

COVID-19 Vaccination Hesitancy among the General Population: A Gender-Based Review and Bibliometric Analysis

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How to cite this article: Panda M, Kundapur R, Kamble B. COVID-19 Vaccination Hesitancy among the General Population: A Gender-Based Review and Bibliometric Analysis. *Archives of Razi Institute*. 2024;79(1):33-40. DOI: [10.32592/ARI.2024.79.1.33](https://doi.org/10.32592/ARI.2024.79.1.33)



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Article Info:

Received: 31 May 2023

Accepted: 16 July 2023

Published: 29 February 2024

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ABSTRACT

December 2019 was momentous since it experienced the trajectory of another novel pathogenic HCoV recognized as 2019-nCoV in Wuhan, China, which further unfurled to all countries on the entire globe at lightning speed. The Majority of COVID-19 vaccines are being manufactured using protein subunits, viral vectors, inactivated viruses, as well as DNA and mRNA vaccine platforms. This study aimed to conduct a gender-based review of COVID-19 vaccine hesitancy among the general population and bibliometric analysis. Various articles related to COVID-19 vaccine hesitancy, either based on their title, abstract, or keywords in the search strategy, were reviewed. For COVID-19 vaccine hesitancy, we used the definition of “Reluctance to receive safe and recommended available vaccines”. Accordingly, 408 articles were included in the complete evaluation and the bibliometric analysis. Data Analysis was done using the Vos viewer Software. The strength of co-cited publications showed strong contributors from the American and Asian continents. The words with the maximum weightage based on their occurrences were female, health personnel, acceptance, social media, socio-economic factors, and ethnic groups, as covered in the red cluster. On the other hand, the Overlay Visualization on the right side, based on the total link strength of MeSH items, showed the largest clusters with items such as females, attitude to health, trust, cross-sectional studies, the acceptance of healthcare, rural population, public health, and parents, which were toward the center. The terms toward the periphery, which had less weightage, need more analysis. Greater perceived susceptibility, risk perception, benefits, and low levels of barriers and self-efficacy were the prime reasons for getting vaccinated, more specifically among females. In most instances, the female being the decision-maker of the family needs to be attended to first as she can further change the mindset of the entire family and carry the future forward.

Keywords: COVID vaccine hesitancy, Intention to vaccinate, Risk perception

1. Introduction

The 21st century saw the emergence of two highly pathogenic human Coronaviruses: the severe acute respiratory syndrome Coronavirus and the Middle East respiratory syndrome Coronavirus, which emanated from an animal reservoir, thereby causing global epidemics with startling human agony (1,2). December 2019 was momentous since it experienced the trajectory of another novel pathogenic HCoV recognized as 2019-nCoV in Wuhan, China, which further unfurled to all countries on the entire globe at lightning speed (3,4). The majority of COVID-19 vaccines are being manufactured using protein subunits, viral vectors, inactivated viruses, as well as DNA and mRNA vaccine platforms.

1.1. Challenges in Vaccination

During the initial period of the COVID-19 vaccination drive, there was a shortage of vaccine supply until the last cold chain points, especially in rural and difficult-to-reach areas, as only a few vaccine candidates were in the phase-III clinical trial and received emergency use licensing (EUL) from licensing authorities in various countries. This resulted in poor vaccination coverage during the initial period. However, the situation changed in the second half of 2021 as a larger number of vaccine candidates got EUL and the manufacturing capacities of vaccine-producing companies increased. However, the availability of the COVID-19 vaccine for everyone is still doubtful in many African and low-income countries (5).

