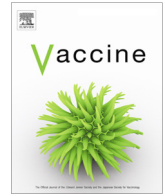




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Review

Overcoming COVID-19 vaccine hesitancy among ethnic minorities: A systematic review of UK studies



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ABSTRACT

Ethnic minority communities in the UK have been disproportionately affected by the pandemic, with increased risks of infection, severe disease, and death. Hesitancy around the COVID-19 vaccine may be contributing to disparities in vaccine delivery to ethnic minority communities. This systematic review aims to strengthen understanding of COVID-19 vaccine concerns among ethnic minorities in the UK. Five databases were searched in February 2022, yielding 24 peer-reviewed studies reporting on vaccine hesitancy or acceptance in ethnic minority groups. Data were extracted using a standardised form, and quality assessment was carried out using the Standard Quality Criteria. There were three key themes: (1). Prevalence of vaccine hesitancy; (2). Reasons for vaccine hesitancy and acceptance; and (3). Recommendations to address vaccine concerns. Vaccine hesitancy, which was more common among some ethnic minority groups, is a complex phenomenon, driven by misinformation, mistrust, concerns about safety and efficacy, and structural and systemic inequities. Community engagement and tailored communication may help to address vaccine concerns. Robust data disaggregated by ethnicities are needed to better understand barriers and facilitators for COVID-19 vaccine delivery in ethnic minority communities. Strategies to address structural disadvantage need to be inclusive, comprehensive, and behaviorally informed and foster confidence in healthcare systems and governments. Community leaders and health care practitioners may prove to be the most important agents in creating an environment of trust within ethnic minority groups.

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1. Introduction

The 8 million individuals from ethnic minority backgrounds in the UK [1] have been shown to be at increased risk of acquiring COVID-19, and are over-represented among those who become ill and die [2–4]. The reasons behind these disparities are multifaceted and complex [5]. Social circumstances, alongside experiences of discrimination and racism in the healthcare system may contribute to mistrust, and to disparities in morbidity and mortality [6].

The UK Government recognised ethnic minorities as a priority group for vaccinations following disproportionate morbidity and mortality in this population [7,8]. Despite strong evidence for the safety and effectiveness of the vaccine, rates of vaccination are lowest in ethnic minority groups [9]. Vaccine hesitancy, defined as “the delay in acceptance or refusal of vaccines despite availability of vaccination services” [10] is a key obstacle to attaining the vaccination levels necessary to contain the pandemic [12]. The aim of this systematic review was to identify and synthesise evidence on COVID-19 vaccine concerns among ethnic minorities in the UK.

2. Methodology

2.1. Design

Systematic review using PRISMA guidelines (PROSPERO RD42021243083) [13].

2.2. Search strategy

AMED, CINAHL, Embase, Ovid Medline, and PsycInfo were searched up to 18th February 2022. Hand searches were made of key journals and reference lists from included papers. Searches were limited from January 2020 because COVID-19 started in December 2019 and vaccines were rolled out from November 2020. The search strategy (Table 1) was developed in consultation with an information specialist.

2.3. Eligibility Criteria

Peer-reviewed primary studies related to vaccine hesitancy or acceptance in ethnic minority groups published in English from January 2020 to February 2022 were included (Table 2).

2.4. Selection of studies, data collection and management

All references identified by the search strategy were exported to Endnote and deduplicated, followed by title and abstract, then full text screening (BH). If the decision was unclear this was discussed with a second reviewer (KN) with adjudication by a third (AL) (Fig. 1).

2.5. Data extraction

BH extracted study data using methods described in the Cochrane handbook for systematic reviews [14]. A standardised data extraction form was used to ensure consistency in the review [15] (Table 3). KN reviewed the data extraction, and any queries were resolved through discussion.

2.6. Assessment of methodological quality of the studies

The Standard Quality Criteria [16] were used to assess the quality of primary data (Table-III). Studies were not excluded based on quality. Two reviewers (BH and KN) assessed the quality of each study independently and met to compare their assessments. Disagreement was resolved by discussion, and a third reviewer (AL) checked the appraisals if an agreement was not reached.

2.7. Data analysis

Included studies were analysed using narrative synthesis in line with Guidance on the Conduct of Narrative Synthesis in Systematic Reviews [17]. The preliminary synthesis was performed by tabulation, grouping and clustering to demonstrate the characteristics of each included paper.

3. Findings

3.1. Overview

Twenty four studies were included. Nineteen studies used survey-based quantitative methods, two were Randomised Control Trials (RCTs), and two used mixed methods (qualitative semi-structured interviews alongside a survey), one used semi-structure interviews. The findings are presented under three themes.

Theme – I Prevalence of vaccine hesitancy and vaccine acceptance among ethnic minority populations.

A substantial proportion of ethnic minority adults in the UK report uncertainty about the safety and effectiveness of the COVID-19 vaccine. Vaccine hesitancy was more common among individuals from Black, Asian, and Mixed ethnic backgrounds [18–22]. Only one study reported that ethnicity was not associated with vaccine hesitancy [23].

Freeman et al. [19] found that vaccine hesitancy is associated with ethnicity along with other factors such as younger age, female gender, and lower income. Robertson et al. [21] reported vaccine hesitancy was highest in Black (71.8%) and Pakistani/Bangladeshi (42.3%) groups (OR 13.42, 95% CI: 6.86, 26.24 and 2.54, 95% CI: 1.19, 5.44 respectively) compared to white British/Irish. Bell et al. [18] found that participants that identified as Black, Asian, Chinese, Mixed or Other ethnicity were 2.7 times (95% CI: 1.27–5.87) more likely than White participants to report that they would decline a COVID-19 vaccine for themselves or their child.

In Jackson et al. [24] study 16% of participants did not trust vaccines. A survey among undergraduates (n = 739) found that participants from Black backgrounds expressed considerably lower

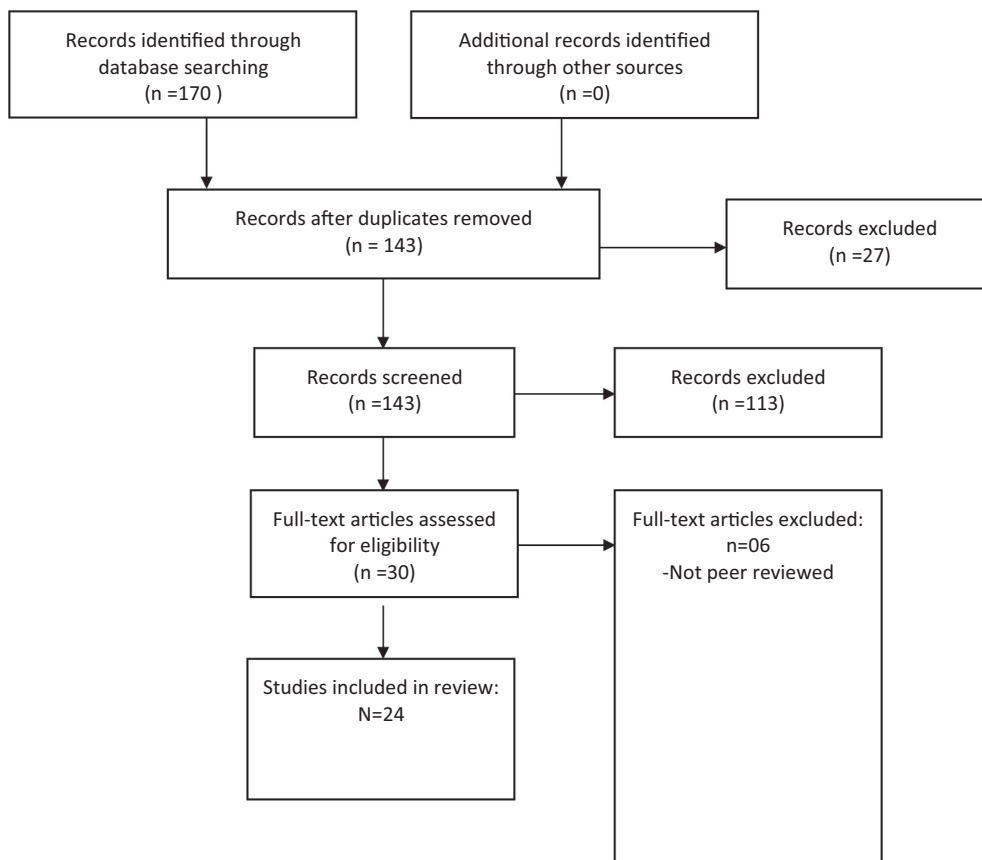


Fig. 1.

confidence than those from White or Mixed backgrounds ($p < 0.001$) [25].

Williams et al. [22] found that white participants were more likely to accept a vaccine compared to those from ethnic minorities (regression coefficient 2.91; 95% CI 1.75–4.8; $p < 0.001$). Sherman et al. [23] reported contradictory results, showing that intention to be vaccinated was not associated with ethnicity (regression coefficient -0.66 (0.394, 261) $p = 0.602$). Loomba et al. [26] found that individuals from Black ethnic groups were less likely to reject the vaccine upon exposure to misinformation, relative to factual information to protect self and others, while participants from Asian ethnic backgrounds were more likely to decline the vaccine upon exposure to misinformation, relative to factual information to protect self and others.

Freeman et al. [27] investigated the effects of different types of written vaccination information on hesitancy. They concluded that Black individuals tended to have an opposite reaction to some of the information conditions (i.e. they had lower hesitancy scores for the control condition) compared with other ethnicities, although this was only significant for the condition “collective benefit of not transmitting”; mean difference 1.25, 95% CI 0.03 to 2.47; $p = 0.033$). “Collective and personal benefit” was the only other condition to show significant differences by ethnicity, with Asian individuals showing the greatest reduction in hesitancy (-1.28 , -2.26 to -0.31 ; $p = 0.038$) [27]. Glampson et al. [28] found that Black or Black British individuals had the highest rates of declining a vaccine invitation at 16.14% (4337/26,870). Perry et al. [29] aimed to identify inequalities in COVID-19 vaccination in Wales. The odds of being vaccinated were lower for individuals who were from an ethnic group other than White. The largest inequality was seen

between Black individuals compared to those from any White ethnic group (OR 0.22, 95%CI 0.21–0.24).

Skirrow et al. [30] investigated pregnant women’s views on the vaccine. Compared to women from White ethnic groups, women from ethnic minorities were twice as likely to reject a vaccine ($p < 0.005$). Income and ethnicity were the main drivers. Blakeway et al. [31] found evidence of reduced vaccine uptake in younger pregnant women ($P < 0.001$), women with high levels of deprivation, and women of Afro-Caribbean or Asian ethnicity compared with women of White ethnicity ($P < 0.001$). Nguyen et al. [32] compared U.S. and U.K. participants. In the U.K., ethnic minority participants showed higher vaccine hesitancy than the White ethnic group.

Woolf et al. [33] studied vaccine hesitancy among healthcare workers (HCWs). Black Caribbean (OR 3.37, 95% CI 2.11–5.37), Black African (OR 2.05, 95% CI 1.49–2.82), and White Other ethnic groups (OR 1.48, 95% CI 1.19–1.84) were significantly more likely to be hesitant than white British. Martin et al. [34] examined vaccine uptake in NHS staff. Compared to White HCWs (70.9% vaccinated), a significantly smaller proportion of ethnic minority HCWs were vaccinated (South Asian, 58.5%; Black, 36.8%; $p < 0.001$ for both). After adjustment, belonging to any non-White ethnic group was negatively associated with vaccine uptake (Black: adjusted odds ratio [OR] 0.30, 95% CI 0.26–0.34, $p < 0.001$; South Asian: OR 0.67, 95% CI 0.62–0.72, $p < 0.001$).

Byrne et al. [35] measured vaccination intention in England and Wales. They found that over the studied time frame (December 2020–January 2021), association between minority ethnicity and intention to accept the vaccine weakened, but did not disappear. Curtis et al. [36] studied actual vaccine uptake in different clinical

Table 1
Search strategy.

