

The 100 Most-Cited Articles in COVID-19 Vaccine Hesitancy Based on Web of Science: A Bibliometric Analysis

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Purpose: To perform a bibliometric analysis of the 100 most-cited articles (T100 articles) on COVID-19 vaccine hesitancy to characterize current trends.

Methods: The data of the bibliometric analysis were retrieved from the Web of Science Core Collection (WoSCC) database on January 29, 2023, and the results were sorted in descending order by citations. Two researchers independently extracted the characteristics of the top 100 cited articles, including title, author, citations, publication year, institution, country, author keywords, Journal Cited Rank, and impact factor. Excel and VOSviewer were used to analyze the data.

Results: The T100 articles ranged from 79 to 1125 citations, with a mean of 208.75. The T100 articles were contributed by 29 countries worldwide, of which the USA ranked first with 28 articles and 5417 citations. The T100 articles were published in 61 journals; the top three citations were *VACCINES*, *NATURE MEDICINE*, and *EUROPEAN JOURNAL OF EPIDEMIOLOGY*, and the number of citations was 2690, 1712, and 1644, respectively. Professor Sallam, M(n=4) from Jordan, is the author who participated in the most published articles. Catholic University of the Sacred Heart (n=8) had the most T100 articles.

Conclusion: It is the first bibliometric analysis of the T100 articles in the field of COVID-19 vaccine hesitancy. We carefully analyzed and described the characteristics of these T100 articles, which provide ideas for further strengthening COVID-19 vaccination and fighting against the epidemic in the future.

Keywords: COVID-19, vaccine hesitancy, bibliometric analysis, citation

Introduction

This year marks the fourth year of the Coronavirus Disease 2019 (COVID-19) epidemic, which has had a massive impact on the public health, production, and economies of countries around the world. Vaccination is known to be the most cost-efficient way to prevent infectious diseases and prevent the spread of epidemics.^{1,2} However, vaccine hesitancy is a growing and significant barrier to vaccination. Vaccine hesitancy is defined as a delay in acceptance or refusal of vaccines,^{3,4} despite the availability of vaccine services. Some studies indicate that vaccine hesitancy is influenced by several factors, including but not limited to confidence, complacency, and convenience.^{5–7} In addition, the COVID-19 vaccine is a novel product, and there may be greater hesitancy with a new vaccine than with other vaccines that are well known. COVID-19 vaccine hesitancy is prevalent worldwide, although the rates vary across countries/regions. A cross-sectional survey of community-based research in Turkey showed that 45.3% of participants hesitated to receive the COVID-19 vaccine.⁸ The Freeman et al⁹ study showed that COVID-19 vaccine hesitancy is up to 28.3% in the UK. In addition, many studies have shown that social media significantly impacts vaccine hesitancy. Misinformation, scandal, or

negative emotions can reduce people's confidence in vaccines, leading to high vaccine hesitancy rates.^{10–14} Choudhary et al¹⁵ report that vaccine hesitancy is reportedly a widespread challenge in India, particularly in rural areas, due to misinformation and mistrust. On August 31st, 2022, the US Food and Drug Administration (FDA) granted emergency authorization to use Pfizer and Moderna's bivalent COVID-19 vaccines. The experts strongly recommend receiving a booster dose with a bivalent COVID-19 vaccine if you are eligible for one to ensure you are protected against the current circulating variants of the virus.¹⁶ However, Pfizer was reported by the media recently to have produced a COVID-19 variant virus, which has generated much discussion. Whether this is true remains to be seen, but it will undoubtedly impact the COVID-19 vaccination.

Several theories or tools have been used to analyze factors contributing to vaccine hesitancy. Such as the Health Belief Model (HBM),¹⁷ Protective Motivation Theory (PMT),¹⁸ Theory of Planned Behavior (TPB),¹⁹ 3Cs model, MoVac-COVID19S,^{20–22} DrVac-COVID19S,^{23,24} VAX scale,²⁵ VHS scale²⁶ and Vaccine Conspiracy Beliefs Scale (VCBS),²⁷ etc. These tools and theories provide a comprehensive understanding of the underlying factors behind vaccine hesitancy, enabling public health officials to develop tailored interventions to address vaccine hesitancy and promote vaccine uptake. On the other hand, some countries/regions also call for multiple vaccinations to ensure that the body's immune system has a continuous defensive role against COVID-19. For example, China implemented 10 new epidemic prevention measures last December, which have significantly impacted both domestically and internationally. Thus, a fourth dose of the COVID-19 vaccine has been called for in China.

Citation analysis is a critical component of bibliometric analysis, which is an important method for assessing the impact of research articles.²⁸ In the context of our rapidly evolving and complex social landscape, coupled with the significant variability in COVID-19 vaccine coverage across countries/regions, it is imperative to identify and review critical articles in the field. It will allow us to improve our understanding of the field and assess the potential impact of such articles on future research directions.

Methods

The study was a retrospective bibliometric analysis, and there was no need for institutional review board approval.

Data Extraction

The Web of Science Core Collection (<https://www.webofscience.com/wos/>) was searched on January 29, 2023, for all COVID-19 vaccine hesitancy-related articles, and the results were sorted in descending order according to their citations. The search strategy is as follows: $(TS=(COVID-19) OR TS=(Corona Virus Disease 2019) OR TS=(SARS-CoV-2) OR TS=(2019-nCoV)) AND (TS=(Vaccine hesitancy))$. Inclusion criteria: The literature topic is related to COVID-19 vaccine hesitancy. Exclusion criteria: animal literature, book chapters, book reviews, conferences. Two researchers carefully and independently used the same search strategy to search and review the abstracts or full texts of the retrieved articles in several rounds, excluding articles unrelated to COVID-19 vaccine hesitancy. In case of ambiguity, a third researcher would judge again to resolve the disagreement. After screening out the T100 articles, a pre-established data collection form was used to collect the following information: Title, author, journal, author keywords, publication year, institution, country (subject to the first author), Journal Citation Reports (JCR Q1–Q4), the impact factor (IF), citation number, article type, the average number of citations.

Statistical Analysis

Microsoft EXCEL 2019 calculated descriptive statistical analysis, including title, years, journal, country (subject to the first author), total citation, average citation, and IF. In addition, using Microsoft Excel to analyze the T100 articles' characteristics, we classified North Ireland, Wales, and England into the UK. The T100 articles categories and document types were analyzed by the "Analyze Results" function module in Web of Science. VOSviewer1.6.18 was used for Visual analysis, including the co-countries/regions network, co-institutions network, and the T100 articles source. Nodes represented specific elements such as country, author, or institution. The size of the node indicated the quantity or frequency of publication. The larger the node, the more often the element was present. A line between nodes meant that these appeared together in an article in the T100. The thicker the line, the more often they appeared together.

