Identifying Major Themes in Anti-vaccination Misinformation Surrounding the COVID Vaccine and Childhood Vaccines

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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In the modern world, misinformation proliferates faster than ever before, aided by technologies like social media platforms. This proved especially relevant during the COVID-19 pandemic, when misinformation about the virus itself and the vaccines created to inoculate against it spread at an alarming rate. Misinformation is defined simply as false information and can be spread either intentionally or unintentionally. Vaccine misinformation is especially harmful as it can decrease vaccine uptake rates and distract from factual health information in critical public health situations. Even in normal public health situations, decreased vaccine uptake can result in negative consequences; for example, decreased measles, mumps, and rubella (MMR) vaccine uptake due to misinformation caused measles outbreaks in the United States, the United Kingdom, and Canada in 2008 and 2009 (Rao & Andrade, 2011). Strategies to counter misinformation, such as content screening on social media platforms, have been developed; however, these strategies are often ineffective (Lyons, 2018). Analyzing the main themes present in vaccine misinformation is essential in creating proactive strategies to prevent misinformation instead of simply trying to slow its spread. Co-production will be used to analyze the interactions between the public, vaccine misinformation, and technology, lending actionable insight.

Methods and research question

To analyze the major themes in vaccine misinformation, a documentary review of existing literature about that misinformation is conducted. Co-production is then used to analyze the ways in which the public interacts with vaccine misinformation and how this affects the development of strategies to counter vaccine misinformation, answering the research question "how do the main themes present in misinformation about childhood vaccines and the COVID-19 vaccine compare, and how can that comparison and knowledge about how the public

interacts with vaccine misinformation be used to create strategies that more effectively combat that misinformation?" This analysis lends insight to how strategies to counter vaccine and general health misinformation can be improved to better limit the effect of vaccine misinformation. The sources used to create this analysis include previous scholarship on the main tactics used by sources of vaccine misinformation, explorations of how people interact with health and vaccine misinformation, and clinician and government advice on decreasing the effects of vaccine misinformation and increasing vaccine uptake.

Vaccine misinformation

Despite the availability of scientifically-backed information about COVID-19, many people still believe misinformation. An ongoing research project by the Kaiser Family Foundation (KFF) reveals that 78% of 1,519 adults surveyed said that they either believed to be true or were unsure of the validity of any of eight false statements about COVID-19 (Hamel et al., 2021). Among these false statements were examples of vaccine misinformation such as "you can get COVID-19 from the vaccine" and "the COVID-19 vaccines can change your DNA" (Hamel et al., 2021). The study also found a correlation between belief in COVID-19 misinformation, vaccination status, and partisanship; Republicans and the unvaccinated were more likely to believe COVID-19 misinformation to be true (Hamel et al., 2021). Belief in vaccine misinformation introduces hesitancy and distrust and as a result people are less likely to get vaccinated. Decreased vaccine uptake rates in turn lengthen pandemics by slowing the journey to herd immunity and allowing variants to gain a foothold in the population (Cornell University Media Relations Office, 2021). Even more broadly, general COVID-19 misinformation leads people to challenge or ignore public health recommendations like wearing a mask or socially distancing, adding to the problem (Hamel et al., 2021).

Decreased vaccination uptake rates do not only prolong pandemics, they can also allow rare or previously eradicated diseases to spread once again. In 1998, British physician Andrew Wakefield and 12 colleagues published a paper in the medical journal *The Lancet* that suggested that the measles, mumps, and rubella (MMR) vaccine, administered in early childhood, could lead to the development of autism in children (Rao & Andrade, 2011). The paper gained great publicity. Their findings have since been discredited - the study was only conducted with 12 children and the conclusions were extremely speculative; additionally, 10 of the 12 co-authors have retracted their original interpretations of the data (Rao & Andrade, 2011). Despite the retraction, misinformation about the MMR vaccine had already spread far and wide, and as a result, many parents chose not to vaccinate their children for fear they would develop autism (Rao & Andrade, 2011). Despite the fact that measles, a disease that can be fatal, had been declared to have been eradicated in the United States by the World Health Organization (Centers for Disease Control and Prevention, 2020), decreased MMR vaccine uptake rates led to measles outbreaks in the United States, the United Kingdom, and Canada in 2008 and 2009 (Rao & Andrade, 2011).

