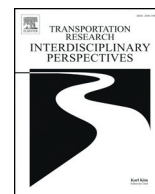




Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

## Transportation Research Interdisciplinary Perspectives

journal homepage: <https://www.journals.elsevier.com/transportation-research-interdisciplinary-perspectives>



# The effect of COVID-19 and subsequent social distancing on travel behavior

Jonas De Vos

Bartlett School of Planning, University College London, 14 Upper Woburn Place, London WC1H 0NN, United Kingdom



### ARTICLE INFO

#### Article history:

Received 6 April 2020

Received in revised form 14 April 2020

Accepted 14 April 2020

Available online 24 April 2020

#### Keywords:

Travel behavior

Social distancing

COVID-19

Health

Well-being

### ABSTRACT

The spread of the COVID-19 virus has resulted in unprecedented measures restricting travel and activity participation in many countries. Social distancing, i.e., reducing interactions between individuals in order to slow down the spread of the virus, has become the new norm. In this viewpoint I will discuss the potential implications of social distancing on daily travel patterns. Avoiding social contact might completely change the number and types of out-of-home activities people perform, and how people reach these activities. It can be expected that the demand for travel will reduce and that people will travel less by public transport. Social distancing might negatively affect subjective well-being and health status, as it might result in social isolation and limited physical activity. As a result, walking and cycling, recreationally or utilitarian, can be important ways to maintain satisfactory levels of health and well-being. Policymakers and planners should consequently try to encourage active travel, while public transport operators should focus on creating ways to safely use public transport.

© 2020 The Author. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

The COVID-19 (also known as coronavirus) outbreak started in December 2019 in Wuhan, China, and rapidly spread in many countries all over the world (e.g., [Jiang et al., 2020](#); [Lipistch et al., 2020](#)). In March 2020, the World Health Organization declared the outbreak as a pandemic, with countries such as China, Italy, Spain and the US being hit hardest. At present (April 14th, 2020), more than 1,750,000 people have been infected and more than 110,000 have died from the virus ([www.who.int](http://www.who.int)). Numerous countries have taken unprecedented measures to prevent social contact and to slow down the spread of the virus, such as closing schools, shops, restaurants and bars, prohibiting public events and stimulating or imposing working from home. These measures can all be labeled as “social distancing”, and are especially efficient for diseases (such as COVID-19) which are transmitted by respiratory droplets and require a certain proximity of people ([Wilder-Smith and Freedman, 2020](#)). Some countries (e.g., China, Italy, Spain) have enforced social distancing by imposing lockdowns (in certain regions or the country as a whole), while other countries (e.g., Netherlands, Sweden, UK, US) have taken less stringent social distancing measures. Up till now, it is unclear how long social distance measures will last. Furthermore, subsequent waves of the virus might result in new waves of social distancing in the near future ([Wu et al., 2020](#)).

Social distancing measures have important effects on activity participation. A lot of people are temporarily unemployed or work from home, and most out-of-home (leisure) activities are cancelled. As a result, travel

demand decreases and many countries have already witnessed spectacular drops in car traffic (strongly decreasing congestion and air pollution), and in public transport ridership (often resulting in less frequent services) (e.g., [Carrington, 2020](#); [Goldbaum, 2020](#); [Plumer and Popovich, 2020](#)). Of course, this is only a temporal situation and we can expect that out-of-home activity participation and travel demand will rise again when the measures are lifted. However, we do not know how long these measures will last and whether or not subsequent waves can be expected. Furthermore, people might still fear social contact when social distancing rules are no longer in force, affecting activity participation and travel. In this viewpoint I offer some hypotheses on the potential effects of social distancing on travel behavior. This viewpoint is organized as follows. In [Section 2](#), I will describe the potential effects of social distancing on travel behavior, while in [Section 3](#) the potential implications for health and well-being are described. [Section 4](#) provides conclusions and policy recommendations. Although the COVID-19 outbreak has major implications on international travel, this viewpoint focuses on daily travel patterns.

