Sustainable Public Safety and the Case of Two Epidemics: COVID-19 and Traffic Crashes. Can We Extrapolate from One to the Other?

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Abstract: COVID-19 and motor vehicle crashes (MVC) are both considered epidemics by the U.S. Centers for Disease Control (CDC) and the World Health Organization (WHO), yet their progression, treatment and success in treatment have been very different. In this paper, we propose that the well-established sustainable safety approach to road safety can be applied to the management of COVID-19. We compare COVID-19 and MVC in terms of several defining characteristics, including evolvement and history, definitions and measures of evaluation, main attributes and characteristics, countermeasures, management and coping strategies, and key success factors. Despite stark differences, there are also some similarities between the two epidemics, and these enable insights into how the principles of sustainable road safety can be utilized to cope with and guide the treatment of COVID-19. Major guidelines that can be adopted include an aggressive policy set at the highest national level. The policy should be data- and science-based and would be most effective when relying on a systems approach (such as Sweden’s Vision Zero, the Netherlands’ Sustainable Safety, and the recommended EU Safe System). The policy should be enforceable and supplemented with positive public information and education campaigns (rather than scare tactics). Progression of mortality and morbidity should be tracked continuously to enable adjustments. Ethical issues (such as invasion of privacy) should be addressed to maximize public acceptance. Interestingly, the well-established domain of MVC can also benefit from the knowledge, experience, and strategies used in addressing COVID-19 by raising the urgency of detection and recognition of new risk factors (e.g., cell phone distractions), developing and implementing appropriate policy and countermeasures, and emphasizing the saliency of the impact of MVC on our daily lives.

Keywords: COVID-19; motor vehicle crashes; sustainable safety; policy; epidemic eradication; best practices

1. Introduction

Traffic crashes have long been considered as an aspect—or collateral damage—of the transportation system and desired mobility; consequently, they have typically been analyzed and treated in this context. In the mid-twentieth century, there were isolated attempts to address this as a public health issue and apply epidemiological approaches to its treatment [1,2]. However, at the end of the last century and the beginning of this one, it became recognized as a major public health issue (by the World Health Organization in 2004 and the U.S. CDC in 1992; see [3]), and even as a neglected public health epidemic [4,5]. This has provided road safety with a new perspective and new tools for dealing with this epidemic. Consequently, significant advances in the approach to crash injury prevention and treatment have yielded continued reductions in injuries and fatalities from road crashes.
Although warning signs for the eruption of new epidemics have been present, and they are not rare events [6], still, the world—and especially most national regulatory agencies—were quite unprepared for the outbreak of COVID-19. Though most specific medical epidemics are short-lived, this is not always the case. Cholera pandemics were first recorded in 1817, and the seventh most recent one was in 1961-1975. HIV/AIDS first surfaced in 1982 and represents an ongoing problem; by the end of 2019, it had killed nearly 33 million people worldwide [7]. In comparison, the rate of MVC injuries seem to have experienced a steady gradual increase since the beginning of the last century, and over 1.3 million people were killed in 2019 [8].

Given that, in 2020, the potential impact of both MVC and COVID-19 should not have been a surprise to any country, why are the differences in their effects so stark? Why is one of the safest countries in the world in terms of traffic safety—Sweden—experiencing one of the highest fatality rates from COVID-19 in its first wave? Why are individuals who value their freedom and privacy willing to wear masks and allow their temperature to be taken in public? Why have populations accepted and adjusted to the shutdown of air travel and public transportation almost immediately?

The main question that emerges and is considered here is whether any of the medical, engineering, behavioral, and policy approaches that have been successfully applied to reduce MVC injuries can be applied to the COVID-19 pandemic. In general, can we extrapolate and learn from one to the other? To consider this possibility, it is first necessary to assess similarities and differences between the two on multiple dimensions that include their history of evolvement, the nature of the data available for each, their defining characteristics, effective countermeasures, and strategic management approaches. These are summarized in Table 1. The discussion that follows touches on all of these issues but focuses on two critical ones: defining characteristics that are relevant to effective interventions and effective policy practices. Finally, based on this analysis, we recommend some approaches to consider for the current COVID-19 pandemic, for the preparedness for the next pandemic, and for the road safety domain as well.

Table 1. Main issues and countermeasures relevant to COVID-19 and road crashes.

| Domain                        | Issues                                      | COVID-19                                              | Road Crashes                                             |
|-------------------------------|---------------------------------------------|-------------------------------------------------------|----------------------------------------------------------|
| Evolvement and History        | Sudden outbreak, rapid and unpredicted evolvement | History as long as the motor car. Slow and predicted evolution |
| Definitions                   | Epidemic/Pandemic                           | Public health problem, road safety issue               |
| Definitions and Measures of Evaluation | Total and rates of deaths, in serious condition, affected and recovered, growth factor, reproduction number (R₀), case fatality rate (CFR) | Deaths and injured per population, per number of vehicles, and per vehicle miles traveled (vmt) | Relatively steady incline and then gradual consistent decline in fatalities in the last 50 years |
| Domain                  | Issues                                                                 | COVID-19                                                                 | Road Crashes                                                                 |
|------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Most at-risk           | The elderly, the poor, and the sick. People in urban concentrations.   | Pedestrians, new/young drivers, elderly, two-wheeler riders               |
| The future/hope        | Vaccination for all and treatment for the infected                     | Behavior modification towards safer driving, Advanced Driver Assistance Systems (ADAS), safer vehicle design, and self-guiding/forgiving roads. Automation |
| Salience and valence   | Episodic immense salience and valence—high but brief impact on life   | Continuous minor salience but high cumulative valence—high impact on life but at a low continuous rate that breeds habituation (“it won’t happen to me”) |
| Intrusion on privacy   | Can be major. Location-based tracking and monitoring of individuals, enforced lockdowns and masks, enforced temperature-taking, compulsory vaccinations | Medium. Enforcement of seatbelt use and alcohol breath tests. Driving behavior and location monitoring with roadside and in-vehicle cameras |
| and freedom            |                                                                        |                                                                           |
| Variance among         | Some of the developing countries are doing better than developed countries, mostly attributed to the ease of implementing immediate strict policy measures. | Developed countries are doing consistently well. Many developing countries perform poorly. |
| countries              |                                                                        |                                                                           |
| Countermeasures        | Location-based operations for detection and monitoring of outbreak, spread, and lockdowns. | Crash prevention and injury mitigation through improved road and vehicle design |
| Engineering/Technology | Medical R&D, advanced medical equipment. Patient care through automated equipment and procedures. | Speed management. Automated crash detection and reporting Automation |
| Enforcement and        | State-mandated and enforced measures, including lockdowns, face masks, social distancing, and obligatory vaccination. | State-mandated and enforced measures for detection and prevention of risky driving (e.g., speeding, DWI (driving while intoxicated), and seatbelt use). |
| regulation             |                                                                        |                                                                           |
| Education and public   | Media has major role in raising awareness and promoting behavioral adaptations such as social distancing, personal hygiene, and protection of the elderly. Scare tactics are used by politicians and health authorities. | Important in deterrence of high-risk behaviors and raising awareness to enforcement. Vital in creating new social norms for safe behaviors. Scare tactics are ineffective (though are still used). |
| information            |                                                                        |                                                                           |
Table 1. Cont.

