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Resistance to COVID-19 Vaccination During Early Phases in USA

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ABSTRACT: COVID-19 time is a great time to assess human sentiment when it comes to resistance that was observed to get vaccine administered in USA. There was large amount of hesitancy bordering on hate to get COVID-19 vaccine and it has blown into a public health challenge. In this paper, we investigate the resistance that was observed during the initial stages on the Vaccine administration in USA from 2021. We will see there was a large demographic group leading into the year indicating that they will resist to get a vaccine, and they remained unchanged for large period of the that year. To every one surprise, the largest group which resisted the vaccine was the age group between 18-24 (27%) and when it comes to race, Blacks resisted the most (20%). Also, we also saw there was more resistance from the east coast with the west coast more inclined to get the vaccine. In this paper, we will show why there was this resistance and try to make sense why the efficacy of the vaccine took such a long time to get the epidemic and population agreeable to vaccine.

KEYWORDS: COVID-19, vaccine, demographic, resistance.

1 INTRODUCTION

During the early months of 2021, the US food and drug safety administration (FDA) approved three vaccines to be administered to the public to stem the death and eradicate the SARS-CoV-2 infection, which had now taken millions of people to the grave worldwide. These three vaccines included two mRNA vaccines produced by Pfizer and my company's (Moderna), and one viral vector vaccine produced by Johnson and Johnson. All these three vaccines were thorough vetted by a series of drug tests and met the safety and effectiveness requirements bar set by the department to obtain its emergency use authorization for COVID-19. Despite the FDA over stemming approach in educating the public on the safety of the vaccine and its efficacy, with little information on the side effects, the vaccine efficacy remained a significant hurdle in bringing the people to get administered and bringing the pandemic to an end sooner. A small number of in fact and older people dying after the initial first shot from the vaccines did not help.

Addressing this resistance to the COVID-19 vaccine required large national communication steps that were not only tailored to regions but different demographics to address their own unique concerns. Data analysis played an important role in informing the department to strategize a method to reach every nook and corner of the country. To support this, both state and local communication and outreach efforts were explored. This paper looks back to see how the strategy panned out to overcome the initial resistance among the different geographic areas and demographics groups and how the time changed quickly in favor of vaccine administration.

2 BACKGROUND

Resistance to vaccine administration is defined as the state or a belief and a behaviour bordering on confusion whether to or not to accept vaccination [1]. This resistance ranges from anger, hate, confusion and though purpose to validate oneself from complete refusal to complete acceptance [2]. Resistance can lead individual to outright reject or delay or adjust vaccination schedules to see the efficacy of the vaccine, or at times vaccinate partially or decline with steadfastness [3]. Vaccine resistance is common and is not reserved for COVID-19 and is seen as a n important issue for all pre-existing infectious diseases worldwide.

It amounts directly to declining rates of vaccination in developing countries than developed countries and at times threaten this herd mentality if the environment is conducive [4]. In addition to other mitigating factors administration take around the world, administering the vaccine during the outbreak is a monumental challenge in reducing illness, spread of epidemic, and deaths. Hence managing the vaccine administration plays an important role in controlling the spread of epidemics.

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Overcoming this resistance to vaccine administration is key to ensuring vaccine reaches enough population to reduce spread, transmission of SARS-CoV-2 and end the COVID-19 pandemic. In the later part of 2020, multiple COVID-19 vaccines were in the last phases of clinical trials not only in USA but in UK [5], showing great promises in their initial phases. During this stage, many Americans and people around the world were surprised and appalled at the speed at time the FDA were pushing the clinical trials and expressed outright hesitancy around these potential vaccines. Their reasoning was, for a vaccine to come about, it would take more testing for larger sample and time, to get it right. They also expressed their resistance in the potential side effects and a total mistrust in the government oversight to ensure safety and were covered that the vaccine is just in too soon and were used a testing mole [5]. This analysis paper shows how vaccine resistance evolved in 2021 during a 10-month period as vaccines became more available to segments of the public. Controlling, mitigating, educating, and managing vaccine administration is a monumental effort and it takes a lot to reduce resistance. Hence the importance of vaccine administration cannot be neglected.