Another important challenge is equitable and universal access to the COVID-19 vaccine. COVAX is a worldwide initiative aimed at equitable access to [COVID-19 vaccines](#), directed by the [GAVI](#) vaccine alliance, the [Coalition for Epidemic Preparedness Innovations](#), and the [World Health Organization](#) (WHO), alongside its key delivery partner [UNICEF](#). The initiative was launched to distribute and apply, in more than 100 countries, two billion doses throughout 2021 and ensure equitable immunization of 40% of the world's population, before reaching 70% in the first half of 2022. Figures aimed at curbing the pandemic. However, disaster lurked around the corner. India was hit by a sudden, devastating wave of COVID-19 infections and thus stopped exporting vaccines. This was when the Serum Institute of India (SII), the world's largest vaccine manufacturer, was to be the source of vaccines for the Gavi-COVAX mechanism. As a result, instead of two billion doses, COVAX distributed less than half of that, 900 million, throughout 2021, which led to poor coverage of COVID-19 vaccination in poor and low-income

countries. This might be responsible for the development of various new variants of COVID-19, especially in African countries (6,7).

Prior evidence suggests multipronged variables for vaccine hesitancy. Most of the time, it is the distorted perception of risk factors or risk perception among the general mass that leads to rejection. The distortion of perception can happen for multiple reasons. At times, it may be a simple lack of awareness or a state of fear of outcome that has not been clarified well, and at other times, there might be serious issues with the understanding of policy and mandates. In all such circumstances, the media plays a pivotal role. Evidence shows that a layperson decides whether to take threats seriously depending on the coverage and stress laid by the media personnel. There have been many such incidents in the past, where coincidental temporal events have been negatively associated with vaccines, and attempts to refute them have resulted in an uproar of hesitancy for that vaccine. It has been observed that the common person has an attitude of acceptance toward a particular vaccine when he feels threatened. Research has also shown an increased intention to get vaccinated with an enhancement in threat salience (8).

The situation across various regions of the world has taken a turn. The strata of social class, ethnicity, religion, troops, community associations, educational background, income lamina, and age have been found to influence the intention to get vaccinated one way or another. Studies so far have documented these as contributing significantly to the vaccine-defiant attitudes among the general population (6,9). In fact, political ideology has also been found to be an indirect strong grantor of such insolent vaccine behavior.

1.1. Present Study

This study is a gender-based review of COVID-19 vaccine coverage and a bibliometric analysis of various reasons for COVID-19 vaccine hesitancy worldwide. Even prior to COVID-19, reluctance to get vaccinated had always been a part of our concern, more so among females. The 5C framework, which was developed around this, helps to determine the levels of confidence, risk calculations, complacency, convenience, and collective responsibility. Framing the intention to get vaccinated would help in labeling various hesitant factors prevalent across different regions and strategizing the response toward it. Besides finding out the reasons for vaccine hesitancy worldwide, we also went through the linkage pattern and weightage of the published documents.

2. Materials and Methods

For the bibliometric analysis, we used search criteria for selecting various articles related to COVID-19 vaccine hesitancy, either based on their title, abstract, or keywords in the search strategy. Various databases in the medical and social sciences were used, mainly PubMed and Google Scholar. For COVID-19 vaccine hesitancy, we used the definition of “Reluctance to receive safe and recommended available vaccines” (7). Accordingly, 408 articles remained for the complete evaluation and bibliometric analysis.

Data Analysis

Data Analysis was done using the Vos viewer Software. It is a free software used for the visualization and analysis of bibliometric codes and thus helps in constructing the linkages between citations. Building on the core techniques of bibliometric analysis, the outcomes of the analysis techniques depend on three enrichment pathways that are predicated on network analysis, clustering, and visualization.

3. Results

Country: The proportion of the occupied area, as shown in shades of different colors in figure 1, gives an estimate of the share of the co-cited publications, along with the strength of linkages, based on the commonality of institutes, journals, authors, keywords, or codes. The contributors from the American and Asian continents, followed by those from Australia, have been shown to have the most documents with linkages with other countries as well.

The Network Visualization on the left side of figure matrix 2 shows the words with the maximum weightage based on their occurrences. Some of the most common words with the maximum weightage were female, health personnel, acceptance, social media, socio-economic factors, and ethnic groups, as covered in the red cluster.

