



How denialist amplification spread COVID misinformation and undermined the credibility of public health science

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Accepted: 3 November 2023 / Published online: 22 February 2024
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Abstract

Denialist scientists played an outsized role in shaping public opinion and determining public health policy during the recent COVID pandemic. From early on, amplification of researchers who denied the threat of COVID shaped public opinion and undermined public health policy. The forces that amplify denialists include (1) Motivated amplifiers seeking to protect their own interests by supporting denialist scientists, (2) Conventional media outlets giving disproportionate time to denialist opinions, (3) Promoters of controversy seeking to gain traction in an ‘attention economy,’ and (4) Social media creating information silos in which denialists can become the dominant voice. Denialist amplification poses an existential threat to science relevant to public policy. It is incumbent on the scientific community to create a forum to accurately capture the collective perspective of the scientific community related to public health policy that is open to dissenting voices but prevents artificial amplification of denialists.

Keywords COVID · Denialist amplification · Misinformation · Science communication · Social media

Key messages

- 1 The disproportionate amplification of denialist science distorted public perception of science and undermined public health policy during the COVID pandemic.
- 2 Denialist amplification can result either from intentional support of denialists by those threatened by the prevailing scientific perspective or by virtue of the attention economy that drives conventional media, social media, and, to some extent, scientific publishing.

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- 3 Countering denialist amplification requires creating an open forum for the scientific community that captures the collective views of subject matter experts without denialist amplification.

Introduction

Scientists played an outsized role in shaping public opinion and determining public health policy during the COVID pandemic (January 2020–May 2023 per WHO) and continue to reshape the narrative with regard to public health interventions in its aftermath. For the purposes of this discussion, denialist something far different from the rigorous, informed critique of research, including one’s own, which is the skepticism essential to science. Denialists not only reject the majority view of the scientific evidence, but they replace it with their own entirely different interpretation with minimal self-skepticism. Industries or institutions which are threatened by the implications of the majority belief, from tobacco to fossil fuels, have long sought to support and amplify denialist scientists [1, 2]. The number of scientists with little or no subject matter expertise or experience, who staked out denialist positions, seemed to explode during the pandemic. Conventional media often provides a platform for denialists in the name of balance. The urgent pace of pandemic science coupled with the unique ability of social media to promote controversy took denialist amplification to an unprecedented level. The resulting deterioration of public confidence in public health science poses an existential threat to rational public health policy. How did this happen?

To understand the nature and effect of denialist amplification and what we might do to limit its impact, consider two publications as case studies. One, from early in the pandemic, concluded that COVID was far less deadly than the public health community believed. The second, released near the putative end of the pandemic in December of 2022, asserted that the risk of COVID vaccine boosters in young men exceeded their benefit. Both espoused denialist viewpoints and both had major impacts on public opinion and public health policy.

Denialist Assertion 1: the lockdowns were unjustified

On 3 March 2020, the World Health Organization estimated that COVID had a case fatality rate (CFR) of 3.4% [3]. The specter of tens of millions of deaths and many times that number of hospitalizations impelled governments worldwide to restrict everything from travel to school openings. We will never know exactly how many lives ‘lockdowns’ saved, but they threatened a broad range of industries, giving rise to many motivated amplifiers. Prominent among them was the air travel industry.

On 17 March 2020, a Stanford epidemiologist argued that “the vast majority of infections due to SARS-CoV-2 are being missed” and the true CFR was between “0.05 and 1.0%”. COVID, he suggested, might be no worse than the flu [4]. A week later, two colleagues at Stanford published an op-ed in the *Wall Street Journal*



arguing that the CFR could be off by “orders of magnitude” [5]. The denialists had declared themselves.

To prove their point, the Stanford team conducted a seroepidemiology study [6], which estimated incidence and concluded that, in the pre-vaccine era, the CFR was 0.17%, a reduction of 95% from the WHO estimate. The paper played a central role in supporting the assertion that COVID is no worse than the flu, meaning the economic impact of the ‘lockdown’ could not be justified. On 15 May 2020, BuzzFeed-News published the revelation that the founder of JetBlue provided key funding for the study, a connection the authors first omitted, then denied, then dismissed as irrelevant [7].

That paper’s Altmetrics score [8], among the top 5% of all preprints in the life sciences, reflected 368 reports in the conventional media, including an opinion piece in the *Wall Street Journal* by a hedge fund manager (who, for unspecified reasons, was a co-author of the seroepidemiology study) [9]. Twitter exploded with 20,277 Tweets (and counting). Controversy sells.

