

Chronology of COVID-19 - Impact on Sustainable Development Goals (SDGs) and Global Transport Sector

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Abstract

The Sustainable Development Goals (SDGs) by United Nations are aimed to have a diplomatic world where a healthy, sustainable, and safe environment is created for human life without any discrimination. However, 2020 was the year of COVID-19 pandemic which has had an extreme impact on environment, human life, energy, economy, and transport sector. These sectors rely on each other and quarantine and lockdown restrictions had drastically affected them due to COVID-19. All transport and industries were shut down with lockdown and caused reduction in energy demand. The change in energy demand had a serious impact on power generation. Declining economy has created adverse impact on financial condition and mental health, which often caused life-threatening decisions. Transport sector also faced a financial dip when it comes to recover the losses that are not feasible without support from the government and new friendly policies. EVs and sustainable transport must be promoted. When people are working from home and staying at home, it is important to take care of indoor environment. This study is aimed to discuss the chronology of COVID-19 pandemic and its impact on SDGs and global transport sector. The findings suggest that SDGs have suffered the effects of COVID-19 significantly to achieve their goals by 2030 and need combined support from all countries.

Keywords: *sustainable development goals (SDGs), COVID-19, global transport sector, environment, lockdown restrictions*

Introduction

There are different types of coronaviruses enveloped by RNA ranging from 60 nm to 140 nm in diameter which look like a crown. They can affect mammals, birds and humans and cause enteric, respiratory, neurologic, and hepatic diseases (Lu et al., 2020). They are well regarded to recombine and mutate to cause infections like OC43, 229E, HKU1, NL63, Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) coronaviruses (Fini, 2020). The first four coronaviruses cause elicit and common cold symptoms while MERS and SARS coronaviruses belong to zoonotic origin and can lead to deadly illness. Over 8000 people faced serious sickness and 774 people died due to SARS in 2002-03. Later, MERS infected 2494 people and took 858 lives across the world in 2012 (Chakraborty and Maity, 2020). There is up to 89% resemblance between SARS-COV-2 or COVID-19 and two SARS like viruses derived from bats, i.e., bat-SL-CoVZC45 and bat-SL-CoVZXC2 (Lai et al., 2020) and around 50% and 79% similar to MERS-CoV and SARS-CoV, respectively.

Background

Pneumonia which affected patients worldwide in December 2019 was evolved from a new cause which is epidemiologically linked with a wet market in Wuhan, one of the largest cities in China. It witnesses subtropical, warm, humid summers, monsoon climate, and cold winters. The mysterious cause of COVID-19 was identified by the WHO on January 9, 2020 and this fast-spreading virus was affirmed officially on January

12, 2020 as 2019-novel coronavirus (nCoV-2019), which was further renamed as SARS-CoV-2 on Feb 2020 and officially called as COVID-19 or “Corona-Virus-Disease-2019 (Tay et al, 2020). After five other global pandemics like H1N1 in the year 2009, polio in the year 2014, Ebola in Western Africa in 2014, Zika in the year 2016 and, again, Ebola in Democratic Republic of Congo in 2019, COVID-19 is the 6th pandemic for international concern (Chakraborty & Maity, 2020).

Wuhan market was eventually shut down on January 1, 2020 in order to contain the virus but a lot of patients were still found positive with COVID-19 even when they were not exposed to the market. However, they travelled from Wuhan or came into contact with a COVID-19 patient like healthcare workers. It showed a strong transmission of the virus among humans, which caused 162,506 cases by March 12, 2020 across the world. Hence, WHO announced this infection as global pandemic on March 11, 2020, when 118,319 cases were recorded and death toll rose to 4292 on the very same date across the world.

Downturns, recessions, earthquakes, revolutions, and volcanoes were just small blips in front of global shutdowns. Lockdown, quarantine, and social distancing are some of the common terms which have been recognized during COVID-19. This study highlights the chronological history of COVID-19 pandemic along with its impact on sustainable development goals (SDGs) and the global transport sector.

Literature Review

COVID-19 has arrived as a major global crisis which needed organizations, people, and countries to take important measures to deal with. To develop systematic and proper knowledge of the impact of pandemic on career development of people and common coping strategies, a cultural perspective has been developed by **Guan et al. (2020)** to understand how internal orientations like regulatory focus, thinking pattern, and values can shape responses and strategies to deal with pandemic, how influential national culture is on the collective measures to deal with the pandemic, and how to get details from cultural norms to build research on career management plans to respond to rapidly changing world.

New technologies are needed for healthcare delivery like IoT, AI, machine learning and big data to look forward and fight against future pandemics. **Vaishya et al. (2020)** review the role of decisive technology like AI to prepare, analyze and prevent COVID-19 and future pandemics. They found 7 important use cases of AI to fight COVID-19. AI is vital to detect the rise of cases and predict where this infection will affect soon by analyzing and gathering all important data. Healthcare organizations are urgently needed for decision-making in order to deal with this infection and get proper real-time suggestions to avoid the spread. AI works smoothly to work like the human brain. It may also be vital to understand and suggest a vaccine to be developed. It is widely used for analyzing, screening, tracking and prediction of patients and potential patients.

COVID-19 has changed the way people used to work and live and has brought the importance of managing operations effectively. A lot of interest has been shown for the process of development, administration and scaling up of vaccines or for the failure of retail and medical supply chains to deal with unexpected demand from consumers and patients. **Micheli et al. (2021)** discussed three major implications of COVID-19 – (1) Focusing on existing topics like collaborated supply chains, (2) Promoting the adoption of practices in areas like digitalization and product development, and (3) Raising questions on some methods in times of uncertainty and volatility and providing opportunity to investigate further approaches related to strategy management and complex supply chains.

Graphical modelling is used specially to choose the best strategies to mitigate the impact of contagious diseases. These days, modelling the spread of COVID-19 is a complex issue. **Alguliyev et al. (2021)** prepared

the graphical modelling of the spread of COVID-19. They studied relevant articles associated with modelling of the pandemic and analyzed factors affecting its spread and characteristics. Considering social distancing, area-wise demographic characteristics, and duration of contact with infected patients, they proposed a COVID-19 conceptual model. As per the hypothetical situation of COVID-19 spread, they developed a graphical model of the process from the first confirmed case to transmission from one human to another. The graphical application for modelling of the pandemic enabled various important factors for numerical tests and epidemiological processes.