3 DATA AND METHODS USED

We look at the trends in the vaccine hesitancy using the US census Bureau's Household Pulse Survey (HPS) and our internal survey of the vaccine adoption. We look at the resistance rate at the time from all parts of the country and local levels using the data from American Community Survey (ACS). The HPS is a national data and includes information on the US resident's vaccination for COVID-19, intensions to receive Vaccine in the coming days when available, reasons for resistance, sociodemographic, geographic, basically including state, county, city and zip code, age, gender, and ethnicity. We used this data from the HPS from January 2021 to October, 2021. The survey sampled are approximately 3.58 million households and response rate of 7% overall [6]. American Community survey is a different ball game, as it provides valuable information on the sociodemographic and geographic information, which when used in tandem with our internal data along with region, state, and county level, as well as the data in the public domain which lists the population along zip codes, which areas had more populations more than 50000 and others. ACS data along with the response data of nearly 7 million in the course of time was used in this study [7]. The HPS data contained questionnaire, along the lines of "Once a vaccine to prevent COVID-19 is available to you, would you...get a vaccine?", which provides the following options: 1) "definitely get a vaccine"; 2) "probably get a vaccine"; 3) "probably not get a vaccine"; 4) "definitely not get a vaccine." [7], [18], [19], [23], [24], [27]. In this study we used 'resistance' in the response indicating whether a person would 'probably not" or "definitely not" receive the COVID-19 vaccine going forward. Here, the strong response like "definitely not" is used to indicate that a person would strongly not consider getting the vaccine when it is available.

In the data we received, individuals who responded with 'yes' or 'no' to have vaccine were included and people whose response were neither 'yes' or 'no' were excluded. The people whose response was 'yes' to the questionnaire, 'have you already received a vaccine' were treated as 'not resistant' and who responded with 'definitely' and 'probably' were also treated or counted as 'not resistant'. People who responded to 'no' to having received the COVID-19 vaccine to who said they do not intend to receive all required dosages, the questionnaire asked, "Which of the following, if any, are reasons that you [only probably will /probably won't/definitely won't], [get a COVID-19 vaccine/won't receive all required doses of a COVID-19 vaccine] ?". Our internal analysis was done in a step -by step fashion linearly, first using the HPS data, we used regression to analyse vaccine resistance using the sociodemographic and information regarding other data like race, age, gender, education, marital status, income, state, zip code. We later used regression from the HPS analysis data done in the previous step to the data gathered from ACS to predict vaccine resistance rates for everyone. We then average it out to predict the values by geographic, area-specific resistance rates.

Patient data was collected from NIMHANS main central system, which already as a file of every teen with down syndrome for other clinical evaluation and procedures at our facility. The evaluation includes Neuropsychiatry units, Paediatric, behavioural information between January 2023 to present. There were some children who were withdrawn from the facility during this period, those samples are not considered in this study. At NIMHANS, all patients would go through paediatric and neuropsychological evaluation although the diagnosis might have occurred at other private facility or hospital. During the initial evaluations, NIMHANS procedure dictates a patient's parents / caregivers complete a thorough measures, medications, procedures, diet, and other information including the sleep patterns using a sleep, psychopathological questionnaires on the teen. Due to this process in place, a vast amount of data is collected and fed into the NIMHANS main computer system, which gives a dashboard view of all identified data that would be analysed or analysed during time. All parents as part of Government of India law are required to sing a written consent for data use for research purposes and privacy statement ensures that data is kept confidential and within the government dictated terms and use.

4 RESULTS

4.1 RESULTS BASED ON TIME

We first look at the resistance level of all adults (age > 18) between January, 2021 and October 2021. People who responded with 'definitely not' and 'probably not' receive a vaccine were regarded as hostile, decreased considerably during this period (p-value < 0.001). It is interesting to note that, this dramatic change in the response to vaccine resistance is mainly due to people who had earlier responded with 'probably not' had changed their mind and were more receptive to vaccine than those people who had responded with 'definitely

not'. The percentage of people who jumped from 'definitely not' to actively receiving vaccine did not change much, clearly pointing that these respondents were stubborn on not getting the vaccine come what way. This is shown in Figure 1.

