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THE PSYCHOLOGY OF SCIENCE DENIALISM AND LESSONS FOR PUBLIC HEALTH AUTHORITIES

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ABSTRACT

As it wreaked tragedy on the world, the outbreak of COVID-19 helped expose a pandemic of a different kind, one steeped in distrust and contrarianism. This movement, termed science denialism, has been lurking and undermining public health efforts for decades. Specifically, it is “the employment of rhetorical arguments to give the appearance of legitimate debate where there is none, an approach that has the ultimate goal of rejecting a proposition on which a scientific consensus exists.” Unlike skepticism, which is “doubt as to the truth of something” and works to progress both science and society, denialism is characterized by individuals’ acceptance of only the evidence that confirms their prior beliefs. The battle cries of denialists are easily recognizable: “vaccines cause autism,” “climate change is a hoax,” and “the flu kills more people than COVID-19,” to name a few. The hallmarks of this thinking include seeing consensus as a conspiracy, using fake experts to give weight to their claims, cherry-picking data, holding impossibly high expectations for science, and relying on misrepresentation and logical fallacies to support their beliefs. With bold statements and calculated tactics, denialists pose a major problem for public health authorities as they undermine research-backed messaging and erode the public’s trust in these authorities’ leadership.

In response, authorities must seek to understand denialists’ thinking on both an individual and group level, using these lessons to better craft policies and outreach. On the individual psychological level, denialists form and maintain their beliefs based on motivated reasoning, cognitive dissonance, psychological reactance, heuristics, belief perseverance, and an array of cognitive biases. Similarly, interacting with their community of denialists further bolsters these beliefs through the mechanisms of cultural cognition, in-group bias, and group polarization. An understanding of these influences can help public health authorities institute a multi-pronged approach to counter denialism and its spread. Some techniques include appealing to denialists’ senses of identity, narrative framing, presenting guidance as permissive, showcasing public health measures as gains instead of losses, using pluralistic advocacy to ensure credible experts of diverse values and backgrounds are represented during debates, rebutting claims and logical fallacies, inoculating audiences against misinformation, and conducting motivational interviews rooted in respect and empathy. With these research-backed approaches in hand, public health authorities can better connect with denialists, rebuild the public’s trust, and fulfill their calling to safeguard society’s health and welfare.

I. INTRODUCTION

On an unassuming Monday in late August 2021, four children became orphans.¹ Just two weeks after their father, Lawrence Rodriguez, died from complications related to COVID-19, the children saw their mother, Lydia, succumb to the same fate.² A disease caused by the SARS-CoV-2 virus, COVID-19 can cause lasting and fatal upper respiratory complications.³ The speed at which it swept across the globe, overwhelming hospitals, governments, and societies alike, was shocking.⁴ The fervor with which individuals also resisted the science, protocols, and treatments for COVID-19 was similarly shocking.⁵ Some resolutely denied the seriousness of the pandemic, even refusing the COVID-19 vaccines once they became publicly available. Such was the unfortunate case for the Rodriguez family.⁶ Lawrence and Lydia reportedly “did not believe in vaccines,” but moments before Lydia was intubated, she begged her sister, “Please make sure my children get vaccinated.”⁷ If Lydia and her husband had reassessed their stout denial of science just a bit sooner, they may still be alive for their children today.⁸

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¹ *In Texas, An Anti-Vax Mother’s Dying Wish: Vaccinate Her Children*, FRANCE 24 (Aug. 20, 2021), <https://www.france24.com/en/live-news/20210820-in-texas-an-anti-vax-mother-s-dying-wish-vaccinate-her-children>.

² *Id.*

³ *What Is Coronavirus?*, JOHNS HOPKINS MED. (Feb. 24, 2022), <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus>.

⁴ See Sudhvir Singh et al., *How an Outbreak Became a Pandemic*, 398 LANCET 2109, 2109 (2021) (noting that “As of Oct 22, 2021, more than 242.3 million infections and 4.9 million deaths have been documented, making it one of the most extensive pandemics in history, which occurred despite evaluations showing that many countries were reportedly prepared to respond to an emerging infectious disease.”).

⁵ See Michael Hiltzik, *2020 Was the Year that American Science Denial Became Lethal*, L.A. TIMES (Dec. 13, 2020, 10:03 AM), <https://www.latimes.com/business/story/2020-12-13/anti-science-gop-lethal> (discussing how the American government under President Donald Trump waged a “political war on science” during the onset of the pandemic); see, e.g., *In Texas, An Anti-Vax Mother’s Dying Wish: Vaccinate Her Children*, *supra* note 1 (detailing one example of a couple’s refusal to receive the COVID-19 vaccine).

⁶ *In Texas, An Anti-Vax Mother’s Dying Wish: Vaccinate Her Children*, *supra* note 1.

⁷ *Id.* (quotation marks omitted).

⁸ *Id.*

The Rodriguezes' story, however, is not unique. Currently, approximately 78% of Americans are partially or fully vaccinated against COVID-19,⁹ leaving 73 million completely unvaccinated and thus highly vulnerable to the disease.¹⁰ Although an individual's refusal to be vaccinated can be influenced by multiple factors,¹¹ one survey reported that 42% of unvaccinated adults attribute their refusal to the fact that they “don't trust the COVID-19 vaccine.”¹² Thus, whether represented in statistics like these or communicated through stories like that of the Rodriguez family, the consequences of science denialism are real, terrifying, and hopefully—through the right messaging—preventable.

Science denialism is defined as “the employment of rhetorical arguments to give the appearance of legitimate debate where there is none, an approach that has the ultimate goal of rejecting a proposition on which a scientific consensus exists.”¹³ Importantly, science denialism is distinctly different from skepticism surrounding scientific findings. Skepticism—which is “doubt as to the truth of something”¹⁴—is necessary for both the progression of science itself and the functioning of a democracy.¹⁵ Skepticism breeds healthy debate, increases the quality of research, and enables the development of robust science, divorced from previously held beliefs.¹⁶

⁹ *Coronavirus (COVID-19) Vaccinations*, OUR WORLD IN DATA, <https://ourworldindata.org/covid-vaccinations?country=USA> (last visited May 6, 2022).

¹⁰ See *Quick Facts: United States*, U.S. CENSUS BUREAU (July 1, 2021), <https://www.census.gov/quickfacts/fact/table/US/PST045221> (reporting that the population of the United States is 331,893,745 people).

¹¹ See Robert Hart, *By the Numbers: Who's Refusing Covid Vaccinations—And Why*, FORBES (Sept. 5, 2021), <https://www.forbes.com/sites/roberthart/2021/09/05/by-the-numbers-whos-refusing-covid-vaccinations-and-why/?sh=607403f052ea> (discussing how age, gender, political affiliation, and education levels influence the likelihood of receiving a COVID-19 vaccine).

¹² Lindsay M. Monte, *Household Pulse Survey Shows Many Don't Trust COVID Vaccine, Worry About Side Effects*, U.S. CENSUS BUREAU (Dec. 28, 2021), <https://www.census.gov/library/stories/2021/12/who-are-the-adults-not-vaccinated-against-covid.html> (quotation marks omitted).

¹³ Pascal Diethelm & Martin McKee, *Denialism: What Is It and How Should Scientists Respond?*, 19 EUROPEAN J. PUB. HEALTH 2, 2 (2009).

¹⁴ *Skepticism*, LEXICO, <https://www.lexico.com/en/definition/skepticism> (last visited Mar. 14, 2022).

¹⁵ Stephan Lewandowsky et al., *Science and the Public: Debate, Denial, and Skepticism*, 4 J. SOC. & POL. PSYCH. 1, 2 (2016); Philipp Schmid & Cornelia Betsch, *Effective Strategies for Rebutting Science Denialism in Public Discussions*, 3 NATURE HUM. BEHAV. 931, 931 (2017).

¹⁶ Schmid & Betsch, *supra* note 15.

In fact, skepticism is intrinsic to scientific inquiry because it enables scientists to withhold judgment while evaluating claims and hypotheses.¹⁷ This ensures that explanations are objectively and rigorously tested, ultimately improving confidence in their validity.¹⁸ Denialism, in contrast, “expresses itself with considerable homogeneity irrespective of which scientific fact is being targeted.”¹⁹ Unlike skeptics, denialists only accept evidence that confirms their prior beliefs.²⁰ This results in a “motivated rejection of science,” fueled not by evidence but rather by preference.²¹ Characterized by a staunch contrarian view, science denialism shares similarities with conspiracy theories, which “reject[] the standard explanation for an event and instead credit[] a covert group or organization with carrying out a secret plot.”²² Other hallmarks of denialism include both *ad hominem* and professional attacks on scientists.²³ These traits make science denialism a formidable foe, so to effectively combat it, leaders must understand not only its causes but also its effects.

Of the myriad of topics commonly subject to denialism, some of the most pressing and concerning are those related to public health. From vaccines causing autism, to climate change

¹⁷ *The Nature of Science*, CLIMATE SCIENCE INVESTIGATIONS (Nov. 8, 2016),

<http://www.ces.fau.edu/nasa/introduction/scientific-inquiry/why-must-scientists-be-skeptics.php>.

¹⁸ *See id.* (explaining how skepticism-inspired objectivity “allows scientists to reach logical conclusions supported by evidence that has been examined and confirmed by others in the same field, even when that evidence does not confirm absolute certainty”).

¹⁹ Lewandowsky et al., *supra* note 15.

²⁰ Schmid & Betsch, *supra* note 15.

²¹ *Id.*

²² *Conspiracy Theory*, DICTIONARY.COM, <https://www.dictionary.com/browse/conspiracy-theory> (last visited May 5, 2022).

²³ Lewandowsky et al., *supra* note 15; *Ad Hominem*, DICTIONARY.COM, <https://www.dictionary.com/browse/ad-hominem> (last visited Mar. 14, 2022). Importantly, science denial is similar to but distinct from conspiracy theories, as those generally carry the following four attributes: “(1) the direct rejection of a widely accepted explanation or justification; (2) the attribution of the event or course of action to recondite, rather than merely alternative causes; (3) the assertion that these recondite causes are orchestrated by a powerful individual or small, organized group; (4) usually, the conclusion that the majority of people in the society are disadvantaged by the actions of this group, and always that the majority of people are being fooled.” Edward L. Rubin, *Rejecting Climate Change*, 32 J. LAND USE & ENVIRON. L. 103, 116 (2016). Many conspiracy theories do not involve science, and individuals’ motivations for believing them generally differ from those behind science denialism. *Id.* at 117–19.

being a hoax, to the COVID-19 pandemic being exaggerated by “fake news,”²⁴ the tenets spouted by science denialists can have widespread negative effects. As felt too keenly by the four Rodriguez children, science denialism can have deadly personal consequences.²⁵ It can also affect society at large. The loud voices of denialists can drown out those of established authorities, weaponizing fear and spreading misinformation.²⁶ This undermines the public’s trust in its leaders, which may spell disaster during public health crises when cooperation is essential to slow the spread of disease or mitigate the repercussions of a warming world.²⁷ Further, denialism can cause scientific study as a whole to falter, as “the aggressive efforts by contrarians have not only had a chilling effect on the academic community but have also adversely affected the communication and even the direction of research itself.”²⁸ Thus, it is essential to combat science denialism, and the nation’s public health authorities are in a prime position to lead the charge.

In the United States, governmental public health authorities at the federal, state, and local levels are vested with the authority and responsibility to champion good science. At the federal level, key players include the Centers for Disease Control and Prevention (CDC) and the Food and Drug Administration (FDA).²⁹ These agencies create nationwide public education campaigns for important health issues, and the public—along with state and local governments and regulated entities—rely on these agencies as sources of scientifically-sound information.³⁰ At the

²⁴ See discussion *infra* Section II.A.

²⁵ See *In Texas, An Anti-Vax Mother’s Dying Wish: Vaccinate Her Children*, *supra* note 1 (discussing how four children lost their parents because of their COVID-19-related science denialism).

²⁶ See Hiltzik, *supra* note 5 (discussing how President Donald Trump’s science denialism during the onset of the COVID-19 pandemic “systematically wrecked the credibility of U.S. agencies that were once the gold standard for the application of scientific expertise in the public interest”).

²⁷ See *id.* (highlighting how science denialism undermines public trust in established scientific authorities, wreaking consequences that “stay with us, measured in deaths, families ruined, and society itself rattled”).

²⁸ Lewandowsky et al., *supra* note 15, at 7.

²⁹ Sarah D. Kowitz et al., *Awareness and Trust of the FDA and CDC*, 12 PLOS ONE 1, 1–2 (2017).

³⁰ *Id.*

state and local levels, health authorities, such as departments of health, form key community partnerships and spearhead smaller-scale initiatives related to issues such as immunization, disease prevention, and environmental health.³¹ Importantly, public health authorities' efficacy at every level is tied directly to public perception; they can only encourage individuals' compliance with their messaging and regulations if the public perceives them to be "trustworthy, competent, and credible."³²

Although appointed the gatekeepers of good science, these authorities are fallible, and scientific inquiry is not a panacea.³³ The scientific process is characterized by trial and error, and authorities must weigh competing interests, causing a shift in recommendations and regulations over time.³⁴ Further, scientists and public health leaders are susceptible to their own biases, and they tend "to react slowly to changing conditions and to view questions narrowly rather than holistically."³⁵ To denialists, these issues culminate in an uncertainty that they use to justify their anti-science beliefs.³⁶ This charges public health authorities with a unique task: they must recognize their shortcomings yet still use their platform to carefully and sensitively appeal to science denialists in hopes of increasing trust and promoting health. To effectively do so, however, these authorities must first understand the origins of this denialism.