| Domain                  | Issues                                                                 | COVID-19                                      | Road Crashes                            |
|-------------------------|------------------------------------------------------------------------|----------------------------------------------|-----------------------------------------|
| Management and Strategic Approach | Strategic goals: Containment and then eradication                        | Sustainable safety.                          |                                        |
|                         |                                                                        | Significance and injury reduction             |                                        |
|                         |                                                                        | Vision Zero                                  |                                        |
|                         | Prevailing treatment approach: WHO 4 pillars approach with selective focus on different groups. | The safe-system approach WHO 5 pillars approach with selective focus on different high-risk groups. |                                        |
|                         | The Swiss Cheese model: Exposes layers that are unknown, neglected, or malfunctioning. | The Dutch 5 principles of sustainable safety. |                                        |
|                         | The Swiss Cheese model: All layers are known and dealt with.            |                                              |                                        |
| Urgency of implementation | An aggressive policy and immediate implementation are crucial            | Due to its slow, consistent, and predictable progression, policy and evidence-based actions can be administered and monitored over time. |                                        |
| Key success factors     | Test                                                                   | Shared responsibility and accountable leadership to ensure sustainability. |                                        |
|                         | Track                                                                  | Commitment to global safety plan.            |                                        |
|                         | Treat                                                                  | Good databases                               |                                        |
|                         | Transparency                                                            | Safer infrastructure                         |                                        |
|                         | Leadership                                                              | Safer vehicles                               |                                        |
|                         |                                                                        | Safer road users                             |                                        |
|                         |                                                                        | Continuous monitoring and analysis            |                                        |

2. The Evolvement and History of Road Injuries and COVID-19-Related Deaths

The history of motor vehicle road crashes (MVC) is as long as the history of the motor vehicle, with the first fatality recorded in 1896 [9]. For the next three quarters of a century, crashes increased in parallel with the growth in motor vehicles. However, the public’s attention and infatuation were to and with the vehicle performance, appearance, and comfort, and not with safety. Crashes were viewed as a necessary cost of the increasing mobility. A clear international alarm was sounded by the first “World Report on Road Traffic Injury Prevention” [10], noting that, at the beginning of this century, MVC had become a major public health issue, claiming the lives of nearly 1.2 million people every year; they were the 11th highest-ranked cause of death and the leading cause of all injury deaths (23%) in the world. Since then, despite many safety improvements and efforts, the number of deaths has exceeded 1.3 million [8]. This immense toll and various safety-oriented systems (most notably seatbelts) brought about a cultural shift and the realization that “road deaths and injuries are preventable”. Most of the efforts to stem the MVC injuries came from transportation agencies and the industry and they focused on road and vehicle improvements. The entry of health organizations such as the CDC and WHO into the field brought with it the epidemiological approach and the medical model as means of dealing with what has been labeled “the neglected epidemic” [5]. In terms of their impact and spread in society, they can be viewed, as WHO phrased it, as “an epidemic on wheels”, with the use of seatbelts as “vaccines” (as cited in [4]). A major difference from medical epidemics is that the spread is not from humans or animals but from a (transportation) system failure, and its impact in terms of affected people is still spreading and is contagious.

COVID-19—unlike MVC—was an unknown threat two years ago. Nevertheless, the history of the world is replete with epidemics and pandemics. In fact, there have been over 100 documented epidemics and 19 in the past decade alone [11]. The more recent ones have pushed some nations to prepare for such an event, even if—unlike crashes—the specific pathogen of each one is unpredictable. The common denominator of epidemics is that its time of appearance and specific nature cannot be determined in advance, and that, given
the slow pace of developing the ultimate countermeasure—a vaccine—the primary initial goal should be rapid detection and the creation of a means of slowing the spread of the causal virus, or “flattening the curve” of the incidence over time, so as not to overwhelm the healthcare facilities. There had been sporadic efforts to prepare coping strategies (e.g., in the U.S., presidents’ calls for preparedness coupled with coping strategies were made by Presidents G.W. Bush in 2005 and Obama in 2014 [12,13]). On an international scale, in 2005, the IHR (International Health Regulations) revisions were adopted and the WHA (World Health Assembly) UN Resolution 58.3.4 Article 2 announced that the scope and purpose of the instrument was “to prevent, protect against, control and provide a public health response to the international spread of disease in ways that are commensurate with and restricted to public health risks”. Since then, signatory countries have been working, individually and collectively, to meet their core capacity requirements under the new framework [14].

In sum, the history of motor vehicle injuries and health crises due to viruses are very different in their time frames of occurrence and spread, mostly in time and in space, but also in the mechanisms employed to deal with them, and in the actual commitment to funding these efforts. However, they have grown to such levels that they now share the recognized need for national and international strategic policies to mitigate them.

3. Definitions and Measures of Evaluation

3.1. Definitions

Traditional definitions of epidemics and pandemics are restricted to the health (rather than injury) domain. Merriam Webster defines an epidemic as “an outbreak of disease that spreads quickly and affects many individuals at the same time. A pandemic is a type of epidemic (one with greater range and coverage), an outbreak of a disease that occurs over a wide geographic area and affects an exceptionally high proportion of the population”. MVC are rarely considered as diseases and, consequently, are typically not labeled or addressed as epidemics. This is probably because the people and institutions that typically monitor them and are charged with containing and eliminating them come from non-health domains, such as engineering, road design, and transportation specialists. However, for all intents and purposes, MVC represent injuries that have become a global public health problem [10,15] and typically are treated as unintended injuries that should and could be minimized. As stated above, the WHO has recognized them as a major public health problem. However, do they constitute an epidemic or pandemic? Strictly speaking, according to the above definition, they are neither epidemics nor pandemics as they are not a medical disease that can be traced to a single specific germ (virus or bacteria). However, in terms of their impact and spread in society, they can be viewed as a progressing epidemic [5], spreading not from humans or animals but from a (transportation) system failure, and its impact in terms of affected people is still spreading and is contagious.

3.2. Measures of Evaluation: Totals, Rates, and Trends

An epidemic—medical or MVC—can be measured and its impact quantified in various terms. The choice of measure of any source of danger is obviously critical, as it defines the damage, defines the assessment of progress, and dictates the choice of countermeasures adopted. To the layperson, the most comprehensible measure is the total number of people affected—either in terms of illness/injuries, or in terms of fatalities. For example, each year, approximately 1.3 million people die worldwide from MVC, and approximately 2.5 people have died from COVID-19 since its outbreak in January 2020 (as of 3 March 2021).

Because this measure, at best, is useful for trends within a specific area, more common measures, useful for comparisons, are rates. Thus, medical epidemics are typically measured in terms of the number of people affected per population. In the case of MVC, the measure favored by transportation safety officials is the number of people killed per total distance traveled (total number of vehicles multiplied by average distance traveled). The rationale for this unique measure—for which there is no parallel in medical epidemics—is
that the most relevant exposure measure for MVC is the actual miles that all the vehicles (in the role of the pathogen) traverse on the roads, where they can crash and injure road users. This difference in measures can yield puzzling results. For example, the risk of an illness in a developing country with a large population can be very high relative to its number of inhabitants. In contrast, because the number of vehicles per person in such a country is low and the total distance traveled by these few vehicles is low, the risk of a crash per size of population can be very low. However, the risk of a crash relative to the number of vehicles or the total distance that these vehicles are covering—especially given poor vehicle conditions, poor infrastructure, and risky driver behaviors—can be very high.

