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RESEARCH ARTICLE

Past Refusals, Reasons and Future of COVID Vaccinations in Colleges

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ABSTRACT

A significant portion of the adult and college student populations have been observed to be reluctant to get vaccinated against COVID-19. COVID-19 is still a threat and the unvaccinated students may yet pose a risk of spreading the disease in the case of a new variant. Many experts believe that COVID is here to stay and new variants are likely to come around. Thus, there is a need to examine the causes of vaccination refusal among college students so that efforts could be made to increase the vaccination rates if needed. Sources of information were classified into three categories: Scientific, Friends/Relatives, and Social Media. Results indicated that "No Faith in Government or Vaccine" was the dominant reason. Differences were noted with respect to gender. Refusal Reasonings also were correlated related to the source of information. The majority of respondents who refused the vaccine would reportedly refuse future COVID-related vaccines. This research may aid in future efforts to reduce reluctance among college-age students to accept the vaccine.

Keywords: Covid, gender, government, vaccine.

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1. Introduction

The impact of the COVID-19 pandemic has been well publicized. There were over one million deaths in the U.S. alone. It imposed enormous burdens of morbidity and mortality while severely disrupting lifestyles and economies [1]. In the year 2023, we finally exited the Pandemic phase and entered the Endemic phase. Initially, the only solutions were lockdowns, social distancing, frequent hand washing and masking. In 2021, three vaccines became available to all adults and children free of charge. However, unlike childhood vaccines required for school entrance, adult vaccines are typically not mandated. As a result, for one reason or another, a significant portion of the adult, as well as, College student populations have been reluctant to take any of the three vaccines. They have simply chosen to remain unvaccinated [2]. These unvaccinated, symptomatic or not, are still capable of transmitting the disease to the vulnerable portion of the population. Should another surge or variant of the disease occur, the authors felt that unvaccinated college students pose a bigger risk of the spread of the disease to others. This is because they are likely to attend social/sports events, visit bars, be present at large gatherings and risk getting COVID-19 infection compared to the seniors. They could be infected without symptoms and some may not be even aware that they have the virus. Additionally, they may also be less likely to be disciplined enough to follow quarantine guidelines. They could easily come in contact with others thus contributing to the spread of the disease.

Invention and subsequent development of vaccines have been a stunning scientific achievement. Vaccination as a prevention method is highly effective for many diseases and has been used for decades to inoculate populations [3]. How many deaths do vaccines prevent each year? According to the Center for Disease Control and Prevention (CDC), an estimated four million deaths worldwide are prevented by childhood vaccinations alone every year [4]. COVID-19 vaccines have also been shown to be amazingly effective as well. The COVID-19 vaccine is the most promising means of limiting the spread of or eliminating the pandemic [5]. The CDC also estimated that people who received the COVID-19 bivalent booster were fourteen times less likely to die compared to those who received no vaccine. Does this constitute a good reason to get vaccinated?

Why is there hesitancy or refusal to accept vaccination among some adult and college student populations? Trust is the key driver in the acceptance of the vaccine [2]. Ironically, the U.S. government's plan to fight the 2019 pandemic was predicated on getting a large portion of the U.S. population vaccinated, thus shielding the unvaccinated in order to exit the pandemic phase. The idea

was to get enough people in the population vaccinated to reach the "Herd Immunity Status" in the country, yet there remain many reasons for refusal. It is important for the government to understand the reasons, check for validity behind those reasons, and take steps to mitigate their effect on vaccine acceptance in case new variants appear or a new global threat emerges.

Limited research found on U.S. college student behavior during the pandemic examined the impact of the pandemic on instruction, learning and some student behaviors. A limitation of the existing research is the absence of data regarding student willingness for vaccine acceptance in the future. Thus, it is necessary to study why young college students refuse the vaccine uptake, that is, what the reasons are and the relationship of these reasons to other factors such as source of their information. Then, the root cause(s) of vaccination refusal in this part of the population could be identified and factors associated with these refusals could be explored to encourage students to accept the vaccines. If the factors are controllable, efforts could be made to increase the vaccination rates among college students.

