



Transport and health during and after COVID-19

AN INSIGHT

June 2020

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Abstract	
<p>The COVID-19 pandemic has far reaching effects on both transportation and health. Spread of the disease was linked to travel and rapidly resulted in the curtailment of certain forms of transportation in countries. Lockdowns in countries have resulted in reductions in road traffic crashes and improvements in air quality but have also brought to the fore inequalities in the system, particularly in low- and middle-income countries. This insight paper looks at the impact of transport on health during and after the COVID-19 pandemic in Africa and South Asia in order to identify areas that require additional research or policy and regulation development. The opinions are those of the authors and a small group of “thinkers” and are offered to stimulate further discussion and debate.</p>	
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ABBREVIATIONS/ACRONYMS

BCG	Bacillus Calmette–Guérin
DFID	Department for International Development
EMS	Emergency Medical System
HVT	High Volume Transport
IMC	IMC Worldwide Ltd
HICs	High-Income Countries
LMICs	Low- and Middle-Income Countries
COVID-19	Coronavirus Disease 2019
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
TB	Tuberculosis
PERC	Partnership for Evidence-Based Response to COVID-19
PPE	Personal Protective Equipment
WHO	World Health Organisation



EXECUTIVE SUMMARY

Transport has been at the heart of the Coronavirus Disease 2019 (COVID-19) pandemic from its beginning. Courtesy of efficient transport systems across the globe, the infection was able to reach most continents within weeks of its commencement. Likewise, transport has been central to the response, and will continue to be critical to the recovery of many systems in the aftermath of the pandemic, from the transportation of patients, essential workers, goods and services, to the restructuring and operation of transport systems as countries and communities seek to end travel restrictions, and revamp economies.

This insight paper looks at the intersections between transport and health during and after the COVID-19 pandemic in order to identify areas that require additional research or policy and regulation development. It is offered only to stimulate further discussion and debate. It is not a systematic review of the topic.

The public health response to the pandemic has focused on hand-washing, physical distancing, testing, tracking and tracing and quarantine, while the transport response has centred on protecting frontline staff, sanitising and cleaning vehicles, adjusting services and managing transport staff. Overlapping in some aspects, many of these guidelines are highlighting the inequities inherent in both health and transport systems in developing countries.

The five interacting dimensions between transport and public health – safety, active transport, clean air, connectivity/ access and equity – are used to discuss the challenges and opportunities that COVID-19 has uncovered particularly in low- and middle-income countries (LMICs). The positive aspects of the pandemic – such as reductions in road traffic crashes, injuries and deaths as well as the improvement in air quality are highlighted with questions around what can be done by governments, local and central, the private sector and individuals to maintain some of these gains. However, there remain more gaps in current knowledge than answers. These, ranging from “how safe are masks in minibus taxis” to “what is the tipping point for people to move from public transport into private vehicles” to “how can this pandemic be used as an opportunity to build better, more equitable, transport systems” are posed.

While focusing on a select number of LMICs in Africa and South Asia, much of what is discussed would be applicable to most low- and middle-income countries. Case studies from India, Uganda and South Africa are used to illustrate lockdown measures, transport restrictions and some of the consequences – both good and bad – that these have had on communities. The plight of the poor, those living in rural areas, women, the elderly and people with disabilities are highlighted.

Some suggestions are offered on how transport and health can work together moving forward. These include increasing the use of safe public transport and reducing reliance on private vehicles, increasing active mobility, integrating residential areas with work hubs to reduce commuting and sanitising and making public transport vehicles and hubs safer.

COVID-19 offers a huge opportunity for an inter-sectoral response from the health and transport sectors. This natural experiment – catastrophic as it has been for people and their families around the world – has shown us how road traffic collisions can come down, how air quality can be improved, how governments can change laws and regulations quickly, how inequitable our systems really are. As lockdowns end, both the transport and health sectors need to instil trust in commuters. Joining forces will be greater than the sum of its parts.



1. Introduction

Transport provides access to jobs and livelihoods, schools, health services, food, and recreation, all of which are important social determinants of health. Without transport systems (land use planning, infrastructure, modal choice and technologies), life as we know it would be extremely difficult. The choice between using private or public transport is driven by a number of factors, including affordability, convenience, distance, concerns for the environment, the desire for recreation and physical exercise, and safety. For many people in low- and middle-income countries (LMICs), particularly women, children, the elderly, persons with disabilities, and the poor, there is little choice. Such people rely on walking, cycling, and public transport, even when the road infrastructure makes these modes of transport unsafe, either because of the high risk of road traffic crashes, or the fear of violence. In Africa, the continent with the lowest motorisation rate in the world, 44% of the people killed on the roads are either pedestrians or riding bicycles.¹

While essential to the way we live, transport systems can have significant negative effects on our health, such as air and noise pollution, congestion, and road traffic injuries. Other than the fact that the majority of people in the world who die from road traffic crashes never owned or drove a car¹, the ill health resulting from motor vehicle related air pollution tends to disproportionately affect the poor², who have contributed little to the generation of the pollutants. Transport infrastructure can fracture the communities through which it passes, making communal spaces inaccessible or dangerous.³ The free movement and safety of many rural communities is often impeded by the construction of high-speed road infrastructure through lands that were previously accessible and used for purposes such as agriculture. The benefits and downsides of transportation are not equally distributed.

Transport has been at the heart of the Coronavirus Disease 2019 (COVID-19) pandemic from its beginning. Courtesy of efficient transport systems across the globe, the infection was able to reach most continents within weeks of its commencement. Likewise, transport has been central to the response, and will continue to be critical to the recovery of many systems in the aftermath of the pandemic, from the transportation of patients, essential workers, goods and services, to the restructuring and operation of transport systems as countries and communities seek to end travel restrictions, and revamp economies. In fact, transport and health have always been closely linked, from the maintenance of the cold chain as the viability of vaccines is assured through various modes of transportation, to the need to get critically ill patients to care in time, to ambulatory care, and the routine movement of people that need or work in healthcare.

Transport management during the COVID-19 pandemic has brought to the surface issues, such as exposure to infections and their control, which have largely been overlooked because many countries have focused too narrowly on the road transport system itself⁴ and not on wider public health aspects. The pandemic has given us the opportunity to think about what makes transport and health systems truly safe and resilient. It questions current thinking in this space and whether the extent of collaboration between health and transport professionals is adequate in responding to the health-transport issues that have come to the fore during the pandemic.

This paper looks at the impact of transport on health during and after the COVID-19 pandemic in order to identify areas that require additional research or policy and regulation development. It is offered to stimulate further discussion and debate. While focusing on a select number of LMICs in Africa and South Asia, we believe that much of what is discussed would be applicable to most low- and middle-income countries. Hopefully the lessons we are learning will make for smarter, cleaner and safer systems for all, or the majority of users.



2. Interactions between transport and health

2.1 How did an infection in one city in China become a global pandemic?

In December 2019, a local outbreak of pneumonia – initially of unknown causation – was detected in Wuhan (Hubei Province, China). It was quickly determined to be caused by a new Coronavirus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The disease spread through China and was soon identified in other countries around the world. COVID-19 was first reported by the World Health Organization on social media on 4 January 2020.⁵ It was declared a Public Health Emergency of International Concern on 30 January 2020 and a Pandemic on 11 March 2020.⁶

The first case in the USA is now known to have occurred on 23 January⁷, while the first three cases in Europe were reported in France on 24 January 2020.⁸ The virus quickly spread across the channel, with the UK documenting its first case in early February. By March, only Antarctica remained free of the virus. By 30 May 2020, according to the [John Hopkins University Coronavirus Resource Center](#), almost 366,000 people had died around the world and nearly 6 million cases had been identified.

While transport modes linking cities and countries focused on preventing injuries (aviation, marine, and road transport systems all have long histories of strictly enforced laws and regulations to minimise crashes and injuries), not enough attention was paid to minimising the spread of deadly infections^a. The magnitude of the global disruption resulting from the pandemic is likely to cause major reviews in the way transport systems are secured against microbial assaults, perhaps in the same manner as the changes following 9/11 attacks.

In Africa, the first case of COVID-19 was confirmed in Egypt on 14 February 2020,⁹ followed by Nigeria two weeks later¹⁰ and South Africa on 5 March 2020.¹¹ The first case was reported in India at the end of January while the epidemic reached Pakistan by the end of February (Table 1).

According to a new report published by Partnership for Evidence-Based Response to COVID-19 (PERC), by early May the confirmed number of cases across Africa remained low, but was growing quickly.¹² While testing capabilities are not optimal across the continent (underreporting, lack of equipment, selection bias, etc.), countries have not documented the spiralling caseloads seen in Europe and the USA, possibly due to the swift and stringent public health and social measures put in place. Other protective factors that might influence the pandemic are the young structure of populations (43% of sub-Saharan Africa population is under 15 years versus 15% in Europe) who are thought to be more resilient against the virus, the weather, and BCG^b vaccinations or anti-malarial/ retroviral or Tuberculosis drugs. On the flipside, infections may just be severely undercounted.¹² South Asia is seeing similarly flat curves however, Latin America has seen a sudden increase in infections in late May – possibly season related.¹³

Table 1: COVID-19 deaths in selected African and South Asian countries

Country	Date first case	Date first death	Number of confirmed cases	Number of deaths as of 28/05/2020
Egypt	14/02/2020	08/03/2020	20,793	845
India	30/01/2020	12/03/2020	173,140	4,975
Kenya	13/03/2020	26/03/2020	1,745	62
Nigeria	27/02/2020	03/04/2020	8,915	259
Pakistan	26/02/2020	20/03/2020	64,028	1,317
South Africa	05/03/2020	27/03/2020	27,403	577

Source: JHU Coronavirus Resource Center, as of 28 May 2020

^a Many countries require passengers from areas known to be endemic for infections such as yellow fever and cholera to produce evidence of valid vaccinations, but this would not detect current infections.

^b Bacillus Calmette–Guérin (BCG) vaccine is used against tuberculosis (TB). In most of Africa, all babies are immunised with one dose as close to the time of birth as possible.



It is postulated by Dahab et al¹¹ that the impact in low-resourced settings could potentially become worse due to:

- higher transmissibility due to larger multi-generational households, overcrowding especially in slums, inadequate water and sanitation, and large gatherings;
- higher infection-to-case ratios because of comorbidities such as HIV, TB, malnutrition and malaria; and
- poorly equipped health care facilities, including the impact of supply chain disruptions through less well-equipped transport systems, leading to higher fatality rates.¹⁴

Modellers in South Africa are now suggesting that there could be between 35,000 and 50,000 deaths by November 2020¹⁵, while others submit that genetic differences in susceptibility and other as yet unconfirmed reasons might spare some countries and regions.

2.2 Responding to the pandemic

While the responses to the pandemic in some European countries and the USA have been criticized for being slow, Africa and South Asia responded rapidly; some countries even by closing their borders, restricting air travel and locking down citizens before any deaths were reported.

For example, on 15 March 2020 the South African President declared a state of disaster followed by a national lockdown on 23 March 2020 including shutting down all domestic and international flights, stopping ships docking, limiting cross-border movement (see Table 2) and even temporarily banning the sale of alcohol and cigarettes.

