Impacts of COVID-19 Pandemic on Public Road Transportation

Subjects: Transportation

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The COVID-19 pandemic has caused an unprecedented reduction in the demand for public road transportation, and it has changed passengers' perceptions from positive to negative when it comes to using public transportation amenities. There is an increasing concern that the public road transportation systems are witnessing a new horizon, especially as developed and developing countries are trying to resume their daily activities post the COVID-19 pandemic.

COVID-19 pandemic public road transportation physical distancing face masks

1. Introduction

A pandemic can be defined as a global disease outbreak found in both developed and developing countries, which at the time of the outbreak had no cure or vaccine to reduce its effect on the human body or the chances of hospitalization [1][2][3]. It can lead to enormous absenteeism, changes in a country's socio-economic landscape, and a limitation in its medical solutions, thereby causing an interruption in the global supply chain. All of these adverse effects of a pandemic can have enormous effects on the day-to-day activities of large multinational companies and the sustainability of large, medium, and small-scale transportation companies. It also highlights a compelling research question: can we say that preparing for a global pandemic is different from preparing for natural hazards such as hurricanes, earthquakes, and hazardous chemical spills? The answer is yes; due to the influence of disasters such as earthquakes, tsunamis, and oil spillage, they can influence infrastructural development and significantly affect human beings and transportation structures. However, it is important to know that Global pandemics affect both natural and human resources.

Throughout the world, public transportation has evolved into a service available to all city dwellers, not just a select few. It's one of the long-term strategies of sustainable transportation. Lockdowns are also putting enormous strain on public transportation systems around the world, lockdowns such as the closure of schools (universities, colleges, high schools, etc.), shopping centres, and the closure of public transport networks [4][5]. The number of people using public transportation has dropped from 50 to 90 percent [6]. For example, the rigorous lockdown imposed in the United Kingdom [7] resulted in a 95 percent reduction in underground train journeys in London. Various emotional and psychological effects have reduced the propensity to use public transport, increasing the use of private transport or of walking and cycling [8][9]. Given its limited resources, Africa has a variety of ways to deal with a crisis of this magnitude. Numerous datasets are available for African nations, including the International Health Regulations Monitoring and Evaluation conceptual framework, which claims that Africa "performs worst in

almost every decade when it comes to health sustainability." All of these groups were formed with the goal of studying the effects of different types of diseases. In comparison to other regions, cases in Africa remained low by 30 [7].

2. The Effects of COVID-19 Pandemic and New Guidelines for Public Transportation

2.1. Physical Distancing

COVID-19 and other respiratory illnesses are spread through droplets of between 5–10 µm, and aerosols less than 5 m in size. These are exhaled by infected people while breathing, speaking, coughing, and sneezing [10]. Several authors have established airborne transmission in closed environments, even though there is still much mystery about the numerous transmission methods in which COVID-19 infection occurs [10][11][12][13][14][15]. As a result, closed environments are more dangerous than open environments when it comes to the COVID-19 virus [16][17]. Aerosols can undergo accumulation and remain infectious in closed environment air for hours [10], making public transit and the resumption of daily human activities in other closed environments the most difficult challenges during the COVID-19 pandemic. Guidance on the resumption of activities in the workplace, for example, emphasizes the importance of natural ventilation, air filtration, and employees adhering to stringent hygiene protocols, as well as the cleaning and disinfection of public surfaces, among other things [18]. Physical distancing (also known as social distancing) has been one of the most extensively used non-pharmaceutical methods for preventing COVID-19 transmission. To limit the risk of COVID-19 transmission, the WHO recommends keeping a physical distance of at least one meter from other people [19]. Still, some health organizations recommend a physical distance of two meters [20]. COVID-19 infection is significantly reduced when people maintain at least a two-metre distance from each other [21]. Physical distancing is the most significant and consequential non-pharmaceutical preventative method to reduce the spread of COVID-19 in transportation systems for pedestrians and public transportation users [22]. Physical distancing significantly lowers the number of vehicles and public transit stations to take passengers from one point to another. In summary, physical distancing is incompatible with the idea of public transportation [23].