Search strategy number	Key concepts	¹ Key words
1	Black Asian Ethnicity Minority	Black OR Asian OR ethnicity OR minority groups OR BAME OR Race OR African Caribbean OR Afro Caribbean OR Indian OR Pakistani OR Bangladeshi OR marginali?ed group\$ OR marginali?ed communities OR hard to reach group\$ OR hard to reach communities
2	COVID-19 vaccines hesitancy acceptance trust	COVID-19 vaccine\$ OR SARS-CoV-2 vaccine\$ OR Coronavirus vaccine\$ OR Vaccine acceptance OR vaccine hesitance OR vaccine refusal OR vaccine trust OR vaccine uptake
3	UK, England, Britain, Scotland, Northern Ireland, Wales	UK or England OR Great Britain OR Scotland OR Republic of Ireland OR Northern Ireland OR Wales
Final search strategy	1, 2 and 3 intersected using the 'AND' function.	

¹ Subject headings and word truncations were entered according to requirements of each database to map all potential keywords. Group 1 concepts were combined using the 'OR' function. Likewise group 2 and group 3 concepts were combined using OR function.

and demographic groups in the first 100 days of the vaccine rollout. Of patients aged ≥ 80 years not in a care home 94.7% received a vaccine, but with substantial variation by ethnicity (White 96.2%, Black 68.3%).

Theme 2 Factors influencing hesitancy and vaccine acceptance among ethnic minority groups.

Nine studies reported information on factors that influence vaccine hesitancy and acceptance. Freeman et al. [19] demonstrated that the variance in vaccine hesitancy among different population groups (including ethnic minorities) is mainly explained by beliefs about the collective importance of getting vaccinated, efficacy of the vaccine, side-effects and the speed of development of a COVID-19 vaccine. Other factors explaining hesitancy included excessive mistrust, conspiracy beliefs, and negative views about doctors and government. Lockyer et al. [37] found that vaccine hesitancy could be attributed to three factors: safety concerns about the vaccine, negative stories about the vaccine and personal knowledge related to health, illness and the vaccine. The more confused, distressed and mistrusting participants felt about their social worlds during the pandemic, the less positive they were about a vaccine.

Table 2
Summary of eligibility criteria.

	Inclusion	Exclusion
Participants	Findings related to sample drawn from ethnic minority population groups including: Black Ethnic, Asian and Minority groups, Other white ethnic minority groups including Eastern European,	Findings related to sample drawn from White British ethnic group
Studies	Empirical studies conducted in the UK in any setting (primary, secondary, tertiary, community, residential homes, care homes etc). Peer reviewed and published studies, Written in English language only. Any study design: quantitative (e.g longitudinal, cross-sectional, surveys), qualitative (e.g. grounded theory or any qualitative design), or mixed-methods.	Studies not peer reviewed Unpublished studies, studies not written in English language, conference proceedings, conference abstracts, Studies conducted outside the UK, Other systematic reviews on the topic
Outcomes	Participants experience around the vaccines, readiness to receive the vaccines, their views about the vaccines, trust and acceptance, hesitancy to receive the vaccines.	Outcomes not related to vaccine acceptance, hesitance, trust and perceptions.

Allington et al. [38] also identified coronavirus conspiracy suspicions and general vaccine attitudes contributed to vaccine acceptance. Robertson et al. [21] found that the main reason for vaccine hesitancy was concerns over future unknown effects of a vaccine, 42.7% citing this as their main reason. When compared to the White British/Irish group, Black/Black British participants were more likely to state they 'Don't trust covid-19 vaccines' (29.2% vs 5.7%), and the Pakistani/Bangladeshi ethnic group cited worries about side-effects (35.4% vs 8.6%). The survey also highlighted that 43.2% of Black/Black British participants were not prepared to have the vaccine with a further 44.7% suggesting that they would consider this if safety of the vaccine was demonstrated. In the Pakistani/Bangladeshi cohort 65.2% reported that they would be persuaded if sure the vaccine reduced their risk of catching the virus and 64.6% if it was demonstrated to be safe. Skirrow et al. [30] also exposed trust issues. They found that safety concerns about COVID-19 vaccines were common, though wider mistrust in vaccines was also expressed. Gaughan et al. [39] found that all minority ethnic groups had lower age-standardized rates of vaccination compared with the white British population. The lower rates were partly explained by socio-demographic differences.

Chaudhuri et al. [40] examined how attitudes towards public officials and government impacted vaccine willingness. They found that ethnic minority groups were more likely to be unwilling to be vaccinated. Positive opinions about public officials (OR 2.680; 95% CI 1.888 – 3.805) and the government (OR 3.400; 95% CI 2.454–4.712) led to substantial increases in vaccine willingness. This effect varied across ethnicity and socio-economic status with those from South Asian backgrounds (OR 4.513; 95% CI 1.012–20.123) being the most unwilling to be vaccinated compared to white groups. Cook et al. [41] sought to examine the factors that impacted the decision to accept the COVID-19 vaccination among an ethnically diverse community. Age and ethnicity were the only sociodemographic factors to predict vaccine hesitancy. 'Lack of trust in government/authorities' and 'concern about the speed of vaccine development' were the most common reasons for non-uptake.

Woodhead et al. [42] identified that decision-making processes were underpinned by an overarching theme of 'weighing up risks of harm against potential benefits to self and others'. They identified ways in which these were weighted more heavily towards vaccine hesitancy for ethnic minority staff groups who perceived institutional and structural discrimination. This included suspicions around institutional pressure to be vaccinated, ethnic injustices in vaccine development and testing, religious or ethical concerns, and legitimacy and accessibility of vaccine messaging and communication.

Theme – 3 Recommendations from included studies to improve vaccine uptake among ethnic minority populations.

Table 3
Data extraction and quality assessment.

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
1	Paul, E., Steptoe, A., & Fancourt, D. (2020). Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. <i>The Lancet Regional Health-Europe</i>	To estimate predictors of four domains of negative attitudes towards vaccines and identify groups most at risk of uncertainty and unwillingness to receive a COVID-19 vaccine in a large sample of UK adults.	Data were cross-sectional and from 32,361 adults in the University College London (UCL) COVID-19 Social Study. Ordinary least squares regression analyses examined the impact of demographic, social and COVID-19 related factors on four types of negative vaccine attitudes: (1) mistrust of vaccine benefit, (2) worries about unforeseen effects, (3) concerns about commercial profiteering, and (4) preference for natural immunity. Multinomial regression examined the impact of socio-demographic and COVID-19 related factors, negative vaccine attitudes, and prior vaccine behaviour on uncertainty and unwillingness to be vaccinated for COVID-19. The socio-demographic variable 'ethnicity' was composed of binary responses: white vs ethnic minority group (i.e., Black or Black British, White and Black or Black British, Asian or Asian British, mixed race, Chinese or Chinese British, Middle Eastern or Middle Eastern British, or any other ethnic group).	16% of the participants did not trust the vaccines. Distrustful attitudes towards vaccination were higher amongst individuals from ethnic minority backgrounds with lower levels of education, lower annual income, poor knowledge of COVID-19, and poor compliance with government COVID-19 guidelines. Overall, 14% of respondents reported unwillingness to receive a vaccine for COVID-19, whilst 23% were unsure. The largest predictors of both COVID-19 vaccine uncertainty and refusal were low-income groups (< £16,000, a year), having not received a flu vaccine last year, poor adherence to COVID-19 government guidelines, female gender, and living with children. Amongst vaccine attitudes, intermediate to high levels of mistrust of vaccine benefit and concerns about future unforeseen side effects were the most important determinants of both uncertainty and unwillingness to vaccinate against COVID-19.	Negative attitudes regarding vaccines are a big public health concern in the UK. Overall mistrust in COVID-19 vaccines and concerns about future side effects in particular will be barriers to achieving population immunity to COVID-19 through vaccination. It is recommended that the public health messages must be tailored so to address concerns of minority groups especially women, people with low socio-economics, and the ethnic minorities.	Average
2	Sherman, S. M., Smith, L. E., Sim, J., Amlôt, R., Cutts, M., Dasch, H., ... & Sevdalis, N. (2020). COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVAccS), a nationally representative cross-sectional survey. <i>Human vaccines & immunotherapeutics</i> , 1–10.	To investigate associations between vaccination intention and theoretically grounded, contextual and sociodemographic factors in a demographically representative sample of the UK adult population.	A cross-sectional survey was conducted between 14th and 17th July 2020. Participants completed the survey online, on Qualtrics. Participants (n = 1,500) were recruited through Prolific's online research panel and were eligible for the study if they were aged 18 years or over and lived in the UK (n = 38,000 + eligible participants). The respondents were recruited through quota sampling based upon divisions of ethnicity, age, and sex. The respondents were asked to report their socio-demographic including ethnicity along with other socio-economic and age-sex categories. The ethnicity was asked in four categories i.e. white, black and ethnic minority, other, and prefer not to say. Furthermore, the data collected underwent a linear and hierarchical regression. Of 1,532 people who began the survey, 1,504 completed it (98% completion rate). Four participants were not included in the sample as they did not meet quality	64% of the participants reported that they were 'very likely' going to receive the COVID-19 vaccine, 27% were 'unsure', and 9% reported being 'very unlikely' to receive the vaccine. Personal and clinical characteristics, previous influenza vaccination, general vaccination beliefs, and beliefs and attitudes about COVID-19 and a COVID-19 vaccination explained 76% of the variance in vaccination intention. Intention to be vaccinated was associated with more positive general COVID-19 vaccination beliefs and attitudes, weaker beliefs that the vaccination would cause side effects or be unsafe, greater perceived information sufficiency to make an informed decision about COVID-19 vaccination, greater perceived risk of COVID-19 to others (but not risk to oneself), older age, and having been vaccinated for influenza last winter (2019/20). Despite uncertainty around the details of a COVID-19 vaccination, most participants	Only two-thirds responded positively towards the vaccine and intend to receive whereas the left one-third is either unsure or unwilling to be vaccinated. It is important to note that in practice less people will actually be ready for the uptake than the number that intend to do so. Therefore, spreading positive beliefs regarding covid-19 is a priority. In the light of this research, it was suggested that people must be motivated to get a vaccine to end this pandemic, to get back at the normal, and through promoting the altruistic passion in them including preventing risk of spreading the virus to others.	Very good

