Carcione. Top Ital. sci. j. 2025;2(2)
https://www.doi.org/10.62684/TEIN7749

Top Italian Scientists Journal

Open Access | Article | Biomedical Sciences

ISSN 3033-5132

COVID-19 pandemic and the anti-vax problem

José M. Carcione

National Institute of Oceanography and Applied Geophysics – OGS, Trieste, Italy.
Email: jcarcione@ogs.it

Published: 3 Mar 2025

Abstract

We present a literature review of recent articles about the COVID-19 pandemic in view of the anti-vax arguments. In Italy, the (unvaccinated) anti-vax population, or anti-vaxxers, amounted to around six to seven million people, including 10% of physicians at the end of the pandemic. The main arguments were and still are: a) the vaccine did not prevent infection (contagion); b) the vaccine does more harm than good and even causes death; c) the defamation of the vaccine (such as serum, drugs, microchips, etc.); c) the virus was created by the health corporations to sell the vaccine, d) the so-called green or vaccination passport, protection masks and lockdown were a restriction of freedom and should be banned; e) the condemnation of science as it represents the interests of the pharmaceutical companies; etc. Ironically, some of these measures protected the anti-vaxxers and the entire population when unvaccinated people occupy the hospitals and prevent cures due to other causes. One could ban cures to anti-vaxxers, and that is an actual restriction of rights that the state cannot claim, otherwise one should apply the same criterion to tobacco smokers, people who do not wear seat belts and get injured, etc.

It is undisputed that vaccines, like any other medicine, have side effects. However, the benefit-risk ratio strongly favors vaccination in old people and patients with age-related or other underlying diseases. Mathematical modeling and statistics are essential for managing a pandemic. Decisions should not be made on the basis of single cases. Interrupting vaccination due to single events could cost the lives of millions of people to avoid adverse effects on a negligible number of people. The reviewed studies clearly show the efficacy of the vaccines, i.e. the high benefit-risk ratio, even if the adverse effects are taken into account, i.e. no-vaccine means orders of magnitude more deaths. The anti-vaccine stance was another problem within the pandemics, causing more deaths attributable to the virus and preventing the cure of other causes in intensive-care units. However, one aspect must be clear: COVID-19 is risky for people over 60 years old and for those with pre-existing conditions. These population groups should be prioritized for vaccination. Youngers (say, under 60) anti-vaxxers could have no harmful effects on society, apart from influencing old and fragile people to avoid vaccination, which is, however, a factor that should not be neglected.

The purpose of this paper is to refute all anti-vax arguments based on current data and evidence.

Keywords: anti-vaxxers; COVID-19 pandemic; green pass; vaccine

Introduction

A coronavirus disease (COVID-19) began at the end of 2019 in Wuhan (China), where the severe acute respiratory syndrome coronavirus 2 was detected for the first time. By the end of September 2022, nearly 600 million cases and 6 million deaths had been detected worldwide [6]. The present reported deaths are approximately 7 million (https://www.worldometers.info/coronavirus).

Immediately after the first wave in Italy, we used an epidemiological SEIR model to simulate the pandemic in Lombardy and calculated the infected population and mortality rate [5]. The results showed a mortality rate of 0.00144/day (IFR = 0.57 %). Subsequent studies have confirmed this result [21]. These studies showed that the mortality rate for COVID-19 can be up to seven times higher than for influenza. Carcione and Ba [4] identified several shortcomings in the management of the Italian pandemic, namely the composition of the

Scientific Committee (CTS), delays in preventing the first wave, the failure to predict the second wave, a flawed vaccination campaign, the incorrect use of the vaccination certificate, misinformation in the media, the failed application of contact tracing and the persistence of the pandemic due to the problem of anti-vaxxers. Vaccine hesitancy is an additional risk factor alongside COVID-19, as it poses a high mortality risk and encourages elderly and sick people of all ages to refuse vaccination.

Carcione et al. [5] and Carcione and Ba [4] have shown that the mortality risk increases from the age of 60-65 years approximately like a Gaussian curve. However, in the first phase the Italian government experts (CTS) recommended vaccination on the basis of the risk of infection (the so-called categories: school employees, lawyers, etc.) and not on the basis of the risk of death. Italian mathematicians [8] calculated the deaths caused by missed vaccinations using the SEIR model. They concluded that the number of additional deaths would be around 2500 if vaccinations were delayed by 30 days.

