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Socio-Demographic and Psychological Determinants of COVID-19 Vaccination Intention in Europe and North America: A Systematic Review

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Keywords
COVID-19 · Vaccination · Intention · Hesitancy · Acceptance · Determinants · Psychological

Abstract
Introduction: Since the beginning of the SARS-CoV-19 pandemic, tremendous efforts have been made to address this public health emergency of international concern. The control of the disease has essentially depended on vaccination programs. Many recent studies continue to explore the factors related to the COVID-19 vaccine acceptance. ***Methods:*** This systematic review was conducted following PRISMA guidelines. PubMed, Scopus, Web of Science, EBSCO, CINAHL, Embase, and PsycoINFO were searched to gather all relevant data on the social and psychological determinants of intention to vaccinate against COVID-19. ROBIS tool was used to evaluate the risk of bias. The main objective of this systematic review was to identify the main social and psychological determinants responsible for the choice to vaccinate against COVID-19 in the adult population of Europe and North America. ***Results:*** This systematic review examined literature identified through seven databases yielding 576 PRISMA records, being used 28 articles. The results suggest that older people, higher education level and Caucasian have a stronger intention to be vaccinated. Many studies confirm that beliefs about vaccine costs and benefits are related with vaccine intention. Social concerns, perceived severity of COVID-19 and perceived risk of being infected are confirmed in most studies as determinants of vaccination intention. Conspiracy beliefs seem to promote vaccine hesitance. ***Conclusion:*** The results point to some useful conclusions for promoting vaccination in future pandemic situations. In addition to the targeting of the most vaccine-resistant groups, this study suggests the main themes that should be focused on future public communication to promote vaccination.

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Determinantes Sociais e Psicológicos da Intenção de Vacinação contra a COVID-19 em adultos Europeus e Norte Americanos – Uma Revisão Sistemática

Palavras Chave
COVID-19 · Vacinação · Intenção · Hesitação · Aceitação · Determinantes · Psicológicos

Resumo
Desde o início da pandemia de SARS-CoV-19, foram feitos esforços enormes para abordar esta emergência de saúde pública de preocupação internacional. O controlo da doença tem dependido, essencialmente, de programas de vacinação. Muitos estudos recentes continuam a explorar os fatores relacionados à aceitação da vacina da COVID-19. Com o objetivo de reunir todos os dados relevantes sobre os determinantes da intenção de se vacinar contra a COVID-19, o objetivo desta revisão da literatura que teve por base a metodologia PRISMA foi identificar os principais determinantes socio-demográficos e psicológicos responsáveis pela escolha da população adulta em se vacinar contra a COVID-19. Os resultados sugerem que, na Europa e América do Norte, pessoas mais velhas, com maior nível de educação e caucasianos têm uma intenção mais forte de serem vacinados. Muitos estudos confirmam que as crenças sobre os custos e benefícios da vacina estão relacionadas com a intenção de vacinação. Preocupações sociais, perceção da gravidade da COVID-19 e perceção do risco de infeção são confirmadas na maioria dos estudos como determinantes da intenção de vacinação. Crenças conspiratórias parecem promover hesitação em relação à vacina. Os resultados apontam para algumas conclusões úteis para a promoção da vacinação em futuras situações de pandemia. Para além de identificar os grupos mais resistentes à vacinação, o presente estudo aponta os temas principais que devem ser considerados na comunicação com as populações para promover a vacinação.

Introduction

The World Health Organization (WHO) declared that the SARS-CoV-2 infection became a pandemic on March 11, 2020 [1]. Coronavirus disease (COVID-19) pandemic has substantially influenced daily life for societies and individuals, affecting economics, health, and well-being. From the beginning of the pandemic caused by SARS-CoV-2, tremendous efforts have been made to tackle this public health emergency of international concern [2, 3]. The scientific community started working together on strategies to combat the virus, being the development of vaccines one of the most relevant.

In the past, the wide use of vaccines has decreased mortality and morbidity of different transmissible diseases [4]. Therefore, an effective COVID-19 vaccination program, like other infectious diseases, has played and still plays an essential role in disease control, depending on a broad uptake, to decrease its incidence and prevalence [5, 6].

However, universal vaccination is assumed to be difficult [1, 7, 8]. Among other factors, some public safety concerns and scepticism are related with vaccine hesitance [9, 10], although most of the approved COVID-19 vaccines have reported an efficacy greater than 90% in the phase 3 trials [11–13]. Previous studies of influenza vaccination show that not all citizens took up the vaccines with a series of factors influencing its uptake [14]. Also, approximately 5–10% of individuals have solid anti-vaccination beliefs, and a larger proportion could be viewed as being hesitant regarding vaccination in general [15, 16]. This led the WHO to declare vaccine hesitancy as one of the top challenges to world health [17]. Vaccine hesitancy can vary between infectious diseases, and the rationale behind hesitancy for different diseases, such as influenza and COVID-19, can be influenced by a variety of factors, such as perception of disease severity, novelty of the disease, perceived vaccine effectiveness, political and ideological factors and misinformation and social media. Therefore, the SARS-CoV-2 virus has been perceived as more severe and life-threatening, particularly during the early stages of the pandemic. The high mortality rate in specific groups and the potential for long-term health consequences have generally increased vaccine acceptance. Despite the initial clinical trials for COVID-19 vaccines showing high effectiveness in preventing illness, particularly severe cases, COVID-19 is a novel coronavirus, and the vaccines developed to combat it are new, and concerns about vaccine safety and side effects remain. Additionally, the response to COVID-19 has become politicized in some countries, with vaccine hesitancy driven by political affiliations and ideologies. Finally, misinformation and conspiracy theories related to COVID-19 and its vaccines have been widely circulated on social media, leading to significant hesitancy in some communities [18, 19].