In both situations, the spread of vaccine misinformation led to adverse public health outcomes. The power that misinformation has necessitates effective strategies to counter its spread. During the COVID-19 pandemic, the United States Department of Health and Human Services created a guide detailing ways to address COVID-19 vaccine misinformation (2021). This guide contains ways that individuals and entities like technology platforms, governments, and research institutions can do to combat the spread of misinformation (United States Department of Health and Human Services, 2021). Despite the existence of these strategies and actions taken accordingly, misinformation dramatically affected and continues to affect vaccine

uptake rates. Analyzing major themes in vaccine misinformation can give insight into how strategies to combat misinformation can be improved. Additionally, taking less of a one-size-fits-all approach could render these strategies more effective, with belief in misinformation being correlated with demographics like the unvaccinated and Republicans. Targeted efforts to increase vaccine uptake rates in these groups could help bring the pandemic to a close.

Co-production: interactional and constitutive

In her 2006 book *States of Knowledge*, American social scientist Sheila Jasanoff defines co-production as the bidirectional influence between society and technology. This is a departure from the frameworks of the social construction of technology (SCOT), which states that only human action shapes the development of technology, and technological determinism, which states that technology alone determines the course of human history. Co-production is useful in analyzing the complex ways in which society and technology influence each other, but it is a relatively new framework. Its critics say that "it requires a stronger agreed understanding and evidence base to make a real impact in policy" (Boyle & Harris, 2009). This is a fair criticism; much scholarship that involves co-production defines it as a collaborative effort between citizens and public service organizations to create policy; the policy affects the citizens and the citizens affect the policy (Co-production (public services), 2021). Co-production is also defined as "a form of knowledge production based on the dynamic interaction between technology and society" (Co-production (society), 2021). The existence of three similar but ultimately conflicting definitions of co-production makes finding scholarship that involves Jasanoff's definition of co-production challenging.

Co-production has two strands: the constitutive and the interactional. The constitutive approach analyzes "how particular states of knowledge are arrived at" while the interactional approach investigates "how human beings organize, and periodically reorganize, their ideas about reality" (Jasanoff, 2006). In short, the constitutive approach seeks to understand *what* is known and the interactional with *how* it is known (Jasanoff 2006). In the context of vaccine misinformation, the constitutional approach might examine the opinions the public forms when presented with a vast array of information around vaccines, some of it misinformation. The interactional might explore how those opinions change when people interact with new information or strategies meant to combat misinformation.

Both strands of co-production will be useful in investigating how the public currently interacts with vaccine misinformation. Formalizing the public/misinformation interactions using co-production can then be combined with the main themes present in vaccine misinformation to lend valuable insight into how strategies to combat misinformation can be improved.

Analysis of themes present in vaccine misinformation

Sources that disseminate vaccine misinformation rely on emotional appeals that are often fallacious in nature. Understanding how these sources attempt to convince people of their veracity and why people believe them lends insight into how vaccine misinformation can be more effectively countered. Interactions with vaccine misinformation can be formalized using co-production; this analysis follows below. First, constitutive co-production will be used to explore the major themes in childhood and COVID vaccine misinformation. Then, interactional co-production will be used to explore how people interact with vaccine misinformation, forming new ideas about the world in which they live.

<u>Constitutive co-production: what people know</u>

Constitutive co-production can be more simply understood as understanding *what* people know (Jasanoff, 2006). In the context of vaccine misinformation, it is therefore useful to examine scholarship around the common themes in vaccine misinformation that are then believed by the public.

Childhood vaccines

One of the common claims of misinformation surrounding childhood vaccines is that vaccines cause other diseases or disorders to develop, like autism or encephalopathy (Cabrera-Lalinde, 2021). These claims are usually unfounded, but media attention allows any suggestion of their veracity to circulate quickly and widely. In 1998, Andrew Wakefield's publication of an article linking the MMR vaccine to the development of autism caused parents to forgo vaccinating their children against measles, mumps, and rubella (Rao & Andrade, 2011). Similarly, concerns around effects including encephalopathy caused by the pertussis vaccine circulated in the 1980s, decreasing vaccine uptake rates (Cabrera-Lalinde, 2021). Due to the exaggerated nature of possible risks from vaccination, parents are more likely to avoid vaccinating their children, even if the risk of negative effects from contracting the diseases the vaccines inoculate against is in actuality far higher.