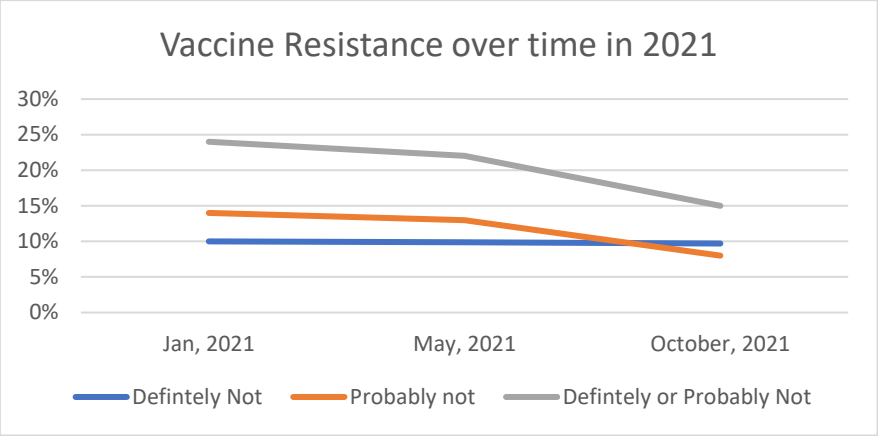

Fig. 1. vaccine resistance over time in 2021

4.2 RESULTS BASED ON DEMOGRAPHICS.

In this section, we investigate the resistance rate based on the demographic data in the same period. Table 1 summarizes the results. From the data, we see there is bit a variation when data was looked closely by gender, age, race, and college education. We see from the results that women were more resistant than men and surprisingly resistance was less for people whose age was greater than 65 and highest recorded resistance in the age group of 25 and above. It also pointed that Asians had the highest resistance to vaccine amongst all races while people without college education also exhibited the same emotion / preference to vaccine. Overtime the resistance to vaccine decreased considerably amongst all gender/ race / education wise too from 25% to 15% by gender, education wise, it dropped from high 20's to high teen percentage wise. Looking at the race subsection, we see that Asians embraced the vaccine over time along with Blacks, the resistance level dropped from high 30's to low 20s.

Table 1. Resistance based on demography

Demography	January, 2021	October, 2021
Male	23%	15%
Female	26%	15%
Age: 18-24	27%	19%
Age: 25-39	31%	24%
Age:40-54	26%	18%
Age: 55-64	17%	12%
Age: >65	13%	6%
White	23%	14%
Black	37%	19%
Asian	7%	5%
Hispanic	18%	11%
Rest	36%	25%
College White	28%	21%
Non-College White	11%	7%
College Black	29%	10%
Non-College Black	38%	23%
College Asian	7%	4%
Non-college Asian	11%	5%
College Hispanic	21%	14%
Non-College Hispanic	19%	13%

Table 2. Demographic score

Demographic	January, 2021	October, 2021
Age		
18-24	0.05	0.04
25-39	1.33	1.45
40-54	1.01	1.04
55-64	0.58	0.54
>65	0.32	0.26
gender		
male	0.79	0.96
Female	1.02	0.87
Race		
White	0.88	0.78
Black	1.287	0.96
Asian	0.42	0.26
Hispanic	0.58	0.42
Education		
High School	0.93	0.88
College	0.68	0.68
Higher	0.23	0.21
Marital Status		
Married	1.03	1.01
Divorced/ Widowed/separated	1.4	1.11
Single	1	0.75
Income		
< 25k	0.87	0.89
25k - 35k	0.89	0.94
35k - 50k	0.81	1.02
50k - 75k	0.82	0.88
75k-100k	0.95	0.98
100k - 150k	0.82	0.83
150k - 200k	0.62	0.82
>200k	0.43	0.66

There was substantial variation in resistance based on the geographical location of the responder. From the results we saw there was less resistance from west coast and in the northeast like new England. Regions like the bible belt and south showed higher resistance to vaccine administration. From an economical point of view coupled with age group, we saw that there was greater resistance from younger uneducated or high school educated responders than college or higher educated people.

Results based on the questionnaire were also looked upon, we saw there was a lot of anxiety on the safety of the vaccine. More than 25 percent of them believe they did not need them, and a higher percentage did not tryst the vaccines or the government, citing vaccines would take longer time to mature to be administered. A small percentage of the people wanted to wait, or said, 'I plan to wait' or 'Do not know if vaccine work'. This percentage decreased over time as the initial administered vaccines showed good results and people started trusting both the vaccine and the government. While there was high single digit percentage of people still hesitant to take the vaccine citing ' I do not believe I need', this percentage are also ebbed over time. Surprisingly the number of people who vehemently resisted the vaccine citing 'I do not trust' remained the same.