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Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
3	Freeman, D., Loe, B. S., Chadwick, A., Vaccari, C., Waite, F., Rosebrock, L., ... & Lambe, S. (2020). COVID-19 vaccine hesitancy in the UK: the Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II. <i>Psychological medicine</i> , 1–15.	To estimate provisional willingness to receive a coronavirus 2019(COVID-19) vaccine, identify predictive socio-demographic factors, and, principally, determine potential causes in order to guide information provision.	control checks. To measure vaccination intention, researchers asked participants to state how likely they would be to have a COVID-19 vaccination “when a coronavirus vaccination becomes available to [them]” on an eleven-point scale from “extremely unlikely” (0) to “extremely likely” (10). A non-probability online survey was conducted (24th September – 17th October 2020) with 5,114 UK adults, quota sampled to match the population for age, gender, ethnicity, income, and region. The Oxford COVID-19 vaccine hesitancy scale assessed intent to take an approved vaccine. Structural equation modelling estimated explanatory factor relationships.	reported intending to be vaccinated for COVID-19. N = 3,667 (71.7%) stated they were willing to be vaccinated, n = 849 (16.6%) were very unsure, and n = 598 (11.7%) were strongly hesitant. An excellent model fit (RMSEA = 0.05/ CFI = 0.97/TLI = 0.97), explaining 86% of variance in hesitancy, was provided by beliefs about the collective importance, efficacy, side-effects, and speed of development of a COVID-19 vaccine. A second model, with reasonable fit (RMSEA = 0.03/ CFI = 0.93/TLI = 0.92), explaining 32% of variance, highlighted two higher-order explanatory factors: ‘excessive mistrust’ (r = 0.51), including conspiracy beliefs, negative views of doctors, and need for chaos, and ‘positive healthcare experiences’ (r = - 0.48), including supportive doctor interactions and good NHS care. Vaccine hesitancy was associated with demographic and social factors such as younger age, female gender, lower income status, and ethnicity, however socio-demographic variables explained little variance (9.8%). The vaccine hesitancy was found associated with belongingness to Black ethnicity or Mixed ethnicity. There was found an association between right-wing political beliefs and the conspiracy beliefs (B = 0.093, standard error = 0.007, Beta = 0.17, p < 0.001, R2 = 0.03).Vaccine hesitancy was also associated with lower adherence to physical distancing guidelines (2 m apart).	The hesitancy to uptake the covid-19 vaccine was found evenly spread throughout the UK population without discrimination of socio-demographic factors i.e. ethnicity or low socio-economics. And the factors like conspiracy theories may have fostered the mistrust within the public through various mechanisms including damaging social cohesion within the majority population and ethnic minorities. Such factors are needed to be discouraged for which vaccine public information may important role while highlighting the prosocial benefits and emphasis on collective action and importance may support people in deciding to take up the covid-19 vaccines.	Average
4	Bell, S., Clarke, R., Mounier-Jack, S., Walker, J. L., & Paterson, P. (2020). Parents' and guardians' views on the acceptability of a future COVID-19 vaccine: A multi-methods study in England. <i>Vaccine</i> , 38(49), 7789–7798.	To investigate parents' and guardians' views on the acceptability of a future COVID-19 vaccine.	The study incorporated a mixed methods approach including semi-structured in-depth interviews as well as a cross-sectional survey that was conducted online. A sample of 1,252 parents and guardians participated in	Most of the study participants reported they would likely accept a COVID-19 vaccine for themselves (Definitely 55.8%; Unsure but leaning towards yes 34.3%) and their child/ children (Definitely 48.2%; Unsure but	Information on how COVID-19 vaccines are developed and tested, including their safety and efficacy, must be communicated clearly to the public. To prevent inequalities in uptake, it is crucial to understand and	Average

Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
			the research. Only the guardians with age above 16 years, are UK citizens, and living with a child were included in the sample. Among a large sample size for survey, only 19 participants were interviewed in depth. Most of the participants were White (94.1%; n = 1178): British, Irish, and Other minority ethnicity.	leaning towards yes 40.9%). <4% of survey participants reported that they would definitely not accept a COVID-19 vaccine. Participants were more likely to accept a COVID-19 vaccine for themselves than their child/children. Ethnicity and financial status were associated with vaccine acceptance, for example; participants that self-reported as Black, Asian, Chinese, Mixed or Other ethnicity were almost 3 times more likely to reject a COVID-19 vaccine for themselves and their children than White British, White Irish and White Other participants. Survey participants from lower income households were also more likely to reject a COVID-19 vaccine. Self-protection from COVID-19 was reported as the main reason for vaccine acceptance. Common concerns identified in open-text responses and interviews were around COVID-19 vaccine safety and effectiveness, mostly prompted by the newness and rapid development of the vaccine.	address factors that may affect COVID-19 vaccine acceptability in ethnic minority and lower-income groups who are disproportionately affected by COVID-19.	
5	Williams, L., Flowers, P., McLeod, J., Young, D., & Rollins, L. (2021). Social patterning and stability of intention to accept a COVID-19 vaccine in Scotland: Will those most at risk accept a vaccine?. <i>Vaccines</i> 2021, 9(1), 17	To assess key sociodemographic variables and intention to accept a COVID-19 vaccine.	Following the longitudinal design, the data collection was occurred at two different times, once (Time 1) during the lockdown announced by the government of Scotland and the other time (Time 2) was two months later when restrictions had been lifted to some extent. At Time 1, the sample consisted of 3,436 respondents however, the cohort reduced to 2016 respondents at Time 2.	In the first survey, the majority of the participants (74%) reported willingness to receive the COVID-19 vaccine. In a Logistic regression analyses, there were sociodemographic differences in relation to intention to accept a vaccine for COVID-19. The intention to receive the vaccine was higher in participants of white ethnicity background compared with Black, Asian, and minority ethnic (BAME) groups. Intention was also higher among participants with higher income levels and higher education levels. Intention was also higher in those who had “shielding” status due to underlying medical conditions.	The social agents like mass media and social marketing must consider the ethnic minorities and disadvantaged sections of the population for the even uptake of covid-19 vaccines across the population. The study was limited in terms of generating results for the ethnicities due to data collection over binary responses i.e. White vs BAME.	Average
6	Loomba, S., de Figueiredo, A., Piatek, S., de Graaf, K., & Larson, H. J. (2020). Measuring the Impact of Exposure to COVID-19 Vaccine Misinformation on Vaccine Intent in the UK and US. <i>Nature human behaviour</i> , 5(3), 337–348.	To inform successful vaccination campaigns, we conducted a randomized controlled trial in the UK and the USA to quantify how exposure to online misinformation around COVID-19 vaccines affects intent to vaccinate to protect oneself or others.	The total sample consisted of 8,001 respondents in which 4,000 were from the UK and 4,001 were from the US. Following an experimental design each sample section i.e. UK section and US section, was divided into treatment group and a control group. The treatment group consisted of	in both countries—as of September 2020—fewer people would ‘definitely’ take a vaccine than is likely required for herd immunity, and that, relative to factual information, recent misinformation induced a decline in intent of 6.2 percentage points (95th percentile interval 3.9 to 8.5) in the	Due to widespread of misinformation, the vaccine uptake rates were affected and if not tackled it may lead to further undesirable outcomes. Therefore, there is a need to work on the strategies to improve the public health communication.	Poor

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Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
			3,000 respondents in the UK section whereas 3,001 in the US section. Meanwhile, control groups of both sample sections were consisted of 1,000 respondents. After measuring intention for receiving covid-19 vaccine in both sample sections, both treatment groups were exposed to a set of misinformation, selected through a vigilant process, which was different in both countries while the control group was provided with the accurate information and being based on facts it didn't varied with the context. After the exposure, the intention for receiving the vaccine was measured once again. Furthermore, respondents in the treatment groups were also asked to report on their exposure to such misinformation and misleading content on the social media in the month prior to that.	UK and 6.4 percentage points (95th percentile interval 4.0 to 8.8) in the USA among those who stated that they would definitely accept a vaccine. It was also reported that some sociodemographic groups including ethnic minority are differentially impacted by exposure to misinformation. Furthermore, scientific-sounding misinformation is more strongly associated with declines in vaccination intent.		
7	Robertson et al. 2021. Predictors of COVID-19 vaccine hesitancy in the UK Household Longitudinal Study	To investigate the prevalence of COVID-19 vaccine hesitancy in the UK and identified vaccine hesitant sub-groups	It was a longitudinal study. The sample consisted of 12,035 respondents who filled the covid-19 'understanding society' survey. The sample was boosted with ethnic minority groups and the questionnaire also included various categories of ethnicity rather than just binary responses. They responded on the likelihood of receiving the vaccine and the reasons behind their hesitance towards the vaccine. The responses underwent logistic regression analysis to calculate odds ratios and generate results.	The overall vaccine hesitancy was low (18% unlikely/very unlikely). Main demographic variables with vaccine hesitancy were gender, age, education level and ethnicity. Vaccine hesitancy was higher in female gender (21.0% vs 14.7%), younger age groups (26.5% in 16–24 year olds vs 4.5% in 75 +) and those with lower education levels (18.6% no qualifications vs 13.2% degree qualified). Vaccine hesitancy was high in Black (71.8%) and Pakistani/Bangladeshi (42.3%) ethnic groups. Odds ratios for vaccine hesitancy were 13.42 (95% CI:6.86, 26.24) in Black and 2.54 (95% CI:1.19, 5.44) in Pakistani/Bangladeshi groups (compared to White British/Irish) and 3.54 (95%CI:2.06, 0.09) for people with no qualifications versus degree. Urgent action to address hesitancy is needed for some but not all ethnic minority groups.	This indicated that not all ethnicities are at risks but there are other ethnic groups in need of immediate help. These findings suggested the inclusive decision making in vaccine programs, especially the heterogeneity in terms of ethnicities must be considered. Some of the general concerns over the vaccine were regarding safety and efficacy and reducing these fears may help in increasing the rate of vaccine uptake.	Average
8	Lockyer, B., Islam, S., Rahman, A., Dickerson, J., Pickett, K., Sheldon, T., ... & Sheard, L. (2020). Understanding COVID-19 misinformation and vaccine hesitancy in context: Findings from a qualitative study involving citizens in Bradford, UK; <i>Health Expectations</i> . 2021;00:1–10	To understand people's COVID-19 beliefs, their interactions with (mis) information during COVID-19 and attitudes towards a COVID-19 vaccine.	A sample of 20 participants from different ethnic minority groups was selected for the study. Within the sample, 10 were from South Asian backgrounds including Pakistani, Indian, and Bangladeshi ethnicities; 6 were British Whites; and 4 were from Other White backgrounds. The ages of the participants, in the sample, were	All of the 20 participants had been exposed to a variety of covid-19 related misinformation which caused them in to disorientation, and in a state of distress and mistrust. The participants had experienced these mental states for their social backgrounds mostly during the ongoing pandemic. Personal	The widespread of covid-19 related misinformation, through inducing different emotional states within a receiver, is responsible for the prevalent vaccine hesitancy. Therefore, the vaccine programs need to replace the misinformation with the accurate and factual information via focused, localised and empathetic	Very good

Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
9	Freeman, D., Loe, B. S., Yu, L. M., Freeman, J., Chadwick, A., Vaccari, C., ... & Lambe, S. (2021). Effects of different types of written vaccination information on COVID-19 vaccine hesitancy in the UK (OCEANS-III): a single-blind, parallel-group, randomised controlled trial. <i>The Lancet Public Health</i> S2468-2667(21) 00096–7	To test which types of written information about COVID-19 vaccination, in addition to a statement of efficacy and safety, might increase vaccine acceptance.	between 25 and 54. The telephonic in-depth interviews were conducted for 30 to 90 min in different areas in Bradford. A reflexive thematic analysis was carried out to draw conclusions. A single-blind, parallel-group, randomised controlled trial was used. Recruit 15,000 adults in the UK, who were quota sampled to be representative including ethnic minority. Participants were randomly assigned equally across ten information conditions stratified by level of vaccine acceptance (willing, doubtful, or strongly hesitant). The control information condition comprised the safety and effectiveness statement taken from the UK National Health Service website; the remaining conditions addressed collective benefit, personal benefit, seriousness of the pandemic, and safety concerns. After online provision of vaccination information, participants completed the Oxford COVID-19 Vaccine Hesitancy Scale (outcome measure; score range 7–35) and the Oxford Vaccine Confidence and Complacency Scale (mediation measure). The primary outcome was willingness to be vaccinated. Participants were analysed in the groups they were allocated. p values were adjusted for multiple comparisons.	knowledge, safety concerns, and the negative stories are some keys to invite hesitancy in. Moreover, the participants displayed less acceptability towards covid-19 vaccines. From Jan 19 to Feb 5, 2021, 15,014 adults were recruited. Vaccine hesitancy had reduced from 26.9% the previous year to 16.9%, so recruitment was extended to Feb 18 to recruit 3841 additional vaccine-hesitant adults. N = 12463 (66.1%) of the participants were classified as willing, n = 2932 (15.6%) as doubtful, and n = 3460 (18.4%) as strongly hesitant (ie, report that they will avoid being vaccinated for as long as possible or will never get vaccinated). Information conditions did not alter COVID-19 vaccine hesitancy in those willing or doubtful (adjusted p values > 0.70). In those strongly hesitant, COVID-19 vaccine hesitancy was reduced, in comparison to the control condition, by personal benefit information (mean difference -1.49, 95% CI -2.16 to -0.82; adjusted p = 0.0015), directly addressing safety concerns about speed of development (-0.91, -1.58 to -0.23; adjusted p = 0.0261), and a combination of all information (-0.86, -1.53 to -0.18; adjusted p = 0.0313). In those strongly hesitant, provision of personal benefit information reduced hesitancy to a greater extent than provision of information on the collective benefit of not personally getting ill (-0.97, 95% CI -1.64 to -0.30; adjusted p = 0.0165) or the collective benefit of not transmitting the virus (-1.01, -1.68 to -0.35; adjusted p = 0.0150). Ethnicity and gender were found to moderate information condition outcomes.	measures. About 10% of the population was strongly hesitant of the covid-19 vaccine but this hesitancy reduced when provided with the information on the personal benefit rather than the collective action. These results indicate towards a change in the direction of covid-19 campaigns. As evident, covid-19 campaigns are more focused on collective action and may seem to work but following the study's conclusions the key to convince strongly hesitant portion of the public is to motivate them otherwise i.e. instead of collective benefit inform them about the personal benefits of getting the covid-19 vaccine.	Very good
10	Allington, D., McAndrew, S., Moxham-Hall, V., & Duffy, B. (2021). Coronavirus conspiracy suspicions, general vaccine attitudes, trust and coronavirus information source as predictors of vaccine hesitancy among UK residents during the COVID-19 pandemic. <i>Psychological Medicine</i> , 1–12.	To explain the statistical variance of the predictors of vaccine hesitancy. It has previously been found to be associated with youth, female gender, low income, low education, low medical trust, minority ethnic group membership, low perceived risk from COVID-19, use of certain social media platforms and conspiracy beliefs.	An online survey with a representative sample of 4343 UK residents (including minority ethnicity), aged 18–75, between 21 November and 21 December 2020. Predictors of vaccine hesitancy were assessed using linear rank-order models	Belonging to an ethnic group other than White ethnicity is one of the factors that are found to be associated with the vaccine hesitancy. Other factors included young age, female sex, low socio-economics, high reliance over social media for information than mainstream information channels, low perceived	Strengthening positive attitudes to vaccination and reducing conspiracy suspicions with regards to the coronavirus may have a positive effect on vaccine uptake, especially among ethnic minority groups with heightened vaccine hesitancy.	Good

