roads; Changes in travel behavior were influenced by spring break and decisions made by local governments and employers | Florida, USA |
| Parker et al. [25] | Traffic survey by smartphone | Mobility data analysis | The pandemic impacted the travel patterns of transit riders more than the travel patterns of nonriders; Due to transit service changes, infection risk on transit, trip reduction, 75% transit riders reported taking transit less | USA |
| Wang et al. [43] | Regional Household Travel Survey (RHTS); Citywide Mobility Survey (CMS); General Transit Feed Specification (GTFS); Open Street Map (OSM); Metropolitan Transportation Authority (MTA) | Develop pre-COVID Model & COVID Model by using MATSim-NYC | Number of cars increases to 142%; Transit ridership would decrease 50% due to limiting transit capacity; The trips by transit, walking and driving have decreased to 88%, 54%, 76%, respectively; The total number of trips also drastically reduced | New York, USA |
| Abdullah et al. [2] | Online Questionnaire Survey | Multinomial logistic regression | Shifted from public transport to private transport and non-motorized modes; Majority of trips were conducted for shopping; Factor affecting mode choice such as gender, employment, car ownership, primary traveling purpose | Worldwide |
| Truong and Truong [41] | Bureau of Transportation Statistics (BTS); Centers for Disease Control and Prevention (CDC) | Time-series models using Autoregressive Moving Average (ARIMA) method Statistical analysis | Shows a closed loop scenario between residents’ travel behavior and COVID-19 infections | USA |
| Hara and Yamaguchi [11] | Mobile spatial statistics (MSS) | Exploratory factor analysis | Significantly reduced in trips and inter-prefectural travel; Reduced trips 45% in Tokyo and 27% in Osaka; The number of individuals traveling from large cities to local cities has decreased dramatically | Japan |
| Anwari et al. [4] | Questionnaire Survey | Contingency tables; Ordinal logistic regression | In urban areas online work or education (95%) and shopping (170%) has risen; During the epidemic, buses are still the most popular mode of transportation for short-distance recreation (26.75%), markets (43.18%), and long-distance recreation (35.66%); Males continue to work and shop outside, putting them at more danger of COVID-19 infection than females | Bangladesh |
| Chua et al. [7] | Web-based survey | Confirmatory factor analysis (CFA); SPSS and AMOS 24 | Global health issue has opened up new possibilities to be more resilient and agile for the tourism and travel industry by reconsidering and remaking the operational practices | USA |
| Abdullah et al. [1] | Questionnaire survey | McNemar-Bowker test; Mann-Whitney U test; Exploratory factor analysis (EFA) | Significant shift in primary travel from work and studies to shopping; Non-commuting travels were also notably different; Shift travel from motorbike to non-motorized modes for distances less than 5 km, People shifted from public transport to private car for long distances | Pakistan |
| Wachyani and Kusumaningrum [42] | Online questionnaires survey | Descriptive study using quantitative approach | Majority (78%) of respondents would go back on tour; 65% will return to travel within 6 months; Travel intention is higher than travel anxiety | Jakarta, Indonesia |
| Menon and Keita [23] | Web-based survey by University of South Florida (USF) | Descriptive data analysis | The number of people using public transportation and hailing a cab has plummeted; Bike sharing operations have increased; The number of people using bike-sharing services has grown | USA |
| Huang et al. [13] | Baidu Maps | Data-driven analysis | Public transit declines to 45%; Proportions of taking a private vehicle and riding on a bicycle significantly increased; Proportion of visiting residential areas greatly increases to 31.25% and the proportion of visiting transport facilities rapidly declines to 19.00% | China |
| Zudhy et al. [56] | Web-based questionnaire survey | Structural Equation Model (SEM) | Teleworking and e-learning directly affected activity-travel behavior changes; Significant decline in the volume of cars, motorbikes, and other types of transportation; Nearly 80% higher than normal use of ICT tools | Indonesia |
| Shakibaei et al. [38] | Paper-based panel survey | Panel data and descriptive analysis, Chi-square test | The shift in travel activity patterns and mobility appears to be quite extreme; Teleworking and distance education is encouraging particularly for commuting and Social/Recreational/Leisure (SRL) trips | Istanbul, Turkey |
| Shamshiripour et al. [39] | Travel behavior survey; Questionnaire survey | Descriptive and statistical analysis | Commuting to workplace and in-store shopping are being switched by telecommuting and online shopping, around 43% is expected to travel with | Chicago, USA |

(continued on next page)
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Yan and Zhu [52] built novel applications of multi-output linear
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behavior, according to this analysis. Working from home and e-learning,
as well as views regarding COVID-19, all had a direct impact on
activity-travel behavior modifications; however teleshopping certainly
didn’t help reduce out-of-home engagements during the COVID-19
epidemic. Huang et al. [12] had been using a massive amount of
human movement information recorded from Baidu Maps, a popular
web map-based system in China, to look into the thorough attitude of the
crowd there throughout the epidemic in order to truly comprehend the
effect of COVID-19 on public transit behavior patterns and to provide
more focused anti-epidemic initiatives. Truong and Truong [41] built
time-series prediction model using the Autoregressive Moving Average
(ARIMA) approach to identify possible patterns of regular visits by dis-

not changed, while a minor percentage stated that they were less in-
clined to interact in such risky driving practices. When comparison to
that before COVID-19, a large percentage of people said they were more
inclined to engage in unsafe driving behaviors during the epidemic.
Sekadakis et al. [35] used three distinct Seasonal Autoregressive Inte-
rated Moving Average (SARIMA) time series models to assess the
impact of the COVID-19 epidemic on road traffic crashes, fatalities, and
injuries. The total number of road accidents, fatalities, and minor in-
juries fell as a result of the substantial reduction in traffic volume, ac-
cording to the modeling results. Another conclusion was that the
number of fatalities and minor injuries increased dramatically during
the shutdown and the following month.