COVID-19 affected the well-developed processes to deliver quality care to cirrhosis patients. The crisis has drastically affected the quality of care but there are some lessons which should be learned. **Tapper & Asrani (2020)** review the impact of COVID-19 on care of cirrhosis. They explained how this impact is unveiled over 3 waves. They discussed solid steps needed to preserve treatment quality for patients with cirrhosis. It consists of strengthening the preventive care for patients with proactive management of chronic illness, compensated cirrhosis, robust programs related to telehealth, and reorganizing delivery of care for full service with flexible staffing of clinics. It is not challenging to manage the serious chronic illness in the pandemic.

Research Gap

Majority of studies are conducted on the impact of COVID-19 on the healthcare system and economy worldwide (Susilawati et al., 2020). This study is based on the chronological timeline of COVID-19 and its global impact on transport systems and sustainable development goals (SDGs).

Research Question

- What major chronological events took place related to COVID-19 globally?
- How COVID-19 affected the global transport sector and sustainable development goals?

Research Objectives

- To understand major COVID-19 events that took place globally in chronological order
- To discuss the impact of COVID-19 on SDGs and global transport sector

Research Methodology

This study fulfils the above research objectives with secondary data collected from various research articles published in recent years, government documents, and other publications. This data will help identify the gaps and provide relevant information on unidentified and untouched areas.

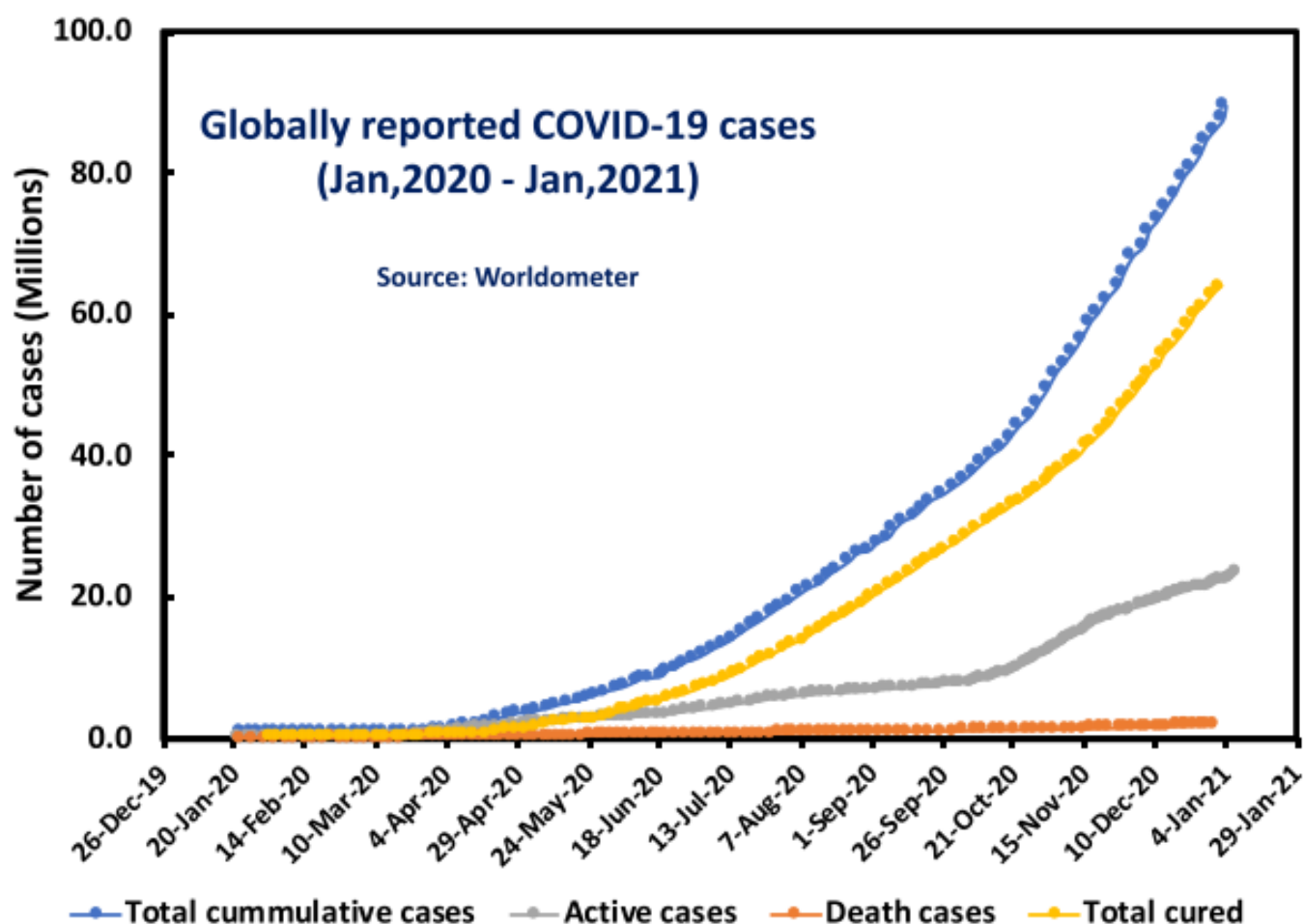
Analysis of Study

Major Chronological Events related to COVID-19 Globally

On average, “COVID-19 takes 14 days to transform from the onset of symptom to death as per regular observations on 1099 confirmed cases. Its incubation period is shorter than SARS, which takes 4 days (Lessler et al, 2009) and MERS, which takes 7 days (Cho et al., 2016), while latency period is up to 24 days (Wang et al, 2020e), which shows high transmission risk of COVID-19 (Wang et al, 2020). Coronaviruses can also be detected on copper (for 3 hours), aerosol (for four hours), cardboard (for 24 hours), and on plastic and stainless steel (for 2 to 3 days) (Van Doremalen et al., 2020).