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				risk from the pandemic, poor trust in paramedics and, for quite lesser extent, poor trust in the government. Other than this, general attitudes towards vaccine and conspiracy notions were also found explaining the vaccine hesitancy by 35%. More importantly, the effects on hesitancy due to ethnicity, trust and reliance on social media completely disappear by controlling conspiracy theories and general attitudes regarding the vaccine, and for education it gets reversed.		
11	Siani, A., Driscoll, M., Hurst, T. M., Coker, T., Grantham, A. G., & Bunet, A. (2021). Investigating the determinants of vaccine hesitancy within undergraduate students' social sphere. <i>Journal of Public Health</i> , 1–9.	To explain the socio-demographic factors for university students in terms of their covid-19 vaccine hesitancy.	The sample comprised of undergraduate students (7 3 9) including minority ethnicity. The data were collected via an online survey. The students responded their perceptions over the practice of vaccination. The data was analysed via non-parametric tests of variance.	Vaccine confidence varied significantly ($p < 0.001$) with age, ethnicity and religion, and to a lesser (yet still statistically significant) extent ($p < 0.05$) with graduate status. No statistically significant differences were observed with regard to gender or number of children. The respondents with Black ethnicity show lowest level of vaccine confidence (median VCS = 18) in comparison to Mixed ethnicities (median VCS = 22.5; $p = 0.015$) and the White ethnicities (median VCS = 23; $p < 0.0001$).	The underpinning socio-demographic factors for the university students are presented that are responsible for vaccine hesitancy which may help in improving the strategies for the mitigation interventions.	Very good
12	Martin, C. A., Marshall, C., Patel, P., Goss, C., Jenkins, D. R., Ellwood, C., ... & Pareek, M. (2021). SARS-CoV-2 vaccine uptake in a multi-ethnic UK healthcare workforce: A cross-sectional study. <i>PLoS medicine</i> , 18(11), e1003823.	To understand demographic and occupational associations with vaccine uptake in a large UK hospital workforce.	Conducted cross-sectional surveillance examining vaccine uptake amongst all staff at University Hospital of Leicester NHS Trust. We examined proportions of vaccinated staff stratified by demographic factors, occupation, and previous COVID-19 test results (serology/ PCR) and used logistic regression to identify predictors of vaccination status after adjustment for confounders. We included 19,044 HCWs; 12,278 (64.5%) had received SARS-CoV-2 vaccination.	Compared to White HCWs (70.9% vaccinated), a significantly smaller proportion of ethnic minority HCWs were vaccinated (South Asian, 58.5%; Black, 36.8%; $p < 0.001$ for both). After adjustment for age, sex, ethnicity, deprivation, occupation, SARS-CoV-2 serology/PCR results, and COVID-19-related work absences, factors found to be negatively associated with vaccine uptake were younger age, female sex, increased deprivation, pregnancy, and belonging to any non-White ethnic group (Black: adjusted odds ratio [aOR] 0.30, 95% CI 0.26–0.34, $p < 0.001$; South Asian: aOR 0.67, 95% CI 0.62–0.72, $p < 0.001$). Those who had previously had confirmed COVID-19 (by PCR) were less likely to be vaccinated than those who had tested negative.	Ethnic minority HCWs and those from more deprived areas as well as younger staff and female staff are less likely to take up SARS-CoV-2 vaccination. These findings have major implications for the delivery of SARS-CoV-2 vaccination programmes, in HCWs and the wider population, and should inform the national vaccination programme to prevent the disparities of the pandemic from widening.	Very good
13	Glampson, B., Brittain, J., Kaura, A., Mulla, A., Mercuri, L., Brett, S. J., ... & Mayer, E. K. (2021). Assessing COVID-19 vaccine uptake and effectiveness through the North West London	To assess the early vaccine administration coverage and outcome data across an integrated care system in North West London, leveraging a unique population-level care data set.	A retrospective cohort study identified 2,183,939 individuals eligible for COVID-19 vaccination between December 8, 2020, and February 24, 2021, within a primary,	5.88% (24,332/413,919) of individuals declined and did not receive a vaccination. Black or Black British individuals had the highest rate of declining a vaccine at 16.14% (4337/	This study highlights an important area of focus for quality improvement, public and societal engagement, and outreach initiatives to improve vaccination coverage across all	Good

Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
	Vaccination Program: retrospective cohort study, <i>JMIR public health and surveillance</i> , 7(9), e30010.		secondary, and community care integrated care data set. These data were used to assess vaccination hesitancy across ethnicity, gender, and socioeconomic deprivation measures (Pearson product-moment correlations).	26,870). There was a strong negative association between socioeconomic deprivation and rate of declining vaccination ($r = -0.94$; $P = 0.002$) with 13.5% (1980/14,571) of individuals declining vaccination in the most deprived areas compared to 0.98% (869/9609) in the least.	population groups, especially for ethnic minority groups.	
14	Perry, Malorie, Ashley Akbari, Simon Cottrell, Michael B. Gravenor, Richard Roberts, Ronan A. Lyons, Stuart Bedston, Fatemah Torabi, and Lucy Griffiths. "Inequalities in coverage of COVID-19 vaccination: A population register based cross-sectional study in Wales, UK." <i>Vaccine</i> 39, no. 42 (2021): 6256–6261.	To identify inequalities in coverage of COVID-19 vaccination in Wales, UK and to highlight areas which may benefit from routine enhanced surveillance and targeted interventions.	Records within the Wales Immunisation System (WIS) population register were linked to the Welsh Demographic Service Dataset (WDS) and central list of shielding patients, held within the Secure Anonymised Information Linkage (SAIL) Databank. Ethnic group was derived from the 2011 census and over 20 administrative electronic health record (EHR) data sources. Uptake of first dose of any COVID-19 vaccine was analysed over time, with the odds of being vaccinated as at 25th April 2021 by sex, health board of residence, rural/urban classification, deprivation quintile and ethnic group presented. Using logistic regression models, analyses were adjusted for age group, care home resident status, health and social care worker status and shielding status. This study included 1,256,412 individuals aged 50 years and over.	Vaccine coverage increased steadily from 8th December 2020 until mid-April 2021. Overall uptake of first dose of COVID-19 vaccine in this group was 92.1%. After adjustment the odds of being vaccinated were lower for individuals who were male, resident in the most deprived areas, resident in an urban area and an ethnic group other than White. The largest inequality was seen between ethnic groups, with the odds of being vaccinated 0.22 (95%CI 0.21–0.24) if in any Black ethnic group compared to any White ethnic group.	Ongoing monitoring of inequity in uptake of vaccinations is required, with better targeted interventions and engagement with deprived and ethnic communities to improve vaccination uptake.	Fair
15	Nguyen, L. H., Joshi, A. D., Drew, D. A., Merino, J., Ma, W., Lo, C. H., . . . & Chan, A. T. (2022). Self-reported COVID-19 vaccine hesitancy and uptake among participants from different racial and ethnic groups in the United States and United Kingdom. <i>Nature communications</i> , 13(1), 1–9.	To estimate odds ratios of vaccine hesitancy and uptake in the UK and USA.	Performed a cohort study among U.S. and U.K. participants who volunteered to take part in the smartphone-based COVID Symptom Study (March 2020–February 2021) and used logistic regression to estimate odds ratios of vaccine hesitancy and uptake.	In the U.S. ($n = 87,388$), compared to white participants, vaccine hesitancy was greater for Black and Hispanic participants and those reporting more than one or other race. In the U.K. ($n = 1,254,294$), racial and ethnic minority participants showed similar levels of vaccine hesitancy to the U.S. However, associations between participant race and ethnicity and levels of vaccine uptake were observed to be different in the U.S. and the U.K. studies. Among U.S. participants, vaccine uptake was significantly lower among Black participants, which persisted among participants that self reported being vaccine-willing. In contrast, statistically significant racial and ethnic disparities in vaccine uptake were not observed in the U.K sample	Self-reported vaccine hesitancy and uptake, lower levels of vaccine uptake in Black participants in the U.S and UK during the initial vaccine rollout may be attributable to both hesitancy and disparities in access.	Good
16	Woolf, K., McManus, I. C., Martin, C. A., Nellums, L. B., Guyatt, A. L.,	Concerns have been raised that HCWs from ethnic minority groups are more	Nationwide prospective cohort study and qualitative study in a multi-	11,584 HCWs were included in the cohort analysis. 23% (2704) reported	Strategies to build trust and dispel myths surrounding the COVID-19	Very good