According to current research, keeping two m from other people as a social distance measure is appropriate for outdoor activities. However, the benefits of the social distance guidelines have been debated because people still get infected even if the social distance is more than two metres [14]. A typical example of this is a bus excursion in Ningbo, China, in January 2020, where a single asymptomatic person was suspected of spreading COVID-19 to twenty-two passengers over a 100-min travel time. However, it is important to note that passengers were not wearing face masks in this scenario. According to current studies [10][24], however, it remains unknown how the probability of contagion grows as a function of the duration of exposure. This is especially important when using public transportation to clarify the inherent risks of trips. Overall, without face masks, regular cleaning, and proper air ventilation, public transportation meets all the criteria for a top viral spreader: it is a closed environment where people may be trapped for an extended amount of time. Social distancing can limit the number of persons infected in this situation; however, it will not stop the infection from spreading.

2.2. Face Masks

The use of face masks by asymptomatic people as a viral containment technique has been a divisive topic, especially during the early months of the COVID-19 pandemic [25][26]. The usage of face masks have faced a lot of public controversies such as reduced validation of their efficacy, usage abuse because of inadequate information on how to wear them appropriately, and the likelihood of experiencing risky health behaviours while using masks are all arguments against recommending broad usage of face masks [26]. In the early days of the COVID-19 pandemic, the WHO suggested using face masks solely for respiratory diseases and workers in the medical field [19]. WHO updated its guidelines on 5 June 2020, recommending the application of fabric masks in public settings, including public transportation, and medical masks for people susceptible to respiratory diseases [27].

Following WHO's recommendation, the CDC initially suggested that the public should not wear masks in public, but this was reviewed and updated in early 2020 to recommend the usage of fabric masks in public [20], presumably as a substitute due to a surgical mask shortage [26][28] investigated the efficiency of different textiles in filtering aerosol particulates, finding that when numerous layers are employed and various types of combinations of fabrics, the level of filtration can be comparable to surgical masks. Even though many countries had reservations about using face masks, particularly in the early days of the COVID-19 pandemic, a new study reveals that face mask use is important for COVID-19 prevention. Face masks can considerably lower the quantity of infectious COVID-19 viruses in exhaled breath, especially in asymptomatic and mildly ill persons [10][11][21]. Fabric masks were shown to have a filtering capacity of more than 80% for particles smaller than 300 nm and more than 90% for particles larger than 300 nm, with certain combinations of common textiles such as cotton, silk, chiffon, and flannel [28].

The "precautionary principle" has recently been used to advocate for widespread usage of face masks during the COVID-19 pandemic, claiming that the potential benefits to public health will likely outweigh the risks) [25][26]. In the last few months, information based on epidemiological features shows that countries that have successfully halted the spread of COVID-19, such as Taiwan, Japan, Hong Kong, Singapore, and South Korea, have mandated compulsory usage of face masks in both public and indoor environments [10]. Simulation models have predicted that there is a high efficiency of prevention percentage of using face masks in the human population in decreasing the death rate caused by COVID-19 [29][30]. Because incorrectly fitted masks can impair aerosol filtering efficacy by 60%, education on proper mask use is just as important as ensuring universal face mask usage [28]. As a result, the research suggests that wearing a face mask on public transportation can be an effective strategy to prevent transmission of COVID-19, but only if the masks are appropriately fitted and handled logically. A campaign to promote the use of face masks must ensure that appropriate face masks are inexpensive and that people are well-informed on how to use them. Although eye protection devices minimize the risk of COVID-19 infection [21], their use for public transport passengers has not been enforced.

