

BMJ Open Gender disparities in COVID-19 vaccine hesitancy in high-income countries: an umbrella review protocol

Christian J Wiedermann ¹, Chiara Noviello,² Claudia Palmieri,² Pasquale Stefanizzi ², Giuliano Piccoliori,¹ Adolf Engl,¹ Silvio Tafuri ²

To cite: Wiedermann CJ, Noviello C, Palmieri C, *et al*. Gender disparities in COVID-19 vaccine hesitancy in high-income countries: an umbrella review protocol. *BMJ Open* 2025;**15**:e095490. doi:10.1136/bmjopen-2024-095490

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-095490>).

Received 23 October 2024

Accepted 20 June 2025



© Author(s) (or their employer(s)) 2025. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ Group.

¹Institute of General Practice and Public Health, Claudiana Landesfachhochschule für Gesundheitsberufe, Bolzano, Italy

²Department of Biomedical Science and Human Oncology, Università degli Studi di Bari Aldo Moro, Bari, Italy

Correspondence to

Professor Christian J Wiedermann;
christian.wiedermann@am-mg.claudiana.bz.it

ABSTRACT

Introduction Vaccine hesitancy remains a critical public health challenge, especially in high-income countries. Gender differences in vaccine hesitancy can significantly affect vaccination rates and public health outcomes. The aim of this research is performing an umbrella review and meta-analysis to systematically investigate gender disparities in vaccine hesitancy for COVID-19 in high-income countries, as well as the quality, potential biases and dependability of epidemiological evidence.

Methods and analysis The study will systematically search, extract and analyse data from reported systematic reviews and meta-analyses that focus specifically on gender differences in vaccine hesitancy. The search will include CINAHL, Cochrane Library, PubMed/MEDLINE, EMBASE and Epistemonikos for studies published from 2019 onward. The inclusion criteria will encompass systematic reviews and meta-analyses of non-interventional studies conducted in high-income countries. The identified factors contributing to vaccine hesitancy will be categorised based on demographic, psychological, social and economic dimensions. The methodological quality of the included meta-analyses will be assessed using the “Joanna Briggs Institute Critical Appraisal Checklist for Systematic Reviews and Research Syntheses” tool.

Ethics and dissemination Ethical approval is not required for this umbrella review. These results will be published in a peer-reviewed journal.

PROSPERO registration number CRD42024572978.

INTRODUCTION

Vaccine hesitancy represents a pressing public health concern, characterised by a delay or outright rejection of vaccination services despite their accessibility.¹ Understanding the factors contributing to vaccine hesitancy is critical for boosting vaccination rates and preserving public health. Gender disparities in vaccination behaviour are particularly significant as they can affect the success of immunisation initiatives, especially in high-income countries.^{2–4}

Research suggests that women generally exhibit greater reluctance to receive vaccines than men, a trend that continued with the

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The review will provide a comprehensive synthesis of gender disparities in COVID-19 vaccine hesitancy in high-income countries, addressing a critical gap in current literature.
- ⇒ Use of the Joanna Briggs Institute Critical Appraisal Checklist ensures a rigorous evaluation of included studies, strengthening the reliability of findings.
- ⇒ Inclusion of studies from multiple databases ensures a broad and thorough literature search.
- ⇒ Exclusion of non-English language and qualitative studies may limit insights into cultural and individual reasons for vaccine hesitancy.
- ⇒ Variability in study designs and outcomes may limit the ability to draw strong conclusions on gender disparities.

COVID-19 vaccine. However, despite higher levels of expressed hesitancy, often linked to safety concerns and lack of information, actual vaccine uptake among women can be substantial. This is particularly evident in contexts where strong healthcare provider recommendations, targeted public health strategies, and good access to information are in place.^{5 6} This elevated level of caution among women is often linked to concerns about the novelty of the vaccine, potential adverse consequences, and medical constraints.⁴ Both genders tend to attribute philosophical or religious convictions to reasons for declining vaccination. Moreover, vaccine hesitancy is more pronounced among economically vulnerable women, especially those with migration background.⁷

The inclination towards vaccine hesitancy can be attributed to varying levels of health awareness among men and women.⁴ Research on health literacy indicates that gender disparities exist but are influenced by cultural background, educational attainment and access to health-related information.⁸ For instance, a survey in Germany found no significant difference in COVID-19-related

health literacy between women and men.⁹ Generally, women demonstrate greater commitment to preventive health measures and are more likely to comply with public health guidelines, although these behaviours can vary regionally and are shaped by local cultural and socio-economic factors.⁴ In South Tyrol, Italy, women were observed to be more inclined than men to adhere to COVID-19-related health recommendations.¹⁰

