Taking Shots at Shots: How Misinformation on Twitter & Facebook Shapes Risk Perception and Could Lead to the Collapse of the Vaccine Network

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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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Introduction

Prevention of highly infectious diseases has historically been and remains one of the most important challenges facing our global society. For example, tuberculosis has infected an estimated 1.8 billion people, almost a fourth of the world's population (Tuberculosis, 2019, p. 1). Currently, researchers are closing in on a new vaccine to treat pulmonary tuberculosis, which could have revolutionary effects on disease prevalence similar to vaccines for polio and measles (Dressing, 2010, p. 12). The success of this new drug will depend not only on the efficacy of the drug as a means of preventing infection but also upon the navigation of potential social obstacles to adoption and availability. One obstacle that could prove catastrophic is public mistrust of pharmaceutical companies and the health care industry in general and vaccines in particular (McCarthy, 2019, p. 2). The figure below demonstrates how perceptions of the safety, importance, and benefits of vaccines have declined since 2008.

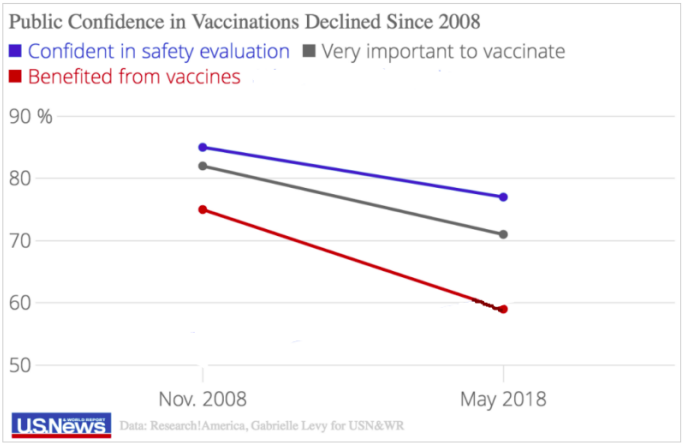

Figure 1 – Survey of Public Confidence in various metrics of vaccines from 2008 to 2018 indicating rising distrust in pharmaceutical insist (Levy, 2019, p. 1)

It is clear that there is a sense of rising distrust of drug and vaccine producers. The reasons for this rising distrust, on the other hand, are not well defined. Heidi J. Larson, a professor of risk and decision science at the London School of Hygiene & Topical Medicine,

explains why this mistrust is important when she predicts that “the next major outbreak —will not be due to a lack of preventive technologies. Instead, emotional contagion, digitally enabled, could erode trust in vaccines so much as to render them moot” (Larson, 2018, p. 8). If the citizens of well developed nations begin refusing vaccination, the effects may resemble those of low income nations, where reduced availability of vaccines means that 5 million children a year fail to reach the age of 5 due to preventable infectious disease such as tuberculosis (Clements, 2007, p. 1). The consequences include the loss of marginal decrease in preventable infections and an increase in infections caused by international travel between nations with tuberculosis prominence and less affected areas of the globe.

In this paper, I argue that misinformation on Twitter and Facebook can cause heightened perception of risk in vaccines and harm the implementation of a new. Identifying the strategies used to manipulate this risk perception and analyzing similar scenarios where misinformation affected an industry or event can guide a resolution strategy before network collapse occurs. This is parallel to my capstone project, which produced a design for a vaccine manufacturing plant, specifically Merck’s blockbuster drug Keytruda. By doing this I hope to understand the entire vaccine sociotechnical system from research & development to manufacturing to implementation.

Part I: Lack of Trust in Vaccine Producers Is Emerging in a World Influenced by Social Media

Since the start of the 21st century, Americans have experienced a significant decline in their public sentiment towards the pharmaceutical industry. They currently rank last in the Gallup poll's rankings of "Americas' Views of Business Sectors." Figure 1 shows that the sector has reached a new net low of -31 beating out industries such as oil & gas, the federal government, and the legal field (McCarthy, 2019, p. 1). This view is clearly not the result of a lack of innovation or technological developments as year after year impressive advancements are made throughout the large industry as new cures and treatments are discovered. In 2019, the FDA approved 48 drugs which are considered novel therapies constituting brand treatments to untreated diseases (FDA, 2019). The reasons why approval of the pharmaceutical industry is so poor when the object of the industry is to prevent and mitigate the effects of the various ailments from which billions of people suffer are complex and less understood.