The Overlay Visualization on the right side is based on the total link strength of MeSH items. Blue depicts studies toward 2020, and yellow toward 2021 and the latest. The largest clusters have items such as females, attitudes toward health, trust, cross-sectional studies, acceptance of healthcare, rural population, public health, and parents. This implies that most studies have dealt with these items in common. Less common terms toward the periphery, such as capacity building, mass vaccination, risk assessment, race, schools, and vulnerable, can be further studied and explored.

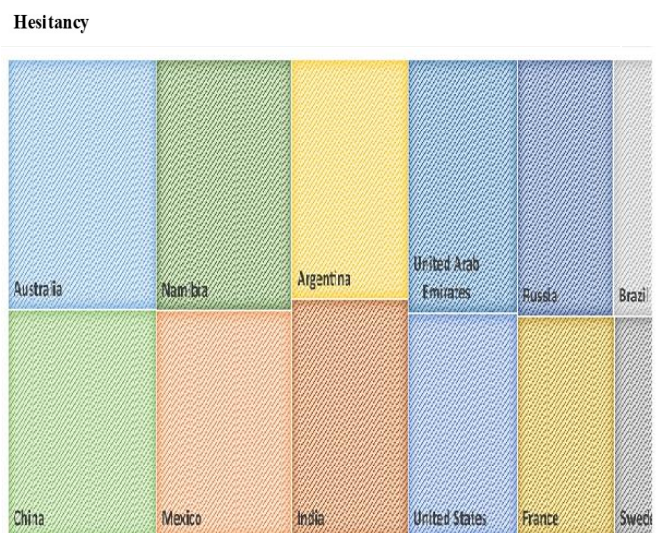
For the term co-occurrence map of textual data, using binary counting, there were 8352 terms out of which 295

met the threshold of 10 occurrences of a term. On the left side of the collated figure matrix 3, the network map shows the co-term analysis based on occurrences and relevance scores. The co-terms, such as participant, risk, response, effect, and barriers, depicted by the larger red rounds have more weightage based on their relevance scores. The other terms that surround these words and are denoted by smaller circles toward the periphery gradually take on lesser importance. Different clusters that are formed are depicted by different color circles, but all of them have the term female in common. Most of the networking or connections are found toward the central, denser part, as shown by the grey interconnecting linkages, which gradually fade toward the periphery.

The depiction on the right side of figure 3 shows the cluster density mapping based on the occurrences of these co-terms. We found that the red cluster is the densest with words such as social medium, government, policy, vaccine confidence, access, approach, disparity, and distrust, which were commonly mentioned by the US and India. On the other hand, the dense green area shows a cluster aggregation of co-terms such as healthcare workers, physicians, intention, confidence, vaccination campaigns, intention, and females. Although no association can be charted accordingly, the depictions clearly demarcate the clusters and terms that find the most mentions and weightage. On the other hand, the terms toward the periphery, which have less weightage, need more surveys.

Co-occurrence Analysis: The total strength of the co-occurrence of keywords was calculated. Based on the relevance score, which considers the weightage of the keywords, important ones with higher scores have been listed for each cluster. Most of them dealt with keywords such as female attitudes, beliefs, healthcare workers, knowledge, social determinants, safety, demand, and co-morbidities, as shown in table 1.