Results

Characteristics of the T100 Articles

A total of 3167 COVID-19 vaccine hesitancy-related articles fit the Web of Science search strategy, and the T100 articles were sorted in descending based on the number of their citations (Table 1). The T100 articles ranged from 79 to 1125

Table 1 Top 100 Articles Cited Article in COVID-19 Vaccine Hesitancy

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|-----------------|---|-------------------------------------|-------------------|-----------------|---------|
| 1 | Lazarus, JV | A global survey of potential acceptance of a COVID-19 vaccine | NATURE MEDICINE | 2021 | 1225 | Spain |
| 2 | Dror, AA | Vaccine hesitancy: the next challenge in the fight against COVID-19 | EUROPEAN JOURNAL OF EPIDEMIOLOGY | 2020 | 798 | Israel |
| 3 | Sallam, M | COVID-19 Vaccine Hesitancy Worldwide: A Concise Systematic Review of Vaccine Acceptance Rates | VACCINES | 2021 | 749 | Jordan |
| 4 | Fisher, KA | Attitudes Toward a Potential SARS-CoV-2 Vaccine A Survey of US Adults | ANNALS OF INTERNAL MEDICINE | 2020 | 626 | USA |
| 5 | Murphy, J | Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom | NATURE COMMUNICATIONS | 2021 | 527 | UK |
| 6 | Loomba, S | Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA | NATURE HUMAN BEHAVIOUR | 2021 | 459 | UK |
| 7 | Khubchandani, J | COVID-19 Vaccination Hesitancy in the United States: A Rapid National Assessment | JOURNAL OF COMMUNITY HEALTH | 2021 | 450 | USA |
| 8 | Puri, N | Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases | HUMAN VACCINES & IMMUNOTHERAPEUTICS | 2020 | 379 | Canada |
| 9 | Kreps, S | Factors Associated With US Adults' Likelihood of Accepting COVID-19 Vaccination | JAMA NETWORK OPEN | 2020 | 371 | USA |
| 10 | Roozenbeek, J | Susceptibility to misinformation about COVID-19 around the world | ROYAL SOCIETY OPEN SCIENCE | 2020 | 368 | UK |
| 11 | Sherman, SM | COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey | HUMAN VACCINES & IMMUNOTHERAPEUTICS | 2021 | 361 | UK |
| 12 | Lin, C | Confidence and Receptivity for COVID-19 Vaccines: A Rapid Systematic Review | VACCINES | 2021 | 346 | USA |

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Table I (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|-------------------|---|--|-------------------|-----------------|--------------|
| 13 | Schwarzinger, M | COVID-19 vaccine hesitancy in a representative working-age population in France: a survey experiment based on vaccine characteristics | LANCET PUBLIC HEALTH | 2021 | 345 | France |
| 14 | Kwok, KO | Editor's Choice: Influenza vaccine uptake, COVID-19 vaccination intention and vaccine hesitancy among nurses: A survey | INTERNATIONAL JOURNAL OF NURSING STUDIES | 2021 | 320 | China |
| 15 | Detoc, M | Intention to participate in a COVID-19 vaccine clinical trial and to get vaccinated against COVID-19 in France during the pandemic | VACCINE | 2020 | 319 | France |
| 16 | Lin, YL | Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China | PLOS NEGLECTED TROPICAL DISEASES | 2020 | 305 | China |
| 17 | Arce, JSS | COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries | NATURE MEDICINE | 2021 | 299 | Germany |
| 18 | Al-Mohaithef, M | Determinants of COVID-19 Vaccine Acceptance in Saudi Arabia: A Web-Based National Survey | JOURNAL OF MULTIDISCIPLINARY HEALTHCARE | 2020 | 296 | Saudi Arabia |
| 19 | Wilson, SL | Social media and vaccine hesitancy | BMJ GLOBAL HEALTH | 2020 | 291 | USA |
| 20 | Gagneux-Brunon, A | Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey | JOURNAL OF HOSPITAL INFECTION | 2021 | 290 | France |
| 21 | Troiano, G | Vaccine hesitancy in the era of COVID-19 | PUBLIC HEALTH | 2021 | 289 | Italy |
| 22 | Sallam, M | High Rates of COVID-19 Vaccine Hesitancy and Its Association with Conspiracy Beliefs: A Study in Jordan and Kuwait among Other Arab Countries | VACCINES | 2021 | 289 | Jordan |
| 23 | Peretti-Watel, P | A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicisation | LANCET INFECTIOUS DISEASES | 2020 | 288 | France |
| 24 | Freeman, D | COVID-19 vaccine hesitancy in the UK: the Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II | PSYCHOLOGICAL MEDICINE | 2022 | 283 | UK |
| 25 | Freeman, D | Injection fears and COVID-19 vaccine hesitancy | PSYCHOLOGICAL MEDICINE | 2021 | 283 | UK |

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Table I (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|---------------|--|--|-------------------|-----------------|----------|
| 26 | Ruiz, JB | Predictors of intention to vaccinate against COVID-19: Results of a nationwide survey | VACCINE | 2021 | 274 | USA |
| 27 | Chou, WYS | Considering Emotion in COVID-19 Vaccine Communication: Addressing Vaccine Hesitancy and Fostering Vaccine Confidence | HEALTH COMMUNICATION | 2020 | 269 | USA |
| 28 | Robertson, E | Predictors of COVID-19 vaccine hesitancy in the UK household longitudinal study | BRAIN BEHAVIOR AND IMMUNITY | 2021 | 251 | UK |
| 29 | Pogue, K | Influences on Attitudes Regarding Potential COVID-19 Vaccination in the United States | VACCINES | 2020 | 234 | USA |
| 30 | Wang, KL | Intention of nurses to accept coronavirus disease 2019 vaccination and change of intention to accept seasonal influenza vaccination during the coronavirus disease 2019 pandemic: A cross-sectional survey | VACCINE | 2020 | 229 | China |
| 31 | Palamenghi, L | Mistrust in biomedical research and vaccine hesitancy: the forefront challenge in the battle against COVID-19 in Italy | EUROPEAN JOURNAL OF EPIDEMIOLOGY | 2020 | 227 | Italy |
| 32 | Barello, S | "Vaccine hesitancy" among university students in Italy during the COVID-19 pandemic | EUROPEAN JOURNAL OF EPIDEMIOLOGY | 2020 | 223 | Italy |
| 33 | Nzaji, MK | Acceptability of Vaccination Against COVID-19 Among Healthcare Workers in the Democratic Republic of the Congo | PRAGMATIC AND OBSERVATIONAL RESEARCH | 2020 | 223 | Congo |
| 34 | Soares, P | Factors Associated with COVID-19 Vaccine Hesitancy | VACCINES | 2021 | 221 | Portugal |
| 35 | Lucia, VC | COVID-19 vaccine hesitancy among medical students | JOURNAL OF PUBLIC HEALTH | 2021 | 217 | USA |
| 36 | Harrison, EA | Vaccine confidence in the time of COVID-19 | EUROPEAN JOURNAL OF EPIDEMIOLOGY | 2020 | 211 | USA |
| 37 | Karlsson, LC | Fearing the disease or the vaccine: The case of COVID-19 | PERSONALITY AND INDIVIDUAL DIFFERENCES | 2021 | 201 | Finland |
| 38 | Robinson, E | International estimates of intended uptake and refusal of COVID-19 vaccines: A rapid systematic review and meta-analysis of large nationally representative samples | VACCINE | 2021 | 197 | UK |

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Table I (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|-----------------|---|---|-------------------|-----------------|--------------|
| 39 | Verger, P | Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020 | EUROSURVEILLANCE | 2021 | 196 | France |
| 40 | Machingaidze, S | Understanding COVID-19 vaccine hesitancy | NATURE MEDICINE | 2021 | 188 | South Africa |
| 41 | Caserotti, M | Associations of COVID-19 risk perception with vaccine hesitancy over time for Italian residents | SOCIAL SCIENCE & MEDICINE | 2021 | 187 | Italy |
| 42 | Biswas, N | The Nature and Extent of COVID-19 Vaccination Hesitancy in Healthcare Workers | JOURNAL OF COMMUNITY HEALTH | 2021 | 186 | USA |
| 43 | Skjefte, M | COVID-19 vaccine acceptance among pregnant women and mothers of young children: results of a survey in 16 countries | EUROPEAN JOURNAL OF EPIDEMIOLOGY | 2021 | 185 | USA |
| 44 | Fridman, A | COVID-19 and vaccine hesitancy: A longitudinal study | PLOS ONE | 2021 | 183 | USA |
| 45 | Bogart, LM | COVID-19 Related Medical Mistrust, Health Impacts, and Potential Vaccine Hesitancy Among Black Americans Living With HIV | JAIDS-JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES | 2021 | 177 | USA |
| 46 | Razai, MS | Covid-19 vaccine hesitancy among ethnic minority groups | BMJ-BRITISH MEDICAL JOURNAL | 2021 | 169 | UK |
| 47 | Goldman, RD | Caregiver willingness to vaccinate their children against COVID-19: Cross sectional survey | VACCINE | 2020 | 164 | Canada |
| 48 | Saied, SM | Vaccine hesitancy: Beliefs and barriers associated with COVID-19 vaccination among Egyptian medical students | JOURNAL OF MEDICAL VIROLOGY | 2021 | 160 | Egypt |
| 49 | Taylor, S | A Proactive Approach for Managing COVID-19: The Importance of Understanding the Motivational Roots of Vaccination Hesitancy for SARS-CoV2 | FRONTIERS IN PSYCHOLOGY | 2020 | 160 | Canada |
| 50 | El-Elimat, T | Acceptance and attitudes toward COVID-19 vaccines: A cross-sectional study from Jordan | PLOS ONE | 2021 | 158 | Jordan |
| 51 | Ward, JK | The French public's attitudes to a future COVID-19 vaccine: The politicization of a public health issue | SOCIAL SCIENCE & MEDICINE | 2020 | 158 | France |