Serious epidemiologists had major concerns about the study, particularly with respect to selection bias and the potential impact of false positives, and immediately posted them to Twitter [10]. Unfortunately, trying to have a serious discussion of science on Twitter is like playing football with the fans on the field. According to Altmetrics, 94% of tweets were from non-scientists.

Peer review did not fare much better than Twitter at catching the study’s flaws when it was published a year later in the *International Journal of Epidemiology*, a journal with one of the senior authors on its editorial board.

So, the research was amplified and denialist, but was it misinformation? Ignoring the fact that the CFR estimate of 0.17% was based on an unvaccinated population, the 1.13 million COVID deaths confirmed to date in the US would represent 650 million infections, almost twice the US population. Accounting for deaths prevented by the vaccine [11] could put the inferred number of cases at almost 2.6 billion, which suggests that the study’s estimate of CFR was off by a factor of 7 or more.

Evolution of denialist amplification during COVID

This early episode of COVID denialist amplification was extremely effective and there were clear connections between amplifiers and the authors [7]. Over the next three years opponents of lockdowns built a network of organizations with more opaque funding, such as the Brownstone Institute [12], The Urgency of Normal [13], and Collateral Global [14] to gather and promote denialist voices [15]. Conservative media outlets regularly interviewed denialist scientists [16]. The Trump Administration brought them in as advisors [17]. The American Institute for Economic Research, with its network of donors that includes Charles Koch, a major funder of climate change contrarians, provided the forum for creating and amplifying the anti-lockdown Great Barrington Declaration with the senior author of the Santa Clara Study as one of three authors [18, 19]. Throughout, amplifiers identified and supported researchers with affiliations and degrees suggestive of great expertise and



presumably genuine beliefs about COVID that align with libertarian, anti-lockdown thinking.

The urgent demand for pandemic information and divisive politics made social media a perfect tool for denialist amplification. At the same time, the conventional media, in seeking to present a balanced perspectives on important issues, solicited input from denialists, creating the illusion of substantial scientific uncertainty. In our second example, even the scientific publishers became part of the mix.

Denialist Assertion 2: the vaccine causes more harm than good

Vaccines have long been a soft target for contrarians [20, 21]. In August of 2022, a medical anthropologist and a team of six co-authors published an essay which argued that restricting activity “based on COVID-19 vaccination status impinges on human rights, promotes stigma and social polarization, and adversely affects health and wellbeing” and, as a result, undermines “trust in scientific institutions” [22]. The authors encouraged “social and behavioral scientists, bioethicists, epidemiologists, legal scholars, and others to assess the benefits and harms of COVID-19 vaccination policies.” Within 4 months, four of the authors had joined with four new co-authors, three of whom were physicians with prior clearly stated opposition to public health mandates [23–28], to produce the called for Risk Benefit Assessment (RBA) with exactly the results they had anticipated [29].

To the non-scientist, their paper might appear to be above reproach. This team has affiliations with five of the world’s top ranked institutions for studying infectious diseases [30]. It was published in a peer-reviewed affiliate of the British Medical Journal.

But let’s take a closer look. The three physicians primarily responsible for the RBA got credibility in infectious disease primarily through proximate expertise. Although their institutions have strong programs in infectious disease, none of them had a direct affiliation with those programs nor a background in infectious disease epidemiology prior to COVID. All three were also connected to motivated amplifiers including the Brownstone Institute, which has been a supporter of a senior author from the Stanford team [31]. Another has received major funding from the Arnold Foundation, which has also supported a senior author of the Santa Clara Study [32]. The team member who “researched the inputs for the risk–benefit analysis, performed the computations, and created the visuals,” works, according to her own website, for a “Boutique science and technical communications consultancy” [33].

But was it Misinformation? The credentials, funding sources, and past behavior of the authors should not prejudice assessment. However, a review of their methods reveals glaring irregularities. First, note that they cited, but ignored an existing RBA from CDC [34], which estimated that the booster was preventing 114 hospitalizations for every seven hospitalizations it caused in this group. Second, they didn’t even cite a far more comprehensive RBA by leading British epidemiologists, data scientists, and virologists [35], which found benefits dramatically exceeded risks in adolescents. Second, consider the authors’ decisions in estimating risks and



benefits. (Note that all information cited in these lists is from either the CDC or the authors' own references).