Other sources claim that natural immunity gained by physically contracting a disease is "better" than the immunity gained from vaccines ("Vaccine hesitancy", 2022). While infection with certain diseases can give longer or stronger immunity than the immunity given by a vaccine, the effects of actually contracting the disease can be devastating ("Vaccine hesitancy", 2022). For example, the measles virus can cause lifelong complications like hearing loss or panencephalitis, which is usually fatal ("Vaccine hesitancy", 2022). This theme of the superiority of natural

immunity appeals to parents that want to do what is best for their children, but the risks of contracting preventable diseases far outweigh any benefit given by natural immunity.

Another claim in favor of delaying or forgoing routine childhood vaccinations is that there are too many vaccines given to children and that so many vaccines will overwhelm the immune system (Geoghegan et al., 2020). However, there has been no evidence that immune function is impacted (Geoghegan et al., 2020). Additionally, the childhood vaccine schedule recommended by the Advisory Committee on Immunization Practices (ACIP) is “designed to protect children against preventable diseases when they are most vulnerable”, so delaying the vaccination schedule can increase the time children are vulnerable to disease ("Vaccine hesitancy", 2022). Once again, the perceived risk of “overwhelming” a child’s immune system deters parents from vaccinating their children even though in doing so they expose their children to more risk. All three of the tactics discussed prey on parent’s love for and desire to protect their children, making them easy to believe and hard to combat.

COVID vaccines

Given the severity of the COVID-19 pandemic, it was extremely important that a vaccine be developed as quickly as possible. When a vaccine was developed, many anti-vaccine sources claimed that the vaccine had been developed too quickly and possible negative effects could not be known. However, all vaccines undergo many rounds of testing and clinical trials, and the COVID vaccines are no exception (Suran, 2022). Some sources also allege that mRNA vaccine technology is new when in fact it has existed for nearly two decades (Suran, 2022). Legitimate concern around the safety and efficacy of a quickly developed vaccine are more than understandable, but anti-vaccine sources target this concern and use it to increase vaccine hesitancy.

Some sources focus heavily on potentially dubious accounts of harm that has befallen those who have been vaccinated against COVID-19. For example, one video shows a healthy young girl leading a normal life, but then shows her sick and in pain, supposedly due to the COVID-19 vaccine (even though the actual cause of her illness is in reality unknown) (Zadrozny, 2021). Videos like these use visceral and emotional images and narratives to take advantage of uncertainty that people, especially parents, may have about vaccinating their children against COVID-19 (NBC). Such narratives convince parents that the perceived risks of vaccination outweigh the harm of contracting COVID-19, which in many cases is not serious for children. However, it is still important to vaccinate children so that even if they do contract the virus, they are less likely to infect someone who may have a much more serious reaction.

Misinformation about both childhood and COVID-19 vaccines target understandable concern that members of the public may have in an effort to deter them from vaccinating themselves and their children. Misinformation specifically about childhood vaccines also takes advantage of parents' concern for their children; COVID vaccine misinformation does so less often. Understanding how people interact with these often emotionally charged pieces of misinformation is important in more effectively combating misinformation.

Interactional co-production: how people come to know what they know

Interactional co-production concerns itself with "how human beings organize, and periodically reorganize, their ideas about reality" (Jasanoff, 2006). The astonishing wealth of vaccine misinformation available on social media platforms and across the internet in general means that many people confront or have confronted vaccine misinformation in their daily lives, especially during the ongoing COVID-19 pandemic. Understanding the rhetoric that is used in vaccine misinformation lends insight into how people interact with that misinformation.

Sources of vaccine misinformation often use logical fallacies to advance their messages. One such example is the "post hoc, ergo propter hoc" (Latin for "after this, therefore because of this") fallacy (LaSalle, 2020). Sources often portray information as if there is a causal relationship between occurrences; for example, many sources link the administration of the MMR vaccine to the development of autism when there is a large body of work showing no causal relationship (LaSalle, 2020). The video showing a healthy girl harmed by a COVID-19 vaccine mentioned earlier is a prime example; despite the actual cause of her condition being unknown, a false narrative is created to advance an anti-vaccine message. This fallacy is easy to accept because people like to be able to explain things that happen in their lives, especially things like serious disorders or disease; even an erroneous explanation can be comforting (LaSalle, 2020). Recognizing this fallacy can often be difficult for people, especially if they already have preconceived notions about the safety and efficacy of vaccines.