³¹ See LOCAL HEALTH DEPARTMENTS IMPACT OUR LIVES EVERY DAY, NAT'L ASSN. OF COUNTY & CITY HEALTH OFFS. 1–2 (2017), <https://www.naccho.org/uploads/downloadable-resources/transition-appendix-A-Infographic.pdf> (discussing the key functions of local health departments as they work alongside state and national partners to accomplish health-related goals); see, e.g., *Healthy Living*, MO. DEPT. HEALTH & SENIOR SERVS., <https://health.mo.gov/living/> (last visited May 12, 2022) (providing the public information on diseases, wellness initiatives, and state health statistics).

³² Kowitt et al., *supra* note 29.

³³ David Leonhardt, *Follow the Science?*, N.Y. TIMES (Feb. 11, 2022), <https://www.nytimes.com/2022/02/11/briefing/covid-cdc-follow-the-science.html>.

³⁴ See *id.* (recognizing that COVID-19 restrictions "can both slow the virus's spread *and* have harmful side effects," and public health entities must balance these concerns).

³⁵ *Id.*

³⁶ See Diethelm & McKee, *supra* note 13, at 3 (noting how denialists have "impossible expectations of what research can deliver. For example, those denying the reality of climate change point to the absence of accurate temperature records from before the invention of the thermometer.").

A keen understanding of psychological influences at the individual level offers authorities valuable insights into denialists' thinking. Specifically, motivated reasoning causes denialists to view facts only through the lens of their preferred conclusions.³⁷ Cognitive dissonance—meaning the discomfort that results from a mismatch between an individual's beliefs and actions—also encourages denialists to discount or explain away scientific evidence that contradicts their preferred beliefs or behaviors.³⁸ Relatedly, when a denialist sees scientific consensus as a threat to his decision-making freedom, psychological reactance inspires him to rebel, seeking to maintain or regain that freedom.³⁹ Additionally, heuristics, which are mental decision-making shortcuts, can cause denialists to repeatedly disregard consensus, further solidifying their beliefs over time.⁴⁰ These ideas are also bolstered by belief perseverance, which causes denialists to remain strongly attached to their views, despite contrary evidence of scientific consensus.⁴¹ Finally, there are a slew of cognitive biases—namely, confirmation, overconfidence, optimism, and self-interest—that cause denialists' skewed assessment of information.⁴² Importantly, these individual influences work in tandem to reinforce denialists' beliefs, and they are also strengthened by group effects.

Although to many, denialists may appear to be fringe thinkers, together they find a community that shares and reverberates their beliefs, inspiring powerful group psychological dynamics. One such influence is cultural cognition, a theory that involves a collection of mechanisms that encourage individuals to judge experts' credibility based on shared worldviews.⁴³ Additionally, in-group bias causes denialists to preferentially value the opinions

³⁷ See discussion of motivated reasoning *infra* Section III.B.a.

³⁸ See discussion of cognitive dissonance *infra* Section III.B.b.

³⁹ See discussion of psychological reactance *infra* Section III.B.c.

⁴⁰ See discussion of heuristics *infra* Section III.B.d.

⁴¹ See discussion of belief perseverance *infra* Section III.B.e.

⁴² See discussion of cognitive biases *infra* Section III.B.f.

⁴³ See discussion of cultural cognition *infra* Section III.C.a.

and views of other denialists, while simultaneously discounting the conclusions of experts, who denialists view as the out-group.⁴⁴ Further, group polarization can radicalize denialists as it causes individuals to become more extreme in their beliefs after deliberating with those who are like-minded.⁴⁵ This is especially apparent as modern denialists use social media to connect with others and amplify their voices, ultimately increasing the size, scope, and sway of the community.⁴⁶

With this bevy of influences, public health authorities must find ways to combat denialism and its spread. Potential solutions range from the arguably obvious—refute denialists’ claims⁴⁷ and warn audiences against misinformation⁴⁸—to the more nuanced and creative. Namely, public health authorities may craft guidance and regulations in ways that affirm denialists’ identities and appeal to their values.⁴⁹ For example, they can use narrative framing to rewrite the messages underlying public health measures to be based on communal cooperation, rather than individualism and division.⁵⁰ Further, when appropriate, messages could be framed as permissive and introduced as a gain instead of a loss.⁵¹ Authorities could also better appeal to denialists by using pluralistic advocacy, such as through showing panels of experts who approach problems with different viewpoints and backgrounds but ultimately agree that change must occur.⁵² Another approach based in empathy and respect would be to interview denialists, addressing specific concerns, motivations, and ambivalences.⁵³ If public health authorities

⁴⁴ See discussion of in-group bias *infra* Section III.C.b.

⁴⁵ See discussion of group polarization *infra* Section III.C.c.

⁴⁶ See discussion of social media’s influence *infra id.*

⁴⁷ See discussion of solutions *infra* Part IV.

⁴⁸ *Id.*

⁴⁹ *Id.*

⁵⁰ *Id.*

⁵¹ *Id.*

⁵² See discussion of solutions *infra* Part IV.

⁵³ *Id.*

employed a multi-pronged approach using these techniques, they could effectively counter denialism, ultimately supporting the scientific community and increasing public trust.

Because both individual and group psychological dynamics play an important role in the creation and preservation of science denialism, public health authorities should employ research-backed techniques to combat this influence. Part II discusses the impact of science denialism in multiple contexts throughout history, particularly as it relates to public health. It also details the role of public health authorities as they communicate with the public. Part III then analyzes the psychological origins of science denialism, both through the individual and group lens. Finally, Part IV proposes various effective strategies that public health authorities can use in a multi-pronged approach to counteract science denialism and promote public trust.

II. SCIENCE DENIALISM AND THE ROLE OF PUBLIC HEALTH AUTHORITIES

A. *Science Denialism, Defined and Exemplified*

At its core, denialism is a complex and elusive phenomenon. Because it shares similarities with skepticism (a healthy hesitancy towards new information), science denialism can often be overlooked or miscategorized.⁵⁴ In some instances, science denialists may even masquerade their beliefs as skepticism, perhaps to appear more credible or persuasive.⁵⁵ Yet, denialism's uniqueness becomes apparent as it denotes a strong resistance towards information that contradicts an individual's previously-held beliefs.⁵⁶ This manifests in a spectrum of attitudes, ranging from "a rejection of science itself, [meaning] the refusal to accept *any* naturalistic explanation for a given physical phenomenon" to "the rejection of a prevailing

⁵⁴ See Lewandowsky et al., *supra* note 15 (discussing how "the dividing line between denial and skepticism may not always be apparent to the public").

⁵⁵ Tanya Wyatt & Avi Brisman, *The Role of Denial in the 'Theft of Nature': Comparing Biopiracy and Climate Change*, 25 CRITICAL CRIMINOLOGY 325, 332 (2017).

⁵⁶ Schmid & Betsch, *supra* note 15.

consensus about a *particular* naturalistic explanation.”⁵⁷ With these nuances in mind, it is essential that authorities do not generalize. Although certain characteristics may influence an individual’s denialistic tendencies⁵⁸—and some groups may be particularly vocal and sway public perception of who is likely to be a denialist⁵⁹—, “those who deny science defy simple categorization.”⁶⁰ In truth, the phenomenon permeates social classes, education stratospheres, and political parties.⁶¹ A better indicator of denialism is an individual’s religious and political identities as the stronger these identities are, “the more likely [these individuals] are to espouse attitudes consistent with them” and resist those that are not.⁶² Given how ubiquitous denialism can be, public health authorities must be ready and able to identify it in order to effectively combat its influence.

Authorities can pinpoint science denialism by looking for some or all of its five characteristic elements. First, denialists view scientific consensus as a conspiracy.⁶³ To them, scientists do not reach the same conclusion because it is supported by independently gathered evidence, but rather because they are all involved in a “complex and secretive conspiracy” to peddle a given viewpoint.⁶⁴ In this vein, peer reviews are used to suppress the voices of dissenters.⁶⁵ Second, denialists use fake experts, meaning individuals whose views are “entirely

⁵⁷ Rubin, *supra* note 23, at 107 (emphasis added).

⁵⁸ E.g., Bruce Miller, *Science Denial and COVID Conspiracy Theories*, 324 J. AM. MED. ASSN. 2255, 2255 (2020) (“In a study that included 9654 US adults, 48% of those who had a high school education or less believed there was some truth to the conspiracy theory that COVID-19 was planned but only 15% among those with some postgraduate training endorsed this idea.”).

⁵⁹ See Hiltzik, *supra* note 5 (discussing science denialism amongst conservatives under former President Donald Trump during the onset of the COVID-19 pandemic).

⁶⁰ *Science Denial: Lessons and Solutions*, RUTGERS GLOB. HEALTH INST. (Nov. 2, 2018), <https://globalhealth.rutgers.edu/news/science-denial/>.

⁶¹ See *id.* (noting how “someone might be highly educated, politically liberal, accepting of climate change, but fearful of vaccines”) (quotation marks omitted).

⁶² Caitlin Drummond & Baruch Fischhoff, *Individuals with Greater Science Literacy and Education Have More Polarized Beliefs on Controversial Science Topics*, 36 PSYCH. & COGNITIVE SCIENCES 9587, 9587 (2017).

⁶³ Diethelm & McKee, *supra* note 13.

⁶⁴ *Id.*

⁶⁵ *Id.*

inconsistent with established knowledge” in the field, to provide a seemingly credible contrarian stance.⁶⁶ Rather than base their views in fact, however, these experts are influenced by religious beliefs, corporate affiliations, or financial motivations.⁶⁷ For example, from 2009 to 2014, three tobacco companies paid a group of six board-certified otolaryngologists to testify that patients’ exposure to cleaning solvents and salted fish were more likely to have caused their head and neck cancers than the patients’ years of heavy smoking—a claim that was vehemently rejected by other physicians.⁶⁸ In addition to this reliance on fake experts, science denialists ostracize real experts, degrading and doubting their findings and their motivations.⁶⁹ Third, denialists rely on selectivity to fuel their opposition towards entire fields of science; they do this by “drawing on isolated papers that challenge the dominant consensus or high-lighting the flaws in the weakest papers among those that support it.”⁷⁰ Interestingly, denialists do not appear to question why these papers are so few and marginalized; rather, they believe this championing is a sign of their fearless resistance to established practice.⁷¹ Fourth, denialists hold impossibly high expectations of what scientists can achieve.⁷² For example, they weaponize inherent uncertainty in mathematical models or demand to see data from a time period that predates the necessary data-gathering technology.⁷³ Finally, denialists use misrepresentation and logical fallacies to support their beliefs.⁷⁴ Among other efforts, they may use red herrings, a term used to describe

⁶⁶ *Id.*

⁶⁷ *Id.* at 3.

⁶⁸ Tracie White, *Physicians Testified for Tobacco Companies Against Plaintiffs with Head, Neck Cancers*, STANFORD MED. NEWS CTR. (July 17, 2015), <https://med.stanford.edu/news/all-news/2015/07/physicians-testified-for-tobacco-companies-against-plaintiffs.html>. Notably, “the scientific literature demonstrates that tobacco directly contributes to head and neck cancers at a greater than 50 percent likelihood,” *id.*, so consensus appears to refute these doctors’ claims.

⁶⁹ Diethelm & McKee, *supra* note 13, at 3.

⁷⁰ *Id.*

⁷¹ *Id.*

⁷² *Id.*

⁷³ *Id.*

⁷⁴ Diethelm & McKee, *supra* note 13, at 3.

“deliberate attempts to change the argument,” or straw men, a tactic describing how “the opposing argument is misrepresented to make it easier to refute.”⁷⁵ With these five tools in their arsenal, science denialists pose a formidable threat to public health.

Throughout history, the impact of science denialism has been far-reaching and disastrous. Not only does it work to dissuade and demonize scientific research and those who conduct it, but in the context of public health, it undermines the credibility of authorities, disrupts public cooperation, and causes otherwise-preventable suffering and death.⁷⁶ A notorious example of science denialism stems from a 1998 study conducted by Andrew Wakefield and twelve colleagues.⁷⁷ Published in *The Lancet*, this study rose to infamy as it suggested a link between autism and the measles-mumps-rubella (MMR) vaccine.⁷⁸ The public’s response was swift and severe. The study gave rise to a media circus, widespread fear, plummeting MMR vaccination rates, and a corresponding spike in measles outbreaks through the United Kingdom and elsewhere.⁷⁹ Soon afterwards, scientists pointed out severe flaws in the study,⁸⁰ and ten of the paper’s thirteen authors recanted the suggested link.⁸¹ Despite a “large and increasing body of evidence” showing no link between autism and vaccines, studies have shown that parents still doubt vaccines’ safety and believe they may be linked to autism.⁸² For example, one study surveyed 197 parents of children with autism and found that almost half attributed their child’s

⁷⁵ *Id.*

⁷⁶ Lewandowsky et al., *supra* note 15, at 7; *see* Hiltzik, *supra* note 5 (discussing the devastating outcomes of science denialism).

⁷⁷ Alicia Bazzano et al., *Vaccine-Related Beliefs and Practices of Parents of Children with Autism Spectrum Disorders*, 117 *AM. J. ON INTELL. & DEVELOPMENTAL DISABILITIES* 233, 233 (2012).

⁷⁸ *Id.*

⁷⁹ *Id.*

⁸⁰ *See id.* (discussing how “the Wakefield study has [] been discredited,” and “[t]he assertion of a link between the MMR [measles-mumps-rubella] vaccine and ASD [autism spectrum disorder] remains unsubstantiated.”).

⁸¹ Diethelm & McKee, *supra* note 13, at 3.