A large number of studies continue to be published exploring the perception of the COVID-19 vaccination program and other determinants of its acceptance [20–22]. The acceptance rate of COVID-19 vaccines has been investigated and reported in previous studies, varying across countries globally, ranging from 43.4% to 94.3% [23–25]. By bringing together relevant data on COVID-19 vaccine intention determinants, the underlying role of these factors could be clarified, which would eventually provide the opportunity for primary interventions targeting the groups of unvaccinated people, not only in COVID-19 but also in any other potential pandemic. Some data had already focused on predicting vaccination intention, using theoretical planned behaviours [26]. Other systematic reviews had highlighted acceptance of COVID-19 vaccination or demographic social and contextual factors that may influence the vaccination intention or hesitancy determinants [27–29]. Nevertheless, this systematic review aims to determine which socio-demographic and psychological determinants could be responsible for the adults' intention to be vaccinated against COVID-19 in European and North American adults. These two regions have political and ideological affinities, determining our choice for its inclusion in this review. In addition, Europe and the USA share trust in government and public health institutions, namely, vaccination regulation, multiple approved vaccines, mass vaccination campaigns, and global collaboration (e.g., North America and Europe participated in global initiatives such as COVAX) [30, 31].

Methods

Design

A systematic literature review of quantitative studies was performed to summarize the available evidence on the social and psychological determinants of the intention to be vaccinated against COVID-19, in European and North American adults. The review was conducted taking into consideration the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) [32], which encompass four phases: Identification, Screening, Eligibility, and Inclusion. The PROSPERO registration number is CRD42023402405. The protocol is also available at the Open Science Framework platform (DOI 10.17605/OSF.IO/QE7CD).

A Population, Exposure, and Outcome (PEO) statement was developed by the reviewers' team as an aid to identify search terms and inclusion/exclusion criteria as appreciate for addressing this systematic review (Table 1). The definition of adults was provided by the National Institute of Health that affirms that adult is a person with an age between 18 and 65.

Table 1. PEO criteria for inclusion and exclusion in systematic review

P	European and North American adults
E	Social and/or psychological and determinants
O	COVID-19 vaccine intention

Search Strategy

Publications which describe original quantitative research were retrieved via electronic database searches of PubMed, Scopus, Web of Science, EBSCO, CINAHL, Embase, and PsycoINFO, in the period from January to February 2023. The research included articles published from January 2020 to December 2022. A combination of several terms was used, such as COVID-19 vaccines, intention, refusal, hesitation, determinants, and social. The keywords used with the Boolean operators AND and OR are presented in Table 2. The last date that the data was consulted was in April 2023.

No restrictions regarding language or publication type (original articles or reviews) were applied in this phase. This search strategy led to a total of 126 PubMed papers, 313 Scopus papers, 131 Web of Science papers, and six EBSCO papers. A list of inclusion and exclusion criteria was defined, as detailed in Table 3.

Firstly, the titles and abstracts of studies identified from the search were independently reviewed by two reviewers. Secondly, the full text of each study deemed possibly relevant was retrieved and independently reviewed by two reviewers. Each reviewer compiled a list of studies that meet the inclusion criteria, in their view. The lists were compared, and any disagreements resolved by team discussion and consensus.

Quality Assessment of the Articles

Quality assessment was done using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Study [33]. JBI is an international research organisation based in the Faculty of Health and Medical Sciences at the University of Adelaide, South Australia and accordingly to Ma et al. (2020) [33], this tool is the most used in quality assessment of analytical cross-sectional studies. Two

Table 2. Detailed description of the keywords used in each electronic database

Databases	Keywords
PubMed	("COVID-19 Vaccines"[MeSH]) AND ("Intention"[MeSH] OR "Vaccination Refusal"[MeSH] OR "Hesitation") AND ("Social Determinants of Health"[MeSH] OR "Sociology, Medical"[MeSH] OR "Decision Theory"[MeSH] OR "Psychology Determinants")
Web of Science	ALL=("COVID-19" OR "SARS COV 2") AND ALL=("Vaccin*") AND ALL=("Intention" OR "Hesitation" OR "Refus*") AND ALL=("determinants") AND ALL=("Social" OR "Sociolog*" OR "Psycologic*")
Scopus	ALL ("COVID-19" OR "SARS COV 2") AND ALL ("Vaccin*") AND ALL ("Intention" OR "Hesitation" OR "Refus*") AND ALL ("determinants") AND ALL ("Social" OR "Sociolog*" OR "Psycologic*")
EBSCO; CINAHL; EMBASE; PsycoINFO	COVID-19 or sars-cov-2 AND Vaccine or Vaccination AND Intention OR Hesitation OR Refusal

Table 3. Detailed description of the inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
- European and North America studies	- Health professionals
- Quantitative studies	- Children (<18 years old) - Parents of children <18 years old - Parents representing children <18 years old
- Adults	- Review and meta-analysis studies
- Articles in English, Portuguese	

reviewers evaluated independently all articles as "yes", "no," "unclear," and "not applicable" in the eight dimensions proposed on JBI tool. Disagreements were resolved by consensus and a third reviewer was available to arbitrate any issues that remained unresolved.

After discussing the ratings and resolving any disagreement, the global rating for each of the selected articles was obtained by dividing the sum of ratings given ("No" = 1; "Unclear" = 2; "Yes" = 3) for the number of dimensions. Those dimensions rated as "not applicable" were not considered, to permit a more adjusted score within studies. All the articles were assessed in the eight dimensions, despite only seven being scored (see online suppl. Material S1; for all online suppl. material, see https://doi.org/10.1159/000546311). With the support of a tool called robvis [34], it was possible to build the quality assessment results in a creative way.

Data Extraction

Data were extracted from all articles independently by two reviewers. For each study, information was extracted regarding the authors, date of publication, country, goals, participants recruitment, and study design (including sampling and methodology).

