

**An Actor Network Theory Analysis of Social Media's Role in the Reduction of HPV
Vaccinations**

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By

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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

Vaccines are important for personal and public health and are often referred to as one of the greatest achievements in modern medicine due to its ability to reduce illnesses and deaths from preventable diseases (Hoffman et al., 2019). Receiving a vaccine will help the recipient become immune to whatever pathogen the vaccine protects against. However not everyone is eligible to take every vaccine due to age, preexisting conditions, or other reasons but these people can still be protected from pathogens through herd immunity. Herd immunity is when enough people in a population are immune to a pathogen so there are not sufficient hosts to propagate the disease (Aschwanden, 2020). To ensure there are not enough hosts to propagate a disease, there is a rough percentage of the population that needs to be immune. For example, measles is extremely infectious and would need a herd-immunity threshold of 92-94% for the disease to stop spreading. While these immunity thresholds can possibly be reached using vaccines, measles can persist within the population with an outbreak even happening in 2019 even after it was declared eliminated in 2000 (APIC, 2020). While vaccines are vital for human health, vaccine rates for preventable diseases like human papillomavirus (HPV), which has been linked to cancers, are falling. In western countries, anti-vaccination movements have been increasing in prominence due to anti-vaxxers using methods such as social media to spread propaganda (Hussain et al., 2018). Current studies on the overlap of social media and the anti-vaccination movement focus on how the internet is being used as a new source of medical information for individuals but it is being targeted by anti-vaxxers to flood patients with conflicting information to doctor's recommendations (Forkner-Dunn, 2003). Current studies also find that social media algorithms promote controversial issues which raises awareness for the anti-vaccination movement (Stahl et al., 2016). However, while studies are focused on how people can find anti-vaccination content on social media, current research tends to miss the

importance of the connections between doctors, patients, and social media. Current studies are limited because while patients do have access and use social media for medical information, the studies often lack analysis of the new relationship between patients and physician which needs to be understood in a context of social media providing misinformation. By understanding a new connection between doctors and patients, the way that social media is currently disrupting vaccination efforts can be better understood.

In this paper I will argue that social media is destabilizing the vaccination network because patients are increasingly relying on information from social media instead of doctors and social media's interconnectivity increases access to misinformation from previously fringe groups, like anti-vaxxers, whose connections have strengthened using social media. Through the case study of a pro-HPV vaccination video posted on Facebook which was flooded by antivaccination comments, I will use Actor Network Theory (ANT) to illustrate that out of the actors of vaccines, doctors, patients, anti-vaxxers, and social media that it is social media that primarily destabilizes the network of vaccination and is causing vaccination rates to decrease. I will initially layout how the network is organized for vaccinations using ANT. Using the network I describe, I will use the case of a pro-vaccination video about HPV on Facebook to firstly show how social media is overpowering doctors as the primary way for patients to get information and recommendations for vaccines. I will then illustrate how social media has strengthened connections between fringe groups like anti-vaxxers which increases their prominence on social media further supporting that destabilization of vaccination that is caused by social media.

Literature Review

Many other scholars have discussed how patient care is changing due to the rise of the internet and how social media has affected vaccinations rates. It is important to note that almost

all articles found in academic journals have the view that vaccinations are important to society and therefore argue that anti-vaccination due to patient directed care is detrimental. A paper by Forkner-Dunn highlights how even in “2002, an estimated 100 million Americans will have obtained information, including health information, from the web as a basis for making decisions” (Forkner-Dunn, 2003). Forkner-Dunn states that the internet can be a revolutionary tool for improving patient care and improving health outcomes but indicates that because patients are being empowered, it is causing a shift in the patient physician relationship (Forkner-Dunn, 2003). The paper also mentions that doctors are forced to answer for misinformation found by patients on the internet but lacks the analysis of why misinformation is widely available to patients. Forkner-Dunn also indicates that the internet does cause some sort of change in how patients look for medical information, but they fail to analyze the cause of why patients are looking away from their doctors for information and move towards the internet.

Moving away from how the internet affects patient care, a paper by Azhar Hussain looks specifically at how the anti-vaccination movement has grown and changed throughout history and its continuation onto the internet (Hussain et al., 2018). Hussain studies the extent to which anti-vaccination compared to pro-vaccination sentiments are shown on social media and attempts to assess the social implications of the disparity on declining vaccinations for children. He finds parents, even those originally favorable to vaccines, question their choices after finding misinformation online (Hussain et al., 2018). While Hussain’s analysis does indicate the need for improving the connection between patient and physician, his analysis lacks understanding to why patients are finding more information from social media than their doctors in the first place.

