Commentary

# From Medieval Scapegoating to Modern Conspiracy Theories in Healthcare

**Milan Toma**[1,2]

1. Department of Osteopathic Manipulative Medicine, New York Institute of Technology, USA; 2. College of Osteopathic Medicine, New York Institute of Technology, USA

**The popularization of science, while essential for making complex discoveries accessible to the public, carries significant risks, particularly in healthcare where misinformation can lead to harmful behaviors and even lethal outcomes. This commentary examines the dual nature of science communication, highlighting its potential to foster public engagement and scientific literacy while also discussing the dangers of oversimplification and sensationalism. Historical and contemporary case studies, such as the misrepresentation of ivermectin during the COVID-19 pandemic and the enduring "5-Second Rule" myth, illustrate how distorted scientific findings can erode trust in institutions and fuel conspiracy theories. The digital age exacerbates these issues, with algorithms and social media amplifying misinformation at an unprecedented scale. The discussion emphasizes the heightened stakes of medical science communication, where misrepresentation can directly endanger lives. It calls for a balanced approach to science popularization, advocating for transparency, interdisciplinary collaboration, and public education to combat misinformation. The discussion also extends to the emerging role of artificial intelligence in healthcare, warning against inflated claims and the risks of overreliance on unverified AI tools. Ultimately, this commentary underscores the need for systemic reforms to ensure that science communication prioritizes accuracy, fosters critical thinking, and builds public resilience against the spread of pseudoscience and disinformation.**

## 1. Introduction

Science popularization plays a crucial role in making scientific knowledge accessible to the public, but it also carries the risk of distorting findings through oversimplification. This dual nature is especially significant in healthcare, where miscommunication can have immediate and harmful consequences.

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The stakes are high, as the spread of misinformation in this field can lead to dangerous behaviors and even lethal outcomes, as illustrated by the crises discussed below.

### *1.1. The Importance and Challenges of Science Popularization*

The popularization of science plays a critical role in making complex discoveries accessible to the public. It acts as a bridge between the scientific community and the general public, translating technical jargon into language that is easy to understand. This process fosters curiosity and engagement with research that shapes our understanding of the world. It encourages scientific literacy, promotes critical thinking, and empowers individuals to make informed decisions about their lives and the world around them. However, the process of science popularization is fraught with challenges. One of the main issues is the oversimplification of scientific findings. While simplification is necessary to make complex concepts understandable, there is a fine line between simplification and distortion. When findings are oversimplified, they risk being distorted, misunderstood, or misused. This can lead to the spread of misinformation, which can have serious consequences. Similarly, in an effort to attract attention and engage the public, some media outlets may exaggerate or sensationalize scientific findings. This can lead to misconceptions and a lack of trust in science. It can also contribute to the spread of conspiracy theories, as people may start to question the validity of scientific research. This issue is particularly pronounced in healthcare, where misinformation can lead to harmful behaviors, poor health outcomes, and even lethal consequences.

### *1.2. The Heightened Stakes of Medical Science Communication*

While the public may marvel at the development of rockets capable of reaching distant planets or dream of traveling beyond our solar system, such advancements are often seen as exciting but remote from our daily lives. In contrast, healthcare directly impacts people's well-being, making the public far more sensitive and critical about related claims.

For example, during the COVID-19 pandemic, the antiviral drug ivermectin became a flashpoint for misinformation. Early in vitro studies suggested that ivermectin could inhibit the replication of the SARS-CoV-2 virus under controlled laboratory conditions[1]. However, these findings were preliminary and did not translate to human treatment, as the dosages required for similar effects in humans would be toxic[2]. Despite this, sensationalized headlines and social media posts oversimplified these findings, omitting the critical context and leading to widespread belief that

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ivermectin was a proven cure for COVID-19. This misinformation prompted individuals to self-medicate, often using formulations intended for livestock, leading to health risks, hospitalizations, and even deaths. The ivermectin case illustrates how oversimplified science communication in healthcare can have immediate, real-world consequences, unlike the relatively harmless misunderstandings in other fields of science, such as space exploration or physics.

This analysis focuses on the ways in which oversimplified science communication can distort public understanding, erode trust in scientific institutions, and have real-world consequences, emphasizing the importance of responsible and nuanced science communication in an increasingly information-saturated era. The healthcare field, in particular, requires heightened sensitivity and responsibility, as the misrepresentation of medical science can directly endanger lives, fuel conspiracy theories, and undermine trust in healthcare systems.

## 2. The Pitfalls of Oversimplification

The following subsections analyze the risks of oversimplification in science communication, examining how the pursuit of sensationalism distorts findings, revisiting enduring historical myths, and dissecting systemic errors in attributing causality, from medieval plague-era scapegoating to modern misrepresentation of medical research. As attempted to show in Figure 1, the balance between essential simplification (transparent, peer-reviewed communication) and dangerous oversimplification (sensationalized or distorted findings) in medical science directly correlates with public health outcomes; from improved vaccine uptake to ivermectin-related misdiagnoses.