Results

Study Selection

As it was previously described, it was used the PRISMA Framework, and the results are represented in the flow diagram PRISMA 2020 (Fig. 1). Overall, none of the 28 studies were considered to be seriously flawed according to the quality assessment. The 28 included studies scored between 11 and 21 in the JBI Checklist (see online suppl. Material S1: S1.1 and S1.2). All studies were considered to have a low risk of bias for selection (Fig. 2).

Characteristics of Included Studies

The 28 selected studies involved a total of 138,487 subjects (see online suppl. Material S2), and were conducted from February 2020 to December 2022, half of them (n = 14) taking place in 2021 [18, 35–44]. Considering the country of origin, nine (32.1%) studies were carried in the USA [35, 40, 41, 43–48], five (17.9%) in the United Kingdom [18, 25, 42, 49, 50], even though two of them also included participants from the Republic of Ireland [42, 50], three (10.7%) studies were conducted in Germany [38, 51, 52], two (7.1%) studies in multiple

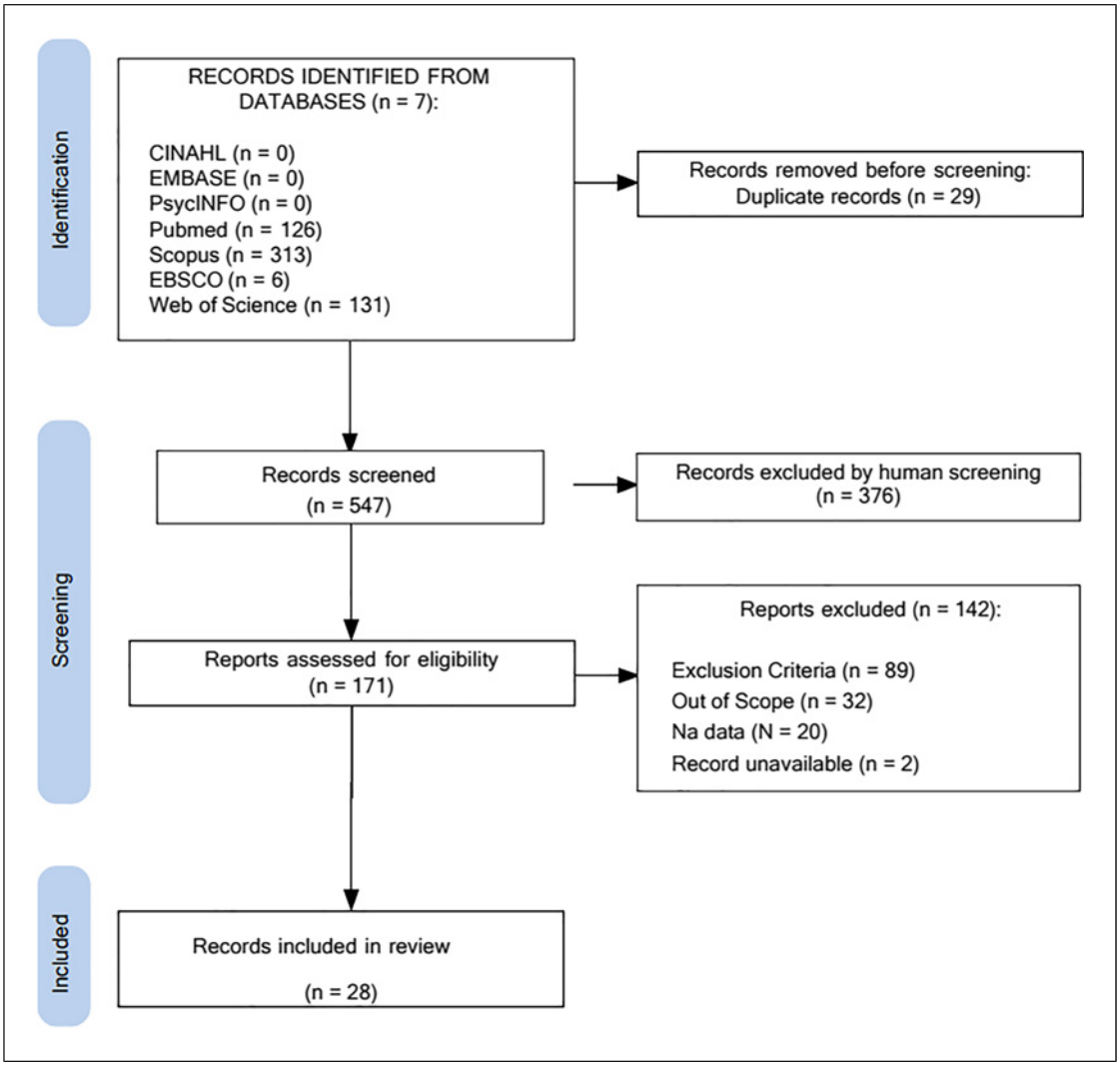

Fig. 1. Search and study selection PRISMA flow diagram.

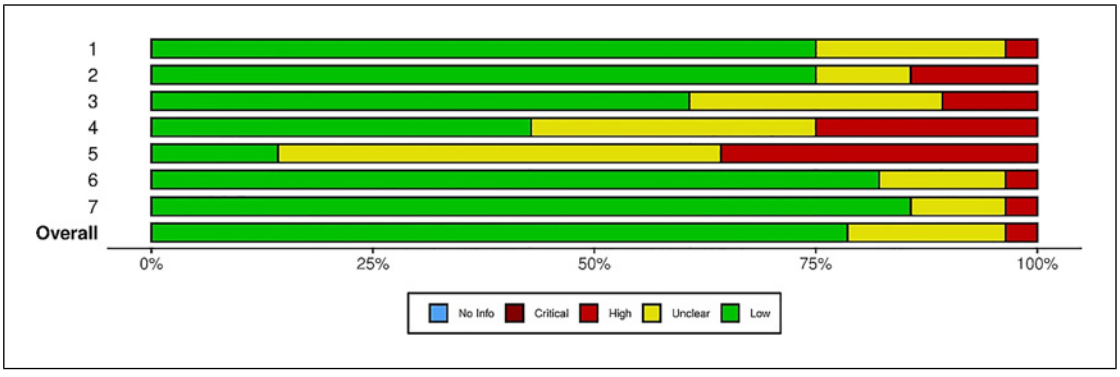

Fig. 2. Summary of the critical appraisal based on JBI checklist (risk of bias).

countries [35, 49], and the remaining studies (32.2%) took placed in Turkey [53], Finland [38], Northern Ireland and Republic of Ireland [36], Netherlands [54], Federation of Bosnia and Herzegovina [55], Switzerland [56], Czech Republic [57], Italy [58], and Belgium [59].