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Table 1 (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|--------------|--|---|-------------------|-----------------|-----------------|
| 52 | Latkin, CA | Trust in a COVID-19 vaccine in the US: A social-ecological perspective | SOCIAL SCIENCE & MEDICINE | 2021 | 146 | USA |
| 53 | Edwards, B | COVID-19 vaccine hesitancy and resistance: Correlates in a nationally representative longitudinal survey of the Australian population | PLOS ONE | 2021 | 145 | Australia |
| 54 | Riad, A | Prevalence of COVID-19 Vaccine Side Effects among Healthcare Workers in the Czech Republic | JOURNAL OF CLINICAL MEDICINE | 2021 | 141 | Czech Republic. |
| 55 | Islam, MS | COVID-19 vaccine rumors and conspiracy theories: The need for cognitive inoculation against misinformation to improve vaccine adherence | PLOS ONE | 2021 | 135 | Australia |
| 56 | Machida, M | Acceptance of a COVID-19 Vaccine in Japan during the COVID-19 Pandemic | VACCINES | 2021 | 134 | Japan |
| 57 | Yoda, T | Willingness to Receive COVID-19 Vaccination in Japan | VACCINES | 2021 | 134 | Japan |
| 58 | Cascini, F | Attitudes, acceptance and hesitancy among the general population worldwide to receive the COVID-19 vaccines and their contributing factors: A systematic review | ECLINICALMEDICINE | 2021 | 130 | Italy |
| 59 | Wang, KL | Change of Willingness to Accept COVID-19 Vaccine and Reasons of Vaccine Hesitancy of Working People at Different Waves of Local Epidemic in Hong Kong, China: Repeated Cross-Sectional Surveys | VACCINES | 2021 | 129 | China |
| 60 | Aw, J | COVID-19 Vaccine Hesitancy-A Scoping Review of Literature in High-Income Countries | VACCINES | 2021 | 128 | Singapore |
| 61 | Khan, YH | Threat of COVID-19 Vaccine Hesitancy in Pakistan: The Need for Measures to Neutralize Misleading Narratives | AMERICAN JOURNAL OF TROPICAL MEDICINE AND HYGIENE | 2020 | 118 | Arabia |
| 62 | Bendau, A | COVID-19 vaccine hesitancy and related fears and anxiety | INTERNATIONAL IMMUNOPHARMACOLOGY | 2021 | 116 | Germany |
| 63 | Bono, SA | Factors Affecting COVID-19 Vaccine Acceptance: An International Survey among Low-and Middle-Income Countries | VACCINES | 2021 | 113 | Malaysia |

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Table I (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|------------------|--|---|-------------------|-----------------|---------|
| 64 | Head, KJ | A National Survey Assessing SARS-CoV-2 Vaccination Intentions: Implications for Future Public Health Communication Efforts | SCIENCE COMMUNICATION | 2020 | 112 | USA |
| 65 | Jennings, W | Lack of Trust, Conspiracy Beliefs, and Social Media Use Predict COVID-19 Vaccine Hesitancy | VACCINES | 2021 | 111 | UK |
| 66 | Blakeway, H | COVID-19 vaccination during pregnancy: coverage and safety | AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY | 2022 | 110 | UK |
| 67 | Qattan, AMN | Acceptability of a COVID-19 Vaccine Among Healthcare Workers in the Kingdom of Saudi Arabia | FRONTIERS IN MEDICINE | 2021 | 108 | Arabia |
| 68 | Latkin, CA | Mask usage, social distancing, racial, and gender correlates of COVID-19 vaccine intentions among adults in the US | PLOS ONE | 2021 | 107 | USA |
| 69 | Willis, DE | COVID-19 vaccine hesitancy: Race/ethnicity, trust, and fear | CTS-CLINICAL AND TRANSLATIONAL SCIENCE | 2021 | 106 | USA |
| 70 | Viswanath, K | Individual and social determinants of COVID-19 vaccine uptake | BMC PUBLIC HEALTH | 2021 | 106 | USA |
| 71 | Dzieciolowska, S | Covid-19 vaccine acceptance, hesitancy, and refusal among Canadian healthcare workers: A multicenter survey | AMERICAN JOURNAL OF INFECTION CONTROL | 2021 | 105 | Canada |
| 72 | Schoch-Spana, M | The public's role in COVID-19 vaccination: Human-centered recommendations to enhance pandemic vaccine awareness, access, and acceptance in the United States | VACCINE | 2021 | 102 | USA |
| 73 | Kashte, S | COVID-19 vaccines: rapid development, implications, challenges and future prospects | HUMAN CELL | 2021 | 102 | India |
| 74 | Coustasse, A | COVID-19 and Vaccine Hesitancy A Challenge the United States Must Overcome | JOURNAL OF AMBULATORY CARE MANAGEMENT | 2021 | 102 | USA |
| 75 | Graffigna, G | Relationship between Citizens' Health Engagement and Intention to Take the COVID-19 Vaccine in Italy: A Mediation Analysis | VACCINES | 2020 | 102 | Italy |

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Table I (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|---------------|---|---|-------------------|-----------------|-------------|
| 76 | Alqudeimat, Y | Acceptance of a COVID-19 Vaccine and Its Related Determinants among the General Adult Population in Kuwait | MEDICAL PRINCIPLES AND PRACTICE | 2021 | 101 | Kuwait |
| 77 | Al-Qerem, WA | COVID-19 Vaccination Acceptance and Its Associated Factors Among a Middle Eastern Population | FRONTIERS IN PUBLIC HEALTH | 2021 | 101 | Jordan |
| 78 | Freeman, D | Effects of different types of written vaccination information on COVID-19 vaccine hesitancy in the UK (OCEANS-III): a randomised controlled trial | LANCET PUBLIC HEALTH | 2021 | 100 | UK |
| 79 | Chu, HR | Integrating health behavior theories to predict American's intention to receive a COVID-19 vaccine | PATIENT EDUCATION AND COUNSELING | 2021 | 99 | USA |
| 80 | Germani, F | The anti-vaccination infodemic on social media: A behavioral analysis | PLOS ONE | 2021 | 98 | Switzerland |
| 81 | Rutten, LJF | Evidence-Based Strategies for Clinical Organizations to Address COVID-19 Vaccine Hesitancy | MAYO CLINIC PROCEEDINGS | 2021 | 98 | USA |
| 82 | Ayhan, SG | COVID-19 vaccine acceptance in pregnant women | INTERNATIONAL JOURNAL OF GYNECOLOGY & OBSTETRICS | 2021 | 97 | Turkey |
| 83 | Verger, P | Restoring confidence in vaccines in the COVID-19 era | EXPERT REVIEW OF VACCINES | 2020 | 95 | France |
| 84 | Li, M | Healthcare workers' (HCWs) attitudes and related factors towards COVID-19 vaccination: a rapid systematic review | POSTGRADUATE MEDICAL JOURNAL | 2021 | 94 | China |
| 85 | Abedin, M | Willingness to vaccinate against COVID-19 among Bangladeshi adults: Understanding the strategies to optimize vaccination coverage | PLOS ONE | 2021 | 92 | Bangladesh |
| 86 | Yigit, M | Evaluation of COVID-19 Vaccine Refusal in Parents | PEDIATRIC INFECTIOUS DISEASE JOURNAL | 2021 | 91 | Turkey |
| 87 | Kaplan, RM | Influence of a COVID-19 vaccine's effectiveness and safety profile on vaccination acceptance | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA | 2021 | 90 | USA |
| 88 | Chen, MS | An online survey of the attitude and willingness of Chinese adults to receive COVID-19 vaccination | HUMAN VACCINES & IMMUNOTHERAPEUTICS | 2021 | 87 | China |