For evaluating and comparing among medical epidemics or pandemics, a measure of the rate of spread—the reproduction number, $R_0$—is used. This is the number of people, on average, that an individual who contracts the disease will then transmit it to. Because, typically, not everyone in the community is equally susceptible to infection, the effective $R_0$ is typically less than the “pure” $R_0$—depending on factors such as whether some individuals have been vaccinated or are naturally immune. If the $R_0$ value is less than 1, the epidemic is in decline. Due to the difficulties in calculating it, this measure is often presented by a range. To give a sense of its magnitudes, the $R_0$ values for measles range from 12 to 18; for Ebola, the range is 1.51-2.5, for Influenza, it is 1-2, and for COVID-19, the initial estimates are 2-3 [16,17]. No such measure is available for MVC.

An important criterion used to measure pandemic severity is the case–fatality rate (CFR), the percentage of deaths out of the total reported cases of the disease. Interactive CFR maps are now available (for example: https://ourworldindata.org/mortality-risk-covid (accessed on 11 March 2021). The CFR varies among countries and over time and is highly dependent on the number of tests performed. For COVID-19, on June 2020, it ranged from 1.7% in Israel through 5.8% worldwide to 14.4% in Italy. The CFR can be a highly volatile index; indeed, four months later, in February 2021, it was 0.7% in Israel, 2.2% worldwide, and 3.5% in Italy. The equivalent measure to CFR for MVC is the number of fatalities, relative to the number of crashes or injuries. More generally, it could be relative to the drivers’ population, amount of vehicle miles traveled, or number of vehicles.

In summary, medical epidemics and MVC share some rate-based measures that could make them comparable. An illustration comparing the two is depicted in Figure 1, where COVID-19 and MVC fatalities per population are presented for the countries with the best and worst road safety records (in addition to the U.S. and China as in-between cases). Two observations are inescapable: first, fatalities per population of MVC and COVID-19 are negatively correlated ($r = -0.68$). These negative relationships will be further analyzed and discussed in this paper. Second, there is a negative relationship between a country’s wealth and its MVC fatality rates: rich countries display better MVC fatality rates than poor countries. The correlation between the GDP and the MVC fatality rate (for the countries depicted in Figure 1) is negative: $r = -0.89$. In contrast, the relationship between COVID-19 death rates and the GDP is positive ($r = 0.64$). Thus, the safest countries in terms of MVC-related deaths are in the developed world, where significant efforts (detailed below) have been expended over the past few years to improve safety, but health programs have floundered when it comes to dealing with COVID-19.

Comparing the trends of the two epidemics over time is interesting and insightful. The outbreak of COVID-19 erupted with exponential growth in cases. This means that as the number of cases increases, so does the rate at which it grows, and the number of patients doubles itself every few days. In the early days of the outbreak, the doubling rate—the time it took for the number of cases to double—was 3–6 days for many countries. As this doubling rate becomes larger, the curve flattens, and the wave of cases diminishes. A new wave can be detected once this rate declines again. Analysis of the trend and flattening of the curve is used to monitor, track, and promote the desired countermeasures. Typically, shutdowns and social distancing are used as temporal explanatory factors for the change in doubling rate.
Figure 1. Annual death rates due to Motor Vehicle Crashes (MVC) [15] and COVID-19 [18] by country.

In the world of MVC, the progression of deaths and injuries over time is slow and relatively steady, with seasonal fluctuations. Roughly speaking, in the past century, the first 70 years were characterized by a steady increase in deaths and injuries accompanying the growth in motorization and mobility, but since 1970—even though mobility continued to grow—there has been a continual decrease in death rates, at least in high-income countries. This consistent decline has been thoroughly researched and investigated and is mostly attributed to coordinated management, improved infrastructure, advances in vehicle technologies, enforcement, and education, many of which can be applied to the management of the COVID-19 epidemic (detailed below).

4. Main Attributes and Characteristics

4.1. Most At-Risk

Effective management requires a consensus regarding the target population. In medical epidemics, this varies as a result of the specific traits of the pathogen. For example, in terms of age, it can be all ages (Malaria), children (Polio), or, as in the case of COVID-19, the elderly. Furthermore, depending on how the epidemic spreads, there are subgroups of the population-at-risk that are defined in terms of their habitat and lifestyles.
(e.g., high-density urban concentration for COVID-19). In the case of MVC, where kinetic energy is the pathogen (Haddon, 1967), the populations at greatest risk have been quite stable: young/novice drivers and older drivers/pedestrians. The former lack the proper experience and maturity to comprehend and operate their vehicles within the transportation system, and the latter suffer from age-related physical frailty and cognitive limitations/impairments. Additional vulnerable road users include pedestrians and two-wheeler riders. Thus, the overlap between the vulnerable populations of the two epidemics is partial.

4.2. The Future/Hope

Whereas pandemics come and go, MVC seem to be here to stay, though at progressively lower rates. Nevertheless, even Sweden, with its Vision Zero policy [19] of zero road fatalities, is still far from eliminating MVC, despite a drop by a factor of 2.5 since the policy’s inception. Experts estimate that as long as human perception, judgement, and control are involved, human errors and consequently fatalities are unavoidable. Therefore, the current hope for zero (or close to zero) fatalities relies less on safer driving behavior and more on safer vehicles and forgiving roads. The breakthrough towards zero fatalities is expected to occur mostly from the transition to automation, autonomous driving, and driverless cars. The move towards this goal is fraught with obstacles [20], but multiple Advanced Driver Assistance Systems (ADAS) are continually being integrated into new vehicle models. Nevertheless, although most experts agree that the future of driving is automation, they estimate that full automation in massive quantities is decades away.

In contrast, COVID-19, based on the history of pandemics, science, and technology, will eventually be eliminated due to herd immunization, vaccination development and implementation, behavioral adaptations, external factors, or all of the above. The debate among experts centers on when and at what rate the pandemic will eventually disappear, with the expected worst-case scenario being 2024 or 2025 [21]. Thus, the hope for the near-eradication of MVC fatalities is realistic, but it will take at least a decade to achieve, while the eradication of COVID-19 fatalities will be significantly faster, but with a likely higher associated cost.

4.3. Salience and Valence

Two striking differences between the two phenomena—COVID-19 fatalities and MVC fatalities—are their salience and valence. Salience is the extent to which an event or phenomenon captures our attention, and valence is the value, cost, or impact that a phenomenon has for the relevant population. Psychologically, valence is the intrinsic attractiveness or averseness that the phenomenon has. One would think that the two should be highly related, i.e., events with high cost (such as MVC and COVID-19 infections) should have high salience, amplifying our efforts to deal with them. This, however, is not the case. Significant but rare threats (such as COVID-19) have very low salience as long as they remain as such: unmaterialized threats. Thus, COVID-19—even after its materialization in China—seemed to be of little concern to most people around the world. This changed dramatically when it started to affect other countries. Only then did its salience (as reflected by its coverage by the media) skyrocket. In contrast, MVC fatalities, because of their relatively constant rate over many years, have much greater valence (in terms of total lives lost), yet their salience remains low for most people. Most of us have habituated to their presence so that it is hardly discussed. However, due to constant national efforts in developed countries over the past few years, most people have made using safety belts and refraining from driving after drinking a habit.