Furthermore, vaccine hesitancy varies significantly among countries with different income levels. In high-income countries, factors such as misinformation, mistrust in government and pharmaceutical companies, and perceived lack of necessity for vaccines contribute to higher hesitancy rates.¹¹ By contrast, vaccine acceptance in low-income and middle-income countries is generally higher because of the perceived greater risk of infectious diseases and greater trust in vaccines. However, access to vaccines remains a significant challenge in these countries, which casts doubt on the role of hesitancy in influencing vaccine uptake.¹² Recognising these income variations is essential for designing public health programmes tailored to specific regional and socioeconomic circumstances.

Developing public health initiatives that specifically address the unique concerns and obstacles faced by different gender groups can increase vaccine acceptance. It is essential to conduct a thorough examination of the existing literature on gender disparities in vaccine hesitancy in high-income countries. This review should encompass a wide range of demographic groups including individuals with varying demographic characteristics. Recognising and addressing these disparities can enable the development of targeted and effective public health interventions to improve vaccine uptake and reduce hesitancy.

Rationale for the umbrella review

The rationale for this umbrella review stems from the need to synthesise and analyse existing research on gender disparities in vaccine hesitancy, particularly focusing on COVID-19 in high-income countries. While numerous systematic reviews and meta-analyses exist on vaccine hesitancy, there is a gap in the literature specifically addressing gender differences and sociodemographic factors influencing these disparities. This review aims to provide a comprehensive overview of existing evidence, identify common barriers and facilitators of vaccination among different genders, and offer well-informed recommendations for future research and public health interventions.

In this review, gender is operationalised as a binary construct comparing men and women, consistent with the classification used in most systematic reviews and meta-analyses. While we acknowledge that gender encompasses a spectrum of identities and social constructs, including norms, roles and relations, such dimensions are not explored due to a frequent lack of disaggregated data in the existing literature. Similarly, data on gender

minority populations (eg, non-binary individuals) are not represented in this umbrella review.

Target audience and aim

This study aims to provide insights for public health experts, policymakers, researchers and healthcare providers. The objective is to inform the development of guidelines and strategies that can effectively address vaccine hesitancy, thereby enhancing vaccination rates and promoting better public health outcomes in affluent nations.

Preliminary search and existing reviews

A preliminary investigation was carried out using the Cochrane Library, CINAHL, PubMed, EMBASE, Epistemonikos and PROSPERO databases. No existing comprehensive review has specifically targeted gender disparities in COVID-19 vaccine hesitancy in high-income countries. This finding highlights the originality and importance of this review.

Objective

The primary objectives of this review are to systematically analyse data on gender disparities in COVID-19 vaccine reluctance among adults in high-income countries and to recognise the obstacles and encouragers that affect vaccine hesitancy among diverse socioeconomic groups. This review aims to offer a thorough comprehension of the factors contributing to vaccine reluctance and suggest recommendations for future research and public health strategies. The precise goals are:

- ▶ To examine gender disparities in COVID-19 vaccine hesitancy.
- ▶ To identify and analyse the barriers and facilitators influencing vaccine hesitancy among different socio-demographic groups.
- ▶ To provide recommendations for addressing vaccine hesitancy and improving vaccination rates.

This review aims to accomplish these objectives, thereby facilitating the formulation of tailored interventions and policies aimed at mitigating vaccine hesitancy in high-income nations. The research question for this study is: “What are the gender disparities in COVID-19 vaccine hesitancy among adults in high-income countries, and what specific barriers and facilitators influence vaccine hesitancy among various sociodemographic subgroups?”

METHODS

Design

An umbrella review is a type of evidence synthesis designed to summarise the findings of multiple systematic reviews and meta-analyses.¹³ This approach enables the comparison of results from different studies, helping to address the heterogeneity inherent in systematic reviews.¹⁴ The insights gained from an umbrella review can inform guidelines, clinical practices and recommendations for future research.¹⁵ Therefore, this study undertakes an

umbrella review to synthesise evidence on gender differences in vaccine hesitancy in high-income countries, focusing on various sociodemographic subgroups.

Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols reporting guidelines are used.¹⁶ This study will adhere to the Joanna Briggs Institute guidelines for umbrella reviews.¹⁵ The study protocol was registered in PROSPERO (registration number: CRD42024572978).

Inclusion and exclusion criteria

The selection criteria for this umbrella review will be established through the employment of the Population, Exposure, Outcomes (PEO) framework, which will provide unambiguous instructions for the identification of pertinent studies.

Population

This review will encompass research pertaining to individuals aged 18 years and above who reside in high-income nations, as defined by the World Bank. The population of interest comprises individuals of all genders, ethnicities and races. Studies concentrating on vaccine hesitancy in animals have been excluded. The rationale for the inclusion of adults is grounded in the considerable influence of adult vaccination behaviour on public health outcomes.

Exposure

This article aims to investigate and discuss COVID-19 vaccine hesitancy, with a particular emphasis on both general population and parental hesitancy in vaccinating their children against the COVID-19 virus. Research exploring hesitancy towards other vaccines, such as influenza, will not be considered to maintain a clear and specific focus on COVID-19 vaccine hesitancy.

Outcomes

The main objective of this study is to investigate the gender disparities in COVID-19 vaccine hesitancy. Secondary goals include examining disease-related risks, migration history and other sociodemographic factors, such as education and occupation. The collected data will be used to measure vaccine hesitancy or refusal, either directly or indirectly, through vaccine uptake rates. It is important to note that while the secondary outcomes will provide additional context, they will not replace the primary outcome.

Types of studies

This review will include systematic reviews and meta-analyses adhering to internationally accepted methodologies for data extraction and quality appraisal, including an adequate number of reviewers and inter-rater agreement procedures, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.¹⁷ Only meta-analyses providing a clear estimate of heterogeneity and overall effect size will be included. Therefore, rapid systematic reviews and meta-analyses should be considered. Reviews incorporating theoretical studies, text

and opinion, qualitative, and mixed-methods studies will be excluded. Both peer-reviewed and pre-printed studies will be included to ensure that most of the current research is considered. Abstracts alone will be excluded because of insufficient detail for quality appraisal and data extraction. Non-English language will be an exclusion criterion. Only studies published from 2019 onward will be included to focus on COVID-19 and the latest evidence.

Search strategy

The search strategy was developed in consultation with academic librarians from the Library of the College of Health Professions of Bolzano. Their input included principles outlined in the PRESS (Peer Review of Electronic Search Strategies) guideline.¹⁸

The search strategy will be applied to the following databases: CINAHL, Cochrane Library, PubMed/MEDLINE, EMBASE and Epistemonikos, with tailored approaches for each database. Boolean logic will be used to combine search terms related to COVID-19, vaccine hesitancy and gender. Gender-related terms will include “gender,” “sex differences,” “male,” “female,” “men,” “women,” “sex-disaggregated,” “gender-disaggregated,” and “transgender.” In databases with predefined search filters (eg, “systematic(sb)” for PubMed), these will be applied. Where unavailable, equivalent terms such as “systematic review” or “meta-analysis” will be searched in title and abstract fields.

The search process will follow a three-phase strategy: first, keyword mapping and analysis of index terms from relevant records; second, construction of search filters per database; and third, manual backward citation searches of all included reviews. The search will be restricted to studies published in English due to resource limitations related to translation. Both peer-reviewed and pre-print studies will be considered.

Recognising that relevant reviews may not explicitly frame findings through a gender lens, the inclusion criteria will allow studies that disaggregate results by sex or gender. A gender analysis will be performed during synthesis to interpret gendered differences in vaccine hesitancy.

Preliminary search terms are provided in box 1. To enhance the sensitivity and reproducibility of the search, a validated COVID-19 search filter will be applied.¹⁹ This validated filter is adapted to PubMed and will be adjusted for use in the other included databases.

A complete search strategy for PubMed is provided in the supplementary material (online supplemental file 1), as recommended by Preferred Reporting Items for Systematic Reviews and Meta-Analyses Search Extension.²⁰ By following this rigorous search strategy, the umbrella review will identify and include studies related to COVID-19 vaccine hesitancy, focusing on gender differences.

