



Impacts of COVID-19 on transportation: Summary and synthesis of interdisciplinary research

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Last spring, TRIP (Transportation Research: Interdisciplinary Perspectives) issued a call for papers for a special issue on the COVID-19 pandemic. We received many submissions, the first 27 of which have been through our peer review process and been published on-line at: <https://www.sciencedirect.com/journal/transportation-research-interdisciplinary-perspectives/special-issue/10QQ201V2HM>. More papers are under review and we expect to publish additional research on the impacts of the pandemic on transportation. While the waiver of open access fees granted by our publisher, Elsevier, will only apply to those submissions received by December 25th 2020, we will consider publication of papers on this topic into the future. There is much interest in the topic and in advancing our understanding of the pandemic and its continuing impacts. Our knowledge of COVID-19 impacts on transportation and society continues to evolve and progress.

As of my writing today, across the world, more than 67.2 million people have been infected with SARS-CoV-2 and more than 1.5 million people have died from the disease – see covid19.who.int. The United States leads the world with over 14.5 million cases, followed by India (9.7 million) and Brazil (6.6 million). With more than 3,000 daily cases in the U.S., the impacts of the pandemic persist. In addition to loss of life and illness, there have been significant economic losses, business closures, job losses, and widespread disruption of educational, religious, cultural, and social activities, with resulting negative impacts to our quality of life. The pandemic has resulted in decreased travel by ground, air and water transportation modes. These changes have resulted both from fear of getting sick and from restrictions imposed by government. [Parr et al. \(2020\)](#) found that in Florida while the decrease in mobility was triggered by emergency orders, business closures, online schooling and reduced social activities led to freeway traffic declining by 52.4% and arterial volumes by 40.5% compared to 2019. Social distancing orders and curtailment of non-essential travel were common restrictions implemented by many state and local governments throughout the United States and the rest of the world ([Kim et al., 2021](#)).

The goal of the TRIP journal is to promote international, interdisciplinary exchange of research on emergent topics relevant to transportation planning, engineering, and the management and operations of transport services and facilities. I'm happy to report that researchers from across the world answered our call. We received papers from the United States, Canada, Europe, Asia, Australia and Africa focusing on topics ranging from the impacts of the pandemic on travel behavior to changes in the operations of transit, ridesharing,

bikeshare and urban mobility services. Contributors also reported on the impacts on airline travel, cruise ship operations, freight transport, and analyzed short term changes in behavior and operations and longer term impacts and changes in the transportation industry.

A wide range of different theoretical approaches and analytical techniques, methods, and styles of research was used. Some researchers developed and administered surveys, others used observational data or compiled information on ticketing, transport services, or industry operations to capture changes over time and space. In addition to census and travel databases, new sources extracting mobile phone location data as well as integration and assimilation of data on roadway congestion, accidents, travel speeds, and other pertinent information were used in these studies.

1. Short-term impacts

The impacts of the pandemic on intercity travel and movements within and across urban regions have been significant. [Sobieralski \(2020\)](#) studied the airline industry, which experienced reduction in capacity of major carriers by 60–80%, and used previous global crises such as 9/11, SARS and other shocks to gain insights into likely airline operations and recovery. He argues that volatility spikes have a slight effect, but employment follows similar trends in relation to average volatility over time. Using VAR (Vector Autoregression) this study shows that the decline could last for many years and that employees at airlines will be most impacted, with approximately 7% displaced initially, but the upper bound of the estimated reduction may be over 13% of the airline workforce. The most significant reductions are seen by major carriers rather than low cost and regional airlines. Low skilled employees will face deeper cuts than others. [Monmousseau et al. \(2020\)](#) found that airlines reacted differently to restrictions imposed by governments on travel. They examine the effects on passenger arrivals of bans and closures imposed by Italy, the US, and the European Union, using Customs and Border Patrol (CBP) and Bureau of Transportation Statistics (BTS) data and also social media data from both airlines and passengers to gauge the extent not only of cancellations and service changes, but also of passenger sentiments and assessment of service.

The cruise ship industry experienced significant impacts from the pandemic. As Ito, Hanaoka, and Kawasaki report, the outbreak of COVID-19 struck this industry in early February 2020 with the largest clusters outside China occurring on cruise ships in Japan, California,

and 25 other locations. Tracking cruise ships, the largest calls occur in the Caribbean followed by Oceania, South America and North America. Their study provides information on cruise ship landings by country and reported COVID-19 cases. They found that the largest ships had the highest rates of infection and that ship operating schedules and itineraries also affected infection rates.