⁸² *E.g.*, Bazzano et al., *supra* note 77, at 234.

diagnosis to vaccinations.⁸³ Further, this belief translated to action as one-fifth of parents in the study halted vaccinating their children after their diagnoses, and many chose to not vaccinate their other, undiagnosed children as well.⁸⁴ As a result, such anti-science credence has caused “a large and growing group of children” both with and without current autism diagnoses to now be vulnerable to vaccine-preventable diseases.⁸⁵ Although decades old and discredited many times over, the Wakefield study is still used as a cornerstone for those opposing vaccination, exemplifying the breadth, pervasiveness, and danger of science denialism.⁸⁶

Science denialists do not simply use flawed studies to manifest false links; they also reject rigorously conducted research that does not align with their viewpoints. For example, there are still some individuals who believe that exposure to secondhand smoke does not cause health problems, despite “clear evidence of rapid reductions in myocardial infarctions where [smoking] bans have been implemented.”⁸⁷ The preservation of this belief is at least partially fueled by the tobacco industry’s decades-long contrarian stance; discrediting the science that showed otherwise, the tobacco industry and pro-smoking groups pointed to other influences, such as stress and having pet birds, to explain smoking-related diseases.⁸⁸ Like smoke itself, the effect of this science denialism lingers. In 2003, the *British Medical Journal* published a study, finding that “exposure to tobacco smoke does not increase the risk of lung cancer and heart disease.”⁸⁹ Although it was later discredited—particularly for a failure to disclose competing interests—the study is still extensively cited by influential pro-smoking groups, such as Japan Tobacco

⁸³ *Id.* at 238–39.

⁸⁴ *Id.* at 239.

⁸⁵ *Id.*

⁸⁶ Diethelm & McKee, *supra* note 13, at 3.

⁸⁷ *Id.* at 2.

⁸⁸ *Id.*

⁸⁹ *Id.* at 3.

International in 2008.⁹⁰ Another example of science denialism casting doubt on the true causes of disease and jeopardizing public health occurred from 2000 to 2005.⁹¹ During this time, the South African government denied the scientific consensus that HIV causes AIDS, a chronic and potentially fatal disease.⁹² The country instituted a policy banning the import of antiretroviral treatment, a necessity for HIV-positive individuals to halt the onset of AIDS.⁹³ Because of this science denialism, more than 330,000 South Africans died of AIDS, and 35,000 children were born infected with HIV.⁹⁴ Thus, whether it is relying on flawed science or rejecting sound research, science denialism results in grave and lasting consequences.

In addition to questioning specific causes and effects, science denialists also cast doubt on entire bodies of evidence at large. For example, although there is widespread expert consensus that human activity has caused a recent increase in greenhouse gases, which in turn is the primary driver of Earth's warming temperature, some sects of the public vehemently oppose this finding.⁹⁵ In fact, one 2019 survey found that thirteen percent of Americans believed that "human activity is not responsible at all" for climate change, while five percent stated that the climate was not changing.⁹⁶ Despite overwhelming evidence to the contrary, some media sources emphasizes these denialists' voices, proclaiming "that warming has stopped or that we are heading for a global cooling."⁹⁷ Although potentially a balm to a worried public, these

⁹⁰ *Id.*

⁹¹ *Science Denial: Lessons and Solutions*, *supra* note 60.

⁹² *Id.*

⁹³ *Id.*

⁹⁴ *Id.*

⁹⁵ Lewandowsky et al., *supra* note 15, at 1.

⁹⁶ Oliver Milman & Fiona Harvey, *US Is a Hotbed of Climate Change Denial, Major Global Survey Finds*, GUARDIAN (May 8, 2019), <https://www.theguardian.com/environment/2019/may/07/us-hotbed-climate-change-denial-international-poll>.

⁹⁷ Lewandowsky et al., *supra* note 15, at 1. Specifically, an opinion article in the Wall Street Journal claimed that warming stopped, and the Daily Mail reported that global cooling is occurring. Matt Ridley, *Whatever Happened to Global Warming*, WALL ST. J. (Sept. 4, 2014), <https://www.wsj.com/articles/matt-ridley-whatever-happened-to-global-warming-1409872855>; David Rose, *And Now It's Global COOLING! Return of Arctic Ice Cap as It Grows by*

techniques downplay the seriousness of the issue and enable prolonged inaction and disbelief.⁹⁸

Notably, “societies that ignore climate change contribute to global risks, including food insecurity, political instability, and environmental degradation.”⁹⁹ While the full effects of climate change denialism have yet to be realized, another recent example tells a cautionary tale.

When the COVID-19 pandemic took the world by surprise, it was shrouded in mystery, but even when new facts were discovered, some turned to denialism. As exemplified by the Rodriguezes’ tragedy, opposing science to one’s own detriment has resounding consequences; those consequences, however, are magnified when a country’s leader encourages such beliefs.¹⁰⁰ During the onset of the pandemic in 2020, then-President Donald Trump frequently and fervently downplayed the seriousness of the virus and even supported the use of untested and potentially harmful therapies, such as antimalarial pills and bleach injections.¹⁰¹ He also opposed scientifically-sound public health initiatives, such as masking, to slow the spread, and he openly questioned doctors’ motives, falsely claiming that they profited from COVID-19 diagnoses.¹⁰²

Experts postulated that the United States could conquer the pandemic in mere months if proper protocols were followed, but Trump’s messaging appealed to thousands.¹⁰³ Specifically, although six out of ten Americans disagreed with Trump’s messaging, a late 2020 poll found that ten percent believed he was “completely right,” and thirty-two percent believed he was “mostly

29% in a Year, DAILY MAIL (Sept. 7, 2013), <https://www.dailymail.co.uk/news/article-2415191/And-global-COOLING-Return-Arctic-ice-cap-grows-29-year.html>.

⁹⁸ See Lewandowsky et al., *supra* note 15, at 1 (discussing how claims that downplay climate change “have no scientific support but they may be welcome news to a public concerned about the potential impact of climate mitigation on their lifestyles”).

⁹⁹ Drummond & Fischhoff, *supra* note 62.

¹⁰⁰ See Hiltzik, *supra* note 5 (discussing how the American government under President Donald Trump waged a “political war on science” during the onset of the pandemic).

¹⁰¹ *Id.*

¹⁰² *Id.*

¹⁰³ *Id.*

right.”¹⁰⁴ With so many subscribing to this anti-science view, cases and deaths skyrocketed, the economy collapsed, and a distrust of public health authorities spread, ultimately crippling the scientific community at a crucial time.¹⁰⁵ Findings about COVID-19 were still coming to light, and accordingly, authorities altered their recommendations and regulations,¹⁰⁶ but with the public’s trust severely fractured, encouraging ongoing compliance became an uphill battle, the effects of which are still felt two years later.¹⁰⁷

These examples reveal that science denialism can lead to devastating outcomes in the public health sector, but other fields remain vulnerable as well. For example, after the highly contested presidential election of 2020, one poll revealed that “30 percent of Americans—including 70 percent of Republicans—[did] not believe that Joe Biden legitimately won.”¹⁰⁸ Rather, they subscribed to the idea that Donald Trump had been elected, and any contrary results were a product of election irregularities, such as voter fraud.¹⁰⁹ The science, however, clearly indicated otherwise. Dozens of studies—including those conducted by a conservative-led Department of Justice—concluded that voter fraud is infinitesimally rare, and election processes are largely secure and standardized.¹¹⁰ One report found voter fraud occurred at rates between

¹⁰⁴ Mark Jurkowitz, *Majority of Americans Disapprove of Trump’s COVID-19 Messaging, Though Large Partisan Gaps Persist*, PEW RSCH. CTR. (Sept. 15, 2020), <https://www.pewresearch.org/fact-tank/2020/09/15/majority-of-americans-disapprove-of-trumps-covid-19-messaging-though-large-partisan-gaps-persist/>.

¹⁰⁵ Hiltzik, *supra* note 5.

¹⁰⁶ *E.g.*, Leonhardt, *supra* note 33 (discussing how policies change when realities change, and during the COVID-19 pandemic, “[t]he C.D.C. was initially too slow to urge mask use — and then too slow to admit that outdoor masking has little benefit”).

¹⁰⁷ See Hiltzik, *supra* note 5 (postulating that although President Biden has “made clear that he will put science back in the center ring of government policymaking,” countering the effects of science denialism that infiltrated “the highest reaches of American government” will require “an immense effort”).

¹⁰⁸ Charlie Cook, *Only in the State of Denial is Vote-Fraud Rampant*, THE COOK POL. REP. (May 14, 2021), <https://www.cookpolitical.com/analysis/national/national-politics/only-state-denial-vote-fraud-rampant>.

¹⁰⁹ *Id.*

¹¹⁰ See, e.g., *id.* (discussing how, in a nation of 300 million people, a 2006 report from George W. Bush’s Department of Justice stated that 86 individuals were convicted of ballot fraud offenses); DEBUNKING THE VOTER FRAUD MYTH, BRENNAN CTR. FOR JUSTICE 1–4, https://www.brennancenter.org/sites/default/files/analysis/Briefing_Memo_Debunking_Voter_Fraud_Myth.pdf (last visited Mar. 16, 2022).

0.0003% and 0.0025%,¹¹¹ and given that over two billion votes have been cast in federal elections since 1980, the notion that fraud has swayed elections is unfounded.¹¹² Yet, this narrative has called the integrity of the electoral system into question, and in response to the perceived threat of voter fraud, some states have instituted strict voter ID laws.¹¹³ These laws, however, have been shown to lead to voter suppression, ultimately silencing many Americans' voices.¹¹⁴ Thus, a keen understanding of science denialism can help both public health authorities and those in other spheres to combat its effects.

B. The Role of Public Health Authorities

In the United States, governmental authorities at multiple levels share the responsibility of safeguarding public health. At the federal level, administrative agencies such as the CDC and the FDA frequently disseminate health-related information to the public, particularly as they issue recommendations and regulations.¹¹⁵ At the state and local levels, departments of health take on more granular roles, putting federal guidelines into practice and directly interfacing with the community's questions and concerns.¹¹⁶ To effectively garner public trust, authorities at all levels face the challenge of presenting a unified front, meaning they must convey scientifically-sound information in a consistent and cohesive manner.¹¹⁷ Already a high bar in light of

¹¹¹ DEBUNKING THE VOTER FRAUD MYTH, *supra* note 110, at 1.

¹¹² Cook, *supra* note 108.

¹¹³ DEBUNKING THE VOTER FRAUD MYTH, *supra* note 110, at 4.

¹¹⁴ *Voter ID 101: The Right to Vote Shouldn't Come with Barriers*, INDIVISIBLE, <https://indivisible.org/resource/voter-id-101-right-vote-shouldnt-come-barriers> (last visited May 5, 2022). Specifically, voter ID laws disproportionately disadvantage the elderly, low-income earners, and minorities. *Id.* For instance, “18 percent—or almost 6 million—citizens over the age of 65 do not have photo ID; . . . 25 percent of voting age African Americans—5.5 million people – do not have ID; and 15 percent of voting age Americans who earn less than \$35,000 do not have ID.” *Id.*

¹¹⁵ Kowitz et al., *supra* note 29.

¹¹⁶ See LOCAL HEALTH DEPARTMENTS IMPACT OUR LIVES EVERY DAY, *supra* note 31 (discussing the key functions of local health departments as they work alongside state and national partners to accomplish health-related goals); see, e.g., *Healthy Living*, MO. DEPT. HEALTH & SENIOR SERVS., <https://health.mo.gov/living/> (last visited May 12, 2022) (providing the public information on diseases, wellness initiatives, and state health statistics).

¹¹⁷ See, e.g., Fiona Crichton, *What Are the Roots of Science Denialism in the Time of COVID-19, and How Do We Untangle Them?*, UNIV. OF AUCKLAND (Dec. 16, 2020), <https://www.thebigq.org/2020/12/16/what-are-the-roots-of->

science’s inherent uncertainty, this task is further complicated by the rise of social media, which enables the spread of information and misinformation alike.¹¹⁸ Given the importance of these authorities’ role, it is no surprise that when they falter, serious consequences soon follow.

One recent instance exemplifies how rapidly science denialism can take root when public health authorities’ communication is skewed and ineffective. During the onset of the COVID-19 pandemic, CDC officials—influenced by the White House¹¹⁹—“repeatedly brushed off calls to take COVID-19 more seriously,” dismissed those who outlined flaws in the agency’s screening program for overseas travelers, and frequently reassured Americans that the threat of the virus was low, despite mounting evidence to the contrary.¹²⁰ This incongruity translated to the state level as “authorities in at least 13 states questioned CDC guidance that contradicted either scientific evidence or information put out by the CDC itself.”¹²¹ Thus, people were understandably confused and concerned when the CDC began taking the virus more seriously, particularly as the number of cases and deaths quickly climbed.¹²² At that point, however, some members of the public had lost faith in the CDC’s messaging and instead sought answers from other sources, such as social media¹²³ and political figures whose opinions were encouraged by

science-denialism-in-the-time-of-covid-19-and-how-do-we-untangle-them/ (noting that “[u]pdated safety advice during a pandemic can be unsettling and upsetting to a public craving certainty, and serve to confirm suspicions that scientists are making it up as they go along.”).

¹¹⁸ Laura Otto, *A Social Approach to Fighting COVID-19 Misinformation*, UNIV. OF WISCONSIN (Mar. 18, 2021), <https://uwm.edu/publichealth/a-social-approach-to-fighting-covid-19-misinformation/>.

¹¹⁹ Brett Murphy & Letitia Stein, *How the CDC Failed Public Health Officials Fighting the Coronavirus*, USA TODAY (Jan. 26, 2021), <https://www.usatoday.com/in-depth/news/investigations/2020/09/16/how-cdc-failed-local-health-officials-desperate-covid-help/3435762001/> (stating that the “White House handicapped the [CDC] from the start.” Notably, the CDC publishes a weekly scientific journal, the Morbidity and Mortality Weekly Report (MMWR) as guidance for doctors and researchers, but shortly after the onset of the pandemic, “White House officials had started screening the MMWR reports, receiving full drafts before publication. Former CDC leaders said that practice undermines good science.”).

