

## **Sentiment Analysis of Tweets on Vaccination Vaxxers or Anti-vaxxers - Who is Creating More Noise on Twitter?**

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### **Abstract**

Covid-19 has changed our world like never before. Covid-19 was first declared a global pandemic in March 2020 by The World Health Organization (WHO) (Cucinotta & Vanelli, 2020). Since then, we all have witnessed a different life, a life full of uncertainty and no philosophy or history books to help us sail through. The time spent online increased exponentially, and like-minded people started generating, watching, and sharing information/misinformation. The conspiracy theory crept in; regarding the origin, vaccination, and treatment of the virus and has led to the creation of vaxxers (believers in vaccination) and anti-vaxxers (non-believers in vaccination). This research paper attempts to analyze the social buzz and sentiments of the tweets on vaccination. The analysis of the 15622 tweets has been done with the help of Nvivo-12, by interpreting the word cloud and performing sentiment analysis. This would help the policymakers understand what is being discussed online, since that is where people talk and curb the side effects.

### **Keywords**

Covid-19, Covid Vaccine, Vaccination, Anti-vaxxers, and Pandemic.

### **1. Introduction and Literature Review**

Covid-19 pandemic that started in early 2020, has changed the outlook of many. Physical interactions that have been the norm since the birth of civilization, but the pandemic changed that Covid protocol required people not to interact socially (physically) and so the only way was to stay connected socially and that is what people did-social media usage increased by 61 percent (globally) during the first wave of the pandemic (Fullerton, 2021). During the early days of the pandemic,

social media apps were used as crutches to navigate through the uncertain time, sharing the pics of zoom family/friends meetings, home-cooked food videos, etc gave the feeling that everyone was together in it. The natural extensive use of social media to gather information about the virus, its origin, and vaccination, proved to be a double-edged sword. It led to the grouping of people into two different categories-vaxxers, those who believe that vaccinations can help eradicate or control disease, and anti-vaxxers are the people who are against the administration of vaccinations (Khandola, 2020).

The pandemic has been discerning for the virtual citizens and the government alike. The Indian government has started talking tough with the social media giants on curbing fake news in India, stressing that if the content is taken down, it becomes the act of taking away the freedom of speech (Reuters, 2022). It is time to take cognizance of the fact that the pandemic fuelled the association of like-minded people who got together and started discussing what they felt was the flip side of vaccination, creating a tribe called anti-vaxxers, sometimes also referred to as vaccine-deniers (Benoit & Mauldin, 2021; Ullah et al., 2021).

In the study, “Prevalence of Health Misinformation on Social Media: Systematic Review” the study of 69 related studies found out that across the six identified categories of health information, Vaccines were the top of the pack, followed by drugs and smoking which was the highest on twitter (Suarez-Lledo & Alvarez-Galvez, 2021). Another study, “Systematic Literature Review on the Spread of Health-related Misinformation on Social Media” confirms the high prevalence and popularity of health misinformation on social media, especially vaccines with the help of content analysis and social network analysis (Wang et al., 2019).

The classic example of vaccination confusion and discussion has been the Australian Open Tennis Tournament 2022 and Novak Djokovic, who was deported for the vaccine fiasco. He did not share his vaccination status but shared that he tested positive on Dec 16, 2021, the next day of which he was seen unmasked presenting awards to young kids and traveling to Spain for training while infected. And now as on Feb 2, 2022, the reports that he might be deciding to get vaccinated are doing rounds (Biswas, 2022).

The studies have been enumerating the various conspiracy theories and the reasons for the same (Douglas, 2021; Podgorica, 2021; van Prooijen & Douglas, 2017) have been explained by various extensive studies prior to Covid-19 and also post the beginning of the pandemic. The most suitable explanation for the development of the anti-vaxxers is that the reliance on conspiracy gives solace to human beings when they encounter extreme situations. Covid-19 has been one of the sharpest attacks on civilization (Douglas, 2021).