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S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/ Implications	Quality assessment
	Melbourne, C., ... & Group, U. R. S. C. (2021). Ethnic differences in SARS-CoV-2 vaccine hesitancy in United Kingdom healthcare workers: Results from the UK-REACH prospective nationwide cohort study. <i>The Lancet Regional Health-Europe</i> , 9, 100180.	likely to be vaccine hesitant (defined by the World Health Organisation as refusing or delaying a vaccination) than those of White ethnicity, but there are limited data on SARS-CoV-2 vaccine hesitancy and its predictors in UK HCWs.	ethnic cohort of clinical and non-clinical UK HCWs. We analysed ethnic differences in SARS-CoV-2 vaccine hesitancy adjusting for demographics, vaccine trust, and perceived risk of COVID-19. We explored reasons for hesitancy in qualitative data using a framework analysis.	vaccine hesitancy. Compared to White British HCWs (21.3% hesitant), HCWs from Black Caribbean (54.2%), Mixed White and Black Caribbean (38.1%), Black African (34.4%), Chinese (33.1%), Pakistani (30.4%), and White Other (28.7%) ethnic groups were significantly more likely to be hesitant. In adjusted analysis, Black Caribbean (aOR 3.37, 95% CI 2.11–5.37), Black African (aOR 2.05, 95% CI 1.49–2.82), White Other ethnic groups (aOR 1.48, 95% CI 1.19–1.84) were significantly more likely to be hesitant. Other independent predictors of hesitancy were younger age, female sex, higher score on a COVID-19 conspiracy beliefs scale, lower trust in employer, lack of influenza vaccine uptake in the previous season, previous COVID-19, and pregnancy. Qualitative data from 99 participants identified the following contributors to hesitancy: lack of trust in government and employers, safety concerns due to the speed of vaccine development, lack of ethnic diversity in vaccine studies, and confusing and conflicting information. Participants felt uptake in ethnic minority communities might be improved through inclusive communication, involving HCWs in the vaccine rollout, and promoting vaccination through trusted networks.	vaccine in these communities are urgently required. Emphasis should be placed on the safety and benefit of SARS-CoV-2 vaccination in pregnancy and in those with previous COVID-19. Public health communications should be inclusive, non-stigmatising and utilise trusted networks.	
17	Woodhead, C., Onwumere, J., Rhead, R., Bora-White, M., Chui, Z., Clifford, N., ... & Hatch, S. L. (2021). Race, ethnicity and COVID-19 vaccination: a qualitative study of UK healthcare staff. <i>Ethnicity & health</i> , 1–20.	COVID-19-related inequities experienced by racial and ethnic minority groups including healthcare professionals mirror wider health inequities, which risk being perpetuated by lower uptake of vaccination. We aim to better understand lower uptake among racial and ethnic minority staff groups to inform initiatives to enhance uptake.	Twenty-five semi-structured interviews were conducted (October 2020–January 2021) with UK based healthcare staff. Data were inductively and thematically analysed.	Vaccine decision-making processes were underpinned by an overarching theme, 'weighing up risks of harm against potential benefits to self and others'. Sub-themes included 'fear of harm', 'moral/ethical objections', 'potential benefits to self and others', 'information and misinformation', and 'institutional or workplace pressure'. We identified ways in which these were weighted more heavily towards vaccine hesitancy for racial and ethnic minority staff groups influenced by perceptions about institutional and structural discrimination. This included suspicions and fear around institutional pressure to be vaccinated, racial injustices in vaccine development and testing, religious or ethical concerns, and legitimacy and	Drawing on a critical race perspective, we conclude that acknowledging historical and contemporary abuses of power is essential to avoid perpetuating and aggravating mistrust by decontextualizing hesitancy from the social processes affecting hesitancy, undermining efforts to increase vaccine uptake.	Good

Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/ Implications	Quality assessment
18	Gaughan, C. H., Raziheh, C., Khunti, K., Banerjee, A., Chudasama, Y. V., Davies, M. J., ... & Nafilyan, V. (2022). COVID-19 vaccination uptake amongst ethnic minority communities in England: a linked study exploring the drivers of differential vaccination rates. <i>Journal of public health (Oxford, England)</i> .	Despite generally high coronavirus disease2019 (COVID-19) vaccination rates in the UK, vaccination hesitancy and lower take-up rates have been reported in certain ethnic minority communities.	Used vaccination data from the National Immunisation Management System (NIMS) linked to the 2011 Census and individual health records for subjects aged ≥ 40 years (n = 24094186). We estimated age standardized vaccination rates, stratified by ethnic group and key sociodemographic characteristics, such as religious affiliation, deprivation, educational attainment, geography, living conditions, country of birth, language skills and health status. To understand the association of ethnicity with lower vaccination rates, we conducted a logistic regression model adjusting for differences in geographic, sociodemographic and health characteristics.	accessibility of vaccine messaging and communication. All ethnic groups had lower age standardized rates of vaccination compared with the white British population, whose vaccination rate of at least one dose was 94%(95%CI:94%–94%).Black communities had the lowest rates,with75%(74–75%)of black African and 66%(66–67%) of black Caribbean individuals having received at least one dose. The drivers of these lower rates were partly explained by accounting for sociodemographic differences.However,model led estimates showed significant differences remained for all minority ethnic groups, compared with white British individuals.	Lower COVID-19 vaccination rates are consistently observed amongst all ethnic minorities.	Very good
19	Chaudhuri, K., Chakrabarti, A., Chandan, J. S., & Bandyopadhyay, S. (2022). COVID-19 vaccine hesitancy in the UK: a longitudinal household cross-sectional study. <i>BMC public health</i> , 22(1), 1–13.	To examine how the attitude towards public sector officials and the government impact vaccine willingness. The secondary aim is to understand the impact of ethnicity on vaccine willingness after we explicitly account for trust in public institutions.	This cross-sectional study used data from a UK population based longitudinal household survey (Understanding Society COVID-19 study, Understanding Society: the UK Household Longitudinal Study) between April 2020-January 2021. Data from 22,421 participants in Waves 6 and 7 of the study were included after excluding missing data. Demographic details in addition to previous survey responses relating to public sector/governmental trust were included as covariates in the main analysis. A logit model was produced to describe the association between public sector/governmental mistrust and the willingness for vaccination with interaction terms included to account for ethnicity/socio-economic status.	Individuals BAME groups were more likely to be unwilling to take the COVID-19 vaccine. We found that positive opinions towards public sector officials (OR 2.680; 95% CI 1.888 – 3.805) and the UK government (OR 3.400; 95% CI 2.454–4.712) led to substantive increase in vaccine willingness. Most notably we identified this effect to vary across ethnicity and socio-economic status with those from South Asian background (OR 4.513; 95% CI 1.012–20.123) and possessing a negative attitude towards public officials and the government being the most unwilling to be vaccinated.	trust in public sector officials play a key factor in the low vaccination rates particularly seen in at-risk groups. Given the additional morbidity/mortality risk posed by COVID-19 to those from lower socio-economic or ethnic minority backgrounds, there needs to be urgent public health action to review how to tailor health promotion advice given to these groups and examine methods to improve trust in public sector officials and the government.	Very good
20	Cook, E. J., Elliott, E., Gaitan, A., Nduka, I., Cartwright, S., Egbutah, C., ... & Ali, N. (2022). Vaccination against COVID-19: Factors That Influence Vaccine Hesitancy among an Ethnically Diverse Community in the UK. <i>Vaccines</i> , 10(1), 106.	To examine the influential factors that impact the decision to accept the COVID-19 vaccination among an ethnically diverse community.	A total of 1058 residents from Luton, UK, a large town with an ethnically diverse population, completed a community survey. Questions centred around uptake or individuals' intentions to accept the offer of COVID-19 vaccination alongside demographics, knowledge, and views on the vaccine. A binary logistic regression analysis was conducted to determine the most significant predictors of vaccine hesitancy, while	Age and ethnicity were the only sociodemographic factors to predict vaccine hesitancy. Knowledge of symptoms and transmission routes, alongside ensuring information about COVID-19 was objectively sourced, were all identified as protective factors against vaccine hesitancy. Qualitative analysis revealed that 'lack of trust in government/authorities' and 'concern of the speed of vaccine development' were the most common	This research reinforces the importance of age, ethnicity, and knowledge as influential factors in predicting vaccine hesitancy. Further, this study uncovers some of the barriers of uptake that can be utilised in developing promotional campaigns to reduce vaccine hesitancy in certain sections of the diverse UK population.	Very good

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S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
			respondents' reasons for not getting vaccinated were identified using qualitative content analysis.	reasons for non-uptake.		
21	Skirrow, H., Barnett, S., Bell, S., Riaposova, L., Mounier-Jack, S., Kampmann, B., & Holder, B. (2022). Women's views on accepting COVID-19 vaccination during and after pregnancy, and for their babies: A multi-methods study in the UK. <i>BMC pregnancy and childbirth</i> , 22(1), 1–15.	To investigate pregnant women's views on COVID-19 vaccine acceptability for themselves when pregnant, not pregnant and for their babies.	One thousand one hundred eighty-one women, aged over 16 years, who had been pregnant since 23rd March 2020, were surveyed between 3rd August–11th October 2020. Ten women were interviewed.	The majority of women surveyed (81.2%) reported that they would 'definitely' or were 'leaning towards' accepting a COVID-19 vaccine when not pregnant. COVID-19 vaccine acceptance was significantly lower during pregnancy (62.1%, $p < 0.005$) and for their babies (69.9%, $p < 0.005$). Ethnic minority women were twice as likely to reject a COVID-19 vaccine for themselves when not pregnant, pregnant and for their babies compared to women from White ethnic groups ($p < 0.005$). Women from lower-income households, aged under 25-years, and from some geographic regions were more likely to reject a COVID-19 vaccine when not pregnant, pregnant and for their babies. Multivariate analysis revealed that income and ethnicity were the main drivers of the observed age and regional differences. Women unvaccinated against pertussis in pregnancy were over four times more likely to reject COVID-19 vaccines when not pregnant, pregnant and for their babies. Thematic analysis of the survey freetext responses and interviews found safety concerns about COVID-19 vaccines were common though wider mistrust in vaccines was also expressed. Trust in vaccines and the health system were also reasons women gave for accepting COVID-19 vaccines.	Safety information on COVID-19 vaccines must be clearly communicated to pregnant women to provide reassurance and facilitate informed pregnancy vaccine decisions. Targeted interventions to promote COVID-19 vaccine uptake among ethnic minority and lower-income women may be needed.	Good
22	Byrne, T., Patel, P., Shrotri, M., Beale, S., Michie, S., Butt, J., ... & Gilson, R. (2021). Trends, patterns and psychological influences on COVID-19 vaccination intention: Findings from a large prospective community cohort study in England and Wales (<i>Virus Watch</i>). <i>Vaccine</i> , 39(48), 7108–7116.	Public intention to take a COVID-19 vaccine is high in England and Wales compared to other countries, but vaccination rate disparities between ethnic, social and age groups has led to concern.	Online survey of prospective household community cohort study participants across England and Wales (<i>Virus Watch</i>). Vaccination intention was measured by individual participant responses to 'Would you accept a COVID-19 vaccine if offered?', collected in December 2020 and February 2021. Responses to a 13-item questionnaire collected in January 2021 were analysed using factor analysis to investigate psychological influences on vaccination intention.	Survey response rate was 56% (20,785/36,998) in December 2020 and 53% (20,590/38,727) in February 2021, with 14,880 adults reporting across both time points. In December 2020, 1,469 (10%) participants responded 'No' or 'Unsure'. Of these people, 1,266 (86%) changed their mind and responded 'Yes' or 'Already had a COVID-19 vaccine' by February 2021. Vaccination intention increased across all ethnic groups and levels of social deprivation. Age was most strongly associated with vaccination intention, with 16–24-year-olds more likely to respond "Unsure" or "No"	Four in five adults (86%) who were reluctant or intending to refuse a COVID-19 vaccine in December 2020 had changed their mind in February 2021 and planned to accept, or had already accepted, a vaccine.	Good

Table 3 (continued)

S. No.	Study Ref	Aim	Methodology/method/sample	Key Findings	Recommendations/conclusion/Implications	Quality assessment
23	Blakeway, H., Prasad, S., Kalafat, E., Heath, P. T., Ladhani, S. N., Le Doare, K., ... & Khalil, A. (2022). COVID-19 vaccination during pregnancy: coverage and safety. <i>American Journal of Obstetrics and Gynecology</i> , 226(2), 236-e1.	To investigate the uptake and safety of COVID-19 vaccination among pregnant women.	This was a cohort study of pregnant women who gave birth at St George's University Hospitals National Health Service Foundation Trust, London, United Kingdom, between March 1, 2020, and July 4, 2021. The primary outcome was uptake of COVID-19 vaccination and its determinants.	versus "Yes" than 65–74-year-olds in December 2020 (OR: 4.63, 95%CI: 3.42, 6.27 & OR 7.17 95%CI: 4.26, 12.07 respectively) and February 2021 (OR: 27.92 95%CI: 13.79, 56.51 & OR 17.16 95%CI: 4.12, 71.55). The association between ethnicity and vaccination 1328 pregnant women of whom 140 received at least 1 dose of the COVID-19 vaccine before giving birth and 1188 women who did not; 85.7% of those vaccinated received their vaccine in the third trimester of pregnancy and 14.3% in the second trimester of pregnancy. Of those vaccinated, 127 (90.7%) received a messenger RNA vaccine and 13 (9.3%) a viral vector vaccine. There was evidence of reduced vaccine uptake in younger women (P=0.001), women with high levels of deprivation (ie, fifth quintile of the index of multiple deprivation; P=0.008), and women of Afro-Caribbean or Asian ethnicity compared with women of White ethnicity (P < 0.001).	Clear communication to improve awareness among pregnant women and healthcare professionals on vaccine safety is needed, alongside strategies to address vaccine hesitancy.	Good
24	Curtis, H. J., Inglesby, P., Morton, C. E., MacKenna, B., Walker, A. J., Morley, J., ... & Goldacre, B. (2021). Trends and clinical characteristics of COVID-19 vaccine recipients: a federated analysis of 57.9 million patients primary care records in situ using OpenSAFELY. <i>British Journal of General Practice</i> , January 2022	To describe trends and variation in vaccine coverage in different clinical and demographic groups in the first 100 days of the vaccine rollout.	A cohort study was conducted of 57.9 million patient records in general practice in England, in situ and within the infrastructure of the electronic health record software vendors EMIS and TPP using OpenSAFELY. Vaccine coverage across various subgroups of Joint Committee on Vaccination and Immunisation (JCVI) priority cohorts is described.	A total of 20 852 692 patients (36.0%) received a vaccine between 8 December 2020 and 17 March 2021. Of patients aged ≥ 80 years not in a care home (JCVI group 2) 94.7% received a vaccine, but with substantial variation by ethnicity (White 96.2%, Black 68.3%) and deprivation (least deprived 96.6%, most deprived 90.7%).	Targeted activity may be needed to address lower vaccination coverage observed among certain key groups.	Good

Table 4
Three Cs framework.