All articles adopted a cross-sectional design. Twenty studies used a non-probabilistic sampling method, namely, quota sampling [25, 35, 38, 40, 42–44, 49, 51, 55], convenience sampling [37, 40, 47, 50, 56, 59], or snowball sampling [36, 53, 58]. Four studies were conducted using a stratified sample [18, 41, 52, 60], two of them randomly [52, 60]. For the other five studies, sampling methodology was not described in detail.

Participant recruitment was done essentially online [18, 35, 36, 38, 39, 43, 50, 51, 55–61], including social media [37, 40, 53], e-mail [47], or using online panel providers [42–44, 49, 52]. On the Latkin et al. (2021) study, an online panel provider was combined with a telephone contact. For the other two studies, the way participants were recruited was not described in detail [41].

Being intention to be vaccinated against COVID-19 the focus, there are some differences in how this variable was measured in the studies under analysis. Despite most of them measure intention to be vaccinated, in four studies [38, 47, 52, 57], the focus was on acceptability or acceptance of a COVID-19 vaccine and in eight other studies [36, 40–43, 48, 59, 60], it was vaccine hesitancy that was measured. For the studies focusing on psychological determinants, 13 of them were theory-based [18, 25, 35, 36, 39, 41, 44, 45, 50, 51, 56, 59, 61], which was reflected in the questions posed in the questionnaires being used. In the study conducted by Sanders et al. (2021), although it was not theory-based, the beliefs related to vaccination intention, under assessment, are the result of an extensive literature review [54].

Socio-Demographic Determinants

The full version of the results regarding socio-demographic data and vaccination intention are presented in the online supplementary Material S3. Vaccination intention ranged from 45.4% [18] to 89% [57], with an average of 65%.

Regarding socio-demographic determinants, not all were evaluated in every study. Age was addressed in 21 studies [18, 38–45, 47, 48, 50, 52–55, 57, 60, 61], although six of them [18, 38, 45, 48, 53, 57] were not considered statistically significant. Apart from the study conducted by Khubchandani et al. (2021), vaccination intention was higher in older participants [40].

Only three studies did not address gender differences [35, 51, 59]. In ten studies [37–39, 41, 42, 44, 47, 49, 53, 61], intention to be vaccinated was higher in men and in five studies [43, 50, 55, 60], the opposite. In the remaining studies, gender was found to be a non-statistically significant variable.

Within the studies addressing educational level as a determinant of vaccination intention, only in the studies conducted by Musa et al. (2022) and by Lazarus et al. (2020) the intention to be vaccinated was higher in participants with a lower educational level (namely in Canada, Spain, and the United Kingdom) [52, 55]. In the remaining countries and in all the other studies addressing, this determinant [40, 41, 44, 47, 49, 56, 58, 60, 61] vaccination intention was higher in participants with a higher educational level.

The influence of marital status on the intention to be vaccinated was not addressed in 19 studies. Participants that were married/civil united or living in a cohabitation demonstrated higher vaccination intention in four studies [41, 44, 47, 61], while in two studies [49, 53] that was higher for single/separated participants. In the remaining studies, no differences were found concerning marital status. Finally, in the studies where ethnicity was found to be a determinant for vaccination intention [35, 40, 41, 43, 44, 47–50, 60], white (Caucasian) participants always reflected a higher vaccination intention.

Psychological Determinants

Of the 28 selected articles, 23 focused on psychological determinants. The identified factors were classified in eleven thematic categories, namely, trust on media, social and scientific entities (addressed in 52% of the 23 studies); disease severity (57%); vaccine costs and risks (52%); vaccine efficacy (35%); social concerns (30%); conspiracy beliefs (27%); perceived of risk to be infected (30%); control perception (26%); social norms (30%); personal concerns (22%); and emotions and personality (22%). To enable a more substantiated analysis, categories that were addressed only in one study were excluded (e.g., perceived health status).

Disease Severity and Perceived Risk to Be Infected

Of the 13 studies that addressed disease severity (Table 4), 10 (76%) studies fully confirmed that people with a higher perception of COVID-19 severity tended to have a stronger intention to be vaccinated. Only one study found no significant relation with vaccine intention [51]. Sherman et al. (2021) distinguish between perceived severity of COVID-19 for the individual and for the community, with only the former being a predictor of vaccination intention.