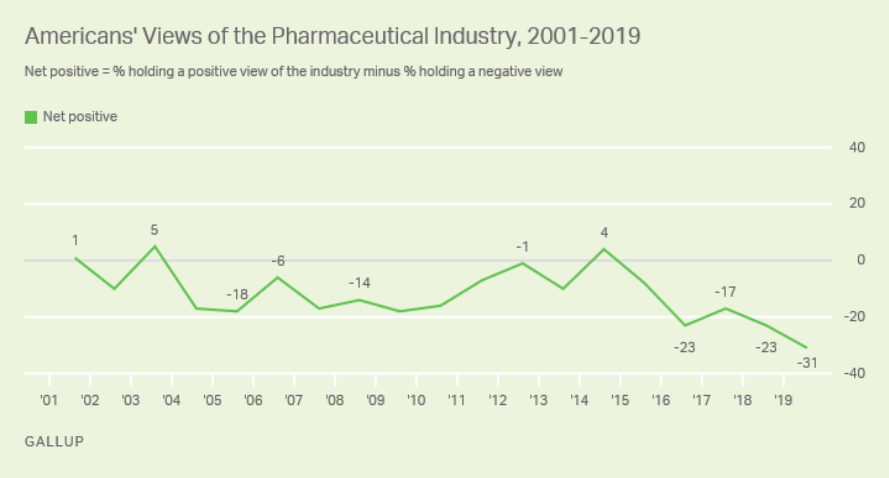

Figure 2 - Disapproval of the Pharmaceutical Industry Mounts Despite the Large Portion of the Population Treated by Novel Therapies Produced Alluding to Outside Factors Influencing Public Opinion. (Gallup, 2019, p. 1)

Vaccines are one form of pharmaceuticals developed first in the 1940's. They have had a diverse history in terms public understanding, regard, and hesitation. In the 1950's, the American public feared for the safety of their children during the summertime when the polio virus was a

serious risk to public health. Even less affluent families sent dimes to the white house in hopes that it would help fund the development for a vaccine to protect their children from the virus.\ (Offit, 2019, p. 3). Once the vaccine was created in 1955, its inventor Jonas Stalk was celebrated as a hero with no hesitancy or sense of riskiness seen in parents. In the 1970's the Diphtheria, Tetanus, and Pertussis (DTP) vaccine became controversial due to claims which alleged 36 children suffered neurological conditions following immunization. In 1998, British doctor Andrew Wakefield recommended further investigation of a possible relationship between bowel disease, autism, and the MMR vaccine (Grignolio, 2018). Despite the debunking of his claims and investigation into his conflict of interests, his work caused fear and caution among many people which lead to multiple measles outbreaks in Western countries where the measles virus was previously considered eliminated by manipulating public opinion on vaccines (Hussain, 2018). This exemplifies the volatility of the public perception and indicates how vaccines are perceived at a given time can affect the success of the vaccines.

Vaccine success in the context of this paper refers to the ability of the vaccine to induce a community immunity which protects the general public health from a disease against which it inoculates. Every new user of a vaccine not only immunizes themselves but eliminates their potential for becoming a disease incubator and distributor. Disease spread is a nonlinear

phenomenon and by keeping the potential hosts small, vaccines prevent outbreaks from taking hold (Rypdal, 2019). Furthermore, community immunity is especially important for people with severe allergies or compromised immune systems who cannot be vaccinated due to their preexisting conditions. The importance of reaching a critical mass of vaccinated population is seen best in the various scenarios depicted in Figure 2 (Helft, 2014, p. 1). It is clear that a completely non-immunized public such as in areas which cannot afford vaccines will be in danger of spreading disease; however, if enough people remain unvaccinated due to an opt-out program voluntarily entered into because of a miscalculation of risk and reward, then contagion cannot be contained (as seen in the second diagram).