Table 2: Box 1: COVID-19, transport and health in South Africa

Box 1: COVID-19, transport and health in South Africa
<p>Background: On the 5th March 2020, the Minister of Health in South Africa announced that the first case of COVID-19 had been confirmed in the country. Ten days later the President declared a state of disaster – closing schools, prohibiting gatherings of more than 100 and restricting travel within days. A national lockdown started on 26 March 2020 with a gradual and phased easing beginning 1 May 2020.</p> <p>Lockdown restrictions: The following stringent measures were put in place:</p> <ul style="list-style-type: none"> • All international and domestic flights prohibited. • All commuter trains were shut down. • Ban on all cruise ships entering ports. • Minibus taxis only allowed to travel essential workers – taxis should be sanitized between each trip – could only operate from 05h00 to 09h00 and again from 16h00 to 20h00. Operators were encouraged to put in place physical distancing – but no guidelines were given. • Metered taxis and e-hailing vehicles only allowed to transport essential workers between certain hours in the morning and late afternoon. • Limited buses for essential workers only. • All cross-border passenger movements banned.¹⁶ <p>In addition to these, on 26th March 2020 a new Regulation Notice 398 was gazetted which prohibited the sale of alcohol and closed places of consumption. Liquor was specifically excluded from the list of essential goods and services. The main reason for this restriction of alcohol was to reduce the impact on hospital facilities of alcohol-related injuries – such as road traffic collisions and violence – thereby freeing up staff and facilities to deal with COVID-19 cases.</p> <p>Response:</p> <p>Immediately after the lockdown and the alcohol restriction, the emergency medical services saw huge reductions in the number of road traffic crashes (personal communication C. Parry). On an average</p>



Box 1: COVID-19, transport and health in South Africa

weekend one emergency service reported dealing with between 217-308 transport emergencies – this dropped to 159 the weekend after lockdown.¹⁷ During Easter, 9-13 April 2020, there were only 28 deaths from road traffic collisions versus 162 in 2019.¹⁸

According to researchers at the SA Medical Research Council, during the first phase of lockdown there were significant reductions (approx. 60-65%) in trauma admissions in the Western Cape and Gauteng. Approximately 40% of these cases would, in pre-COVID19 times, have been alcohol-related. Taking into account various assumptions, including a general reduction in trauma not only in South Africa but worldwide, the researchers concluded that this reduction in alcohol-related injuries has saved the health care sector around R720 million (USD36 million) and that 15 deaths per day were averted (personal communication C. Parry).

Morocco completely closed all borders by all modes of transport, closed all activities except for medical and food on 19 March 2020. Only one family member was allowed to go out with a special permit to buy food. During Ramadan, going out after 7 pm was not allowed.¹⁹ Special permits were required to move from one city to another.

In Uganda, lockdown and travel restrictions were imposed on 1 April 2020 resulting in many untoward consequences for the many people who live hand to mouth (Box 2).

Table 3: Box 2: How Uganda responded to COVID-19

Box 2: How Uganda responded to COVID-19

Background: Uganda is an East African country with population 41 million of whom 7.7 million under 5 years. Its GNI per capita is US\$660, the average life expectancy is 62 years, and the country counts 1 health worker (doctor, nurse, or midwife) for every 11,000 patients. Uganda is also among the least motorised countries in the world, with less than 10 cars per 1,000 population.

History of COVID-19: The first case was diagnosed on 22 March 2020, a passenger from United Arab Emirates coming into Entebbe International Airport. The airport was closed on 23 March. This resulted the same day in a partial lockdown. At that point, private cars with 3 or fewer people on board were allowed to circulate, and markets and food stores to operate. A total lockdown and a curfew were announced on 1 April 2020. COVID-19's cases have grown very slowly, and the curve has remained almost flat. As of 14 May, more than half of the 121 positive cases are truck drivers coming into the country from neighbouring countries.

Lockdown restrictions: Only vehicles carrying essential personnel and goods were allowed. The Ministry of Works and Transport issued stickers for the quick identification of permitted cars. Only stores and markets selling food and essential goods were allowed to open (market vendors to reside at the markets) – including agricultural inputs (farms considered essential). Construction sites have remained open if the workers were able to reside at the site. Initially, anyone needing to go to hospital was required to call the Office of the Resident District Commissioner for permission to use a private car, or for an ambulance to pick them up. Later, this was relaxed to enable different modes of transport to take patients to hospitals. Boda boda riders were barred from carrying passengers, only goods. They were to work only until 5.00pm.

Response:

- There was instant outcry from essential workers - health workers, market vendors, and utility services personnel – about lack of transport to and from work.
- Security agents enforced the lockdown, and in two separate, widely reported incidents, two boda boda riders were shot, one fatally, for disobeying the regulations.²⁰
- Informal workers, such as roadside vendors, cleaners, and porters in markets, were harassed for leaving their homes to go to trading centres, and they, in turn, complained that if they stayed in their homes they and their families would starve.



Box 2: How Uganda responded to COVID-19

- Doctors were arrested and held at police stations because they did not possess the right stickers, and a Member of Parliament found distributing food to poor families was arrested and imprisoned.²¹
- Patients did not get to hospitals, and some died in the community, having failed to find transport to seek healthcare.²²
- Testing of truck drivers revealed them to be an important avenue for the coronavirus transmission; as of 29 March 2020, 23 of the 79 positive tests have been from truck drivers. (Truck drivers move goods from the coast in Kenya and Tanzania, destined for Uganda, or further inland, to Rwanda, Sudan, or the Democratic Republic of the Congo.)
- After only 2 weeks of lockdown, it was reported that Kampala's air pollution was reduced by 40%.²³

The government of India ordered a nationwide lockdown on 24 March 2020. All transport services were suspended with the exception of transportation of essential goods and emergency services. Anyone who failed to follow the restrictions could face a year in jail.

Public transport systems are considered high risk environments due to the high number of people in a confined space, limited ventilation, no way to identify sick people and a number of fomites where the virus can be transmitted through, such as ticket machines, money, handrails, and door knobs.

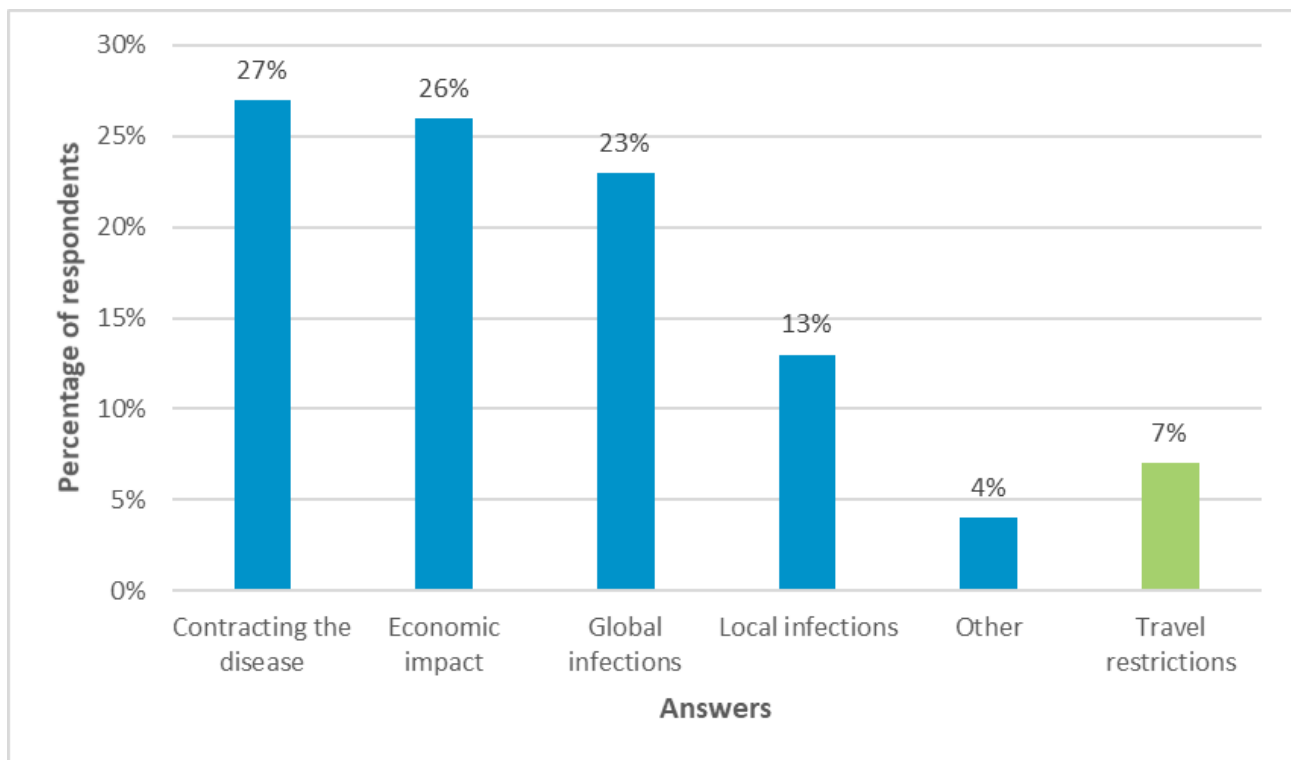
Consequently, the pandemic has led to a rapid movement away from the use of public transport. Even before lockdowns, people stopped using public transport in an attempt to reduce their exposure to the virus.²⁴ As physical distancing and lockdowns were put in place, more people moved to work from home (where possible), and when schools were closed, children began tele-schooling. This has led to dramatic reductions in the use of public transport.²⁵ In New York, for instance, there has been a 60% reduction in the use of subways and 90% reduction in train usage²⁶, while in Chile, Argentina, and France policymakers quoted public transport reductions of around 80-85% during a recent webinar entitled "[Mobility and COVID-19: A Blessing in Disguise for Road Safety?](#)" hosted by the Inter-American Development Bank on 8 May 2020.

In India, following the lockdown, only 1-2% of public transport services were operational with 56% of these operating services only for essential services. 81% of operators reported no ridership at all, while the rest witnessed a 90% reduction. The final impact has been staggering with private operators suffering more than public bus operators. These financial hardships coupled with physical distancing and frequent cleaning can put at risk the long-term sustainability of the sector.²⁷

A recent study conducted by GeoPoll in 12 African countries found that 96% of people reported that they had taken measures to prevent themselves catching the virus. 54% had improved their hand-washing, 50% were avoiding public places, and 18% said that they were avoiding public transport.²⁸ Although contracting the disease was the participants' greatest concern, 7% were also concerned about the travel restrictions and more than a quarter about the economic impact of the disease (Figure 1).



Figure 1: What concerns you most about Coronavirus?



Source: <https://www.geopoll.com/blog/report-covid-19-coronavirus-africa/>

“Across the country, cities with public transit systems are being forced to adapt to the risks posed by the Coronavirus. While carrying out stringent sanitation protocols, and amid a major decline in ridership, transit officials must also balance discouraging people from riding and reassuring those who have no other transportation options that their buses and trains are safe”.²⁹

Substantial lessons have been learnt on how to address COVID-19 on public transport from China. A recently published reflection paper sets out four recommendations for public transport operators:

- Protecting frontline staff – providing protective equipment for staff and passengers including monitoring body temperature;
- Sanitising and cleaning vehicles after each service and ensuring good ventilation;
- Adjusting bus services including reducing services to discourage unnecessary travel, reducing by half the capacity of all vehicles, and monitoring services 24 hrs a day; and
- Staff management and deployment – recording staff travel, mandatory self-isolation if in contact with anyone positive, counselling services and provision of sanitation products.³⁰

In addition, [the International Road Union](#) has set up a Coronavirus information hub and published checklists for bus and coach operators as well as for truck drivers in multiple languages.