Table 4. List of beliefs: disease severity and perceived risk to be infected

	Disease severity	Perceived risk to be infected
[47]	Perceived severity of COVID-19 infection: > intention	Perceived likelihood of getting COVID-19 infection in the future: > intention
[40]	Perceived threat and concern of getting infected with COVID-19 in the next year: > intention	Perceived threat and concern of getting infected with COVID-19 in the next year: > intention
[25]	Perceived risk of COVID-19 for population: > intention Personal risk of COVID-19: NSSD	Probability of being infected: NSSD
[44]	Health threat appraisal: > intention	NE
[41]	NE	Worried about COVID-19 infecting family or self: NSSD
[37] [38] [18]	COVID-19 health threat: > intention Worried about severe disease: > intention Disease severity: > intention	NE
[39][1]	Worry about COVID: > intention (Germany, Italy, Sweden)	Perceived infection risk: > intention (USA, Germany, Italy)
[55] [57] [58]	COVID-19 risk: > intention Fear of COVID-19: > intention COVID-19 perceived risks: > intention	NE
[51]	Fear of COVID-19: NSSD Risk of COVID-19: NSSD	NE
[50][2]	Fear of COVID-19: > intention Perceived severity: > intention Perceived susceptibility: > intention	Fear to be infected: > intention
[61]	NE	Having risk factors for COVID-19: > intention

[1]Only stronger predictors are mentioned, due to the high number of determinants and countries under study. Countries with more than one evaluation, only the last was considered. [2]Only results for combined samples (Ireland & UK) are presented. NE, not evaluated; NSSD, non-statistically significant determinant.

Regarding perceived risk to be infected (Table 4), six studies assessed risk and concern of being infected and one focused the perception of individual health risk factors for COVID-19 [61]. Five (71%) studies confirm that intention to be vaccinated is directly related to a higher perception of risk to be infected [18, 39, 40, 47, 50, 51, 61]. One study found mixed results on different national samples.

Vaccine Costs and Risks, Control Perception, and Vaccine Efficacy

Twelve studies focused on beliefs about vaccine costs and risks (Table 5). With exception of Musa et al. (2022) [55], all the studies (92%) confirmed that a strong perception of vaccine costs and risks is related with a low intention to be vaccinated.

Table 5 shows that three of six studies focusing control perception (i.e., to be able to obtain the vaccine, when/if available) found no significant relation with vaccination intention [18, 45, 51]. Bleakley et al. (2022) [35] presented heterogeneous results concerning this relation, varying according to age and ethnicity. Only two (33%) studies found that intention to vaccinate is related with the perception of easy access [36, 55].

Five of eight (62%) studies presented in Table 5 support that people who perceive high vaccine effectiveness/efficacy (e.g., the perception/belief in the positive effect of the vaccine in preventing COVID-19 or reducing its symptoms) tend to have a stronger intention to be vaccinated [18, 36, 47, 49, 50]. Two articles found this relation but only in specific ethnic and age groups [36, 38]. The remaining two articles do not confirm this association.

Personal Concerns, Social Concerns, Social Norms, and Emotions and Personality

Three [18, 38, 50] of the five (60%) studies confirm the relevance of personal concerns (e.g., protection of oneself; avoid future regret for not having been vaccinated) in the development of vaccination intention (Table 6). With respect to social concerns (Table 6), seven articles [39, 42, 45, 49, 50, 54, 58] confirm that vaccination intention is related with social concerns (86%): altruistic motivations

Table 5. List of beliefs: vaccine costs and risks, cost perception, and vaccine efficacy

	Vaccine costs and risks	Control perception	Vaccine efficacy
[47]	Perceived potential harm of a COVID-19 vaccine: > intention	NE	Perceived effectiveness of a COVID-19 vaccine: > intention
[25]	Vaccine side effects: < intention	NE	NE
[49]	Vaccine side effects: < intention	NE	Perceived effectiveness of a COVID-19 vaccine: > intention
[38]	Worries about potential side effects: < intention	NE	Vaccine efficacy: NSSD (<50 years old) Vaccine efficacy: > intention (>50 years old)
[36]	Vaccine negative attitude[1]: < intention Mistrust of vaccine benefits: < intention Worries about unforeseen future events: < intention Preference for natural immunity: < intention	Control[1]: > intention	Confidence in the COVID-19 vaccine: > intention
[35]	NE	Control to get the vaccine when it becomes available[1] **Autonomy**: NSSD for 18–49 years old; < intention for >50 years old (only White) **Self-efficacy**: NSSD for 18–49 years old; > intention for 50 years old+ (only Black)	Attitudes (favourability towards being vaccinated)[1] > Intention for 18–49 years old (White, Black, but not in Hispanic) > Intention for >50 years old (for the three ethnic groups)
[54]	Short or long-term side effects: < intention	NE	NE
[18]	NE	Control to get vaccinated: NSSD	Perceived vaccine benefits: > intention
[55]	Side effects of vaccine: NSSD	Vaccine being easy to get: > intention	NE
[43]	Anti-vaccine beliefs: < intention	NE	NE
[45]	Vaccine negative attitude[1]: < intention	Control against COVID-19: NSSD	NE
[58]	Doubts about vaccine: < intention	NE	NE
[51]	Vaccine Negative attitude[1]: < intention	Perceived control[1]: NSSD	Scepticism towards vaccines: NSSD
[50][2]	Vaccine risk: < intention	NE	Perceived benefit: > intention

[1]Theory of planned behaviour. [2]Only results for combined samples (Ireland and UK) are presented. NE, not evaluated; NSSD, non-statistically significant determinant.

[42, 58], collective importance of COVID-19 vaccine [49], civic responsibility [50], the perception of community benefits [39, 45], and moral duty to be vaccinated [50, 54]. Only one study does not confirm this conclusion [39].

As shown in Table 6, influence of social pressure on vaccine intention was confirmed by four (66.7%) studies [18, 36, 50, 51]. Bleakley et al. [35] found a significant relation between normative pressure and vaccine intention but only for people over 50 years old.