Three Cs framework
In this framework, individual behaviour is understood from an individual's perspective of perceived risks, and the benefit of the vaccine and the nature of a given threat of the virus to their lives.
Confidence: Trust in the effectiveness and safety of vaccines and the system managing the programme.
Complacency: Behavior is influenced by life/health responsibilities and complacency exists where perceived risks of vaccine-preventable diseases are low and so vaccination is not deemed necessary.
Convenience: Physical availability, affordability, geographical accessibility, ability to understand (language and health literacy) and appeal of immunisation services, all which impact on decisions to be vaccinated.

Table 5
Recommendations.

(1) Because of the complexity and heterogeneity found, further disaggregated data on all ethnic minority groups are needed.
(2) Where policy initiatives are present (i.e. availability of information in different languages), these have often been implemented utilising simple conceptualisations of ethno-cultural identity that are generic and fixed. This has led to calls for a more nuanced approach to optimise COVID-19 vaccine uptake, one rooted in equality, respect for diversity, and cultural competence. This may redress some of the poorer public health messaging and insensitivity to people's cultural beliefs. These fixed understanding of cultural concepts and interventions may not be helpful in meeting the needs of patients from minority groups, and concerns have been raised that poorly designed or implemented public health interventions used to reduce COVID-19 transmission, (e.g. local lockdowns) may exacerbate pre-existing inequities and stigma, with potential to generate new ones.
(3) An important issue that has yet to be fully explored in ethnic minority groups, is how misinformation available to individuals largely through popular and social media platforms threatens to compromise vaccine confidence. As established in a large body of literature, anti-vaccination groups that promote fabricated or inaccurate information and conspiracy theories, are major contributors to infodemics, which may disproportionately impact those from lower educational or income levels, or ethnic minority backgrounds. This may be addressed through pro-vaccination strategies that build vaccine confidence in the population. Multi-level involvement and engagement of key stakeholders (e.g. community leaders, employers, parents) will be important to further influence behaviour change in a positive way.

3.2. Communicating information about risks of not getting vaccination and benefits of vaccination

Six studies reported data on communicating about the risks and benefits of vaccination. Sherman et al. [23] stated that COVID-19 vaccination intention reflected general vaccine beliefs and attitudes. Campaigns and messaging about vaccination could consider emphasising the risk of COVID-19 to others, and the necessity for everyone to be vaccinated for it to be effective in controlling infection. Freeman et al. [27] identified that willingness to take a COVID-19 vaccine is closely bound to recognition of the collective importance of vaccination. Therefore, vaccine public information that highlights prosocial benefits may be especially effective.

However, Freeman et al. [19] found that for people who are strongly hesitant about COVID-19 vaccines, offering information on the personal health benefits and addressing safety concerns about speed of development of the vaccine, upfront, helps in reducing vaccine hesitancy. Communicating the collective benefits of getting the vaccination, such as not transmitting the virus to others were not found helpful in reducing vaccine hesitancy among those holding strong negative views on the vaccine.

Woodhead et al. [42] suggested that instead of generalised approaches to encouraging uptake, vaccine promotion activities should be: tailored to the concerns within and between different groups; transparent in acknowledging the causes of concerns; and considerate of intersectional social statuses. Approaches must avoid perpetuating mistrust by decontextualising hesitancy from underpinning social processes and not pressuring, discriminating against, or shaming marginalised communities for being hesitant. Gaughan et al. [39] recommended that culturally tailored public health measures to improve vaccination rates should be targeted to Black communities, certain religious groups and people living in deprived areas. For women who are pregnant, Skirrow et al. [30] recommended that safety information on COVID-19 vaccines must be clearly communicated to pregnant women to provide reassurance and facilitate informed pregnancy vaccine decisions. Targeted interventions to promote COVID-19 vaccine uptake among ethnic minority and lower-income women may be needed.

3.3. Addressing mistrust

Eight studies reported data on addressing mistrust about the vaccine. Bell et al. [18] reported that information on how COVID-19 vaccines are developed and tested, including their safety and efficacy, must be communicated clearly to the public. They identified concerns around the safety and effectiveness of a 'rushed' COVID-19 vaccine, and suggested that starting a conversation with the public early is key to understanding factors that may affect vaccine acceptability, and developing approaches to allay concerns.

Freeman et al. [19] noted that factors such as conspiracy beliefs that foster mistrust and erode social cohesion will lower vaccine up-take. Allington et al. [38] suggested strengthening positive attitudes to vaccination and reducing conspiracy suspicions may have a positive effect on vaccine uptake. Lockyer et al. [37] recommended that the vaccine programmes should provide a localised and empathetic response to counter misinformation. Paul et al. [20] reported negative attitudes towards vaccines as a major public health concern. General mistrust in vaccines and concerns about future side effects are barriers to vaccination. They recommended public health messaging should be tailored to address these concerns, for women, ethnic minorities, and people with lower levels of education and incomes.

Robertson et al. [21] recommended urgent initiatives to improve vaccine uptake in Black ethnic groups by working in close partnership with communities and making use of community champions. While universal and targeted educational interventions are necessary to enable the public to understand the importance of vaccination, they are not enough to modify behaviour or increase confidence. Therefore, full endorsement from regulatory bodies is likely to increase confidence, but efforts to combat misinformation, especially around vaccine safety, may be warranted. The rise in vaccine hesitancy as a result of misinformation coincides with the rise in social media. There is a need to proactively engage young people using online platforms and traditional formal and informal communication mediums such as churches, mosque, and family gatherings in order to meaningfully engage with these groups and support the delivery of vaccines.

Woodhead et al. [42] concluded that acknowledging historical and contemporary abuses of power is essential to avoid perpetuating and aggravating mistrust by decontextualizing hesitancy from the social processes affecting hesitancy, undermining efforts to increase vaccine uptake. Chaudhuri et al. [40] suggested that trust in public officials plays a key factor in the low vaccination rates seen in at-risk groups. Health promotion advice given to these groups needs to be tailored as well as examining methods to improve trust in public officials and the government.

3.4. Need for more research

Five studies reported the need for more research on the reasons for vaccine hesitancy. Bell et al. [18] argued that it is important to understand factors affecting COVID-19 vaccine uptake in Black, Asian and other ethnic minority groups. For Lockyer et al. [37] vaccine hesitancy needs to be understood in the context of the relationship between misinformation and associated emotional reactions. William et al. [22] suggest that future interventions, such as mass media and social marketing, need to be targeted at a range of sub-populations, necessitating better understanding of the barriers to vaccination. Robertson et al. [21] said that qualitative research on the reasons for vaccine hesitancy should help develop approaches to overcoming hesitancy. Similarly Cook et al. [41] recommended that further work is needed to investigate the most effective approaches to communicating with ethnically diverse communities.

4. Discussion

This systematic review is the first comprehensive study to bring together the UK literature about vaccine hesitancy in minority groups. It is evident that communities that face higher levels of systemic deprivation and low levels of vaccination coverage for non-communicable diseases like seasonal influenza may also be more likely to experience vaccine hesitancy. The pandemic has been recognized to have a syndemic nature [43], as COVID-19, adverse social conditions, and structural inequalities have been found to work together to increase risk from the virus [44]. Vaccine hesitancy is a complex phenomenon depending on a host of contextual factors. Our findings align with the SAGE report on factors influencing COVID-19 vaccine uptake among ethnic minorities [9], which highlighted perception of risk, confidence, loss of trust, inconvenience, and lack of appropriate communication about vaccines from trusted healthcare providers or community leaders.

Misconceptions about the immunisation process [45], lack of trust in government or healthcare [46], newness of a vaccine [47], perceived incompatibility of vaccines with religious and cultural beliefs [25] and conspiracy theories [48] were highlighted as factors known to aggravate lack of confidence in vaccines. The framework of confidence, complacency, and convenience (three Cs) is used to summarise the different facets that contribute to vaccine hesitancy [11,49], reflecting the SAGE report [9] (Table 4).

Existing uncertainty about the vaccine has been attributed to the novelty of the virus, the fast pace of vaccine development, medical mistrust and suspicion towards science, health services, or government within sub-groups [50–52] as well as mounting apprehensions over politicisation of the vaccine and standards of its efficacy and safety [51–53]. For instance, a significant decline in vaccine acceptability was recorded in the United States [52], potentially resulting from politicisation of the vaccine during the US 2020 Presidential Election campaign [54,55]. Another important factor is historical medical mistrust resulting from historical coercion and structural inequalities, notably within the Black community, which has been found to lower vaccine uptake [56].

Earlier experiences with vaccination campaigns have demonstrated the significance of engagement with audiences for effective promotion and implementation. Communication with specific audiences is essential, and will require development of effective and tailored vaccination-related information and messages predicated on an understanding of wide-ranging concerns and beliefs of audiences [57–59]. A human-centered, targeted approach that relies on a range of intervention methods suited to specific subsets of the population has been found to be effective [60]. It is also crucial that these interventions are developed from research-based insight. Further investment in social science research will be paramount [61].

Vaccine hesitancy is driven largely by a wide range of individual experiences and personal beliefs [62]. Appropriate information and positive engagement may facilitate uptake [63]. The extensive anxiety, experiences of loss, and psychological exhaustion caused by the COVID-19 crisis have had a severe bearing on health behaviours and vaccination intent [64–67]. COVID-19 vaccine messaging will require understanding and engagement with feelings of fear and mistrust in order to decrease vaccine-related uncertainties. A focus on awareness in the target audiences of the manipulative tactics used by anti-vaccination campaigns can be helpful in protecting individuals from the effects of those campaigns [63].

Healthcare professionals are seen trusted sources of vaccine-related information [68], particularly in the pandemic [69]. The SAGE report supports this, highlighting the benefit of engagement between communities and trusted sources [9]. Vaccination rates have been influenced by healthcare provider recommendations [70–72]. A survey in the US showed a higher probability of vaccine acceptance among patients after recommendation from a healthcare provider [56]. However, given medical mistrust, conspiracy theories, and experiences of marginalisation, healthcare provider education is needed on vaccine safety, efficacy, and cultural issues [9,56,61].