Fig 1: Country wise depiction of Documentation related to Covid Vaccine



| Clusters | Total Items | Important Keywords with higher occurrence |
|------------|-------------|--|
| CLUSTER 1 | 107 | Female, Acceptance, Attitudes, Beliefs, Gender, Health Belief Model, Health care workers, Knowledge, Pregnancy, Primary Health care, Social Determinants, Campaigns, Acceptance, Safety, Adolescents, Adults, Aged, Attitude of Health personals, Vaccine Demand, Nationalism, Co-morbidity, Testing, Culture, Females, Health Behaviour |
| CLUSTER 2 | 40 | Female Behaviour, Communication, Concern, Confidence, Conspiracy, Content analysis, Emotion, Fear, Infodemic, Infoveillance, Misinformation, Sentiment Analysis, social media, Willingness, Twitter, Media, Herd immunity, Information Dissemination, Patient compliance, Public opinion. |
| CLUSTER 3 | 18 | Ethnicity, Migrants, Religion, Vaccine confidence, Geography, Accessibility, Disparity, Income, Minority groups, Race, Social determinants, Time factors, Coverage, Vulnerable population |
| CLUSTER 4 | 18 | Adolescent, Anti-vaccine movement, Health Equity, Policy, Intentions, Parents, Refusal, Caregivers, Government, Primary Care |
| CLUSTER 5 | 15 | Adverse Reactions, Efficacy, Data Mining, Communication, Health education, Mass media, Religion, Schools, Trust |
| CLUSTER 6 | 10 | Education, Herd Immunity, Infection, Prevention, Anxiety, Fear, Primary Prevention, VPDs |
| CLUSTER 7 | 9 | Cohort, Developing countries, Hospitalization, Reproducibility, Vaccine Resistance |
| CLUSTER 8 | 8 | Global Health, Health Promotion, Prevalence, Probability, Migrants, Uncertainty, WHO |
| CLUSTER 9 | 8 | Survey, Vaccine Uptake, Young Adults, Motivation, Preference, Students |
| CLUSTER 10 | 7 | Epidemiology, Vaccine attitudes, Capacity Building, Cooperative Behaviour, Health care Delivery, Health Policy, Pandemic |
| CLUSTER 11 | 6 | Conspiracy Belief, Media, Public Trust, Vaccines |
| CLUSTER 12 | 5 | Decision Making, Risk factors, Self-Report |
| CLUSTER 13 | 5 | Public Policy, Social Norms, Persuasive Communication |

Table 1: Total Clusters formed and Co-Occurrence Analysis of important keywords

Fig Matrix 2: Keyword Occurrences and Link Strength related to studies on COVID Vaccine Hesitancy