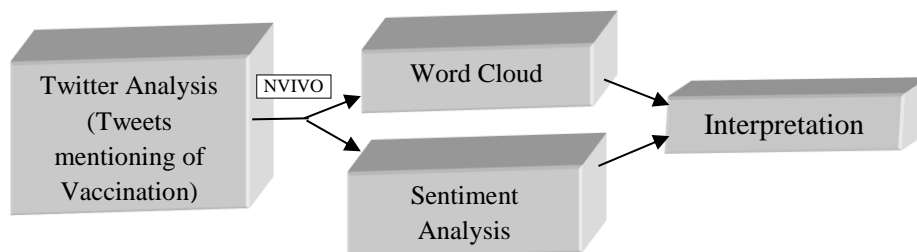
## **2. Research Methodology**

Twitter Analysis by using NVivo 12 was done to understand the discussions around Vaccinations. Qualitative analysis is practical and used extensively through specialized softwares like NVivo (Shahzad, 2020), Computer-Assisted Qualitative Data Analysis Software (CAQDAS), and similar ones. The data-rich lives result from the virtual world interactions the netizens are so used to now. The pandemic has increased the volume of these interactions beyond anyone's imagination. The reason for this explosion of the expressions on social media during the pandemic is the confinement to home during the pandemic, the social or physical distancing and the queer nature of the virus, Covid-19, the less researched (but life-saving) vaccines, etc. The tweets with the word "Vaccination" (Jan, 2022) were captured through NCapture and exported to NVivo 12, to analyze the buzz and discussions around the topic. In total, 15622 tweets were captured discussing the topic of vaccinations. An effort was made to remove the objectionable (abusive) words, only English tweets were captured, and any declared promotional posts were also not considered.

**RQ1:** What are people discussing around the word "Vaccination" during the pandemic?

**RQ2:** Can we analyze the sentiments around the topic of Vaccination? The following figure explains the data methodology adopted in this research paper using NVivo.

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**Figure 1: Data Methodology Adopted**

### 3. Data Analysis

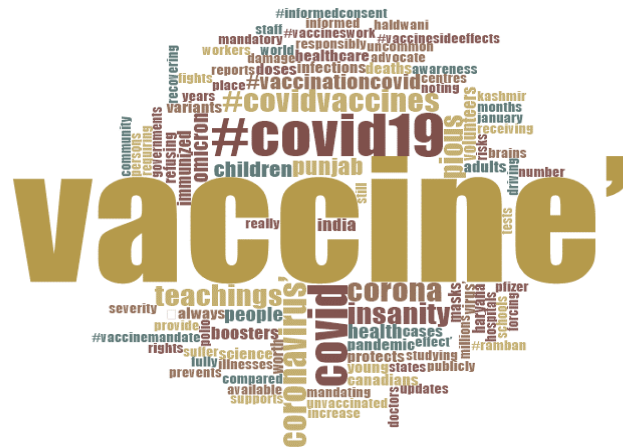
Nvivo 12 has been extensively used to add meaning and rigour to the qualitative research on one of the most trending topics of discussion on social media, i.e., vaccination. Vaccinations have been the point of debate ever since the pandemic started-starting with the wait for it, to whether it is safe or has efficacy, etc.

#### a. Word Cloud

“A picture speaks more than words”, the word cloud and treemap are excellent tools of data visualization made possible with precision through Nvivo.

**RQ1.**What are people discussing around the word “Vaccination” during the pandemic?

The word clouds help decipher the qualitative data, like open-ended questions in an interview (Jackson & Trochim, 2016) or tweets. In these cases, the data to be analyzed is non-structured, and the word cloud highlights the words that are used more frequently; hence it would be wise to conclude that these are the points of discussion. Word clouds give the researcher an overview of the content of a group of words, where the word size (as in font size) reflects how frequently the term appears in the text collection (Sinclair & Cardew-Hall, 2007; Tessem et al., 2015). It is imperative that the stop words (words which bear little or no significance to the research question).



**Figure 2: Word Cloud 1**

Figure 2, highlights the most used words amongst the 15622 tweets. The word clouds are especially recommended for huge qualitative data analysis else it is not humanly possible to pick the most used words to analyse what is being discussed on one of the most used social media platforms (Anger & Kittl, 2011).