Stahl’s paper on the impact of social networks on vaccination is the most closely related to the subject of my claim. Stahl illuminates the significant role of social networks in growing

the trend of vaccine hesitancy. Stahl point to the role of algorithms fueling controversial issues such as vaccinations due to the increase in traffic for websites as a major driver for the rise in interaction with anti-vaccination ideas (Stahl et al., 2016). Stahl continues by describing information on social media as having origins from anywhere and the ability to be posted and interacted with in real time allowing patients to have a stronger connection with the online content (Stahl et al., 2016). Stahl lacks analysis of how misinformation is growing as a source on social media, but I will use his work as a starting point for this paper. Building off these sources and others I will illustrate why in the network of vaccination, social media's connection with doctors, patients, and anti-vaxxers is destabilizing the network as well as provide more analysis on the impact of fringe groups like anti-vaxxers having more power on social media causes further destabilization of the network.

Conceptual Framework

Actor Network Theory is a Science, Technology, and Society framework used to describe how a system functions through looking at the connections between the network's actors. In this paper my analysis of a network will be focused on vaccinations which allows me to analyze how different actors interact in relation to each other. ANT is associated with writers such as Michel Callon, Bruno Latour, and John Law and is often used to study "science and technology in the making" instead of finished products (Latour 1987). ANT studies sociotechnical networks by uniquely considering actors, both human and non-human, equally within the network and has their position defined by their relation to other actors. Callon explains the process of creating an actor network through a process called translation which is composed of the following steps: Problemitization, Interessement, Enrolment, and Mobilisation (Callon, 1984). Problemitization is where a network builder identifies a goal that the actors need to solve and interessement is when

that network builder recruits actors to join the network (Callon, 1984). Enrolment is how the network builder assigns roles within the network and mobilisation is when the network builder defines themselves as the coordinator for the network and helps to define its function (Callon, 1984). Relations between heterogeneous actors are the defining aspect of ANT with power within the network being focused on the strength of connection between two actors rather than the power of a single actor (Cressman, 2009). An actor can use these connections to stabilize the network and help it succeed or be a rogue actor which causes destabilization within the network. I will use ANT to illustrate that within the sociotechnical network of vaccination, social media has become a rogue actor which is destabilizing the network. I will further use ANT to discuss the strength of connections between doctors, patients, social media, and anti-vaxxers within the vaccination network and how that also contributes to the continuing failure of the network.

Analysis

Vaccinations have been administered since the late 18th century to prevent diseases in the human population. Social media's growth in the health space has reduced the influence of doctors on patients and increased visibility of anti-vaxxers causing a decrease in overall vaccination rates. The case study I will focus on is a pediatric video on Facebook from Kids Plus Pediatrics of Pittsburg called "We Prevent Cancer" made in 2017 that talked about the benefits of an HPV vaccine. I will use this video as a study to apply ANT and highlight how social media is destabilizing the vaccination network by increasing its strength of connection to patients. The increasing connections by social media is causing the connections between doctors and patients to be weaker in comparison leading to diminishing vaccination rate and therefore network failure.

First, I will describe how the vaccination network is laid out for the purpose of this paper. The actors involved in HPV vaccination network are HPV vaccines, patients receiving the vaccines, doctors administering the vaccines, social media, and anti-vaxxers. Following translation of the vaccination network as described by Callon, during problematization, the network builder are the doctors who have identified the goal of getting patients vaccinated for HPV using a vaccine. During the next steps of interessement and enrolment in a stable network, doctors would have recruited HPV vaccines as a non-human actor with the purpose of providing the immunity to the diseases that the patient may encounter. Patients are recruited with the purpose of receiving those vaccines as an end user from their doctor and their successful vaccination would signal the stable network. Social media would also be recruited as a tool for doctors to spread information about vaccines that can be seen by patients without direct contact with their doctor. In this stable network vaccines are only associated to doctors as they are the only distributor of vaccines to patients. Doctors, patients, and social media are all independently associated with each other. Doctors place themselves as the director of the vaccination network to complete the mobilisation step of translation. However, the current network has been destabilized because social media overtime has become a rogue actor that is working against the goal of the network due to the influence of an actor defined as anti-vaxxers. The resulting network is changed from the stable network by having anti-vaxxers connected to social media independently of doctors causing the network to be destabilized due to the resulting changes of actors' association with social media.

Social Media's Connections are Strengthened

Regarding the case study of the Kids Plus Pediatric video "We Prevent Cancer", I argue that the network described above using ANT has connections between social media and patients

that are too strong compared to doctors and patients which is destabilizing the HPV vaccination network. A stable network is a network where there is an increasing vaccination rates for patients. The pediatric video was posted on the social media platform Facebook which was founded in 2004. After only ten years since Facebook's founding, there are an average of 48,000 public posts related to vaccination made each month on social media and google searches relating to vaccines have been increasing over time with a trend search between 2012-2014 indicating that around 400,000 searches are made each month (Stahl et al., 2016). Social media posts related to vaccines are continually increasing and will lead to the greater likelihood that patients will be exposed to the content of vaccine related posts and information on social media. Previously, only doctors had information regarding vaccines and patients were forced to them, but that is no longer the case. The growth of social media in relation to vaccine information shows that at the very least patients' connections to social media is growing within the network.