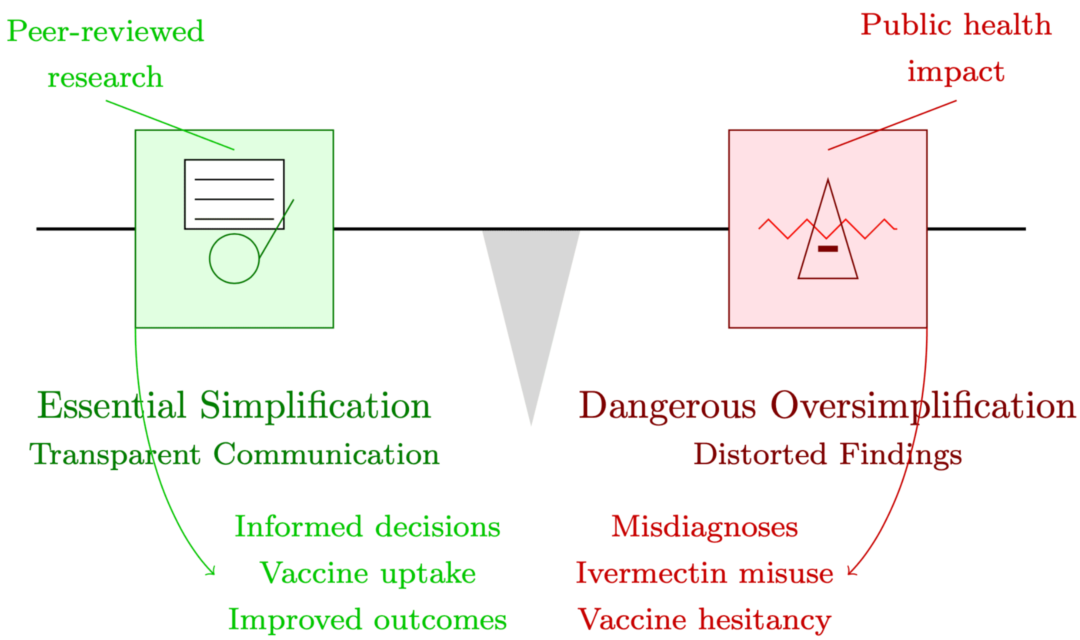


**Figure 1.** The Precarious Balance of Medical Science Communication. Conceptual diagram contrasting responsible simplification (left) with harmful distortion (right) using historical and contemporary healthcare examples. The fulcrum represents institutional oversight, while imbalance consequences reflect recurring crisis patterns: dangerous oversimplification (pseudoscientific tonics, ivermectin misuse, vaccine reversal claims) versus essential transparency (validated therapies, causal clarity). Arrows trace outcomes observed in both medieval and modern case studies, including misdiagnoses from Radithor-style quackery juxtaposed with improved outcomes from rigorous communication.

### *2.1. Prioritizing Engagement Over Accuracy*

Scientific research is inherently complex, requiring specialized knowledge to interpret intricate methodologies, contextualize findings within broader disciplinary frameworks, and disentangle nuanced variables that shape outcomes. This complexity arises not only from the technical jargon but also from the layered interplay of experimental controls, statistical caveats, and provisional conclusions that define rigorous inquiry. Journalists, bloggers, and science communicators face the formidable task of distilling such complexity for public consumption, often stripping away granular details to craft palatable narratives. However, this process of simplification risks morphing into distortion when engagement metrics (clicks, shares, or subscriptions) eclipse fidelity to evidence. In their quest to captivate audiences, critical qualifiers (e.g., small sample sizes, in vitro vs. human trials)


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are omitted, speculative correlations are framed as causation, and incremental advances are sensationalized as "breakthroughs."

### *2.2. The Distortion of Scientific Findings*

For example, a study suggested a correlation between chocolate consumption and cognitive function[3], leading to headlines declaring that eating chocolate increases IQ. While such headlines are eye-catching and likely to drive traffic to a website or magazine, they fail to provide the necessary nuance. The actual research indicated that the potential benefits of chocolate on cognition were based on specific compounds found in cocoa, such as flavonoids. However, to achieve a meaningful IQ increase, one would need to consume an unrealistic amount of chocolate—so much that the negative health effects (such as obesity or diabetes) would far outweigh any potential cognitive benefits[4]. These critical details are often downplayed or omitted in popular science articles because they would make the story less appealing to readers. Instead, the simplified claim that "chocolate makes you smarter" is presented as fact, misleading audiences and contributing to a distorted understanding of the research.

This tendency to prioritize engaging narratives over accurate science illustrates a broader problem: many popular science articles prioritize attracting readers over conveying the complexities of scientific findings. While this approach may increase clicks and magazine sales, it risks spreading misinformation and creating unrealistic expectations among the public.

### *2.3. Historical Examples of Science Misrepresentation*

The issue of oversimplifying and misrepresenting scientific findings is not new. Throughout history, misunderstandings or deliberate distortions of scientific research have led to widespread myths and misconceptions. Two notable examples—the "5-Second Rule" and the "Spinach and Iron Myth"—highlight how such misrepresentations can take root in public consciousness, often with lasting effects.

#### *2.3.1. The "5-Second Rule" Myth*

One pervasive myth is the so-called "5-Second Rule," which suggests that food dropped on the floor is safe to eat if picked up within five seconds. This claim originated from studies examining how quickly bacteria transfer from surfaces to food[5]. However, the actual research revealed that factors


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like surface type, moisture, and food composition are far more significant than the time food remains on the floor. The "five-second" aspect was a gross oversimplification, likely popularized because it was easy to remember and appealing as a rule of thumb. As a result, a nuanced scientific finding became a misleading cultural phenomenon, encouraging potentially unsafe practices.

#### *2.3.2. The Spinach and Iron Misconception*

Another example is the widely held belief that spinach is an exceptional source of iron. This misconception stems from a 19th-century calculation error in which a misplaced decimal point exaggerated spinach's iron content by a factor of 10[6]. Despite the correction, the myth persisted and was reinforced by popular media and education materials. While spinach is indeed nutritious, its iron content is not particularly remarkable, and its bioavailability is limited due to the presence of oxalates, which inhibit iron absorption[7]. This enduring myth demonstrates how scientific inaccuracies can become entrenched in collective memory, often overshadowing efforts to correct the record.

#### *2.3.3. The Radithor Tragedy*

In the early 20th century, the discovery of radioactivity sparked both scientific fascination and public misconceptions. Unregulated by modern safeguards, entrepreneurs exploited this ambiguity by marketing radioactive substances as health tonics. Among the most infamous was Radithor, a patent medicine introduced in the 1920s[8]. Marketed as a "miracle cure-all," Radithor contained distilled water laced with radium-226 and radium-228, emitting alpha, beta, and gamma radiation. Advertisements promoted it as a safe, energizing elixir for conditions ranging from arthritis to impotence, capitalizing on public enthusiasm for "scientific" wellness trends and the aura of cutting-edge discovery.