¹²⁰ *Id.*

¹²¹ *Id.*

¹²² *Id.*

¹²³ See Ed Pertwee et al., *An Epidemic of Uncertainty: Rumors, Conspiracy Theories and Vaccine Hesitancy*, 28 *Nature Med.* 456, 456–57 (2022) (discussing how genuine concerns about the pandemic have been “susceptible to exploitation,” particularly through social media. For example, “figures connected with the Black Nationalist Nation

personal gain, not science.¹²⁴ Although far from infallible given science’s intrinsic uncertainty and officials’ own biases,¹²⁵ public health authorities must recognize their shortcomings and present information in ways tailored to prevent a denialism movement. A better understanding of denialists’ psychological motivations at both the individual and group levels may help these authorities correct their missteps, foster public trust, and counter anti-science influence.

III. THE PSYCHOLOGY OF SCIENCE DENIALISM

A. *A League of Its Own*

In analyzing science denialism, public health authorities are forced to ask whether there is something special about science that results in bold and persistent opposition from denialists, or whether this phenomenon also occurs in other areas that commonly divide people. It seems that the former rings true. For example, regarding the often-polarizing topic of religion, one Pew poll found that “half of Americans have changed their religion domination at least once in their lives—many several times—and 28 percent have switched faiths altogether.”¹²⁶ Thus, “[w]e do not see a kind of principled, fundamental rejection of a religious worldview.”¹²⁷ Similarly, although politics has grown increasingly polarized,¹²⁸ Americans in general have switched views on the controversial topic of the death penalty over time. Specifically, in 1966, only forty-two percent of individuals supported the death penalty—compared to the forty-seven percent who opposed it—but by the mid-1990s, this support steadily grew to a peak of eighty percent.¹²⁹

of Islam [] actively promot[ed] vaccine misinformation to African American audiences through a network of social media accounts.” Instances such as this have caused platforms to enforce stricter misinformation policies.).

¹²⁴ Murphy & Stein, *supra* note 119; e.g., Hiltzik, *supra* note 5.

¹²⁵ Murphy & Stein, *supra* note 119; Leonhardt, *supra* note 33.

¹²⁶ Jane Lampman, *Why So Many Americans Switch Religions*, CHRISTIAN SCI. MONITOR (Apr. 28, 2009), <https://www.csmonitor.com/USA/Society/2009/0428/p02s01-ussc.html>.

¹²⁷ *Id.*

¹²⁸ POLITICAL POLARIZATION IN THE AMERICAN PUBLIC, PEW RSCH. CTR. 6 (2014).

¹²⁹ *National Polls and Studies*, DEATH PENALTY INFO. CTR., <https://deathpenaltyinfo.org/facts-and-research/public-opinion-polls/national-polls-and-studies> (last visited Mar. 16, 2022).

Since then, Americans have increasingly become more opposed, with the most recent 2021 poll reporting that only fifty-four percent were “for” while forty-three percent were “against.”¹³⁰ With the opposition rate currently at the highest it has been in nearly six decades, this shows how Americans’ views on a highly divisive topic have oscillated between extremes throughout the years.¹³¹

In contrast to these other subjects, two recent reports from the Association for the Advancement of Science and Pew Research Center found that over the past five decades, Americans’ views on science have shown little change; specifically, “the data reveal a persistent divide between the two-thirds of Americans who trust science and those who do not.”¹³² Thus, science appears unique in its ability to incite strong and lasting reactions, including denialism, likely because of its perception as “incompatible with cherished beliefs about God, family, or country.”¹³³ Importantly, although some attributes may influence it,¹³⁴ the phenomenon of science denialism transcends strict factors such as gender, education level, and political affiliation.¹³⁵ Yet, science denialists appear to share a similar habit: cherry-picking the science that best suits their values and ideologies.¹³⁶ For example, “people who trust science as a whole may reject science on specific topics such as climate change or evolutionary theory,”¹³⁷ and “someone might be highly educated, politically liberal, accepting of climate change, but fearful

¹³⁰ *Id.*

¹³¹ *Id.*

¹³² Daniel Oberhaus, *Why Some Citizens Reject Science*, HARVARD MAG. (Oct. 2021), <https://www.harvardmagazine.com/2021/09/right-now-clash-science-ideology>.

¹³³ *Id.*

¹³⁴ *See, e.g.*, Miller, *supra* note 58 (discussing how one study of 9654 of American adults found that “48% of those who had a high school education or less believed there was some truth to the conspiracy theory that COVID-19 was planned but only 15% among those with some postgraduate training endorsed this idea”).

¹³⁵ *See Science Denial: Lessons and Solutions*, *supra* note 60 (noting how “someone might be highly educated, politically liberal, accepting of climate change, but fearful of vaccines”) (quotation marks omitted).

¹³⁶ Oberhaus, *supra* note 132.

¹³⁷ *Id.*

of vaccines.”¹³⁸ Thus, public health authorities must approach denialists with sound persuasive strategies, cognizant of science’s unique ability to cause persistent division.

Although it is likely that some denialists are privately skeptical about their own beliefs (and thus their numbers may never be truly known),¹³⁹ it appears that others’ convictions are sincerely held, even if improperly divined. For this latter group, political scientist Charles Taber explains that when denialists confront science that contradicts their beliefs, they experience “a subconscious negative response to the new information—and that response, in turn, guides the type of memories and associations formed in the conscious mind. They retrieve thoughts that are consistent with their previous beliefs and that will lead them to build an argument and challenge what they’re hearing.”¹⁴⁰ Essentially, denialists’ brains largely seek to rationalize their beliefs, suiting the facts to fit the theory instead of the theory to fit the facts.¹⁴¹ Their denialistic “logic” becomes a means to the end of supporting their pre-existing convictions, and thus, it is highly susceptible to influence from not only their own psychology but also that of their denialist “group.”¹⁴²

¹³⁸ *Science Denial: Lessons and Solutions*, *supra* note 60 (quotation marks omitted).

¹³⁹ Keith Kahn-Harris, *Denialism: What Drives People to Reject the Truth*, *GUARDIAN* (Aug. 3, 2018), <https://www.theguardian.com/news/2018/aug/03/denialism-what-drives-people-to-reject-the-truth>; Paul Thagard, *The Cognitive Science of COVID-19: Acceptance, Denial, and Belief Change*, 195 *METHODS* 92, 94 (2021) (in seeking to understand why people reach different conclusions based on the same evidence, “[t]he simplest explanation would be that the dissidents simply lack some of the information: if they are not aware of the relevant evidence, then they can easily reach a different conclusion about what is the most plausible hypothesis. Another explanation is that people who reject the scientific conclusion are lying and that they know the right answer but refuse to say it because of personal or political goals. But the most psychologically interesting case involves people who are familiar with much of the relevant evidence and the alternative hypotheses but sincerely believe conclusions that are contrary to evidence and explanatory coherence.”)

¹⁴⁰ Chris Mooney, *What Is Motivated Reasoning? How Does It Work? Dan Kahan Answers*, *DISCOVER* (May 5, 2011), <https://www.discovermagazine.com/the-sciences/what-is-motivated-reasoning-how-does-it-work-dan-kahan-answers> (quotation marks omitted).

¹⁴¹ *See id.* (detailing how people can “go to great lengths to explain away behavior that seems obvious to everybody else—everybody who isn’t too emotionally invested to accept it, anyway,” and although people are motivated to perceive the world accurately, “we have other important goals besides accuracy—including identity affirmation and protecting one’s sense of self—and often those make us highly resistant to changing our beliefs when the facts say we should”).

¹⁴² *E.g., id.* (providing the example of how the political ideologies of Republicans and Democrats influence how they remain sharply divided over climate change).

B. *Individual Mechanisms*

In seeking to better understand the creation and preservation of science denialism, public health authorities can look to a myriad of potential psychological explanations. These influences—both individual and group—likely affect each science denialist in a unique way, but analyzed together, they paint a cohesive picture of the tenacity underlying denialists’ beliefs. Such an understanding of each nuanced psychological effect thus enables public health authorities to craft an effective response.

a. *Motivated Reasoning*

In psychology, science denialists’ proclivity to suit the facts to fit the theory is called motivated reasoning. Specifically, it is “the unconscious tendency of individuals to fit their processing of information to conclusions that suit some end or goal.”¹⁴³ Thus, denialists do not solely rely on an objective evaluation of the evidence to inform their decisions; rather, they are also influenced by their own goals and pre-existing beliefs.¹⁴⁴ One researcher offers an example: “coffee drinkers are less inclined to believe that caffeine causes cancer compared to non-drinkers.”¹⁴⁵ So then, a denialist who opposes vaccines is likely to doubt the scientific consensus of their safety and believe even flawed contrary evidence, such as the Wakefield study, because it re-affirms their views.¹⁴⁶ Importantly, the underlying mental processes that drives denialists to their conclusions are “often unconscious and nonverbal.”¹⁴⁷ This results in more than mere

¹⁴³ *Id.*

¹⁴⁴ Thagard, *supra* note 139.

¹⁴⁵ *Id.* Notably, “people tend to evaluate causal theories based not just on the evidence but also on their own personal goals.” *Id.* Thus, these coffee drinkers are likely motivated to believe their habit does not cause cancer *because* they drink coffee and accepting contrary evidence would jeopardize their habit. For more information on this motivation, see the discussion of cognitive dissonance, *infra* Section III.B.b.

¹⁴⁶ See Thagard, *supra* note 139 (discussing the use and impact of motivated reasoning).

¹⁴⁷ *Id.* Thagard contrasts these “unconscious and nonverbal” processes with “the conscious and verbal nature of reasoning.” *Id.*

wishful thinking or picking a belief system at random; instead, these beliefs are likely sincerely held and supported by whatever evidence the denialist could find to bolster their views.¹⁴⁸

One blatant example of motivated reasoning occurred during the COVID-19 pandemic. During July 2020, in Sturgis, South Dakota, bikers wanted to host their annual motorcycle rally.¹⁴⁹ The state's governor and then-President Donald Trump supported the event, relying on the bikers' conclusion that "they could have their annual party without taking any risks."¹⁵⁰ In granting their support, these political leaders were highly motivated by ideals of "personal freedom, keeping the economy flourishing, and maintaining their own popularity."¹⁵¹ These underlying motivations caused them to ignore the science of the worsening pandemic and disregard protective public health measures.¹⁵² By October of that year, the state had one of the country's highest rates of cases per population, thus showing the dangerous consequences of denialists' motivated reasoning.¹⁵³

Experiments have yet to reveal precisely how motivated reasoning works in the mind, but experts believe that it is largely driven by emotion. For denialists, the process of reasoning to a specific conclusion is skewed by strong emotions, which may either be positive, such as happiness or pride, or negative, such as fear or insecurity.¹⁵⁴ Because scientific consensus on serious issues often encourages caution and may invoke fear (e.g., the deaths caused by COVID-19, the impending climate disaster, and the link between tobacco and cancer),¹⁵⁵ it is thus

¹⁴⁸ *See id.* (discussing how "people do not believe whatever they want to believe but rather seek out evidence and arguments that support what they want to believe").

¹⁴⁹ *Id.* at 92, 94.

¹⁵⁰ Thagard, *supra* note 139.

¹⁵¹ *Id.*

¹⁵² *See id.* (stating that "[s]uch personal and social goals swamped the increasingly available information that COVID-19 dangerously combines a high degree of contagion from both symptomatic and asymptomatic carriers with a high risk of death, especially for victims who are older or have other conditions such as obesity").

¹⁵³ *Id.* at 92, 94.

¹⁵⁴ *Id.* at 94–95.

¹⁵⁵ *See* discussion *supra* Section II.A.

unsurprising that people turn to denialism. Instead of facing an unsettling reality that may necessitate lifestyle alterations, actively seeking contrary data “may bring security and calm.”¹⁵⁶ With emotion overriding logical reasoning, science denialists arrive at placating but unsubstantiated beliefs. Indeed, a desire to avoid discomfort underlies another key psychological explanation as well.

b. Cognitive Dissonance

Motivated reasoning may be the result of individuals’ efforts to avoid cognitive dissonance, a term used to describe the “mental discomfort that results from holding two conflicting beliefs, values, or attitudes.”¹⁵⁷ This phenomenon originates as people seek alignment between their attitudes and behaviors.¹⁵⁸ When there is an irreconcilable difference between what an individual thinks and what he does, cognitive dissonance urges him to resolve this tension by “rejecting, explaining away, or avoiding new information” that creates or strengthens the disconnect.¹⁵⁹ Science denialists may experience cognitive dissonance when scientific consensus does not align with their pre-existing beliefs or actions. For example, if a denialist accepts the consensus that the burning of fossil fuels creates greenhouse gases that cause climate change, and yet he still owns stock in an oil company, there is an uncomfortable incongruity between the consensus and his actions.¹⁶⁰ Motivated by a desire to rectify this cognitive dissonance, the

¹⁵⁶ Miller, *supra* note 58, at 2256.

¹⁵⁷ Kendra Cherry, *What Is Cognitive Dissonance?*, VERYWELL MIND (Feb. 8, 2022), <https://www.verywellmind.com/what-is-cognitive-dissonance-2795012>. In addition to cognitive dissonance, another explanation for motivated reasoning is self-protective ego maintenance; this occurs as an individual may utilize a slew of thought processes to maintain their image and identity. See Hanan Parvez, *10 Ego Defence Mechanisms in Psychology*, PSYCHMECHANICS (Jan. 20, 2021), <https://www.psychmechanics.com/defence-mechanisms/> (explaining various protective mechanisms).