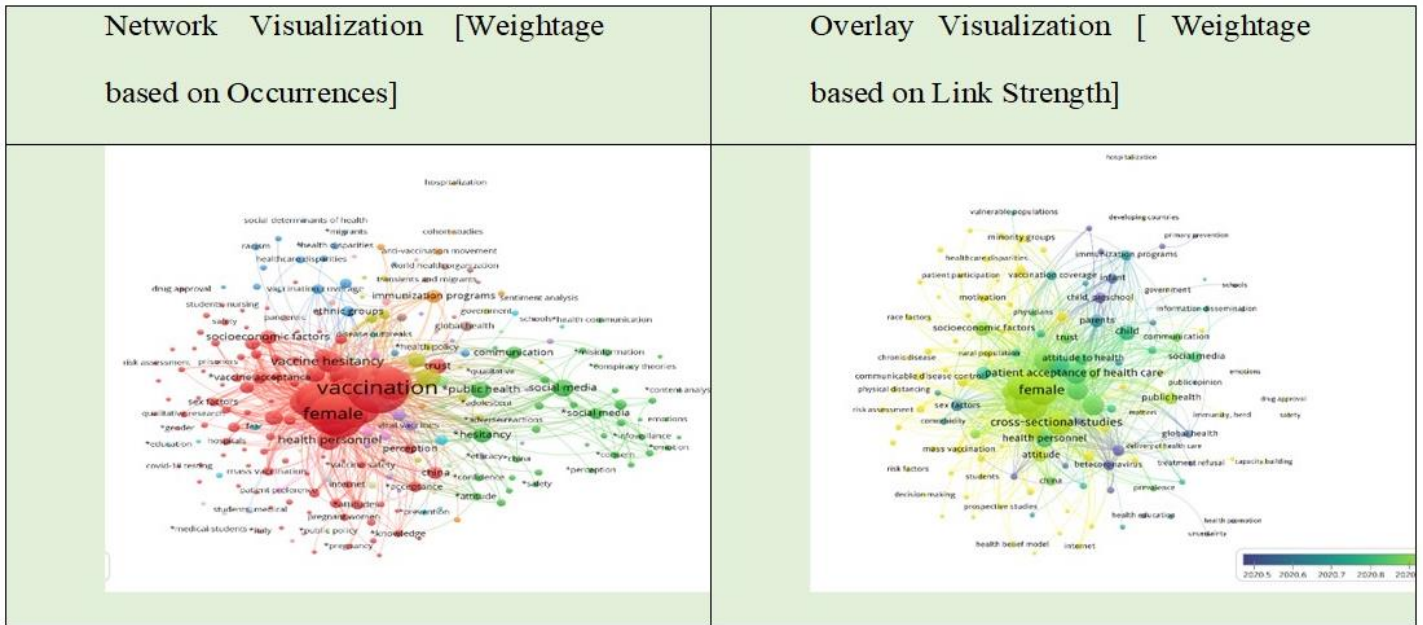
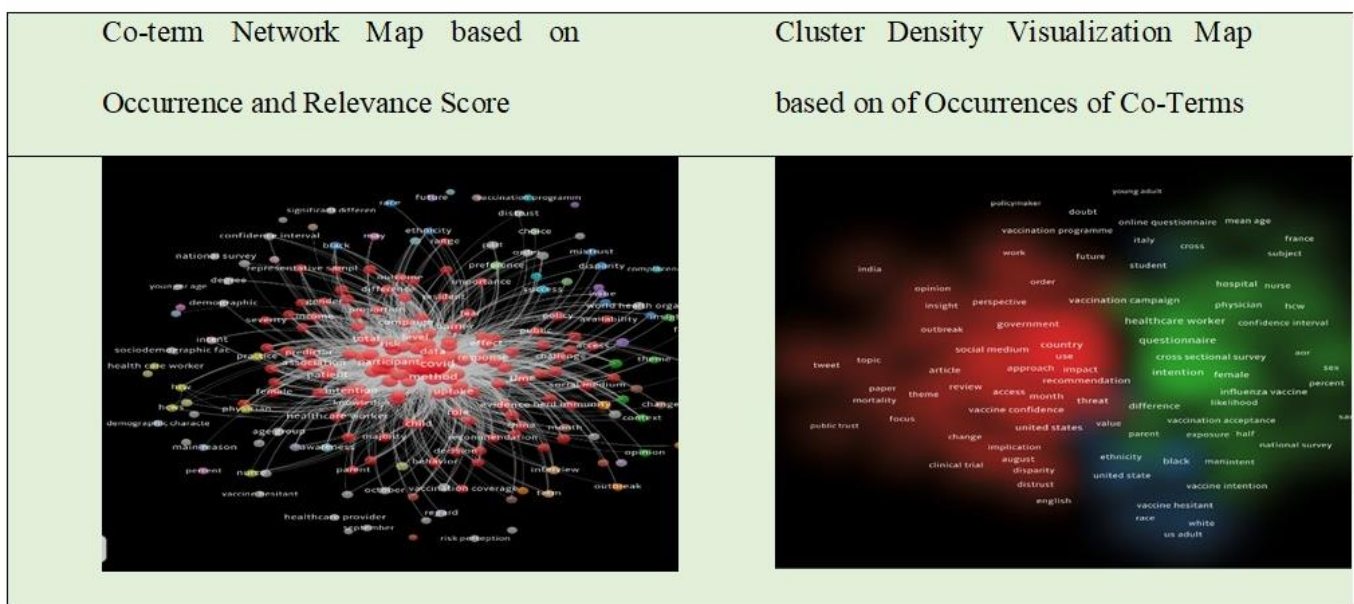