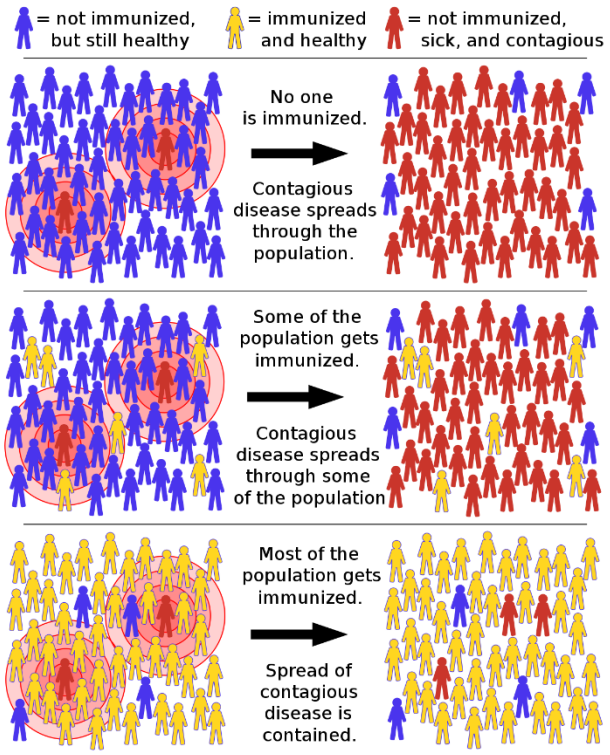

Figure 3 - Community Immunity is State of Vaccine Success when Sufficient Amount of the Population becomes Immune to a Disease Thus Lowering the Probability of those Unable to be Vaccinated to Acceptable Levels ((Helft, 2014, p. 1)

Adoption of a technology is a key factor that persists no matter how efficient, effective, or elegant the design of the technical aspects of the product are. Vaccines are no different, involving a voluntary choice to receive a vaccine or not. This leads to complications much different from those involved in development of the technology itself. The process of decision making and risk assessment among individuals in a population with any technology available to them depends how well informed they are, how well they understand the information presented to them, and their relationship with the information providers. Technology such as nuclear power, hydraulic fracturing, and weight loss pills are all well studied and understood by

academic communities. This understanding fails to extend to the public who either directly choses to utilize the technology or influence the extent to which the technology is used with their vote. Social factors such as affluence, education level, and age affect the decision making of the public significantly, especially in vaccine hesitant areas. In 2014, it was estimated that some very wealthy areas of L.A. had school age vaccination rates as low as South Sudan with between 50-60% of the students not receiving the MRR vaccine (Khazan, 2014, p. 3). The result of hesitation to utilize vaccine technology is evident in the 2014-2015 Disney measles outbreak in Anaheim, California. Approximately 125 cases of measles resulted from an outbreak in the area caused by an estimated 50% MRR vaccination rate (Grignolio, 2018, p. 4). Vaccine hesitancy in America is centered in the west coast but 18 states across the country allow for parents to opt out of school required vaccinations for non-medical reasons such as personal beliefs (Hotez, 2018).

One difference from both previous eras of vaccine prominence and controversy seen in the 20th century is the prominence of social media. The abundance of media choice has resulted in audiences drifting away from mainstream media (Prior, 2007; Stroud, 2011). Research has demonstrated a steady decline of public trust in the institution of news (Gronke & Cook, 2007). Pew Research (2014) finds that half of all users are consuming news on Facebook. This constitutes 30% of US adults. The research also finds 78% report exposure to news on Facebook while using the site for other purposes (Pew Research, 2014, p. 13). The speed and public nature of social media platforms give an avenue which allows misinformation to be spread to large amounts of people at fast rates. This can undermine legitimate sources of news and lead to a blurring of facts when it comes to controversial scientific subjects. As many as half of all new parents with children under the age of 12 have been exposed to misinformation about vaccinations on social media (Broadbent, 2019, p. 1).