(Continued)

Table I (Continued).

| Rank | First Author | Title | Journal | Publication Years | Total citations | Country |
|------|----------------|---|---|-------------------|-----------------|--------------|
| 89 | Wang, W | Global, regional, and national estimates of target population sizes for covid-19 vaccination: descriptive study | BMJ-BRITISH MEDICAL JOURNAL | 2020 | 86 | China |
| 90 | Dai, HC | Behavioural nudges increase COVID-19 vaccinations | NATURE | 2021 | 85 | USA |
| 91 | Di Gennaro, F | Attitudes towards Anti-SARS-CoV2 Vaccination among Healthcare Workers: Results from a National Survey in Italy | VIRUSES-BASEL | 2021 | 85 | Italy |
| 92 | Joshi, A | Predictors of COVID-19 Vaccine Acceptance, Intention, and Hesitancy: A Scoping Review | FRONTIERS IN PUBLIC HEALTH | 2021 | 83 | USA |
| 93 | Wiysonge, CS | Vaccine hesitancy in the era of COVID-19: could lessons from the past help in divining the future? | HUMAN VACCINES & IMMUNOTHERAPEUTICS | 2022 | 83 | South Africa |
| 94 | Mercadante, AR | Will they, or Will not they? Examining patients' vaccine intention for flu and COVID-19 using the Health Belief Model | RESEARCH IN SOCIAL & ADMINISTRATIVE PHARMACY | 2021 | 82 | USA |
| 95 | Al-Amer, R | COVID-19 vaccination intention in the first year of the pandemic: A systematic review | JOURNAL OF CLINICAL NURSING | 2022 | 82 | Jordan |
| 96 | Klugar, M | Side Effects of mRNA-Based and Viral Vector-Based COVID-19 Vaccines among German Healthcare Workers | BIOLOGY-BASEL | 2021 | 81 | Germany |
| 97 | Kourlaba, G | Willingness of Greek general population to get a COVID-19 vaccine | GLOBAL HEALTH RESEARCH AND POLICY | 2021 | 81 | Greece |
| 98 | Vergara, RJD | Building public trust: a response to COVID-19 vaccine hesitancy predicament | JOURNAL OF PUBLIC HEALTH | 2021 | 80 | Philippines |
| 99 | Szilagy, PG | Parents' Intentions and Perceptions About COVID-19 Vaccination for Their Children: Results From a National Survey | PEDIATRICS | 2021 | 79 | USA |
| 100 | Sallam, M | Low COVID-19 Vaccine Acceptance Is Correlated with Conspiracy Beliefs among University Students in Jordan | INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH | 2021 | 79 | Jordan |

citations; the total number of citations reached 20875, with a mean of 208.75. The publication years were concentrated in 2021 (n=71). Only one article was cited more than 1000 times, written by Lazarus, JV, and published in *NATURE MEDICINE* in 2021, describing potential COVID-19 vaccine acceptance and influence factors.

A total of 29 countries participated in the T100 articles, of which 8 countries had ≥ 3 T100 articles (Table 2). The USA ranked first with 28 T100 articles and 5417 citations. The UK ranked second with 12 T100 articles and 3229 citations,

Table 2 Countries of Origin of the T100

| Country | Total Citations | Articles | Average Citations/Article |
|-----------------|-----------------|----------|---------------------------|
| USA | 5417 | 28 | 193 |
| UK | 3219 | 12 | 268 |
| France | 1691 | 7 | 242 |
| Jordan | 1458 | 6 | 243 |
| China | 1250 | 7 | 179 |
| Italy | 1243 | 7 | 178 |
| Spain | 1225 | 1 | 1225 |
| Canada | 808 | 4 | 202 |
| Israel | 798 | 1 | 798 |
| Germany | 496 | 3 | 165 |
| Saudi Arabia | 296 | 1 | 296 |
| Australia | 280 | 2 | 140 |
| South Africa | 271 | 2 | 136 |
| Japan | 268 | 2 | 134 |
| Arabia | 226 | 2 | 113 |
| Congo | 223 | 1 | 223 |
| Portugal | 221 | 1 | 221 |
| Finland | 201 | 1 | 201 |
| Turkey | 188 | 2 | 94 |
| Egypt | 160 | 1 | 160 |
| Czech Republic. | 141 | 1 | 141 |
| Singapore | 128 | 1 | 128 |
| Malaysia | 113 | 1 | 113 |
| India | 102 | 1 | 102 |
| Kuwait | 101 | 1 | 101 |
| Switzerland | 98 | 1 | 98 |
| Bangladesh | 92 | 1 | 92 |
| Greece | 81 | 1 | 81 |
| Philippines | 80 | 1 | 80 |

followed by France (1691 citations), China (1250 citations), and Italy (1243 citations), tied for third with 7 T100 articles. For information on all countries of T100 articles can be found in [Table 2](#).

The T100 articles were published in 61 different journals. The *VACCINES* published the most T100 articles and had 2690 citations, followed by *PLOS ONE*, with 7 T100 articles and 918 citations. *VACCINE* ranked third, with 6 T100 articles and 1285 citations. The journal of Quartile in category was mainly distributed in Q1–Q3, including 36 journals in Q1, 16 in Q2, and 5 in Q3. In addition, 3 journals were not in the 2021 edition of JCR. The impact factors of the journals ranged from 2.1322–96.2167, and the number of citations ranged from 79–2690. The *ANNALS OF INTERNAL MEDICINE* has the most average citations per article, with 626 citations ([Table 3](#)).