Community leaders are valuable mediators for knowledge-sharing between marginalised communities, and healthcare providers and policymakers, and can facilitate engagement and inform response strategies [9]. Religious leaders are effective in delivering communication regarding vaccinations, positively influencing vaccination uptake in their communities, as well as facilitating engagement where there is limited trust in governments or health care systems [73]. Engaging religious leaders in vaccine promotion can also help in mitigation of vaccine-related uncertainty fuelled by conspiracy theories and misinformation. However, it is important that engagement with religious leaders is sensitive to religious and cultural concerns, and supported by adequate training and education. For instance, a decline in vaccine confidence in Indonesia was associated with Muslim leaders' concerns regarding safety of the MMR vaccine, which was then declared 'haram' (religiously prohibited) and thus forbidden for Muslims [74]. The identification of 'community leaders' must be guided by communities themselves to ensure they meaningfully represent the views of these groups.

Effective and equitable delivery of COVID-19 vaccinations will depend on organizational-level change. Removal of structural barriers to vaccine access can increase vaccination uptake, especially among ethnic minority groups [6]. Reduction in procedure-related friction e.g. waiting times, and inconvenient locations of vaccination centres can lead to higher levels of vaccine uptake. Research [71] has suggested that making vaccination available at accessible outlets within the community (e.g. retail pharmacies, healthcare centres, schools, retirement homes or community centres) has potential to increase both vaccine confidence and vaccine uptake across populations.

4.1. Strengths and limitations of the review

This is the first comprehensive examination of the evidence on vaccine hesitancy among ethnic minority communities in the UK. It highlights the limited evidence in this area and the need for more robust research. The main limitation is that several studies recorded data before the approval of COVID-19 vaccines and are therefore based on intention to vaccinate [18–20,22,23,26]. Views around vaccine hesitancy are also likely to fluctuate. Another limitation concerns the small sample sizes reported in the studies. In most cases, findings related to ethnic minority groups are presented collectively, rather than disaggregating groups by ethnicity [22,75,76].

Most of the studies were survey-based, conducted online, and using a cross-sectional design, which may have limitations. There may be disparities in access to online surveys due to language barriers or digital literacy, particularly among first-generation migrants or elderly participants. No standard definition given in the studies of BAME or BME, and different studies used these terms interchangeably, making generalization of the findings challenging.

5. Conclusions and implications for policy and practice

To address disparities in delivery and uptake of the vaccine, the voice of ethnic minority groups and their social and health circumstances must be better understood. There have been strong calls for attention to the disproportionate burden of COVID-19 on ethnic minority groups, with warnings that inaction will be responsible for further inequities in mortality [8,77]. This systematic review therefore has several important implications, which we outline in Table 5.

The evidence base points to concerns around the COVID-19 vaccine in ethnic minority communities which contributes to disparities in delivery of vaccinations. More robust data are needed, disaggregated by ethnicity, to better understand barriers and facilitators to the delivery of COVID-19 vaccinations. Effective promotion will require the development of tailored information informed by the concerns and experiences of ethnic minority communities. In addition, organisational level change is needed to address structural barriers, inequities, and discrimination. Ultimately, this review underscores the importance of meaningful engagement and co-production approaches with ethnic minority communities to address the complex and multidimensional concerns and experiences contributing to vaccine hesitancy in ethnic minority communities in the UK.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

None.

Appendices

See Table 1.

Database: Embase <1974–2022 February 18>.
Search Strategy:

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- limit 3 to yr="2020 -Current" 346.
- (UK or England or Great Britain or Scotland or Republic of Ireland or Northern Ireland or Wales).mp. [mp = title, abstract, heading word, table of contents, key concepts, original title, tests & measures, mesh word] 94,323.
- limit 5 to yr="2020 -Current" 6356.
- 2 and 4 and 6 = 6.

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12 references retrieved.

References

- Office for National Statistics. Coronavirus (COVID-19) latest insights 2021. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/articles/coronaviruscovid19/latestinsights#ethnicity>.
- Public Health England Teams. Disparities in the risk and outcomes of COVID-19. 2020.
- Sze S, Pan D, Nevill CR, Gray LJ, Martin CA, Nazareth J, et al. Ethnicity and clinical outcomes in COVID-19: a systematic Review and Meta-analysis. *EClinicalMedicine* 2020;29:. <https://doi.org/10.1016/j.eclinm.2020.100630>
- Price-Haywood EG, Burton J, Fort D, Seoane L. Hospitalization and Mortality among Black Patients and White Patients with Covid-19. *N Engl J Med* 2020;382:2534–43. <https://doi.org/10.1056/nejmsa2011686>.
- COVID-19 Response – Spring 2021. Cabinet Off 2021. <https://www.gov.uk/government/publications/covid-19-response-spring-2021> (accessed February 25, 2021).
- Jeraj S. Doing the work to end health inequalities caused by systemic racism. *BMJ* 2021;373. <https://doi.org/10.1136/bmj.n821>.
- Razaq A, Harrison D, Barr B, Asaria M, Routen A, Khunti KBAME. COVID-19 DEATHS - What do we know? Rapid Data & Evidence Review Oxford COVID-19 Evid Serv 2020.
- Public Health England. Coronavirus (COVID-19) Rules, guidance and support 2021. <https://www.gov.uk/government/organisations/public-health-england>.
- SAGE organisation. Factors influencing COVID-19 vaccine uptake among minority ethnic groups, 17 December 2020. UK Gov 2021. <https://www.gov.uk/government/publications/factors-influencing-covid-19-vaccine-uptake-among-minority-ethnic-groups-17-december-2020> (accessed February 19, 2022).
- MacDonald NE, Eskola J, Liang X, Chaudhuri M, Dube E, Gellin B, et al. Vaccine hesitancy: Definition, scope and determinants. *Vaccine* 2015;33:4161–4. <https://doi.org/10.1016/j.vaccine.2015.04.036>.
- Bedford H, Attwell K, Danchin M, Marshall H, Corben P, Leash J. Vaccine hesitancy, refusal and access barriers: The need for clarity in terminology. *Vaccine* 2018;36:6556–8. <https://doi.org/10.1016/j.vaccine.2017.08.004>.
- Palamenghi L, Barello S, Boccia S, Graffigna G. Mistrust in biomedical research and vaccine hesitancy: the forefront challenge in the battle against COVID-19 in Italy. *Eur J Epidemiol* 2020;35:785–8. <https://doi.org/10.1007/s10654-020-00675-8>.
- Hussain B, Latif A, Timmons S, Nkhoma K. COVID-19 vaccine hesitancy in Black, Asian and minority ethnic groups in the UK: a rapid systematic review. *PROSPERO* 2021 CRD42021243083 2021.
- Higgins JPT, Green S, editors. *Cochrane handbook for systematic reviews of interventions*. Wiley-Blackwell; 2008.
- Systematic Reviews: CRD's Guidance for Undertaking Reviews in Health Care. 2009.
- Kmet LM, Cook LS, Lee RC. Standard quality assessment criteria for evaluating primary research papers from a variety of fields 2004. 10.7939/R37M04F16.
- Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, et al. *Guidance on the Conduct of Narrative Synthesis in Systematic Reviews*. Institute For Health Research; 2006.
- Bell S, Clarke R, Mounier-Jack S, Walker JL, Paterson P. Parents' and guardians' views on the acceptability of a future COVID-19 vaccine: A multi-methods study in England. *Vaccine* 2020;38:7789–98. <https://doi.org/10.1016/j.vaccine.2020.10.027>.
- Freeman D, Loe BS, Chadwick A, Vaccari C, Waite F, Rosebrock L, et al. COVID-19 vaccine hesitancy in the UK: the Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II. *Psychol Med* 2020;1–15. <https://doi.org/10.1017/S0033291720005188>.
- Paul E, Steptoe A, Fancourt D. Attitudes towards vaccines and intention to vaccinate against COVID-19: Implications for public health communications. *Lancet Reg Heal - Eur* 2021;1. <https://doi.org/10.1016/j.lanepe.2020.100012>.
- Robertson E, Reeve KS, Niedzwiedz CL, Moore J, Blake M, Green M, et al. Predictors of COVID-19 vaccine hesitancy in the UK Household Longitudinal Study. *Brain Behav Immun* 2021;94:41–50. <https://doi.org/10.1016/j.bbi.2021.03.008>.
- Williams L, Flowers P, McLeod J, Young D, Rollins L. Social Patterning and Stability of Intention to Accept a COVID-19 Vaccine in Scotland: Will Those Most at Risk Accept a Vaccine. *Vaccine* 2021;9. <https://doi.org/10.3390/vaccines9010017>.
- Sherman SM, Smith LE, Sim J, Amlot R, Cutts M, Dasch H, et al. COVID-19 vaccination intention in the UK: results from the COVID-19 vaccination acceptability study (CoVaccS), a nationally representative cross-sectional survey. *Hum Vaccin Immunother* 2021;17:1612–21. <https://doi.org/10.1080/21645515.2020.1846397>.
- Jackson SE, Paul E, Brown J, Steptoe A, Fancourt D. Negative Vaccine Attitudes and Intentions to Vaccinate Against Covid-19 in Relation to Smoking Status: A Population Survey of UK Adults. *Nicotine Tob Res* 2021;1–6. <https://doi.org/10.1093/ntr/ntab039>.
- Siani A, Driscoll M, Hurst TM, Coker T, Grantham AG, Bunet A. Investigating the determinants of vaccine hesitancy within undergraduate students' social sphere. *J Public Heal* 2021;1–9. <https://doi.org/10.1007/s10389-021-01538-6>.
- Lomba S, de Figueiredo A, Piatek SJ, de Graaf K, Larson HJ. Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Mayo Clin Proc* 2021;5:7789–98. <https://doi.org/10.1038/s41562-021-01056-1>.
- Freeman D, Loe BS, Yu LM, Freeman J, Chadwick A, Vaccari C, et al. Effects of different types of written vaccination information on COVID-19 vaccine hesitancy in the UK (OCEANS-III): a single-blind, parallel-group, randomised controlled trial. *Lancet Public Heal* 2021;6:e416–27.
- Glampson B, Brittain J, Kaura A, Mulla A, Mercuri L, Brett SJ, et al. Assessing COVID-19 vaccine uptake and effectiveness through the north west London vaccination program: Retrospective cohort study. *JMIR Public Heal Surveill* 2021;7:. <https://doi.org/10.2196/30010>.
- Perry M, Akbari A, Cottrell S, Gravenor MB, Roberts R, Lyons RA, et al. Inequalities in coverage of COVID-19 vaccination: A population register based cross-sectional study in Wales. *UK Vaccine* 2021;39:6256–61. <https://doi.org/10.1016/j.vaccine.2021.09.019>.
- Skirrow H, Barnett S, Bell S, Riaposova L, Mounier-Jack S, Kampmann B, et al. Women's views on accepting COVID-19 vaccination during and after