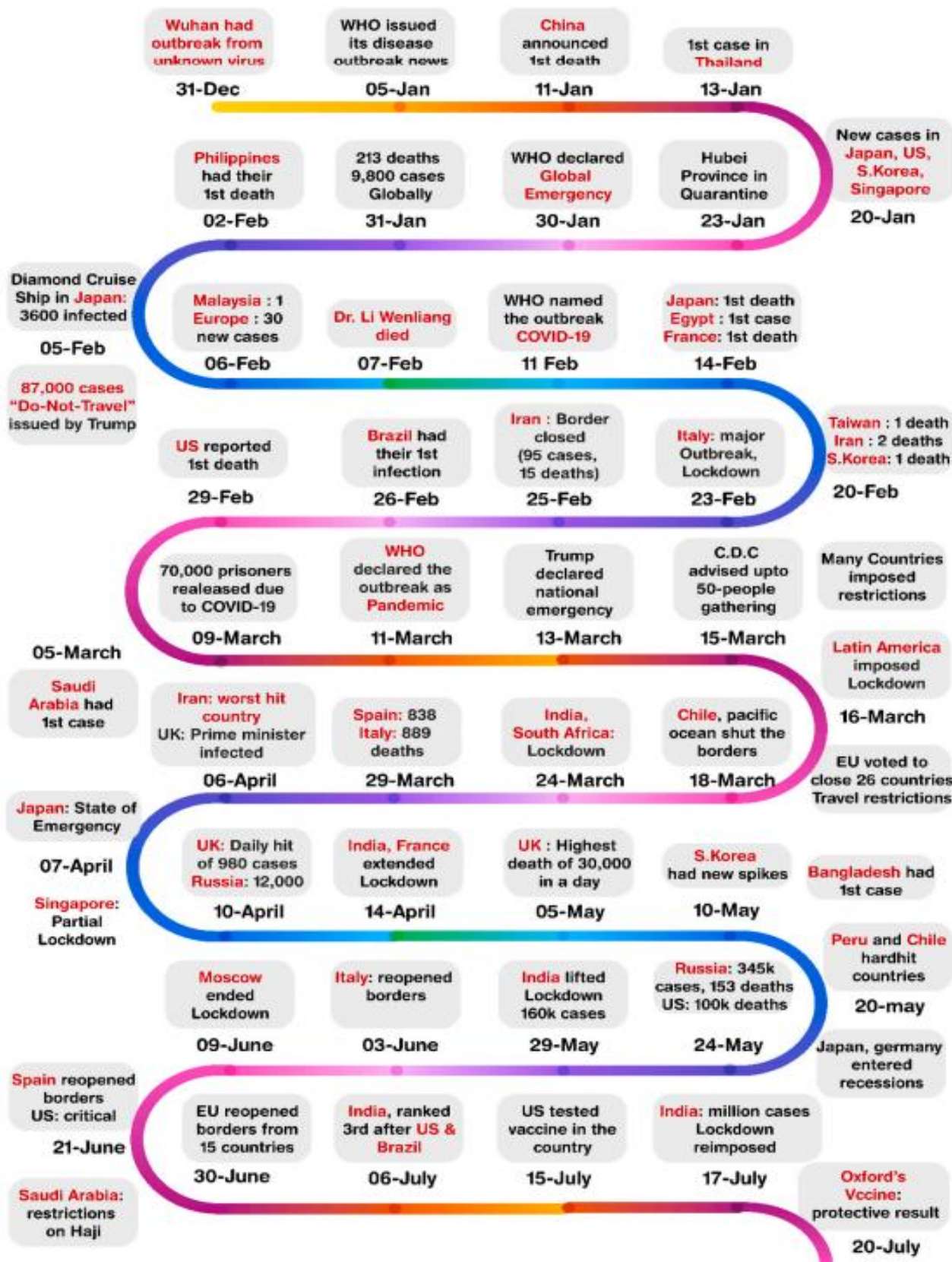
These findings suggest important data about the stability of these viruses which show that the infection or transmission is conceivable to people via direct contact or droplets to cause human-to-human transmission and touching contaminated objects (Remuzzi & Remuzzi, 2020). COVID-19 is spread even faster worldwide with cruise travel and air travel from China (Lau et al, 2020; Nakamura and Managi, 2020; Ito et al., 2020). Figure 1 illustrates number of COVID-19 cases worldwide from December 2019 to January 2021 and Figures 2 and 3 illustrated the chronology of COVID-19 cases worldwide (Hafeez et al., 2021).