The public health response around the world has prioritised hand-washing or the use of an alcohol-based hand gel, and yet, according to the WHO/UNICEF 2017 WASH report, only 27% of the population in the least developed countries have basic hand-washing facilities with soap and water, while 26% have some hand-washing facilities and the remaining 47 per cent have no facilities at all.³¹ In Africa less than 50% of the population used hand-washing facilities in 2015. In Nigeria, Africa’s second largest economy, only 4 out of 10 people have access to basic hand-washing facilities at home putting around 150 million people at significant risk of transmission through lack of hand sanitation while around 600 million people in Pakistan and India lack access to hand-washing facilities.³¹ The lack of clean water and soap will have a significant impact on public transport operators, since most guidance involves sanitising public service vehicles and/or taxis (formal and informal) between each trip. Even more disturbing is that an estimated 896 million people use health care facilities with no water service.³²



The issue of wearing face masks in public is still out for debate. While the World Health Organisation (WHO) only recommends masks for ill people and care workers, some countries have made mask wearing mandatory (Box 3), while others have not. A recent Lancet article concluded that, although evidence that face masks can provide effective protection against respiratory infections in the community is scarce, encouraging their usage by everyone could risk supply to frontline workers.³³ Whereas an article in the British Medical Journal suggests that because masks are simple, cheap and potentially effective they should be worn by those who are ill at home as well as outside the home when meeting with other people is inevitable, e.g. during shopping, on public transport.³⁴ Whether wearing masks will actually reduce the need for physical distancing (for instance in minibus taxis) or reduce transmission in confined spaces, has yet to be determined.

Table 4: Box 3: USA CDC advice on face mask usage

Box 3: USA CDC advice on face mask usage
<ul style="list-style-type: none"> • Cover your mouth and nose with a cloth face cover when around others. • You could spread COVID-19 to others even if you do not feel sick. • Everyone should wear a cloth face cover when they have to go out in public, for example to the grocery store or to pick up other necessities. • Cloth face coverings should not be placed on young children under age 2, anyone who has trouble breathing, or is unconscious, incapacitated or otherwise unable to remove the mask without assistance. • The cloth face cover is meant to protect other people in case you are infected. • Do NOT use a facemask meant for a healthcare worker. • Continue to keep about 6 feet [2 metres] between yourself and others. The cloth face cover is not a substitute for physical distancing. <p>Source: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/index.html</p>

While WHO was the voice of the public health response to the virus (Box 4), there has been no concerted voice for transport despite these systems being central to the spread of the disease. As a result, there has not been a cohesive international response – some countries stopped air travel nationally and internationally, while others continued to operate nationally. Other countries put in place restrictions on citizens from particular countries only. A few countries put in place a 14-day quarantine for anyone returning from a foreign country. Some countries actively discouraged the use of public transport, even by keyworkers who continued to work during lockdown. Here an agreed response might have been beneficial.

Table 5: Box 4: Protecting yourself and others from the spread COVID-19

Box 4: Protecting yourself and others from the spread COVID-19
<p>WHO has provided the following guidance to reduce the chances of being infected or spreading COVID-19:</p> <ul style="list-style-type: none"> • Regularly and thoroughly wash hands with soap and water or an alcohol-based hand rub. • Maintain at least 1 metre distance between yourself and others. • Avoid crowded places. • Follow good respiratory hygiene. • Stay at home and self-isolating even with minor symptoms (cough, headache, mild fever) until fully recovered. • Seek immediate medical attention for high fever, shortness of breath, and coughing. • Wear a mask if ill or caring for someone that is ill (NOTE: this might change in the light of new research showing benefits for all people wearing masks especially in shops, public transport, etc.) <p>Source: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public</p>



2.3 Interactions between transport and health

Transportation is an important factor influencing individual’s health and the health of communities. Five interacting dimensions have been identified between transport and public health. These are safety, active transport, clean air, connectivity/access and equity (Figure 2). In order to have a healthy and safe system there needs to be balance among those dimensions, with equity taking a central role, so that all people have access irrespective of age, sex, ability, or income.³⁵ Inequities in the transport system can lead to reduced access to health-related destinations such as hospitals, rehabilitation centres, food, fitness and recreation facilities which can further interact with other risk factors to cause morbidity and premature mortality.³⁶ Transport, climate action and health, need to work together to ensure that clean air is not unduly sacrificed to achieve connectivity for some, that those wishing to engage in active transport can do so safely, that public transport does not expose the users to dangerous infectious agents, and that, to the extent possible, the risks and benefits of our transport system are shared equitably.

Below we outline some of these interactions in greater detail.

Figure 2: Transportation and health framework



2.3.1 Connectivity/access

Lockdowns (see Box 5) across the world have led to significant changes in mobility – with fewer transport services on the roads, and people taking to walking and cycling (as lockdown has allowed) for exercise and to obtain essential supplies. In some LMICs, throngs of especially low-income earners and migrant workers took to the roads to walk back to their villages after lockdowns were announced, raising concerns that this could lead to the urban-to-rural spread of the virus given that many elderly and vulnerable people tend to live in villages.³⁷⁻³⁹ As they bring essential goods to land-locked and otherwise inaccessible countries and cities in the interior, trucks have continued to ply the roads, but the truck drivers now constitute a significant proportion of those testing positive for COVID-19 in a number of countries in the African region^{40,41} while delivery drivers are at high risk in South Asia.⁴²

Table 6: Box 5: Common features of lockdown

Box 5: Common features of lockdown
<p>Most countries have implemented lockdowns which include most of the following restrictions (or modifications thereof):</p> <ul style="list-style-type: none"> • Stopping international and/or national air travel; • Closing down all non-essential services including shops, restaurants, cafes, etc.; • Requiring those who can, to work from home or furloughing those who cannot;



- Prohibition of travel except for essential and keyworkers;
- Prohibiting large gatherings;
- Closing borders to people;
- Implementing physical distancing (WHO suggests 1 metre apart – however, some countries have implemented 1.5 metres or 2 metres. There is still a lot of discussion about what the optimal distance should be in the academic literature);⁴³
- Allowing some time outside for exercise; and
- Requiring the wearing of masks in public places.

Lockdowns have also resulted in the closure of most non-essential businesses, shops, restaurants, etc. in countries. In the United Kingdom, for example, following lockdown, retail and recreation locations such as restaurants and cafes saw about an 80% decline in their footfall in March 2020 compared with their usual activity.⁴⁴ By contrast, residential locations saw a 17% increase in mobility, implying that people in the UK are complying with the physical distancing encouraged by the government (Table 7). Much lower reductions in footfalls are seen in the LMICs profiled, with the exception of India. It will be important to observe what happens as lockdowns are lifted. Will communities return to old behaviours, or has travel to inner cities to do business and shop changed forever? Will this reduced travel have long term impacts on the health of nations going forward?

Table 7: Changes in mobility in the UK and selected African and South Asian countries

Changes in Mobility	UK	Egypt	India	Kenya	Pakistan	South Africa
Retail & recreation	-78%	-54%	-85%	-42%	-59%	-54%
Grocery & pharmacy	-30%	-8%	-44%	-29%	-41%	-22%
Parks	-18%	-42%	-64%	-27%	-34%	-51%
Transit stations	-63%	-52%	-64%	-28%	-51%	-60%
Workplaces	-49%	-32%	-54%	-20%	-37%	-35%
Residential	+17%	+13%	+27%	+19%	+17%	+20%

Source: Google COVID-19 Community Mobility Report, as of 2 May 2020, <https://www.google.com/covid19/mobility/>

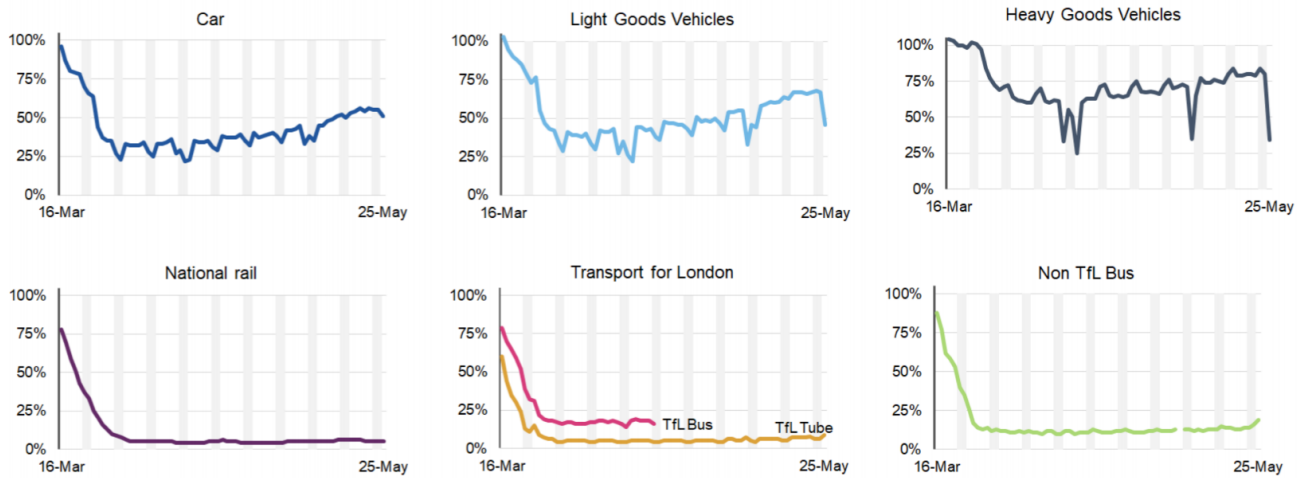
The United Kingdom also publishes on a daily basis the reductions in vehicle travel to undertake various activities such as shopping, recreation, work and mobility (see Figure 3). Dramatic reductions were seen at the beginning of lockdown with only small increases more than 6 weeks later. Unfortunately, similar graphs for LMICs could not be located at this stage.



Figure 3: in transport usage and mobility in the UK during COVID-19

Social distancing

Changes in transport use (Great Britain)



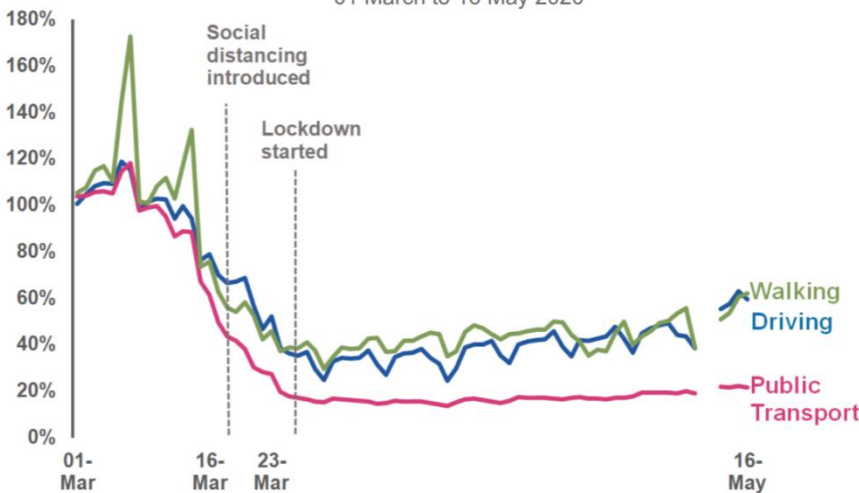
Transport data is indexed to the equivalent day in either January or February 2020 (Traffic and Buses) or 2019 (Rail). Shaded areas represent weekends.