Selection process

Duplicate entries will be identified and removed to streamline the screening process. The remaining citations

Box 1 Preliminary search strategy

Search Terms and Boolean Operators

(COVID-19 OR COVID-19 OR COVID-19 OR SARS-CoV-2 OR SARS-CoV2 OR SARSCoV2 OR SARSCoV-2 OR SARS coronavirus 2 OR 2019 nCoV OR 2019nCoV OR 2019-novel CoV OR nCov 2019 OR nCov 19 OR severe acute respiratory syndrome coronavirus 2 OR novel coronavirus disease OR novel corona virus disease OR corona virus disease 2019 OR coronavirus disease 2019 OR novel coronavirus pneumonia OR novel corona virus pneumonia OR COVID-19 innoculat* OR COVID-19 immuni*)
AND
(vaccine hesitan* OR vaccine accept* OR vaccine refus* OR vaccine reluct* OR vaccine uptake)
AND
(gender differences OR gender disparity OR male OR female OR men OR women OR sex differences OR sex-disaggregated OR gender-disaggregated OR transgender)

will be screened based on their titles and abstracts against predefined inclusion criteria to identify potentially relevant studies for full-text review.

Studies that pass this initial screening will undergo a full-text review and will be independently assessed by two blinded reviewers to ensure that they meet the inclusion criteria. Their citation details will be imported into the Joanna Briggs Institute (JBI) System for the Unified Management, Assessment and Review of Information (JBI SUMARI; The JBI, Adelaide, Australia).²¹ The full texts of the selected citations will be assessed in detail against the inclusion criteria by two independent reviewers. Reasons for exclusion of full-text articles that do not meet the inclusion criteria will be recorded and reported in the umbrella review. Any disagreements between the reviewers at each stage of the selection process will be resolved through discussion or by a third reviewer. Furthermore, an assessment of inter-rater agreement will be conducted to guarantee consistency and dependability in the screening process.

The results of the search will be reported in full in the final report and presented in a PRISMA flow diagram.¹⁷

Data extraction

The collection of data will involve the extraction of relevant information from the systematic reviews and meta-analyses included in the study using the standardised data extraction tools developed by the JBI, an international research organisation based at the Faculty of Health and Medical Sciences, University of Adelaide, South Australia.²² To ensure consistency and accuracy, the reviewers will first discuss and pilot the tools before beginning the data-extraction process.

The data extraction process systematically gathers information from each included review, covering aspects such as citation information, review objectives, participant characteristics, settings, context, databases sourced, database search dates, types of studies included, instruments used for quality appraisal, and outcomes relevant to the review question. Detailed information, such as sociodemographic

and population characteristics and outcome differences, will also be extracted. Where available, data will also be extracted on intersecting sociodemographic characteristics, including but not limited to race, ethnicity, migration status, education level and employment sector (eg, healthcare workers), to enable a contextualised and intersectional synthesis of gender-related vaccine hesitancy. Vaccine hesitancy among pregnant women will be specifically noted where reviews have disaggregated findings for this subgroup. This population is of particular interest due to heightened concerns about vaccine safety during pregnancy and their unique risk-benefit perceptions.

The classification of high-income countries will be based on the World Bank's most recent country income classifications. During the screening process, included systematic reviews will be assessed to determine whether the primary studies they synthesise were conducted in high-income countries. Reviews that predominantly include studies from low-income or middle-income countries will be excluded.

Data extraction will be conducted independently by two reviewers to minimise bias and error. Any discrepancies that arise will be resolved through discussion with a third reviewer, mediating, if necessary. This approach ensures a thorough and unbiased data-extraction process. Before implementation, any modifications to the data extraction tool will be reviewed and approved by all reviewers to maintain consistency and accuracy.

The extraction and presentation of data will be limited to the results and findings presented in the included research syntheses. This approach avoids the retrieval of primary studies for additional data and focuses solely on published information in the included reviews. It is not anticipated that the authors of the umbrella review will contact the authors of the included research syntheses, as the review will rely exclusively on the available published data.

In cases where relevant data are missing or inconsistently reported across included reviews, these data points will be coded as "not reported" and the limitation will be documented narratively in the synthesis.

The JBI SUMARI platform will be used to support a standardised and efficient data extraction process, facilitating structured collation and comparison of data across included reviews. Quantitative outcomes, such as vaccine hesitancy rates disaggregated by gender, will be synthesised meta-analytically where appropriate. Contextual and qualitative data related to sociodemographic characteristics, including gender and intersecting factors, will be synthesised narratively to identify common themes and patterns.