Figure 1 – Rise in COVID-19 cases worldwide from December 2019 to January 2021

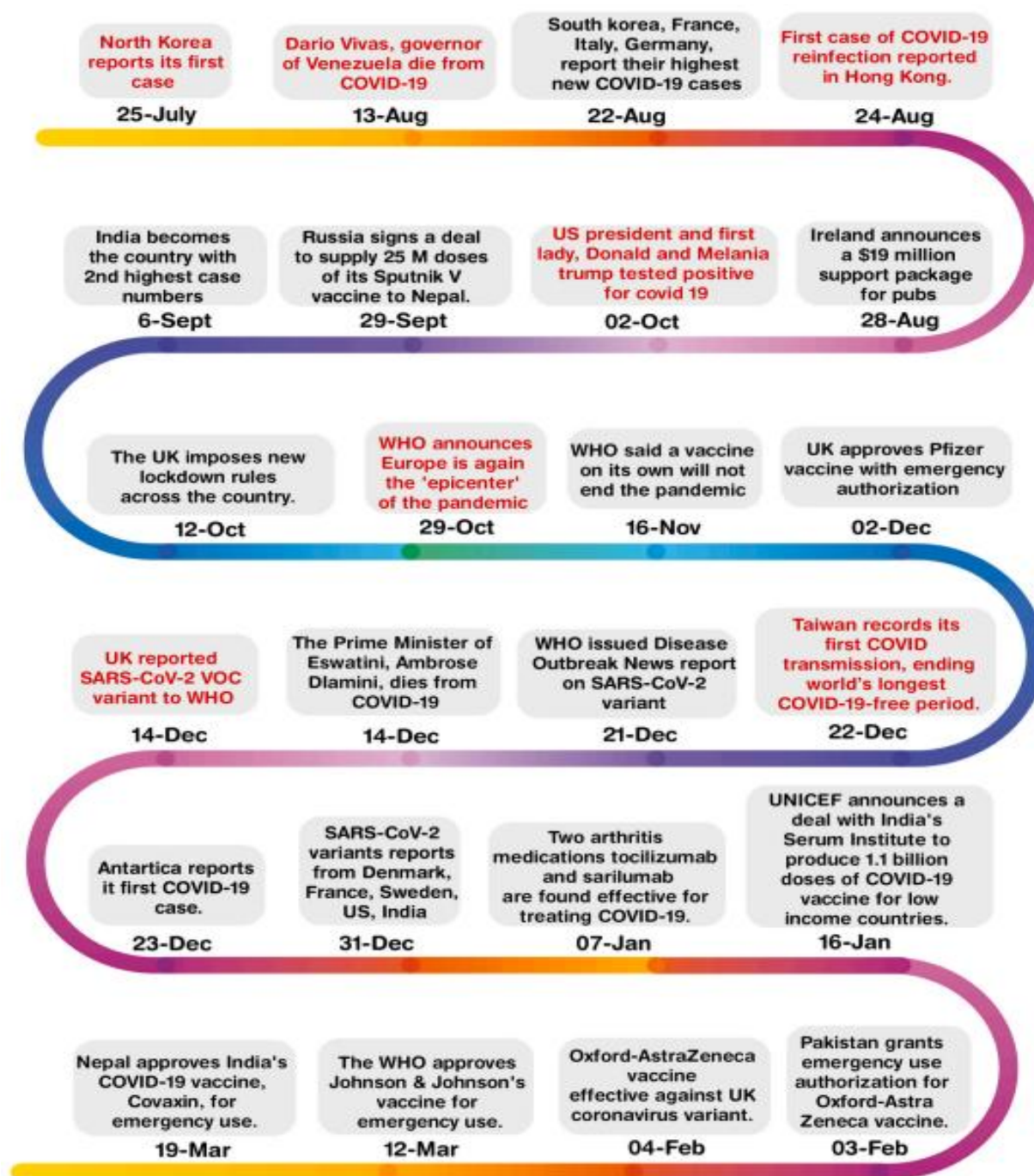


Source – Nundy et al. (2021)

In order to control the spread of infection, governments across the world have released guidelines and safety protocols for every citizen, such as washing mouth and hands frequently, covering nose during sneezing and coughing, and using masks when going outdoors. In addition, it is recommended to maintain up to 2 meters of social distance to prevent close contact. Social distancing became highly appreciated and recommended practice to avoid unwanted spread of transmission. Lockdown was imposed in around 100 countries to contain the spread of COVID-19 by March 2020 (Roberts, 2021). Wastewater management became very common to detect COVID-19 early on and prevent the spread.

Figure 2 – Major Chronological Events from December 2019 to July 2020 related to COVID-19

Source - Nundy et al. (2021)

Figure 3 - Major Chronological Events from July 2020 to March 2021 related to COVID-19

Source – Nundy et al. (2021)

Despite the fact that social distancing recommended by the WHO was 1 meter for influenza viruses, there are several social distancing guidelines introduced across the world. For example, it was 2 meter in New Zealand and the UK, 1 meter in Singapore, 1.5 meter in Australia and 1.8 m in the US. All the social distancing guidelines adopted in various countries were not scientific. There is no specific detail on how far a contagious droplet can go. There is a lack of real-time experimental information as there are several variables in analysis, such as number of transmissible particles and how long they can survive in the air, the pace of expulsion, and humidity, making the process even more complex.

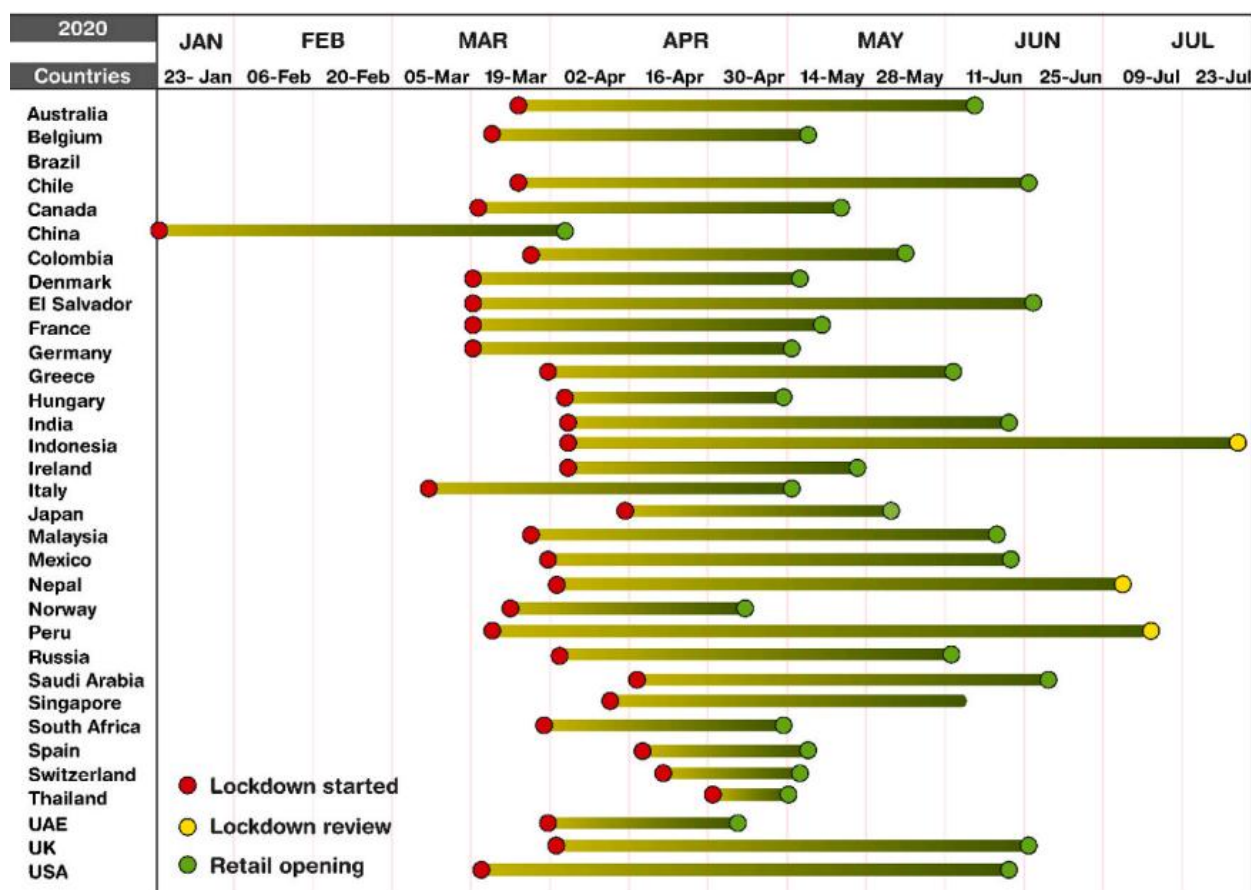
COVID-19 Guidelines

Still, in order to play safe, all the nations have their own guidelines. As per the length of shopping trolley, the distance is executed in Australia. Health bodies and services in the UK adopted higher distance for added safety. Earlier, the US considered 1.8m as safe distance to decline the transmission of flu. However, 5m is a safe distance during activities like workout and cycling, while 20m for cyclists. The use of personal protective equipment (PPE) kits by healthcare workers in China led to least spread of existing COVID-19 in hospitals (Brook, 2020).