Figure Matrix 3: Term Co-Occurrence Mapping of Textual Data



4. Discussion

With the emergence of newer strains, it is particularly anticipated that the role of vaccination as the greatest preventive tool will double. Of particular interest is the fact that full vaccination coverage reduces severity and fatality and gives an appreciable amount of time for recovery. In all instances, it has been observed that the intention to get vaccinated matters the most. Strong intentions to get vaccinated arise either from an inbuilt fear among people or from some mandatory government guidelines that might impair their functioning. Tagging the omicron as mild might have led to this worse edge of not creating or dissuading the intention to get vaccinated (10). Complacency might result in more inequalities and incidents of vaccine hesitancy. The storyline of vaccine hesitancy will give an idea of what and where to intervene. A concerted effort toward the elimination of the defying factors might help us take positive strides toward vaccination and bridge this inequity gap. Greater perceived susceptibility, benefits, and cues to actions, as well as low levels of barriers and self-efficacy, were the prime reasons a person would become willing to receive vaccination, more specifically among females (11,12). Around 33% of healthcare staff in Italy declared refusal. They were mostly using Facebook and had conflicting thoughts about vaccination. Investing in vaccine education and health promotion through proper channels of communication was the most crucial (13). Younger ages (aOR=9.3), single individuals (aOR=4.97), lower-income people (aOR= 2.8), and nurses (aOR = 0.3) more than doctors (aOR = 0.2) were associated with higher vaccine-defying behavior, compared to their counterparts in the study done in Nigeria (14). However, Abedin et al. in Bangladesh described that the intent to get vaccinated was significantly lower among the elderly, rural and slum dwellers, day laborers, co-morbid people, homemakers, and farmers. This difference in choices across continents might be a result of beliefs in health infrastructure, as well as government policies and dealings. Considering the gradual plateauing of the

rates of vaccination among the masses, it becomes very important to consider the outcome of perceiving desired benefits across each age group. The female being the decision-maker of the family in most instances needs to be attended to first as she can further change the mindset of the entire family. Findings in our study are also more or less consistent with the results in Kuwait, Israel, France, China, and India, which show good acceptance rates for vaccination, along with the reasons for hesitancy (15,16). Most of the studies conducted so far belonged to developed nations. The first global-level study of 19 nations by Lazarus et al. (2021) found that respondents from China were the most certain to take up the approved vaccine, whereas those from Russia were the least interested. Age, economic status, and education level were strong predictors (17). Moreover, the bibliometric analysis can be a tool for tracking quality research related to vaccine hesitancy worldwide. At a global level, hesitancy factors become more dispersed, although our cluster co-occurrence analysis showed otherwise. Local factors that are contributing more to hesitant factors have more to do with the underlying reasons. Although there are many articles, there are marked inequalities considering gender, specific regions, health infrastructures, media coverage, and attitudes. For this, the retaliation needs a graded scaled-up approach instead of a common response for all. Networking among authors and institutions is yet another area that was dim, and institutes need more collaboration to be able to capture the real screenplay. The Hub and Spoke model to reach interiors will be a better model for a comeback. Vaccine education depends a lot on apt media coverage, and for improved settings, we require adequate finance and institution building for better collaboration, coordination, and linkages.

Authors' Contribution

MP and RK contributed with the design, intellectual content and data acquisition. MP, RK and BK did the literature search, data analysis, manuscript preparation

and editing. RK and BK contributed for the review. MP shall be the guarantor.

Ethics

The study did not receive any funding. Necessary ethical formalities as part of a project have been maintained under AIIMS Bibinagar, Hyderabad; Institute Ethics Committee.

Conflict of Interest

There is no conflict of interest in our knowledge.

Acknowledgment

I would acknowledge Dr. Shasanka Shekhar Panda from Paediatric Surgery, AIIMS Hyderabad for his help in software application.

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