The consequences of this pseudoscientific marketing proved catastrophic. Industrialist Eben Byers, an avid Radithor consumer, became a prominent casualty. Byers consumed over 1,400 bottles between 1928 and 1930, trusting the manufacturer's claims that modest radiation exposure stimulated vitality. Instead, prolonged ingestion led to progressive radiation poisoning: his jaw disintegrated from osteonecrosis, his bones became riddled with tumors, and he died in 1932 from systemic organ failure.


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### *2.4. Misconnecting Causality*

This pattern of misconnecting causality extends far beyond dietary myths. During the Black Death in medieval Europe communities grappling with plague outbreaks catastrophically misinterpreted observable correlations. Households with cats, often associated with women later accused of witchcraft, experienced fewer cases of the plague, as cats preyed on the rats that carried disease-spreading fleas[9]. Rather than recognizing the link between cats and reduced rodent populations, superstition and fear transformed these observations into narratives of witchcraft. Women, particularly those living alone with their cats, were scapegoated as the cause of the plague, leading to persecution, torture, and executions. This tragic episode illustrates how the human tendency to attribute unexplained phenomena to deliberate malice (e.g., witchcraft) rather than systemic causality mirrors modern mistrust in medical institutions: both arise from the same cognitive gap between observable correlation and misunderstood mechanisms, exacerbated by societal fears. Just as medieval communities turned to witch hunts to impose false order on chaos, public health crises today can fuel conspiracy theories when science communication fails to address uncertainty with clarity and empathy. This cyclical pattern of substituting blame for understanding, whether through medieval witch trials or modern conspiracies, reveals how societal fears, when amplified by gaps in scientific literacy, continue to drive demonization of the "other" rather than rational inquiry.

## 3. The Amplifying Effects of the Digital Age

The digital age transforms historical patterns of scientific misrepresentation into high-velocity threats, analyzing systemic incentives for exploiting healthcare misinformation (e.g., ivermectin deaths, Ozempic misuse), algorithmic amplification of pseudoscientific narratives, and the weaponization of distrust, mirroring medieval scapegoating dynamics with digital-age lethality.

### *3.1. The Rapid Spread of Misinformation Online*

While historical examples like the "5-Second Rule" and the "Spinach and Iron Myth" highlight how misrepresentations can persist over time, the advent of the internet has significantly exacerbated the issue. In today’s digital age, information spreads faster and farther than ever before. Echoing Mark Twain’s observation that “A lie can travel halfway around the world while the truth is putting on its shoes,” the same factors that enabled these historical myths to flourish (i.e., oversimplification,

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engaging narratives, and insufficient critical scrutiny) are now amplified by algorithms, social media platforms, and the 24-hour news cycle[10].

### 3.2. Viral Narratives and the Ozempic Weight Loss Craze

The viral popularity of Ozempic as a weight loss solution is a striking example of how oversimplified narratives can lead to misinformed behavior. Originally developed to treat type 2 diabetes, Ozempic gained attention for its appetite-suppressing effects, which led to its widespread promotion as a ’miracle’ weight loss drug. Social media posts and headlines simplified the drug’s use, often failing to mention that its off-label use for weight loss requires medical supervision due to potential side effects like nausea, vomiting[11], long-term dependency[12], and emerging concerns about a possible link to thyroid cancer (though human studies remain inconclusive)[13]. Furthermore, the focus on Ozempic overshadowed the importance of addressing weight issues through sustainable lifestyle changes[14]. Such oversimplification not only misleads the public but also contributes to the misuse of the drug, with some individuals obtaining it without proper medical guidance.

### 3.3. The Turmeric "Superfood" Phenomenon

Similarly, the popularization of turmeric as a "superfood" demonstrates how the internet amplifies scientific oversimplification. Turmeric has been touted as a cure-all for ailments ranging from inflammation to cancer, largely due to the presence of curcumin, a compound with documented health benefits in controlled studies[15]. However, much of the research has been conducted in laboratory settings using concentrations of curcumin that far exceed what can be consumed through diet alone. Despite this, social media posts and articles often promote turmeric as a simple, everyday solution to serious health problems, creating unrealistic expectations and fueling a thriving market for supplements. This oversimplified narrative distracts from the broader context of healthy living and the limitations of dietary interventions, further illustrating the pitfalls of popularized science in the digital age.

The internet has created an environment where sensational headlines and viral content are prioritized over accuracy. A simplified or distorted scientific claim can now reach millions of people within hours, often without the necessary context or clarification. For example, misleading headlines like "Chocolate Boosts IQ," "Ozempic as a Weight Loss Miracle," or "Turmeric Cures Cancer" are more likely to be shared widely than a detailed explanation of the underlying science. As a result, the public is exposed to a flood of oversimplified or outright incorrect information, making it even harder to distinguish accurate findings from myths.

### *3.4. The Ivermectin Case Study*

#### *3.4.1. Misinterpreting Preliminary Findings*

The oversimplification of scientific findings becomes even more dangerous when it fuels conspiracy theories or leads to harmful behaviors. The case of ivermectin during the COVID-19 pandemic is a striking example of how misrepresented science can have real-world consequences. Early laboratory studies suggested that ivermectin could inhibit the replication of the SARS-CoV-2 virus in vitro—that is, in a petri dish under controlled laboratory conditions. However, these studies did not account for the vastly different conditions within the human body. The amount of ivermectin required to achieve similar effects in humans would be toxic.

#### *3.4.2. The Dangers of Self-Medication and Conspiracy Theories*

When these findings were simplified in popular articles, the critical "in vitro" qualifier was often omitted, leading to the mistaken belief that ivermectin was a proven treatment for COVID-19. Social media and alternative health advocates amplified these claims, fueling a wave of disinformation that led people to self-medicate with ivermectin, often using formulations intended for livestock. This not only endangered public health but also undermined trust in the medical community and public health measures, such as vaccines[16].