In addition, lack of PPE kits caused severe infection among 25% of healthcare staff in Sweden. In addition, it is also important to keep healthy people safe to prevent the spread. Hence, using facemasks is promoted as a proactive way to prevent the spread among patients, healthcare staff, and healthy people during this outbreak and future pandemics. Using facemasks makes it important to prevent the spread of the infection from infected patients. Lockdown was imposed on March 23, 2020 in the UK, barring essential stores. People could only go out for health reasons, buying essential items, only one form of exercise once a day, or work if it is related to essential roles like police, firefighters, or electricity department. On March 12, 2020, Belgian government was even stricter by shutting down cafes and schools and cancelling all public meetings. On March 17, 2020, strict measures were issued to close all the non-essential stores, ban all public gatherings, and restrict unnecessary travel.

Figure 4 illustrates the dates of lockdowns implemented in various countries across the world.

Figure 4 – A timeline of lockdown imposed in various countries worldwide



Source – Nundy et al. (2021)

Treatment and Vaccination

Some of the most common COVID-19 symptoms are fatigue, cough, muscle ache, fever, sore throat, gastrointestinal issues, sneezing, rhinorrhoea, headache, and nasal blockage (Xu et al., 2020b). In positive COVID-19 cases, the immunity declines rapidly within a month after recovery (Chen et al., 2020). A longitudinal study was conducted on 90 healthcare workers and patients at “Guy’s and St Thomas’ NHS” trust and observed the peak of 3 weeks of antibodies which can kill the virus after the beginning of symptoms (Seow et al., 2020). Table 1 shows various stages/levels of development of COVID-19 vaccines, such as, safety tests, preclinical tests, human and animal trials. 23 vaccines out of 155 were under human trial. There was a huge success in developing vaccines. Around 64 vaccines underwent human trials as of January 2021. There are 3 vaccines among these which got approval for massive use, 7 vaccines in the stage of limited or early use, 20 vaccines cleared the Phase 3 of efficacy tests on a large scale, 20 vaccines have cleared the Phase 2 of expanded safety trials, 85 preclinical vaccines were investigated actively in animals, and 43 vaccines have been tested with their dosage and safety criteria in Phase 1 (Zimmer et al, 2020).

Table 1 – Stages of Testing and Development of COVID-19 vaccines

Stages	Tests/Trials	Developments
Stage 1	Preclinical	A vaccine is given to monkeys or mice to find out if there is any immune response.
Stage 2	“Phase 1 (Safety)”	“A vaccine is given to a few people to test dosage and safety and to ensure that it boosts immune response”
Stage 3	Phase 2 (Expanded Tests)	“Hundreds of people got vaccinated including adults and children to find out its reaction. In addition, safety and ability of the vaccine is tested to promote the immune response”.
Stage 4	Phase 3	Thousands of people got vaccinated to find out how many got infected in comparison to volunteers who had placebo. These tests showed if the vaccine works against the virus.
Stage 5	Approval	Trial results are reviewed by regulators and policymakers in each country to find out whether to approve the particular vaccine. A vaccine may be authorized for emergency use during the pandemic before official approval.

Source – Zimmer et al. (2020)

Impact of COVID-19 on SDGs and Global Transport Sector

Pandemics have brought a lot of social changes from the Middle Ages’ black plague to 20th century’s Spanish flu, and COVID-19 has also brought similar effects. It caused a lot of changes in day-to-day life. Lockdown and social distancing were imposed in majority of the countries to control the transmission (Mitjà et al., 2020). People were guided to stay at home and go out only when it is very important during the lockdown, such as buying groceries, and hence, advised to maintain social distance and use masks to reduce the spread of infection (Lau et al, 2020).

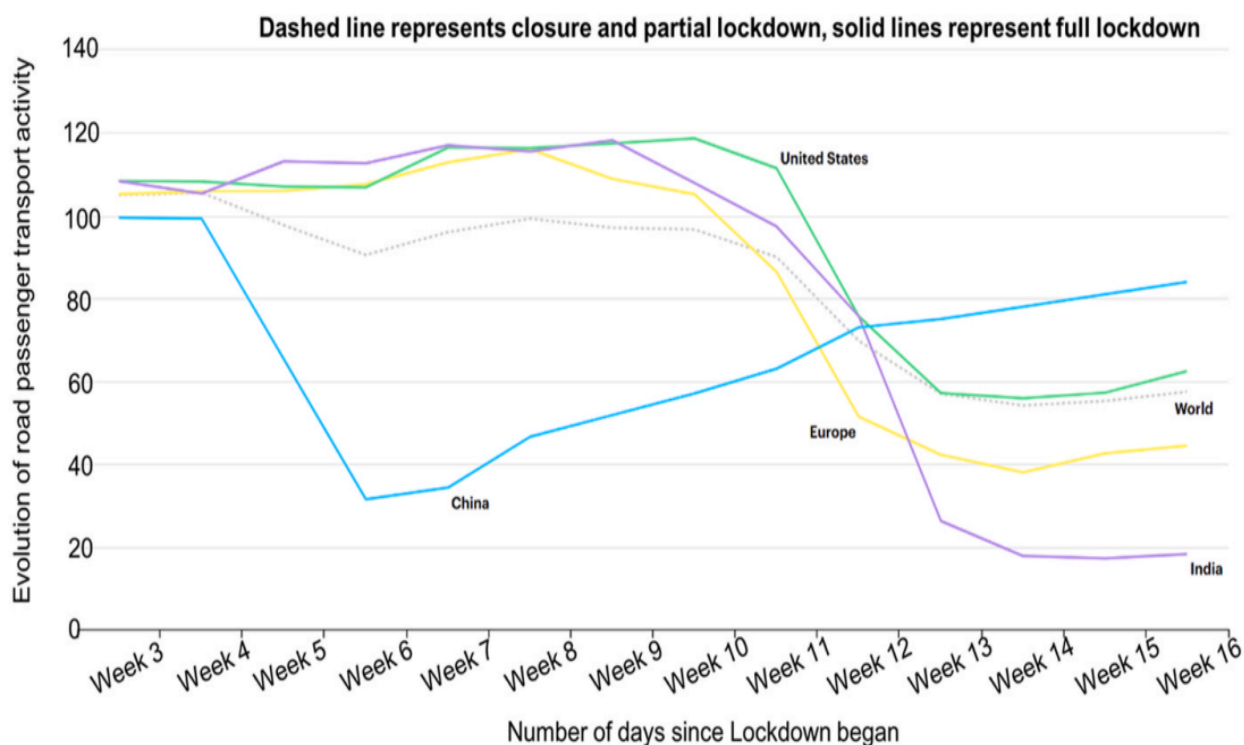
These rules are applied to all respiratory illnesses. Various sports events were cancelled like Olympics and Paralympics due to social distancing (BBC, 2020). However, COVID-19 had also brought some positive changes to society. People started using technology to frequently connect with far relatives and friends, sharing stories and experiences, and knowing their wellbeing and health. They got enough time and opportunities to nurture their interest, old habits, and explore creative things. People started watching various tutorials to learn new things (Sheth, 2020).