Source: Department for Transport. Further details on data sources can be found here: <https://www.gov.uk/government/collections/slides-and-datasets-to-accompany-coronavirus-nriss-conferences>

Mobility (UK)

Apple maps directions requests data 01 March to 16 May 2020



Source: Apple mobility data. Opinions and Lifestyle Survey, Office for National Statistics. Data not available for 11/12 May. Further details on data sources can be found here: <https://www.gov.uk/government/collections/slides-and-datasets-to-accompany-coronavirus-nriss-conferences>



Opinions and lifestyle survey 24 April to 3 May 2020

44%
Of employed adults worked from home compared to around 12% last year

80%
Of adults only left their home for the permitted reasons, if at all



Sources: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/887877/2020-05-27_COVID-19_Press_Conference_Slides_-_For_Publication_UPDATED.pdf and https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/885918/2020-05-18_COVID-19_Press_Conference_Slides_-_for_publication_1.pdf

Many countries shut down schools and encouraged non-key workers to work from home, thereby removing the two major activities – school and work (formal and informal) – that are responsible for the majority of vehicles on the road in the morning and afternoons. Global Workforce Analytics estimates that more than half of the US population could work, at least partially, from home. A GeoPoll survey in Africa has found that only 20% of participants said they were able to work from home.²⁸ Reasons for this large gap are likely to be related to higher unemployment levels, higher proportion of zero-hour contract workers (jobs cannot be conducted from home) and lower level of internet connectivity.⁴⁵



Where public transport was closed, lack of transport impacted people needing to go to health facilities for non-COVID-19 services. These included primary health care (antenatal care, routine immunisation, well-baby clinics), consultations and medicine refills for chronic diseases, such as diabetes, hypertension, Sickle Cell anaemia, and mental health conditions, as well as for medical emergencies, such as bleeding related to pregnancy, and acute asthmatic attacks. In countries such as Uganda and India, there is a concern that gains made in childhood immunisation could be rolled back significantly, leading to epidemics.⁴⁶ Most High-Income Countries (HICs) and some LMICs like South Africa and India have put in place community groups to assist the vulnerable, shielding^c, people with disabilities, sick or those in self-isolation or quarantine under these circumstances.

Where a functional emergency medical system (EMS) did not exist before the pandemic, communities have found it very difficult to access care, since the public transport they could have used was grounded. In countries like Uganda, deaths are being attributed to this lack of transport.⁴⁷ Even in countries with well-established EMS, services have at times been overwhelmed, resulting in longer than usual waits for an ambulance. Pharmacy trips have presented challenges, especially for the older people who are at increased risk of contracting and dying from COVID-19, meaning that for them a trip to the pharmacy, even in one's neighbourhood, is a very high-risk activity.⁴⁸

Health worker mobility has emerged as a problem in many countries. In LMICs, many health workers rely on public transport to get to and from work. With the complete closure of public transportation in some countries, many are unable to access their workplaces, or have to walk great distances to get to work.⁴⁹ To get around this, some are accommodated at the health facilities, both to reduce chances of transmission from hospitals to communities, and to ease travel. This is likely to create a sense of alienation for the health workers who are thus separated from their families, and stigmatisation by communities, because the health workers are assumed to be contagious. Where special transport was arranged for health workers for instance, other equally essential or key workers, such as cleaners and food workers, were left out of these arrangements.⁵⁰

One of the biggest challenges in managing the pandemic has been the availability of personal protection equipment (PPE) especially for health workers, and testing kits.⁵¹ Most LMICs have limited capacity to manufacture PPE, and until recently, none were able to make their own testing kits. Even the limited stock that might have been available within country could be difficult to distribute because of restrictions on transport. There are reports that PPEs are not getting to those that need them because of the restriction on transport.⁵¹

This section has identified a number of **gaps in knowledge or research questions** that need answering. These include:

- What habits will communities adopt in place of travelling to inner cities to do business and shopping?
- What impacts on health will reduced travel have in the long term?
- How can LMICs modify schooling and work attendance to reduce travel at peak times of the day and early afternoon?
- How can governments convince the public that they should travel to hospital in emergencies – that they are safe and that they should attend for non-COVID-19 medical problems and injuries?
- What are the best practices in countries to improve the travel safety of healthcare and other key workers who need to work during lockdown?
- What is the impact of transport restrictions on the distribution of PPEs in LMICs?

2.3.2 Safety and security

Lockdown mobility restrictions have had a positive impact on road traffic crashes and pollution,⁵² as well as other less desirable outcomes. Less cars on roads means a significant reduction in exposure to road traffic collisions. This has meant that some countries and cities have seen substantial reductions in injuries and deaths – freeing up their emergency rooms to deal with COVID-19 patients coming into hospital.

^c A term used in the UK to describe those people who need to stay at home because they have been classified as vulnerable, e.g. undergoing cancer treatment, asthmatic, auto-immune disease, etc.



In South Africa, according to the Minister of Transport¹⁸ there has been a 70% reduction in vehicle movement, resulting in significant reductions in road traffic crashes and their consequences. For example, during the Easter weekend (9-13 April 2020) there were 28 road traffic fatalities compared with 162 over the same period in 2019.

In India, significant reductions in deaths are being attributed to massive reductions in road traffic crashes.⁵³ Chandigarh, for example, recorded zero road fatality for the first time in a decade and are encouraged "... to ditch cars and walk to their neighbourhood grocery stores in an effort to keep traffic congestion and pollution in the city from reaching the previous dangerous levels".⁵⁴

There is a concern however, that in some areas the clearer roads have encouraged speeding, which could result in more severe injuries when crashes do happen. But, no peer-reviewed literature could be found to substantiate these reports in newspapers. Furthermore, many LMICs do not have robust enough data systems to provide accurate and rapid data on these aspects and so these data remain anecdotal.

Women, children, the elderly and people with disabilities are particularly vulnerable transport users and therefore travel restrictions and lockdowns could have more impact on them. Women, for example:

- account for two-thirds of public transport users;
- are more likely to use multiple types of transportation;
- rely on the use of a private vehicle less frequently than men; and
- are more likely to be travelling with children and or luggage.⁵⁵

As transport providers and workers, women may be at increased risk of catching and spreading the virus because they are over-represented in customer-facing and cleaning roles and may lack sufficient or appropriate protection.⁵⁶

Domestic violence has been reported to be on the increase among many communities under lockdown.⁵⁷ With people being compelled to stay together for days and weeks on end, often with the added stresses of loss of incomes and jobs, and the inability to escape and find help outside the home, those vulnerable to violence are the worst affected. In addition, there is anecdotal evidence of increased sexual harassment on women essential workers on public transport during the pandemic.

As lockdowns begin to ease up in many countries, personal protective measures including physical distancing and other hygiene measures such as automatic doors, access through the back of the vehicle, plexiglass to shield the driver, and cashless tickets should be applied to reassure both operators and passengers. While keeping 1-2 metres apart might be feasible in a large bus or train, this could present challenges in LMICs, where public transport often involves minibuses and motorbikes. Some measures such as improving ventilation, adjusting seating arrangements, reducing services, and reminders or checklists for operators and passengers with regard to personal hygiene could be put in place, even though this would still mean that passengers are closer than 1 metre apart.

This section has identified a number of **gaps in knowledge or research questions** that need answering. These include:

- How do masks worn in public transport reduce the transmission of the virus?
- What kind of masks should be worn by commuters?
- What is the optimum distance between passengers travelling on public transport?
- How do you physically distance passengers in minibus taxis and on boda boda motorcycle taxis?
- Has there been an increase in sexual harassment of women essential workers using public transport during COVID-19.
- What support is being provided for women in LMICs experiencing domestic violence during lockdown?

2.3.3 Active transport

Physical activity is known to enhance health in various ways, and to reduce the occurrence of certain types of illnesses, including diabetes, hypertension, obesity, and depression.^{58,59} While walking and cycling are recreational in most high-income countries, or undertaken as part of a healthy life-style, in low-income



countries most people walk or cycle out of necessity. In addition to the benefits related to the physical exercise itself, these modes of active transport are an important strategy for promoting cleaner air, especially in urban areas.

During the COVID-19 pandemic most HICs have allowed at least some outdoor activity even during lockdowns. However, it has become apparent that the space available for people to walk and cycle on streets in most countries, even high-income countries, is not adequate if a 2-metre physical distance is required at all times. As lockdowns are lifted and people start returning to school and work, active transport should be encouraged in order to maintain the gains made with regards to reductions in road traffic collisions and improvements in cleaner air. In many countries, particularly the LMICs, infrastructure for safe cycling and walking is lacking.¹ To continue to benefit from active transport, countries will have to put in the infrastructure, and to ensure they are safe from the risk of road traffic crashes, assaults (especially for women), and contracting infections.

A number of cities in Australia⁶⁰, Canada⁶¹, France⁶², Italy, USA, Austria, and Germany⁶³ have already put in place popup cycle lanes and closed roads or adopted one-way sidewalks. Argentina, Colombia and Mexico⁶⁴ have also opened up miles of new bike routes by closing streets or temporarily separating lanes in urban areas in the hope of maintaining reductions in congestion, pollution and person-to-person contact. Some cities, such as Paris and Milan, have indicated that they plan to make these changes permanent.

Germany has exempted bicycle repair shops from lockdowns, while the UK is offering vouchers to obtain free bicycle repairs, and Italy is providing vouchers to individuals of up to €500 to cover up to 60% of the cost of a new bicycle.⁶⁵ The UK has also announced a £2 billion fund to put walking and cycling at the heart of governments transport policy post COVID-19. The first stage will involve popup cycle lanes, widening pavements, and cycle and bus only streets.⁶⁶ According to ESCAP, COVID-19 has prompted many Asian countries to rethink mobility and urban planning⁶⁷ while the Sub-Sahara Africa Transport Program has recommitted to “building safe, inclusive, and sustainable transport systems to ensure that all Africans have access to the essential goods and services needed” in the wake of the pandemic.⁶⁸

Through the ages, epidemics have shaped cities. A newly published playbook entitled “Streets for Pandemic Response and Recovery”⁶⁹, encourages cities to create “safe, walkable streets and choices for getting around” in the immediate response to the crisis, but to also think longer term to encourage economic recovery “that is equitable, sustainable, and enduring.”