Risks

- 1 Their highest estimate of myopericarditis risk for men aged 18–29 of 14.7/100,000 (95% CI 4.0–37.6), was based on just four cases [36], included men up to age 39, and was just a subset of data from a much larger CDC study [37].
- 2 In reporting data from that larger CDC study, they simply ignored risks in the control group and reported the absolute risk of 4.8/100,000 rather than the excess risk of 3.2/100,000 [34].
- 3 They also ignored a large Israeli study [38], which estimated myopericarditis risk from the booster as 2.0/100,000 in men aged 20 to 29. They instead chose a much smaller Israeli study [39] from a brief research letter, listing a risk of 12.7/100,000 [the source of which is unclear, given the published estimate of 11.3/100,000 (95% CI 2.92–19.59)]. Note that this is again absolute, not excess risk.
- 4 They ignored control data for reactogenicity [40] and serious adverse events [40], which, in both cases, showed higher rates of morbidity than the booster group.
- 5 They equated COVID hospitalizations to post-vaccination reactogenicity and serious adverse effects, the definitions of which explicitly exclude almost all hospitalizations [29].

Benefits

- 1 Despite evidence in the authors' own references that the booster reduced the incidence of symptomatic disease by 93–95% and dramatically reduced rates of asymptomatic infections [34, 40, 41] they assumed the booster provided no reduction in secondary transmission, symptomatic disease, or long COVID [42].
- 2 The only benefit they ascribed to the booster was a decrease in hospitalizations of only 6.4/100,000 for 18–29-year-old men, which, given the prevailing rate of US hospital admissions in this age group was 150/100,000 per 6 months [43], corresponded to a presumed vaccine efficacy of 4%. The CDC estimate at the time was that the booster reduced hospitalization rates by 91% [40].
- 3 Despite reduced hospital admissions, they assumed no reduction in mortality even though there were 3.3 deaths/100,000 in the US during this period for this age group [44].
- 4 Despite evidence the vaccine had an efficacy at 6 months of 50–90% [34], they assumed the vaccine provided no benefits after 6 months.
- 5 They ignored the benefits of the bivalent booster [45].

In sum, in each of the cases described above, the authors made choices that maximized risk and minimized or ignored benefits from the booster. It seems highly unlikely that this reflects random error. (Note that when I pointed out the problems listed above to the journal editor, I received an email informing me that “it’s clear that the authors haven’t maximized the risks of vaccination nor minimized the risks



associated with Covid” [46], a statement of surprising confidence for someone with no training in medicine, laboratory science, or epidemiology.)

Even if any of these choices were justifiable, most were made without explanation or even acknowledgment. This pattern suggests a profound disregard for fundamental scientific principles. Denialism without self-skepticism is advocacy, not science.

Journals as denialist amplifiers

How could this team publish such a deeply flawed RBA in an epidemiology or public health journal? The solution was to avoid the epidemiological journals entirely, choosing instead the *Journal of Medical Ethics (JME)*. A review of papers published in *JME* during the pandemic reveals no other original epidemiology. There are several papers by the authors of the RBA, including one titled, “How to Hold an Ethical Pox Party” [47], published by its corresponding author. Of the five previous papers considering the ethics of vaccine mandates, all argued that they were, in some way, unethical [48–52].

The Editor-in-Chief is President of the National Ethical Advisory Council in New Zealand, which published a report in 2007 on preparing for pandemics. That report cautioned against mandates in almost every mention of vaccines [53]. In 2021, with New Zealand imposing bold, highly effective COVID intervention policies [54], he published an open letter arguing against a rule requiring vaccinations for anyone participating in a clinical trial [55].

Not only does *JME* seem receptive to arguments against vaccine mandates, but it also seems receptive to denialist science. A Senior Editor had just published an essay [56] arguing that a tendency on the part of medical researchers to assert unwarranted confidence in their findings often evolves into a medical orthodoxy that excludes opposing viewpoints. In the face of what he called “Broad Medical Uncertainty,” he argued dissenting viewpoints must be heard. In this case, it appears that denialist voices were amplified with a marked lack of critical review.

Social media and denialist amplification

Given the kernel of truth in the evidence of vaccine related myocarditis risks, there are important ethical discussions to be had, but the authors’ representation of the paper on social media focused almost exclusively on the RBA and the tremendous attention it was receiving on Twitter [29, 57–63].

Twitter has long been the platform of choice for scientists discussing science [64] but existing efforts to filter misinformation have been largely abandoned [65–67]. The RBA of vaccines in adolescents by a team of 15 British subject matter experts had 867 tweets at the time of this writing [35]. The denialist paper has over 53,700 tweets giving it the highest Altmetrics score in the history of *JME*.