Findings related to gender disparities in vaccine hesitancy will be interpreted using a gender framework to assess how norms, roles and relations may shape behaviours and barriers differently among and between men and women.²³

Quality assessment

Studies eligible for inclusion will be assessed for methodological quality using the “JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses”.²⁴ This tool consists of a series of criteria that reviewers will score as “met,” “not met,” “unclear,” or “not applicable.” Quality assessment will be conducted independently by two reviewers to minimise bias. Each reviewer will be blinded to the others’ assessments, and comparisons will only be made after both reviewers have completed their initial appraisal. In cases where there is a lack of consensus, discussions will take place between the reviewers. If disagreements persist, a third reviewer is consulted to reach a resolution. JBI SUMARI software will be used for the critical appraisal process.²¹ This software incorporates JBI assessment criteria and facilitates the systematic evaluation of research syntheses.

Data synthesis

The primary data will be the percentage values of vaccine hesitancy in males vs females. ORs will be used as the summary measure to compare these groups. A random-effects model will be applied to account for variability between studies. Heterogeneity will be assessed using the I^2 statistic, with values above 50% indicating substantial heterogeneity. If necessary, sensitivity analyses will be conducted to explore potential sources of heterogeneity. The corrected covered area method will be used to assess the overlap among the included studies.²⁵

To assess potential meta-biases, such as publication bias, we will use funnel plots to visually inspect the symmetry of study effects. An asymmetrical funnel plot may suggest the presence of publication bias. In addition, Egger’s test will be applied to statistically evaluate the likelihood of bias across studies. A significant result from Egger’s test would indicate potential bias, which will be further explored in sensitivity analyses.

A numerical summary will present a quantitative overview of the data on vaccine hesitancy based on gender from different populations, while thematic analysis will identify and describe the key determinants of vaccine hesitancy, such as beliefs, attitudes, motivations, trust in healthcare systems, and vaccine-specific concerns.

The cumulative evidence strength will be evaluated using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) approach.²⁶ This methodology systematically assesses evidence across domains such as risk of bias, consistency, directness, precision and publication bias. Each domain will be scrutinised in all included systematic reviews and meta-analyses. The overall confidence in the evidence will be rated as high, moderate, low or very low, reflecting the quality and reliability of the aggregated data.

Summary of evidence

The findings from this umbrella review will be synthesised and presented in a comprehensive and easily interpretable format. The Results section concludes with a summary table that offers a clear visual representation of

the evidence on gender disparities in COVID-19 vaccine hesitancy across various populations. Detailed findings and outcome estimates are also discussed.

Data management and availability

All data extraction will be performed using structured spreadsheets specifically designed for umbrella reviews, ensuring consistency across reviewers. Version control will be maintained by timestamping files and logging changes. Data will be securely stored on institutional drives managed by the Claudiana College of Health Professions. While the umbrella review will not involve primary data collection, the final dataset of extracted variables may be made available through open-access repositories such as the Open Science Framework on publication, in accordance with journal data-sharing policies.

DISCUSSION

Expected results and implications

It is anticipated that females will exhibit greater vaccine hesitancy than males, particularly regarding COVID-19 vaccines. This trend may be observed across diverse populations, and the review is likely to identify distinct barriers and facilitators of vaccine hesitancy between genders. For females, barriers may include concerns about vaccine safety and reproductive health, as well as socioeconomic factors, such as economic vulnerability and caregiver responsibilities. On the other hand, males might exhibit hesitancy due to misinformation or mistrust in health authorities. Facilitators for females may involve targeted education on vaccine safety and its impact on fertility and pregnancy; whereas, for males, addressing misinformation and enhancing trust through community engagement may be crucial.

Public health interventions should employ communication strategies that address females’ specific concerns, such as providing detailed information on vaccine safety. Campaigns should use trusted sources and community leaders to build trust. For males, interventions may focus on countering misinformation and enhancing trust through clear communication.

Policy implications include adopting gender-sensitive vaccination strategies that facilitate vaccine access for women, particularly those in vulnerable socioeconomic positions. This can be achieved by providing childcare during vaccination, offering flexible clinical hours and addressing financial barriers. Transparent communication about vaccine safety and efficacy tailored to gender-specific concerns is essential. Collaboration with community organisations can enhance the effectiveness of these policies.

Limitations

One limitation of the present study is the exclusion of non-English-language studies. While this decision is often made for practical reasons, it introduces a language

bias that may result in overlooking important studies published in other languages.