In the context of MVC, the continuous minor salience but high cumulative valence may be changing as the very few crashes associated with automated driving have appeared to attract significant attention in the automotive community, the government, and the press. Every fatal crash involving an autonomous vehicle captures our attention. For COVID-19, valence and salience are greatly affected by the rate of spread, both across countries and
over time. The public’s reactions to an approaching hurricane represent a good analogy: while it is still far away, with some uncertainty of where, when, and with what power it will reach the shore, people may appear very casual about it. It is only when it is certain and imminent—and sometimes only after it has struck— that some people react, and often with panic.

4.4. Intrusion on Privacy and Freedom

Effective short-term countermeasures for both epidemics involve intrusion on privacy. In the road safety domain, where each driver is enclosed in his/her own car, there used to be a false sense of privacy and anonymity [22]. This is clearly not the case anymore. All drivers are subject to enforcement and can be stopped by police to present documents, to be tested for alcohol use, or checked for restraint use. Furthermore, automated enforcement allows authorities to measure and document cars’ behavior with respect to speed, red-light violation, dangerous overtaking, cellphone use, and other unsafe maneuvers. Lastly, many drivers are being subjected to monitoring of their driving behavior, either by built-in monitoring systems in their cars (such as: Intelligent Speed Adaptation and black-box) or nomadic devices (such as GPS, in-car cameras, and headway and lane-keeping monitoring devices). Hence, drivers nowadays should be aware that once they are in their cars, their behavior—especially that which is high-risk—is monitored and documented.

In the health arena, massive privacy intrusions and curtailment of freedom are less common and less acceptable but are gradually being implemented. Hence, it took considerable time for authorities in many countries to impose and enforce restrictions. The U.S. and Sweden are good examples of such delays in administering restrictive policies, which apparently caused a major increase in the spread of COVID-19 and consequently resulted in prohibitive increases in infections and fatalities. However, over a period of a few months only, major privacy intrusion acts have been suggested, enacted, regulated, and somewhat enforced. While the public in many countries seemed divided on the appropriateness of some of these measures, in locations most affected by the epidemic, there was a general acceptance of most measures. For example, the Israeli Knesset granted temporary use of the tracking system developed by the General Security Service (SHABAC—equivalent to the FBI), originally developed to track suspected terrorists, to identify people in close proximity to individuals diagnosed with the disease. Other measures include monitoring of individuals for social distancing, enforcing lockdowns and quarantines, limiting mobility, obligatory mask-wearing in public areas, and taking temperature in entrances to public buildings and shops. “Nudges” are now being considered and implemented to convince and motivate people who refuse vaccinations to actually get them (such as permission to go to theaters and restaurants, as well as easier travel and avoidance of lockdown and quarantine). The question of whether vaccinations should be mandatory in the context of privacy intrusion and free will is the topic of major current debates.

When comparing public acceptance of privacy intrusion measures, it seems that in the case of COVID-19, the initial high acceptance in some countries was mostly due to its urgency of implementation, and the hope and expectation that these measures would be temporary. However, currently, the controversial issue of compulsory vaccinations is looming large [23]. In contrast, invasion of privacy to support driver monitoring on the road to improve public safety is more covert and less salient but is here to stay and will probably even increase as automation increases. Thus, for the eradication of epidemics, invasion of privacy is progressively becoming more common and becoming increasingly acceptable, while for road safety, it is slow and constantly challenging.

4.5. Variance among Countries

A striking difference between the two epidemics is their geographical and international distribution in terms of rates of transmission and affected people and fatality rates. Figure 1 presents the fatality rates of the safest and least safe countries in terms of road crashes and COVID-19 death rates. It is patently obvious that, road-wise, the safe countries are all high-
income countries, while the most dangerous are low-income countries. The opposite is true for COVID-19 fatalities. For both epidemics, management and implementation strategies heavily correlate with geographic location. For MVC, developing countries contribute to the overall death rate significantly more than developed countries. The risk of a road traffic death in a low-income country is 27.5 per 100,000 people, versus 8.3 per 100,000 population in high-income countries [15]. The case of COVID-19 is more complicated because both its onset and spread over its lifetime have varied greatly among countries. Pandemics are quite insensitive to location and, in a very mobile society, they can quickly migrate to and spread among the more developed countries with high international mobility. This is especially so because of the long latent incubation period of the virus. Some of the developing countries are faring better than developed countries, possibly because of the ease of implementing immediate strict policy measures. Thus, in China, which has relatively poor performance in MVC statistics, the number of COVID-19 deaths per population rate is very low. Much of the control of the spread is attributed to the centralized authoritarian regime in the country, which enabled a rapid lockdown of the whole city of Wuhan and Huan province. In contrast, some of the high-income, liberal, civil-rights-oriented countries, which have the best road safety performance, were among the worst countries in terms of deaths per population and case fatality rates, as is demonstrated in Figure 1 (e.g., the UK, Sweden, and the Netherlands).

As long as the vaccination for COVID-19 is not widespread, these differences in performance can naturally be attributed to many factors that affect its containment. These include the timing of mandatory and voluntary measures encouraged by the authorities, population density, population age distribution, culture, safety culture, hygienic and health-service levels, enforcement, and rates of compliance with proven precautionary measures (such as social distancing). The differences among countries in these respects are profound—first and foremost, in the timing of declaring a state of emergency and then in the steps taken towards implementing restrictions necessary to execute lockdowns, isolation, quarantines, and social distancing. Among the developed countries that delayed the implementation of a lockdown strategy during the first wave of the disease is, most notably, Sweden. Though it closed universities and high-schools, restaurants, primary schools and kindergartens stayed open, and the government only recommended that older and at-risk residents avoided social contact. With COVID-19 death rates much higher than in any of its neighboring countries (see Figure 1), the policy turned out to be disastrous, as admitted by its Public Health Agency and by King Gustaf, who said last year, “I think we have failed” [24]. The case of Sweden is of special interest in the context of road safety and the discussion on safety culture, safety management and strategies, restrictions, and compliance with traffic laws, as Sweden is one of the leading countries in the world in terms of road safety performance, displaying a consistent downwards trend. Whereas the concept of shared responsibility seemed to work well for road safety in Sweden, this was not necessarily case for their management of COVID-19.

5. Countermeasures—The Three Es

In the world of injury prevention, and specifically in road safety, the Three Es model is often used to categorize and evaluate different countermeasures according to their approach: namely, engineering, enforcement, and education. The same can be done with medical epidemics, though the specific treatments in each category may differ significantly.

5.1. Engineering and Technology

Technology plays a central role in the management of COVID-19. Its application areas can be categorized according to the following three domains: 1. Location-based operations, 2. Medical equipment and R&D, 3. Patient care. Location-based operations include positioning technologies to help track patients and affected places in order to contain the virus and analyze its spread patterns. Satellite technologies are used to create interactive maps to facilitate people’s awareness of the geographical reach of the virus and
determine the distance between them and active infection. Smartphone apps are used for tracking both infected and quarantined individuals. In some locations (e.g., in China), facial recognition cameras have been installed to help in monitoring lockdowns and quarantines.