¹⁵⁸ Cherry, *supra* note 157.

¹⁵⁹ *Id.*

¹⁶⁰ See Crichton, *supra* note 117 (providing examples of cognitive dissonance in climate change deniers).

denialist faces a choice: either change his behavior or change his beliefs.¹⁶¹ The first option often poses a challenge as most behaviors are rewarding,¹⁶² many habits are ingrained,¹⁶³ and behavioral change can evoke anxiety.¹⁶⁴ As a result, changing a behavior may often be seen as an unattractive and risky option.¹⁶⁵ Because of these factors, the latter choice to change a belief offers an easier “out,” and the denialist may accordingly seek out information discrediting the consensus finding¹⁶⁶ or discount it.¹⁶⁷

c. Psychological Reactance

Particularly key to understanding science denialism is psychological reactance. Generally, people believe that they are free to engage in certain behaviors at will; reactance occurs when prohibitions are put into place that challenge this belief.¹⁶⁸ Specifically, psychological reactance is “an unpleasant motivational arousal that emerges when people experience a threat to or loss of their free behaviors.”¹⁶⁹ In response to this threat—or even the perception of one—, people seek to regain control over their freedom, and this effort is often accompanied by intense emotion, such as aggression and an urge to rebel.¹⁷⁰ Notably, the strength of individuals’ reactance varies with the importance of the freedom and the magnitude of the threat.¹⁷¹ Additionally, Americans’ individualistic culture likely heightens science

¹⁶¹ Markham Heid, *How Identity—Not Ignorance—Leads to Science Denial*, ELEMENTAL (July 9, 2020), <https://elemental.medium.com/how-identity-not-ignorance-leads-to-science-denial-533686e718fa>.

¹⁶² *Id.*

¹⁶³ Yasmine Kalkstein, *Why Is Changing Behavior so Hard?*, DECISION LAB, <https://thedecisionlab.com/insights/environment/change-is-hard> (last visited May 11, 2022).

¹⁶⁴ *Id.*

¹⁶⁵ *See id.* (explaining how maintaining the status quo prevents individuals from confronting the losses that may be incurred alongside behavioral change, and noting that “[t]his loss aversion prevents us from wanting to take the ‘risk’ of change”).

¹⁶⁶ *See* discussion on confirmation bias, *infra* Section III.B.f.

¹⁶⁷ *See* discussion on belief perseverance, *infra* Section III.B.e.

¹⁶⁸ Christina Steindl et al., *Understanding Psychological Reactance*, 223 ZEITSCHRIFT FÜR PSYCHOLOGIE 205, 205 (2015).

¹⁶⁹ *Id.*

¹⁷⁰ *Id.* at 205–06.

¹⁷¹ *Id.* at 205.

denialists' reactance because members of such societies are more threatened by perceived threats to their personal freedoms than those in collectivist societies, who exhibit more reactance in the face of threats to the group.¹⁷²

This became readily apparent during the COVID-19 pandemic lockdowns, when governmental orders prevented people from being able to “shop, dine, travel, or congregate as usual.”¹⁷³ These measures—although scientifically valid efforts to slow the virus' spread— infringed on individuals' ability to live how they would have preferred: without such widespread governmental interference or regulation.¹⁷⁴ Given the explanation offered by psychological reactance, it is clear why large sects of the population resisted the changes.¹⁷⁵ Political leaders, such as then-President Donald Trump and other GOP members, even exemplified this by citing personal freedom as a reason to oppose mask mandates¹⁷⁶ and social distancing.¹⁷⁷

Although the COVID-19 pandemic provides a ready and extreme example, psychological reactance is present during other instances of science denialism as well. For those who deny the demonstrated health effects of tobacco usage, warning labels act as a perceived threat to their freedom.¹⁷⁸ As a result, these labels appear to be ineffective and can even trigger “forbidden fruit effects, making the forbidden item more attractive to consumers.”¹⁷⁹ In this way, people are

¹⁷² *Id.* at 207.

¹⁷³ Heid, *supra* note 161.

¹⁷⁴ See Hiltzik, *supra* note 5 (discussing the governments' efforts to slow the spread of COVID-19).

¹⁷⁵ See *id.* (discussing how Republican leaders undermined scientific knowledge during the pandemic, and this largely benefitted “special interests that profit from the old ways of doing things,” such as the oil and gas industry in the case of climate change denialism and people who wanted to “evade responsibility for dealing with the crisis” in the context of COVID-19).

¹⁷⁶ *Id.*

¹⁷⁷ See Peter Baker et al., *Trump Fomenting Protests Against Governors; Experts Warn of Testing Shortages*, N.Y. TIMES (Apr. 20, 2020), <https://www.nytimes.com/2020/04/17/us/coronavirus-cases-news-update.html> (explaining that President Trump “openly encouraged right-wing protests of social distancing restrictions in states with stay-at-home orders,” calling to “liberate” those states).

¹⁷⁸ See SARA PROT & CRAIG A. ANDERSON, MED. MISINFORMATION & SOC. HARM IN NON-SCIENCE-BASED HEALTH PRACTICES 28 (2020) (discussing the link between reactance and tobacco warning labels).

¹⁷⁹ *Id.*

driven to counter the perceived threat by engaging in the exact behavior that is warned against, despite evidence of its harm.¹⁸⁰ Additionally, in the context of those who oppose vaccination, pro-vaccination messaging and encouragement can be perceived as a threat to parents' freedom to raise their children as they see fit, causing them to exhibit even stronger anti-vaccination tendencies.¹⁸¹ Thus, psychological reactance can be a major contributor to anti-science beliefs and behaviors, particularly when that science urges a change in lifestyle and decision-making.

d. Heuristics

Another psychological influence on decision-making is termed heuristics, or cognitive “shortcuts that humans use to reduce task complexity in judgment and choice.”¹⁸² Decision-making is a complex process involving both basic cognitive functions, such as perception, memory, and retrieval, and the more intricate element of choosing between alternatives.¹⁸³ Heuristics, then, are an adaptive behavior upon which people rely to simplify this process and conserve mental energy.¹⁸⁴ In response to a given stimulus—often ones encountered in the past—, an individual influenced by a heuristic will exhibit certain behaviors “in virtually the

¹⁸⁰ See Steve Sussman et al., *Forbidden Fruit and the Prediction of Cigarette Smoking*, 45 *Substance Use & Misuse* 1683, 1684 (2010) (explaining that, particularly in the context of youth, anti-smoking directives from authority may encourage the behavior as it allows people to feel that “they are making their own choice,” and this can be “interpreted as a sign of independence”).

¹⁸¹ PROT & ANDERSON, *supra* note 178.

¹⁸² Cleotilde Gonzalez, *Decision-Making: A Cognitive Science Perspective*, OXFORD HANDBOOK COGNITIVE SCI. 1, 4–5 (2017) (quotation marks omitted).

¹⁸³ *Id.* at 1.

¹⁸⁴ Gerd Gigerenzer & Wolfgang Gaissmaier, *Heuristic Decision Making*, 62 *ANN. REV. PSYCH.* 451, 454 (2011) (defining a heuristic as “a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally, and/or accurately than more complex methods”). Notably, understanding complex scientific topics requires a vast amount of time and cognitive resources, while concepts such as freedom and individualism (common themes echoed by science denialists) are often easier to grasp, thus making heuristics even more adaptive and attractive in this context. See Ethan Siegel, *You Must Not ‘Do Your Own Research’ When It Comes to Science*, *FORBES* (July 30, 2020), <https://www.forbes.com/sites/startswithabang/2020/07/30/you-must-not-do-your-own-research-when-it-comes-to-science/?sh=6a7e9ff0535e> (“Even those of us with excellent critical thinking skills and lots of experience trying to dig up the truth behind a variety of claims are lacking one important asset: the scientific expertise necessary to understand any finds or claims in the context of the full state of knowledge of your field. It’s part of why scientific consensus is so remarkably valuable: it only exists when the overwhelming majority of qualified professionals all hold the same consistent professional opinion.”); for a discussion of freedom-based thinking underlying science denialism, see psychological reactance explanation, *supra* Section III.B.c..

same fashion and in the same order every time.”¹⁸⁵ These predictable responses are largely beneficial because they often produce desired outcomes.¹⁸⁶ For example, when passing a dark alley with strangers in it, an individual may unconsciously decide to walk faster.¹⁸⁷ The decision likely did not result from careful reasoning but instead from the heuristic that danger may be present.¹⁸⁸ Thus, heuristics are often employed when someone is feeling an intense emotion or experiences a high cognitive load.¹⁸⁹ Although these simplified shortcuts have reduced the burden of everyday decision-making, they can misfire, leading to incorrect conclusions and behaviors.¹⁹⁰

In the quest to evaluate scientific findings, heuristics are a double-edged sword. On one hand, a mental shortcut could enable a layperson to agree with scientific consensus on an issue, as “consensus implies correctness.”¹⁹¹ Research has shown that “people prefer to take cues from the combined judgment of multiple experts.”¹⁹² By relying on the heuristic that expert consensus is generally correct, non-specialist members of the public save themselves the cognitive load of having to learn complex science and rely on their own judgment alone.¹⁹³ So while heuristics can benefit some, they can also further entrench anti-science ideas in denialists. On this other hand, denialists can be influenced by a heuristic that causes them to disregard consensus and instead believe only the contrary information they are seeking out. Thus, heuristics can reinforce denialists’ beliefs, “especially when particular myths are frequently encountered, when existing

¹⁸⁵ ROBERT CIALDINI, *INFLUENCE: THE PSYCHOLOGY OF PERSUASION* 2 (1984).

¹⁸⁶ *Id.*

¹⁸⁷ *Heuristics*, CONCEPTUALLY, <https://conceptually.org/concepts/heuristics> (last visited Mar. 18, 2022).

¹⁸⁸ *Id.*

¹⁸⁹ *Id.*

¹⁹⁰ *Id.*

¹⁹¹ Sander van der Linden et al., *Inoculation the Public Against Misinformation About Climate Change*, GLOB. CHALLENGES 1600008, 1600008 (2017) (quotation marks omitted).

¹⁹² *Id.*

¹⁹³ *Id.*

knowledge is incorrect, and/or when one's social neighborhood shares or even identifies through false beliefs."¹⁹⁴ This heuristic can be further validated by widely available anecdotal evidence and false media balance, a term used to describe the practice of news sources treating opposing viewpoints as equally credible, even when the evidence shows otherwise.¹⁹⁵ As a result, these automatic, subconscious shortcuts can either further align individuals with scientific consensus or work to alienate them from it.

e. Belief Perseverance

Another psychological motivator for denialists is belief perseverance, which describes people's strong attachment to their prior views of how the world works, even if there is abundant evidence to the contrary.¹⁹⁶ This phenomenon, then, explains why first impressions are usually the most lasting: "initial perceptions, opinions, and attitudes persevere in the face of disconfirming evidence."¹⁹⁷ For science denialists, this disconfirming evidence takes the form of scientific consensus that opposes their pre-existing beliefs.¹⁹⁸ Research indicates that the topics most likely to elicit belief perseverance—and thus, those that are the hardest to change—are individuals' views on stereotypes, religious faiths, and their own self-concepts.¹⁹⁹ The last of these may be particularly helpful in understanding denialists. For instance, if an individual views himself as an anti-elitist, independent thinker, he may be inclined to oppose scientific consensus

¹⁹⁴ John Cook et al., *Neutralizing Misinformation Through Inoculation*, 12 PLOS ONE 1, 2 (2017).

¹⁹⁵ Van der Linden et al., *supra* note 191; Liz Spayd, *The Truth About 'False Balance'*, N.Y. TIMES (Sept. 10, 2016), <https://www.nytimes.com/2016/09/11/public-editor/the-truth-about-false-balance.html>.

¹⁹⁶ PROT & ANDERSON, *supra* note 178, at 26–27.

¹⁹⁷ *Id.*

¹⁹⁸ See Crichton, *supra* note 117 (discussing scientific consensus, belief perseverance, and the idea that "[a]s human beings, we are much less likely to be persuaded by and accept information that challenges or undermines the things we believe in").

¹⁹⁹ Carrie Arnold, *Diss Information: Is There a Way to Stop Popular Falsehoods from Morphing into 'Facts'?*, SCI. AM. (Oct. 4, 2012), <https://www.scientificamerican.com/article/how-to-stop-misinformation-from-becoming-popular-belief/>.

that encourages a change in behavior.²⁰⁰ Because this consensus threatens the individual's established habits and because automatic compliance would clash with his self-perception, belief perseverance may encourage him to discount or discredit the widely accepted conclusion. Thus, this may at least partly explain why some leaders' anti-science messaging during the COVID-19 pandemic was so effective: it appealed to individuals' sense of freedom and their desire not to be unthinking "sheeple."²⁰¹

Because people naturally resist being wrong²⁰² (and underestimate the chances that they are wrong²⁰³), public health authorities have particular reason to worry about belief perseverance: changing individuals' incorrect beliefs requires getting them to admit they have been mistaken, and this poses a daunting task. For example, the Wakefield study, although decades old and debunked many times over, still influences parents in both the United States and the United Kingdom; their deep-rooted fear that vaccines can cause autism encourages them to decline vaccinating their children.²⁰⁴ This presents a major risk to public health and reveals the lasting power of belief perseverance.²⁰⁵ By rejecting information that could disprove their beliefs, science denialists fiercely guard their initial inclinations.²⁰⁶ Belief perseverance,

²⁰⁰ See *id.* (explaining that "we are especially vulnerable [to belief perseverance] when invalidated beliefs form a key part of how we narrate our lives" and providing the example of "if an individual has become known in her community for purporting that vaccines cause autism, she might build her self-identity as someone who helps prevent autism by helping other parents avoid vaccination. Admitting that the original study linking autism to the MMR (measles–mumps–rubella) vaccine was ultimately deemed fraudulent would make her look bad (diminish her self-concept)").