COVID-19 impact on transport sector

People travel for various reasons, such as, for work, shopping, essential services, etc. COVID-19 spread because of travelling. Hence, travel restriction was very important during this pandemic. Those restrictions were even stricter for people traveling from a moderate to high-risk zones. People used various public transport modes which helped in spread of COVID-19 (Zhao et al., 2020). International air travel was highly responsible for spreading the virus from one country to another (Shen et al., 2020). It was observed that there were 1392 times higher positive cases and 1545 times higher casualties in areas around the airport (~25 miles) because of COVID-19 rather than places in the radius of over 50 miles (Gaskin et al., 2021). Local travel was also risky. So, transport sector was completely shut down to prevent the spread.

Those restrictions caused a huge and prolonged damage to transport sector. Impact on transport sector due to COVID-19 was higher than the same during Swine flu outbreak in 2008 and SARS epidemic in 2003 (Vickerman, 2021). Due to mobility restrictions and lockdown, the demand for oil across the world was also reduced to 57%. In addition, pollution was also declined significantly because automobiles are directly related to the environment. There was up to 75% decline in road transport in lockdown regions (Figure 5).

Figure 5 – Usage of Automobile during and after lockdown



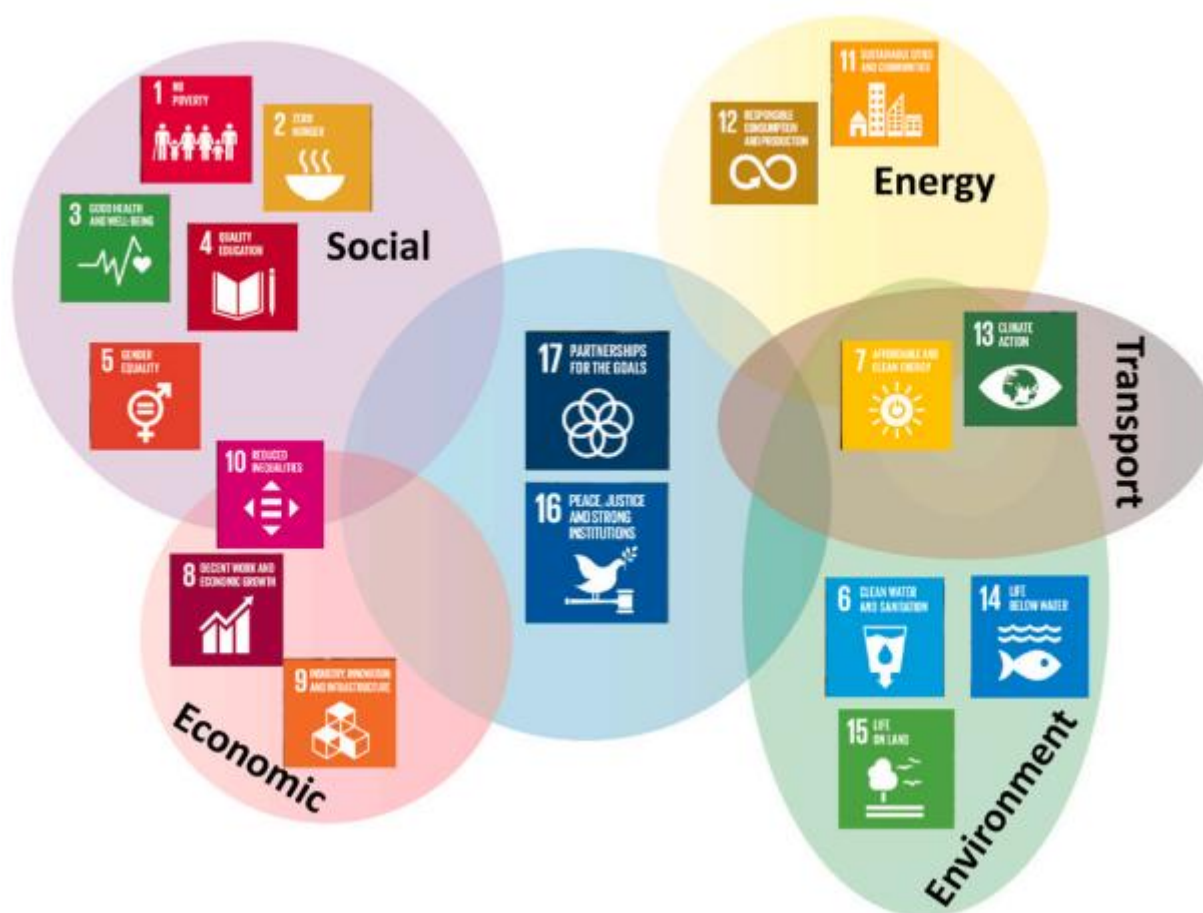
Source – IEA (2020b)

Impact on “Sustainable Development Goals (SDGs)”

A lot of “countries faced lockdown from March and April as they shut their transport, industries, and various non-essential areas (Haleem et al, 2020). There are 17 SDGs defined by the United Nations in 2015, which should be fulfilled by all developed and developing countries with new strategies and collaboration to make this world sustainable and peaceful. These sustainable development goals include “no poverty, zero hunger, good well-being and health, quality education, gender equality, clean water and sanitation, clean and affordable energy, decent economic growth, innovation and infrastructure in industries, low inequalities, green cities, responsible production and consumption, climate control, saving water, life on land, strong institution and peace justice, and partnerships for goals, ranging from SDG1 to SDG 17, respectively”.