## 2. Changes in travel behavior

As a result of social distancing, travel demand might drop due to an increased amount of working from home, e-learning, and a reduced number of public activities and events. People might be more inclined to perform activities at home with family members or close friends. This might result in less car traffic – and less congestion during peak hours – and in reduced public transport ridership. People might also be more inclined to get home-delivery of goods purchased online (e.g., food, clothes), resulting in fewer shopping trips ([Shi et al., 2019](#)). Of course, social distancing might also

E-mail address: [jonas.devos@ucl.ac.uk](mailto:jonas.devos@ucl.ac.uk).

influence travel mode choice. People might avoid public transport as these can be considered a breeding ground for viruses and places where it might be difficult to avoid contact with other passengers (Troko et al., 2011). Those that do not have other options than using public transport might try to avoid crowded buses and trains by travelling during off-peak hours. Of course, this might be difficult if public transport operators decide to decrease capacity or frequency due to low ridership. People with access to a car, might be inclined to drive more, as the car “protects” them from other travelers. Because of the reduced travel demand, a higher share of car use will probably not result in more kilometers travelled by car. In fact, less driving and lower amounts of congestion can be expected. An increase in the use of taxis and ridehailing services, especially of those typically using public transport, might also be expected. Also walking and cycling might – in case of short trips – increase, since social contact can (mostly) easily be avoided during active travel. Due to the reduction of out-of-home activities, people might also walk and cycle more recreationally.

### 3. Effects of changed travel behavior on health and well-being

Since people often plan and perform out-of-home activities in order to maintain or enhance well-being, reduced activity participation as a result of social distancing can negatively affect subjective well-being (De Vos et al., 2013; Ettema et al., 2010). Out-of-home activities might no longer take place or – in case of reduced public transport services – might become inaccessible for those without a car. This isolation results in lower levels of social interaction and self-development, and higher levels of stress, boredom and depression (Brooks et al., 2020). Since people no longer have a lot of destinations to travel to, social distancing might also result in more “undirected travel”, i.e., trips without a destination. People might walk, jog, cycle, or joyride as a recreational activity, and thereby enjoy the sensation of speed, the exposure to the environment and scenic beauty (Mokhtarian and Salomon, 2001). As a result, recreational travel can play an important role in maintaining a certain level of subjective well-being. Since studies have indicated that active travel results in the experience of positive emotions (e.g., De Vos et al., 2016; Singleton, 2019), especially walking and cycling should be stimulated.

Social distancing measures have clear direct positive effects on health, as they are implemented to avoid people getting infected by the COVID-19 virus. However, since people often derive physical activity from participation in certain out-of-home activities (e.g., fitness, sports, work), social distancing might result in a significant drop in physical activity (Panik et al., 2019). Since adults are recommended to engage in at least 150 min of moderate physical activity per week in order to prevent weight gain (WHO, 2010), it is important to remain physically active by frequently walking and cycling, recreationally or utilitarian. Otherwise, it is likely that the total amount of physical activity will drop for most people, possibly resulting in increased levels of obesity, diabetes and cardiovascular diseases (Lee et al., 2010). On the positive side, a reduced demand for (motorized) transport – as long it is not compensated too much by a higher share of car use – will most likely result in fewer car accidents (and related injuries and fatalities), and safer walking and cycling conditions (Pucher and Dijkstra, 2003). Several cities already reported significant reductions in traffic accidents (although the share of speeding cars is often reported to increase) (e.g., Sahagun and Writer, 2020). Furthermore, less traffic might lower air pollution, resulting in reduced chances of respiratory diseases, asthma, lung damage and high blood pressure (WHO, 2016), and possibly slowing down global warming.

### 4. Conclusion

It can be expected that – in times of social distancing – people will travel less, will try to avoid public transport and might travel more actively (recreationally or in case of short distances) or by car. The reduced demand for travel – as a result of decreased out-of-home participation – might, however, result in more social isolation, negatively affecting subjective well-

being. Recreational walking and cycling might play an important role in maintaining well-being levels, but also in maintaining physical activity levels reducing the risk of increased obesity. Policymakers and transport planners can try to stimulate walking and cycling by (temporarily) allocating less-used street space to cyclists and pedestrians (King and Krizek, 2020), especially at places that were previously affected by traffic congestion and did not have adequate walking and cycling infrastructure. Cities in Europe (e.g., Berlin, Vienna), North America (e.g., Philadelphia, Vancouver), and Latin America (e.g., Bogota, Mexico City) have already decided to temporarily turn car lanes into sidewalks and bike lanes (Laker, 2020). Additionally, restricting cars from certain local streets, placing additional (pop-up) cycling parking, and reducing waiting time for pedestrians to cross roads might be easy, cheap and fast ways to stimulate active travel. Some Australian cities, for instance, have already started implementing automatic pedestrian crossings, so that people do not have to press a button (Laker, 2020). At places where these measures turn out to be successful (i.e., resulting in large flows of active travelers), these measures could remain in force permanently.