The defamation of the vaccine (like serum, drugs, microchips, etc.) by the media and some politicians is illustrated by the AstraZeneca case. In terms of adverse effects, there were 7 deaths from thrombosis (blood clots) in 18 million people vaccinated in the UK with this vaccine (https://www.bbc.com/news/health-56620646), compared to 1.6 per 1000 annually [27]. Non-vaccination with the AstraZeneca vaccine has led to thousands of deaths in Italy [8].

Examples of misinformation can be found in Carcione and Ba [4]. Many emphasize that the vaccine is ineffective because it does not prevent infections (contagion), ignoring the fact that it can significantly reduce the risk of severe disease. The false argument relates to the risk of infection and not to the significant reduction in the risk of death. Even in peer-reviewed papers, false information is being spread. For example, the fraudulent 1998 Lancet publication by Wakefield, which after 12 years has done considerable damage. Eventually this paper was retracted by the journal in 2010 [7]. Unfortunately, false claims reaches the public via the media.

In Italy, almost 12 million people were not vaccinated in September 2021. Paradoxically, the green passport protected vaccine opponents because it prevented them from being in crowded places and indirectly protected the entire population because it prevented the increase of COVID-19 patients in intensive care units. From May 1, 2022, the green passport was

abolished and the obligation to use ffp2 masks was maintained until June 15. The opposite should be the case, with the mask requirement only applying to anti-vaxxers. From 01.02.2021 to 10.01.2022, there were 46,572 COVID-19 positive deaths. (www.epicentro.iss.it, report-COVID-2019_10_january_2022.pdf). Of these, 41,227 deaths were among unvaccinated people and those with an incomplete vaccination cycle (almost 90% of all deaths), while 5,345 deaths were among vaccinated people with a complete vaccination cycle (around 10%). So 90% compared to 10%. The average age of those vaccinated was 80 years, and almost all of them already had a previous illness.

On November 1, 2022, the new (current) Italian government allowed vaccination opponents to resume work, citing a worrying shortage of medical staff and a decline in COVID-19 cases. The anti-vaccination campaigners were constantly spreading misinformation about the COVID-19 vaccine, and even proposing alternative ineffective cures [17]. Physicians' reluctance to vaccinate is greater than expected: 1 in 10 do not believe vaccines are the solution to the pandemic. Misconceptions about vaccines are a threat to global health, despite 200 years of empirical evidence of vaccine efficacy [11].

Recent research

This section mainly reports on peer-reviewed studies. At the beginning of the pandemic, there were the miraculous home treatments. We give just one example here, namely the use of azithromycin. The international literature shows that there is no evidence that taking azithromycin affects the development of COVID-19 or reduces transmission [14,17]. Whoever has treated the COVID-19 virus with this antibiotic should simply publish the results in a scientific journal and face the opinion of peers. Fake, misleading and over-interpreted health messages are a potential threat to public health.

Xu et al. [29] analyzed all deaths between December 14, 2020 and August 11, 2021 in individuals from eight Vaccine Safety Datalink sites following a first series COVID-19 vaccination in the United States. They conclude that no increased risk of non-COVID-19 mortality was found among vaccine recipients, supporting the proven safety of the vaccines. Anti-vaccine sentiment is increasingly associated with conservative political positions. Republican-inclined states in the US had lower COVID-19 vaccination rates. Asch et al. [2] examined reports of adverse effects following COVID-19 vaccination from 2020 to 2022,

using influenza vaccines from 2019 to 2022 as a reference. This study found that the more heavily states were inclined toward voting Republican, the more likely vaccine recipients were to report adverse effects from the COVID-19 vaccine. These results suggest that either the perception of adverse effects or the motivation to report them is related to political inclination. Obviously, this does not mean that non-Republican voters had less adverse effects.

Liko et al. [18] determined the risk of sudden cardiac death in adolescents and young adults (aged 16-30 years) after COVID-19 vaccination in the period June 2021–December 2022. The data do not support an association between receipt of the COVID-19 mRNA vaccine and sudden cardiac death in previously healthy young people.

Fasce et al. [9] examined 152 scientific articles and analyzed the arguments against vaccination thematically. Effective refutation of these arguments requires consideration of the underlying psychological characteristics that drive a person's belief -- opposition to vaccines. They developed a hierarchical taxonomy that associates common arguments and themes with 11 underlying attitudes that explain why a person might oppose vaccination.