Advanced medical technologies are used to detect individuals who have contracted the disease (symptomatic and asymptomatic), to treat patients, to conduct research towards the development of treatments and vaccines, and to provide medical professionals with the equipment, tools, and procedures needed. Extensive research and genome sequencing are used to find cure and vaccines. As of 3 March 2021, approximately 268 million people have received the first round of vaccinations (out of two) and approximately 56 million have been fully vaccinated (https://ourworldindata.org/covid-vaccinations (accessed on 3 March 2021).

Patient care is being administered with the help of advanced robotics, which are used to prevent the spread of the virus. In many hospitals, robots perform diagnosis, conduct thermal imaging, transport medical equipment and patient samples, and deliver essential goods such as medicines and food items.

Overall, A.I.-powered technologies, big data and deep-mining procedures, and advanced sequencing, sensing, and location technologies are extensively used in all domains of COVID-19 management. However, along with these unprecedented abilities, their widespread use has raised serious ethical issues (such as infringement on privacy) which need to be acknowledged and addressed. Though many of the engineering measures were derived ad-hoc to deal with situations evolving from the fast spread of COVID-19, some of them are likely to remain (e.g., improved medical equipment, vaccinations, and tele-medicine). In other cases, the acquired knowledge will have a long-term impact on responses to future epidemics and crises (such as dissemination logistics, location-based operations, and ZOOM capabilities for teleworking and even tele-pleasure).

In the world of road safety and MVC, engineering and technology play a major role. Engineering—especially in combination with education and enforcement—has proven to be the most effective contributor to the massive reductions in injuries. It has significantly contributed to reductions in DWI (driving while intoxicated) through the use of alcohol testers and alcolocks, speed management through the use of speed detectors and Intelligent Speed Adaptation (ISA) systems, and occupant protection with seatbelts, air bags, and forgiving roads. The contributions of such systems can be measured directly [25], and their advancement is spurred by the assumption that it is more feasible to program and improve vehicles and infrastructure than to reprogram humans not to make mistakes or wrong judgments. Most important engineering improvements are sustainable, whereas education and enforcement require continued intensive labor.

Sustainable safety through technological advancements in the road safety arena during the last century can, first and foremost, be attributed to major improvements in vehicle safety. A dramatic visual demonstration of improved crashworthiness and occupant protection is the IIHS crash test between a 1959 Chevrolet Bel Air and 2009 Chevrolet Malibu. This case demonstrates that, with an impact speed of 36 mph in an offset head-on collision, the driver of the Bel-Air would most likely die, while the driver of the 2009 Malibu might be slightly injured, if at all. Indeed, in-vehicle injury reduction systems have been very effective in deaths reduction [26]. Additionally, in-vehicle technologies have been effective in crash prevention, with ADAS including electronic stability control, active cruise control with emergency braking, blind spot monitoring, brake assist, obstacle and collision warning, and lane departure warning and prevention. In the area of infrastructure, the risk of vehicles leaving the road has been greatly reduced with shoulder rumble strips and by providing adequate recovery space when vehicles do run off the road. Forgiving facilities include barriers to minimize head-on collisions and ensure that any collision with roadside objects will have lowered impact forces on vehicle occupants.

In summary, advanced vehicle safety and improved, forgiving infrastructure are at the core of sustainable safety. As manifested in the Dutch Sustainable Safety Program [27], the road and the vehicle protect drivers and those around them against major traffic hazards. It
is plausible to expect that technology and engineering will be at the core of the sustainable eradication of COVID-19 and might possibly be the key to the earlier and better detection and handling of the next medical pandemic.

5.2. Enforcement and Regulation

In contrast to the case of COVID-19, where the regulations and their enforcement are constantly shifting, nearly all countries now have well-established national policies and regulations for managing road safety. Many of these regulations concern driver (and even rider and pedestrian) behavior, and their enforcement, for the most part, is effective. For example, on July 1, 1975, Israel regulated the use of seatbelts in the front seats of vehicles on inter-urban roads. The passing of the law was accompanied by widespread media coverage and was followed with massive enforcement. Consequently, within a month, the use rates increased from approximately 6% to 77% [28]. In contrast, in the U.S., where initial seatbelt laws were secondary laws (another infraction had to be cited), and often carried no penalties for non-use, use rates remained quite low. This reflected the lack of political will to enforce a regulation that was imposed on the states by the federal government. When, finally, states started changing the seatbelt laws to primary laws and enforcing them, compliance rose to the current high European levels of over 90% [29]. Similarly, speed limit violations and DWI decrease whenever enforcement increases, and they increase when enforcement ceases [30].

In the case of COVID-19, governments have been under extraordinary pressure to swiftly develop policy responses to the pandemic and have generally used shortened administrative procedures and new forms of coordinating committees to urgently pass a range of crisis-related regulations [31]. Consequently, the regulations are often inconsistent, and their enforcement is low and irregular. As with road safety, in order to be effective, regulations should be clear, consistent, and perceived as appropriate by most of the public. This is complicated by the distribution of responsibilities among the different agencies and between local and federal governments, who often disseminate different messages. This is probably one of the major obstacles to controlling the spread of COVID-19 and “flattening the curve”. To overcome this, the delineation of responsibility among the regulating and enforcement agencies must be clarified and acceptable by all stakeholders.

5.3. Education and Public Information

In road safety, the role of education is not simply to improve knowledge, but to effect a sustainable behavioral change towards safer driving. Unfortunately, a change in knowledge only is not sufficiently effective in changing attitudes, and even less so in changing behavior. Attitude, a principal determinant of driving behavior, is much more affected by changes in emotional and in behavioral dispositions, and these are not easy to manipulate through information. Education and media play an important role in road safety, but only as a supplementary component in the safe system approach. All experts and researchers agree that education, public information, and media campaigns should be coordinated, advocate a clear message, offer motivation, provide tools to enhance the desired behavior, deal with barriers to implementation, and work towards the long-term maintenance and sustainability of safe behaviors. Furthermore, education aims to create social norms of safe behaviors both at the individual and the community levels, according to which individuals are encouraged to behave safely and eschew those that are not [32]. Approaches using scare tactics have been proven to be ineffective for behavioral change, and even counterproductive, as they might produce denial, avoidance, and anxiety and even promote increased risky behaviors. Over the years, message content has evolved from a call to personal behavioral change towards the creation of social norms that condemn unsafe behaviors. An example is drinking and driving. Although still not eradicated, it has become “socially unacceptable” in many communities and countries. However, it must still be part of the safe system approach. The Dutch Sustainable Safety approach emphasizes that “Human factors are the primary focus: by starting from the demands, competencies,
limitations and vulnerabilities of people, the traffic system can be realistically adapted to achieve maximum safety” [27].

The media’s role in fighting COVID-19 has not yet been thoroughly evaluated, but initial evidence [33] suggests that, here, too, scare tactics can be harmful. Fear appeals by politicians and health professionals are used to deter people from unwanted behaviors by showing graphic visuals of injuries and fatalities and alarming statistics regarding the exponential growth and outbreak of the pandemic and other extreme unwanted outcomes. Instead, to promote and encourage the desired behavior of using masks, social distancing and hand-washing media messages and campaigns should focus on raising awareness and motivation as well as providing practical and useful implementation practices. A major challenge for the media is how to address the gradual lifting of restrictions while still not resuming “normal” or pre-COVID-19 lifestyles. The equivalent challenge in the road safety arena is how to maintain alertness and attention to the road in the face of increasing automation.