Trust on Media, Social and Scientific Entities; Conspiracy Beliefs; Emotions and Personality

Table 7 shows the conclusions of the nineteen studies that addressed the relation between vaccine intention and (a) trust on media, social and scientific entities, (b) conspiracy beliefs, and (c) emotions and personality [18, 37–39, 48, 50, 51, 55, 58, 59, 61]. From the eleven studies that access specifically confidence in political institutions and health authorities seven confirm the relation of this

Table 6. List of beliefs: personal concerns, social concerns, and social norms

	Personal concern	Social concerns	Social norms
[42]	NE	Ireland and UK sample Altruistic motivations: > intention	NE
[36]	NE	NE	Subjective norms: > intention
[35]	NE	NE	Normative pressure[1]: NSSD in 18–49 years old (for the three ethnic groups); > intention in >50 years old (for the three ethnic groups)
[49]	NE	Collective importance of COVID-19 vaccine: > intention	NE
[38]	Assumed protection of oneself was a reason to get vaccine: > intention	NE	NE
[54]	Will protect one-self: NSSD	Vaccination protects others (moral duty): > intention Vaccination is key to reopening society: NSSD	NE NE
[18]	Anticipated regret of not having a vaccine: > intention	NE	Subjective norm[2]: > intention
[39][3]	NE	Pro-sociality (to do things for the benefit of others and society): NSSD	NE
[45]	Anticipated regret (not to vaccinate): NSSD	Perceived community benefits: > intention	Subjective norm[2]: NSSD
[58]	NE	Protection of others (altruistic motivations): > intention	NE
[50][4]	Vaccine attitudes (need to be vaccinated: > intention	Civic responsibility: > intention Moral duty (VS choice) > intention	Peer influence: > intention GP influence: > intention Govern. influence: > intention
[51]	NE	NE	Subjective norm[2]: < intention

[1]Normative pressure: perceptions about what others think and do about performing the behaviour. [2]Theory of planned behaviour. [3]Only more stronger predictors are mentioned, due to the due to high number of determinants and countries under study. Countries with more than one evaluation, only the last was considered. [4]Only results for combined samples (Ireland and UK) are presented. NE, not evaluated; NSSD, non-statistically significant determinant.

variable with vaccine intention [18, 37, 43, 50, 55, 59, 61]. Two do not confirm this relation [25, 51] and the remaining two present heterogeneous results depending on age [38] and country [39]. The impact of trust in health professionals on willingness to vaccinate is specifically assessed in three studies with heterogeneous results [38, 39, 51]. Two studies do not confirm that trust in science is relevant in the decision to take the vaccine [48, 51].

Concerning media information, El-Far Cardo et al. [37] concluded that those who use media as a source of information have a stronger intention to vaccinate which was not confirmed in Stoler et al. study [48]. Musa et al. [55] found that people who think that COVID-19 information is exaggerated by the media tend to have a low vaccination intention [55].

In four studies, the confidence is assessed combining two or more entities (science, health and political institutions, health professionals) [42, 54, 55, 58] with three of them confirming a direct relation with the intention to be vaccinated [39, 51, 55]. Overall, the relation with trust on media, social and scientific entities is fully confirmed in 10 (62.5%) studies.

The results concerning adherence to conspiracy beliefs (Table 7) show heterogeneous conclusions, with four (57%) studies concluding that they are predictors of the

Table 7. List of beliefs: trust on media, social and scientific entities; conspiracy beliefs; emotion and personality

	Trust on media, social and scientific entities	Conspiracy beliefs	Emotions and personality
[54]	Trust in science or institutions: > intention	NE	
[53]	NE	NE	Anxiety: > intention
[42]	Ireland and UK, respectively Trust in scientists, health professionals and state: > intention and NSSD	Ireland and UK, respectively Conspiracy beliefs: < intention and NSSD Paranoia: NSSD and < intention	NE
[25]	Perceived trust in the virus management: NSSD	NE	NE
[49]	NE	Conspiracy beliefs: < intention	NE
[38]	Vaccine given are safe > intention (>50 years) Recommendation from a health professionals > intention (<50 years)	NE	NE
[37]	Trust in health authorities > intention Use of media as inform source: > intention	NE	NE
[39][1]	Trust in National sci/med advisors > intention (Spain and EUA) Trust in experts: > intention (Spain) Trust in WHO: > intention (Germany)	NE	NE
[44]	NE	Conspiracy beliefs: < intention	NE
[58]	Trust in politics and science: > intention	NE	NE

[1]Only stronger predictors are mentioned, due to the due to high number of determinants and countries under study. Countries with more than one evaluation, only the last was considered. [2]Embitterment defined as a feeling of disappointment and anger in response to perceived injustices by others towards the self and to negative life events, and feelings of social exclusion, a lack of social support and the perception of unrightfully been let down. [3]Only results for combined samples (Ireland and UK) are presented. NE, not evaluated; NSSD, non-statistically significant determinant.

unwillingness to be vaccinated [44, 49, 56, 59], while two studies do not confirm this idea [48, 51] and another presents mixed results [42].

Emotions as a predictor of vaccine intention are analysed in four of six studies (Table 7) [53, 55, 56, 61]. Though Musa et al. (2022) [55] conclude that negative affective states are predictors of vaccine intention, Roberts et al. (2022) [43] do not confirm this relation for depression and stress. Embitterment and life satisfaction seem to be positively related with the intention to be vaccinated [56, 61]. The results of the one study that focus on personality variables do not confirm their influence on vaccine intention [48].

From a more global analysis, the most widely confirmed determinants categories of vaccine intention are vaccine costs and risks (92%), social concerns (86%), disease severity (76%) and perceived risk to be infected (71%). The remaining determinants are confirmed in around 50% of the studies, with exception for control perception (33%) and emotions and personality.

Discussion

Vaccines are essential to accelerate the immunization process [62]. However, the COVID-19 vaccines acceptance is influenced by psychosocial variables. The present study aims to systematize the socio-demographic and psychological determinants of the adult intention to be vaccinated against COVID-19 in European and North American adults.