²⁰¹ See, e.g., Lachlan Gilbert, *Power to the Sheeple: Why Common Sense Prevails Despite COVID-19 Uncertainty*, U. NEW S. WALES (Sept. 23, 2021), <https://newsroom.unsw.edu.au/news/general/power-sheeple-why-common-sense-prevails-despite-covid-19-uncertainty> (discussing how most people "may complain about the restrictions or even think them unfair, but ultimately they seem to believe and trust the reasoning of the leaders and experts, even when that reasoning appears to change," but "the doubters laugh and call the compliant masses 'sheeple.'"). An individual's desire to avoid cognitive dissonance, discussed *supra* Section III.B.b., also supports this thinking as they aim to behave in ways that are consistent with their self-concepts.

²⁰² Crichton, *supra* note 117.

²⁰³ See discussion of overconfidence bias *infra* Section III.B.f.

²⁰⁴ PROT & ANDERSON, *supra* note 178, at 27.

²⁰⁵ *Id.*

²⁰⁶ Cynthia Vinney, *What Is Belief Perseverance? Definition and Examples*, THOUGHT CO. (Oct. 30, 2019), <https://www.thoughtco.com/belief-perseverance-4774628>.

however, may also work in tandem with other psychological influences, such as those that encourage what types of information denialists seek out in the first place.

f. Cognitive Biases: Confirmation, Overconfidence, Optimism, and Self-Interest

In psychology, cognitive biases are “subconscious deviations in judgment leading to perceptual distortion, inaccurate judgment and illogical interpretation.”²⁰⁷ The brain often relies on these automatic processes to simplify how it assesses information, which is largely a beneficial behavior as individuals receive “11 million bits of information per second, but [] can only process about 40 bits of information per second.”²⁰⁸ Thus, biases can originate because of processing limitations, mental shortcuts (heuristics), social pressure, and internal motivations, such as those that validate emotions and safeguard self-perception.²⁰⁹ With multiple potential origins, a slew of biases can arise, and while each has the power to independently influence a denialist, they can also work together to further bolster beliefs.

An important bias related to the acquisition of new information is confirmation bias. This bias describes how “people seek out and recall information that supports their preconceived beliefs.”²¹⁰ Similar to how belief perseverance causes individuals to discount contrary information, confirmation bias causes them to seek out only favorable information.²¹¹ In today’s world, such favorable information—even if unscientific—is plentiful and easily accessible,

²⁰⁷ NICOLA COOPER & JOHN FRAIN, ABC OF CLINICAL REASONING 24 (2017).

²⁰⁸ Charlotte Ruhl, *What Is Cognitive Bias?*, SIMPLY PSYCH. (May 4, 2021), <https://www.simplypsychology.org/cognitive-bias.html> (citing G. Orzan et al., *Neuromarketing Techniques in Pharmaceutical Drugs Advertising*, 5 J. MED. & LIFE 428 (2012)).

²⁰⁹ COOPER & FRAIN, *supra* note 207.

²¹⁰ Vinney, *supra* note 206.

²¹¹ *Id.*

particularly considering false media balance²¹² and social media misinformation.²¹³ On social media sites, such as Facebook and Twitter, advanced algorithms encourage confirmation bias as the sites present the stories, posts, and articles that users are most likely to agree with, based on their previous interactions, all while suppressing contrary information.²¹⁴ Thus, it is unsurprising that many science denialists found a platform on social media; after all, the two main reasons people use the sites are to stay connected with others and to stay up-to-date with news and current events.²¹⁵ But the real-world impact of social media-based science denialism remains startling. For example, over the course of four months in 2020, a group of researchers observed a spike in anti-science tweets originating from some Mountain West and Southern states; soon after, these areas were ravaged by corresponding spikes in COVID-19 deaths.²¹⁶ Thus, denialists' discourse can directly influence public health outcomes, and the confirmation bias seeks to reinforce these beliefs.

²¹² See Spayd, *supra* note 195 (noting that news organizations seek to present “balanced coverage” of issues and “present each side of a debate as equally credible, even when the factual evidence is stacked heavily on one side”). This approach may mislead audiences, however, as it strays from “forceful, honest reporting” that “hold[s] power accountable.” See *id.* (discussing how false media balance “masquerades as rational thinking”).

²¹³ See Ruhl, *supra* note 208 (discussing how “[v]arious social media platforms, such as Facebook, help reinforce our confirmation bias by feeding us stories that we are likely to agree with – further pushing us down these echo chambers”); see generally, Dietram A. Scheufele & Nicole M. Krause, *Science Audiences, Misinformation, and Fake News*, 116 PROC. NAT. ACADEM. SCI. 7662 (2019) (providing a detailed overview of how and why misinformation related to science and politics takes root, and specifically outlining the influence of social media in this process).

²¹⁴ See Jim Fournier, *How Algorithms Are Amplifying Misinformation and Driving a Wedge Between People*, The Hill (Nov. 10, 2021), <https://thehill.com/changing-america/opinion/581002-how-algorithms-are-amplifying-misinformation-and-driving-a-wedge/> (explaining that the design of social media platforms “are based on algorithms that look for, learn from, and implement patterns,” and these algorithms “feed people content to increase ‘engagement’ and keep them scrolling to see more ads. On average, emotionally provocative content that reinforces what we already believe works better than factual information. This creates a circular feedback loop that traps each of us in our own filter bubble and drives a wedge between people with differing schools of thought or political beliefs.”).

²¹⁵ Geoff Desreumaux, *The 10 Top Reasons Why We Use Social Networks*, WERSM (Oct. 14, 2018), <https://wersm.com/the-10-top-reasons-why-we-use-social-networks/>.

²¹⁶ Emily Chen et al., *Tracking Social Media Discourse About the COVID-19 Pandemic: Development of a Public Coronavirus Twitter Data Set*, 2 J. MED. INTERNET RES. 19273, 19273 (2010).

Another influential bias underpinning science denialists' thinking is overconfidence bias, or the "overestimation of one's actual ability to perform a task successfully, [fueled by] by a belief that one's performance is better than that of others, or by excessive certainty in the accuracy of one's beliefs."²¹⁷ Because this bias causes individuals to fail to spot the limits of their knowledge, they tend to underestimate risk, which can lead to disastrous consequences.²¹⁸ During the COVID-19 pandemic, for example, entire countries appeared to fall victim to this bias.²¹⁹ Although the United States "was considered one of the countries best equipped to confront a [deadly] virus," it soon became the world's leader in total cases and deaths.²²⁰ Other countries also faltered, and the one common feature was that their leaders—and thus, likely many of their citizens—subscribed to the belief that their countries were somehow exceptional compared to the rest of the world. In the United States, this exceptionalism took the form of leaders withdrawing from the World Health Organization and claiming the virus would dissipate "like a miracle," and many individuals followed suit by resisting preventative efforts such as mask-wearing.²²¹ In Brazil, one leader suggested that Brazilians were "tough enough to survive infection," so public health measures were unnecessary.²²² Thus, bias-fueled science denialism wreaked havoc on emergency preparedness systems, ultimately resulting in needless suffering and death.

Optimism bias also cements science denialists' beliefs as it causes them to "overestimate [their] likelihood of experiencing positive events and underestimate [their] likelihood of

²¹⁷ *Overconfidence*, AM. PSYCH. ASSN., <https://dictionary.apa.org/overconfidence> (last visited Mar. 9, 2022).

²¹⁸ *Cognitive Bias*, MIND TOOLS, <https://www.mindtools.com/pages/article/avoiding-psychological-bias.htm> (last visited Mar. 19, 2022).

²¹⁹ Martha Lincoln, *Study the Role of Hubris in Nations' COVID-19 Response*, NATURE (Sept. 15, 2020), <https://www.nature.com/articles/d41586-020-02596-8>.

²²⁰ *Id.*

²²¹ *Id.*

²²² *Id.*

experiencing negative events.”²²³ People exhibit this bias because it encourages a feeling of control over events; even if this belief is false or exaggerated, it poses an adaptive function as optimism has social, physical, and mental benefits, such as reducing stress and fear.²²⁴ For science denialists, an abundance of optimism may allow them to cope with disconcerting scientific realities. For example, well-known climate change deniers such as former President Donald Trump share the personality trait of extreme optimism.²²⁵ This likely causes them to think that they are resilient enough to recover from any setback, even if seemingly doomsday scientific consensus proves to be true.²²⁶ Further, this bias can cause people to feel that an impending disaster such as climate change is not personal and will have little effect on them, meanwhile others should worry.²²⁷

Finally, self-interest bias, also termed self-serving bias, can explain science denialists’ beliefs. This bias describes how individuals “attribute positive events and successes to [their] own character or actions, but blame negative results to external factors unrelated to [their] character.”²²⁸ Several factors motivate this bias, particularly individuals’ need to preserve their self-esteem, safeguard their self-presentation to others, and maintain optimism.²²⁹ It can also lead to people “evaluat[ing] their own wrongdoings more leniently than identical deeds of others.”²³⁰ This bias became readily apparent during the COVID-19 pandemic as public health measures necessitated that individuals sacrifice their own interests, such as travelling or having large

²²³ *Why Do We Overestimate the Probability of Success?*, DECISION LAB, <https://thedeisionlab.com/biases/optimism-bias> (last visited Mar. 19, 2022).

²²⁴ *Id.*

²²⁵ Geoffrey Beattie, *Optimism Bias and Climate Change*, 33 BRITISH ACA. REV. 12, 13 (2018).

²²⁶ *Id.*

²²⁷ *Id.*

²²⁸ *Why Do We Blame External Factors for Our Own Mistakes?*, DECISION LAB, <https://thedeisionlab.com/biases/self-serving-bias> (last visited Mar. 19, 2022).

²²⁹ *Id.*

²³⁰ Mengchen Dong et al., *Self-Interest Bias in the COVID-19 Pandemic: A Cross-Cultural Comparison Between the United States and China*, 52 J. CROSS-CULTURAL PSYCH. 663, 664 (2021).

gatherings, in order to serve the greater goal of preventing infections.²³¹ Studies found that when others defied this goal and subverted public health restrictions, Americans viewed these actions negatively, but when they personally performed identical actions—namely, exploiting test kits, gathering socially, and sneezing without covering one’s mouth—, they found their own self-serving acts to be more acceptable.²³² Thus, the self-interest bias can enforce science denialists’ views by enabling a double standard that relieves them of responsibility for negative outcomes, ultimately decreasing cognitive dissonance.²³³ Individual mechanisms such as this, however, can all be further bolstered by group psychological influences.

C. *Group Influence*

In seeking to understand the dynamics of denialism, psychologists find that the reaction is often attributable to denialists’ sense of identity and belonging, not mere ignorance of scientific consensus.²³⁴ Ultimately, denialists are seeking to find and uphold membership in a collective that conveys meaning to them.²³⁵ This collective can take the form of a political or religious group or some other community that adheres to certain ideals.²³⁶ For those denialists enmeshed with such a community, rejecting an anti-science view that the group has adopted could be seen as rejecting the entire community itself.²³⁷ Experts find that this result would clash with self-determination theory, which proposes that individuals have three needs that motivate their behavior: autonomy (the belief that actions are self-originating), competence (the belief that goals can be achieved), and relatedness (the feeling of social belonging).²³⁸ A community with

²³¹ *Id.*

²³² *Id.* at 673–74.

²³³ See discussion of cognitive dissonance *supra* Section III.B.b.

²³⁴ Heid, *supra* note 161.

²³⁵ *Id.*

²³⁶ *Id.*

²³⁷ *Id.*

²³⁸ *Id.*

shared social values, such as science denialism, can satisfy all of these needs, so “people are strongly motivated to accept their group’s ideas or to engage in behaviors that are valued within their social spheres.”²³⁹ Importantly, research has shown that a group does not have to be large to elicit this response. For example, “three to five people will elicit much more conformity than just one or two,”²⁴⁰ and conformity increases with the number of people in the group’s majority, up to seven individuals.²⁴¹ Thus, from a group psychology standpoint, the influence of even small groups of denialists can be powerful, and beliefs tied to social identity can quickly become widespread and even radicalized, necessitating a careful understanding of potential influences.

a. Cultural Cognition

One method of explaining science denialism through a group psychological lens is through analyzing cultural cognition. Yale Law Professor Dan Kahan posits this theory, which involves “a collection of psychological mechanisms that dispose individuals selectively to credit or dismiss evidence of risk in patterns that fit values they share with others.”²⁴² These psychological mechanisms, such as outlooks on hierarchy and egalitarianism, individualism and communitarianism, and identity-protective reactions, work to align one’s beliefs with those of like-minded peers in an attempt to mitigate cognitive dissonance and preserve social status.²⁴³ Encouraged by these mechanisms and others, individuals tend to “fit their perceptions of risk and related factual beliefs to their shared moral evaluations of putatively dangerous activities.”²⁴⁴

²³⁹ Heid, *supra* note 161.

²⁴⁰ Fakhar Naveed, *Influence of Group Size, Unanimity, Cohesion and Status on Conformity*, MASS. COMMUNIC’N TALK (Mar. 15, 2013), <https://www.masscommunicationtalk.com/influence-of-group-size-unanimity-cohesion-and-status-on-conformity.html>.

²⁴¹ *Group Behavior*, LUMEN, <https://courses.lumenlearning.com/wmopen-psychology/chapter/conformity-compliance-and-obedience/> (last visited May 11, 2022) (once the majority in a group reaches seven individuals, conformity from the group’s other members levels off and even slightly decreases).