Fortunately, public opinions related to COVID-19 do not suffer from some of the myths that accompany the road safety domain, and with which safe driving information campaigns must cope. Too many drivers and road users believe that an accident “will not happen to me”, “crashes happen to unsafe people”, and “I am in control”. Regarding COVID-19, however, the overwhelming message that seems to be validated as the pandemic spreads is that “everybody and anyone can get it” and that “nobody is in control”. Public acceptance of these messages has to do with the current huge salience of COVID-19, the speed of its spread, and its large and conspicuous impact.

6. Management and Strategic Approach

Management involves multiple dimensions. In this section, we focus on those that we consider critical to successful management and to the constructive comparison of the two epidemics considered in this paper.

6.1. Strategic Goals

The strategic goals of “managing” the two epidemics are only now converging: total eradication of fatalities. In medical epidemics, the prevailing management strategy is a two-step process: containment, followed by eradication. The goal of containment is to slow or limit the spread so as not to overwhelm the health delivery system. Eradication is a slower process that typically requires the development of an antibody stimulant to fight the antigen.

Until recently, the goal for MVC injuries was very different. MVC injuries were considered as part of the cost of mobility, and the strategic goals of most countries were to simply reduce them. Thus, the UN in its Decade of Action for 2011-2020 called for a 50% fatality reduction, a goal that was considered quite challenging—and indeed was not achieved in most countries. The significant transformational change came about when Sweden, in 1996, declared a new strategic goal—“Vision Zero”—according to which no one should be killed on its roads [19]. Its underlying ethical principle is that “it can never be ethically acceptable that people are killed or seriously injured when moving within the road transport system.” Vision Zero functions to guide strategy selection and not to set particular goals or targets. This approach is contrary to the one that prevailed earlier in most countries, according to which road users bear the primary responsibility for their safety. Vision Zero changed this relationship by emphasizing that responsibility is shared by transportation system designers and road users, and that the former should anticipate and design the roads and vehicles to compensate for human foibles. Still, as a goal, Vision Zero, when first presented, lacked a timeframe for its achievement. This is now being remedied as the different organizations that adopt it have included deadlines for its achievement.

The Netherlands expanded and generalized the Swedish Vision Zero into its Sustainable Safety vision, according to which, “A sustainably safe road traffic system prevents road deaths, serious road injuries and permanent injury by systematically reducing the
underlying risks of the entire traffic system” [27]. This vision is commonly known also as the “safe system approach” because it encompasses the system in its entirety. Whereas, until the 1960s, crashes (then called “accidents”) were mainly accepted as “bad luck” or the result of human errors, the current approach is to focus on the potential preventive role of road and vehicle features and to identify organizational factors that can increase responsibility and accountability at the national level.

6.2. Prevailing Treatment Approach

In the case of health, the prevailing model of handling an epidemic is the classic medical model: a solution (antidote/vaccine) can only be found after the pathogen is identified. Unfortunately, this model is quite inappropriate for MVC, as MVC are typically the result of several different “causes”, and the definition of a cause is problematic as well [9,34–36]. The emerging treatment approach is to address MVC as the outcome of a system failure, and their reduction or elimination must therefore be treated within the realm of the complete transportation system, using models such as the safe system approach and its application in Vision Zero (Sweden and Norway) and Sustainable Safety (The Netherlands).

Interestingly, at the international level, the WHO has attempted to address the two epidemics in a similar system-based fashion using the term “pillar” for the traditional term of system component. To overcome medical epidemics, the WHO posits four pillars: creating a single framework, setting up health delivery systems and programs that get results, defining an effective role for WHO at country level, and defining the role of WHO in the international health systems agenda [37]. To combat MVC, WHO proposes a system consisting of five pillars: road safety management, improvements in infrastructure, creating safe vehicles, improving road user behavior, and improving post-crash response [38,39]. While work on each of these components is to be carried out by the individual countries, guidance and coordination is to be done by the WHO. Thus, despite the use of the same term, “pillar”, the substance of the pillars in the case of the two epidemics is very different. They are process-oriented for dealing with medical epidemics, giving WHO a central role, and they are both physical component- and process-focused for dealing with MVC through its three constituents (roads, users, and vehicles), post-crash treatment process, and policy/management of the whole effort—all being handled by the individual countries. It is only in the last component—policy/management—that the two epidemics converge, at least in name.

Not surprisingly, the Dutch Sustainable Safety approach is also centered around five similar principles: three design principles (functionality, homogeneity, and predictability) and two organizational principles (responsibility, learning and innovation). This systematic approach set an international example and made the Netherlands a top-ranking player in the field of road safety [27].

A very visually appealing model to describe accident progression, causation, and treatment was suggested by James Reason [40]. Reason argues that in an ideal world, each defensive layer would be intact and foolproof. However, in reality, each layer is more like a slice of a Swiss cheese, having many holes. Because the holes in the different layers do not necessarily overlap, a negative outcome occurs only in the unfortunate coincidence of many overlapping holes. The metaphor of the Swiss cheese is consistent with the safe system approach, which is applicable to both the road safety and the health system domains, where each slice of cheese is one of the pillars mentioned above. In the MVC domain, all layers (pillars) are known and dealt with. In the COVID-19 case, the model needs to expose layers that are yet unknown, neglected, or malfunctioning (e.g., hospital capacity, respirator availability, management and enforcement of home quarantines) and deal with them. An example of a malfunctioning layer for the case of COVID-19 is the current, much-delayed dissemination of vaccinations. Although, in many regions, vaccines are available, policies regarding priorities and administration, as well as the logistics of
implementation, are preventing their widespread application. Furthermore, obstacles such as low public acceptance seem to be being addressed ineffectively.

6.3. Urgency of Implementation

Urgency of implementation depends on objective external issues: the availability of a “remedy”, the rate of spread of the pandemic, and its criticality. Medical pandemics in general, and COVID-19 in particular, differ significantly from MVC on all three issues.

In contrast to COVID-19, the rate of spread of the MVC has been decreasing in a slow and stable manner over the past few decades. This suggests that, despite the growth in mobility, countermeasures are working, though at a slow rate. Various remedies are being implemented at different times, at different rates, and with different success rates depending on funding (mostly in infrastructure design and construction), political leadership and will (against multiple interest groups), and public acceptance (mostly where behavioral measures are concerned).

The criticality of the MVC is a problematic issue. Objectively, the cost in lives lost is huge and persists from year to year. Furthermore, its victims are mostly the young, while COVID-19’s victims are mostly the elderly. However, perceived criticality, or salience, is much lower. The high salience of COVID-19 creates an opportunity for dealing with it urgently, persistently, and thoroughly until its eradication, using extreme measures that are not available to manage the MVC.

Urgency of implementation can also help to explain why some of the best-performing countries on the MVC front fare poorly in their COVID-19 performance. As the time factor is so crucial in COVID-19 and less so in road safety, it is possible that countries that excel in their thorough systematic approach to MVC (e.g., the UK, the Netherlands, Sweden) are less capable of generating quick measures, regulations, and enforcement acts. In addition, western countries are more sensitive to human rights, privacy, and equality, and hence are more hesitant to adopt emergency ad-hoc measures.