1.1. Brief History of Vaccines

In a Historical Perspective, after Edward Jenner first developed the vaccination method to protect people against smallpox in 1796, a plethora of vaccines have been developed to protect against other diseases. As a result, Immunization schedules suggested by the Centers for Disease Control became more intricate. As a matter of fact, people in certain occupations such as healthcare, military etc., today must get vaccinated as a prerequisite for employment.

In the past vaccines were deemed to be "only for children." Today, vaccines for adults are becoming increasingly common and necessary. However, when it comes to vaccines, many adults still only think of the Tetanus booster as a necessary vaccine, recommended every 10 years, and that, only if they injure themselves. Influenza vaccines, available since the 1940s, are recommended today for most adults and appear to be better accepted especially among seniors in the population.

The first-generation vaccines involved injecting the weakened version of the vaccine into the body. The weakened cells cannot reproduce and do damage but help produce an antigen, allowing the immune system to learn what to look for. The downfall is that it is a slow process that requires months of growing the virus in other living cells [5]. The second-generation vaccines (called vector vaccines) involved only giving the body antigen which activates the immune response. The third-generation vaccines use the newest approach and do not require any form of virus at all. The dose provides the body with instructions that include tiny pieces of genetic code that tell the cells to produce the antigens needed to activate the immune response. These vaccines are known as the Messenger RNA vaccines [6]. Some people thought that this new approach in the third-generation vaccines has not been tested enough. As a result, there has been a significant anti-vaccine movement all over the globe creating mistrust of the vaccine manufacturers and the government. Is the mistrust valid? Are the anti-vaxers right? What is their source of information? This research explores the vaccine refusal reasons among college students, their sources of information, and their intentions regarding future vaccine acceptance.

2. Literature Review

Hearing relevant information from doctors and scientific sources was positively associated with vaccine uptake while talking to other people and social media was associated with increased safety concerns as well as misinformation. Misinformation can considerably reduce COVID vaccine acceptance among the general population, probably more so among the younger college population some of whom perceive themselves as less prone to COVID-19 infection than others [7]. This may be due to unrealistic optimism (a tendency to perceive peers as being more at risk than you are, an illusion). One previous study examined vaccine acceptance among college students at a South Carolina university [2]. They felt that "Mistrust" in the vaccine may be associated with the source of information. It is also known that College students are heavy users of social media, which can be a likely source of such information. Actually, Scientific and Medical communities have already established the safety and efficacy of the vaccines after accelerated trials due to the urgency of the pandemic. However, the basis for believing information leading to refusal of vaccine uptake may not come from scientific or medical sources. Today's digitalization and expansion of social media offer other sources of information. These social media sources can provide inaccurate, incomplete or simply incorrect information to the users. During the COVID-19 pandemic, knowledge acquisition about COVID-19 was shaped by news sources [8]. This study revealed how the use of different news sources differentially shapes access to accurate knowledge about COVID-19. Those who rely on informal and local news sources have the largest knowledge gaps about these topics, while those who seek information from national or international news outlets have the most accurate knowledge. These findings have implications for knowledge dissemination that impact an individual's decision for vaccine uptake.

College students have a high risk of COVID-19 infection and its spread, especially if they remain asymptomatic since they are susceptible to health-compromising behaviors [2]. Such behaviors may be due to their sense of invulnerability, comparative optimism, and a perception that COVID-19 is not a serious health threat to them. Yet, this was the only study we found in our search that dealt with vaccine acceptance among college students. Thus, we decided to study this problem on another campus. If the students refuse the vaccine today due to incorrect information, will they continue to do the same if new variant(s) of the virus come around in the future? Will they be at least willing to take the necessary precautions to minimize or prevent the spread if they choose to remain unvaccinated? Our study also explores this issue.

2.1. Research Objectives

Even though the pandemic is over, the overall goal of this study was to determine whether college students will be willing to take the vaccine in the future, if necessary, given that they had refused it in the past. Also, of interest was to study the refusal reasons, and, to find out if they would be willing to take other precautions necessary to prevent the spread if they had refused the vaccine uptake so that appropriate intervention strategies could be developed. Thus, this study explores past reasons for vaccination refusal among college students given that the vaccine has been effective, and whether the reasons are related to student gender and sources of information.