There was mixed progress towards such SDGs before the COVID-19 (Huan et al., 2021). There is still “no toilets for 673 million people, 736 million people are poor, no supply of drinking water for 785 million people, 821 million people are malnourished, and lack of electricity for 840 million people, and around 28 poor countries would fail to achieve sustainable development goals 1 to 4, 6 and 7 by the year 2030” (Moyer & Hedden, 2020). Achieving this target is going to be even slower after the pandemic (Lancet & Health, 2020). A lot of sectors like energy, economy, environment, social, transport, etc. are interconnected (Figure 6) and COVID-19 has had a drastic impact on them.

Figure 6 – Interconnectedness of 5 Sectors to meet SDGs



Source – Nundy et al. (2021)

Women empowerment and gender equality have become even more important during COVID-19 because of increasing cases of domestic violence during the lockdown. Health and socio-economic sectors have shown inequalities and poor and most vulnerable people had a huge impact of COVID-19.

Results

It is evident that potential risks of COVID-19 took place by undermining previous epidemics like SARS, Spanish Flu, H1N1, Ebola, and Zika fever. It seems that human society still has a lot to learn from previous pandemics. It goes without saying that environment, social, energy, transport, and energy are important segments which were highly affected by COVID-19. Responses were highly different for various countries to the impact of COVID-19. It is also observed that it is possible to save up to US\$40.76 trillion by reducing mortality rate (Yoo & Managi, 2020). When developing a vaccine takes several years for other diseases, the impact of COVID-19 was so high that it was developed in a year (Mahase, 2020). For example, polio vaccine was developed in 40 years, Ebola vaccine in 5 years, and most vaccines were developed in 15 years on average (Wibawa, 2021).

The US, China, and the EU are the top three countries which emit greenhouse gases but they also reduced their carbon emissions due to COVID-19 lockdowns. Cleaner air, reduced vehicle traffic and air travel, shipping, and manufacturing provided a lot of environmental benefits. No other global event in 20th century was able to reduce the emissions drastically at such a high level (Perkins et al., 2020). However, COVID-19 had also halted sustainable growth of cities and society by keeping people at home. Densely populated countries and cities were not suitable for sustainable living which caused uncontrolled urbanization (Liu, 2020). There is a strong relation between economy and human health. Construction sector also needs improvement (Pinheiro & Luís, 2020). Around 90% of time of people is spent indoors like office, bedroom, cinemas, shopping mall, gym, etc. (Ghosh & Norton, 2019). So, there is a huge demand to assess indoor environment quality.

Conclusion

COVID-19 emerged as one of the lethal viruses over the past century. It has changed day-to-day lives of people completely and locked people at their homes. Vaccines were developed within a year to contain the virus. However, there was no treatment of COVID-19 in the beginning. So, old approaches like quarantine, lockdown, personal hygiene, and social distancing were used until vaccines were developed to promote herd immunity. Since total lockdown and closures of key industries wreaked havoc on the economy, caused financial instability, job losses, and a recession, it caused a huge change in mindset of people and their social life.

There was a negative impact of staying 24x7 at home in mental health of people and self-harm and domestic violence was very common. Using technology immensely and working from home have become the new normal. Transport and industrial sectors were closed, which eventually helped the environment because of declining air pollutants and use of fossil fuel. It is evident that SDGs would take even longer than 2030 to be achieved because of various adverse impacts of COVID-19.

References-

Alguliyev, R., Aliguliyev, R., & Yusifov, F. (2021). Graph modelling for tracking the COVID-19 pandemic spread. *Infectious disease modelling*, 6, 112-122.

- BBC (2020). Tokyo 2020: Olympic and Paralympic Games Postponed Because of Coronavirus. <https://www.bbc.co.uk/sport/olympics/52020134>.
- Brook, B. (2020). Coronavirus Social Distancing: Why Distance Differs Around the World.
- Chakraborty, I., & Maity, P. (2020). COVID-19 outbreak: Migration, effects on society, global environment and prevention. *Science of the total environment*, 728, 138882.
- Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., ... & Wei, Y. (2020). J.'. Xia, T. Yu, X. Zhang and L. Zhang, Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The Lancet*, 395(10223), 507-513.
- Cho, S. Y., Kang, J. M., Ha, Y. E., Park, G. E., Lee, J. Y., Ko, J. H., ... & Kim, Y. J. (2016). MERS-CoV outbreak following a single patient exposure in an emergency room in South Korea: an epidemiological outbreak study. *The Lancet*, 388(10048), 994-1001.
- Fini, M. B. (2020). What dentists need to know about COVID-19. *Oral oncology*, 105, 104741.
- Gaskin, D. J., Zare, H., & Delarmente, B. A. (2021). Geographic disparities in COVID-19 infections and deaths: The role of transportation. *Transport policy*, 102, 35-46.
- Ghosh, A., & Norton, B. (2019). Optimization of PV powered SPD switchable glazing to minimise probability of loss of power supply. *Renewable Energy*, 131, 993-1001.
- Guan, Y., Deng, H., & Zhou, X. (2020). Understanding the impact of the COVID-19 pandemic on career development: Insights from cultural psychology. *Journal of vocational behavior*, 119, 103438.
- Hafeez, S., Din, M., Zia, F., Ali, M., & Shinwari, Z. K. (2021). Emerging concerns regarding COVID-19; second wave and new variant. *Journal of Medical Virology*, 93(7), 4108.
- Haleem, A., Javaid, M., & Vaishya, R. (2020). Effects of COVID-19 pandemic in daily life. *Current medicine research and practice*, 10(2), 78.
- Huan, Y., Liang, T., Li, H., & Zhang, C. (2021). A systematic method for assessing progress of achieving sustainable development goals: A case study of 15 countries. *Science of the Total Environment*, 752, 141875.
- IEA (2020b). Evolution of Road Passenger Transport Activity in Selected Countries in Early 2020. Paris. Accessed from <https://www.iea.org/data-and-statistics/charts/evolution-of-road-passenger-transport-activity-in-selected-countries-in-early-2020>.
- Ito, H., Hanaoka, S., & Kawasaki, T. (2020). The cruise industry and the COVID-19 outbreak. *Transportation research interdisciplinary perspectives*, 5, 100136.
- Lai, C. C., Shih, T. P., Ko, W. C., Tang, H. J., & Hsueh, P. R. (2020). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. *International journal of antimicrobial agents*, 55(3), 105924.
- Lancet, T. & Health, P. (2020). Will the COVID-19 pandemic threaten the SDGs?. *The Lancet. Public Health*, 5(9), e460.
- Lau, H., Khosrawipour, V., Kocbach, P., Mikolajczyk, A., Ichii, H., Zacharski, M., ... & Khosrawipour, T. (2020). The association between international and domestic air traffic and the coronavirus (COVID-19) outbreak. *Journal of Microbiology, Immunology and Infection*, 53(3), 467-472.