The most important is a conspiracy theory attitude, i.e. a) Government cover-up: health authorities and corporations conspire to withhold important information from the public; b) Big Pharma: pharmaceutical companies conspire to make a profit or test new drugs; c) Population control: vaccines are a means to sterilize, depopulate or persecute the existing population; d) Invented threat: vaccine-preventable diseases are exaggerated or do not exist; e) Targeting the disadvantaged: Vaccines are intended to harm disadvantaged groups or poor countries. Other causes are:

- Corporate information about vaccines is motivated by financial interests.
- Traditional and natural remedies (e.g. homeopathy) have a similar healing record and no side effects.
- The disease will disappear on its own as it follows a natural cycle (herd immunity) [this is probably true after a high cost of lives].
- The science and policies behind vaccination are driven by political and economic goals.
- Not allowing religious exemptions from vaccination is perceived as discriminatory.
- All or nothing: We should not accept anything that is less than 100% effective.

- Vaccinations are perceived as an authoritarian or totalitarian violation of civil liberties [freedom has no limits].

The universal nature of the COVID-19 pandemic gave vaccination opponents a much larger and broader field of activity. As the pandemic spread, anti-vaccination activists capitalized on discontent by appealing to health freedom in opposition to public health measures, neglecting the severity of COVID-19. Capriano et al. [3] noted that without concerted efforts against the anti-vaccination movement, the US would face an ever-growing mortality burden from an increasingly under-vaccinated and unvaccinated society. They suggest separating narratives about freedom from anti-vaccination attitudes.

Of the studies that consider the COVID-19 vaccines to be harmful, the one by Mostert et al. [19] should be mentioned, which found that excess mortality persisted even after administration of the vaccine. However, cause-specific mortality data were not fully available, so a detailed, direct and robust analysis to identify the underlying factors was not possible. This is in contrast to the analysis by Carcione and Ba [3, Fig. 4], who compared the number of people who died in an average of 7 days around December 6, 2020 (without vaccine) and around December 6, 2021 (with vaccine) as a function of the total population (in millions of people). In Italy, there were about 100 victims per day in 2021. These deaths are largely attributable to the anti-vaccine population.

The adverse effects observed by Li et al. [16] were only headache, pyrexia and fatigue to a comparable extent, and they observed a decreasing rate over time. Another study is that of Hulscher et al. [13], which linked the vaccine to deaths from myocardial infarction (28 cases). The authors acknowledge the limitations resulting from the small sample size and selection bias, which may exclude undetected cardiotropic agents, alcohol and drug abuse, all of which compromise validity.

The efficacy of the vaccines is demonstrated by Polack et al. [23], who considered a total of 43,448 participants who received injections: 21,720 with BNT162b2 and 21,728 with placebo. There were 8 cases of COVID-19 occurring at least 7 days after the second dose in participants given the BNT162b2 vaccine and 162 cases in participants given placebo; the vaccine was 95% effective in preventing COVID-19. Vaccination is undoubtedly an important tool in containing the pandemic and the vaccines are central to saving thousands of lives. However, adverse effects following vaccination have also been identified (e.g. [25]),

and research to avoid these drawbacks should continue in order to increase the benefit-risk factor. The most frightening side effect was blood clots. In this context, although a small risk of blood clots is possible in some people taking the AstraZeneca vaccine, this risk is much lower than with many other things, including the contraceptive pill – and significantly lower than the risk of blood clots after COVID-19 infection, although there are different kinds of clots. In Denmark [22] the number of venous thromboembolic events from 2010 to 2018 were 1.76 every 1000 aged 18-99. In a population of 5 million people this would mean 170 per week. The data suggest that the reported number of thromboembolic events among Europeans who have received the Oxford–AstraZeneca COVID-19 vaccine does not seem to be increased relative to the expected number estimated from incidence rates from the entire Danish population before the introduction of the vaccination programme [22]. The coronavirus poses a greater risk than the vaccines [24].

Alessandria et al. [1] examined the effects of the vaccination campaign in the province of Pescara, Italy, by comparing the risk of deaths of all types between the vaccinated and unvaccinated population. They suggest that vaccines may have unintended effects on overall mortality. The results show that the group that had received at least one dose had a significantly lower overall mortality risk compared to the unvaccinated, but surprisingly, those who had been vaccinated with multiple doses had a comparable risk, suggesting that the booster doses are ineffective or even harmful, in contrast to a previous study with the same data [10]. In a similar study, Nafilyan et al. [20] showed that there is no significant increase in cardiac mortality or all-cause mortality in the 12 weeks after COVID-19 vaccination compared to more than 12 weeks after one dose. A positive SARS-CoV-2 test is associated with increased cardiac and all-cause mortality in vaccinated or unvaccinated individuals at the time of testing, implying that the virus, not the vaccine, is the main cause of risk. A significant decrease in recorded all-cause deaths attributable to the first two weeks after vaccination was found, as well as a lower risk of hospitalization in the first two weeks after vaccination (regardless of the number of doses). As mentioned above, Fig. 4 in Carcione and Ba [4] showed the benefits of vaccination. For a country with 80 million inhabitants, for example, the results show that the number of deaths could be reduced by a factor of about 5, considering that the deaths are mainly due to the anti-vaxxers (in Italy there were almost 12 million anti-vaxxers in September 2021).