### *3.5. The Vaccine-Autism Disinformation Campaign*

The false claim that vaccines cause autism or contain harmful chemicals exemplifies how digital platforms amplify debunked science into enduring public health threats[17]. Originating from a since-retracted 1998 paper by Andrew Wakefield, which fraudulently linked the MMR vaccine to autism[18], this narrative persists despite overwhelming scientific consensus to the contrary. Wakefield's work, funded by litigation groups seeking to sue vaccine manufacturers, was riddled with methodological flaws, including falsified data and a sample size of 12 children. Yet, sensationalized media coverage and algorithmic amplification on social media transformed this fringe theory into a global movement.


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The myth gained traction by exploiting parental concerns about childhood development and misrepresenting correlation as causation, like the aforementioned blaming women with cats for plagues because they came to less contact with flea-ridden rats. Similarly, the rise in autism diagnoses coincided with expanded vaccine schedules, a temporal overlap seized upon by anti-vaccine activists despite robust epidemiological studies showing no causal link. Similarly, claims about "toxins" like thimerosal (removed from most vaccines in 2001) or aluminum adjuvants rely on oversimplified toxicology, ignoring that trace amounts in vaccines are orders of magnitude below harmful thresholds.

Like the ivermectin case, this disinformation campaign thrives on gaps in scientific literacy and distrust in institutions. Public figures and influencers weaponize cherry-picked anecdotes (e.g., parents attributing autism onset to vaccination) while dismissing replicated cohort studies involving millions of children. The consequences are severe: declining vaccination rates, resurgence of preventable diseases like measles, and diversion of resources from genuine autism research. This case underscores how digital ecosystems sustain medical myths long after their scientific debunking, prioritizing emotional narratives over empirical rigor.

### *3.6. Exploiting Science for Personal, Political, or Financial Gain*

The internet not only accelerates the spread of these misrepresentations but also provides a platform for individuals and groups to exploit them for personal, political, or financial gain. In this environment, the long-standing issue of science misrepresentation has evolved into a more pervasive and urgent problem, requiring critical attention from both scientists and communicators.

#### *3.6.1. The Nauru Measles Tragedy: Colonial Distrust and Profit-Driven Supplements*

The 2024 measles outbreak in Nauru, which infected over 1,200 children and claimed 34 lives, exemplifies how historical trauma and distrust in Western medicine are weaponized for profit. Echoing colonial-era suspicions, a prominent anti-vaccine advocate leveraged social media to amplify debunked claims linking vaccines to neurological harm and infertility, framing measles as a “natural immunity” opportunity while downplaying its risks. This narrative, rooted in historical grievances over forced medical interventions during colonial rule, sent vaccination rates plummeting from 92% to 54% and redirected scarce healthcare resources toward outbreak containment. Meanwhile, profit-driven supplements like “MiracleMyrrh” and “VirusVacate” capitalized on fears by baselessly


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promising to "neutralize vaccine toxins" for $89 per bottle, mirroring early 20th-century pseudoscientific tonics like Radithor.

The tragedy began in 2023, when that anti-vaccine advocate targeted Nauru's postcolonial distrust of global health institutions. By late 2024, the outbreak's origin was traced to an unvaccinated child whose parents cited the advocate's claims as their primary information source. Health officials documented over 1,200 pediatric infections, 20% under age 5, with 34 fatalities from encephalitis and secondary infections. Public health efforts shifted from nutrition programs to outbreak triage, while profit-driven entities sold supplements under the guise of "community-led immunity," diverting resources and deepening inequities. This case underscores how digital networks amplify historical traumas into modern crises, transforming misrepresentation into lethal consequence.

#### *3.6.2. Monetizing Misinformation: Influencer-Broker Networks and Parasocial Commerce*

The Nauru tragedy underscores a systemic disinformation economy sustained by interconnected actors, from conspiratorial influencers to content brokers. Ballard et al.[19] identified YouTube's "fear monetization loops," where creators profit from vaccine-hesitant audiences via donations and premium memberships[19]. Moran et al.[20] extend this model to Instagram's wellness communities, where influencers monetize parasocial relationships through curated authenticity[20]. By blending anti-vaccine narratives with aspirational aesthetics (e.g., organic homesteading or faith-based parenting), these actors convert pseudoscientific claims into revenue streams, directing followers to unregulated supplements, subscription services, and "alternative health consultations", a modern echo of Radithor's radioactive elixirs.

These influencer-broker networks exemplify a structural shift in disinformation economics: distrust is commodified across platforms. Ballard's analysis of YouTube conspiracy brokers reveals that 72% of surveyed channels supplemented ad revenues with donations (median $2,100/month), while Moran's Instagram ethnography found 89% of anti-vaccine influencers used profit-driven links promising "Big Pharma-free wellness." This ecosystem mirrors Nauru's supplement peddlers, who leveraged colonial grievances to market products as both "traditional remedies" and resistance tools.


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### *3.6.3. Platform-Specific Exploitation: Fear Monetization Loops vs. Curated Authenticity*

Disinformation brokers strategically adapt their tactics to platform architectures, exploiting algorithmic incentives to maximize reach and profit. Ballard et al.[19] observed that YouTube's long-form video format enables creators to weave intricate fear narratives (false claims about vaccine infertility or "Big Pharma conspiracies") that sustain viewer engagement and recurring donations. Conversely, Moran et al.[20] found Instagram's visually driven ecosystem favors influencers who obscure profit motives behind curated lifestyles, such as promoting herbal tinctures amid rustic, garden-heavy posts.

Platform dynamics dictate monetization strategies. YouTube's algorithm rewards watch time, incentivizing creators to prolong fear narratives across multi-part series. Instagram prioritizes aesthetic cohesion, enabling influencers to embed anti-vaccine claims within faith-based parenting grids. Ballard terms this "fear vs. facade" asymmetry: YouTube sustains outrage through suspense, while Instagram sanitizes pseudoscience through aspirational content. Both models exploit gaps in health literacy, but their divergence highlights the adaptability of disinformation economies.

### *3.6.4. From Witch Hunts to Vaccine Reversal: Historical Parallels in Scapegoating Science*

The Nauru outbreak mirrors medieval witch hunts in its substitution of scientific causality with fabricated malice. During the Black Death, communities misattributed reduced plague mortality in cat-owning households to witchcraft rather than rodent control, scapegoating women as deliberate poisoners. Similarly, conspiracy brokers in 2024 Nauru framed measles outbreaks as intentional "child poisoning" by medical institutions, diverting blame from the unvaccinated patient zero to manufactured villains.