Public transport operators should focus on making public transport a safer way of travelling in times of social distancing, enabling those without a car or physically disabled to travel around. Especially people with low-income jobs – and lower access to cars – are often not able to work from home and therefore keep using public transport (e.g., Goldbaum and Cook, 2020). Although public transport services strongly depend on revenues from fares, public transport operators should be encouraged not to drastically reduce public transport frequency or capacity (as a result of lower ridership), but remain a certain level of service enabling travelers to keep a safe distance from each other. Since many public transport operators currently have – due to plummeting revenues – financial difficulties (e.g., Badger, 2020; Foye, 2020), governments could temporarily provide public transport operators with financial support in doing so. If social distance measures would continue for longer periods, operators should think about reorganizing the interiors of buses and train cars (e.g., making more separate compartments), so passengers can more easily avoid social contact and travel in a safe way. Finally, policymakers and planners should try to create and open up more public green spaces in cities where residents can walk, cycle or hang out, in order not to create residential preferences for low-density suburbs and related car-dependent lifestyles.

### CRedit authorship contribution statement

**Jonas De Vos:** Conceptualization, Visualization, Writing - original draft, Writing - review & editing.

### Acknowledgments

The author would like to thank the anonymous reviewer for the valuable comments, making it possible to improve the quality of this viewpoint. This work was supported by the Research Foundation - Flanders (FWO) under grant 12F2519N.

### References

- Badger, E., 2020. Transit has been battered by coronavirus. What's ahead may be worse. The New York Times, 9 April 2020. <https://www.nytimes.com/2020/04/09/upshot/transit-battered-by-coronavirus.html?searchResultPosition=2>, Accessed date: 14 April 2020.
- Brooks, S.K., Webster, R.K., Smith, L.E., Woodland, L., Wessely, S., Greenberg, N., Rubin, G.J., 2020. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet* 395 (10227), 912–920.
- Carrington, D., 2020. UK road travel falls to 1955 levels as Covid-19 lockdown takes hold. The Guardian (3 April 2020). <https://www.theguardian.com/uk-news/2020/apr/03/uk-road-travel-falls-to-1955-levels-as-covid-19-lockdown-takes-hold-coronavirus-traffic>, Accessed date: 13 April 2020.
- De Vos, J., Schwanen, T., Van Acker, V., Witlox, F., 2013. Travel and subjective well-being: a focus on findings, methods and future research needs. *Transp. Rev.* 33 (4), 421–442.
- De Vos, J., Mokhtarian, P.L., Schwanen, T., Van Acker, V., Witlox, F., 2016. Travel mode choice and travel satisfaction: bridging the gap between decision utility and experienced utility. *Transportation* 43 (5), 771–796.