Yandle [30] reviews the Vaccine Damage Project (https://perma.cc/59KJ-3R4Z), which claims that vaccines led to 310,000 additional deaths among Americans aged 25 to 64 in 2021 and 2022. She shows that serious adverse events were uncommon in large, randomized mRNA vaccine trials and occurred at a similar rate among people who got the vaccines and those who got the placebos (unvaccinated).

Ward et al. [28], considering almost 40 million adults aged 50 to 100 years, showed in their Fig. 1 that the association between age and COVID-19 death increases from the age of 60 to 70 years, which is consistent with Fig. 2 of Carcione and Ba [4], who showed that the risk of death increases roughly like a Gaussian curve from the age of 60 to 65 years. The risk of an 80-year-old was 46 times higher for COVID-19-related deaths and 30 times higher for non-COVID-19-related deaths compared to a 50-year-old. Women had a lower risk of both deaths than men. By May 2021, around 10 million people had been vaccinated in Italy, half of whom were under 65 years old, which clearly ignores the age factor.

Anti-vaxxers use data from the US VAERS (Vaccine Adverse Event Reporting System) to back up their claims. From December 2020 to August 2021, more than 469 million doses of the COVID-19 vaccine were administered in the US, and VAERS has received 10,483 reports of deaths (0.0022%). However, this statistic does not indicate the cause of death in these people. Vaccine opponents use the VAERS numbers to make statements that infer cause and effect. This misinformation then influences some people not to get vaccinated. The numbers are correct, but the conclusions are not (https://www.muhealth.org).

The COVID-19 pandemic led to the largest sustained decline in vaccination coverage in the last three decades. Anti-vaxxers and other factors added new risks, as post-pandemic social, political and economic disruptions may lead to persistently low vaccination coverage, causing additional non-COVID-19 deaths [12]. Geopolitical wars have also taken place. For example, the Pentagon launched a military program to undermine China during the pandemic under former President Donald Trump and continued it for months after Joe Biden's presidency, Reuters found, even after alarmed social media executives warned the new administration, that the Pentagon was trading on COVID misinformation (see the article by C. Bing and J. Schectman: Pentagon ran secret anti-vax campaign to undermine China during pandemic. A Reuters investigation, filed June 14, 2024. https://www.reuters.com).

Turner et al. [26] showed that the "We Can Do This COVID-19 public education campaign" saved more than 50,000 lives in the US and prevented hundreds of thousands of hospitalizations and millions of COVID-19 cases, representing hundreds of billions of dollars in benefits in less than one year, indicating that public education campaigns are a cost-effective approach to reducing COVID-19 morbidity and mortality.

A false claim: If you are not vaccinated, you can get COVID-19 and have a survival rate of 98%, as this percentage implies that you do not need to be vaccinated. This claim is misleading and dangerous. The national average cannot be used to calculate the probability of a person dying from the virus. The probability of a COVID-19 infection causing death increases dramatically with age (above 60 years) and if the patient has previous pathologies. Example: in Italy, about 30% of the population is over 60 years old. We know that the mortality risk for COVID-19 follows a semi-Gaussian curve starting at age 60 [4]. The Italian population is about 58 M (million). So if 98% of the 58 M survive, we obtain 56.84 M. Neglecting severe pathologies of under 60, since these have a survival rate of about 100%, (58-56.84) M = 1.16 M deaths are over 60. Since there are 17.4 million people over 60, their risk of death is 1.16M/17.4M = 6.66%, a huge percentage. With this probability, nobody would play Russian roulette with COVID-19. The number of deaths in Italy amounted to approximately 0.2 M as of January 1, 2025. (https://www.worldometers.info/coronavirus). Then, based on 98%, only 17% of the 1.16 million died, which can be attributed to the success of the vaccine. On June 28, 2021, 50 million doses were administered in Italy, so we can say that the vaccination cycle is completed with one dose. After this date, there have been 0.07 million deaths to date, most of which were anti-vaxxers. If these were 6 million, the claimed 98% gives 0.98 x 6 million = 5.88 million surviving anti-vaxxers and 0.12 million anti-vaxxers deaths!, which is still more than 0.07 M. Although these are very rough calculations, the figures show how dangerous it is to rely on high probabilities to represent harmless conditions. The fact is that vaccines reduce the risk of death by more than 95%.