This section has identified a number of **gaps in knowledge or research questions** that need answering. These include:

- How possible is it for cities to change land use? To move residential areas closer to work? Or to change zoning? What proportion of people would this affect?
- What proportion of the population would need to relocate for there to be noticeable change in air pollution reduction, or traffic congestion reduction?
- What is the tipping point for people to move from public transport to private cars?
- What will be the cost impact of the sanitation and distancing measures on public transport?
- How much cost will be added to the current finances of running public transport? Who will bear the cost?

2.3.4 Clean air

Air pollution (indoor and outdoor) kills 7 million people around the world every year.⁷⁰ Particles in air can cause inflammation in the respiratory system and people living in areas with high levels of pollution are thus more likely to develop chronic respiratory conditions.

Recent research indicates that viruses may bond with pollutant particles, thereby helping them to stay in the air longer, and enabling them to make their way into people’s respiratory tracts.⁷¹ Whether the SARS-CoV-2 is truly airborne or not remains debatable, but experts encourage increasing ventilation indoors and not re-circulating air in order to dilute and or flush out the virus. Some even suggest banning indoor meetings entirely, which would imply that transportation modes that hold large numbers of people in enclosed spaces are likely to be discontinued, at least in the foreseeable future.

Statisticians at Harvard are suggesting that COVID-19 death rates follow those areas with high population density and high particulate matter (PM2.5 specifically) and that long-term exposure to air pollution could



increase vulnerability to the most severe COVID-19 outcomes.⁷² They suggest that if Manhattan had lowered its average PM2.5 by a single unit over the last two decades they would have prevented 248 COVID-19 deaths by the end of April 2020.⁷²

Similar results have been noted by scientists in Italy, who found that the high levels of pollution in northern Italy were a cofactor in the high lethality rate in that area.⁷³

This new evidence coming out on the link between pollution and COVID-19 outcomes does not bode well for 90% of the world’s population who live in regions like South Asia (particularly India), the Middle East, sub-Saharan and North Africa that exceed WHO’s pollution limits.

However, on the flipside, pollution levels appear to have plummeted in some countries as lockdowns have been enforced (see Box 6). The drop in pollution has been most pronounced in cities and along major transportation corridors.⁷² Some environmental economists are even suggesting that the reduction in pollution seen around the world – even just in the last three months – will save more lives than the virus has taken.⁷⁴

Table 8: Box 6: Impact of COVID-19 on transport and air quality in India

Box 6: Impact of COVID-19 on transport and air quality in India
<p>On 24 March 2020, the Government of India ordered a nationwide lockdown, limiting movement of the entire 1.3 billion population of India as a preventive measure against the COVID-19 pandemic in India. In what has been termed the world’s biggest lockdown, the following restrictions were imposed ⁷⁵:</p> <ul style="list-style-type: none"> • Ban on people from stepping out of their homes. • All services and shops closed except pharmacies, hospitals, banks, grocery shops and other essential services. • Closure of commercial and private establishments (only work-from-home allowed). • Suspension of all educational, training, research institutions. • Closure of all places of worship. • Suspension of all non-essential public and private transport, prompting hundreds of thousands of low-income earners to head back to the villages on foot – in many instances travelling for hundreds of kilometres from cities.⁷⁶ • Prohibition of all social, political, sports, entertainment, academic, cultural, religious activities. <p>Vehicular sales ground to a halt, and the transportation sector began to register huge revenue losses. Soon the auto industry closed down for lack of sales, and migration of the workforce was registered, mostly going back to rural areas. While the data are not available, anecdotal information indicates that hospitals have seen a decrease in road traffic injuries.</p> <p>Just days after imposing the lockdown, the level of particle pollution dropped by nearly 60% in New Delhi, and has continued to go down, reaching levels considered acceptable by WHO, by mid-April.⁷⁷ The results of this natural experiment prove that if the National Clean Air Programme launched in 2019 was strictly implemented its goal of reducing particulate matter by 30% would be achievable.⁷⁸</p> <p>India’s cities are among the most densely populated in the world. They will need to make major changes to their public transport in order to observe infection control measures.</p> <p>The 348-km of the Delhi Metro network, with 310 train coaches, catered to an average of 5.7 million passengers in February, with a density of six passengers per square metre on the train. The system would need to increase services at least six-fold to observe physical distancing of one-metre separation.</p> <p>The suburban train in Mumbai caters to over 7.5 million passengers per day. Peak-hour density inside trains is 14-16 passengers per square metre. To implement physical distancing of 1sq m per person, the railway system requires expansion of services 14 to 16 times its capacity.⁷⁹ Bangalore Municipal Transport Corporation will need to expand its fleet size 4-fold, a capacity of 24,000 buses.</p>



Hopefully countries will learn from the COVID-19 experience and “build back better” unlike the backward trend, particularly with regard to emissions, seen after the 2008/9 Banking Crisis.⁸⁰

The challenge is to keep pollution levels down sustainably. To get healthier air in the long term will mean shifting to cleaner energy sources and prioritising active transportation.

This section has identified a number of **gaps in knowledge or research questions** that need answering. These include:

- How can cities and countries capitalize on the positive aspects of air quality as a result of COVID-19?
- How many lives have been saved as a result of months of cleaner air in some cities?
- What design changes are needed to minimize infection transmission in minibuses?
- How will the trucking and heavy vehicle private sector respond to the global call to keep emissions down?

2.3.5 Equity

"The lockdown is actually causing more deaths. The lockdown was supposed to reduce deaths but the deaths are increasing. It is just that they are in the villages. So, if they want the lockdown to have an impact, then they have to be efficient where the ambulances are enough, fuelled, and there is a toll-free line. But if there is no ambulance, and a service that is free with a toll-free line, there is no point of lockdown because it is causing death...They have already told you, they brought two mothers just to remove the foetus for burial, and that has not been happening. It is the first time I'm seeing it."

Dr Alfred Lumala, the medical director of St Joseph's Hospital Kitovu, Uganda.⁸¹

According to the United Nations, more than 1 billion people live in informal settlements and slums around the world.⁸² Furthermore, more than 60% of employment in the developing world is informal⁸³ including minibus drivers, e-hailing services and other informal transport providers. Most of these people live hand-to-mouth, sharing basic commodities such as electricity, sanitation and even water. Almost half of the African population does not have running water in their own homes.³¹ Although many now own mobile phones, few have internet connections, and even fewer have jobs that can be done remotely.⁸⁴ Those that can work from home in developing countries are unlikely to live in informal settlements – and so work from home orders during COVID-19 are just making the chasm between the “haves” and the “have-nots” wider.

For the billion people who live in slums, the physical distancing guidelines issued by their governments are simply impossible. Small, overcrowded houses do not have adequate space to exercise the necessary distancing, and therefore millions of people in Asia, Africa and Latin America cannot obey this fundamental public health response to the pandemic.⁸⁵

Gender plays an important role in the pandemic. Healthcare and care workers, for instance, are predominantly women as are those working in essential services such as shop assistants, cleaners, etc. These keyworkers have continued to travel to their places of work as they play an indispensable role in the response to the pandemic and are thus at greater risk of both catching and spreading the virus. In some countries, e-hailing and rideshare companies are providing free transport for health care workers reducing the risk of infection from shared public transport. The economic hardships as a result of COVID-19 are also likely to impact women more than men. What support, both financial and emotional, is being provided to healthcare workers?

Information is key to the control of the pandemic. While certain sections of the population have had easy access to information, and maybe even an overload of information about the pandemic, preventive measures, and predictions for the future, there are segments of the population, especially in LICs, where information flow is limited. People in rural areas, those with no cell phones, illiterate people, the blind, the deaf, and some with mental disabilities, are all at risk of not getting much needed information when they are made to ‘stay home’. Sources of information such as billboards, conversations with others on the road or in markets, clinics, or maybe on the radio in a public place, would be closed off under lockdown. This could lead to increased risk for these disadvantaged groups of people.

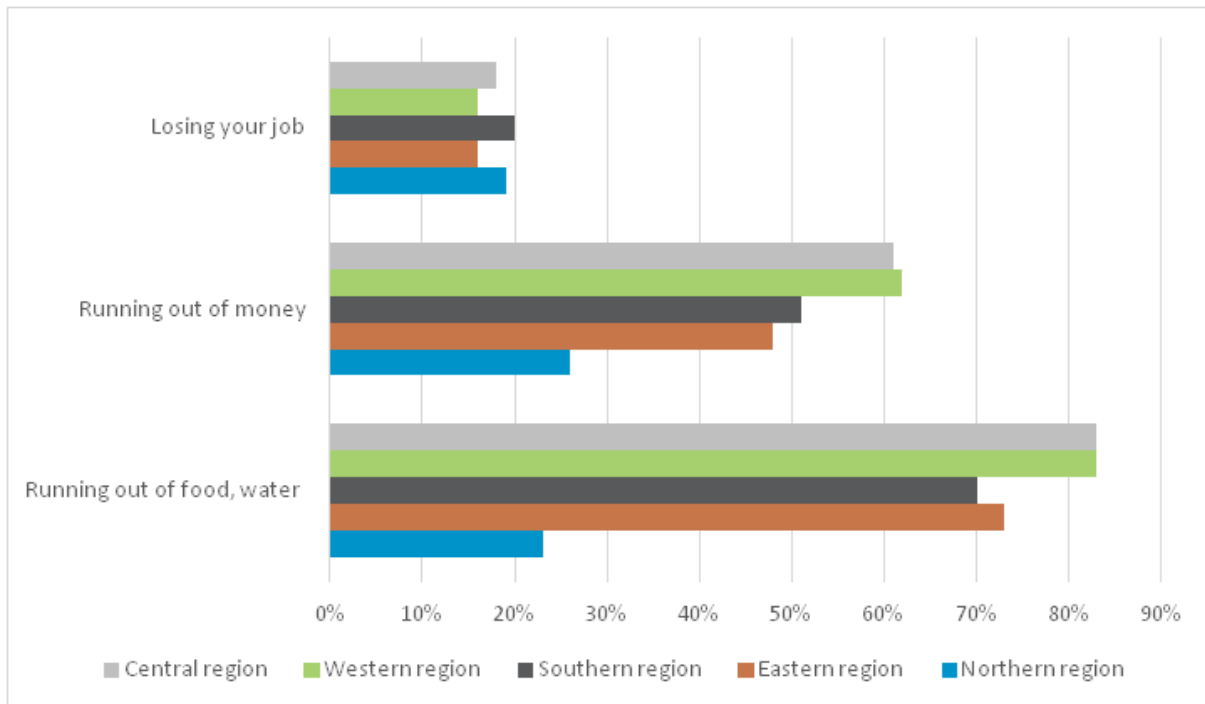
More than the fear of contracting the virus, the fear of having nothing to eat is paramount in many poor communities.⁸⁶ Children and low-income workers that had previously counted on at least one meal at school and in the workplace are now going hungry.⁸⁷ Reduced transport has led to constrained food supply channels,



made even more tenuous by border closures in many regions.⁸⁷ In some peri-urban settings the poor rely on food being brought in from the outlying farming communities – an avenue that is closed under lockdown. There is a real danger of acute or chronic malnutrition in the most vulnerable sectors of society as a result.