The research community has become increasingly connected to the larger ‘attention economy’, a term introduced in 1971 by Herbert Simon to characterize the



growing market for human attention, which has risen steadily in importance since the advent of social media. Altmetrics scores [68], essentially a measure of attention, have become a ubiquitous measure of papers' perceived significance despite its heavy dependence on merely counting Tweets. The scientific community's embrace of Twitter⁵⁹ (now X) as an indicator of import is astonishing given the features that make it uniquely ill-suited to meaningful discussion of science. Imagine a scientific conference in which comments are limited to 240 characters, 95% of the people in the room are non-scientists, anyone in the audience can show a slide whenever they want (but only one at a time) and the microphones go to celebrities.

Even a citation index is heavily influenced by controversy and the attention it generates. Controversial papers get cited even if only to refute their findings. In other words, the scientific journals themselves tend to be denialist amplifiers.

Amplifying the prevailing scientific perspective

The assessment of information is based on trust rather than any specific indicator of accuracy [69]. A Pew Foundation survey in April of 2020 found that the single most reliable source for health information were medical scientists with 87% of respondents expressing "a great deal" or "a fair amount" of trust in scientists to act in the best interests of the public [70]. The amplification of contrarians, which goes far beyond the two papers mentioned here, not only gave unwarranted prominence to their minority opinion, it appears to have undermined trust in scientists, which by October of 2023, had dropped to 73% [71, 76].

From the perspective of sheer volume, the bulk of COVID misinformation involved blatant falsehoods and conspiracy theories [72] spread by trolls, bots, and content polluters with little or no connection to scientific papers [73]. Proposed strategies for addressing misinformation have tended to focus on either public rebuttal of misinformation [74] or some form of public education [75]. Neither, however, addresses the challenge posed by denialist amplification: how to provide balance by amplifying the collective perspective of subject matter experts in the scientific community. A necessary first step is to build a forum for that community with the explicit intention of capturing that perspective.

This forum must include strategies for:

- *Assembling the Evidence* the central goal of any such forum is to bring together and summarize the weight of the evidence such that no individual study can be taken out context and no individual voice can be artificially amplified.
- *Establishing Public Credibility* to have credibility, this forum must have initial buy-in from a highly regarded scientific organizations, institutions, and funders.
- *Preventing Twitterization* any online platform faces the same risks as existing platforms. That is, how to avoid being distorted by contrarian amplification. At a minimum, this will require keeping the fans off the field by defining and requiring participant expertise. Also, participants must follow rules of engagement agreed to by the community.



- *Incentivizing engagement* this may be the most difficult challenge to creating such a forum. Scientists are busy and operate in a prestige economy. Any such platform must include a system for acknowledging the contribution of participants and the reaction of their peers to that contribution.

These are serious challenges, but they are no more daunting than the current, losing game of scientific Whack-a-Mole that defines individual efforts to debunk misinformation. The point is not to replace popular social media, but instead to provide a forum or platform that captures the collective voice of public health experts and can be shared on social media, while minimizing noise and distortion.

Conclusions

Denialist Amplification predates COVID, but the unique nature of the pandemic elevated it to an entirely new and dangerous level. The discussion above identifies four factors that artificially amplified contrarian voices.

1. *Motivated Amplifiers* motivated amplifiers are individuals or organizations seeking to protect or promote their interests in opposition to the prevailing scientific perspective who provide support, financial or otherwise, for denialists.
2. *Conventional Media Presenting “Balance”* the media routinely seeks to present both sides on an issue, effectively amplifying denialists and creating the illusion of a significant split within the research community.
3. *Marketers and Promoters of Controversy* controversy sells, consensus does not. In an attention economy many outlets, including scientific journals, amplify denialists simply for the attention they generate.
4. *Structural Amplifiers* the silos of social media can create environments in which the denialist voices can dominate and consensus views can be so minimized that they appear to represent a radical fringe. The voices of subject matter experts are lost in the noise of social media.

The instantaneous, seamless reach of the internet makes denialist amplification an inherently global problem, not limited to any one country.

Skepticism and dissent are essential to scientific progress, but denialism undermines that process. Their artificial amplification in the media, particularly the social media, poses an existential threat to public health science. We need to create a forum for researchers where, in the bright glare of scientific scrutiny, misinformation goes to die.

Acknowledgements The thoughtful editing of Donna Gerardi and Loretta Torago is greatly appreciated.

Funding This work was completed without external funding.

Data availability There are no data associated with this viewpoint piece.



Declarations

Conflict of interest The author declares no conflict of interest.

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