The combination of the current vilification of the pharmaceutical industry, the historic controversy associated with vaccines, and the rise of Twitter and Facebook are all critical aspects which influence the perception of risk associated with vaccines. With the nature of vaccine technology, with regard to requirements for effectiveness, this directly impacts the success of vaccine adoption. These aspects create an environment which threatens the success of amazing technological achievements in the form of vaccines for highly infectious diseases such as pulmonary tuberculosis. Analysis of why the public perception of risk towards these vaccines is trending upwards in the face of scientific research supporting their safety and efficacy can determine whether a new vaccine is in serious risk of failing.

Part II: Using Psychometric Paradigm to Describe where Twitter and Facebook can affect Vaccine Sentiment

In his paper, "Beyond Numbers: A Broader Perception on Risk Perception and Risk Communication," Paul Slovic discusses public perception of risk and explains how it can be influenced by various factors that are not quantifiably relevant to actual risk prediction. I apply this framework to the ability of Twitter and Facebook to manipulate these factors and push public perception of risk associated with vaccine technology to the degree where it can affect decision making and cause issues for a future tuberculosis vaccine.

Understanding How Risk Assessment Can Be Limited and Effected

The psychometric paradigm is a way of understanding the physiological approach people take to assessing risk and the factors influencing the perception of risk. Risk assessment or perception by the public is subject to limitations caused by strong emotional responses, memorable events,

strongly held beliefs, naïve or uneducated competency, and focus on individualism (Slovic, 1991). These limitations cause fallacies in our perception of risk as a public. For example, most people would say that risks associated with nuclear reactors or being in the army during the Vietnam war outweighs the risk of smoking. Yet as seen in Figure 3, cigarette smoking in males accounts for the highest loss of life among the listed activities (Slovic, 1991). Exploring the psychometric paradigm constitutes often involves asking people how risky they perceive an action in some quantifiable way. By doing this they can run controlled experiments which isolate experiences or behaviors which modify our sense of risk of an action (Slovic, 1991).

Various Causes

Cause	Days
Cigarette smoking (male)	2,250
Heart disease	2,100
Being 30% overweight	1,300
Being a coal miner	1,100
Cancer	980
Stroke	520
Army in Vietnam	400
Dangerous jobs, accidents	300
Motor vehicle accidents	207
Pneumonia, influenza	141
Accidents in home	95
Suicide	95
Diabetes	95
Being murdered (homicide)	90
Drowning	41
Job with radiation exposure	40
Falls	39
Natural radiation (beir)	8
Medical x-rays	6
Coffee	6
All catastrophes combined	3.5
Reactor accidents (UCS)	2*
Radiation from nuclear industry	0.02*

Figure 4 – Table of Risk Associated with Actions Quantified by Days Taken Off of Life as a Result of Action. Illustrates the Misperception of Risk Associated with Actions Based on Characteristics of the Action. (Slovic, 1991, p. 5)

In his discussion about how the public has limitations to their risk assessment, Slovic explains that risks from dramatic causes tend to become overestimated. He asserts that new media tends to follow the same trend in terms of coverage and therefore compounds the issue. It follows that the since news media tends to aim for emotional response in viewers, topics which are most vulnerable to false risk perception tend to get presented in a way that evokes emotions such as fear. Studies by Slovic and collaborators claim that this evaluation or risk can also be tied to the general attitude towards the action, such as enjoyment achieved from partaking, and

perceived benefit (not necessarily actual benefit) associated with the action. This further indicates that actions which are undesirable or manifest no explicit visual benefit can be perceived as higher risk than their counterparts. Although Slovic mentions that these findings might require "educational programs or warnings," he asserts that "merely mentioning the possibility of adverse consequences of some product or activity can enhance their perceived likelihood and make them more frightening" (Slovic, 1991, p. 3).