Modern supplements like "MiracleMyrrh" echo the pseudoscientific antidotes of plague-era Europe, which promised witchcraft "detoxification" through mercury-laced tonics. The pharmacologically absurd claim that herbs could "reverse vaccines" mirrors medieval assertions that goat bile neutralized curses. Both eras monetize fear through pseudoscientific products, exploiting societal crises to reframe exploitation as empowerment.

### *3.6.5. Weaponized Empowerment: Repackaging Pseudoscience as Resistance Narratives*

Anti-vaccine influencers and supplement peddlers reframe medical misinformation as empowerment tools, transforming vaccine hesitancy into "bodily autonomy" and unproven therapies into "Big


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Pharma resistance." Ballard and Moran's studies reveal how disinformation brokers co-opt social justice language to evade critique: anti-vaccine narratives are recast as resistance to "colonial medicine," while "immune-boosting" supplements are marketed as grassroots alternatives to corporate healthcare.

Influencers promoting a "natural living" ethos position unregulated tinctures as acts of ecological stewardship, while others framing vaccine refusal as spiritual defiance. Even "vaccine reversal" supplements exploit decolonial rhetoric, branding chemical detoxification as "reclaiming ancestral wellness." This rebranding, enabled by platform algorithms that privilege emotive narratives over evidence, transforms pseudoscience into cultural rebellion, incentivizing distrust as both identity and commodity.

## 4. Addressing the Challenges of Science Popularization

Building on the systemic risks and historical failures of science communication outlined earlier, this section proposes structural shifts to mitigate healthcare misinformation, emphasizing accountability for communicators, fostering cross-disciplinary collaboration among scientists, and integrating algorithmic transparency with educational reforms to combat the lethal asymmetry between virality and truth.

### *4.1. The Drive for Clicks and Views*

The examples of chocolate and ivermectin highlight a key issue in the popularization of science: the pressure to attract as many readers as possible. The modern media landscape, driven by clicks, views, and shares, incentivizes sensationalism over accuracy. A headline like "Chocolate Makes You Smarter!" will undoubtedly attract more attention than a nuanced explanation of the study's limitations. Similarly, a bold claim about a "miracle cure" for COVID-19 is more likely to go viral than a cautious discussion of why preliminary lab results may not translate to real-world efficacy.

This drive for attention creates a cycle in which scientific research is increasingly distorted as it is adapted for popular consumption. Writers and editors are often more concerned with crafting attention-grabbing stories than with accurately representing the science. As a result, the public is exposed to misleading or incomplete information, which can lead to misinformed beliefs and behaviors.

The Figure 2 illustrates the tension between evidence-based rigor and sensationalized health narratives. The horizontal axis represents the spectrum from validated medical evidence to viral clickbait headlines. As one moves from left to right, the integrity of the information diminishes, while the potential for sensationalism increases. On the vertical axis, the contrast between inaccessible expert discourse and sensationalized health narratives is depicted. The blue curve represents the decline of institutional rigor as sensationalism rises, while the red curve illustrates how distorted narratives can overshadow credible information. The star marker in the middle indicates the desired balance between these two extremes, highlighting the importance of achieving equilibrium in healthcare communication.

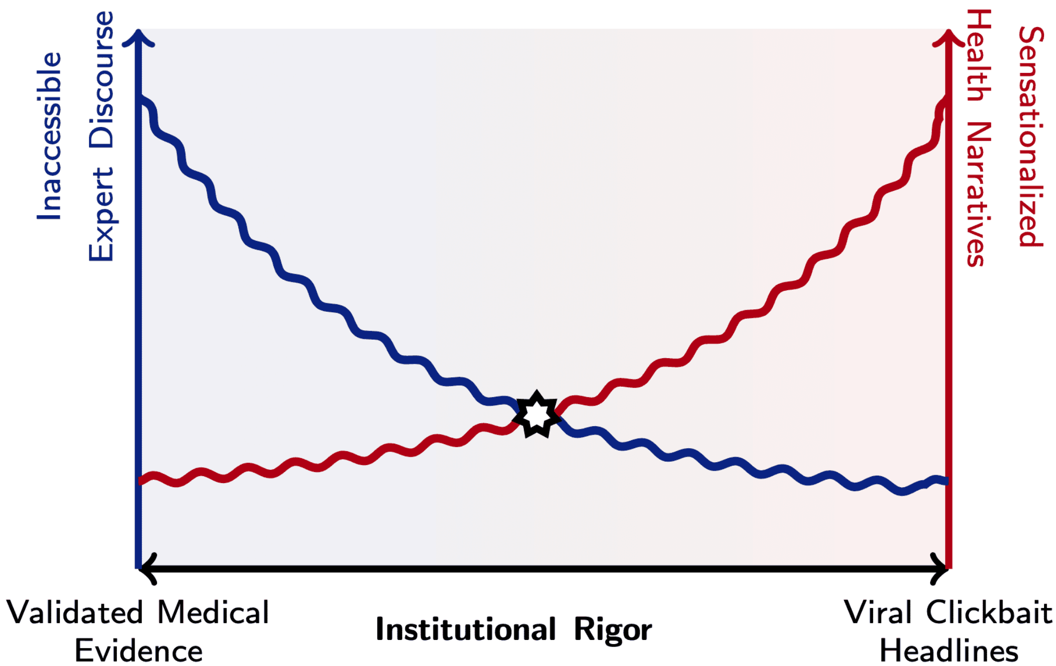


**Figure 2.** This figure illustrates the tension between evidence-based rigor (represented by the blue curve) and sensationalized health narratives (represented by the red curve) in science communication. The horizontal axis ranges from validated medical evidence on the left to viral clickbait headlines on the right, while the vertical axis contrasts inaccessible expert discourse with sensationalized narratives. The star marker indicates the ideal balance between these two extremes, signifying the critical point where both scientific accuracy and public engagement can coexist, ultimately promoting informed decision-making and trust in healthcare information.