To explore the total influence of COVID-19 on e-bike safety in China,
Yan and Zhu [52] built novel applications of multi-output linear
regression and clustering-based multi-output regression models. At the
national level, the number of COVID-19 instances has a considerable
negative impact on the number of e-bike accidents and deaths. Hung
et al. [12] conducted a retrospective study in Suzhou, China, to highlight
recent ideas in the epidemiological of road traffic crashes during the
COVID-19 pandemic. These were accompanied by an increase in the
number of electric bicycle-related accidents and an increase in the
number of road traffic injuries with disturbance of awareness. The
summary of previous research that analyzes the impact of COVID-19
on road traffic safety is depicted in Table 1.

4.2. Travel behavior

Using a structural equation model, Irawan et al. [14] investigated the
variation in activities and related travelling during the commencement
of the COVID-19 epidemic in Indonesia. The regularity of mobility
during the COVID-19 epidemic was significantly affected by approach
behavior, according to this analysis. Working from home and e-learning,
The Coronavirus pandemic, all policymakers continue working to stop the virus from spreading. In the event of a pandemic, pedestrian walkways and pathways should be part of a network that provides an adequate level of service and safety along the whole trip. Extending sidewalks, establishing safe cycling routes, and implementing ITS systems aimed to construct smart pedestrian networks will be the most effective initiatives taken by governments [8]. Researchers can take these agenda to study to assist transport management after pandemics. Other variables, such as employment kind, must be explored in future studies to better understand the determinants of activity travel behavior change during the epidemic.

Future research also looking into the influence of more demographic variables to better comprehend travel behavior. Future research should look at how the variables interact and how that affects travel behavior and modal share. More study, on the other hand, is required to address the prevalence of active forms of transportation and to fully comprehend the long-term ramifications. Future research should look into whether diverse geographies of the world might contribute new insights, especially for low- and middle-income countries. In the post-COVID era, researchers are also looking into how tourism and leisure activities might aid recovery and inspire personal growth.

6. Conclusions

The purpose of this research was to assess the influence of the COVID-19 pandemic on road traffic safety and travel behavior. The magnitude of COVID-19 was found to result in fewer crashes and impacts on human movement, predicting its direct and indirect consequences on traffic accidents is challenging.

Throughout COVID-19, shopping had become the key reason for traveling. Government may enforce self-isolation or shutdowns to limit travel for employment or study. During this epidemic, transport lengths shorten and travels were less common. Online behavior, such as shopping and studying, could have been a realistic option for reducing physical travels. Those behavioral changes may have been influenced by public perception established by the news and social media. During COVID-19, there was a rise in the use of personal vehicles and active transportation modes such as cycling and walking, as well as a decline in the usage of public transportation and paratransit, such as taxis, for main travel goals. COVID-19, in any case, pushed communities to rethink road infrastructure to offer safer spaces for walking and bicycling. Considering the detrimental effects of the COVID-19 epidemic, the transport and tourist sector has been able to re-define and re-shape operating methods to better deal with the pandemic’s negative effects on respective companies. The Summary of previous researches that analyzes the impact of COVID-19 on travel behavior is presented in Table 2.

4.3. Review conclusions

The most of research in the literature looked at the impact of COVID-19 on traffic safety and risk and traveling activity by using interpretive or before/after descriptive statistic to evaluate the variations in travel safety and movement. The majority of research work used a questionnaire survey to collect data, then compared the influence of COVID-19 on road safety and travel behavior to the pre-pandemic period using various statistical methods and analysis. Most previous studies only looked at data on traffic volume, crashes, and travel behavior over a short period of time. To understand the present status of traffic fatalities and mobility patterns, the majority of studies used limited parameters. All of the prior research has found that travel habits in pandemic scenarios change significantly from those in everyday life. No study compared model performance, validity, or excellence; instead, the majority of research focused on the impact of the pandemic on traffic safety and travel behavior. No previous study has attempted to forecast the evolution of accident and injury data in concert with the COVID-19’s growth. The present study is motivated by this fact which aims to provide an overview of the impact of the COVID-19 pandemic on road traffic collisions, deaths, and injuries, as well as road travel behavior, by building on past research work.