Explaining How Twitter and Facebook Capitalize on Slovic's Insights About Risk Perception

In "Beyond Numbers: A Broader Perspective on Risk Perception and Risk Communication," Slovic claims that "naïve views are easily manipulated by present format." This applies to vaccine risk because the large majority of the public does not have a background in immunology or pharmaceuticals production. (Slovic, 1991, p. 4) These tactics are as simple as framing information in a particular view. Slovic cites a study that showed a significant change in responses to which hypothetical lung cancer treatment participants would choose radiation or surgery, depending on weather they were give death or survival rates. In addition to framing the information in a manner that causes an emotional response, misinformation effective at altering risk perception uses technical language that can intimidate and convince the lay person who lacks advanced knowledge of statistics and who lacks the proper education to evaluate the information with the required level of scrutiny (Smith, 2017). Because of this lack of concrete understanding of the complex science, the public is vulnerable to the common misleading facts, objections and references that vaccine rejecters use (Smith, 2017). Very active antivaxxer groups use Twitter and Facebook to reach this naïve public. They play on the publics propensity to accept certain kinds of formats that appeal towards the emotions.

Additionally, Twitter and Facebook groups play on the invincibility type biases found naturally in affluent nations to influence the risk perception relative balance between diseases and vaccines which prevent them. Results from a study on perception of risk of diseases and vaccinations based on segmented groups show that non-immunizers dreaded unknown, long-term side effects of vaccines. “Participants believed that the risks of diseases and complications from diseases are not equally spread throughout the community; therefore, when listening to reports of epidemics, it is not the number of people who are affected but the familiarity or unfamiliarity of the disease and the characteristics of those who have had the disease that prompts them to take preventive action” (Bond, 2011, p. 7). In the developed world, the lack of encounters one typically has with diseases such as measles, mumps, rubella, and tuberculosis is severely limited, lessening the perception of risk of these diseases. This leads to vaccine hesitancy when risk perception increases due to exposure to claims of adverse side effects supported by anecdotal or unsubstantiated evidence.

The distrust in the pharmaceuticals industry plays a key role in allowing Twitter and Facebook to have an effect on risk perception. By applying the psychometric paradigm of expressed preference, it is clear that the dissatisfaction with the manner in which both companies operate and regulatory agencies allow the field to be run has a carry-over effect. Since a gap between the desired normative mode in which the industry should operate and its unacceptable descriptive mode with respect to consumer costs or cooperate greed exists, the risk associated with the industries endeavors is also perceived as unacceptably high (McCarthy, 2019). Furthermore, expressed preference harms risk assessment because the nature of receiving a vaccine is not enjoyable nor is its benefit seen explicitly since tuberculosis is not a major issue in

developed countries. This concept makes the public more likely to accept information which questions the safety of vaccines when they are inevitably exposed to it on Twitter and Facebook.

As the digital age continues to engulf the global population, the growing volume of people, with all kinds of motivations and who have a platform to reach large amounts of people, causes a near certainty of being exposed to misinformation. Platforms like Twitter and Facebook serve as unregulated methods which allows 2.45 billion people to broadcast whatever they want. The article “How Misinformation Spreads on Social Media-and What To Do About It” explains that, unlike traditional news outlets, social media are SOCIAL. What this means is that users not only act as consumers of information as they do whewatching TV or reading the news, but also act as distributors (Meserole, 2018). There will always be one channel playing FOX news or MSMBC but number of social media posters about a topic can multiply quickly thus amplifying information. Antivaxxers can use this as a weapon with posts that exploit expressed preference against parasite empires or lack of public understanding regarding statistical misrepresentation. As mentioned, these can be effective at influencing the risk perception of the public.

Part III: Evidence That Twitter and Facebook Can Be the Main Drivers Causing Institutional Disarray via Manipulated Risk Perceptions

As previously discussed, Twitter and Facebook have become a large source of information and news that members of the public are exposed to on a daily basis. The influence that platforms like Facebook, Twitter, and Instagram have gained has reached the point where their effects on public perception of risk alone can be disruptive to established institutions or well-understood scientific fields. The current gap in understanding is that antivaxxers are seen as a marginal group with a small online presence which pose no serious threat to vaccines. By analyzing case

studies where misinformation has had a considerable effect on public perception other technology then relating to vaccines, I will argue that the threat of antivaxxers on Twitter and Facebook to risk perception of public is clear and present.