### *4.2. The Responsibility of Science Writers and Communicators*

#### *4.2.1. The Consequences of Misleading Popular Science*

The consequences of oversimplified science go beyond individual misunderstandings. They can erode public trust in science and fuel conspiracy theories. For example, the misrepresentation of studies on chocolate or ivermectin can make people skeptical of the broader scientific community when the sensationalized claims fail to deliver. In the case of ivermectin, the spread of disinformation not only endangered individuals who self-medicated but also contributed to a broader narrative of distrust in public health institutions. Conspiracy theorists leveraged the ivermectin story to claim that effective treatments were being suppressed in favor of vaccines, further polarizing public discourse.

Similarly, sensational claims about chocolate boosting IQ may seem harmless at first glance, but they contribute to a culture in which scientific research is seen as a source of entertainment rather than a rigorous process of discovery. When people are repeatedly exposed to oversimplified or exaggerated claims, they may become less likely to trust legitimate scientific findings or more likely to believe in pseudoscience.

#### *4.2.2. The Role of Public Figures in Spreading Discord*

Public figures, including politicians, influencers, and conspiracy theorists, often exploit oversimplified or sensationalized popular science articles to sow discord between scientists and the public. By cherry-picking misleading headlines or framing nuanced scientific findings as evidence of nefarious intent, these individuals can manipulate public perception for personal or political gain. For instance, during the COVID-19 pandemic, certain public figures and media personalities amplified misrepresented claims about ivermectin as a cure, using popular science articles as "evidence" to argue that scientists or health authorities were suppressing effective treatments in favor of vaccines. This deliberate misuse of oversimplified science not only fueled vaccine hesitancy but also deepened mistrust in the scientific community and public health institutions. Such actions highlight the responsibility of science writers to ensure accuracy and context, as well as the need for vigilance against those who weaponize science communication to divide and mislead society.

### *4.2.3. Prioritizing Accuracy and Nuance*

Science writers must exercise caution when interpreting and rewriting scientific articles for popular magazines, as oversimplification and sensationalism can distort the original research and mislead the public. While the goal of making science accessible is important, simplifying complex findings often results in critical nuances being omitted or misrepresented. For instance, claims like "chocolate boosts IQ" or "ivermectin cures COVID-19" have emerged from the misinterpretation of research, where important qualifiers, such as context, dosage, or study limitations, are ignored to create eye-catching headlines. Such distortions can have real-world consequences, from fostering mistrust in the scientific community to promoting harmful behaviors, as seen when people self-medicated with ivermectin based on incomplete information.

### *4.2.4. Including Necessary Context and Limitations*

To prevent the spread of disinformation, science writers and communicators must rigorously prioritize accuracy by preserving the context and limitations of research. This means explicitly stating qualifiers such as study conditions (e.g., in vitro vs. human trials), dosage constraints, or methodological weaknesses that affect interpretability. For instance, articles discussing ivermectin's antiviral properties should clarify that lab results do not equate to clinical efficacy and that unsafe self-medication practices ignore toxicity risks. Similarly, simplifications like "chocolate boosts IQ" must explicitly address impractical consumption levels and associated health trade-offs. Writers should resist clickbait pressures by balancing accessibility with fidelity to the science, ensuring omissions do not mislead readers. The responsibility lies with communicators to protect scientific integrity, avoid fueling harmful behaviors, and prevent mistrust in institutions through transparent reporting.

## *4.3. The Role of Scientists in Combating Disinformation*

Fighting misinformation would be more effective if experts from different fields (e.g., doctors, engineers, or mathematicians) learn to collaborate as early as possible, developing the ability to explain complex ideas in ways that people outside their field can understand. Over time, scientists and engineers who work exclusively within their own disciplines become trapped in "echo chambers." From their college years onward, a medical researcher might primarily discuss angiogenesis pathways with fellow biologists, while a materials engineer exchanges fatigue failure equations with peers.

Through thousands of repetitions, they internalize highly specialized jargon and assumptions that outsiders cannot decode. This creates the aforementioned "ivermectin paradox," where experts lose the ability to contextualize findings for non-specialists, leading to gaps such as misreported drug dosage contexts.

However, those who collaborate across fields from their student days onward develop a counterbalance. A clinical researcher who has been paired with computer engineers since their university projects learns to replace phrases like "nonlinear pharmacokinetics" with analogies such as "drug absorption behaves like traffic flow, meaning small increases in cars (dosages) can suddenly jam the system (cause toxicity)." This mirrors the "Medieval lesson" mentioned earlier, when 14th-century communities catastrophically misunderstood plague causality due to communication failures. Modern experts must actively practice translating their concepts into shared frameworks. Teams forged through decades of cross-talk retain their capacity to bridge knowledge gaps[21], which is a critical defense against crises like anti-vaccine misinformation that exploit disciplinary jargon silos.

Critically, multidisciplinary teams can also exploit asymmetric public trust; populations skeptical of one domain may still trust another. During COVID-19, individuals dismissing epidemiologists' warnings about ivermectin could defer to toxicologists' dosage analyses or engineers' risk-modeling visuals. By diversifying messengers rooted in lifelong cross-training, science communicators can hedge against sector-specific distrust crises. This approach transforms isolated expertise into a pluralistic trust lattice, where technical rigor and narrative agility emerge from the friction of sustained interdisciplinary engagement.

### *4.4. Fostering Critical Thinking Through Education*

Systemic educational reform is critical to building societal resilience against misinformation. Elementary and high school curricula should integrate classes that teach students to deconstruct claims, identify credible sources (e.g., peer-reviewed journals vs. social media posts), and recognize manipulative tactics like sensationalized headlines or causal oversimplification. Lessons could include case studies; such as analyzing the ivermectin misinformation cycle, to demonstrate how context gaps and uncritical acceptance of claims lead to harm. By training students to ask, "What evidence supports this?", education systems can cultivate a generation adept at navigating information complexity. This foundational critical thinking reduces reliance on clickbait and empowers individuals to challenge pseudoscience, creating a public less vulnerable to algorithmic amplification of disinformation.