2.3. Proper Hygiene, Regular Sanitization, and Open Ventilation

Regarding adequate hygiene and improved levels of cleaning, it has been discovered that COVID-19 infections can last longer than anticipated, albeit on various types of surfaces such as plastic and steel [31][32]. Therefore, having

contact with physical surfaces that have been exposed to the COVID-19 virus is a likely carrier of the COVID-19 spreader. This means that public transportation and bus stations' regular cleaning of public surfaces is a proposed preventive solution. The sanitization of public transportation has been widely acknowledged worldwide depending on the different types of stages of intensity based on the availability of resources. Some countries' regulations on COVID-19 already advised pedestrians and motorists to make sure that they sanitize potentially infected surfaces and dressing and meeting room surfaces, not excluding management offices [33][34]. Aggressive investigations on these cogent guidelines in public transportation systems are seriously inadequate. During Post COVID-19 lockdown, it is important to have personal hygiene protection equipment and materials in public and office places to safeguard staff and motorists and also improve their confidence in using public transportation systems for their day-to-day activities, even though the risk of being infected is at an elevated level [33]. Appropriate and useful information needs to be provided to motorists and pedestrians, including the conduct of hygiene, the appropriate ways to use a face mask in public, and what to do when a passenger exhibits COVID-19 symptoms [34].

What is still undetermined is whether an air conditioner can escalate the spread of COVID-19 in a closed outdoor environment or spread using recirculated air in closed ventilation. Insufficient evidence suggests that air conditioners are a super spreader of COVID-19 in indoor activities such as open mic bars and hotels [35]. The US Centres for Disease Control and Prevention (CDC) has suggested that air conditioners should be applied in an environment that uses non-recirculation of air [36]. Regular ventilation in closed places is usually recommended, especially in public spaces like bus stations, as a preventive measure for COVID-19 [15][24][36]. These preventive measures are imperative to public motorists who spend several minutes with people inside public vehicles. However, suppose there are inadequate precautionary measures in public transportation systems. In that case, the efficient air flow of ventilation for public buildings should be adhered to, usually around ten persons, which means litre/seconds/person of ventilation air excluding recirculation; this was stated by the United Kingdom Government [24].

3. The Challenges of COVID-19 Infections on the Socio-Economic Aspects of Public Transportation

3.1. Financial Implications

During the early days of the COVID-19 pandemic, the virus spread rapidly in a matter of days, becoming the largest socio-economic crisis for public transportation systems in more than 20 years. The drastic decline in the use of public transportation systems due to COVID-19 has been compounded by high expenses because of new cleaning hygiene regimens. Due to these circumstances, many public transportation institutions, both public and private, have faced financial hardship, leading to pressure on governments. Due to the COVID-19 pandemic, the biggest US public transportation institution (the New York Metropolitan Transportation Authority) asked the US government for a bailout totalling about four billion dollars ($) [37].

In some South American countries like Chile, the Chilean government came out with a package to compensate operators of the public sectors in Santiago for the financial loss they incurred during COVID-19 [38]. In Europe, the

Netherlands came out with a financial package of up to €1.5 billion to soften the financial impact of COVID-19 on the Dutch Railway System and the major public transportation stations in the three most developed and congested cities, Amsterdam, the Hague, and Rotterdam [39]. In addition to this, the Swedish Government spent 3 billion SEK to compensate for the nation's losses incurred in the reduction of prices of public transit tickets [40]. Another significant problem most public transportation organizations face is the inability to secure funds from the government; this is due to the decimation of so many countries' economies due to the impact of COVID-19. This has led to inadequate funding from governments because of the competition from other socio-economic sectors also requiring financial assistance from the government.

With regard to the payment of public transit fares, new regulations and guidelines for public transportation usage may have detrimental effects on revenue reduction. Principles such as requiring mandatory boarding using the rear door can be suggested to reduce and eliminate physical contact between pedestrians and drivers if drivers are not separated physically from their commuters. This principle has been applied in major metropolises since 2020, like Santiago in Chile, Montreal in Canada, and some parts of Holland. However, in public transportation systems that are dependent on commuters entering the bus from the front door to pay their fare, this can lead to enormous financial implications, for example forcing non-payment bus rides. Also, further problems such as the conventional bus ticket checking of commuters if they hold a genuine bus ticket might not be feasible due to the increased likelihood of being infected by COVID-19 [33]. This problem may increase transport fare evasion if no optional transportation fare payment is feasible.