Food Technology Controversy Persists Due to Unwarranted Risk Assessment of GMOs

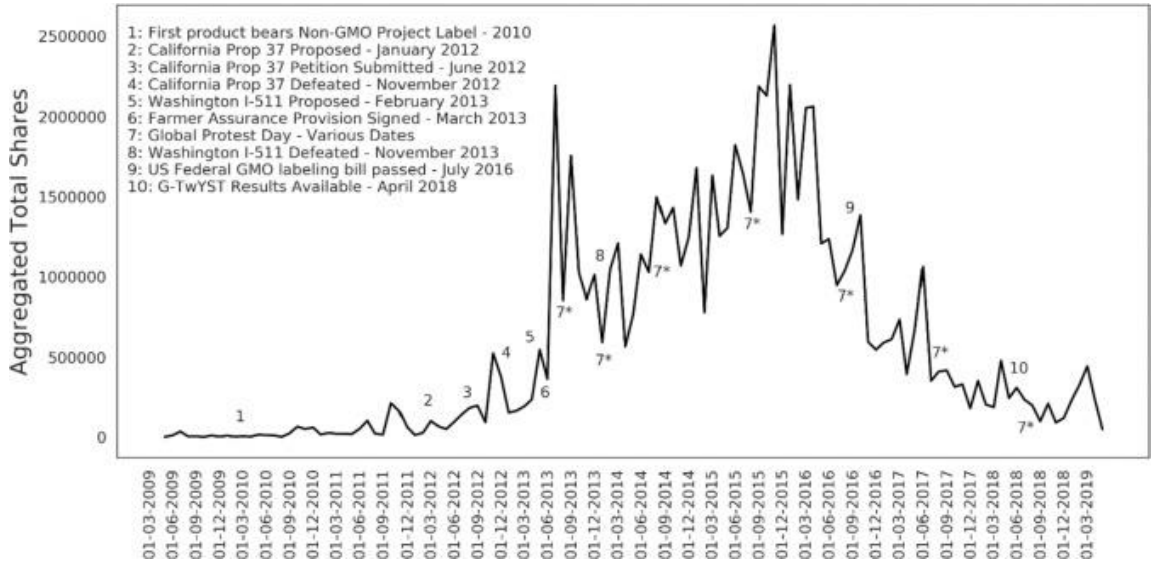

Figure 5 – Time line of social media shares of articles about GMOs originating from sites which traditionally speak misinformation and compacity theories (Ryan, 2020, p. 4)

Many similarities, in terms of methods used, exist between groups which advocate against GMOs and those which advocate against vaccines. By utilizing misinformation on Twitter and Facebook that targets the public in areas susceptible to risk assessment fallacies, these groups once again cause social and political controversy to continue to surround the GMO narrative despite the scientific consensus of the safety and benefits of this technology. A case study by Camille Ryan of Bayer Crop Science, "Monetizing disinformation in the attention economy: The case of genetically modified organisms (GMOs)," analyzed 94,993 unique online articles about GMOs and found that a small group of alternative health and pro-conspiracy sites received more total engagement on social media than traditional media outlet sites (Ryan, 2020, p. 6). The

results of the study show that much of the most visible or impactful online coverage of GMOs originates from alternative health and pro-conspiracy sites that typically frame their coverage in the most attention-grabbing fashion. In figure 5, it can be seen that a rise in sharing of anti GMO articles happened in 2015, a period of political controversy surrounding GMOs. This figure speaks to the tremendous amplifying ability of social media, which gives misinformation a place to spread (as traditional news outlets are much more scrutinous) (Ryan, 2020, p. 4). The specific disrupting consequences of these anti-GMO movements can be seen in excessive additional safety requirements, costing the government 15 million dollars in studies and subjecting companies to unnecessary regulations. One example is a mandatory 90-day rodent feeding study for each new GMO product which increases costs to producers of GMOs and inhibit innovations and market entry.