Conclusions

Dr. Peter Hotez**,** in his book "The deadly rise of anti-science: A scientist's warning", tell us how the antivaccine movement became a dangerous political campaign amplified by the news media, and caused thousands of deaths. Worldwide there have been seven million

deaths from COVID-19, with the US reporting more than a million deaths, Italy 186 thousand and China between 6 and 17 thousand (WHO data). These large differences between the figures of Western countries and China are due to the way each country dealt with the pandemic. In China, immediate lockdowns, the use of masks, equivalent green passports through contact tracing, and compulsory vaccinations were implemented, all measures that are condemned by those who invoke freedom and are against vaccination. In Italy, the problem was the due to several factors, such as delays in preventing the first wave, flawed vaccination campaign, misuse of the green passport, media misinformation about vaccines and the pandemic theory, failure of the contact tracing and the persistence of the pandemic due to the anti-vaccination problem. Surely, the management of the pandemic helped create anti-vax arguments. The effectiveness of lockdowns is controversial, and there are conflicting opinions (see discussion between Edward Melnick and Professor John Ioannidis in BMJ 2020;369:m1924 doi: 10.1136/bmj.m1924). As has already been suggested, a thorough risk-benefit analysis needs to be carried out before such a ban is imposed in the future [31].

This review of new statistics and research shows the effectiveness of the vaccine and its high benefit-risk factor. Freedom of expression and media coverage are fundamental to a democratic society, but adequate information about health risks is also essential in emergencies. The spread of disinformation in all media poses as great a threat to public health as the virus itself, e.g. the spread and amplification of unconfirmed stories, such as the spread of conspiracy theories, hoaxes, etc. This misinformation problem undermines public confidence and hinders efforts to contain the spread of the virus and prevent anti-vaccination positions. We should ask ourselves: Are lockdowns and/or quarantines legal in an emergency or a deprivation of liberty and a restriction of human rights? Is restricting the dissemination of inaccurate and false information during an emergency a restriction on freedom of expression? If so, then our options for dealing with a pandemic are very limited. Surely this is a competing human rights issue, "freedom versus health", as well as "economy versus health" (or "increase GDP or save lives?") [15].

Declarations

Conflict of Interest

The Author declares that there is no conflict of interest.

References

[1] Alessandria, M. et al. (2024). A reanalysis of an Italian study on the effectiveness of COVID-19 vaccination suggests that it might have unintended effects on total mortality. doi: 10.20944/preprints202406.0384.v1

[2] Asch, D.A., Luo, C., and Chen, Y. (2024). Reports of COVID-19 vaccine adverse events in predominantly Republican vs Democratic states, JAMA Network Open, 7(3):e244177. doi:10.1001/jamanetworkopen.2024.4177

[3] Capriano, R.M. et al. (2023). Confronting the evolution and expansion of anti-vaccine activism in the USA in the COVID-19 era, www.thelancet.com Vol. 401 March 18.

[4] Carcione, J.M., and Ba, J. (2024). Policy lessons from the Italian pandemic of COVID-19. Top Italians Scientists Journal 1(4). https://doi.org/10.62684/NZFA6144

[5] Carcione, J.M., Santos, J.E., Bagaini, C., and Ba, J. (2020). A simulation of a COVID-19 epidemic based on a deterministic SEIR model, Frontiers in Public Health, 8, Article 230. https://doi.org/10.3389/fpubh.2020.00230.

[6] Cucinotta, D., and Vanelli, M. (2020). WHO declares COVID-19 a pandemic, Acta Biomedica, Atenei Parmensis, 91(1), 157-160.

[7] Eggertson, L. (2010). Lancet retracts 12-year-old article linking autism to MMR vaccines, CMAJ, 182(4), E199-E200.

[8] Faranda, D., Alberti, T., Arutkin, M., Lembo, V., and Lucarini, V. (2021). Interrupting vaccination policies can greatly spread SARS-CoV-2 and enhance mortality from COVID-19 disease: The AstraZeneca case for France and Italy, Chaos 31, 041105 (2021). https://doi.org/10.1063/5.0050887.