- Lau, H., Khosrawipour, V., Kocbach, P., Mikolajczyk, A., Schubert, J., Bania, J., & Khosrawipour, T. (2020). The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. *Journal of travel medicine*.
- Lessler, J., Reich, N. G., Brookmeyer, R., Perl, T. M., Nelson, K. E., & Cummings, D. A. (2009). Incubation periods of acute respiratory viral infections: a systematic review. *The Lancet infectious diseases*, 9(5), 291-300.
- Liu, L. (2020). Emerging study on the transmission of the Novel Coronavirus (COVID-19) from urban perspective: Evidence from China. *Cities*, 103, 102759.
- Lu, R., Zhao, X., Li, J., Niu, P., Yang, B., Wu, H., ... & Chen, J. (2019). Meng Y. Wang J, Lin Y, Yuan J, Xie Z, Ma J, Liu WJ, Wang D, Xu W, Holmes EC, Gao GF, Wu G, Chen W, Shi W, Tan W. Genomic characterisation and epidemiology of 2019 novel coronavirus: implications for virus origins and receptor binding. *Lancet* 395, 565–574.
- Mahase, E. (2020). Covid-19: UK approves Oxford vaccine as cases of new variant surge. *BMJ* 371, 4968.
- Micheli, P., Johnson, M., & Godsell, J. (2021). Editorial How the Covid-19 pandemic has affected, and will affect, operations and supply chain management research and practice. *International Journal of Operations & Production Management*, 41(6), 773-780.
- Mitjà, O., Arenas, À., Rodó, X., Tobias, A., Brew, J., & Benlloch, J. M. (2020). Experts' request to the Spanish Government: move Spain towards complete lockdown. *The Lancet*, 395(10231), 1193-1194.
- Moyer, J. D., & Hedden, S. (2020). Are we on the right path to achieve the sustainable development goals?. *World Development*, 127, 104749.
- Nakamura, H., & Managi, S. (2020). Airport risk of importation and exportation of the COVID-19 pandemic. *Transport policy*, 96, 40-47.
- Nundy, S., Ghosh, A., Mesloub, A., Albaqawy, G. A., & Alnaim, M. M. (2021). Impact of COVID-19 pandemic on socio-economic, energy-environment and transport sector globally and sustainable development goal (SDG). *Journal of Cleaner Production*, 312, 127705.
- Perkins, K. M., Munguia, N., Ellenbecker, M., Moure-Eraso, R., & Velazquez, L. (2021). COVID-19 pandemic lessons to facilitate future engagement in the global climate crisis. *Journal of Cleaner Production*, 290, 125178.
- Pinheiro, M. D., & Luís, N. C. (2020). COVID-19 could leverage a sustainable built environment. *Sustainability*, 12(14), 5863.
- Remuzzi, A., & Remuzzi, G. (2020). COVID-19 and Italy: what next?. *The lancet*, 395(10231), 1225-1228.
- Roberts, M. (2021). South Africa coronavirus variant: What is the risk. *BBC News*, 29.
- Seow, J., Graham, C., Merrick, B., Acors, S., Pickering, S., Steel, K. J., ... & Doores, K. J. (2020). Longitudinal observation and decline of neutralizing antibody responses in the three months following SARS-CoV-2 infection in humans. *Nature microbiology*, 5(12), 1598-1607.
- Shen, J., Duan, H., Zhang, B., Wang, J., Ji, J. S., Wang, J., ... & Shi, X. (2020). Prevention and control of COVID-19 in public transportation: Experience from China. *Environmental pollution*, 266, 115291.

- Sheth, J. (2020). Impact of Covid-19 on consumer behavior: Will the old habits return or die?. *Journal of business research*, 117, 280-283.
- Susilawati, S., Falefi, R., & Purwoko, A. (2020). Impact of COVID-19's Pandemic on the Economy of Indonesia. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, 3(2), 1147-1156.
- Tapper, E. B., & Asrani, S. K. (2020). The COVID-19 pandemic will have a long-lasting impact on the quality of cirrhosis care. *Journal of hepatology*, 73(2), 441-445.
- Tay, M. Z., Poh, C. M., Rénia, L., MacAry, P. A., & Ng, L. F. (2020). The trinity of COVID-19: immunity, inflammation and intervention. *Nature Reviews Immunology*, 20(6), 363-374.
- Vaishya, R., Javaid, M., Khan, I. H., & Haleem, A. (2020). Artificial Intelligence (AI) applications for COVID-19 pandemic. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(4), 337-339.
- Van Doremalen, N., Bushmaker, T., Morris, D. H., Holbrook, M. G., Gamble, A., Williamson, B. N., ... & Munster, V. J. (2020). Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. *New England journal of medicine*, 382(16), 1564-1567.
- Vickerman, R. (2021). Will Covid-19 put the public back in public transport? A UK perspective. *Transport Policy*, 103, 95-102.
- Wang, M., Jiang, A., Gong, L., Lu, L., Guo, W., Li, C., ... & Li, H. (2020). Temperature significantly change COVID-19 transmission in 429 cities. *medrxiv*, 2020-02.
- Wibawa, T. (2021). COVID-19 vaccine research and development: ethical issues. *Tropical Medicine & International Health*, 26(1), 14-19.
- Yoo, S., & Managi, S. (2020). Global mortality benefits of COVID-19 action. *Technological Forecasting and Social Change*, 160, 120231.
- Zhao, S., Zhuang, Z., Ran, J., Lin, J., Yang, G., Yang, L., & He, D. (2020). The association between domestic train transportation and novel coronavirus (2019-nCoV) outbreak in China from 2019 to 2020: a data-driven correlational report. *Travel medicine and infectious disease*, 33, 101568.
- Zimmer, C., Corum, J., Wee, S., & Kristoffersen, M. (2020). Coronavirus Vaccine Tracker. Retrieved 21 March 2023, from <https://www.nytimes.com/interactive/2020/science/coronavirus-vaccine-tracker.html>.