The specific objectives of the research were to assess:

- *Reasons* for refusal of vaccines among the unvaccinated student population in the pandemic era
- *Dominance* if any, of any Reason(s)
- *Relationship* between Refusal Reasons and Gender
- *Relationship* between Refusal reasons and Sources of information
- Student *Willingness* to take the vaccine in future
- Student Willingness to *take necessary precautions* in the future if vaccine was refused

3. Methodology

This study used a short survey to determine primary student reasons for vaccine refusal at a regional university in the Southeastern United States. The questionnaire sought their Sources of information associated with their reasoning, their willingness to take the vaccine in the future if necessary, and if not whether they will take necessary precautions to prevent the spread. It also requested data on student demographics. The data was collected in the year 2022. Respondents were students who refused to be vaccinated. Vaccination was required at the time for attending classes in person. These students were required by the university to get tested weekly and fill out a "descent form" for refusal. The students arriving at the University Health Center for testing because of the vaccine refusal were requested to complete this anonymous short survey. If a student had participated in the survey in the prior weeks, they were not allowed to participate again. The inclusion criteria included: (1) being 18 years of age or older; and (2) being currently a full-time student enrolled in the university. Participation was completely voluntary and the student could withdraw at any time. Students showed up randomly for testing, and every 4th student was requested to participate. Thus, the sample could be considered a Systematic sample with characteristics of a simple random sample. Data collection was stopped when a total of 300 valid surveys/responses were collected. All the data recorded was qualitative or categorical. There were 188 female and 112 male participants in the sample. The university student population is approximately two-thirds female.

The following reasons are reportedly relevant for vaccine refusal/reluctance: Risk perception, Trust in Healthcare, Misinformation, and Concerns about side effects [9]. It has also been suggested that trust in pharmaceutical companies and Government was negatively associated with vaccine hesitancy [2]. Sources of this information were reportedly social media, mass media (TV), government, healthcare and medical publications. Misinformation from multiple sources can impact vaccine acceptance.1 Trust in government is highly associated with vaccine acceptance [1]. A Focus group of students was created to identify possible refusal reasons for vaccine uptake among our college student population and their possible sources of information. The possible refusal reasons and possible sources of information from the literature, and, the ones identified by the focus group were used in developing categories for the following variables included in the study: Refusal Reasons, Sources of Information, Willingness to take COVID vaccine in the future, Willingness to take precautions to prevent COVID spread and Gender of the respondent.

Refusal Reasons: This was the first variable studied which had five categories consisting of the following reasons:

1. Personal; It is my Constitutional right
2. Side effects concern (Short/Long Term); Have Medical condition
3. No Trust or Faith in Government and/or vaccine
4. Good Health/Have antibodies (I do not need the vaccine)
5. Religious

The students were to select the most appropriate (dominant) category for the response and also state their reason for refusal of the vaccine. We need to be mindful of the fact that while some of these refusal reasons (such as having a medical condition) may be legitimate, certain concerns and reasons such as "vaccine will affect fertility," "it may cause myocarditis" may be baseless. The risk of myocarditis as a side effect is 100 times higher from a COVID-19 infection than with vaccination [10]. Also, the "I am in good health so I do not need the vaccine" thinking maybe a fallacy since college students can still get the virus, be asymptomatic and spread it. Similarly, no trust in vaccine development and government may be without any valid ground. To some, the development of the vaccine in a very short time implied that it is not yet possible to know its long-term efficacy as well as the possible side effects. Many felt that the early development of the vaccine was due to the huge influx of government financial contributions that led to the quick start-up and development of over 300 vaccination projects. They felt that the government was pushing the pharma industry for quick development of the vaccine. Adding to the mistrust is the fact that COVID-19 is an RNA virus known to have a high degree of mutation. These mutated strains appear to be more resilient to vaccines and may not respond to the vaccine [11].

One study reviewed twenty-two other studies to identify factors that affect vaccine acceptance which included trust in authorities [2]. Thus, "No Trust in Government and/or vaccine" was included as a category in the "Refusal reasons." Can the government develop some intervention strategies to address these issues of trust so the vaccine refusals are not for the wrong reasons? Can we address the refusals due to religious reasons? Actually, similar

problems had to be addressed in the early years of vaccine development.