Table 3 Journals Publishing the Top 100

| Journal | Articles | IF (2021) | Quartile in Category | Total Citations | Average Citations/Article |
|--|----------|-----------|----------------------|-----------------|---------------------------|
| VACCINES | 12 | 4.9608 | Q2 | 2690 | 224 |
| PLOS ONE | 7 | 3.7521 | Q2 | 918 | 131 |
| VACCINE | 6 | 4.1686 | Q3 | 1285 | 214 |
| EUROPEAN JOURNAL OF EPIDEMIOLOGY | 5 | 12.442 | Q1 | 1644 | 329 |
| HUMAN VACCINES & IMMUNOTHERAPEUTICS | 4 | 4.5257 | Q2 | 910 | 228 |
| NATURE MEDICINE | 3 | 87.2448 | Q1 | 1712 | 571 |
| SOCIAL SCIENCE & MEDICINE | 3 | 8.5134 | Q1 | 491 | 164 |
| JOURNAL OF COMMUNITY HEALTH | 2 | 6.2855 | Q1 | 636 | 318 |
| PSYCHOLOGICAL MEDICINE | 2 | 10.5915 | Q1 | 566 | 283 |
| LANCET PUBLIC HEALTH | 2 | 72.4283 | Q1 | 445 | 223 |
| JOURNAL OF PUBLIC HEALTH | 2 | 5.0583 | Q1 | 297 | 149 |
| BMJ-BRITISH MEDICAL JOURNAL | 2 | 96.2167 | Q1 | 255 | 128 |
| FRONTIERS IN PUBLIC HEALTH | 2 | 6.4608 | Q1 | 184 | 92 |
| ANNALS OF INTERNAL MEDICINE | 1 | 51.5993 | Q1 | 626 | 626 |
| NATURE COMMUNICATIONS | 1 | 17.6939 | Q1 | 527 | 527 |
| NATURE HUMAN BEHAVIOUR | 1 | 24.253 | Q1 | 459 | 459 |
| JAMA NETWORK OPEN | 1 | 13.3593 | Q1 | 371 | 371 |
| ROYAL SOCIETY OPEN SCIENCE | 1 | 3.653 | Q2 | 368 | 368 |
| INTERNATIONAL JOURNAL OF NURSING STUDIES | 1 | 6.6119 | Q1 | 320 | 320 |
| PLOS NEGLECTED TROPICAL DISEASES | 1 | 4.7807 | Q1 | 305 | 305 |
| JOURNAL OF MULTIDISCIPLINARY HEALTHCARE | 1 | 2.9193 | Q3 | 296 | 296 |
| BMJ GLOBAL HEALTH | 1 | 8.0614 | Q1 | 291 | 291 |
| JOURNAL OF HOSPITAL INFECTION | 1 | 8.9445 | Q1 | 290 | 290 |
| PUBLIC HEALTH | 1 | 4.9844 | Q1 | 289 | 289 |
| LANCET INFECTIOUS DISEASES | 1 | 71.4217 | Q1 | 288 | 288 |

(Continued)

Table 3 (Continued).

| Journal | Articles | IF (2021) | Quartile in Category | Total Citations | Average Citations/ Article |
|---|----------|-----------|----------------------|-----------------|----------------------------|
| HEALTH COMMUNICATION | 1 | 3.5007 | Q2 | 269 | 269 |
| BRAIN BEHAVIOR AND IMMUNITY | 1 | 19.2273 | Q1 | 251 | 251 |
| PRAGMATIC AND OBSERVATIONAL RESEARCH | 1 | - | - | 223 | 223 |
| PERSONALITY AND INDIVIDUAL DIFFERENCES | 1 | 3.9503 | Q2 | 201 | 201 |
| EUROSURVEILLANCE | 1 | 21.2862 | Q1 | 196 | 196 |
| JAIDS-JOURNAL OF ACQUIRED IMMUNE DEFICIENCY SYNDROMES | 1 | 3.7709 | Q3 | 177 | 177 |
| FRONTIERS IN PSYCHOLOGY | 1 | 4.2319 | Q1 | 160 | 160 |
| JOURNAL OF MEDICAL VIROLOGY | 1 | 20.6927 | Q1 | 160 | 160 |
| JOURNAL OF CLINICAL MEDICINE | 1 | 4.9643 | Q2 | 141 | 141 |
| ECLINICAL MEDICINE | 1 | 17.0321 | Q1 | 130 | 130 |
| AMERICAN JOURNAL OF TROPICAL MEDICINE AND HYGIENE | 1 | 3.7073 | Q2 | 118 | 118 |
| INTERNATIONAL IMMUNOPHARMACOLOGY | 1 | 5.7142 | Q1 | 116 | 116 |
| SCIENCE COMMUNICATION | 1 | 7.4411 | Q1 | 112 | 112 |
| AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY | 1 | 10.6931 | Q1 | 110 | 110 |
| FRONTIERS IN MEDICINE | 1 | 5.0583 | Q2 | 108 | 108 |
| BMC PUBLIC HEALTH | 1 | 4.1353 | Q2 | 106 | 106 |
| CTS-CLINICAL AND TRANSLATIONAL SCIENCE | 1 | 4.5159 | Q2 | 106 | 106 |
| AMERICAN JOURNAL OF INFECTION CONTROL | 1 | 4.3029 | Q2 | 105 | 105 |
| HUMAN CELL | 1 | 4.3739 | Q3 | 102 | 102 |
| JOURNAL OF AMBULATORY CARE MANAGEMENT | 1 | - | - | 102 | 102 |
| MEDICAL PRINCIPLES AND PRACTICE | 1 | 2.1322 | Q3 | 101 | 101 |
| PATIENT EDUCATION AND COUNSELING | 1 | 3.4669 | Q1 | 99 | 99 |
| MAYO CLINIC PROCEEDINGS | 1 | 12.2131 | Q1 | 98 | 98 |
| INTERNATIONAL JOURNAL OF GYNECOLOGY & OBSTETRICS | 1 | 4.4474 | Q1 | 97 | 97 |
| EXPERT REVIEW OF VACCINES | 1 | 5.6826 | Q2 | 95 | 95 |
| POSTGRADUATE MEDICAL JOURNAL | 1 | 4.9731 | Q2 | 94 | 94 |
| PEDIATRIC INFECTIOUS DISEASE JOURNAL | 1 | 3.8059 | Q1 | 91 | 91 |
| PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA | 1 | 12.7784 | Q1 | 90 | 90 |
| NATURE | 1 | 69.5026 | Q1 | 85 | 85 |
| VIRUSES-BASEL | 1 | 5.8184 | Q2 | 85 | 85 |

(Continued)

Table 3 (Continued).

| Journal | Articles | IF (2021) | Quartile in Category | Total Citations | Average Citations/Article |
|---|----------|-----------|----------------------|-----------------|---------------------------|
| JOURNAL OF CLINICAL NURSING | 1 | 4.4231 | Q1 | 82 | 82 |
| RESEARCH IN SOCIAL & ADMINISTRATIVE PHARMACY | 1 | 3.3481 | Q2 | 82 | 82 |
| BIOLOGY-BASEL | 1 | 5.1678 | Q1 | 81 | 81 |
| GLOBAL HEALTH RESEARCH AND POLICY | 1 | - | - | 81 | 81 |
| INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH | 1 | 4.6141 | Q1 | 79 | 79 |
| PEDIATRICS | 1 | 9.7031 | Q1 | 79 | 79 |

A total of 283 institutions worldwide participated in the research of the T100 articles, of which 14 institutions participated in more than 3 articles, as seen in [Table 4](#). The *Catholic University of the Sacred Heart* from Italy participated in 8 T100 articles, ranking first and having 1181 citations. The *University of Jordan* and the *University of Oxford* ranked second, with 7 T100 articles. The *University of Jordan* is the most cited institution, with 2392 citations. It is worth noting that the institutions in which more than 3 T100 articles were involved, of which 7 (50%) were from the UK.