Many of the researchers investigated the relationships between outbreaks and actions to contain or limit the spread of the virus. David Lee and Jaehong Lee from South Korea (2020) described early actions and innovative approaches such as mobile, drive-thru testing facilities as well as aggressive contact tracing and adoption of new technologies to fight the spread of the disease. Countries varied in terms of their approaches and the degree to which they adopted “responsible transport” policies that include identification of individual responsibilities as well as collective and environmental considerations (Budd and Ison, 2020). Hadjidemetriou et al. (2020) showed that the reductions in mobility had a significant impact on COVID-19 deaths in the United Kingdom. While other publications have concentrated on the disease and epidemiology, there are convincing linkages between behaviors and movements and the spread of the disease. Romero et al. (2020) studied the potential spread of the virus based on pedestrian traffic patterns within buildings. Social distancing and use of masks (Dzisi and Dei, 2020) and changes in behavior (de Haas et al., 2020) and implementation of quarantine, isolation and social distancing requirements (Chen and Pan, 2020) affect the spread of the disease. There were also significant changes in travel mode with declines in public transit ridership in Hungary (Bucsky, 2020). According to Jenelius and Cebecauer (2020), although public transit was “hit hard by COVID-19”, the decreases in ridership varied across Sweden, with the largest reductions (60%) occurring in Stockholm and the smallest (40%) in Vastra, Gotland. Hotle et al. (2020) studied risk perceptions and changes in travel behavior due to influenza outbreaks and showed that personal factors including experience with symptoms, gender, and trip purpose influence both risk perceptions and decision-making. In the Netherlands, approximately 80% of the population reduced their activities because of the pandemic, leading to 55% reduction in number of trips and 68% decline in distance travelled, with the proportion working from home increasing from 6% to 39% (de Haas et al., 2020). Similar findings in terms of overall travel with significant decreases in trips for school and work and increased use of private vehicles and active transportation modes (bicycling and walking) were reported across different countries (Abdullah et al., 2020; Arimura et al., 2020; Chen and Pan, 2020; Teixeira and Lopes, 2020).

Many of the researchers report reductions in travel except for grocery trips (Abdullah et al., 2020). Loske (2020) found “panic buying” and initial shifts in consumer behavior towards dry goods, which in turn affected retail freight logistics. Using a revealed preference survey in Chicago, Shamshiripour et al. (2020) found increases in not just online shopping but also telework activities. In studying trip-making activities in the greater Kanto region, including the Tokyo metropolitan area, Parady et al. (2020) found differences between grocery and other types of shopping and that trips for eating out and leisure activities had greater declines. They point to the importance of social norms and group processes in understanding changes in behavior. Similar findings were reached in Sapporo, with the densely populated areas of the city experiencing the most significant reductions in travel and contacts between people. Using smartphone tracking technologies in Greece and Saudi Arabia, Katrakazas et al. (2020) detected reductions in travel volume, but also increased travel speeds (6–11%), with more frequent sudden braking and acceleration. They also found an overall reduction in accidents (41%), with early morning crashes (0:00–5:00 AM) having the largest reduction (81%). Saladie et al. (2020) found similarly large reductions in accidents (74% compared to February of 2020; 76% compared to 2019) attributable to overall reductions in travel volume (nearly 63%) in Tarragona Province, Spain. Colonna and Intini (2020) found that overall reduced mortality from

traffic accidents was compensated by increased deaths due to the pandemic.

Of special concern have been the impacts of COVID-19 on people with disabilities and limited mobility. Abigail Cochran (2020) conducted in-depth interviews with San Francisco Bay Area residents with disabilities and found that the pandemic aggravated transportation problems that people with disabilities regularly encounter. More concerted, intentional and inclusive efforts to address barriers, improve communications and assistance for people with disabilities are needed.

2. Concerns from the global South

As an international journal, TRIP also heard from researchers in Africa, Asia, South America and other emerging economies. The impacts of the disease and responses to it have been uneven. Mogaji (2020) describes how government lockdown orders and movement restrictions in emerging economies with high population densities, poor transportation infrastructure and large informal economies may be largely ineffective; and reports on the impacts of the pandemic on social, economic and religious activities in Lagos, Nigeria. Social distancing, mask wearing and compliance with protective actions are also more limited in countries like Ghana (Dzisi and Dei, 2020). Socioeconomic and household factors including motor vehicle or motorcycle ownership as well as the presence of virtual services such as e-commerce, home delivery, ridesharing and other technological factors affect behavior in Jakarta as in wealthier countries (Irawan et al., 2020). In countries such as India, government-imposed lockdowns created urgent need to transport stranded migrant workers back to hometown locations (Maji et al., 2020). Accounting for the surge in cases using a modified susceptible-exposed-infected-removed (SEIR) model, they estimate the train and bus fleet requirements to repatriate migrant workers. The pandemic and the response to it have led to more integration between public health and transportation models and databases.