- pregnancy, and for their babies: a multi-methods study in the UK. *BMC Pregnancy Childbirth* 2022;22:1–5. <https://doi.org/10.1186/s12884-021-04321-3>.
- [31] Blakeway H, Prasad S, Kalafat E, Health PT, Ladhani SN, Doare KL, et al. COVID-19 vaccination during pregnancy: coverage and safety. *Am J Obstet Gynecol* 2022;226:236.E1–236.E14. <https://doi.org/10.1016/j.ajog.2021.08.007>.
- [32] Nguyen LH, Joshi AD, Drew DA, Merino J, Ma W, Lo C, et al. Self-reported COVID-19 vaccine hesitancy and uptake among participants from different racial and ethnic groups in the United States and United Kingdom. *Nat Commun* 2022;13:1–9. <https://doi.org/10.1038/s41467-022-28200-3>.
- [33] Woolf K, McManus IC, Martin CA, Nellums LB, Guyatt AL, Melbourne C, et al. Ethnic differences in SARS-CoV-2 vaccine hesitancy in United Kingdom healthcare workers: Results from the UK-REACH prospective nationwide cohort study. *Lancet Reg Heal* 2021;9:100180.
- [34] Martin CA, Marshall C, Patel P, Goss C, Jenkins DR, Ellwood C, et al. SARS-CoV-2 vaccine uptake in a multi-ethnic UK healthcare workforce: A cross-sectional study. *PLoS Med* 2021;18:. <https://doi.org/10.1371/journal.pmed.1003823>.
- [35] Byrne T, Patel P, Shrotri M, Beale S, Michie S, Butt J, et al. Trends, patterns and psychological influences on COVID-19 vaccination intention: Findings from a large prospective community cohort study in England and Wales (Virus Watch). *Vaccine* 2021;39:7108–16. <https://doi.org/10.1016/j.vaccine.2021.09.066>.
- [36] Curtis HJ, Inglesby P, Morton CE, Mackenna B, Green A, Hulme W, et al. Trends and clinical characteristics of COVID-19 vaccine recipients: A federated analysis of 57.9 million patients' primary care records in situ using OpenSAFELY. *Br J Gen Pract* 2022;72:e51–62. <https://doi.org/10.3399/bjgp.2021.0376>.
- [37] Lockyer B, Islam S, Rahman A, Dickerson J, Pickett K, Sheldon T, et al. Understanding Covid-19 misinformation and vaccine hesitancy in context: Findings from a qualitative study involving citizens in Bradford. *UK Heal Expect* 2021;24:1158–67. <https://doi.org/10.1111/hex.13240>.
- [38] Allington D, McAndrew S, Moxham-Hall V, Duffy B. Coronavirus conspiracy suspicions, general vaccine attitudes, trust and coronavirus information source as predictors of vaccine hesitancy among UK residents during the COVID-19 pandemic. *Psychol Med* 2021;1–12.
- [39] Gaughan CH, Razieh C, Khunti K, Banerjee A, Chudasama YV, Davies MJ, et al. COVID-19 vaccination uptake amongst ethnic minority communities in England: A linked study exploring the drivers of differential vaccination rates. *J Public Health (Bangkok)* 2022;1–9. <https://doi.org/10.1093/pubmed/fdab400>.
- [40] Chaudhuri K, Chakrabarti A, Chandan JS, Bandyopadhyay S. COVID-19 vaccine hesitancy in the UK: A longitudinal household cross-sectional study. *BMC Public Health* 2022;22:1–3. <https://doi.org/10.1186/s12889-021-12472-3>.
- [41] Cook EJ, Elliott E, Gaitan A, Nduka I, Cartwright S, Egbutah C, et al. Vaccination against COVID-19: Factors that influence vaccine hesitancy among an ethnically diverse community in the UK. *Vaccines* 2022;10:106. <https://doi.org/10.3390/vaccines10010106>.
- [42] Woodhead C, Onwumene J, Rhead R, Bora-White M, Chui Z, Clifford N, et al. Race, ethnicity and COVID-19 vaccination: A qualitative study of UK healthcare staff. *Ethn Health* 2021;1–20. <https://doi.org/10.1080/13557858.2021.1936464>.
- [43] Singer M. A dose of drugs, a touch of violence, a case of AIDS: conceptualizing the SAVA syndrome. *Free Inq Creat Sociol* 2000;28:13–24.
- [44] Bamba C, Riordan R, Ford J, Matthews F. The COVID-19 pandemic and health inequalities. *J Epidemiol Community Health* 2020;74:964–8. <https://doi.org/10.1136/jech-2020-214401>.
- [45] Zingg A, Siegrist M. Measuring people's knowledge about vaccination: Developing a one-dimensional scale. *Vaccine* 2012;30:3771–7. <https://doi.org/10.1016/j.vaccine.2012.03.014>.
- [46] Lee C, Whetten K, Omer S, Pan W, Salmon D. Hurdles to herd immunity: Distrust of government and vaccine refusal in the US, 2002–2003. *Vaccine* 2016;34:3972–8. <https://doi.org/10.1016/j.vaccine.2016.06.048>.
- [47] Karafillakis E, Simas C, Jarrett C, Verger P, Peretti-Watel P, Dib F, et al. HPV vaccination in a context of public mistrust and uncertainty: a systematic literature review of determinants of HPV vaccine hesitancy in Europe. *Hum Vaccines Immunother* 2019;15:1615–27. <https://doi.org/10.1080/21645515.2018.1564436>.
- [48] Hornsey MJ, Finlayson M, Chatwood G, Begeny CT. Donald Trump and vaccination: The effect of political identity, conspiracist ideation and presidential tweets on vaccine hesitancy. *J Exp Soc Psychol* 2020;88:. <https://doi.org/10.1016/j.jesp.2019.103947>.
- [49] Dudley MZ, Privor-Dumm L, Dubé É, MacDonald NE. Words matter: Vaccine hesitancy, vaccine demand, vaccine confidence, herd immunity and mandatory vaccination. *Vaccine* 2020;38:709–11. <https://doi.org/10.1016/j.vaccine.2019.11.056>.
- [50] Funk C, Kennedy B, Johnson C. Trust in Medical Scientists Has Grown in U.S., but Mainly Among Democrats. *Pew Res Cent* 2020. <https://www.pewresearch.org/science/2020/05/21/trust-in-medical-scientists-has-grown-in-u-s-but-mainly-among-democrats/>.
- [51] KFF Health Tracking Poll- September 2020. *Kaiser Fam Found* 2020.
- [52] Tyson A, Johnson C, Funk C. U.S. public now divided over whether to get COVID-19 vaccine: Concerns about the safety and effectiveness of possible vaccine, pace of approval process. *Pew Res Cent* 2020. <https://www.pewresearch.org/science/2020/09/17/u-s-public-now-divided-over-whether-to-get-covid-19-vaccine/>.
- [53] CUNY SPH weekly COVID-19 survey update week 12 – Vaccines. *City Univ New York Sch Public Heal* 2020. https://www.eurekaalert.org/pub_releases/2020-06/cgso-csw061720.php.
- [54] Galvão J. COVID-19: the deadly threat of misinformation. *Lancet Infect Dis* 2021;21:. [https://doi.org/10.1016/S1473-3099\(20\)30721-0](https://doi.org/10.1016/S1473-3099(20)30721-0).
- [55] Peretti-Watel P, Seror V, Cortaredona S, Launay O, Raude J, Verger P, et al. A future vaccination campaign against COVID-19 at risk of vaccine hesitancy and politicisation. *Lancet Infect Dis* 2020;20:769–70. [https://doi.org/10.1016/S1473-3099\(20\)30426-6](https://doi.org/10.1016/S1473-3099(20)30426-6).
- [56] Bogart LM, Ojikutu BO, Tyagi K, Klein DJ, Mutchler MG, Dong L, et al. COVID-19 Related Medical Mistrust, Health Impacts, and Potential Vaccine Hesitancy Among Black Americans Living With HIV. *J Acquir Immune Defic Syndr* 2021;86:200–7. <https://doi.org/10.1097/QAI.0000000000002570>.
- [57] Poland CM, Poland GA. Vaccine education spectrum disorder: The importance of incorporating psychological and cognitive models into vaccine education. *Vaccine* 2011;29:6145–8. <https://doi.org/10.1016/j.vaccine.2011.07.131>.
- [58] Poland GA, Tilburt JC, Marcuse EK. Preserving Civility in Vaccine Policy Discourse: A Way Forward. *J Am Med Assoc* 2019;322:209–10. <https://doi.org/10.1001/jama.2019.7445>.
- [59] Centers for Disease Control and Prevention. *News CDC* 2020. <https://www.cdc.gov/>.
- [60] Schoch-Spana M, Brunson EK, Long R, Ruth A, Ravi SJ, Trotochaud M, et al. 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;39:6004–12. <https://doi.org/10.1016/j.vaccine.2020.10.059>.
- [61] French J, Deshpande S, Evans W, Obregon R. Key guidelines in developing a pre-emptive COVID-19 vaccination uptake promotion strategy. *Int J Environ Res Public Health* 2020;17:1–14. <https://doi.org/10.3390/ijerph17165893>.
- [62] Amin AB, Bednarczyk RA, Ray CE, Melchiori KJ, Graham J, Huntsinger JR, et al. Association of moral values with vaccine hesitancy. *Nat Hum Behav* 2017;1:873–80. <https://doi.org/10.1038/s41562-017-0256-5>.
- [63] Chou WYS, Budenz A. Considering Emotion in COVID-19 Vaccine Communication: Addressing Vaccine Hesitancy and Fostering Vaccine Confidence. *Health Commun* 2020;35:1718–22. <https://doi.org/10.1080/10410236.2020.1838096>.
- [64] Jungmann SM, Witthöft M. Health anxiety, cyberchondria, and coping in the current COVID-19 pandemic: Which factors are related to coronavirus anxiety? *J Anxiety Disord* 2020;73:. <https://doi.org/10.1016/j.janxdis.2020.102239>.
- [65] Lwin MO, Lu J, Sheldenkar A, Schulz PJ, Shin W, Gupta R, et al. Global sentiments surrounding the COVID-19 pandemic on Twitter: Analysis of Twitter trends. *JMIR Public Heal Surveill* 2020;6:1–4. <https://doi.org/10.2196/19447>.
- [66] Morgul E, Bener A, Atak M, Akyel S, Aktaş S, Bhugra D, et al. COVID-19 pandemic and psychological fatigue in Turkey. *Int J Soc Psychiatry* 2021;67:128–35. <https://doi.org/10.1177/0020764020941889>.
- [67] Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations. *Gen Psychiatry* 2020;33:1–4. <https://doi.org/10.1136/gpsych-2020-100213>.
- [68] Jackson DN, Peterson EB, Blake KD, Coa K, Chou WYS. Americans' trust in health information sources: Trends and sociodemographic predictors. *Am J Heal Promot* 2019;33:1187–93. <https://doi.org/10.1177/0890117119861280>.
- [69] Charron J, Gautier A, Jestin C. Influence of information sources on vaccine hesitancy and practices. *Médecine Mal Infect* 2020;50:727–33. <https://doi.org/10.1016/j.medmal.2020.01.010>.
- [70] Rosenthal SL, Weiss TW, Zimet GD, Ma L, Good MB, Vichnin MD. Predictors of HPV vaccine uptake among women aged 19–26: Importance of a physician's recommendation. *Vaccine* 2011;25:890–5. <https://doi.org/10.1016/j.vaccine.2009.12.063>.
- [71] Jacobson RM, Agunwamba AA, St. Sauver JL, Rutten LJF. The most effective and promising population health strategies to advance human papillomavirus vaccination Robert. *Expert Rev Vaccines* 2016;15:257–69. <https://doi.org/10.1586/14760584.2016.1116947>.
- [72] Darden PM, Jacobson RM. Impact of a physician recommendation. *Hum Vaccines Immunother* 2014;10:2632–5. <https://doi.org/10.4161/hv.29020>.
- [73] Obregon R, Chitnis K, Morry C, Feek W, Bates J, Galway M, et al. Achieving polio eradication: A review of health communication evidence and lessons learned in India and Pakistan. *Bull World Health Organ* 2009;87:624–30. <https://doi.org/10.2471/BLT.08.060863>.
- [74] Yufika A, Wagner AL, Nawawi Y, Wahyuniati N, Anwar S, Yusri F, et al. Parents' hesitancy towards vaccination in Indonesia: A cross-sectional study in Indonesia. *Vaccine* 2020;38:2592–9. <https://doi.org/10.1016/j.vaccine.2020.01.072>.
- [75] Salali GD, Uysal MS. COVID-19 vaccine hesitancy is associated with beliefs on the origin of the novel coronavirus in the UK and Turkey. *Psychol Med* 2020:1–3. <https://doi.org/10.1017/S0033291720004067>.
- [76] Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Hum Vaccin Immunother* 2020;16:2204–14. <https://doi.org/10.1080/21645515.2020.1790279>.
- [77] Iacobucci G, The BMJ. Interview: Victor Adebowale on systemic racism in the NHS. *Bmj* 2020;371. <https://doi.org/10.1136/bmj.m4111>.