²⁴² Dan M. Kahan et al., *Cultural Cognition of Scientific Consensus*, J. RISK RESEARCH 1, 2 (2010).

²⁴³ *Id.* at 2–3.

²⁴⁴ *Id.* at 2.

Essentially, when adopting and evaluating beliefs about societal dangers, people are influenced by their commitment to their specific idea of what constitutes an ideal society.²⁴⁵

In the context of science denialism, cultural cognition influences how people judge experts' credibility.²⁴⁶ Under the theory, individuals are predisposed to impute knowledge and trustworthiness to those experts who share their worldviews, while they withhold those attributes from experts with differing worldviews.²⁴⁷ This means that when evaluating scientific consensus, individuals more readily recall findings from like-minded experts to inform their views; thus, people rely on the availability heuristic, a mental shortcut that simplifies decision-making by emphasizing the most readily recalled information.²⁴⁸ So, even if the credibility of experts on both sides of an issue is exactly the same (a rarity), cultural cognition and the availability heuristic cause people with opposing outlooks to ultimately hold "different impressions of what 'most' credible experts believe."²⁴⁹ Such differing views can be further supported as people often seek out information that aligns with their cultural predispositions,²⁵⁰ an effort that results in motivated reasoning.²⁵¹ Thus, influenced by her cultural values, a denialist is likely to search for and evaluate consensus information in a way that supports her pre-existing convictions and emotions.²⁵²

b. In-Group Bias

²⁴⁵ Dan M. Kahan, *Cultural Cognition as a Conception of the Cultural Theory of Risk*, HANDBOOK OF RISK THEORY 1, 1 (2008).

²⁴⁶ Kahan et al., *supra* note 242, at 3.

²⁴⁷ *Id.* at 3–4.

²⁴⁸ *Id.*

²⁴⁹ *See id.* at 4 (discussing cultural cognition, the availability heuristic, and how "information sources that share their worldviews will be overrepresented in individuals' mental inventories of experts").

²⁵⁰ *Id.*

²⁵¹ *See* discussion of motivated reasoning *supra* Section III.B.a.

²⁵² Kahan et al., *supra* note 242, at 22.

Cultural values and social identity can influence which group individuals feel they belong to, and this can lead to a special kind of bias and alienation. In-group bias is a term used to describe “the tendency for people to give preferential treatment to others who belong to the same group that they do.”²⁵³ This also influences how people treat non-members of the group; in an extreme example, such out-group vitriol can result in prejudice and discrimination.²⁵⁴ Research has shown that in-group favoritism is present and sways members’ beliefs and actions, even when groups were assigned by a random coin toss.²⁵⁵ Notably, individuals are quick to sort themselves and others into groups based on a variety of factors, such as “gender, nationality, and political affiliation,” and while “[n]ot all of these categories are equally important, [] they all contribute to the idea we have about who we are and what role we play in society.”²⁵⁶

One example of in-group bias in the context of science denialism is that exhibited by political parties. Some may believe that science denialism is solely an attribute of conservatives as that is the political party that vocally opposes certain matters garnering scientific consensus, such as COVID-19’s impact²⁵⁷ and climate change.²⁵⁸ But research has shown that both conservatives and liberals are motivated to evaluate scientific claims in ways that support their pre-existing ideological convictions.²⁵⁹ As a result, members of both political parties exhibit

²⁵³ *Why Do We Treat Out In-Group Better than We Do Our Out-Group?*, DECISION LAB, <https://thedecisionlab.com/biases/in-group-bias> (last visited Mar. 20, 2022).

²⁵⁴ *Id.*

²⁵⁵ *Id.*

²⁵⁶ *Id.*

²⁵⁷ See Hiltzik, *supra* note 5 (exploring why American political leadership denied the seriousness of the COVID-19 pandemic and proposing that “[i]t may be that anti-science policy has become so ingrained in the GOP that downplaying the deadliness of the pandemic just came naturally”).

²⁵⁸ See Anthony N. Washburn & Linda J. Skitka, *Science Denial Across the Political Divide: Liberals and Conservatives Are Similarly Motivated to Deny Attitude-Inconsistent Science*, SOC. PSYCH. & PERSONALITY SCI. 1, 1 (2017) (noting that “[o]ne well-documented area of science denial is the tendency for conservatives to be more likely to deny scientific evidence of climate change,” and conservatives also “support policies inconsistent with the scientific consensus on evolution.” This has led “some to speculate that conservatives may be more dispositionally inclined and/or motivated to be skeptical and distrustful of scientific evidence than liberals”).

²⁵⁹ *Id.* at 2. Importantly, in-group bias is bolstered by other individual psychological influences, such as motivated reasoning, confirmation bias, and self-interest bias. See discussion *supra* Section III.B.

science denialism; the key difference is in the underlying issues.²⁶⁰ The media and researchers tend to focus on issues that conservatives oppose, such as climate change, but studies indicate that if issues that conflicted with liberal values, such as the safety of genetically modified foods, were included, science denialism from the left would be more apparent.²⁶¹ In-group bias compounds these outcomes as it causes individuals to preferentially value the opinions and views of fellow party members when evaluating information, all while vehemently opposing the conclusions of the political out-group.²⁶² Thus, in-group bias can reinforce the attitudes, beliefs, and behaviors of group members, regardless of which group is under scrutiny.

c. Group Polarization

Another group psychological influence that is often cited in relation to political affiliation is group polarization. Under this effect, “members of a deliberating group move toward a more extreme point in whatever direction is indicated by the members’ predeliberation tendency.”²⁶³ Essentially, when like-minded individuals deliberate, it can cause members’ attitudes to become more extreme.²⁶⁴ For example, two individuals who are initially moderate in their opposition of gun control may leave a conversation with each other as more enthusiastic opposers.²⁶⁵ This phenomenon is encouraged by both the social comparison theory, which proposes that “people often change their opinions when in a group in order to fit in or to be accepted, and to be looked upon more favorably,” and informational influence, which states that people are swayed by the

²⁶⁰ Washburn & Skitka, *supra* note 258, at 2.

²⁶¹ *Id.*

²⁶² See *Why Do We Treat Out In-Group Better than We Do Our Out-Group?*, *supra* note 253 (explaining the impact of in-group bias and how it affects individuals’ views).

²⁶³ Cass R. Sunstein, *The Law of Group Polarization*, JOHN M. OLIN PROGRAM L. & ECON. WORKING PAPER 1, 3–4 (1999).

²⁶⁴ *Group Polarization in Social Psychology*, ALVERNIA U. (May 1, 2018), <https://online.alvernia.edu/articles/group-polarization-social-psychology>.

²⁶⁵ See Sunstein, *supra* note 263, at 4 (giving the example of gun control discussions in the context of those favoring gun control).

side that presents more information in its arguments.²⁶⁶ So, when people hear arguments involving additional information that further bolsters their previously held beliefs, they assign these arguments particular weight, and their attitudes become more extreme as a result.²⁶⁷ Although many deliberations appear to be productive, polarization may “nevertheless sometimes cause the group to move further away from the truth.”²⁶⁸ Such is often the case amongst science denialists.

In discussions surrounding COVID-19 and climate change, group polarization becomes readily apparent. During COVID-19, science denialism was aided by social media; before such a rapid and convenient way to communicate with others, conspiracy theories “usually remained siloed and quickly died off due to lack of supporters.”²⁶⁹ But social media creates echo chambers, allowing individuals to connect with others who increasingly fuel their shared beliefs and discount outsiders and their alternative explanations.²⁷⁰ In psychology, an echo chamber can trigger an availability cascade, which is a “self-reinforcing process of collective belief formation by which an expressed perception triggers a chain reaction that gives the perception increasing plausibility through its rising availability in public discourse.”²⁷¹ This is enhanced by precise algorithms that increase the prevalence of similar information on a given feed while hiding dissimilar information.²⁷² Over time, individuals engaging with this content and each other can

²⁶⁶ *Group Polarization in Social Psychology*, *supra* note 264.

²⁶⁷ See Sunstein, *supra* note 263 (describing the causes and effects of group polarization).

²⁶⁸ Neil Levy, *Due Deference to Denialism: Explaining Ordinary People’s Rejection of Established Scientific Findings*, 196 SYNTHESE 313, 317 (2019).

²⁶⁹ Miller, *supra* note 58, at 2256.

²⁷⁰ See *id.* (finding that “social media–fueled echo chambers amplify these [science denialism] theories, reinforcing false beliefs and discouraging people from seeking the truth”). An “echo chamber” is “an environment where a person only encounters information or opinions that reflect and reinforce their own,” and they can “create misinformation and distort a person’s perspective so they have difficulty considering opposing viewpoints and discussing complicated topics.” *Digital Media Literacy: What Is an Echo Chamber?*, GCF GLOB., <https://edu.gcfglobal.org/en/digital-media-literacy/what-is-an-echo-chamber/1/> (last visited May 11, 2022).

²⁷¹ Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STANFORD L. REV. 683, 683 (2007).

²⁷² See Fournier, *supra* note 214 (explaining the functioning and impact of social media algorithms).

become influenced by group polarization, which reinforces and strengthens shared beliefs, however false, and prohibits individuals from objectively evaluating scientific consensus.²⁷³ The same effect is seen through political party affiliation; for example, eighty-four percent of Democrats agree with the consensus that human activity has resulted in climate change, while only forty-three percent of Republicans share this belief.²⁷⁴ Research has shown that over time, such perceptions of science have become increasingly partisan and polarized, and both liberals and conservatives are susceptible.²⁷⁵ Perhaps more concerning, this polarization is also true “in other countries, for other scientific claims, and for trust in science as a whole.”²⁷⁶ Thus, influenced by a multitude of psychological explanations, denialists cultivate and adhere to their anti-science beliefs, but countering these misguided convictions—although a daunting undertaking—remains a worthwhile and necessary goal for public health authorities.

IV. RECOMMENDATIONS FOR PUBLIC HEALTH AUTHORITIES

Given the complex psychological motivations underlying and reenforcing science denialism, public health authorities will likely benefit from a multi-faceted approach to effectively counter denialists’ beliefs. Authorities can employ strategies backed by psychological findings to better frame their guidance and mandates to increase connection with denialists and encourage science-compliant behavior.

²⁷³ See Miller, *supra* note 58, at 2256 (noting that echo chambers on social media encourage false beliefs and handicap truth-seeking); see also Paul Barrett et al., *How Tech Platforms Fuel U.S. Political Polarization and What Government Can Do About It*, BROOKINGS (Sept. 27, 2021),

<https://www.brookings.edu/blog/techtank/2021/09/27/how-tech-platforms-fuel-u-s-political-polarization-and-what-government-can-do-about-it/> (discussing how social media is often a “key facilitator” of polarization and partisan animosity in the United States, leading to “declining trust in institutions; scorn for facts; legislative dysfunction; erosion of democratic norms; and, in the worst case, real-world violence”) (quotations omitted).

²⁷⁴ Roderik Rekker, *The Nature and Origins of Political Polarization Over Science*, 30 PUB. UNDERSTANDING OF SCI. 352, 352 (2021).

²⁷⁵ *Id.*

²⁷⁶ *Id.* (citations omitted).

Because many psychological influences are rooted in individuals' self-perception of identity and their place in social groups, public health authorities should craft messaging in a way that appeals to a sense of belonging and are not polarizing. To counter the compelling influence of biases exacerbated by culturally defined views, Dan Kahan suggests that messages should affirm denialists' identity.²⁷⁷ For example, when disseminating information that global temperatures are increasing, some will see that as threat to their cultural values as it suggests that commerce should be restricted, and thus, they may dismiss or discredit the information.²⁷⁸ If the message, however, was consistent with cultural identity, such as "society should rely more on nuclear power," people would view the information more open-mindedly.²⁷⁹

Further, public health authorities can utilize narrative framing that appeals to individuals' identities and values.²⁸⁰ This technique works as people sort information "by fitting it to pre-existing narrative templates or schemes that invest the information with meaning."²⁸¹ For instance, the COVID-19 pandemic was most often framed in terms of fighting a war against the virus,²⁸² but this framing is negative and likely elicited feelings of fear, division, and individualism.²⁸³ Instead, authorities may have garnered increased compliance by framing the pandemic in narrative terms of a collective journey, with both obstacles and a clear end in sight.²⁸⁴ Through such a narrative, authorities could also appeal to individualistic denialists by emphasizing that each person has a unique and valuable role to play, and a community is only as

²⁷⁷ Kahan et al., *supra* note 242, at 23.

²⁷⁸ *Id.*

²⁷⁹ *Id.*

²⁸⁰ *Id.* at 24.

²⁸¹ *Id.*

²⁸² Philipp Wicke & Marianna M. Bolognesi, *Framing COVID-19: How We Conceptualize and Discuss the Pandemic on Twitter*, 15 PLOS ONE 1, 22 (evaluating the framing of "war," "storm," "tsunami," "monster," and a control of "family").

²⁸³ Ella Saltmarshe, *8 Tips for Framing COVID-19*, MEDIUM (Apr. 3, 2020), <https://ellasaltmarshe.medium.com/8-tips-for-framing-covid-19-f3c897c1ffa6>.

²⁸⁴ *Id.*

strong as its individual actors.²⁸⁵ Additionally, authorities could frame masks and vaccinations as tools that individuals can use to access the freedoms that come along with being protected against disease. By utilizing these tactics, public health authorities could better appeal to people's senses of identity and social belonging, encouraging increased compliance with scientific consensus.