Another limitation is the exclusion of qualitative data. Qualitative studies provide valuable insights into personal experiences and contextual factors that influence vaccine hesitancy. By excluding these studies, the review may miss factors that quantitative data alone cannot capture, leading to an incomplete understanding of the reasons for vaccine hesitancy.

The variability among the included studies is another potential limitation. Differences in study design, population characteristics and outcome measurements can make it challenging to synthesise the findings accurately. High variability may limit the ability to draw definitive conclusions and may require careful consideration and handling during the analysis.

To minimise bias, data extraction is conducted independently by two reviewers. However, differences in interpretation still exist. Any discrepancies will be resolved through discussion or mediation by a third reviewer. Despite these measures, subjectivity in data interpretation is inevitable.

Future research directions

Depending on the findings, this review may identify several gaps in the current research on gender differences in vaccine hesitancy in high-income countries. One potential gap is the limited understanding of how socio-demographic factors such as age, education and socio-economic status interact with gender to influence vaccine hesitancy. The review may highlight the need for more studies on diverse populations within high-income countries, such as parents, homeless individuals, and migrants. Another potential gap may be the scarcity of longitudinal studies examining changes in gender disparity in vaccine hesitancy over time. Such data could provide insights into evolving attitudes and identify effective interventions at different points.

Conclusion

The publication of this protocol, along with its registration in PROSPERO, highlights transparency and rigour in conducting this umbrella review. By systematically evaluating existing research on gender disparities in COVID-19 vaccine hesitancy in high-income countries, this study provides a synthesis of available evidence. The findings will enlighten public health strategies and policies that address gender-specific impediments and facilitators of vaccine hesitancy, ultimately advancing vaccination rates and public health outcomes. The detailed protocol provides a methodological framework, enhances peer feedback and supports the credibility of the results.

X Chiara Novello @C. Novello

Contributors CJW is the guarantor of this review. ST and CJW were responsible for the overall conceptualisation of the study, including the methodology. PSS, CN, CP and CJW participated in the formal analysis, while CN, CP and CJW conducted the investigation. ST, AE and GP provided resources to support the research. CJW drafted the manuscript, with ST, PSS, CN, CP, GP and AE contributing to the review

and editing. AE and GP supervised the entire process. All authors have read and approved the final version of the manuscript prior to submission for publication. We used the following AI tools: ChatGPT (OpenAI), Paperpal (developed by Cactus Communications) and DeepL Translator (DeepL SE). These tools were employed to support language refinement, clarity enhancement and translation of technical content during manuscript drafting and editing. Their use aimed to improve linguistic precision and consistency, particularly in transforming technical ideas into polished academic English and translating selected content from Italian and German. ChatGPT was used for editing assistance, including rewording, trimming and paragraph restructuring based on manually drafted input. Paperpal was used to check grammar, improve style and polish sentence structure in the final draft. DeepL was used for initial translation of selected passages, which were then manually revised by the authors to ensure technical accuracy and nuance. All AI-assisted content underwent critical review, editing and validation by the human authors. No AI tool was used for data analysis, interpretation of findings or formulation of conclusions. The authors remain fully responsible for the scientific content, integrity and originality of the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Christian J Wiedermann <http://orcid.org/0000-0002-4639-8195>
Pasquale Stefanizzi <http://orcid.org/0000-0002-3279-0196>
Silvio Tafuri <http://orcid.org/0000-0003-4194-0210>

REFERENCES

- 1 Health TLC & A. Vaccine hesitancy: a generation at risk. *Lancet Child Adolesc Health* 2019;3:281.
- 2 Zintel S, Flock C, Arbogast AL, *et al*. Gender differences in the intention to get vaccinated against COVID-19: a systematic review and meta-analysis. *Z Gesundh Wiss* 2022;1–25.
- 3 Jayawardana S, Esquivel M, Orešković T, *et al*. Gender differences in COVID-19 preventative measures and vaccination rates in the United States: A longitudinal survey analysis. *Vaccine (Auckl)* 2024;42:S0264-410X(24)00671-6.
- 4 Toshkov D. Explaining the gender gap in COVID-19 vaccination attitudes. *Eur J Public Health* 2023;33:490–5.
- 5 Lazarus JV, Wyka K, White TM, *et al*. Revisiting COVID-19 vaccine hesitancy around the world using data from 23 countries in 2021. *Nat Commun* 2022;13:3801.
- 6 Skjefte M, Ngirbabul M, Akeju O, *et al*. COVID-19 vaccine acceptance among pregnant women and mothers of young children: results of a survey in 16 countries. *Eur J Epidemiol* 2021;36:197–211.
- 7 Morales DX, Beltran TF, Morales SA. Gender, socioeconomic status, and COVID-19 vaccine hesitancy in the US: An intersectionality approach. *Sociol Health Illn* 2022;44:953–71.
- 8 Paasche-Orlow MK, Parker RM, Gazmararian JA, *et al*. The prevalence of limited health literacy. *J Gen Intern Med* 2005;20:175–84.