A second study, “Framing and Agenda-Setting Effects of the Mass Media on the Farm-Level Impacts of GMO Crops,”,exemplifies perfectly the framing effect identified by Slovic. The study analyzed more than 300 articles published by the *New York Times* and the *Washington Post* between 2000 and 2018. The analysis revealed a huge disconnect between the tone and complexity of social media and the consensus among scientific media and experts. The author of the study, Eleni Galata Bickell, explains how lack of technical competency builds upon this targeted framing stating, “Most of us have no direct exposure to how food with new technology is produced. Therefore, we rely on the information sources of the media to understand our food better”(Bickell, 2019, p. 5). This information combined with a third study titled “Risk Perception and Attitudes Predict Brain Response to Food Technology Infographics” used magnetic resonance imaging to provide evidence that the prefrontal cortex, the part of the brain responsible for one’s emotions and risk perception, is stimulated when people are exposed to

misinformation both framed in effective manors and which is technically complicated (Davis, 2018, p. 91). This final study is centered around how to counteract heightened risk perception and effectively communicate risk but it provides evidence that these marginalized groups, regardless of which scientific topic against which they advocate, can gain influence over the public risk perception.

I believe that in relating case studies regarding everything from GMOs to vaccines, insight can be gleaned regarding the legitimacy of the threats of antivaxxers on Twitter and Facebook as well as the potential impacts. In each case, the technology in question provides a clear benefit to human society yet faces growing resistance due to heightened risk perception caused by misinformation. A potential resolution to these issues that might prevent vaccines from succumbing to similar public scrutiny as GMOs have would be to improve risk communication by utilizing a well-established relationship of trust and to mend areas where trust is fractured to prevent collapse of the global vaccine network. This would entail the use of primary care physicians to communicate risk of avoiding vaccinations. “Preserving relationships with antivaccine parents” takes a physiological approach to the problem suggesting that trusted family doctors who have personal relationships with patients can utilize influence and ability to capture attention to explain complex effects on community immunity in schools, offices, and other public places when vaccines are opted out of (Fortune, 2007). Furthermore, increased marketing spending to improve the public image of pharmaceutical companies may improve the resistance their products have to misinformation by reducing negative expressed preference among the public.

Misinformation Harms the Environmental Movement via Perceived Risk of Climate Change

One segment of the claim which must be established is that misinformation that is spread via Twitter and Facebook can have potent enough effects in the minds of the public to persuade them against an established technology with scientifically proven efficacy and safety. Case studies which examine the effects of climate change deniers, or those who believe that human action has little to no effect on well-document environmental changes, exemplify exactly how dangerous these confounding and misleading figures, statics, and anecdotes can be. Techniques utilized by these individuals include presentations by fake experts using logical fallacies or cherry picking select data to obtain intentionally misleading conclusions which appeal towards the technically confusing or emotionally powerful areas that Slovic identifies as risk limitation areas (Crook, 2019). The effect of this is that only 12% of the American public is aware that a more than 90% scientific consensus rejects deniers of climate change trends, human contributions to global warming, and serious level of impact that exists (Crook, 2019, p. 6).

Once there is an established confusion caused by misinformation, conflict arises on a topic which is scientifically cut and dry. Case studies which examine the public's perception of the climate's effect on policy show why there still remains a significant gap between recommendations and the actions of the public and policy makers. A case study by Davis & Wurth at Stanford University in 2003 found that environmental attitudes have been important drivers in many election outcomes (Davis, 2003). Expanding upon this, studies by Lazarus in 2008 show that environmental spending preferences were important in every presidential election between 1984 and 2000. These studies involved investigating post-election voter choice and segmented data by 10 individual environmental items. Each side of each individual item

showed a positive associated trend in logarithmic regression towards either one candidate or another (Lazarus, 2008). Another study by Agnon which investigated dynamic behavior of elected officials towards environmental spending was positively correlated with the results of index surveys of public environmental attitude (Lazarus, 2008). This means that spending increased when public perception of risk associated with climate change was high. This clearly shows the significance of public opinion on environmental policy and by extension, the indirect effect that misinformation can have on policy though manipulation of public risk perception. The same pathway exists with vaccine policy. Vaccines, being a part of an already scrutinized pharmaceutical industry, are even more susceptible to institutional collapse as individuals can begin to diminish the effectiveness in terms of community immunity before policy changes even occur.

