Vaccine Hesitancy: Inoculating against misinformation with a dose of science

CASE STUDY

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This case study highlights four tactics of science misinformation and disinformation efforts: fabrication of a fake scientific controversy, lack of subject area expertise, putting forth conspiracy theories, and avoiding peer review. See ***Characteristics of Science Misinformation/Disinformation Efforts*** *for more information regarding these tactics and* ***Vaccine Hesitancy: Placing everyone at risk*** *for the companion story to this case study.*

Numbered red flags refer to descriptions of misinformation and disinformation provided at the end of the case study.

5-year-old Amrutha will soon be starting elementary school. Amrutha's mother Sofia, is worried about rumors of a rampant virus among school-aged children in the area. Sofia has scheduled an appointment with Dr. Mayfield to discuss the virus and what can be done to make sure Amrutha has a safe first year at school.

Dr. Mayfield: Good morning, Mrs. Abara. My goodness, Amrutha, is growing so much! So, what brings you in today?

Sofia: There is a virus going around our community, "*M virus"* or something like that. One of our neighbors is even showing symptoms. What are options for keeping her safe from the virus at school this year?

Dr. Mayfield: Hmm, "*M virus"* … that's probably *morbillivirus* - the measles. Well, we have a vaccine available. We should vaccinate Amrutha today if she's not already.

Sofia: Oh no, she will not be getting any vaccines. I was hoping you could help us any other way.

Dr. Mayfield: Perhaps if you share your concerns about the vaccine, we can work through them? Afterall, the vaccine is the best way to protect both Amrutha *and* other children in the community.

Sofia: Well, I have developed a lot of faith in natural medicines. Sharon, from two doors down is completing her Certificate in Homeopathy and was sharing information with us at the local picnic. Her recommendations really sound like they are good for the body.

Dr. Mayfield: I can't be sure about Sharon's recommendations. Hmm, what does she do for work exactly?

Amrutha: Sharon sells organic popsicles! They are so good!

Dr. Mayfield: I am sure they are! Getting medical recommendations from an aspiring homeopath at the local popsicle stand is not the most reliable source. Medical doctors spend 10-14 years in rigorous training and schooling and are licensed to speak with authority about human health. Many of those doctors become specialists in even more focused topics.

Disciplinary expertise in a scientific field results in scientists and practitioners who specialize in and can credibly address a very narrow range of issues. However, misinformation and disinformation, sometimes promoted as alternative theories or practices, is often spread by non-experts who are explicitly or implicitly presented as experts. What would you look for when evaluating someone's status as an "expert" on a given science topic?

Sofia: I have read more even more about natural medicines and homeopathy on social media. Some of them providing this information were even doctors that had travelled all over the world to try out new natural remedies that mainstream doctors don't know about.

Dr. Mayfield: Appealing directly to the public through social media without first going through peer reviewed outlets is not best practice. The peer review process, and the intense scrutiny from a global scientific community, act as a check on the claims of individual doctors and scientists.

In court proceedings, witnesses' and experts' testimonies are subjected to cross examination. Think of peer review and scrutiny of scientific work as an extremely rigorous form of cross examination by global community of authentic experts. If scientific work was not vetted by a rigorous peer review process and heavily scrutinized by fellow scientists, and instead released directly to the public, how would that hinder the trustworthiness of that work?

Sofia: I just don't know how I feel about it. If there are doctors saying something is dangerous, then why should we care what the peer review says? How can we be sure the natural medicines *aren't* better?

Dr. Mayfield: That's a really great question. The rigor involved in medical studies is to assure us that modern medical advancements hold the best possible human health outcomes given the evidence and information at the time. Nearly everyone has heard of COVID-19. When people started spreading every natural remedy that could be thought up, naturally people wanted to believe, and scientists wanted to test.

Sofia: But not every COVID remedy worked.

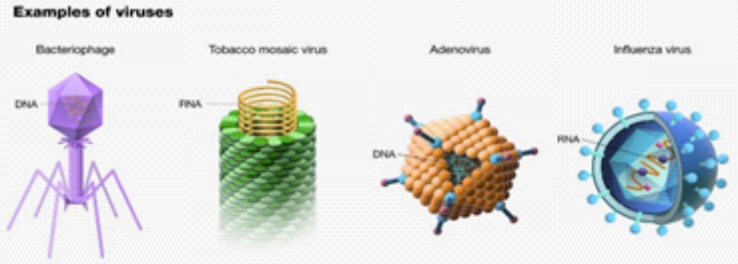
Dr. Mayfield: Exactly. Some people tried self-treatments that had no basis in modern scientific medical studies and information which led to some very poor outcomes. Some alternative treatments and medically approved treatments for other diseases were tested for treating COVID by experts through large scale scientific studies. If those didn't hold up in clinical trial, it is because the evidence simply wasn't there. It wasn't limited to alternative treatments and treatments for other diseases.

Sofia: What do you mean?

Dr. Mayfield: Merck, a vaccine industry titan, was developing two COVID vaccines that failed in clinical trials (Thomas, 2021). Merck didn't go on telling everyone they had a cure for COVID, though, and they didn't make false claims that their solutions were being denied by doctors. Instead, they asked governments how they could assist companies that had vaccines successfully moving through trials.