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# 5. The Next Wave of Misinformation: AI in Healthcare

Emerging at the intersection of technological promise and systemic risk, this section examines artificial intelligence's dual-edged role in healthcare; probing the gap between inflated algorithmic claims and clinical reality, analyzing how methodological gaps fuel destabilizing narratives akin to the ivermectin crisis, and proposing safeguards to counter AI-driven disinformation before it entrenches new cycles of public harm.

## *5.1. The Promise and Pitfalls of AI in Medicine*

The rapid popularization of artificial intelligence (AI) has brought significant advancements in various fields, with healthcare emerging as one of the most promising areas of application[22]. Machine learning (ML) models are being developed to assist in diagnosing medical conditions, predicting patient outcomes, and personalizing treatments. Academic journals are increasingly publishing studies showcasing the potential of AI in clinical settings, often with claims of exceptional accuracy; frequently reported as being in the high 90th percentile or even achieving 100% accuracy[23]. However, this trend is accompanied by a brewing wave of misinformation, driven by the oversimplification and sensationalization of AI research in healthcare[24].

## *5.2. Methodological Shortcomings and Inflated Claims*

Despite the excitement surrounding AI, many of the published studies on AI in healthcare lack the rigorous methodological standards required to ensure reliable and generalizable results[25]. Common pitfalls include improper training of models, inadequate data splitting (e.g., failing to separate training, validation, and testing datasets appropriately), insufficient hyperparameter tuning, and poor assessment metrics[26]. In some cases, studies publish results on models that have not fully converged during training, leading to artificially inflated performance metrics.

The reality is that many of these AI models fail to generalize well when applied to new and unseen data. However, the limitations and nuances of these studies are often downplayed or omitted entirely in academic publications, creating a misleading narrative that AI tools are ready for widespread clinical use. This distortion of scientific rigor is further amplified when popular media outlets pick up these studies, presenting them as evidence that AI is poised to replace human doctors or revolutionize healthcare overnight.


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### *5.3. The Risks of Overreliance and Unrealistic Expectations*

Popular magazines and online articles frequently latch onto the most eye-catching aspects of AI research, often without critically evaluating the underlying science. Headlines such as "AI Diagnoses Disease Better Than Doctors" or "The Future of Medicine: AI Doctors Are Here" are designed to attract clicks and readership but fail to convey the complexity and limitations of the technology. These narratives create unrealistic expectations among the public and policymakers, suggesting that AI systems are infallible and can outperform human clinicians in all scenarios. In reality, healthcare AI is far from achieving the level of reliability and robustness required for independent clinical decision-making. The claim of high accuracy is not only implausible but also dangerous. This false sense of confidence can lead to overreliance on AI systems, potentially putting patient safety at risk when models fail to perform as expected.

The careless popularization of AI in healthcare has broader implications beyond individual misunderstandings. Medical science is a particularly sensitive area where misinformation can have serious consequences. Unlike other scientific fields where oversimplified claims may inspire curiosity or harmless misconceptions, misinformation in healthcare can directly impact patient behavior, public health policies, and trust in medical institutions.

Misinformation AI in healthcare also provides fertile ground for those who seek to exploit medical disinformation for financial or ideological gain. Just as conspiracy theorists have weaponized misrepresented scientific findings in the past, such as ivermectin during the COVID-19 pandemic, they may similarly misuse AI-related claims to undermine trust in healthcare institutions or promote unproven technologies. As AI continues to advance and its applications in healthcare grow, the scientific community, journalists, and policymakers must take proactive steps to prevent the spread of misinformation. This begins with improving the rigor and transparency of AI research.

### *5.4. Safeguarding Against AI Misinformation*

#### *5.4.1. Improving Research Rigor and Transparency*

Researchers must adhere to best practices in AI model development, including proper dataset splitting, thorough hyperparameter optimization, and comprehensive validation on diverse and representative datasets. The FDA's draft guidance emphasizes the criticality of these practices in its 2025 AI framework, flagging dataset quality (e.g., demographic representativeness, clinical context alignment) and algorithmic transparency as non-negotiable safeguards against overclaims or systemic biases[27]. Journals should prioritize studies demonstrating robust methodologies, such as pre-specifying model architectures, validating performance across heterogeneous patient cohorts, and explicitly reporting limitations like overfitting risks or generalizability constraints. For instance, the FDA explicitly advises against publishing AI-driven drug efficacy claims without external validation or documentation of real-world performance monitoring systems to detect model drift. This aligns with the report's broader thesis on healthcare's unique risks: inflated accuracy metrics (e.g., "99% cancer detection AI") echo the ivermectin crisis's dosage-toxicity gaps, tempting clinicians and patients to overtrust unvetted tools. The FDA framework further warns that opaque "black-box" algorithms risk propagating AI-specific misinformation cycles akin to Radithor's pseudoscientific tonics, where uninterpretable outputs invite dangerous misinterpretations. By mandating rigorous documentation of training data provenance, bias audits, and clinical applicability boundaries, regulators and journals can mirror the aforementioned call for interdisciplinary guardrails to prevent AI hype from metastasizing into public harm.

### *5.4.2. Responsible Communication and Reporting*

Science communicators and journalists also have a critical role to play. When reporting on AI in healthcare, they must prioritize accuracy and nuance over sensationalism. This involves emphasizing the experimental nature of most AI tools, highlighting their limitations, and avoiding exaggerated claims about their capabilities. For example, instead of framing an AI model as "replacing doctors," articles could focus on how AI is being developed to complement human expertise by providing decision support or automating routine tasks.

### *5.4.3. Public Education and Informed Skepticism*

Finally, public education is essential to foster a more informed understanding of AI in healthcare. By teaching individuals to critically evaluate claims about AI and recognize the limitations of technology, we can reduce susceptibility to sensationalized narratives. This is particularly important given the rapid pace at which misinformation spreads online, where viral headlines often overshadow nuanced discussions.