Overall, 672 researchers worldwide participated in the study of the T100 articles, and who participated in more than 3 T100 articles can be seen in [Table 5](#). Sallam, M from the *University of Jordan* and Freeman, D from the *University of Oxford*, with the most T100 articles as the first or corresponding author (Articles that the first author is both corresponding authors). Besides, Sallam, M with the most number of citations. Notably, the 14 researchers ranked

Table 4 Institutions Contributing to the 100 Most Cited Articles (Number of Publication≥3)

| Institution | Articles | Country | Citations |
|--|----------|---------------|-----------|
| Catholic University of the Sacred Heart | 8 | Italy | 1181 |
| University of Jordan | 7 | Jordan | 2392 |
| University of Oxford | 7 | UK | 1443 |
| Aix-Marseille University | 4 | France | 886 |
| Johns Hopkins University | 4 | USA | 727 |
| University of Bristol | 4 | UK | 867 |
| University of Cambridge | 4 | UK | 1034 |
| Laval University | 4 | Canada | 776 |
| Aston University | 3 | UK | 666 |
| Chinese University of Hong Kong | 3 | China | 678 |
| London School of Hygiene & Tropical Medicine | 3 | UK | 1789 |
| Loughborough University | 3 | UK | 666 |
| South African Medical Research Council | 3 | South African | 562 |
| University of Liverpool | 3 | UK | 839 |

Table 5 The Most Productive Authors in T100 Articles

| Author | Articles | Authorship | | | Affiliation | Country | Citations |
|----------------|----------|--------------|----------------------|-------|---|---------|-----------|
| | | First Author | Corresponding Author | Other | | | |
| Lewandowsky, S | 4 | 0 | 0 | 4 | University of Bristol | UK | 867 |
| Sallam, M | 3 | 3 | 3* | 0 | University of Jordan | Jordan | 1117 |
| Wong, SYS | 3 | 0 | 0 | 3 | Chinese University of Hong Kong | China | 678 |
| Verger, P | 3 | 2 | 1* | 1 | Aix-Marseille University | France | 579 |
| Freeman, D | 3 | 3 | 3* | 0 | University of Oxford | UK | 666 |
| Loe, BS | 3 | 0 | 0 | 3 | University of Cambridge | UK | 666 |
| Chadwick, A | 3 | 0 | 0 | 3 | Loughborough University | UK | 666 |
| Vaccari, C | 3 | 0 | 0 | 3 | Loughborough University | UK | 666 |
| Waite, F | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Rosebrock, L | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Petit, A | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Vanderslott, S | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Innocenti, S | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Larkin, M | 3 | 0 | 0 | 3 | Aston University | UK | 666 |
| Yu, LM | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| McShane, H | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Pollard, AJ | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Lambe, S | 3 | 0 | 0 | 3 | University of Oxford | UK | 666 |
| Barello, S | 3 | 1 | 1* | 2 | Catholic University of the Sacred Heart | Italy | 552 |
| Graffigna, G | 3 | 1 | 1 | 1 | Catholic University of the Sacred Heart | Italy | 552 |
| Dube, E | 3 | 0 | 0 | 3 | Laval University | Canada | 396 |

Note: *Articles that the first author is both corresponding author.

5–18 in [Table 5](#) all contributed to 3 T100 similar articles, so they had the same number of citations. Of the T100 articles, 82 were articles, 11 were reviews, 4 were Editorial Material, and 2 were Letters. These articles belong to 30 categories of Web of Science, of which the top 3 are Immunology (n=28), Medicine Research Experimental (n=22), and Public Environmental Occupational Health (n=22) ([Table 6](#)).

Furthermore, we analyzed the T100 articles published per continent. Ten countries in Europe published 35 T100 articles with 8616 citations. There were no publications from South America or Antarctica. It is worth noting that even though only two North American countries published T100 articles, they published 35 articles with 6225 citations ([Table 7](#)).

Co-Countries/Regions Network Visualization

All institutions met the criteria when the minimum number of articles published by the countries/regions was set to 1. The co-countries/regions network is revealed in [Figure 1](#). The co-countries/regions network, including 53 institutions,

Table 6 Web of Science Categories in the T100 Articles

| Variable | Number of Studies |
|--|-------------------|
| Type of study | |
| Article | 83 |
| Review | 11 |
| Editorial Material | 4 |
| Letter | 2 |
| Web of science categories | |
| Immunology | 28 |
| Medicine Research Experimental | 22 |
| Public Environmental Occupational Health | 22 |
| Multidisciplinary Sciences | 12 |
| Medicine General Internal | 11 |
| Infectious Diseases | 7 |
| Psychiatry | 6 |
| Biotechnology Applied Microbiology | 5 |
| Psychology | 5 |
| Psychology Clinical | 5 |
| Cell Biology | 4 |
| Health Policy Services | 4 |
| Biochemistry Molecular Biology | 3 |
| Health Care Sciences Services | 3 |
| Social Sciences Biomedical | 3 |
| Communication | 2 |
| Neurosciences | 2 |
| Nursing | 2 |
| Obstetrics Gynecology | 2 |
| Pediatrics | 2 |
| Tropical Medicine | 2 |
| Virology | 2 |
| Biology | 1 |
| Parasitology | 1 |
| Pharmacology Pharmacy | 1 |
| Psychology Biological | 1 |
| Psychology Experimental | 1 |

(Continued)

Table 6 (Continued).

| Variable | Number of Studies |
|-----------------------------------|-------------------|
| Psychology Multidisciplinary | 1 |
| Psychology Social | 1 |
| Social Sciences Interdisciplinary | 1 |

Note: Because there are articles with more than one category, the total sum of this table exceeds 100.

Table 7 The T100 Articles in per Contient

| Continent | Number of Countries/Regions | Articles | Total Citations |
|---------------|-----------------------------|----------|-----------------|
| Europe | 10 | 35 | 8616 |
| North America | 2 | 32 | 6225 |
| Asian | 13 | 27 | 5100 |
| Africa | 3 | 4 | 654 |
| Oceania | 1 | 2 | 280 |
| South America | 0 | 0 | 0 |
| Antarctica | 0 | 0 | 0 |

was divided into 7 clusters represented by different colors. The largest cluster of red and green consists of 15 institutions. In addition, the circles of the USA were significantly larger than others, and total link lines and strength were also significantly more than others, indicating that the USA participated in the most studies in these 100 articles.

Co-Institutions Network Visualization

Using Vosviewer to analyze the co-institutions network of the T100 articles. The co-institutions network can be seen in [Figure 2](#). It involved 124 institutions and was divided into 7 clusters represented by different colors. 24 institutions were included in red clusters, which were the largest. However, from [Figure 2](#), the cooperation strength between the institutions with a large number of publications seems weak.

Citation Source Density Visualization

Previously, we used Microsoft Excel to analyze the published journals of the T100 articles in [Table 3](#). When we used Vosviewer to analyze, the generated density visualization more intuitively reflected the participation of each journal in this field. Each dot has a color and represents a journal. By default, colors range from blue to green to yellow to red, indicating increasing numbers of T100 articles ([Figure 3](#)).

Co-Citation Network of Sources Visualization

A co-citation relationship exists between two journals when they are cited simultaneously in 1 or more of the same publications. The co-citation network of the source is revealed in [Figure 4](#). A total of 1546 journals had co-citation relationships. When setting the minimum number of citations of a source to 10, 54 journals met the criteria. From [Figure 4](#), it is known that *VACCINE* has the highest co-citation frequency (8465 times). In addition, *VACCINE-Basel*, *Human Vaccine & Immunotherapeutics*, and *Plos One* have more than 3000 times co-citations. In general, the above four journals could significantly influence the field.