The most frequented word is naturally “Vaccines” (n=27466), followed by Covid-19(n=8097), covid (n=6208), and coronavirus (n=3961), covid vaccines (n=3400+\*1523) all implying that the words captured are indicators of all of the above. Hence, the query is yielding a fruitful result. (\*vaccine covid)

The focus of the discussion on Twitter regarding the vaccination is on

- a. **insanity (n=3004):** highlighted by both the vaxers and anti-vaxers. Pro-vaccination people call out people against the vaccines as insane following fake news/ teachings (n=3034). And anti-vaxxers are discussing the insanity of the people who opt to get vaccinated.
- b. **children (n=1602):** The recent focus of discussion has moved to children, with debate regarding whether the sickness caused by covid is severe enough to be vaccinated; why the vaccination is not given to the younger children, leading to the opening of schools; the discussion is also around how hospitalization of the children has increased after the onset of omicron (n=1581).

**c. Omicron (n=1581):** The vaccinations have been discussed more due to omicron, evading the vaccine-created immunity. The debate is whether the people who took the vaccine are still dying or lower hospitalization rates due to vaccination. The whole new discussion around booster (n=934) doses to combat every new variant (including the omicron) are important or not.

The rest of the discussion is focused on specific locations discussion including India (n=910), Punjab (n=1949), and Haryana (n=477) where religious sects (pious n=2993; teachings n=3034) have been evoked to get the vaccination done. Some have ignored science (n=564), and claim that governments are using scientific explanations to misguide people. The deaths (n=593) amongst vaccinated vs non-vaccinated people are being discussed with enthusiasm.

The RQ1 that people are discussing the vaccination has been highlighted with the help of the word cloud and the treemap. The vaccines of Covid-19 are discussed concerning the scientific teachings and the conspiracy and insanity around it. The new variants, the booster doses, immunity, and its effect on children and adults all form integral discussion points in the Twitter world.

**b. Sentiment Analysis**

Sentiment analysis is the automated extraction or categorization of sentiments from the text, whether tweets or customer reviews, or interviews, using natural language processing (NLP), text analysis, and computational approaches. (Agarwal et al., 2015; Panda et al., n.d.).

**RQ2:** Can we analyze the sentiments around the topic of Vaccination?

The dependence of the online world to form their opinions and take decisions based on the online buzz, reviews, etc has made an important case for sentiment analysis (Ainin et al., 2020). Sentiment analysis is justified to extract and understand the opinion of a huge group of people, and in sentiment analysis the (Panda et al., n.d.) The analysis takes into account the theory that negative opinions are voiced louder on social media than positive ones. The following table 1 shows the distribution of tweets into Very Negative, Moderately negative, Moderately positive and Very Positive.

**Table 1: Sentiment Analysis of Tweets on Vaccination**

Sentiment	Number of Tweets
Very negative	2470
Moderately Negative	3348
Moderately Positive	1849
Very Positive	1037

The vaccination debate is not a novel phenomenon (Salathé & Khandelwal, 2011), especially driven by the pandemic of Covid-19; the issue has been fuelled by ideas, influencers, fake news, etc. The vaxxers and anti-vaxxers have held their ground, and as researchers caught in the pandemic, an effort in this research paper is to analyze how Twitter is discussing the topic of vaccination (sentiment analysis).

Negative opinions are voiced louder than positive ones as revealed by the sentiment analysis of 15622 vaccination related tweets (18.1.2022-26.1.2022) around the time when booster shots and vaccination/ health passes were made mandatory in most parts of the world.

**Very Negative Tweets:** The 2470 tweets are categorized as “Very Negative” with the statements as enlisted below:

- “Whoever mandates (\*this vaccination) are murderers.”
- “I am however more disturbed that the 750+ deaths reported after #vaccination.”
- “Millions of careers destroyed.”
- “Travel to and within Europe to become more difficult for persons holding Expiring Vaccination Passes.”

