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The use of social media platforms by migrant and ethnic minority populations during the COVID-19 pandemic: a systematic review

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Abstract

Objective To determine the extent and nature of social media use in migrant and ethnic minority communities for COVID-19 information, and implications for preventative health measures including vaccination intent and uptake.

Design A systematic review of published and grey literature following the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) guidelines

Eligibility Criteria for study selection Global research reporting the use of social media by migrants and/or ethnic minority groups in relation to COVID-19.

Data extraction We extracted data on key outcomes, study design, country, population under study, and sample size.

Results 1849 unique records were screened, and 21 data sources included in our analysis involving migrant and ethnic minority populations in the UK, US, China, Jordan, Qatar, and Turkey. We found evidence of consistent use of a range of social media platforms for COVID-19 information in some migrant and ethnic minority populations (including WeChat, Facebook, WhatsApp, Instagram, Twitter, YouTube), which may stem from difficulty in accessing COVID-19 information in their native languages or from trusted sources. There were positive and negative associations with social media use reported, with some evidence suggesting circulating misinformation and social media use may be associated with lower participation in preventative health measures, including vaccine intent and uptake, findings which are likely relevant to multiple population groups.

Conclusions Social media platforms are an important source of information about COVID-19 for some migrant and ethnic minority populations. Urgent actions and further research are now needed to better understand the use of social media platforms for accessing health information by different population groups – particularly groups who are marginalised from health systems – effective approaches to tackling circulating misinformation, and to seize on opportunities to

better use social media platforms to support public health communication and improve vaccine uptake.

Registration This study has been registered with PROSPERO;(CRD42021259190).

Article Summary

- This international review examines available evidence about the use of social media platforms by migrant and ethnic minority communities for information about COVID-19, alongside exploring circulating misinformation via these platforms and implications for health behaviours including vaccine intent and uptake.
- Comprehensive systematic review methods were used, following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, and we searched published and grey literature.
- This review is the first attempt to synthesise global studies exploring the use and impact of social media on migrant and ethnic minority populations during the COVID-19 pandemic. However, it is limited by the availability and quality of the datasets available.
- We acknowledge the limited geographical scope of included studies, with 16 of 21 studies focused on migrant and ethnic minority populations residing in the UK and US and no data at all from low-income countries. There is a stark lack of data on social media use from low and middle-income countries, which merits greater consideration as COVID-19 vaccination gathers pace in these contexts.

Introduction

The pandemic has been accompanied by an infodemic, defined as an excess of information during a disease outbreak – including false or misleading information in digital and physical environments[1] – that makes it difficult to distinguish reliable information from misinformation including disinformation (deliberate misinformation) and conspiracy theories. The World Health

Organization (WHO) highlights that in all communities, infodemics cause 'confusion and risk-taking behaviours that can harm health…it leads to mistrust in health authorities and undermines the public health response, and can intensify or lengthen outbreaks'[1]. The rapid expansion of internet and social media use, in particular, in recent years (including platforms such as Twitter, WhatsApp, and YouTube; Table 1) has meant that both useful and potentially harmful health information can spread rapidly. A large proportion of the most popular COVID-19 videos on YouTube, for example, have been found to contain misinformation, or no factual information, reaching millions of people worldwide[2 3]. YouTube is considered a major platform for information concerning the control of COVID-19, but most COVID-19 videos were of 'undesirable quality' containing few government/public health recommendations according to a recent study[4]. A review of YouTube videos on general vaccination found 65% expressed anti-vaccination sentiment[5], with anti-vaccine posts more likely to be recirculated on Twitter[2]. The spread of misinformation and disinformation has been highlighted as a major risk to ending the COVID-19 pandemic – including undermining trust in vaccines[6] – with researchers highlighting links between misinformation on social media and public doubts around vaccine safety, self-reported compliance with public health guidelines, and intent to vaccinate[7 8].