Another such fallacy is the "appeal to pity" fallacy, wherein emotion is used instead of fact to make a point. This fallacy is commonly used in conjunction with the post hoc fallacy, where "the heartbreaking stories of parents whose children suffered some significant adverse event (they believe) following vaccination" are portrayed (LaSalle, 2020). It is only natural to want to avoid a perceived risk. These fallacies can be especially convincing when presented as videos where sound, dialogue, and images can be used in conjunction. A video of a suffering child is much more distressing than merely reading about a child suffering. Conversely, sources that present truthful, scientific information about vaccines often do not rely on emotional appeals to advance their message, making them less emotionally compelling than misinformation.

Sources also often use the "bandwagon" fallacy to advance their message by asserting that since many people believe their message, so should other readers (LaSalle, 2020). The

bandwagon fallacy often also occurs unintentionally on social media; people surround themselves with content that advances a particular viewpoint and the algorithms that serve content to users continue to display the same sort of content. Thus, an echo chamber of sorts is created, and it seems as if everybody is saying the same thing, when in reality the content the user sees could be a very small portion of the larger discourse.

Another tactic used by sources of vaccine misinformation is an appeal to authority wherein a person in a position of authority portrays vaccines as ineffective or unsafe (LaSalle, 2020). When a trusted authority figure casts doubt on vaccines, this introduces doubt where perhaps there was none before, or strengthens existing doubts.

Several types of bias can also influence how people form opinions. Confirmation bias is a type of bias wherein people are more likely to believe information that agrees with their preconceptions about a topic even if it is factually incorrect (LaSalle, 2020). Sources of vaccine misinformation are often very convincing and coupled with confirmation bias the temptation to believe proves strong. Omission bias results in a "tendency to prefer inactive to active options even when inaction leads to worse outcomes or greater risks." (LaSalle, 2020). Omission bias can play a large role in the decision to vaccinate, especially when people come across emotional accounts of harm caused by vaccines. Making no decision at all can be more comforting than making a perceived wrong decision. Uses of both fallacy and bias interact with people's preconceived notions to influence what information (or in this case, misinformation) those people internalize and the new opinions they form; in this way, sources of misinformation and the consumers of that misinformation co-produce information.

Strategies to confront vaccine misinformation must consider the myriad ways in which people interact with misinformation. Gretchen LaSalle, a family physician, argues that "we have

found no one effective approach to the vaccine discussion with our anti-vaccine patients, because there is no one type of vaccine-resistant person. They are not a singleminded group. They are a group with varying concerns and motivations" (2020). Strategies to combat misinformation must take the context and motivations of vaccine misinformation into account to be maximally effective; people do not believe vaccine misinformation because they are ignorant but because they are doing their best to protect themselves and their families in a confusing and dangerous world.

Primary care physicians and the healthcare industry also play a role in the public's interaction with misinformation. If people do not understand vaccine information, they may ask their physicians about it; the way this interaction goes is very important (Cabrera-Lalinde, 2021). If the patient does not feel heard or understood, or if a physician is not accessible to them, they may turn to alternative sources like social media to ask those questions and receive misinformation as their answer (Cabrera-Lalinde, 2021). Moreover, decreased trust in the healthcare system also causes patients to turn towards alternative sources for health information (Goldenberg, 2021). Thus, misinformation can "be understood to be a "downstream" symptom of poor public relations" (Goldenberg, 2021). Improving trust in and access to physicians and the healthcare system could decrease the amount of misinformation that proliferates. Interactions between primary care providers and patients influence the information that patients seek out and end up believing, thus co-producing that information.

Misinformation strategies are co-produced

The idea that technology and society influence each other simultaneously is the main idea of co-production - technology and society are "co-produced." In the context of vaccine misinformation, vaccine technologies are produced, and then the public interacts with them and

creates misinformation, which necessitates the development of strategies to counter that misinformation, which are an example of technology. Formalizing interactional co-production, as above, is useful in understanding how society interacts with both vaccine technology and misinformation. The better those interactions are understood, the more effective strategies to change those interactions can be - the first step to winning a fight is understanding the opponent.

Improving strategies to combat misinformation and decrease vaccine hesitancy

There are many ways in which strategies to combat misinformation and decrease vaccine hesitancy can be improved. One such way is to reframe the narrative of vaccine hesitancy. Often, those on the right side of the vaccine debate, those who choose to vaccinate, adopt a very "us-versus-them" mentality towards those who choose not to vaccinate that is not conducive to engagement and resolution (Goldenberg, 2021). This mentality is very tempting; after all, why should people feel any differently towards those who seem to be so ignorant? The COVID-19 pandemic especially entrenched this mentality, when so much as seeing someone in a public place during the height of the pandemic not wearing a mask could be frustrating and upsetting. The only way to increase vaccine uptake rates and herd immunity is if everyone works together, and that begins with a more cooperative mindset.