The anti-vaxxers are mainly tweeting and re-tweeting the fact that making vaccines mandatory is a malicious act and would be disastrous to people's health. The conspiracy theories are a result of various psychological facts and can be explained as a frustrated action in an unexplainable or difficult situation and Covid-19 has been one good example of a very unpredictable situation (Van Prooijen & Douglas, 2017).

The conspiracy theorists (Douglas, 2021) regarding Covid-19, include the vaccine angle as well believed that the whole conspiracy theory is being led by SA(48 percent) and least by Denmark (14 percent) (Podgorica, 2021).

**Moderately Negative Tweets (3348):** Some moderately negative tweets are mentioned below.

- “The singular focus on Covid-19 vaccinations has disrupted routine immunization programs around the world.”
- “The vaccine obsession is waning..... and rightly so.”
- “Mandatory vaccination is a mistake.”
- “In the USA allegedly, 17000 doctors say Fauci lied about the vaccines and they are protesting the mandate.”

The moderately negative tweets are focused on the netizen’s objection to the mandatory vaccination and too much focus on Covid vaccination at the expense of the routine immunizations which are tested and tried. The negativity is also aimed at vaxers since the tweets emphasize that the vaccine obsession that is enriching the pharmaceutical industry has been waning now and the anti-vaxer netizens are celebrating that.

**Moderately Positive Tweets (1819):** Some Moderately positive tweets are enlisted below:

- “Clearer thinking about the merits of vaccination mandates is needed.”
- “DOT says “No Vax, no ride” is required to ensure safe travel.
- “Jab and feel freed.”
- “#vaccination is the safe and effective way of fighting all the new variants of Covid-19.”
- “I do not have time to listen to people crying for the freedom to keep covid going by refusing vaccination.”

The people supporting the vaccination are rooting for more information to be shared with the world on the merits of how vaccinated people are better at fighting the pandemic. The netizens supporting the vaccine .mandate are happy that certain public places, including public transport, made the vaccine pass. The focus of the vaccinated or vaxers is to ignore the anti-vaxers who are keeping the pandemic going.



**Very Positive Tweets (1037):** The very positive tweets are lesser in number but are significantly strong; some are enlisted below:

- “Get your vaccination done (if not done yet), stay safe.”
- “It has never been so critical and important as demonstrated now that vaccination protects human lives, from any long-term infection.”
- “The figures provide more compelling evidence that Covid Vaccination saves life.”
- “The next variant will be called Pi, an irrational number, but the emergence of the variant is quite rational, given the millions of dimwits refusing to get vaccinated.”

The focus of the very positive categorized tweets is that the only way to stay safe is to get vaccinated; the data supports, the observations support it but because of people who refuse to get vaccinated, the variants would keep emerging and vaxers will keep suffering for no fault of their own.

#### **4. Implications of the Study**

The main focus of the study has been to highlight the buzz around the vaccinations which have been discussed rampantly across the globe and to suggest ways to use the analysis to suggest to the authorities the way to deal with it. The negative sentiments are focused on the mandate and vaccination is being of no use whereas the positive sentiments support the view that the vaccination will help the people fight the pandemic and thoughtful comments for anti-vaxers.

If the Vaccine passes are to be made a reality, the more precise picture of the advantages it has given the vaxed needs to be highlighted to the anti-vaxers through the people they listen to. Like claimed that the variants would keep coming till all of us are not vaccinated, needs to be explained well and by influencers.

The mandate may be a good idea, but the misinformation needs to be checked at the root. The social media companies have revenue models that sometimes thrive on the fake news being propagated. The Indian government is taking the initiative by admonishing and asking the social media companies to share their plans to check and root out fake news or misinformation. The media would have to build its

reputation of being free from the government's influence; the netizens would keep treating the social media feeds as the real news. The deteriorated media reporting is the primary fuel to the reliance on social media where a typical user cannot verify the posts, videos or pictures. It is not the first or the last time vaccines are being debated. The research paper attempts to decipher the buzz and the sentiments around Covid-19, when new variants are becoming the norm.

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