6.4. Key Success Factors

By now, it is clear that some countries are faring better than others in the management of COVID-19. Despite hugely varied characteristics among countries, some common threads in better-performing countries can be observed. South Korea has formalized its success by the three Ts: Test, Trace, and Treat. Knowledge sharing, transparency, and civilian participation were also key factors in its success. New Zealand, the first country that officially announced the total eradication of COVID-19, pursued a very aggressive policy that included travel restrictions, manufacturing and use of personal protective equipment, massive testing, contact tracing, and lockdowns. Although New Zealand’s restrictions appear to have elicited a high level of voluntary compliance, police encouraged citizens to report violations and many citizens did so. The combination of nationwide, mandatory, and enforced restrictions—framed by Prime Minister Ardern’s appeals to a shared sense of civic purpose, and the promise of a short duration—appear to have achieved broad public support and a remarkably high level of overall compliance. In Taiwan, a country with a population of 23 million people, there are only 955 detected COVID-19 cases and nine deaths (updated to 3 March 2021). The Ministry of Health and Welfare attributed this success to eight factors: lessons learnt from the SARS coronavirus experience, information transparency, timely border control, advanced medical technology, central epidemic command center, good resource allocation, smart community transmission prevention, and good etiquette of citizens [41].

As for MVC, there is a wealth of evidence-based information, textbooks, and best practices for successful fatality reduction and maintenance of good road safety performance (e.g., [9,10,30,42]). The key is a dedicated (and funded) long-term road safety plan according to the principles of the sustainable safe system approach and evidence-based operations and countermeasures. Such plans typically include managerial, strategic, and operational programs and work plans that adhere to the safe system principles. These include the
principle that road design has to be forgiving of human error so that road users are not killed or seriously injured in any crash. Consequently, road safety plans focus on coordinated and accountable leadership and management, safer roads, safer vehicles, safer road users, lower speeds, effective post-crash response, and efficient trauma treatment. Close monitoring and analysis of the system need to be continuously administered and timely feedback must be provided to the decision-makers. Finally, in order to maintain the long-term effects and guarantee sustainability, the responsibility and accountability of the leading agencies at the highest national level must be ensured.

7. Conclusions

While medical epidemics have been occurring over the past few centuries, neither their frequency nor their extent and fatality rates seem to decrease over time. In contrast, MVC rates (relative to total distance driven, or population size) are slowly but consistently decreasing despite the growth in vehicles and mobility worldwide. Though both are now acknowledged as national and global epidemics, their treatment and success in treatment differ markedly. We have shown that the two epidemics are comparable and, therefore, one should be able to learn from the latter to improve the former.

Comparisons between the two are briefly summarized in this paper to highlight both similarities and differences. Whereas road crashes are decreasing but, for the foreseeable future, are here to stay, the spread of COVID-19 was rapid, then started to decline, and then resurfaced (in some places with vengeance) in second and third waves and may remain until an effective vaccine is disseminated, accessible, and accepted by nearly everyone. Though policy transfer between the two domains is not easy or straightforward, it seems that, given the injury prevention nature of the two epidemics addressed in this paper, some lessons can be learned, and extrapolations from one to the other can be made.

7.1. What Can COVID-19 Management and Handling Learn from Road Safety?

1. Aggressive leadership that starts at the top of the relevant regulatory agency—the national government—is essential.
2. A clear, holistic, science-based strategy (such as safe system and sustainable safety) is the most effective approach. All relevant countermeasures must be evidence-based and coordinated. Disparate, short, labor-intensive, and uncoordinated efforts create confusion and guarantee failure, especially when some are contrary to existing science.
3. A system approach that includes all of the interdependent components maximizes effectiveness while ensuring some useful redundancy (such as in the Swiss cheese model). It is effective in the initial spread of the epidemic and in subsequent waves.
4. Enforceable policy must be at the root of all regulatory involvement. Its effectiveness is enhanced when it is made acceptable to the public by education and public information.
5. The spread of the epidemic and the characteristics of those who contract the virus must be tracked on multiple levels (geographic, sociodemographic, hubs, and concentration) to assist in fine-tuning the regulations.
6. Rates and trends of morbidity and mortality should be continuously monitored so as to determine their relationship with behavior and performance. Improvements, e.g., through advanced technologies in road safety and fewer restrictions on daily life in pandemic scenarios, can then follow.
7. Sustainability is key to the required behavioral adaptation. For example, using seatbelts and helmets has become a normative habitual behavior for most drivers and riders in the developed world. Similarly, wearing masks, social distancing, and maintaining basic hygiene standards during the COVID-19 epidemic should become habitual.
8. The regulations should be sensitive to changing trends in behavior and technological innovations. For example, the advent and rapid spread of cellphone use in cars was followed by studies that demonstrated their impact on distracted driving and crashes,
which were in turn followed by various regulations and technologies to restrict their use while driving.

9. Technology and engineering measures are at the core of the detection, monitoring, and eradication of the pandemic. Consistent and funded efforts should be carried out while maintaining international collaboration and the dissemination of knowledge and knowhow to ensure consistent progress and usage of advanced technologies.

10. Scare tactics are generally counterproductive. Although amply demonstrated in the driving domain, they seem to dominate the public information related to COVID-19. When positive messages are not possible, negative messages must be accompanied by practical means to reduce the fear and threat appeal.

11. Ethical issues must be addressed, especially with respect to invasion of privacy, personal freedom, and ownership of data. Regulations must be moral, transparent, and sensitive to the basic principles of respecting individuals’ privacy and freedom.

12. Public trust is important for the adoption of many behavioral countermeasures. Though automation and advanced technologies can have major benefits, the regulator must ensure the public’s trust in them. One way to gain this trust is through knowledge sharing and transparency [43].

7.2. What Can Road Safety Learn from the COVID-19 Experience?

Throughout this paper, we have emphasized the wealth, rigor, and evidence-based foundations of road safety as a multi-disciplinary domain with a sustainable road safety vision and practice. Still, we believe that some lessons can be learnt from the chaotic and unexpected outbreak of COVID-19.

1. The first and foremost lesson is the importance of the urgency of detection, recognition, and initiation of policy and measures. Leading countries in road safety performance (such as the UK, the Netherlands, Sweden) failed to promptly declare a state of emergency and were hesitant in imposing restrictions, causing a loss of precious time while allowing the pandemic to spread. Similarly, in the road safety arena, there are instances in which the industry and the road users act faster than the authorities, which creates irreversible behavior patterns, as was the case with cellphone usage while driving.

2. Eradication of dangerous and risky behaviors demands strict measures. Speeding, for example, is known to be one of the leading causes of road crashes. Technically, it is possible today, with the help of sustainable advanced technologies, to make sure that drivers do not speed (by putting speed limiters in cars, for example), or to ensure that, each time they speed, they will be detected and punished. Nevertheless, speeding continues to be a major cause of MVC because the political will to completely eliminate it is lacking.

3. Public acceptance of limitations during the COVID-19 pandemic is, in general, overwhelming, even though privacy is compromised, personal comfort is marred, and basic liberties are hindered. How can road safety measures experience similar acceptance? This is probably not so easy to achieve. However, generating an increase in the continued salience of MVC might help.

4. Expect the unexpected and be prepared to make quick adjustments. This theme contradicts the complacency of accepting MVC as a part of life and the associated myths of “it will not happen to me” and “I am in control”.