The most striking problem to be experienced by public transportation operators is primarily because of the decrement in demand and the consequences of financial bankruptcy if they are not bailed out financially by the government. Some developed and developing countries may have the financial capacity to bail out their public transportation systems. Unfortunately, the majority of developing countries do not have that capability. It might be due to inadequate regulations regarding public transportation and poor public hygiene on these systems. Most of the time, the ability of the driver to earn more money depends on the number of commuters they can carry in a day [41][42]. The financial implications of such a general framework and the people pertaining to such framework are primarily dependent on the COVID-19 pandemic being over.

3.2. Differences in Social Equities

COVID-19 has exposed a fundamental difference between jobs that attract high salaries and those with lower salaries. For example, during the early months of the pandemic, most people working in jobs with a higher salary were privileged to have access to remote working situations, as reported in countries such as the United States [43], Canada [44], and Chile [45][46]. According to recent research, surveys carried out based on data obtained from twenty thousand questionnaires in developed countries such as the United Kingdom and the United States [47] concluded that high school certificate workers and the female gender are more affected by the pandemic in the employment market. According to documented reports from *The Economist*, COVID-19 has been projected to further expose the disparities and gaps between developed and developing nations in recovering from the COVID-19 pandemic [48].

COVID-19 has exposed the gap between social integration and social segregation and highlights the need for more Government or private organizations efforts to make public transportation a synergy between the social integration of intelligent transportation systems in public transportation. Due to the pandemic, people have neglected public transit usage for their day-to-day activities. However, this neglect only applies to people with high-income jobs. Recent research was carried out by comparing data collected before and during the COVID-19 pandemic in one of the developed cities, Santiago. This research concluded that there is an increment in the number of people living in high-salary earner households that have abandoned the usage of public transit usage due to the fear of being infected by the COVID-19 virus. This cause-and-effect led to a drastic fall in public transportation usage to about 30%, not to exclude the reduction in public transportation system usage by people from high salary earning families by more than 80% [49]. These figures validate the statement that people who stopped using public transportation systems during the pandemic have alternatives to choose from, such as remote working. Instead of going to the market, they can afford other public transportation alternatives such as ride-hailing, private vehicle ownership, and shopping on online marketplaces. At the same time, those individuals that continue using public transportation tend to be from low-income households. This disparity in travel behavior between various social groups is bound to continue during this pandemic unless drastic steps are taken to address the social equities in public transportation.

3.3. Sustainable Mobility

The drastic decrease in the use of public transportation in recent years due to the physical distancing introduced by so many countries to curb the spread of the COVID-19 virus and the fear of passengers in been infected with the virus has exposed future research questions around the sustainability of transportation options and intelligent transportation systems in many major cities in both developing and developed countries. Developing a sustainable plan that will address these issues during the COVID-19 pandemic and the post-COVID-19 era requires systematic, well-coordinated efforts from transportation researchers, public transportation organizations, urban planners, and pedestrians. The primary aim is to ensure that the safety of travelers and drivers in public transportation is assured so that commuters who have no other viable options for public transportation can be accommodated.

A real-life scenario will be if buses and trains are not filling up at an increasing rate compared to before COVID-19. The socio-economic effectiveness of most countries will be severely affected. The only soft landing would be to provide sustainable mobilities to lower-earning income households due to having only public transportation as a viable alternative. Furthermore, due to physical distancing and public transit occupancy guidelines being introduced to curb the spread of COVID-19, there has been a drastic reduction in passengers occupancy in public transportation. This has been evident in major European cities (Copenhagen, Brussels, Paris, and Berlin), Asia (Seoul and Tokyo), and some countries in Southern and Northern Africa.

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