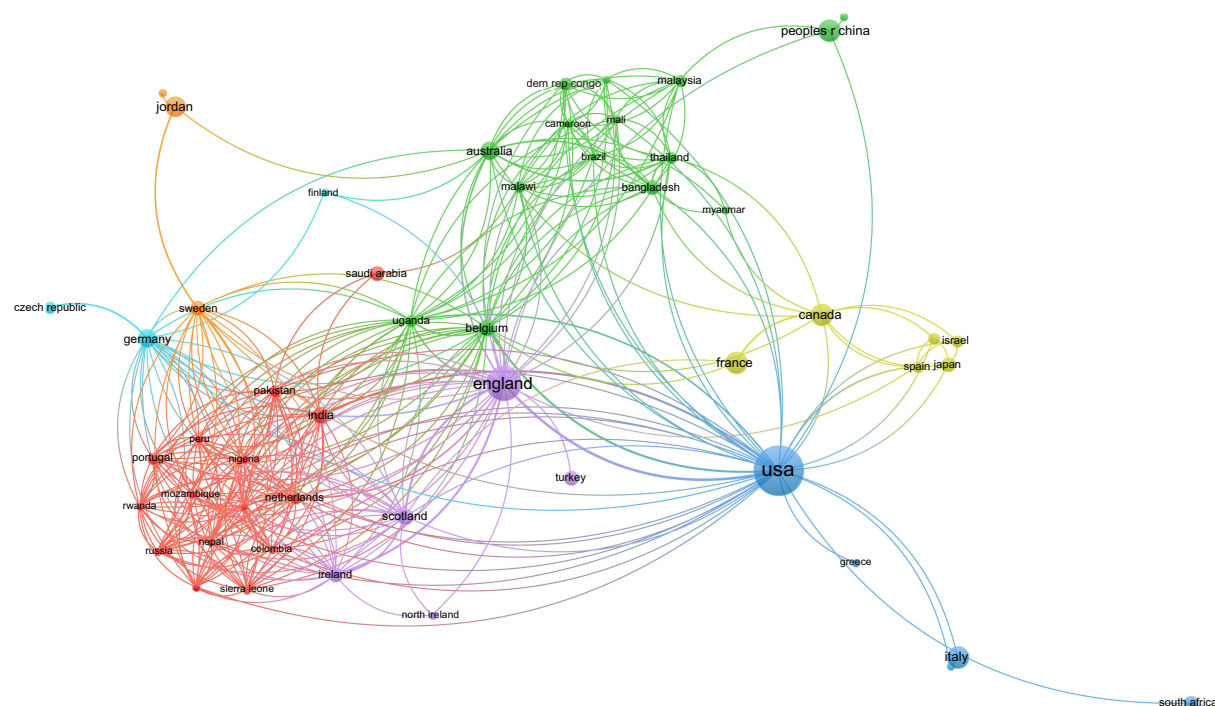


Figure 1 Co-countries/regions network visualization.

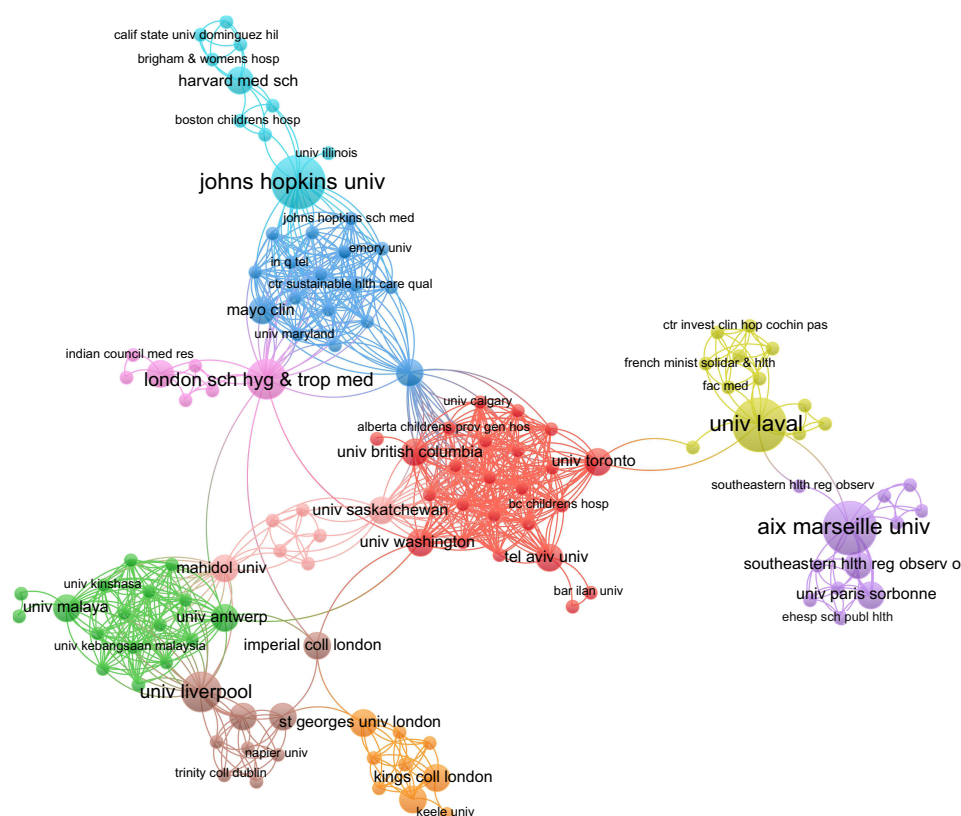


Figure 2 Co-institutions network visualization.

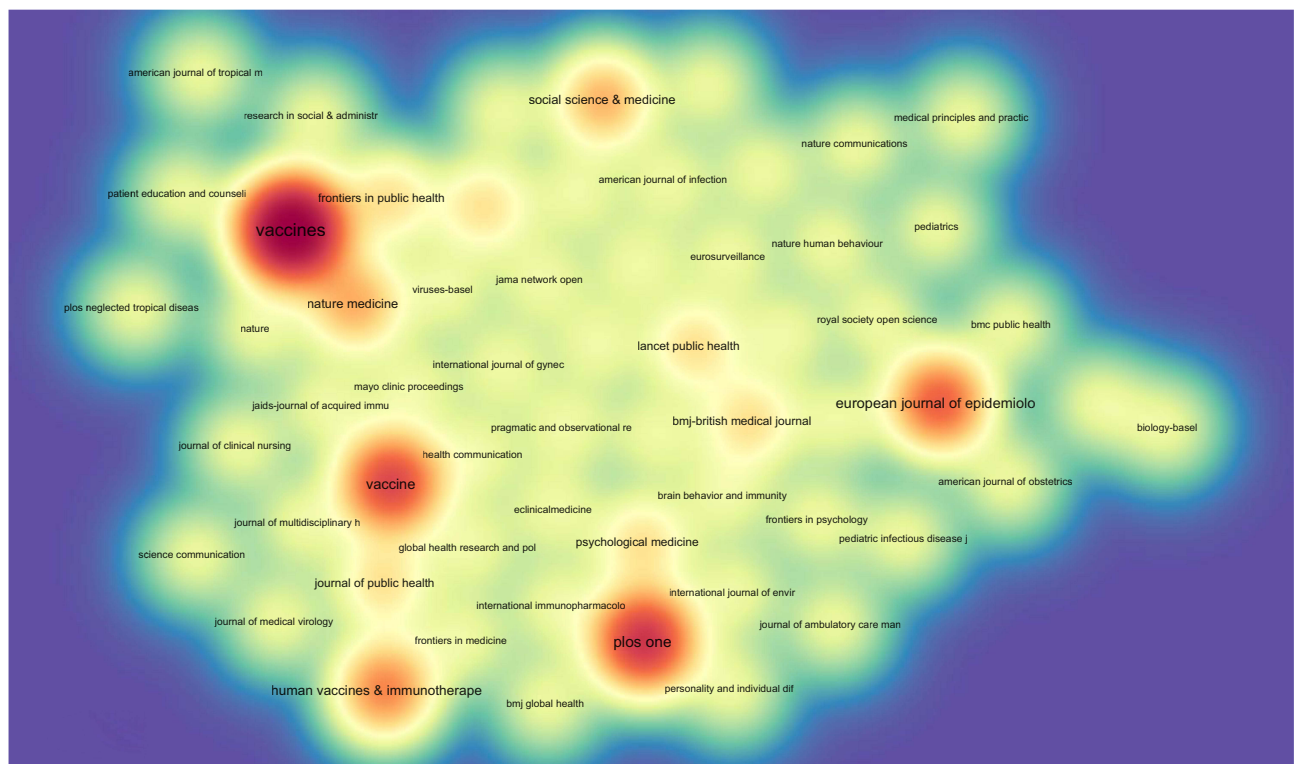


Figure 3 Citation source density visualization.