Changing messaging around vaccines is another way to decrease vaccine hesitancy. Often, messaging can be very individualistic, urging people to protect themselves and their family with no mention of the public good that vaccines create. Goldenberg (2021) mentions how "early nineteenth-century advertising for the diphtheria vaccine in America shifted attention to responsible mothering practices for protecting one's own child," which "contrasted with prior messaging about the smallpox vaccine as a community good." Many messaging strategies during the COVID-19 pandemic did emphasize the community good of vaccination, but vaccine uptake

rates still trailed as a result of other misinformation. Improving messaging to emphasize public good is beneficial, but it can only be so effective on its own. It is also important to consider how such messaging will fare in different cultures; in the hyper-individualistic culture of the United States such messages do not have as much of an impact as elsewhere in the world.

Messaging can also be changed to give people more information about why vaccines are important. Maya Goldenberg, a professor of philosophy at the University of Guelph, details how in one instance Colorado parents did not understand why certain vaccines were required by their state, causing mistrust and resentment: "Why, for example, must infants be vaccinated against rubella, which is experienced as a fairly mild disease? Here, the emphasis on public good again offers clarity. Children are vaccinated to protect pregnant women from rubella, because exposure during pregnancy commonly leads to birth defects. A public relations campaign emphasizing this little-known fact may go far to convince otherwise-reluctant parents." (2021). People seek to make informed decisions about vaccines, and providing the most information possible is a good way to inform those decisions. Gretchen LaSalle also describes the technique of so-called "inoculation messages" that inform patients at physician visits about techniques the anti-vaccine movement uses to promote misinformation so they are aware of them before they come across them in the world (2020). Getting ahead of the conversation allows physicians, armed with correct information, to help their patients towards the right thing to do: vaccinate their children.

Increasing trust in physicians and the healthcare system would also be a valuable tool in combating vaccine misinformation; as previously discussed, decreased trust causes patients to turn towards alternative and potentially untrustworthy sources of health information. One way to build trust in the health industry is to increase diversity. Street et al. conclude that the "physician-patient relationship is strengthened when patients see themselves as similar to their

physicians in personal beliefs, values, and communication" (2008). Increasing diversity in the very healthcare industry thus fosters the development of trust between physicians and their patients.

By increasing public trust in science and improving messaging, vaccine hesitancy can be prevented before it happens. However, those that are already vaccine hesitant, or who do not respond to improved messaging, need to be accounted for. Brewer et al. found that the most reliable way to increase vaccination uptake rates are strategies that change people's behavior without attempting to change their opinions or emotions, such as vaccine mandates (2021). Vaccine mandates must be used carefully, however, and with attention paid to the context in which they are used; they should be a last resort when all other options have been exhausted. Maya Goldenberg describes this as a "delicate balancing act between the force of the mandate (which favors minimal exceptions) and the force of the backlash (which can create many unintended harms like galvanizing anti-vaccine politics)." (2021). As before, culture must be taken into account. For example, a vaccine mandate is likely to generate backlash in a conservative population that values decreased government involvement in daily life and so must be used with care in such an area.

Limitations

To further this research, the politicization of vaccines (especially during the COVID-19 pandemic) could be examined to gather additional insight into how people interact with vaccine misinformation and legitimate information that has been politicized in one way or another. A more detailed documentary review of primary sources of vaccine misinformation or conduct interviews to gather more detailed information on how people interact with vaccine

misinformation could also be conducted. Vaccine misinformation is a complex issue that experts from many fields would need to collaborate to solve.

Conclusion

Both COVID-19 and childhood vaccine misinformation sources take advantage of legitimate concerns that the public may have about the safety and efficacy of vaccines. However, sources of childhood vaccine misinformation also prey on parents' concern for the safety of their children, while sources of COVID-19 vaccine misinformation do so less often. By increasing public trust in science and public health, improving messaging around vaccines, and adopting a more cooperative stance while working to decrease vaccine hesitancy, misinformation can be more effectively countered and vaccine hesitancy decreased. Eliminating vaccine misinformation is a difficult task, and the battle can only be won if we all work together.

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