Why Misinformation on Twitter and Facebook Can Cause Major Issues for the Vaccine Network

The cases above present examples which provided evidence that Twitter and Facebook misinformation spread about similar fields could have similar effect on risk perception of the public towards vaccine. However, this does not automatically constitute a problem were it not for the flawed mental model held by most individuals surrounding the purpose of vaccine technology.

Figure 6 – Example of an emotion targeting post which perpetuities an individually focused mental model of vaccines(Goodchild van Hilten, 2016, p. 1)

The example of antivaxxer social media post seen in figure 6 exemplifies one of the ways risk assessment is influenced, emotional targeting. This was attached to an article which fear mongered the risks of the preservatives in vaccines causing autism and warned the reader to keep their children away. Right there is the fallacy in mental modeling being exposed. When the antivaxxers keep the conversation on the consequences to the individual they exacerbate the mental model of vaccines being an individual's decision to take on the risk of either forgoing their own immunity (or their children's) versus the scary side effects which have no scientific base.

According to the article "Community Immunity" on the NIH website, "Epidemiologists think of infections as chain reactions, whose speed depends on contagiousness…The more contagious the disease, the more vaccination is required. The data tells us that herd immunity works" (NIH, 2011, p. 1). By considering the idea of highly infectious diseases, one can start to understand that

vaccines are not something “you” get it’s something “we” get as a community. In speaking with a health professional from the WHO, he mentioned that vaccines must be thought of as roman defense formation. Nearly everyone who can must hold a shield to protect the group, especially those who cannot, such as the archers (in this scenario they could be the old, young, or immunodeficient). The vaccine network relies on this kind of mental modeling, and the public understanding that herd immunity is the only way to make vaccines truly successful in disease eradication. The evidence I have shown throughout the paper suggests that Twitter and Facebook posts have the power to obscure this reality and the danger presented by thinking of vaccination is an individual choice rather than a network of protection.

Conclusion

Throughout this paper, I establish how misinformation on Twitter and Facebook can alter the risk perception of the public on scientifically proven safe technology, including vaccines. By identifying similar tactics used by these advocacy groups which leverage Slovic’s limits to public risk assessment, I am able to relate consequences incurred in similarly-viewed technological fields to potential vaccine disruption. I argue that misinformation on Twitter and Facebook should be considered a serious threat to the global vaccine network since it has had a marked effect on these other fields including climate change, political elections, and food technology. Not only does the large volume misinformation have outstanding reach with 1 out of 10 parents with young children exposed to this misinformation, but it also confuses and elicits a non-voluntary emotional response which in turn creates an unwarranted increase in risk perception.

Furthermore, because currently mental models of vaccines are individualistic, vaccine networks may suffer more serious consequences than these other fields. The inability of the public to view vaccines as a group effort to fight highly infamous disease but instead focus on unsubstantiated side effects to themselves could provide the chinks in the armor which may eventually cause a significant pandemic.

The misinformation on Twitter and Facebook is a serious disrupter to vaccine success in a few key areas. Heightened risk assessment leads to a decrease in voluntary vaccination in developed countries if there little to no perceived benefit. This is caused by the observational logical fallacy of believing that diseases which are uncommon in developed countries are not a threat. This leads to outbreaks such as the 115 cases of measles reported in the Disney outbreak in Anaheim, California. Secondly, aversion to vaccinations in developed countries can lead to a shortage of availability of vaccines in low income nations due to the funding mechanism being tied to public spending and, by extension, public sentiment. In a world where social media drives public risk perception, a loss of favor for vaccine funding could mean that public officials feel making multiyear commitments to A.M.C. and Gavi, organizations which provide vaccines for 49.2% of children globally. Because of these potential consequences, I conclude that increased risk perception of vaccines caused by Twitter and Facebook can absolutely prevent successful implementation of new, unestablished vaccines if this trend continues to gain traction.

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