5. Open discussions and future challenges

The COVID-19 epidemic has had a variety of impacts in countries all around the world. Lower vehicle numbers owing to lockdowns appear to be prevalent and also had a significant influence on road safety as a result of the COVID-19 outbreak. Whenever there are still more automobiles on the highway, the likelihood of a vehicle collision increases. The majority of research found that the number of road traffic accidents dropped as a result of the lower volume of traffic on the roads during the pandemic. According to recent statistics, there has been a rise in speeding and intoxicated driving, as well as fewer but much higher serious accidents (Hughes et al. [48]). During the COVID-19 pandemic, a fewer percentage of drivers said they were fewer inclined to indulge in unsafe traffic activities than they were before the pandemic. Several causes, including a rise in the number of motorists under the influence of alcohol or drugs, may be contributing causative factors (Volkow, 2020). Because of the uncertainty surrounding the pandemic’s future evolution and impact on human movement, predicting its direct and indirect consequences on traffic accidents is challenging.

Throughout COVID-19, shopping had become the key reason for traveling. Government may enforce self-isolation or shutdowns to limit travel for employment or study. During this epidemic, transport lengths shorten and travels were less common. Online behavior, such as shopping and studying, could have been a realistic option for reducing physical travels. Those behavioral changes may have been influenced by public perception established by the news and social media. During COVID-19, there was a rise in the use of personal vehicles and active transportation modes such as cycling and walking, as well as a decline in the usage of public transportation and paratransit, such as taxis, for main travel goals. COVID-19, in any case, pushed communities to rethink road infrastructure to offer safer spaces for walking and bicycling. Considering the detrimental effects of the COVID-19 epidemic, the transport and tourist sector has been able to re-define and re-shape operating methods in order to become more nimble and robust. The large number of analyses on COVID-19’s impact on travel behavior have been studied in developed countries. Few research in developed countries have attempted to investigate the implications of socioeconomic inequality on travel behavior also [4].

There are indeed a number of limitations to studying the impact of COVID-19 on road traffic safety and travel characteristics. In this paper, we focus more on traffic safety and travel behavior impacts due to COVID-19 pandemic. In roadway, there are also such kinds of factors includes environment, infrastructure, time, cost and others which affects traffic safety and travel behavior besides COVID-19. The pandemic is still exploding in many regions of the world at the time of writing this article, and the effects on travel are continuously changing. There are certain limitations to this study that could lead to more research in the future. In truth, numerous contributing factors influence road traffic accidents. More advanced types of models could be used in forthcoming research with larger sample sizes to establish obvious road traffic safety features. More accident and fatality datasets, including the application of different time series approaches and deep learning, could potentially strengthen the findings of this research. It has opportunity to represent the holistic scenario of travel behavior change in the world by reviewing literature more in post COVID-19 period. The COVID-19 pandemic has also had a number of impacts on roadways, such as pedestrian movement, trip generation, tourist behavior, and so on. As a result of the Coronavirus pandemic, all policymakers continue working to stop the virus from spreading. In the event of a pandemic, pedestrian walkways and pathways should be part of a network that provides an adequate level of service and safety along the whole trip. Extending sidewalks, establishing safe cycling routes, and implementing ITS systems aimed to construct smart pedestrian networks will be the most effective initiatives taken by governments [8]. Researchers can take these agenda to study to assist transport management after pandemics. Other variables, such as employment kind, must be explored in future studies to better understand the determinants of activity travel behavior change during the epidemic. Future research also looking into the influence of more demographic variables to better comprehend travel behavior. Future research should look at how the variables interact and how that affects travel behavior and modal share. More study, on the other hand, is required to address the prevalence of active forms of transportation and to fully comprehend the long-term ramifications. Future research should look into whether diverse geographies of the world might contribute new insights, especially for low- and middle-income countries. In the post-COVID era, researchers are also looking into how tourism and leisure activities might aid recovery and inspire personal growth.
injuries, as well as a reduction in road safety performance, but substantially greater serious accidents. The evident good effects of reduced movement on road fatalities may only last for a short time. Given how important traffic accidents was in predicting and mitigating the state of the community healthcare infrastructure during the various stages of the COVID-19 epidemic, governments and academics may use the insights of such analysis.

COVID-19 has had a huge impact on people’s travel habits all across the world. COVID-19 has caused a movement in activity away from mixed use vehicles and toward driving, walking, and biking, with differences between urban and rural populations. The majority of the studies found that throughout the epidemic, fewer people travelled for job and school than in the pre-pandemic condition. Throughout the epidemic, public transportation usage decreased, while personal vehicle usage, including bicycling and walking, increased. COVID-19 could provide the impetus for a transition in transport strategies to better environmentally sustainable and citizen-centered alternatives.

For the following situations, this review article will be helpful:

- The impact of COVID-19 on road traffic safety and travel behavior is clearly detailed, providing future researchers with relevant domain knowledge.

- An overview of a number of very relevant studies is also provided, together with major findings, data sources, and methodology, which may guide expert-level academics in designing and analyzing future transportation planning and policy.

The findings of this research might be helpful in epidemic transportation planning and policies focused on people’s travel demands. This insight might be used by the administration to design thoughtful and partial shutdowns, and service providers could use it to effectively manage their operational capabilities.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The work presented in this paper is an original research article. We state relationships which may be considered as potential competing interests: no such relationship.
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