The specific wording of guidance and mandates can influence denialists as well. Ordinarily, most authorities' messaging utilizes forceful language, such as "should," "ought," "must," and "need."²⁸⁶ This, however, has been shown to be perceived as more threatening and can thus trigger individuals' psychological reactance, meaning their tendency to oppose perceived threats to their freedoms.²⁸⁷ In contrast, non-controlling language such as "consider," "can," "could," and "may" do not elicit such a strong reactance response.²⁸⁸ Further, there is a significant increase in reactance when the message is framed as a loss (i.e., "If you do not vaccinate your child, he may die.") than when it is framed as a gain (i.e., "Vaccinating your child can help him lead a long and healthy life.").²⁸⁹ Research has also indicated that people react more positively towards messages that include a line saying that they are free to make their own decisions.²⁹⁰ This likely mitigates reactance by reminding individuals of their autonomy, thus reducing the perceived threat; in the context of public health, this may be useful when authorities promulgate non-binding guidance, but it may also be seen as the authorities undermining their own credibility, so use of this technique should be judicious. Notably, reactance has commonly been viewed as a negative outcome, but public health authorities could utilize it to their

²⁸⁵ See *id.* (discussing how individualistic thinking can be replaced with narratives such as "[w]e all have different and important roles to play") (quotation marks omitted).

²⁸⁶ Steindl et al., *supra* note 168, at 209.

²⁸⁷ *Id.*; see discussion of psychological reactance *supra* Section III.B.c.

²⁸⁸ Steindl et al., *supra* note 168, at 209.

²⁸⁹ See *id.* (providing an example of loss/gain framing in the context of using sun protection).

²⁹⁰ *Id.*

advantage as research shows it can activate positive emotions, such as feelings of strength and determination.²⁹¹ Thus, by using some or all of these techniques, authorities can better communicate with denialists and potentially prevent reactance that jeopardizes public health goals.

Public health authorities should also be mindful of how information is presented; they may foster an improved connection with current and potential denialists by including more diverse experts on panels and in debates. Because the cultural cognition theory posits that individuals are predisposed to agree with perceived experts that share their viewpoints (and disagree with those who do not), public health authorities should not discount those who approach science from unique angles.²⁹² Rather, they should utilize pluralistic advocacy by involving “experts of diverse values on both sides of the debate.”²⁹³ Such a technique has been shown to garner increased open-mindedness amongst listeners.²⁹⁴ In practice, this may take the form of a climate change panel where some experts argue that the most pressing issue is a loss of biodiversity, while others argue that it is the economic collapse that rising sea levels could cause in coastal areas, but all can agree that change must occur to prevent further warming.²⁹⁵ This could also take the form of presenting experts with diverse personal backgrounds. For example, Dr. Eugenia South, a Black emergency medicine physician, personally experienced COVID-19 vaccine hesitancy stemming from healthcare’s long history of racism and mistreatment of

²⁹¹ *Id.* at 210–11.

²⁹² Kahan et al., *supra* note 242, at 23.

²⁹³ *Id.*

²⁹⁴ *Id.*

²⁹⁵ See James Hoggan, *The Making of a One-of-a-Kind Climate Change PR Professional*, YALE CLIMATE COMM’NS (Mar. 25, 2021), <https://yaleclimateconnections.org/2021/03/the-making-of-a-one-of-a-kind-climate-change-pr-professional/> (discussing how the goal of pluralistic advocacy is “to find a narrative that people relate to and embed a message that will lead to open-minded consideration,” and finding that “[e]nvironmental risk communication will fail unless it is inclusive, a dialogue of the heart where all sides have something worthwhile to contribute and each respects the other’s views”).

minorities.²⁹⁶ Ultimately, the vaccine's robust science and testimonials from other people and physicians of color persuaded her to get vaccinated.²⁹⁷ By sharing her story, she now empowers others who face similar fears,²⁹⁸ and diversity such as this can bolster the message. Thus, by emphasizing a diverse array of shared values, public health authorities can seek to better appeal to a variety of audiences.

The voices of non-experts may also help persuade some denialists. For example, the heartbreaking story of the Rodriguez family could resonate with those who are indecisive about the COVID-19 vaccine. Notably, the effectiveness data behind such narrative persuasion remains mixed.²⁹⁹ For example, some research indicates that "personal narratives promoting adult vaccinations have more impact on people's risk perceptions and intentions to vaccinate than objective statistics promoting vaccination."³⁰⁰ Other findings, however, show that pro-vaccination narratives alone do not trump the persuasiveness of objective data,³⁰¹ and narratives may backfire, causing audiences to become suspicious "when stories become part of a sales pitch."³⁰² Accordingly, narratives should be used carefully, and they may best serve as attention-grabbers and illustrative examples,³⁰³ rather than techniques to carry the whole weight of the argument.

²⁹⁶ Eugenia South, *I'm a Black Doctor Who Didn't Trust the Covid Vaccine. Here's What Changed My Mind.*, MSNBC (Jan. 22, 2021), <https://www.nbcnews.com/think/opinion/i-m-black-doctor-who-didn-t-trust-covid-vaccine-ncna1255085>.

²⁹⁷ *Id.*

²⁹⁸ *Id.*

²⁹⁹ Rebecca J. Krause & Derek D. Rucker, *Stories Can Be Powerful Persuasive Tools. But It's Important to Understand When They Can Backfire*, NORTHWESTERN U. (Oct. 8, 2019), <https://insight.kellogg.northwestern.edu/article/persuasive-storytelling>.

³⁰⁰ Lisa Vandenberg et al., *Facts Tell, Stories Sell? Assessing the Availability Heuristic and Resistance as Cognitive Mechanisms Underlying the Persuasive Effects of Vaccination Narratives*, 13 FRONTIERS PSYCH. 1, 3 (2022).

³⁰¹ *Id.*

³⁰² Krause & Rucker, *supra* note 299.

³⁰³ *Id.*

Simply acknowledging and rebutting denialists' claims may also be an effective strategy. Importantly, research has found that "not responding to science deniers has a negative effect on attitudes towards behaviours favoured by science (for example, vaccination) and intentions to perform these behaviours."³⁰⁴ As a result, public health authorities should actively seek to combat misinformed beliefs, and some research-backed ways include presenting accurate facts and rebutting denialists' rhetoric and logical fallacies.³⁰⁵ In fact, one meta-analysis showed that audiences that were the most vulnerable to vaccine denial (individuals with low vaccine confidence and conservatives) were the most swayed by these approaches.³⁰⁶ Thus, simply having a pro-science advocate rebut denialists' claims during a debate can yield positive results.

Yet, science denialists may resist change because their beliefs are tied to their worldview, so public health authorities can pursue improved outcomes by using multiple corrective strategies to both counter denialism and stop its spread. Once such proven-effective technique to hinder the influence of science denialism—particularly as denialists may seek to convert skeptics, who already doubt some scientific findings³⁰⁷—has been to inoculate audiences against misinformation.³⁰⁸ This involves public health authorities warning people about denialists' arguments before they are encountered and providing them with ways to discredit those arguments.³⁰⁹ In practice, this can take the form of communicating the scientific consensus surrounding an issue while warning that some may be politically or financially motivated to

³⁰⁴ Schmid & Betsch, *supra* note 15.

³⁰⁵ *See id.* at 934 (finding that there is evidence that "technique rebuttal and topic rebuttal are especially valuable for mitigating the denier's influence in [] vulnerable subgroups").

³⁰⁶ *Id.* at 935.

³⁰⁷ *See Truth or Denial?*, WASH. POST, <https://www.washingtonpost.com/sf/brand-connect/bleecker-street/denial/> (last visited May 11, 2022) (noting that to be successful in spreading their message, denialists must find an audience that is "ripe to be convinced"); for a discussion of such an audience that already harbors doubts and may thus be ripe for convincing, see skepticism explanation *supra* Part I.

³⁰⁸ Schmid & Betsch, *supra* note 15, at 936.

³⁰⁹ *Id.*

make counterclaims.³¹⁰ It may also involve explaining specific flaws in denialists’ arguments and rhetoric.³¹¹ Importantly, such inoculation techniques have been found to be “equally effective across the political spectrum,”³¹² thus providing a way to potentially mitigate group psychological effects and encourage increased compliance with public health measures.³¹³

Finally, public health authorities should seek to better understand—and thus, be more equipped to alter—individuals’ unique motivations underlying science denialist attitudes and behaviors. Through a technique called motivational interviewing, which is a “patient-centered communication style used to enhance patient’s internal motivation to change by exploring and addressing their ambivalences,” authorities can gain greater insight into people’s specific beliefs and concerns, and they have the chance to directly confront those views.³¹⁴ Further, there is evidence that such interviews do not have to be extensive or repetitive to be effective. For example, one study showed that conducting a single motivational interview with a new mother could result in an increased likelihood of nine percent that her child would be fully vaccinated between three and twenty-four months, compared to the children of mothers who received no intervention.³¹⁵ Thus, by being present to directly address concerns and questions, perhaps such as those stemming from the Wakefield study, motivational interviewers could counter misinformation and provide data on scientific consensus.³¹⁶

³¹⁰ Van der Linden et al., *supra* note 191.

³¹¹ Cook et al., *supra* note 194, at 1.

³¹² Van der Linden et al., *supra* note 191.

³¹³ Notably, however, authorities must exercise caution as inoculation could have the accidental effect of encouraging individuals to become overly skeptical of all information, even scientific consensus. *See* Kahn-Harris, *supra* note 139 (“The sheer profusion of voices, the plurality of opinions, the cacophony of the controversy, are enough to make anyone doubt what they should believe.”).

³¹⁴ Thomas Lemaitre et al., *Impact of a Vaccination Promotion Intervention Using Motivational Interview Techniques on Long-Term Vaccine Coverage: The PromoVac Strategy*, 15 HUMAN VACCINES & IMMUNOTHERAPEUTICS 732, 732 (2019).

³¹⁵ *Id.*

³¹⁶ *See id.* (explaining that through this strategy, “healthcare practitioners can identify and target parental concerns or misconceptions about vaccination and provide tailored information”).

This approach could also be effective with COVID-19 denialists, as public health workers could conduct motivational interviews. In doing so, they could address vaccine-related concerns by asking open-ended questions, remaining non-judgmental and empathetic, identifying conflicts between individuals' "current and desired behaviors, such as staying healthy," and educating people while respecting their personal autonomy.³¹⁷ Importantly, motivational interviewing is "a resource- and time-intensive intervention,"³¹⁸ so some viable entry points may be training medical students³¹⁹ and community health workers³²⁰ to employ the technique during their interactions with patients. Building on facts and logic, this skillful and collaborative use of empathy could enable those in the public health sphere to better respect the emotions underlying individuals' beliefs and behaviors.³²¹ By understanding the multitude of psychological influences that support science denialism, public health authorities can craft a multi-faceted corrective approach, enabling them to better anticipate, rectify, and prevent the adoption and preservation of such denialistic thinking.

V. CONCLUSION

A dangerous and devastating phenomenon, science denialism finds its roots in both individual and group psychology. At the individual level, motivated reasoning causes denialists to twist facts to suit their theories, and cognitive dissonance motivates them to discount evidence that contradicts their preferred beliefs and behaviors. Reactance also pushes them to counter

³¹⁷ Thagard, *supra* note 139, at 99.

³¹⁸ Angela G. Pirlott et al., *Mechanisms of Motivational Interviewing in Health Promotion: a Bayesian Mediation Analysis*, 9 INT'L J. BEHAVIORAL NUTRITION & PHYS. ACTIVITY 1, 9 (2012).

³¹⁹ See N. Nicole Jacobs et al., *Motivational Interviewing Training: A Case-Based Curriculum for Preclinical Medical Students*, 17 MEDEDPORTAL 1, 5–6 (2021) (discussing a single-school study in which medical students were trained to conduct motivational interviews, and this effectively increased their knowledge of the technique and gave them the skills necessary to employ it).

³²⁰ See Arica Brandford et al., *Training Community Health Workers in Motivational Interviewing to Promote Cancer Screening*, 20 HEALTH PROMOTION PRAC. 239, 246 (2019) (discussing how training community health workers to promote cancer screenings in underserved populations was a feasible and valuable effort).

³²¹ Thagard, *supra* note 139, at 99.

perceived threats to their freedoms, and scientific consensus, with its potentially unsettling conclusions and fervent calls to action, may be perceived as such a threat. Further still, heuristics can ingrain denialists' thinking as mental shortcuts inspire a knee-jerk distrust of science, and belief perseverance can compound this, causing denialists to resist changing their views. Cognitive biases also underly denialists' thinking, specifically as confirmation bias inspires them to believe only the information they seek out; overconfidence bias causes them to underestimate risks to public health; optimism bias encourages feelings of control over the uncontrollable; and self-interest bias excuses denialists' disobedience of public health measures.

These influences are magnified by denialists' participation in communities that share their beliefs. Because communal belonging is closely tied to their sense of identity, denialists are motivated to adhere to the beliefs of the group. This makes psychological group dynamics a particularly influential and powerful force. In denialistic communities, cultural cognition, in-group bias, and group polarization all work to further instill and entrench anti-science views. With these motivations, denialists selectively trust experts who share their worldviews, distrust those outside their community, and reverberate their shared beliefs in ways that can lead to more extreme views, respectively.

Increased awareness of these influences can better equip the nation's public health authorities in their efforts to combat denialism's effects. Because complex problems require complex solutions, these authorities should consider a multi-pronged corrective strategy to target various mechanisms underlying denialism. For example, they can utilize narrative framing to skillfully craft messages, and they can use pluralistic advocacy to present scientific consensus amongst experts of diverse backgrounds and worldviews, such as those shared by denialists. Further, authorities can seek individual connection with denialists through motivational

interviewing, a technique rooted in respect, empathy, and communication. They can also prevent the spread of science denialism by inoculating audiences against misinformation. Thus, with a multitude of research-backed approaches in hand, public health authorities can better fulfill their calling to safeguard society's health and welfare, all while increasing the public's trust in their leadership.