The United Nations’ Food and Agriculture Organization has warned of a food crisis across vulnerable populations if supply and distribution chains are not protected.⁸⁷ While national and international food supply chains may not be too badly affected, once again it is the local chains or those who live hand to mouth which will be constrained most by the limited public transport and lockdown measures. A GeoPoll survey found, for example, that 80% of participants were more worried about not having enough food to eat than running out of money or losing their job (Figure 4).²⁸

Figure 4: Barriers to stay-at-home orders in African participants



Source: PERC study, 2020²³

Even in South Africa, in Mooiplaas and Spruit informal settlements just north of Johannesburg – the richest city in Africa – a 3 km queue formed when thousands of people came out to collect food hampers on 29 March 2020, just a few days after a lockdown was announced. While many countries have implemented food aid for the poorest, these often do not include informal workers or migrants. For example, in the South African situation, since more than 80% of the community are migrants, they did not receive any help from the government.⁸⁸

Physical distancing, the key intervention for reducing disease transmission during a pandemic, by definition leads to isolation of individuals, especially those who live alone. With visits to friends and family, walking in the park, or going shopping not possible under lockdown conditions, there are likely to be higher rates of depression and other mental health conditions. Patients with Alzheimer’s are at particular risk.⁸⁹ The alternatives being proposed to alleviate isolation, such as frequent phone calls with friends and family, and online visiting e.g. on video conferencing platforms, are only available for those with higher incomes. This means that the poor, whose links to the outside world tended to rely on physical visits, are at a higher risk of extreme isolation.

The need for physical distancing also leads to further isolation of those who are sick with COVID-19, and the fear and reality of patients dying alone results in untold grief for the families and friends who do not get closure. Access to funerals has been greatly curtailed under lockdown.⁹⁰⁻⁹² This is likely to result in long-term psychosocial challenges in communities where burials are communal events.

The poor are likely to get poorer as a result of this pandemic.⁹³ While all countries are expected to suffer significant economic hardship, it will be LMICs that will be the hardest hit as a result of both the lockdown and



the infection. Tourism is at the heart of many African and Asian countries economies and these businesses have effectively been shut down as international air travel remains restricted. A global recession is inevitable.⁹⁴

How much this pandemic itself will cost LMICs is unclear, but lessons from the Ebola crisis in 2013-16 suggest that it could cost billions. The 11,300 deaths caused by Ebola during those 3-4 years cost West-Africa around US\$ 53 billion.⁹⁴ Economists in South Africa are predicting that the national shutdown from 27 March 2020 could cause a 2.5% to 10% contraction in the country's total GDP in 2020.⁹⁵ Countries that manufacture motor vehicles could experience lost revenue initially, as it has been reported in India (car manufacturers have stopped production as there have been no sales).⁹⁶ Yet, an upswing in private car sales can be expected, as people seek to avoid increased risk of COVID-19 associated with public transportation.⁹⁶

In LMICs, a large number of people are employed in the informal sector, and limiting transport cuts off income channels almost instantly. This includes those who work in transport, such as taxi drivers, and drivers of commercial two- and three-wheelers – tuk-tuks, boda bodas, and rickshaws. Because such people often lack health insurance, loss of income quickly translates into loss of financial access to healthcare for both the income earner, and their families. Such vulnerable households may be unable to call for help, or to afford emergency transport in case of acute illness. They would also be at risk of homelessness, defaulting from treatment for chronic conditions (HIV, hypertension, diabetes, heart disease), and malnutrition.

This section has identified a number of **gaps in knowledge or research questions** that need answering. These include:

- How will the post-COVID-19 transport sector impact rural populations?
- How can people living in informal settlements be better protected from the virus?
- What are governments doing to provide financial and psychosocial support to women transport workers and other essential workers who appear to be at greater risk of both catching the virus and passing it on?
- What is the impact of transport restrictions on older people or adolescents or the persons with disabilities in LMICs
- What is the role of transport in food security during and following the pandemic?
- What will be the economic consequences of COVID-19 on transport systems in LMICs? How can we learn from previous economic crises and not return to old ways?



3. Conclusions and recommendations

At this time, HICs seem to have borne the brunt of the COVID-19 pandemic with levels of infection still remaining low in Africa and South Asia. This might perhaps be the lull before the storm, or perhaps these countries are more resilient. Irrespective of this, the pandemic is an opportunity for governments as well as transport, road safety and environmental protection organisations to stop and look at the challenges and lessons that can be learnt. This will make our transport systems healthier, safer and more resilient in anticipation of future airborne pathogens. Transport has been at the heart of the COVID-19 pandemic from its beginning. The efficient interconnectivity of global regions played a central role in allowing the infection to reach all continents within weeks of its commencement. So the linkage between transportation and health has never been more pertinent.

Until a vaccine is found, our lives and mobility patterns will be changed by physical distancing and other public health measures like frequent hand-washing and mask wearing. While these measures are burdensome and costly, we can draw benefits from them in terms of reductions in road traffic crashes, cleaner air, and the health benefits of increased active transport.

Many cities around the world have already taken up this challenge by modifying roads, widening sidewalks and encouraging walking and cycling. The epidemic has shown us that it is possible for cities and countries to rapidly modify or put in place new transportation policies and practices. But we also need to address some of the negative issues which have been brought to the fore by the epidemic – inequities that have resulted from reduced mobility, such as loss of educational and work opportunities, social exclusion, sexism, and ageism – and how these relate to urban and long distance transport.

Many questions remain unanswered about the impact of this pandemic on transport and health.⁹⁷ This insight paper has attempted to highlight some of these gaps and research questions that a programme like High Volume Transport stakeholders could try to answer.⁹⁸ Some of these include:

- How can women transport workers be better supported through COVID-19?
- What is the impact of severe transport restrictions on older people, adolescents, or the persons with disabilities in LMICs?
- How will the post-COVID-19 transport sector impact rural populations?
- What role can the private sector transport companies play in maintaining improved air quality?
- What policies and regulations need to be changed moving forward, to make public transport safe from infection spread?
- What are the cost implications of modifying public transport to allow for sufficient physical distancing in LMICs?
- How can the negative image around public transport be reversed?
- And most importantly, how can the return to mobility be done more equitably across all populations?

Moving forward there are two potential scenarios:

- One which learns little from the pandemic and results in more people using private transport (those who can afford it), causing an increase in vehicle sales. Inequities will grow and all the gains made in road safety and air pollution will be lost as congestion, pollution and exposure increase. While vehicle sales are currently down in most countries as a result of COVID-19, when lockdowns are lifted if governments have not provided adequate information about the safety and security of public transport, vehicle sales could skyrocket as people think only of their own risks and not the risk to the environment and planet. Likewise, the transport of goods and food will require more regulation and the cooperation of the private transport sectors across the world.
- The second which applies lessons learnt from the pandemic:
 - Active transport will be promoted and encouraged. There are encouraging signs from governments around the world that this option is worth investing in – already a number of governments have committed millions of dollars to pop-up cycle lanes, widening sidewalks, road closures, etc. Keeping



people active will improve both their mental and physical health. It will also keep pollution down to manageable levels and reduce road traffic crashes.

- New ways of ensuring that public transport is safe from the virus will be implemented. For example, through increasing seating distances, cleaning and decontaminating vehicles, improving ventilation, using new contactless ways of paying and implementing checklists for operators and passengers in order to reduce the spread of the virus.
- Living, working, schooling and shopping closer to home will be the new normal, supporting local producers and suppliers and reducing the need for long commutes early in the morning and late at night.

Linkages between transport and health call for the engagement of different sectors, some of them with agendas that easily complement each other, such as increasing physical activity and promoting cleaner air. Yet, some have potential for conflict, such as increasing use of public transport and car manufacturing, or instituting physical distancing measures on public transport, and keeping public transport affordable by low-income earners. Countries and cities will have to balance the cost of health against the efficiency and comfort of different modes of transportation. Inclusion and equity will be important lenses to ensure the broader aspirations of the Sustainable Development Goals.

This insight paper has shown that COVID-19 offers a range of opportunities for an inter-sectoral response from the health and transport sectors. This natural event – catastrophic as it has been for people and their families around the world – has shown us how road traffic collisions can come down, how air quality can be improved, how governments can change laws and regulations quickly, but also how inequitable our systems really are. As lockdowns end, both the transport and health sectors need to instil trust in commuters and look for innovative ways of operating in our ‘new normal’ world of physical distancing, mask wearing and sanitising.

It is hoped that this insight paper will stimulate interest in this intersection between transportation and health and encourage researchers to look at some of the questions which have been posed in order to ensure equitable, safe and healthy transportation as we move into the post-COVID-19 era.



4. References

1. *Global status report on road safety 2018*. Geneva, World Health Organization, 2018.
2. Mannucci PM, Franchini M. Health Effects of ambient air pollution in developing countries. *Int J Environ Res Public Health*, 2017, 14(9):1048.
3. Peden M, Scurfield R, Sleet D, et al (eds). *World report on road traffic injury prevention*. Geneva, WHO, 2004.
4. Job S. Can COVID-19 teach us something for the road safety epidemic? *Transport for Development*, 14 April 2020 [<https://blogs.worldbank.org/transport/can-covid-19-teach-us-something-road-safety-epidemic>, accessed 8 May 2020].
5. WHO statement regarding cluster of pneumonia cases in Wuhan, China. Jan 9, 2020 [<https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china>, accessed 29 April 2020].
6. Rolling updates on coronavirus disease (COVID-19), WHO website. [<https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>, accessed 20 June 2020].
7. Spiteri G, Fielding J, Diercke M, et al. First cases of coronavirus disease 2019 (COVID-19) in the WHO European Region, 24 January to 21 February 2020. *Euro Surveill.*, 2020, 25(9):pii=2000178, <https://doi.org/10.2807/1560-7917.ES.2020.25.9.2000178>.
8. Ghinai I, McPherson T, Hunter J, et al. First known person-to-person transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the USA. *The Lancet*, 2020, 395(10230):1137–1144, doi:10.1016/S0140-6736(20)30607-3.
9. Egypt announces first Coronavirus infection. *Egypt Today*, 14 February 2020 [<https://www.egypttoday.com/Article/1/81641/Egypt-announces-first-Coronavirus-infection>, accessed 8 May 2020].
10. Coronavirus: Nigeria confirms first case in sub-Saharan Africa. *BBC News*, 28 February 2020 [<https://www.bbc.co.uk/news/world-africa-51671834>, accessed 8 May 2020].
11. Department of health confirms SA's first Covid-19 case. *The Citizen*, 5 March 2020 [<https://citizen.co.za/news/south-africa/breaking-news/2250939/department-of-health-confirms-sas-first-covid-19-case/>, accessed 8 May 2020].
12. Partnership for Evidence-based Response to COVID-19 (PERC). *Responding to COVID-19 in Africa: Using data to find a balance*. Geneva, WHO, 2020. [<https://www.tralac.org/documents/resources/covid-19/regional/3524-responding-to-covid-19-in-africa-using-data-to-find-a-balance-perc-may-2020.html>, accessed 11 May 2020].
13. Horton J. Coronavirus: What are the numbers out of Latin America? *BBC News*, 28 May 2020 [<https://www.bbc.co.uk/news/world-latin-america-52711458>, accessed 30 May 2020].
14. Dahab M, van Zandvoort K, Flasche S, et al. COVID-19 control in low-income settings and displaced populations: what can realistically be done? *London School of Hygiene and Tropical Medicine*, 22 March 2020 [<https://www.lshtm.ac.uk/newsevents/news/2020/covid-19-control-low-income-settings-and-displaced-populations-what-can>, accessed 9 May 2020].
15. Toyana M. South Africa scientists say up to 50,000 COVID-19 deaths possible. *Reuters*, 21 May 2020 [<https://www.reuters.com/article/us-health-coronavirus-safrica-models-idUSKBN22X180>, accessed 30 May 2020].
16. How South Africa's lockdown will impact transport sectors. *CNBCAfrica*, 2 April 2020 [<https://www.cnbc africa.com/news/2020/03/26/how-south-africas-lockdown-will-impact-transport-sectors/>, accessed 30 May 2020].
17. De Wet P. Car crashes, violence down in SA after new alcohol rules, emergency responders say. *Business Insider SA*, 25 March 2020 [<https://www.businessinsider.co.za/car-accidents-decreased-after-bars-were-closed-early-before-the-national-lockdown-2020-3>, accessed 26 March 2020].