Considering the general characteristics of the 28 selected studies, some methodological and theoretical shortcomings can be identified; first, most studies use non-probabilistic sampling, and second, only half of the

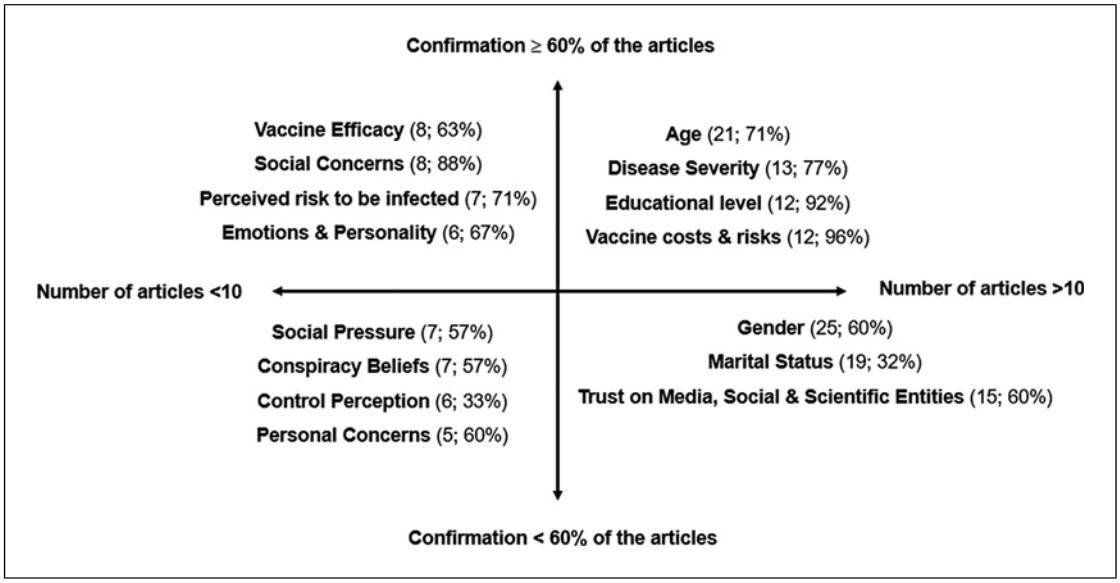

Fig. 3. Determinants of COVID-19 vaccine intention by number of articles and percentage of confirmation.

studies focusing on psychological determinants are theory-based. The selection of psychological determinants under study without a theoretical framework is even more serious given a substantive number of consolidated theories explaining health behaviours (e.g., health beliefs model, theory of planned behaviour; transtheoretical model), which have already been widely used in studies related to vaccination adherence.

Cognitive factors related to vaccine intention can be affected over time. For instance, risk perception and the perception of vaccine efficacy can be influenced by the evolution of the number of deaths and knowledge about the disease/vaccine, among other aspects that change over time. Cognitive factors can be also affected by the periods of lockdown and access to vaccination. However, this time variables were not analysed in the present study due to the absence of international data on dates of lockdown and vaccine access as well as the rate of vaccination for all European and North American countries.

Figure 3 summarizes the results described below, dividing the socio-demographic and psychological determinants along 2 axes: the number of articles found for each determinant and, among these, the percentage of articles fully confirming the relationship between the determinant and the intention to vaccinate.

Socio-Demographic Variables

In the present systematic review study, it was observed in 35% of the studies a positive relation between older adults and their intention to vaccinate [42–44, 47, 49], which may be attributed to the fact that the mortality rate is higher in the elderly population, and consequently there is a perception of greater fragility of this group when facing this disease, leading to a greater need to be vaccinated. These results are corroborated by other authors [6, 22, 63–66].

Regarding gender, a high prevalence of vaccination intention was found in men (9 of the assessed studies) [37, 38, 41, 42, 44, 47, 49, 53]. These results are consistent with many studies that found greater acceptance in men, as well as in individuals with higher educational levels [22, 63–67].

Concerning marital status, those who are married or in a union were the ones who showed the highest vaccination intention, as found in other studies [22, 63–66]. As for race/ethnicity, there was a vast diversity of classification, varying according to the country or region where the study was conducted. Therefore, it is challenging to extract relevant conclusions, except for the higher intention to be vaccinated in white (Caucasian) people. In Cascini's, Fisk's, and Wang's studies [64, 68, 69], minorities of ethnic groups have lower levels of acceptance [64, 68–70]. Nevertheless, the study developed by Szilagyi et al. (2021) [67] only showed lower levels of acceptance for Black race than White, Hispanic, and Asian as [67]. The results of these studies indicate, as pointed out by Fisk (2021) [68] that awareness of vaccination should be strengthened among ethnic minority leaders.

Psychological Variables

One of the aims of this study was to determine which psychological variables could be responsible for the intention to be vaccinated against COVID-19. With

exception of emotion and personality, focused only in five studies, the main psychological variables were beliefs that were grouped into seven categories: disease severity, perceived risk of being infected, vaccine costs and risks, vaccine efficacy, social concerns, conspiracy beliefs, and trust in social scientific entities. A relevant number of studies found a significant relationship between vaccination intention and each category, with which underlies their importance in accepting the COVID-19 vaccine.

All studies confirm an adverse effect of conspiracy beliefs on vaccination intention. These findings are corroborated by Wang's systematic review that, despite just including USA studies, emphasized the association between COVID-19-related conspiracy theories to vaccine acceptance [69, 70]. Trust in science and health institutions/professionals also emerges as a relevant factor since most studies found a positive relationship between those beliefs and vaccination intention [25, 42, 71, 72]. This confirms Nindrea's results (2021) [66] that highlight the relevance of trust in the health system to vaccine acceptance [66], and Joshi's study (2021) that identifies valuing doctor's recommendations and government satisfaction as associated factors of vaccine acceptance [65]. These results point out that individual perceptions of social phenomena influence vaccination intention and are not directly related to personal health.