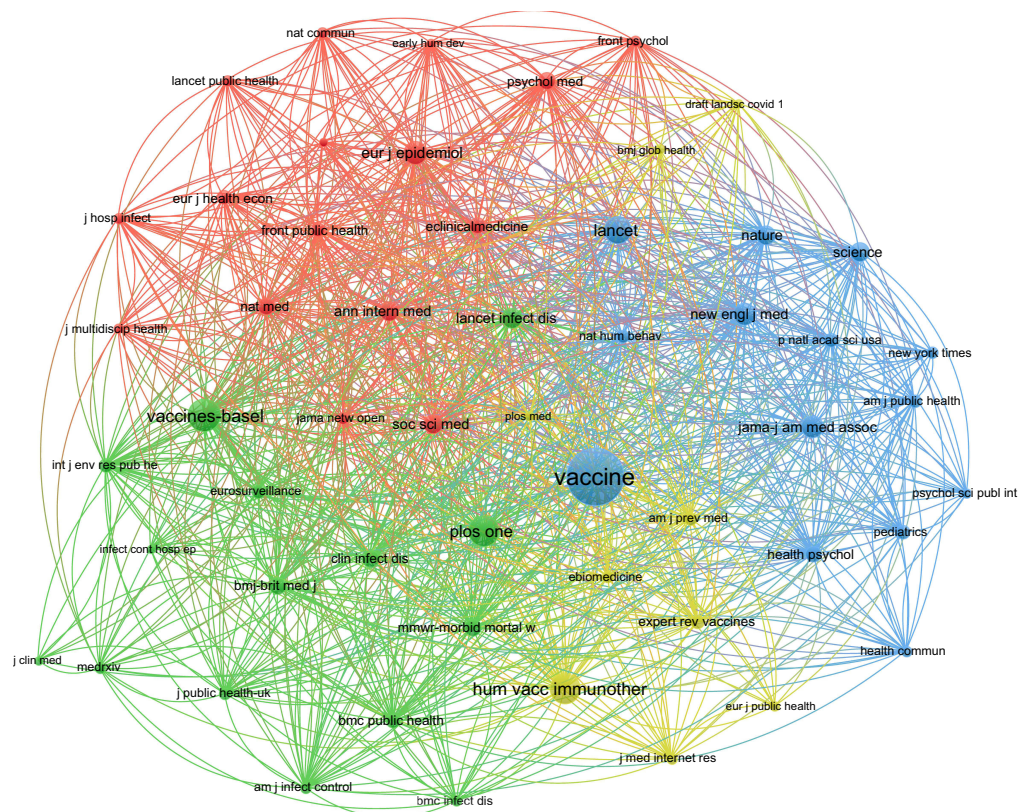


Figure 4 Co-citation network of sources visualization.

Discussion

In this study, we evaluated the current status of T100 articles on COVID-19 vaccine hesitancy by analyzing the field's institutions, authors, countries, and journals. It can help to understand the current information regarding COVID-19 vaccine hesitancy quickly. It can also provide ideas for future research in this area.

With the largest number of T100 articles, the USA is the dominant country in terms of contributions to the development of COVID-19 vaccine hesitancy, and this may have to do with the fact that the USA is a more developed country and has more resources or financial support at its disposal.²⁹ However, it is noteworthy that although there was only one article in Spain, the number of citations was 1225. The *VACCINE* journal published the most T100 articles and the highest number of citations during this multi-year period. In addition, we collected the Quartile in category and impact factor of the journals, most of which were in Q1, and the total impact factor of all the journals is as high as 841.6061. However, there were fewer publications in journals with exceptionally high impact factors, such as *Nature* and *Nature Medicine*. Several factors can influence the decision of which journal to submit manuscripts to, including acceptance rate, impact factor, speed of manuscript processing, and the overall reputation of the journal.³⁰ Authors in the field of COVID-19 vaccine hesitancy tend to publish in corresponding journals rather than general medicine journals. The *Catholic University of the Sacred Heart* in Italy was the largest contributor to the T100 articles, but most institutions involved in the T100 articles were from the UK.

Our study shows that Europe and North America lead in the world's COVID-19 vaccine hesitancy field, with the maximum number of publications and global impacts. It appears that their research receives significant attention and recognition on a global scale. Research platforms with high-quality and advanced technology are critical in promoting research development. Additionally, Europe and North America invest more in research, facilitating its smooth progression. As shown in [Figure 1](#), Europe and North America cooperate closely, enabling them to exchange experiences and resources and expand their research capabilities. The collaborative network density among institutions with many publications is low, suggesting a lack of close collaboration and communication, as seen in [Figure 2](#). Therefore, important to promote more vaccine hesitancy research through cross-national/regional collaborations in the future.

As mentioned above, the USA had the most T100 articles, but vaccine acceptance rates varied from a low of 12% to a high of 91.4%.³¹ One study³² showed that about 20% of Americans have explicitly refused COVID-19 vaccines, not including those who have delayed vaccinations. For those Americans who are already parents, their attitudes influence their decision to vaccinate their children. A study by Ruiz et al³³ showed that accepting the COVID-19 vaccine in children was strongly associated with parents' intentions to receive it for themselves, and up to 1/3 of parents reported pediatric vaccine hesitancy.

Vaccine hesitancy has become one of the most important factors affecting public health.³⁴ The vaccine were potential side effects, safety, how well it works, and not trusting the government, which they were worried about.³⁵ Therefore, measures must be taken to protect public health and quality of life. From the government level, it is necessary to strengthen top-level planning, formulate reasonable vaccination policies, increase the convenience of vaccination, monitor online information, and punish misinformation. Medical institutions and voluntary public health groups should disseminate knowledge about COVID-19 vaccines to the public to increase their understanding and willingness to be vaccinated. A cross-sectional survey³⁶ conducted in India showed that the willingness to be vaccinated increased by 29% among participants who received professional education from medical and health workers. At the same time, health workers' attitudes toward vaccination can impact the public, so health workers should set a good example. Individuals need to learn to distinguish between truth and misinformation, and it is also important to seek professional help or information from official reports.

This study also has some limitations. First, we selected only the Web of Science core collection database as the source of retrieval data and did not consider other databases such as PubMed, Scopus, CNKI, etc. Second, we are and will remain in the era of information explosion, and the information is updated much faster than our cognition, so we cannot guarantee whether some new high-quality articles are excluded. Finally, the software's algorithm is also an important factor affecting the results. We cannot do what software engineers should do but only passively accept the use of the software.

Conclusion

To our knowledge, this study is the first reported attempt to analyze the top 100 most cited articles in the field of COVID-19 vaccine hesitancy. Through the bibliometric analysis, our study sheds light on various aspects of the field, including the most influential journal, country, and author. This information may be useful to researchers, policymakers, and practitioners interested in understanding the field's current state and identifying potential areas for future research. In addition, it is also possible to use our study's findings to address vaccine hesitancy, a critical public health issue. Infectious disease control and prevention efforts can be undermined by vaccine hesitancy. Researchers and policymakers can identify effective strategies to address vaccine hesitancy by identifying the most influential articles and authors in the field, such as developing targeted communication campaigns, addressing misinformation and conspiracy theories, and improving vaccine access.

Overall, the *VACCINE* was the most influential journal, and the USA was the most productive country. Sallam, M was the most influential author. More importantly, this article may support a quick review of the state of the COVID-19 vaccine hesitancy field and direct future research trends.

Abbreviations

COVID-19, Coronavirus disease 2019; FDA, Food and Drug Administration; IF, impact factor; JCR, Journal Citation Reports; HBM, health belief model; PMT, protective motivation theory; TPB, theory of planned behavior.

Data Statement

All data generated or analyzed during this study are included in this published article.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

There is no funding to report.

Disclosure

The authors report no conflicts of interest in this work.

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