18. Statement issued by the Minister of Transport, Fikile Mbalula, on the occasion of the release of Easter fatalities statistics on 17 April 2020.
[https://www.transport.gov.za/documents/11623/140030/Statement_17April2020.pdf/0613d475-a4e9-457a-af1c-449dc39f174c, accessed 11 May 2020].
19. Bouknight S, Schenkman L. Under lockdown in Morocco, Ramadan celebrations get a quiet reset. *The World*, 22 May 2020 [<https://www.pri.org/stories/2020-05-22/under-lockdown-morocco-ramadan-celebrations-get-quiet-reset>, accessed 20 June 2020].
20. Kolyangha M. Boda boda rider shot dead for defying lockdown rules. *Daily Monitor*, 19 April 2020 [<https://www.monitor.co.ug/News/National/Boda-boda-rider-shot-dead-lockdown-rules-Nabunya-/688334-5528650-128qxvv/index.html>, accessed 22 April 2020].
21. Nalweyiso B. Virus lockdown: MP Zaake arrested for distributing relief food. *The Monitor*, 19 April 2020 [<https://www.monitor.co.ug/News/National/Virus-lockdown-MP-Zaake-arrested-distributing-relief-food/688334-5529128-7ar8yy/index.html>, accessed 14 May 2020].
22. Biryabarema E. In Uganda, mothers in labour die amidst coronavirus lockdown. *Reuters*, 9 April 2020 [<https://www.reuters.com/article/us-health-coronavirus-uganda/in-uganda-mothers-in-labour-die-amidst-coronavirus-lockdown-idUSKCN21R2FA>, accessed 22 April 2020].
23. COVID 19 lockdown improves Kampala air quality by 40%. *EABWNews*, 27 April 2020 [<https://www.busiweek.com/covid-19-lockdown-improves-kampala-air-quality-by-40/>, accessed 11 May 2020].
24. Sung J, Monschauer Y. Changes in transport behaviour during the Covid-19 crisis. What can we learn from the lessons of the past. *International Energy Agency*, 27 May 2020, [<https://www.iea.org/articles/changes-in-transport-behaviour-during-the-covid-19-crisis>, accessed 20 June 2020].
25. Amekudzi-Kennedy A, Labi S, Woodall B, et al. Reflections on Pandemics, Civil Infrastructure and Sustainable Development: Five Lessons from COVID-19 through the Lens of Transportation. *Preprints*, 3 April 2020 [doi:10.20944/preprints202004.0047.v1, accessed 8 May 2020].
26. Goldbaum C. M.T.A., Citing huge drop in riders, seeks \$4 Billion virus bailout. *The New York Times*, 17 March 2020 [<https://www.nytimes.com/2020/03/17/nyregion/coronavirus-nyc-subway-federal-aid.html> accessed 8 May 2020].
27. Impact of COVID-19 on Indian bus operators. *UITP Statistics brief*, May 2020 [<https://indd.adobe.com/view/d6dd8493-bfe6-473a-8823-667d66420dc6> accessed 30 May 2020].
28. Elliott R. Corona virus in sub-Saharan Africa. *GeoPoll Survey Reports*, 17 March 2020 [<https://www.geopoll.com/blog/coronavirus-africa/>, accessed 9 May 2020].
29. Taylor K. No bus service. Crowded trains. Transit systems struggle with the virus. *The New York Times*, 17 March 2020 [<https://www.nytimes.com/2020/03/17/us/coronavirus-buses-trains-detroit-boston.html>, accessed 8 May 2020].
30. Combating COVID-19 on public transport: Lessons from Shenzhen. *POLIS*, 25 March 2020 [<https://www.polisnetwork.eu/article/combating-covid-19-on-public-transport-lessons-from-shenzhen/?id=122791>, accessed 30 May 2020].
31. *Progress on Drinking Water, Sanitation and Hygiene: 2017 Update and SDG Baselines*. Geneva: WHO and UNICEF, 2017. Licence: CC BY-NC-SA 3.0 IGO.
32. *WASH in health care facilities: Global Baseline Report 2019*. Geneva, WHO and UNICEF, 2019. Licence: CC BY-NC-SA 3.0 IGO.
33. Feng S, Shen C, Xia N, et al. Rational use of face masks in the COVID-19 pandemic. *The Lancet Respiratory Medicine*, 2020, 8 [[https://www.thelancet.com/pdfs/journals/lanres/PIIS2213-2600\(20\)30134-X.pdf](https://www.thelancet.com/pdfs/journals/lanres/PIIS2213-2600(20)30134-X.pdf), accessed 30 May 2020].
34. Greenhalgh S. Face masks for the public during the covid-19 crisis. *BMJ*, 2020, 369:m1435, [<https://doi.org/10.1136/bmj.m1435>, accessed 28 May 2020].
35. Steedly A, et al. *Connecting transport and health: A guide to communication & collaboration*. Report NCHRP Project 25-25, Task 105, National Cooperative Highway Research Program, April 2019



- [<http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25Task105/NCHRP25-25Task105Guidebook.pdf>, accessed 29 April 2020].
36. Khreis H, Glazener A, Ramani T, et al. *Transportation and Health: A Conceptual Model and Literature Review*. College Station, Texas: Center for Advancing Research in Transportation Emissions, Energy, and Health, May 2019.
 37. Ranscombe P. Rural areas at risk during COVID-19 pandemic. *The Lancet Infect Dis*, 2020 [[https://doi.org/10.1016/S1473-3099\(20\)30301-7](https://doi.org/10.1016/S1473-3099(20)30301-7)].
 38. India coronavirus lockdown: Stranded migrants can return home. *BBC News*, 29 April 2020 [<https://www.bbc.com/news/world-asia-india-52475387>, accessed 14 May 2020].
 39. Kapur M. In locked down India, poor migrants are on a long march back home. *Quartz India*, 27 March 2020 [<https://qz.com/india/1826384/indias-coronavirus-lockdown-has-triggered-mass-migration-on-foot/>, accessed 14 May 2020].
 40. UGANDA: 61 truck drivers have tested positive so far. *The Independent*, 10 May 2020 [<https://www.independent.co.ug/uganda-61-truck-drivers-have-tested-positive-so-far>, accessed 11 May 2020].
 41. Kenyan trucker in hiding after testing positive in Uganda. *The East African*, 11 May 2020 [<https://www.theeastafrican.co.ke/scienceandhealth/Covid-19-Kenyan-truckers-test-positive-in-Uganda/3073694-5548820-3va1svz/index.html>, accessed May 11 2020].
 42. Phartiyal S. As delivery workers emerge as frontline soldiers, India's government warms to e-commerce. *Reuters*, 9 April 2020 [<https://uk.reuters.com/article/uk-health-coronavirus-india-deliveries/as-delivery-workers-emerge-as-frontline-soldiers-indias-government-warms-to-e-commerce-idUKKCN21Q3HV>, accessed 20 June 2020].
 43. Gant J. Is there any science behind two-metre social distancing rule...? *The Mail Online*, 25 April 2020 [<https://www.dailymail.co.uk/news/article-8256109/Social-distancing-two-metres-apart-based-figure-says-government-adviser.html>, accessed 30 May 2020].
 44. Clark D. Change in location footfall after the coronavirus lockdown in the UK. *Statista*, 5 April 2020 [<https://www.statista.com/statistics/1109731/coronavirus-mobility-changes-in-the-uk/>, accessed 11 May 2020].
 45. Plecher H. Youth unemployment rate in South Africa in 2019. *Statista*, 12 Feb 2020 [<https://www.statista.com/statistics/813010/youth-unemployment-rate-in-south-africa/>, accessed May 2020].
 46. Mukhaye D. Children miss immunisation due to COVID 19. *The Monitor*, 30 April 2020 [<https://www.monitor.co.ug/News/National/Children-miss-immunisation-due-to-Covid-19/688334-5538786-q8xdqdz/index.html>].
 47. Biryabarema E. In Uganda, mothers in labour die amidst coronavirus lockdown. *Reuters*, 9 April 2020 [<https://www.reuters.com/article/us-health-coronavirus-uganda/in-uganda-mothers-in-labour-die-amidst-coronavirus-lockdown-idUSKCN21R2FA>, accessed 14 May 2020].
 48. Krassraie A. Pharmacy chains waive delivery fees for prescription drugs during COVID-19 crisis. *AARP*, 24 March 2020, [<https://www.aarp.org/health/drugs-supplements/info-2020/pharmacies-waive-delivery-fees.html>, accessed 20 June 2020].
 49. Landman K, Okerere C. Commuting in a pandemic. *NPR*, 29 April 2020, [<https://www.npr.org/sections/goatsandsoda/2020/04/29/841830595/commuting-in-a-pandemic-these-health-workers-are-trekking-and-canoeing>, accessed 20 June 2020].
 50. Pennic F. NYC hospitals leverage taxi app to transport frontline healthworkers, patients during COVID-19. *HIT*, 18 June 2020 [<https://hitconsultant.net/2020/06/18/how-hospitals-and-city-agencies-are-leveraging-nyc-taxis-for-frontline-health-workers-during-covid-19/#.Xu4F2m5Fydl>, accessed 20 June 2020].
 51. Devi S. Travel restrictions hampering COVID-19 response. *The Lancet*, 2020, 395:1331-2, [https://doi.org/10.1016/S0140-6736\(20\)30967-3](https://doi.org/10.1016/S0140-6736(20)30967-3).
 52. Nelson B. The positive effects of COVID-19. *BMJ*, 2020, 369:m1785 <https://doi.org/10.1136/bmj.m1785>.