Regarding the perceptions about the vaccine, beliefs about adverse effects are essential determinants of vaccination hesitation in all the studies addressing this relation. The side effects were one of the vaccine risks identified as predictors of vaccine hesitancy [25, 49, 54]. In addition, results confirmed that the perception of vaccine efficacy is related to the intention to be vaccinated [47, 49], being corroborated by Lin's study [73]. This outcome confirms Joshi's scoping review finding that vaccine efficacy is related to a high perception of benefits and a low perception of barriers, which were associated with higher vaccination acceptance (Joshi et al., 2021). Cassini's systematic review [64] also highlighted vaccine safety and efficacy perceptions, as well as the study developed by Fernandes et al. (2021) [74]. Finally, Dimasa's systematic review [63] identified individual susceptibility to COVID-19 as one of the main determinants of vaccine acceptance. That confirms the assertion in many psychological models on health behaviour [75–77] that behaviour adopting results from balancing its benefits and disadvantages.

In our systematic review, the studies addressing the risk perception of COVID-19 (severity of the disease; risk to be infected) present the most heterogeneous results since around one-third of the studies do not confirm that intention to be vaccinated is related to the risk perceived of COVID-19. However, regarding previous studies, Nindrea's systematic review found that fear of COVID-19 and perceived risks were positively correlated with vaccine acceptance [66]. Similarly, Joshi's scoping review observed that a higher perceived risk of COVID-19 infection was associated with vaccine acceptance [65]. The results interpretation must consider that half of the included studies were held in 2020 when many people worldwide had no access to clear information about the risks of the disease.

Limitations

Several limitations were identified during the development of this systematic review and should be taking into consideration: 1) different criteria were used to classify some socio-demographic variables, such as race or ethnicity; 2) several studies were developed in multiple contexts, social, cultural, political, economic, etc., differences may have an impact on the results, which increases the relevance of complementary studies at national or continental level. However, the most critical limitation identified by the authors was that 3) several studies were carried out in different periods of the lockdown and phases of the vaccine studies/clinical trials. This is one of the biggest issues regarding the COVID-19′ vaccination studies were the timing of the surveys, as highlighted in the review of 209 studies carried out by Cascini and colleagues [64]. To overcome the limitations identified in future research on vaccination hesitancy, particularly given its status as a major challenge to global health, several approaches could be implemented, namely, standardization of socio-demographic criteria; context-specific research; longitudinal studies; meta-analyses across timeframes; use of advanced analytical tools; global collaboration and data sharing; and survey timing considerations.

One limitation in current studies is the use of different criteria to classify socio-demographic variables like race, ethnicity, and other factors. To address this, future research can establish standardized frameworks for classifying and reporting these variables. International collaborations among researchers, healthcare organizations, and governments can help create consensus-based guidelines for consistent data collection. This will make it easier to compare and synthesize findings across different studies and contexts.

Moreover, given the influence of social, cultural, political, and economic factors on vaccination hesitancy, future studies should focus on tailoring research to specific regions or populations. Conducting more localized or national-level studies can better reflect the unique challenges within different populations. This approach will also help identify context-specific drivers of hesitancy, leading to more effective, targeted interventions.

Although deeply expensive, longitudinal studies that track vaccine hesitancy and uptake over-time – before, during, and after critical events like lockdowns or vaccine rollouts – would provide more comprehensive data. These studies would allow researchers to better understand how attitudes shift based on changing conditions, including evolving pandemic dynamics or the introduction of new vaccines. To address the issue of varying timelines in existing research, future systematic reviews could conduct meta-analyses that account for the period of the studies. By organizing results according to different stages of the pandemic or vaccine development, researchers can better identify temporal patterns in hesitancy.

Several research points that the future is in the use of advanced analytical tools, such as machine learning models, can help future researchers analyse complex, multi-contextual datasets. These tools can identify patterns across socio-demographic variables and contextual factors (social, political, etc.) in a way that might be missed in more traditional analyses.

Plus, enhancing collaboration between countries and institutions can facilitate the sharing of data, which may help overcome some of the variability caused by different contexts. Creating global databases that allow for cross-contextual research will help harmonize findings and better identify universal trends and challenges in vaccine hesitancy.

Finally, when planning future studies, researchers should design surveys and data collection methods that can account for the timing of significant events, such as lockdowns or new vaccine introductions. Timing surveys more strategically, or conducting them continuously throughout vaccine rollouts, will provide more accurate snapshots of public sentiment.

Conclusion

This systematic review showed the socio-demographic and psychological determinants that contributed to the intention of adults being vaccinated against COVID-19 in Europe and North America. There is, in general, a good acceptance of COVID-19 vaccines in these two regions, with wide discrepancies across the identified determinants, such as age; gender; educational level; marital status; race/ethnicity are found. Regarding the psychological determinants identified in this systematic review, the perception of COVID-19 severity for the population and personnel and the perceived risk of being infected should be highlighted. Several included studies also underlined the significance of several beliefs regarding the COVID-19 vaccines, such as lack of confidence, concerns about potential harm, safety, and side effects. Other social concerns and conspiracy beliefs were also linked to being vaccinated.

The findings of this study may help European and North American health institutions and governments to identify the best approach to implement COVID-19 vaccination programs. Moreover, this could contribute to the fight against vaccination hesitancy to promote herb immunity around these countries.

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Statement of Ethics

Ethical approval and participant consent are not applicable in this case, as it is a systematic review.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

M.A.S.: conceptualization, methodology, quality assessment and writing – reviewing and editing. L.V.: writing – original draft preparation, quality assessment, and data treatment. A.G.: methodology and writing – original draft preparation. L.P.: writing – original draft preparation. A.C.: methodology. E.C.: writing – reviewing and editing. O.U.: writing – reviewing and editing. M.G.A.: conceptualization, methodology, quality assessment, and writing – reviewing and editing.

Data Availability Statement

All data generated or analysed during this study are included in this. Further enquiries can be directed to the corresponding author.

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