Sources of Information: This was the second variable considered in the study. "Health information about vaccines" is associated with vaccine acceptance [2]. For college students who are embracing a digital era and being exposed to multimedia, the sources of vaccine information and their trust in this information may play an important role in shaping their acceptance of vaccine uptake. Also, students tend to go along with their peers, partly to be accepted in the group. Thus, we felt that "Source of Information" can be an important variable for such a study that should be included. This variable was also a categorical variable and had three categories as suggested by the focus group, namely:

1. Scientific Source-CDC, Doctor, Medical source
2. Friends, relatives, Newspapers, etc.
3. Different Social Media

The next two variables were also qualitative with three categories for each.

Will take the vaccine in future: The responses to this question were recorded in three categories: Yes, No and Maybe.

Will take necessary precautions to prevent spread in future: The responses to this question were also recorded in three categories: Yes, No and Maybe.

Gender of the Respondent: For this question, the responses were recorded by gender at birth, in two categories: M (Male) or F (Female).

Finally, an EXCEL file was created for analysis containing coded data for each respondent for all the five variables mentioned above to test the following hypothesis:

- *Hypotheses Tested:*
  - *Null Hypothesis 1*: Refusal responses are distributed uniformly among various categories of reasons. There is no dominant reason.
  - *Null Hypothesis 2*: Variables Refusal reasons cited and Gender are independent.
  - *Null Hypothesis 3*: Sources of Information used are distributed uniformly among various categories of sources. There is no dominant source.
  - *Null Hypothesis 4*: Sources of Information behind Refusal reasons cited and Gender is independent.
  - *Null Hypothesis 5*: Refusal reasons cited are independent of the Sources of information.
  - *Null Hypothesis 6*: The majority of the students who have refused the vaccine during this pandemic will continue to do so in the future.
  - *Null Hypothesis 7*: Among the students who have refused the vaccine now, the majority of them will refuse to take precautions to prevent further spread in future.

3.1. Data Analysis

Data was analyzed using EXCEL to identify if any category of reasons dominated the refusal responses. An EXCEL Count-if function was utilized to count observed frequencies in various Refusal Reason categories. A Chi-Square Goodness of Fit Test was employed to test hypothesis 1. EXCEL was also used to generate various cross-tabulations. A Chi-Square Test of Independence was run on the cross-tabulations of Gender and Refusal Reasons to check if Gender and Refusal reasons were related or independent. Finally, the Test of Independence was also run on cross-tabulations for Refusal Reasons and Source of Information to check if the reasons cited were related to the Source of Information. A hypothesis test for proportions was used to check if the Majority of the students who have refused the vaccine now would continue to do so in the future. A second hypothesis test for proportions was also run to check if the Majority of the students who have refused the vaccine now will be willing to take precautions to prevent the spread in future.

4. Results

4.1. Refusal Reasons

The first objective was to examine Reasons for refusal and check if there is a dominant refusal reason(s). Null hypothesis 1 assumed that the Refusal reason responses were uniformly distributed among five refusal reason categories and there was no dominant reason. Under this assumption, we would expect 60 responses in each of the five reason categories. Table I shows the distribution of Reason responses among the students who refused the vaccine. It shows the Observed (found) and Expected frequencies for each Reason. The Calculated Chi-Square test statistic for the Goodness of Fit Test was $= 137.05$ ($p < 0.005$). As seen from Table I, significantly fewer than expected students cited Religion as a reason for refusing the vaccine. Similarly, significantly fewer than expected students chose "Personal" as a reason category for refusing the vaccine. Just about as expected cited the reason "I have good health; I do not need a vaccine." In addition, just about an expected number of students cited the reason "Side Effects/Have medical condition". However, the observed and the expected frequencies showed that significantly more, in fact much more than expected students did not trust the Government or the vaccine manufacturer and refused the vaccine. "No Trust" is clearly the dominant reason behind refusal.

4.2. Distribution of Refusal Reasons by Gender

The second objective was to check if the Refusal reasons cited and Gender are independent. Cross Tabulations in Table II show the observed frequencies of Refusal reasons in the sample by gender of the respondent. Table III shows the Expected frequencies of Refusal reasons by gender.