53. Wallen J. Overall fatalities in India drop despite coronavirus outbreak. *The Telegraph*, 1 May 2020 [<https://www.telegraph.co.uk/news/2020/05/01/overall-fatalities-india-drop-despite-coronavirus-outbreak/>, accessed 8 May 2020].
54. Singh R. Chandigarh records zero road fatality in a month for first time in decade. *Hindustan Times*, 1 May 2020 [<https://www.hindustantimes.com/chandigarh/chandigarh-records-zero-road-fatality-in-a-month-for-first-time-in-decade/story-M3c1eC9P2PeS1ej5xNGbdL.html>, accessed 8 May 2020].
55. Ypma L, Bellman F, Polack D. 5 ways urban transport could step up a gear for women. *The World Economic Forum COVID Action Platform*, 9 March 2020 [<https://www.weforum.org/agenda/2020/03/urban-transport-mobility-women/>, accessed 30 May 2020].
56. International Transport Workers' Federation. *Women transport workers' rights and COVID-19*, 20 May 2020 [<https://www.itfglobal.org/en/news/women-transport-workers-rights-and-covid-19>, accessed 20 June 2020].
57. Snuggs T. Coronavirus: 4,000 domestic abuse arrests in London in just six weeks, police say. *Sky News*, 24 April 2020 [<https://news.sky.com/story/coronavirus-4000-domestic-abuse-arrests-in-london-in-just-six-weeks-police-say-11978358>, accessed 11 May 2020].
58. *Global health risks: mortality and burden of disease attributable to selected major risks*. Geneva, World Health Organization, 2009.
59. *A guide for population-based approaches to increasing levels of physical activity: implementation of the WHO Global Strategy on Diet, Physical Activity and Health*. Geneva, World Health Organization, 2007.
60. Beck B, Ivers R. Australian health and transport experts call for space for safer walking and cycling. *The National Tribune*, 23 April 2020 [<https://www.nationaltribune.com.au/australian-health-and-transport-experts-call-for-space-for-safer-walking-and-cycling/>, accessed 11 May 2020].
61. Forani J. Road closures and 'one-way sidewalks': Cities adapt to physical distancing. *CTV News*, 13 April 2020 [<https://www.ctvnews.ca/health/coronavirus/road-closures-and-one-way-sidewalks-cities-adapt-to-physical-distancing-1.4894067>, accessed 11 May 2020].
62. Reid C. Paris to create 650 kilometers of post-lockdown cycleways. *Forbes*, 22 April 2020 [<https://www.forbes.com/sites/carltonreid/2020/04/22/paris-to-create-650-kilometers-of-pop-up-corona-cycleways-for-post-lockdown-travel/#f71e9e254d40>, accessed 11 May 2020].
63. Pop-up bike lanes help with coronavirus physical distancing in Germany. *The Guardian*, 13 April 2020 [<https://www.theguardian.com/world/2020/apr/13/pop-up-bike-lanes-help-with-coronavirus-social-distancing-in-germany>, accessed 11 May 2020].
64. 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>, accessed 11 May 2020].
65. Italians who buy a new bicycle to get up to 500 euros from government. *Mass Transit*, 12 May 2020 [<https://www.masstransitmag.com/alt-mobility/shared-mobility/bicycle-scooter-sharing/news/21137734/italy-italians-who-buy-a-new-bicycle-to-get-up-to-500-euros-from-government>, accessed 30 May 2020].
66. Brown F. Government announces £2,000,000 plan to encourage more cycling and walking. *Metro*, 9 May 2020 [<https://metro.co.uk/2020/05/09/government-announces-2000000000-plan-encourage-cycling-walking-12678920/>, accessed 11 May 2020].
67. Alisjahbana AS. Asia-Pacific response to COVID-19 and climate emergency must build a resilient and sustainable future. *UNESCAP Op-ed*, 8 April 2020 [<https://www.unescap.org/op-ed/asia-pacific-response-covid-19-and-climate-emergency-must-build-resilient-and-sustainable>, 20 June 2020].
68. Diouf I. SSATP cancels planned meetings amid COVID-19 outbreak. *SSATP News*, 13 April 2020 [<https://www.ssatp.org/news-events/ssatp-cancels-planned-meetings-amid-covid-19-outbreak>, accessed 20 June 2020].



69. National Association of Transportation Officials (NACTO), Streets for Pandemic Response and Recovery. May 2020 [https://nacto.org/wp-content/uploads/2020/06/NACTO_Streets-for-Pandemic-Response-and-Recovery_2020-05-26.pdf].
70. Air pollution [website]. World Health Organization, https://www.who.int/health-topics/air-pollution#tab=tab_1, accessed 11 May 2020].
71. Lewis D. Is the coronavirus airborne? Experts can't agree. *Nature*, 2020, 580:175.
72. Wu X, Nethery RC, Sabath BM, et al. Exposure to air pollution and COVID-19 mortality in the United States. A nationwide cross-sectional study. *medRxiv*, 2020:2020.04.05.20054502, <https://doi.org/10.1101/2020.04.05.20054502>.
73. Conticini E, Frediani B, Caro D. Can atmospheric pollution be considered a co-factor in extremely high level of SARS-CoV-2 lethality in Northern Italy? *Environmental Pollution*, 2020, 261:114465, <https://doi.org/10.1016/j.envpol.2020.114465>.
74. Bowler J. New Evidence Shows How COVID-19 Has Affected Global Air Pollution. *Science alert*, 17 March 2020 [<https://www.sciencealert.com/here-s-what-covid-19-is-doing-to-our-pollution-levels>, accessed 11 May 2020].
75. Naqvi M, Altstedter A. The world's biggest lockdown has been squandered in India. *Bloomberg*, 14 May 2020 [<https://www.bloomberg.com/news/articles/2020-05-14/india-s-50-day-lockdown-brings-misery-as-virus-numbers-surge>, accessed 30 May 2020].
76. Chandrashekar V. As India's lockdown ends, exodus from cities risks spreading COVID-19 far and wide. *Science*, 27 May 2020 [<https://www.sciencemag.org/news/2020/05/india-s-lockdown-ends-exodus-cities-risks-spreading-covid-19-far-and-wide>, accessed 30 May 2020].
77. Amid Covid-19 lockdown, Delhi breathes cleaner air as PM2.5 drops to 35. *Hindustan Times*, 21 April 2020 [<https://www.hindustantimes.com/india-news/covid-19-lockdown-spurs-drop-in-air-pollution-across-the-globe-experts-say-relief-could-be-short-term/story-nOmiaE9H0DaWXTfh23crlJ.html>, accessed 30 May 2020].
78. Sharma S, Zhang M, Anshika, et al. Effect of restricted emissions during COVID-19 on air quality in India. *Science of the Total Environment*, 2020, 728, doi.org/10.1016/j.scitotenv.2020.138878.
79. Bhatt A. Post Covid-19 lockdown, will India's public transport systems be able to maintain social distancing? [<https://scroll.in/article/960063/post-covid-19-lockdown-will-indias-public-transport-systems-be-able-to-maintain-social-distancing>, accessed 30 May 2020].
80. Degnarain N. Not back but forward: What the post-COVID-19 economic recovery models are getting wrong. *Forbes*, 22 April 2020 [<https://www.forbes.com/sites/nishandegnarain/2020/04/22/not-back-but-forward-what-the-post-covid-19-economic-recovery-models-are-getting-wrong/#43d165dc7abb>, accessed 28 May 2020].
81. Lockdown is killing more patients than COVID - Masaka health workers. *The Observer*, 27 April 2020 [<https://observer.ug/news/headlines/64501-lockdown-is-killing-more-patients-than-covid-masaka-health-workers>, accessed 11 May 2020].
82. SDG goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable [website] [<https://unstats.un.org/sdgs/report/2019/Goal-11/>, accessed 20 June 2020].
83. *Women and men in the informal economy: A statistical picture, Third Edition*. Geneva, ILO, 2018, [https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_626831.pdf, accessed 20 June 2020].
84. How the internet is making stay-at-home difficult for Africans. *DW*, 7 April 2020 [<https://www.dw.com/en/how-the-internet-is-making-stay-at-home-difficult-for-africans/a-53048013>, accessed 20 June 2020].
85. Du J, King R, Chanchani R. Tackling inequality in cities is essential for fighting COVID-19. 14 April 2020 [<https://www.wri.org/blog/2020/04/coronavirus-inequality-cities>, accessed 11 May 2020].
86. Agaba J. Uganda's 'urban poor' fear dying of hunger during COVID-19 lockdown. [<https://allianceforscience.cornell.edu/blog/2020/04/ugandas-urban-poor-fear-dying-of-hunger-during-covid-19-lockdown/>, accessed 11 May 2020].



87. Social protection and COVID-19 response in rural areas. *FAO factshseet*, 8 April 2020 [<http://www.fao.org/3/ca8561en/CA8561EN.pdf>, accessed 30 May 2020].
88. Njilo N. 'The need is massive,' say donors as 3km Centurion food queue shocks SA. *The Sowetan*, 30 April 2020 [<https://www.sowetanlive.co.za/news/south-africa/2020-04-30-the-need-is-massive-say-donors-as-3km-centurion-food-queue-shocks-sa/>, accessed 11 May 2020].
89. Alzheimer Europe recommendations on promoting the wellbeing of people with dementia and carers during the COVID-19 pandemic. [<https://www.alzheimer-europe.org/Policy/Our-opinion-on/Wellbeing-of-people-with-dementia-during-COVID-19-pandemic>, accessed 14 May 2020].
90. COVID-19: guidance for managing a funeral during the coronavirus pandemic. *UK government*, 18 May 2020 [<https://www.gov.uk/government/publications/covid-19-guidance-for-managing-a-funeral-during-the-coronavirus-pandemic/covid-19-guidance-for-managing-a-funeral-during-the-coronavirus-pandemic>, accessed 20 June 2020].
91. New COVID-19 regulations for funerals, *SA News*, 2 April 2020 [<https://www.sanews.gov.za/south-africa/new-covid-19-regulations-funerals>, accessed 20 June 2020].
92. Ghosh B. Coronavirus | Rituals in Varanasi ghats curtailed to prevent COVID-19 spread. *The Hindu*, 20 March 2020 [<https://www.thehindu.com/news/national/other-states/coronavirus-rituals-in-varanasi-ghats-curtailed-to-prevent-covid-19-spread/article31115009.ece>, accessed 20 June 2020].
93. Furceri D, Loungani P, Ostry JD. How pandemics leave the poor even farther behind. *IMFBlog*, 11 May 2020 [<https://blogs.imf.org/2020/05/11/how-pandemics-leave-the-poor-even-farther-behind/>, accessed 20 June 2020].
94. Fernandes N. Economic effects of Coronavirus outbreak (COVID-19) on the world economy. SSRN, 22 March 2020, <http://dx.doi.org/10.2139/ssrn.3557504>.
95. Ryan C. SA economy could crater up to 10% this year. *Moneyweb*, 25 March 2020 [<https://www.moneyweb.co.za/news/economy/sa-economy-could-crater-up-to-10-this-year/>, accessed 8 May 2020].
96. Mahindra A. Maruti Suzuki, Mahindra, Hyundai halt production in India due to coronavirus. *Live Mint*, 23 March 2020 [<https://www.livemint.com/companies/news/maruti-suzuki-mahindra-hyundai-halt-production-in-india-due-to-coronavirus-11584927749626.html>, accessed 14 May 2020].
97. Musselwhite C, Avineri E, Susilo Y. Editorial JTH 16 –The Coronavirus Disease COVID-19 and implications for transport and health. *Journal of Transport & Health*, March 2020:16, <https://doi.org/10.1016/j.jth.2020.100853>.
98. Dalkmann H., Obika B., Geronimo L. A call for collective action for international transport stakeholders to respond to the COVID-19 pandemic. *High Volume Transport applied research*, April 2020, London, IMC worldwide & UK Aid.

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