[9] Fasce, A. (2024). A taxonomy of anti-vaccination arguments from a systematic literature review and text modeling, Nature Human Behaviour. https://doi.org/10.1038/s41562-023-01644-3.

[10] Flacco, M.E. et al. (2022). COVID-19 vaccination did not increase the risk of potentially related serious adverse events: 18-Month cohort study in an Italian province. Vaccines (Basel), 11(1):31. doi: 10.3390/vaccines11010031.

[11] Gallegos, M., de Castro Pecanha, V., and Caycho-Rodríguez, T. (2022). Anti-vax: The history of a scientific problem, Journal of Public Health, fdac048. https://doi.org/10.1093/pubmed/fdac048

[12] Hartner, A.-M. et al. (2024). Estimating the health effects of COVID-19-related immunisation disruptions in 112 countries during 2020–30: a modelling study, Lancet Glob. Health, 12: e563-571.

[13] Hulscher, N., Hodkinson, R., Makis, W., and McCullough, P.A. (2024). Autopsy findings in cases of fatal COVID-19 vaccine induced myocarditis, ESC Heart Failure, doi: 10.1002/ehf2.14680

[14] Kournoutou, G.G., and Dinos, G. (2022). Azithromycin through the lens of the COVID-19 treatment. antibiotics, 11, 1063. https://doi.org/10.3390/antibiotics11081063

[15] Lesschaeve, C., Glaurdié, J., and Mochtak, M. (2021). Health versus wealth during the COVID-19 pandemic: Saving lives or saving the economy? Public Opinion Quarterly, 85(3), 808-835.
[16] Li, Y. et al. (2024). Adverse events of COVID-19 vaccines in the United States: Temporal and spatial analysis, JMIR Public Health Surveill. doi:10.2196/51007
[17] Lighter, J., and Raabe, V. (2020). Azithromycin should not be used to treat COVID-19, Open Forum Infectious Diseases, vol. 7(6), https://doi.org/10.1093/ofid/ofaa207
[18] Liko, J., and Cieslak, P.R. (2024). Assessment of risk for sudden cardiac death among adolescents and young adults after receipt of COVID-19 vaccine, Weekly, 73(14), 317-320.
[19] Mostert, S. et al. (2024). Excess mortality across countries in the Western World since the COVID-19 pandemic: 'Our World in Data' estimates of January 2020 to December 2022. BMJ Public Health;2:e000282. doi:10.1136/bmjph-2023-000282
[20] Nafilyan, V. et al. (2023). Risk of death following COVID-19 vaccination or positive SARS-CoV-2 test in young people in England. Nat. Commun.,14(1):1541.
[21] O'Driscoll, M. et al. (2021). Age-specific mortality and immunity patterns of SARS-CoV-2, Nature, 590, 140-145.
[22] Østergaard, S. D. et al., 2021, Thromboembolism and the Oxford-AstraZeneca COVID-19 vaccine: side-effect or coincidence?, The Lancet, 97 (Issue 10283), 1441--1443.
[23] Polack, F.P. et al. (2020). Safety and efficacy of the BNT162b2 mRNA COVID-19 vaccine, N. Engl. J. Med., 383, 2603-2615.
[24] Taquet, M., et al. (2021). Cerebral venous thrombosis and portal vein thrombosis: A retrospective cohort study of 537,913 COVID-19 cases. EClinicalMedicine. Sep, 39:101061.
[25] Trougakos, I.P. et al. (2022). Adverse effects of COVID-19 mRNA vaccines: the spike hypothesis, Trends in Molecular Medicine, 28(7), 542-554.
[26] Turner, S. et al. (2023). Benefit-cost Analysis of the HHS COVID-19 Campaign: April 2021-March 2022, AJPM, 67(2), 258-264.
[27] Waheed, S.M., Kudaravalli, P., and Hotwagner, D. T. (2022). Deep vein thrombosis, StatPearls.
[28] Ward, I.L. et al. (2024). Risk of COVID-19 death in adults who received booster COVID-19 vaccinations in England, Nature Communications, 15:398.
[29] Xu, S. et al. (2024). Mortality risk after COVID-19 vaccination: A self-controlled case series study, Vaccine, 42, 1731-1737.
[30] Yandle, K. (2023). No evidence excess deaths linked to vaccines, contrary to claims online, SciCheck Digest, FactCheck.org.
[31] Yanovskiy, M, and Socol, Y. (2022) Are lockdowns effective in managing pandemics? Int. J. Environ. Res. Public Health., Jul 29;19(15):9295.