Unfortunately, the expected frequency in the "Religious" reason and "Male" cell was less than five. Thus,

TABLE I: Observed and Expected Frequencies for Refusal Reasons

Frequency	Religious	Personal	Good health	Side effects	No trust	Total
Observed	9	33	62	69	127	300
Expected	60	60	60	60	60	300

TABLE II: Observed Frequencies for Refusal Reasons by Gender (n = 300)

Gender	Religious	Personal	Good health	Side effects	No trust	Total
M	5	16	27	27	37	112
F	4	17	35	42	90	188

the categories "Personal" and "Religious" were collapsed for the computation of the of the expected frequencies and the Chi-Square Test statistic to check the independence between these two categorical variables. The null hypothesis of independence of the factors "Refusal Reason" and "Gender" was rejected and the two factors were found to be dependent at 5% level of significance ($p < 0.05$). Further examination of the observed and expected frequencies revealed that significantly more than expected women did not trust the government and/or pharmaceutical companies. However, significantly fewer than expected men stated that no trust in the government and/or pharmaceutical companies was their primary reason for refusing the vaccine. In addition, about the same number of men and women as expected stated "Concerns about the side effects" and "Good Health" as their primary reason for refusal.

4.3. Sources of Information

The third objective was to examine the Sources of Information behind the Reasons for refusal and check if there is a dominant Source of Information. Null hypothesis 3 assumed that the Sources of Information behind the refusals were uniformly distributed among three categories and there was no dominant source. Under this assumption, we would expect 100 responses in each of the three source categories. Table IV shows the distribution of Sources of Information behind refusal among the students who refused the vaccine. It shows the Observed (found) and Expected frequencies for each Source of Information. The Calculated Chi-Square test statistic for the Goodness of Fit Test was = 83.22 ($p < 0.005$). As seen from Table IV, significantly fewer than expected students cited Scientific Sources for information for refusing the vaccine. However, significantly more than expected students (Male or Female) cited social media as their Source for information for refusing the vaccine. It can be easily seen that "Social Media" appears to be the dominant source of information for vaccine refusal among college students. Table V indicates that sources of information differ by gender and indicates that female respondents sought more information with regard to COVID-19 vaccination.

Examination of the observed and expected frequencies that the two factors are related ($p < 0.05$). Significantly fewer than expected males who cited side-effects or no-trust as a reason said their information came from "Scientific" source for refusal to vaccinate. Also, significantly more than expected males who cited "Social Media" as their source of information stated no-trust for refusal to vaccinate.

TABLE III: Expected Frequencies for Refusal Reasons by Gender (n = 300)

Gender	Religious	Personal	Good health	Side effects	No trust	Total
M	3.36	12.32	23.14	25.76	47.41	112
F	5.64	20.68	38.85	43.24	79.58	188

TABLE IV: Observed and Expected Frequencies for Refusal Sources of Information

Frequency	Scientific	Social media	Friends/Rel	Total
Observed	29	155	116	300
Expected	100	100	100	300

TABLE V: Observed Frequencies for Sources of Information and Gender

Frequency	Scientific	Social media	Friends/Rel	Total
Male	2	69	41	300
Female	15	98	75	300

4.4. Willingness to Vaccinate in the Future

Null hypothesis 6 that the "Majority of the students who have refused the vaccine during this pandemic will continue to do so in the future" (*Proportion* $p > 0.50$) could not be rejected since 74% of the students said they would refuse the vaccine in the future.

4.5. Willingness to Take Other Precautions in the Future

Null hypothesis 7 that "Among the students who have refused the vaccine now, majority of them will refuse to take precautions to prevent further spread in future" (*Proportion* $p > 0.50$) was rejected since only 36% of the students said they will refuse to take other precautions in the future given they would not take the vaccine.

In summary, results from Table VI indicated the following rankings for the reasons cited for refusal/reluctance:

1. No Trust or Faith in Government and/or vaccine
2. Side effects Concern/Have Medical condition
3. Good Health/Have antibodies
4. Personal or constitutional right
5. Religious reasons

Some interesting findings from the research include differences in reasons cited for hesitance to take the vaccine were found to be related to gender ($p < 0.05$). More females than expected cited "Personal reasons" for refusal or reluctance, while a greater number of males than females cited "Good Health" for refusal or reluctance. The number of males and females citing "Religion" for refusal was not significantly

TABLE VI: Observed Frequencies for Refusal Reasons by Source of Information

Reason/Source	Religious	Personal	Good health	Side effects	No trust	Totals
Scientific	0	0	0	21	8	29
Social Media	0	20	31	22	82	155
Friends	9	13	31	26	37	116
Totals	9	33	62	69	127	n = 300

different. Hesitance to take the vaccine was found to be related to the Source of Information ($p < 0.05$) and "social media" appeared to be the dominant source of information for vaccine refusal among college students. More males than females who refused the vaccine today said they will still refuse the vaccine or booster in the future. These findings lead us to the following conclusions.