The popularization of AI in healthcare represents both an opportunity and a challenge. On one hand, AI has the potential to enhance medical practice by improving diagnostic accuracy, streamlining workflows, and personalizing treatments. On the other hand, the oversimplification and sensationalism of AI research risk creating unrealistic expectations, eroding trust in healthcare institutions, and endangering patient safety. By addressing these challenges through rigorous research, responsible communication, and public education, we can ensure that the integration of AI into healthcare is guided by evidence, transparency, and a commitment to patient well-being. Only by striking a careful balance between innovation and skepticism can we harness the full potential of AI while minimizing the risks of misinformation and misuse.

# 6. Conclusion

As a collision of historical missteps and digital-age vulnerabilities reshapes public understanding of science, this report underscores the nonnegotiable imperative to recalibrate healthcare communication; confronting pseudoscientific legacies from medieval scapegoating to AI-driven disinformation while advocating for systemic reforms that prioritize transparency, interdisciplinary collaboration, and public resilience against the lethal consequences of oversimplified narratives.

## *6.1. Balancing Accessibility and Accuracy in Science Communication*

The popularization of science stands at a critical crossroads. On one hand, it plays a vital role in making complex discoveries accessible, fostering public engagement, and promoting scientific literacy. On the other, its oversimplification and sensationalism can distort understanding, erode trust in scientific institutions, and fuel the spread of misinformation and conspiracy theories. This duality underscores the importance of striking a careful balance between accessibility and accuracy in science communication.

The examples discussed, from misleading claims about chocolate improving intelligence to the dangerous misrepresentation of ivermectin as a COVID-19 cure, highlight the real-world consequences of oversimplified narratives. These cases demonstrate how even well-intentioned efforts to popularize science can result in public confusion, mistrust, and harmful behaviors when critical nuances are omitted. At the same time, they reveal the growing responsibility of writers, scientists, educators, and the public to navigate and improve the ecosystem of science communication.

To address these challenges, science communicators must prioritize responsible reporting that respects the complexity of research while still engaging the public. This involves not only avoiding sensationalism but also contextualizing findings, clearly stating limitations, and resisting the temptation to reduce nuanced studies into click-worthy headlines. Scientists themselves must also take active roles, using platforms to directly engage the public, correct misconceptions, and build trust through transparency.

However, the responsibility does not lie solely with communicators and scientists. Society as a whole must commit to fostering critical thinking skills, starting with education. By equipping individuals with the tools to assess the credibility of sources, question oversimplified claims, and recognize biases, we can cultivate a more discerning public that is better prepared to navigate the complexities of scientific information.

### *6.2. Empowering Society Through Responsible Popularization*

Ultimately, the popularization of science must aim not just to inform but to empower. When done responsibly, it has the potential to bridge the gap between research and society, inspire curiosity, and provide individuals with the knowledge they need to make informed decisions. Responsible popularization is fostering scientific literacy while respecting public intelligence. This requires dismantling the historical hierarchies that have perpetuated mistrust, as seen in the Nauru measles tragedy, where colonial-era grievances were exploited to equate vaccine hesitancy with empowerment. By integrating equity-centered frameworks into science communication, a lesson underscored by the radium tonic scandals of the 1920s, advocates can recenter marginalized voices and preemptively address systemic distrust.

Critically, empowerment demands confronting algorithmic asymmetry: platform architectures that amplify fear-based narratives (e.g., ivermectin conspiracies) while suppressing corrective nuance. Initiatives like the FDA's 2025 AI guidance, which mandates real-world performance monitoring for health algorithms, exemplify institutional steps toward recalibrating this imbalance. Parallel grassroots efforts, such as "Science Communicator Residencies" embedding researchers in local schools and media outlets, could democratize expertise while rebuilding trust eroded by historical abuses like the Radithor marketing fraud. Ultimately, responsible popularization must evolve into a safeguard; transforming passive audiences into critical collaborators who challenge pseudoscience not through blind faith in institutions, but through shared ownership of scientific progress.

### *6.3. The Path Forward: Understanding, Progress, and Truth*

Navigating the post-truth era requires redefining science communication as a prophylactic against existential threats, from AI-driven disinformation to climate denialism, by anchoring it in three pillars: historical reckoning, systemic accountability, and adaptive resilience. The medieval scapegoating of cat owners during the Black Death and the 21st-century vilification of public health agencies both stem from the same epistemic rupture: societies prioritizing comforting falsehoods over complex realities. Closing this gap demands unflinchingly auditing past failures, such as the pharmaceutical industry's role in opioid misinformation, while proactively addressing emerging risks like generative AI's capacity to mass-produce "personalized" pseudoscience (e.g., deepfake testimonies from fabricated experts).

Progress hinges on institutional reforms that punish predatory practices while incentivizing ethical innovation. Regulatory bodies must expand beyond reactive post-market surveillance (as seen in delayed responses to thimerosal misinformation) to preemptive oversight modeled on the FDA's 2025 AI framework, which ties algorithmic approvals to ongoing bias audits and clinician feedback loops. In this context, journal publishers must require that studies clearly disclose their limitations and validation procedures, emphasizing transparency and methodological rigor. This approach will help address the recurring issue of inflated claims in healthcare AI research, including superficially impressive 99-100% accuracy rates that are often achieved through flawed practices such as improper dataset splitting or inflated training metrics.

Yet policy alone cannot suffice. Building societal resilience requires embedding critical scientific literacy into education; from elementary curricula dissecting the "spinach iron myth" to medical schools training physicians in risk communication, each tier must equip citizens to dissect exploitation patterns spanning turmeric supplements and algorithmic hype. Truth, in this context, becomes a dynamic covenant; not static factoids to be transmitted, but a collective practice of interrogating power structures and epistemic gatekeepers. By learning from the Radithor tragedy's market-driven pseudoscience and the Nauru crisis' weaponized distrust, stakeholders can forge communication ecosystems where understanding flows bidirectionally, progress is measured by equity as much as innovation, and truth emerges not from authority, but from sustained, empathetic engagement with evidence. This path rejects facile optimism, acknowledging that misinformation's roots lie in human vulnerability as much as malice; and that its remedies must be equally human-centered.


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