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**References**

1. Gordon, J.E. The epidemiology of accidents. *Am. J. Public Health Nations Health* **1949**, *39*, 504–515. [CrossRef] [PubMed]
2. Haddon, W.J., Jr. The prevention of accidents. In *Preventive Medicine*; Clark, D.W., MacMahon, B., Eds.; Little, Brown and Company: Boston, MA, USA, 1967; Volume 33, pp. 591–621.
3. Dellinger, A.M.; Sleet, D.A. From Modest Beginnings to Winnable Battle: 20 Years of Road Safety Efforts at CDC’s Injury Center. *J. Saf. Res.* **2012**, *43*, 279–282. [CrossRef] [PubMed]
4. Lamont, M. An epidemic on wheels? Road safety, public health and injury politics in Africa. *Anthropol. Today* **2010**, *26*, 3–7. [CrossRef]
5. Nantulya, V.M.; Reich, M.R. The neglected epidemic: Road traffic injuries in developing countries. *BMJ* **2002**, *324*, 1139–1141. [CrossRef]
6. Hays, J.N. Epidemics and Pandemics (*Their Impacts on Human History*), 1st ed; ABC Clio: Santa Barbara, CA, USA, 2005.
7. WHO. HIV/AIDS. Key Facts. 21 February 2020. Available online: [https://www.who.int/news-room/fact-sheets/detail/hiv-aids](https://www.who.int/news-room/fact-sheets/detail/hiv-aids) (accessed on 7 February 2020).
8. WHO. Road Traffic Injuries. 2020. Available online: [https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries](https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries) (accessed on 7 February 2020).
9. Shinar, D. *Traffic Safety and Human Behaviour*; Emerald Group Publishing: Bingley, UK, 2017.
10. WHO. World Report on Road Traffic Injury Prevention. 2004. Available online: [https://www.who.int/publications/i/item/world-report-on-road-traffic-injury-prevention](https://www.who.int/publications/i/item/world-report-on-road-traffic-injury-prevention) (accessed on 11 March 2021).
11. Wikipedia. List of Epidemics. 2020. Available online: [https://en.wikipedia](https://en.wikipedia) (accessed on 29 April 2020).
12. Bush, G.W. If We Wait for a Pandemic to Appear, it Will be too Late to Prepare. 2005. Available online: [https://abcnews.go.com/Politics/george-bush-2005-wait-pandemic-prepare/story?id=69979013](https://abcnews.go.com/Politics/george-bush-2005-wait-pandemic-prepare/story?id=69979013) (accessed on 11 March 2021).
13. Obama, B. NIH Talk. Available online: [https://www.youtube.com/watch?v=oDHmXdcdShE](https://www.youtube.com/watch?v=oDHmXdcdShE) (accessed on 11 March 2021).
14. Davies, S.E. National security and pandemics. *UN Chron.* **2013**, *50*, 20–24. Available online: [https://www.un.org/en/chronicle/article/national-security-and](https://www.un.org/en/chronicle/article/national-security-and) (accessed on 11 March 2021). [CrossRef]
15. WHO. Global Status Report on Road Safety. 2018. Available online: [https://www.who.int/publications-detail/global-status-report-on-road-safety-2018](https://www.who.int/publications-detail/global-status-report-on-road-safety-2018) (accessed on 11 March 2021).
16. Hilton, J.; Keeling, M.J. Estimation of country-level basic reproductive ratios for novel Coronavirus (SARS-CoV-2/COVID-19) using synthetic contact matrices. *PLoS Comput. Biol.* **2020**, *16*, e1008031. [CrossRef]
17. Unger, J.-P. Comparison of COVID-19 Health Risks with Other Viral Occupational Hazards. *Int. J. Health Serv.* **2021**, *51*, 37–49. [CrossRef]
18. Johns Hopkins University, Corona Virus Resource Center. As of 10 February 2021. Available online: [https://coronavirus.jhu.edu/data/mortality](https://coronavirus.jhu.edu/data/mortality) (accessed on 11 March 2021).
19. Tingvall, C. The zero vision. In *Sustainable Safety*, 3rd ed.; Principles for Design and Organization of a Casualty Free Road Traffic System; SWOV Institute for Road Safety Research: Leidschendam, The Netherlands, 2018.
20. Hakkert, A.S.; Zaidel, D.M.; Sarelle, E. Patterns of safety belt usage following introduction of a safety belt wearing law. *Accid. Anal. Prev.* **1981**, *13*, 65–82. [CrossRef]
29. NHTSA. Seat Belt Use in 2019—Use Rates in the States and Territories; CrashStats Traffic Safety Facts. Report No. DOT HS; U.S. Department of Transportation: Washington, DC, USA, 2020; Volume 812, p. 947.

30. Elvik, R.; Høye, A.; Vaa, T.; Sørensen, M. The Handbook of Road Safety Measures, 2nd ed.; Elsevier: Amsterdam, The Netherlands, 2009.

31. Organisation for Economic Co-operation and Development (OECD). Regulatory Quality and Covid-19: The Use Of Regulatory Management Tools In a Time Of Crisis; OECD: Paris, France, 2020.

32. Guttman, N. Communication, Public Discourse, and Road Safety Campaigns: Persuading People to Be Safer; Routledge: New York, NY, USA, 2014.

33. Stolow, J.A.; Moses, L.M.; Lederer, A.M.; Carter, R. How Fear Appeal Approaches in COVID-19 Health Communication May Be Harming the Global Community. Health Educ. Behav. 2020, 47, 531–535. [CrossRef] [PubMed]

34. Hauer, E. An exemplum and its road safety morals. Accid. Anal. Prev. 2016, 94, 168–179. [CrossRef] [PubMed]

35. Hauer, E. Engineering judgment and road safety. Accid. Anal. Prev. 2019, 129, 180–189. [CrossRef] [PubMed]

36. Shinar, D. Crash causes, countermeasures, and safety policy implications. Accid. Anal. Prev. 2019, 125, 224–231. [CrossRef] [PubMed]

37. WHO. Everybody Business: Strengthening Health Systems to Improve Health Outcomes: WHO’s Framework for Action. 2007. Available online: https://www.who.int/healthsystems/strategy/everybodys_business.pdf?ua=1 (accessed on 11 March 2021).

38. WHO. Global Plan for the Decade of Action for Road Safety 2011–2020. Version 3. 2009. Available online: https://www.who.int/roadsafety/decade_of_action/plan/global_plan_decade.pdf (accessed on 11 March 2021).

39. WHO. Global Plan for the Decade of Action for Road Safety 2011–2020. 2011. Available online: https://www.who.int/roadsafety/decade_of_action/plan/plan_english.pdf?ua=1 (accessed on 11 March 2021).

40. Reason, J. Human error: Models and management. BMJ 2000, 320, 768–770. [CrossRef] [PubMed]

41. Taiwan Ministry of Health and Welfare. Crucial Policies for Combatting COVID-19. 7 July 2020. Available online: https://covid19.mohw.gov.tw/en/np-4769-206.html (accessed on 11 March 2021).

42. NSW. New Road Safety Strategy 2012–2021; NSW Government: Tamworth, NSW, Australia, 2012.

43. Manchon, J.B.; Bueno, M.; Navarro, J. From manual to automated driving: How does trust evolve? Theor. Issues Ergon. Sci. 2020, 1–27. [CrossRef]