- Ettema, D., Gärling, T., Olsson, L.E., Friman, M., 2010. Out-of-home activities, daily travel, and subjective well-being. *Transp. Res. A* 44 (9), 723–732.
- Foye, P.J., 2020. The M.T.A. needs help. Now. *The New York Times*, 24 March 2020. <https://www.nytimes.com/2020/03/24/opinion/mta-new-york-transit.html?searchResultPosition=7>, Accessed date: 13 April 2020.
- Goldbaum, C., 2020. Subway service is cut by a quarter because of coronavirus. *The New York Times* (24 March 2020). <https://www.nytimes.com/2020/03/24/nyregion/coronavirus-nyc-mta-cuts-.html?searchResultPosition=6>, Accessed date: 13 April 2020.
- Goldbaum, C., Cook, L.R., 2020. They can't afford to quarantine. So they brave the subway. *The New York Times* (30 March 2020). <https://www.nytimes.com/2020/03/30/nyregion/coronavirus-mta-subway-riders.html?searchResultPosition=5>, Accessed date: 14 April 2020.
- Jiang, F., Deng, L., Zhang, L., Cai, Y., Cheung, C.W., Xia, Z., 2020. Review of the clinical characteristics of coronavirus disease 2019 (COVID-19). *J. Gen. Intern. Med.* <https://doi.org/10.1007/s11606-020-05762-w>.
- King, D.A., Krizek, K.J., 2020. The power of reforming streets to boost access for human-scaled vehicles. *Transp. Res. D* 83, 102336.
- Laker, L., 2020. World cities turn their streets over to walkers and cyclists. *The Guardian* (11 April 2020). [https://www.theguardian.com/world/2020/apr/11/world-cities-turn-their-streets-over-to-walkers-and-cyclists?CMP=share\\_btn\\_tw](https://www.theguardian.com/world/2020/apr/11/world-cities-turn-their-streets-over-to-walkers-and-cyclists?CMP=share_btn_tw), Accessed date: 13 April 2020.
- Lee, I.-M., Djoussé, L., Sesso, H.D., Wang, L., Buring, J.E., 2010. Physical activity and weight gain prevention. *J. Am. Med. Assoc.* 303 (12), 1173–1179.
- Lipistch, M., Swerdlow, D.L., Finelli, L., 2020. Defining the epidemiology of COVID-19 — studies needed. *N. Engl. J. Med.* <https://doi.org/10.1056/NEJMp2002125>.
- Mokhtarian, P.L., Salomon, I., 2001. How derived is the demand for travel? Some conceptual and measurement considerations. *Transp. Res. A* 35 (8), 695–719.
- Panik, R.T., Morris, E.A., Voulgaris, C.T., 2019. Does walking and bicycling more mean exercising less? Evidence from the U.S. and the Netherlands. *J. Trans. Health* 15, 100590.
- Plumer, B., Popovich, N., 2020. Traffic and pollution plummet as U.S. cities shut down for coronavirus. *The New York Times* (22 March 2020). <https://www.nytimes.com/interactive/2020/03/22/climate/coronavirus-usa-traffic.html>, Accessed date: 13 April 2020.
- Pucher, J., Dijkstra, L., 2003. Promoting safe walking and cycling to improve public health: lessons from the Netherlands and Germany. *Am. J. Public Health* 93 (9), 1509–1516.
- Sahagun, L., Writer, S., 2020. Coronavirus stay-at-home orders have reduced traffic accidents by half. *Los Angeles Times* (1 April 2020). <https://www.latimes.com/environment/story/2020-04-01/coronavirus-stay-at-home-orders-have-reduced-traffic-accidents-by-half>, Accessed date: 13 April 2020.
- Shi, K., De Vos, J., Yang, Y., Witlox, F., 2019. Does e-shopping replace shopping trips? Empirical evidence from Chengdu, China. *Transp. Res. A* 122, 21–33.
- Singleton, P.A., 2019. Walking (and cycling) to well-being: modal and other determinants of subjective well-being during the commute. *Travel Behav. Soc.* 16, 249–261.
- Troko, J., Myles, P., Gibson, J., Hashim, A., Enstone, J., Kingdon, S., Packham, C., Amin, S., Hayward, A., Nguyen Van-Tam, J., 2011. Is public transport a risk factor for acute respiratory infection? *BMC Infect. Dis.* 11, 16.
- WHO (World Health Organization), 2010. *Global Recommendations on Physical Activity for Health* (Geneva, Switzerland).
- WHO (World Health Organization), 2016. *Ambient Air Pollution: A Global Assessment of Exposure and Burden of Disease* (Geneva, Switzerland).
- Wilder-Smith, A., Freedman, D.O., 2020. Isolation, quarantine, social distancing and community containment: pivotal role for old-style public health measures in the novel coronavirus (2019-nCoV) outbreak. *J. Travel Med.* <https://doi.org/10.1093/jtm/taaa020>.
- Wu, J.T., Leung, K., Leung, G.M., 2020. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. *Lancet* 395 (10225), 689–697.