On the video "We Prevent Cancer", in less than eight days there were 10,000 negative comments from 800 people posted (Hoffman et al., 2019). Due to the nature of social media, any person can create a comment at any time on the post with no education or background knowledge of vaccines or their efficacy. The speed at which so many comments can be made highlights the fact that social media is increasing its visibility to users as a potential outlet to spread thoughts on vaccinations. Additionally, the large number of anti-vaccine comments being specifically made on a video that was pro-vaccination increases the likelihood that those coming to a pediatrician for advice or information on an HPV vaccine will encounter contradicting information which causes doubt in patients. This case continually supports the idea that not only is social media a platform that patients are increasingly able to interact with for vaccination

information and specifically anti-vaxxer ideas, but it also shows that doctors are losing visibility to those that are able to overwhelm the original doctors' outlets for information online.

Doctors' connections to patients potentially unrelated to social media have also been weakening over time. A study that tracked the rate that women got their daughters vaccinated for HPV after a doctor recommendation fell from 48% in 2010 to only 30% in 2014 (Stahl et al., 2016). This evidence points to the fact that as online searches for vaccine information increased between 2012 and 2014, the likelihood of a patient following a doctor's recommendation to get vaccinated for HPV has decreased at the same time which indicates that social media's involvement in vaccine information is relevant to HPV vaccination rates decreasing. Although doctors used to hold all medical information, new access to knowledge has caused people to move away from only doctors' recommendations for health-related issues. This analysis highlights how social media's rise in vaccination content has strengthened its connection to patients while diminishing doctor's connection to patients which is ultimately lowering vaccination rates and destabilizing the vaccination network.

I have argued that the growth in power of social media's connections to patients is a negative because it has harmed patient's health outcomes in terms of decreasing vaccination rates. While the argument does suggest that social media is purely harmful, some scholars contend that social media is beneficial in a medical context because it increases health communication because patients can connect by "sharing medical histories, treatment successes and failures, or experienced side-effects" (Kata, 2012). However, this argument fails to consider that just because beneficial forms of connections are possible, negative aspects can also exist and outweigh benefits. For example, social groups can cause homogenous opinions due to individuals wanting to be accepted within a group. A study conducted in Australia showed that in

a group where anti-vaxxers were prominent, new families tended to consider not vaccinating even if their original opinions differed because they may be considered outcasts in their social group (Attwell et al., 2018). It is important to understand the harms of social media's influence on patients as they find groups online that may risk further detriment to patients if they solely look online for information and do not follow doctors' recommendations.

Social Media Connects Anti-Vaxxers

Social media is primarily a tool for people to connect with others they know or that share similar interests to them. Through social media, groups with fringe ideas such as anti-vaxxers have been able to communicate and create communities that were rarer before social media (Hussain et al., 2018). Continuing to look at the case study of the pro-HPV vaccine video "We Prevent Cancer" posted by a pediatrician located in Pittsburg Pennsylvania, commenters that left negative comments were tracked to at least 36 other states and at least eight other countries (Sun, 2019). Only five commenters were in the same state as the pediatrician (Hoffman et al., 2019). People that have no physical connection to this specific pediatrician can find and post their opinions on this video. Social media has the ability to connect physically distanced people together and compound their views and voices to increase their presence to others. Anti-vaxxers connection to each other is being strengthened by social media to a point where they can now affect mainstream sources of information.

On the pro-vaccination video, negative comments related to vaccines causing autoimmune diseases or containing toxic chemicals were commonly being posted (Hoffman et al., 2019). These potentially harmful and otherwise scary notions based on the content of the comments for people who find this video would likely be enough to raise doubt in an average citizen about the safety and efficacy of vaccines. The fact that many commenters are posting

similar themed content would indicate that there are multiple anecdotal reasons to cause worry about their family's health even if they originally believed in the health benefits of vaccines (Kata, 2012). The ability for anti-vaxxer comments on a single video being able to potentially influence patients points to social media's strong connection as a mediator from anti-vaxxers to patients. Additionally, the fact that this can occur on a video that had the sole purpose of originally promoting that people should take an HPV vaccine further cements the influence of social media as a way to both connect antivaxxers but also destabilize the vaccination network. Social media's strong connection to patients and fringe anti-vaxxers together creates a path for vaccine misinformation that doctors cannot currently prevent or handle.

Conclusion

I have used ANT to determine the cause of the destabilization of the vaccination network which led to a decrease in vaccination rates. Used the Facebook video "We Prevent Cancer" by Kids Plus Pediatrics as a case study, I have identified social media as a rogue actor in the network that is causing the destabilization. Social media is becoming more influential in health decisions compared to doctors which is a reason for destabilization. Furthermore, social media's content being flooded by anti-vaxxer communities who can collaborate on social media also contributes to the failure of the network because of misinformation being presented to patients. My analysis will allow readers to better understand how social media is directly competing with doctors for influence over patients' medical decisions. While social media as a source of knowledge will continue to exist, this analysis will allow doctors and others to combat the current negative effects that social media is having on patients by potentially becoming more involved on social platforms. It is therefore possible to move back towards a more stable network

where patients are more accepting of doctors' recommendations and will ultimately increase vaccination rates.

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