5. Conclusions

Government and the educational institutions still need to try to educate students about the importance of vaccines. Some students seem to distrust the government. That could aggravate the problem of the majority getting vaccinated to reach herd immunity. They can also try to increase awareness among college students that social media may offer inaccurate and unreliable information regarding the safety, necessity and efficacy of the COVID-19 vaccines.

5.1. Implications

No action or ignoring the problem of misconceptions caused by social media may keep us from reaching necessary immunization goals and control over this disease. Negligence could be dangerous! If another "Surge" resurrects the old problems of multiple waves of the virus will continue the problems we faced earlier. Should another variant or virus attack, we may face another epidemic or even worse a pandemic. Some Experts have already warned that the threat of Monkeypox (MPOX) may be just around the corner. Also, let us not forget that some experts say *COVID is here to stay like the Flu*!

Conflict of Interest

Authors declare that they do not have any conflict of interest.

References

[1] Joshi A, Kaur M, Kaur R, Grover A, Nash D, El-Mohandes A. Predictors of COVID-19 vaccine acceptance, intention, and hesitancy: a scoping review. *Front Public Health*. 2021 Aug 13;9:698111.

[2] Qiao S, Tam CC, Li X. Risk exposures, risk perceptions, negative attitudes toward general vaccination, and COVID-19 vaccine acceptance among college students in South Carolina. *Am J Health Promot*. 2022;36(1):175–9.

[3] Anand P, Stahel VP. The safety of Covid-19 mRNA vaccines: a review. *Patient Saf Surg*. 2021 May;15(1):22.

[4] CDC. COVID-19 vaccine effectiveness. [Internet]. Dec 14, 2023. Available from: https://www.cdc.gov/coronavirus/2019-ncov/vaccines/effectiveness/work.html.

[5] World Health Organization. *Clinical Management of Severe Acute Respiratory Infection When Novel Coronavirus (2019-nCoV) Infection is Suspected: Interim Guidance*. World Health Organization; 28 January 2020.

[6] Mayo Clinic Staff. Mayo clinic different types of COVID-19 vaccines: how they work. [Internet]. [Cited 2023 Dec 20]. Available from: https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/different-types-of-covid-19-vaccines/art-20506465.

[7] Kulesza W, Dolinski D, Muniak P, Grzyb T, Rizulla A. COVID-19 and a biased public mentality toward infection and vaccination: a case of unrealistic optimism and social comparisons between the vaccinated and unvaccinated. *J Pac Rim Psychol*. 2022 Sep;16:18344909221122573.

[8] King MM. Paying attention to the pandemic: knowledge of COVID-19 facts by news source and demographics. *Am Behav Sci*. 2023 Apr 3;2:00027642231156784. doi: 10.1177/0007642231156784.

[9] Majid U, Ahmad M, Zain S, Akande A, Ikhlaq F. COVID-19 vaccine hesitancy and acceptance: a comprehensive scoping review of global literature. *Health Promot Int*. 2022 Jun 1;37(3):daac078.

[10] Patterson B. As a mother, doctor understands COVID vaccine worries: 'The easiest decision you can possibly make' The advocate. 2021 Dec 13. [Cited 2023 Dec 20]. Available from: https://www.theadvocate.com/baton_rouge/news/coronavirus/as-a-mother-doctor-understands-covid-vaccine-worries-the-easiest-decision-you-can-possibly-make/article_10a729c2-5c58-11ec-9043-8f4fc0c58b44.html.

[11] vaers.hhs.gov. Vaccine Adverse Event Reporting System (VAERS). [Internet]. [Cited 2023 Dec 20]. 2024. Available from: https://vaers.hhs.gov/index.html.