- 9 Orkan O, Bauer U, Hurrelmann K, *et al.* Corona-bezogene gesundheitskompetenz in der bevölkerung. In: *Health literacy survey COVID-19*. Berlin: Bundesministerium für Gesundheit, 2022.
- 10 Landesinstitut für Statistik Autonome Provinz Bozen - Südtirol. Covid-19: Einstellungen und Verhalten der Bürger - Jänner 2021. *Aktuelles Und Publikationen* 2021. Available: https://astat.provinz.bz.it/de/aktuelles-publikationen-info.asp?news_action=4&news_article_id=654232
- 11 Larson HJ, Gakidou E, Murray CJL. The Vaccine-Hesitant Moment. *N Engl J Med* 2022;387:58–65.
- 12 Solís Arce JS, Warren SS, Meriggi NF, *et al.* COVID-19 vaccine acceptance and hesitancy in low- and middle-income countries. *Nat Med* 2021;27:1385–94.
- 13 Becker LA, Oxman AD. Overviews of reviews. In: *Cochrane handbook for systematic reviews of interventions*. John Wiley & Sons, 2008: 607–31.
- 14 Hartling L, Chisholm A, Thomson D, *et al.* A descriptive analysis of overviews of reviews published between 2000 and 2011. *PLoS One* 2012;7:e49667.
- 15 Aromataris E, Fernandez R, Godfrey CM, *et al.* Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *Int J Evid Based Healthc* 2015;13:132–40.
- 16 Moher D, Shamseer L, Clarke M, *et al.* Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4:1.
- 17 Moher D, Liberati A, Tetzlaff J, *et al.* Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 2009;6:e1000097.
- 18 McGowan J, Sampson M, Salzwedel DM, *et al.* PRESS Peer Review of Electronic Search Strategies: 2015 Guideline Statement. *J Clin Epidemiol* 2016;75:40–6.
- 19 Levay P, Finnegan A. The NICE search filters for treating and managing COVID-19: validation in MEDLINE and Embase (Ovid). *J Med Libr Assoc* 2024;112:225–37.
- 20 Rethlefsen ML, Kirtley S, Waffenschmidt S, *et al.* PRISMA-S: an extension to the PRISMA Statement for Reporting Literature Searches in Systematic Reviews. *Syst Rev* 2021;10:39:39.
- 21 Munn Z, Aromataris E, Tufanaru C, *et al.* The development of software to support multiple systematic review types: the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI). *Int J Evid Based Healthc* 2019;17:36–43.
- 22 Joanna Briggs Institute. JBI Data Extraction Form for Review for Systematic Reviews and Research Syntheses. JBI Manual for Evidence Synthesis, 2024. Available: <https://jbi-global-wiki.refined.site/space/MANUAL/355830547/Appendix+9.3+JBI+Data+Extraction+Form+for+Review+for+Systematic+Reviews+and+Research+Syntheses>
- 23 Gender mainstreaming for health managers: a practical approach, Available: <https://www.who.int/publications/i/item/9789241501057>
- 24 Joanna Briggs Institute. Discussion of JBI Critical Appraisal Checklist for systematic reviews and research syntheses. BI Manual for Evidence Synthesis. 2024. Available: <https://jbi-global-wiki.refined.site/space/MANUAL/355830527/Appendix+9.2.+Discussion+of+JBI+Critical+Appraisal+Checklist+for+systematic+reviews+and+research+syntheses>
- 25 Pieper D, Antoine S-L, Mathes T, *et al.* Systematic review finds overlapping reviews were not mentioned in every other overview. *J Clin Epidemiol* 2014;67:368–75.
- 26 Guyatt GH, Oxman AD, Vist GE, *et al.* GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ* 2008;336:924–6.