3. What will the new normal look like?

Many researchers have been investigating longer-term changes and adjustments to a new normal – whether in Jakarta (Irawan et al., 2020) or Chicago (Shamshiripour et al.) or other parts of the world. Will cleaning and sanitization of transit vehicles and public facilities continue after the pandemic? Will the lessons and innovations in testing, contact tracing, and disease surveillance (Lee and Lee, 2020) carry over to the next significant disease outbreak? Will the “new normal” retain focus on public health and foster stronger linkages between science, technology, policy and human welfare? Jonas de Vos (2020) suggests that planners can stimulate more walking and cycling through conversion of streets for pedestrians and cyclists (King and Krizek, 2020), pointing to cities such as Berlin, Vienna, Philadelphia, Vancouver, Bogota and Mexico City which have temporarily converted car lanes into bike lanes and pedestrian spaces (Laker, 2020). The benefits of increased physical activity have been well established (WHO, 2010) and the reductions in motor vehicle travel have contributed to improvements in air quality. Worldwide, carbon emissions are down by a record 7%, with the decline in road transport emissions for the year at 10%, while aviation emissions were down by 40% (Global Carbon Project, 2020). It will be interesting to see how much the increased telework, distance education, and online shopping continue after widespread vaccinations and eventual reductions in COVID-19 active cases. Much of this does depend on the shape and extent of the bounce-back or return to normalcy for air travel (Sobieralski, 2020; Monmousseau et al., 2020) or the cruise ship industry (Ito, Hanaoka and Kawasaki, 2020) or public transit (Abdullah et al., 2020; Jenelius and Cebecauer, 2020; Dzisi and Dei, 2020).

Much of the “new normal” will rest on the assessment of risk by travelers (Hotle, Murray-Tuite, and Singh, 2020) and the lasting impacts of government measures (Hadjidemetriou et al., 2020; Pawar et al., 2020) as well as the evaluation of purported “intelligent” lockdown measures (de Haas et al., 2020). There are significant trade-offs and multi-layered effects involving personal choices, collective actions, and environmental changes, not the least of which include persistent climate challenges and unbridled development in hazardous places. The pandemic did not slow the occurrence of wildfires and hurricanes, nor other natural and human caused hazards and threats. The “new normal” includes managing multiple hazards, compound, cascading, and complex hazards, as well as confronting the ongoing disparities between rich and poor nations and within communities across the world. Social conflicts, equity, fairness and justice with coronavirus testing, vaccines, or treatment are significant concerns that require more attention during a global pandemic. Also, we must not forget the tragic human losses and heightened risks for first responders, health care workers, and others on the front lines. In addition to suffering a disproportionately high rate of infection and morbidity, transportation operators experience additional emotional, psychological, social and economic stress due to the pandemic. The pandemic has increased the need for greater understanding and integration of governance, technology and citizen behavior (Shawet et al., 2020), providing additional lessons and case materials for the building of resilience into transportation systems (Kim et al., 2018).

4. Continued need for interdisciplinary research

The special issue has been a success in terms of the many articles submitted by authors and downloaded by readers, and in providing a venue for transportation researchers to quickly share and disseminate new research. It has been both heartening and remarkable to read the diversity of ideas, methods, sources of data and insights from transportation researchers. We know a lot more about the disease and its impacts compared to early 2020 and the knowledge base and sophistication of analytical approaches continue to grow. Our work, however, is not over. First, there is no clear end in sight for the pandemic. While there is the promise of vaccines, there remain major logistical and operational challenges with inoculating the world. Significant concerns persist regarding social equity, fairness, and reaching vulnerable, underserved populations. Second, while it is tempting to focus narrowly on the SARS-CoV-2 virus, the pandemic has illuminated other threats, hazards, weaknesses and deficiencies in our transportation systems, which have contributed to the spread of the virus. This disaster has illuminated the need for better management of response, recovery, and restoration of social and economic activities in the wake of disruption. Spectacular deficits, unprecedented business failures, job losses, major disruptions, dislocations and human suffering have occurred and require continued research and understanding of the critical role of transportation in the recovery from this disaster.

On behalf of our team at TRIP, I'd like to express my profound gratitude to our publisher for waiving the open access fees and helping to fast-track publication and dissemination of important research, and especially to the other editors, editorial board members, reviewers, and authors who worked collaboratively on this initiative. I express my “aloha” and appreciation to the many authors who sent in papers that were not accepted for publication but contributed to the exchange and dissemination of ideas and knowledge. As Editor-in-Chief, I encourage all authors and reviewers and readers to continue sharing and working together in these challenging, precarious and uncertain times. I remain hopeful that we will be able to resume travel, face-to-face, in-person collaborations in the not-so-distant future.

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