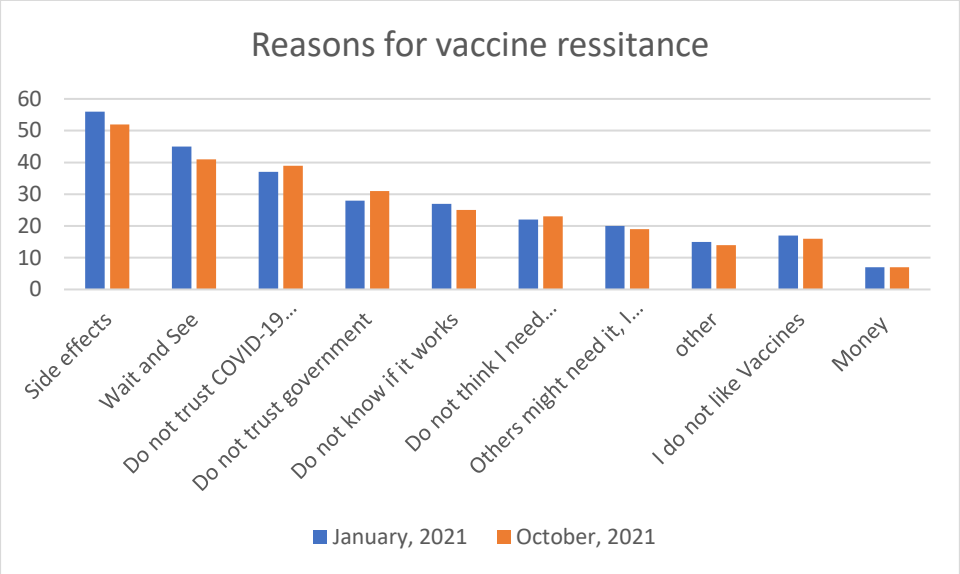

Fig. 2. Reasons for resistance

Figure 2 shows the reasons for resistance for vaccine adminsitration. Most of the reasons that were cited in january, 2021 like side effects, wait and see, do not trust COVID-19, trust in efficay, do not like vaccines, for all of the above reasons, the resistance came down over time in October, 2021. Surprisingly, 'Donot know if it works' and 'Do not think I need them' were the reasons people still held back from getting vaccine treatment. Other reasons like money did not change much over time.

5 DISCUSSION

When the vaccines started getting administered, millions of millions of people here in USA and across the globe were vaccinated. Here in USA, there was still resistance to the vaccination despite the strong safety and efficacy data pouring each day and FDA openly coming on national TVs saying the same. The resistance to anything new is well known, however, when it comes to vaccine it gets really complicated. There are many factors ranging from history of bad experience, social, peer influence, political views which was seen strongly here in USA and others including vaccines brands. In this study, we saw there was resistance in all races, educated or not, and in different income groups.

There are other studies done to see the resistance to vaccines among different age and income groups. Beaumont Foundation found that there was a lot of resistance from the groups living in rural areas and who were black and republic [8], [18], [19], [20]. Over time, the resistance amongst this group gradually decreased. The foundation saw that there was a significant drop in resistance to vaccine among black and Hispanic groups [9], [18], [19], [20].

However, resistance did remain the same among other demographics [10], [11], [21]. A new study found there was a greater willingness to get vaccinated from non-Hispanic black adults in the later stages of 2021 [12], [13]. The percentage of people who either indicated that they would "definitely not" get a COVID-19 vaccine, or responded by "strongly hesitant," did not change considerably over time. A study done by Axios/Ipos concluded that 1/5th of the responders in their study did not like vaccination at all and that it remained the same up until October 2021 [14], [25]. Another study by kaiser group, which is one of the largest medical insurance foundations in USA, showed that people who strongly resisted the vaccine with 'Definitely not' to getting vaccinated, remained unchanged over time [15] clearly pointing to that there will be people who will not get vaccinated and that is a problem as the virus can remain dormant in these people. The study can further investigate various changes to DNA using algorithms such as mentioned in [20], [21], [22], [23], [24], [25], [26], [27].

In this study, we see that a vast majority of people showed resistance and were on the side lines mainly because of concern of side effects, wait and see, and to see the efficacy of the vaccine. This is mainly triggered by the unexpected pause in Johnson and Johnson vaccine in the middle of the year [16], [26]. Other study also pointed to this pause from Johnson and Johnson as the reason people were still sitting on the side lines for other vaccines [17], [28]. We think from this study, that majority of the people over time realized that vaccine was better off than not as the number of deaths decreased considerably all over the globe and in USA. There were still a small percentage of people who did not take the vaccine at all. Today AI is influencing pretty much every industry, perhaps could lead to faster vaccine study and faster lead time to market [28].

6 CONCLUSION

In this paper, we presented the efficacy of vaccine which drove the resistance to vaccine down over time. There is a need to overcome vaccine resistance and this was very much needed to slow the spread of SARS-CoV-2. In this paper, our analysis showed different resistance to COVID-19 vaccines and the challenges FDA faced in getting the public accept the vaccine. The challenges were complex and multi-faceted, and it involved, race, gender, income, education, region, and zip codes. There is a need for sustained monitoring of vaccine efficacy over time and this is critical for policy decision makers to adjust the communication strategies, including the methods, language, and messengers, to improve efficacy and reach to all population in USA.

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