Sofia: So, it's not like everybody wins just because they tried hard. That makes me a lot more confident in vaccines that do make it through trials. How different are measles and COVID? What exactly is a virus? Are they like cells?

Dr. Mayfield: Great question! Check out the poster behind you! There are different kinds of viruses, and they are different from cells. They lack cell membranes, organelles, and ribosomes. Instead they have an RNA or DNA genome and are covered by a protective protein capsid.



Visual representation of how viruses look (image modified from Segre, 2022)

Sofia: Umm… those words *sound* familiar. How can something so small make people sick?

Dr. Mayfield: A virus cannot replicate by itself, so it needs the help of a cell, a "host" cell. Viruses infect host cells by attaching to them or entering directly into cells and then use cells as sort of "factory machines" to replicate and produce more viruses. There are differences between different types of viruses in where replication in the cell occurs, though (American Scientist, 2018).

Sofia: Where do vaccines come into play for keeping my daughter safe?

Dr. Mayfield: Vaccines work by building immunity before a virus infection occurs, before entering your cells. Vaccines can contain weakened viruses, dead viruses, or even sub-particles or blueprints of viruses.

Sofia: Why would we purposefully expose our bodies to the virus? I have heard there are connections to autism that doctors and vaccine producers have tried to cover up because it would hurt profits.

Dr. Mayfield: There is no autism-vaccine link. The idea was largely started from a poorly conducted study. When the paper was scrutinized by the global scientific community, the results were questioned, and evidence of misconduct and outright fraud began to emerge. Perpetuating conspiracy theories about suppressing certain opinions is a common theme across sources of misinformation and disinformation.

> ***When global communities of experts and professional organizations concur with and endorse scientific claims, how does that affect the trustworthiness of the claims? How does that affect the feasibility that a widespread conspiracy regarding science can occur?***

Sofia: So we can be sure that the measles vaccine isn't some ongoing experiment?

Dr. Mayfield: The measles vaccines have been around since the 1960s, are well tested, and led to the elimination of the measles in the United States (CDC, 2020).

Sofia: Wait, if measles were eliminated, then why is it spreading through our community.

Dr. Mayfield: Viruses and vaccines have been subject to misinformation and disinformation efforts for a long time, and it's been found that the misinformation sticks around the public sphere even after being refuted by scientists. When vaccines were wrongly linked to autism, vaccination rates dropped, and measles started to crop up again.

Sofia: I know there are a lot of concerns regarding how fast vaccines come out too, as well as concerns about side effects. Not all hesitancy is the result of denialism. Both sides of the issue are equally true.

Dr. Mayfield: There have been cases of vaccines that have rolled out too quickly, but those are exceptions. Clinical trials for testing and measures put into place during production and distribution have been rigorous and reasonably improve our confidence in vaccine efficacy. When a global scientific community of experts is endorsing the use of the treatments and preventative measures, it's not equivocal. Instead, there is overwhelming evidence regarding the efficacy and safety of the recommended treatment and preventative measure.

> ***How can inappropriately perpetuating the notion that there is credible support for ideas and practices alternative to those endorsed by the scientific community result in detrimental human health and environmental consequences? How could you guard against being persuaded by such misinformation and disinformation?***

Sofia: Even though I've had my concerns, I think it would be responsible to get Amrutha vaccinated. If the majority of medical professionals accept this idea, then maybe I should too.

Using the information from the case study and other credible sources (e.g., your course content) answer the following questions.

> ***How might the features of misinformation and disinformation associated with viruses and vaccines impact peoples' thinking and decision-making?***

> ***How might personal and group-reinforced emotions and biases influence thinking and decision-making regarding this issue?***

Regulating your own emotions and personal biases and citing multiple lines of credible evidence (scientific, economic) as well as ethical and social considerations, propose a resolution regarding the decision to vaccinate.

RED FLAG GLOSSARY

Lack of subject matter expertise

While professionals in a particular field of science may draw from other fields, disciplinary expertise is often quite narrow. Individuals posing as experts or speaking as experts when they lack credentials in relevant, narrow scientific fields is a sign of potential misinformation/disinformation.

Avoiding peer review

During the peer review process, experts in the relevant field rigorously scrutinize the research and conclusions described by the authors. This critical step in science improves the final papers that are accepted, and reduces the number of errant, trivial, irrelevant, or otherwise problematic articles that are published. A major red flag of purveyors of misinformation and disinformation therefore is when scientists bypass the peer review process and instead bring their unvetted work directly to the public.

Promoting conspiracy theories

Reference to conspiracy theories is an often-used misinformation/disinformation tactic in an attempt to explain why pseudoscientific ideas and/or articles have not been published in scholarly journals, or why the global community of scientists has adopted the consensus position.

Creating a fake controversy

Pseudoscientific sources often attempt to manufacture a false sense of legitimacy through the formation of scientific sounding organization and dissemination of information from that organization. This can easily lead to confusion, and cause the public to errantly believe that experts are divided on an issue.

References

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