Table 1: Popular social media platforms

Statistics from Statistica (2021) [9]

Platform	Primary Feature	Country of origin	Organisation	Users
YouTube	Online video sharing and social media platform. Free to use.	US	Google	Approximately >2 billion monthly
WhatsApp	Messaging platform, allows users to send text messages and voice messages, make voice and video calls, and share images, documents, user locations, and other content. Free to use.	US	Meta	Approximately >2 billion monthly
Instagram	Photo and video sharing social networking site. Free to use.	US	Meta	Approximately 1 billion monthly

Facebook	Social networking service, allows messaging, image and video sharing, marketplace online shopping, live video sharing. Free to use.	US	Meta	2.89 billion active monthly
WeChat	Instant messaging, social media, mobile payment. Free to use.	China	Tencent Holdings Limited	1.25 billion monthly
TikTok (Known in China as Douyin)	Video sharing focused on short form videos (15 seconds – 3 minutes). Free to use.	China	ByteDance	837 million monthly active
Snapchat	Photo sharing multimedia app with video features. Free to use.	US	Snap Inc.	347.3 million monthly active
Twitter	Microblogging focused on short messages known as 'tweets'. Live chat event function Tweetchat.	US	Twitter Inc.	330 million monthly active

Although social media platforms are commonly used in the general population, and patterns of use are complex across different population groups[8 10], some migrant and ethnic minority groups – who may experience barriers to accessing health information and health systems – may be more reliant on social media and the internet as a source of health information[11]. The COVID-19 pandemic has disproportionately impacted and exacerbated inequalities faced by migrants and ethnically diverse communities[12 13 11 14 15], with lower take-up of preventative health measures, such as vaccines, noted in some groups due to a range of personal, societal, and physical barriers[13 15 16]. Some migrant and ethnic minority communities may be more exposed to social media misinformation because of access barriers to accurate information (eg, from official government sources)[17 18], due to restricted eligibility and access to services, language barriers, and low health literacy. However, little is known about the extent and nature of social media use in these populations, nor the impact that social media use has had on preventative health measures during the pandemic, including COVID-19 vaccine uptake. In addition, there is an opportunity now to explore the extent to which social media platforms could be better used

to support information sharing and promote public health messaging in marginalised communities during the pandemic and beyond.

We therefore did a systematic review to explore and assess the extent and nature of social media use by migrant and ethnic minority groups to access COVID-19 health information, the extent to which misinformation on social media may have influenced views about COVID-19 preventative measures including vaccination intention and uptake, and to explore good practice.

Methods

Search Strategy

The review was registered with PROSPERO (CRD42021259190)[19] and followed PRISMA guidelines[20]. The study protocol is in the PROSPERO registration. A Boolean search strategy was developed containing terms relating to migrants, ethnic minorities, COVID-19, social media, and misinformation (see Supplementary file 1). We searched the following databases: Embase, Web of Science, Oxford Academic Journals, PubMed NIH, Clinical Trials, China CDC MMWR, CDC reports, ProQuest Central (Proquest), CINAHL, Africa Wide Information (Ebsco), Scopus, PsycInfo, CAB Abstracts, Global Health, J Stage, Science Direct, Wiley Online Journals, JAMA Network, British Medical Journal, Mary Ann Liebert, New England Journal of Medicine, Sage Publications, Taylor and Francis Online, Springer Link, Biomed Central, MDPI, ASM, PLOS, The Lancet, Cell Press, and pre-print sites chemRxiv, SSRNbioRxiv, and medRxiv facilitated through the WHO Global Research on COVID-19 database from inception to 9/6/2021 (https://search.bvsalud.org/global-literature- on-novel-coronavirus-2019-ncov/). The WHO's COVID-19 Database[21], is a daily updated multilingual resource of all literature (peer-reviewed literature, pre-prints and grey literature) pertaining to COVID-19.

Records were imported to Rayyan QCRI[22]. Both title and abstract screening and full text screening were conducted independently by two reviewers (MR-P and LG) using Rayyan QCRI[22].

Additional relevant papers and grey literature (e.g. from third-sector organisation websites) were identified using hand searching including backwards and forwards citation tracking.

Selection criteria and primary outcomes

Papers reporting the use of social media platforms and implications for preventative health measures and vaccination intent of migrants and/or ethnic minority groups to COVID-19 globally were eligible. All types of scientific articles, reports and commentaries, editorials, correspondence letters were eligible for inclusion. Social media platforms were defined as any medium whereby content (including images, videos, and messages) is circulated to the general public and may include YouTube, Facebook, Twitter, TikTok, and Snapchat. 'Migrants' were defined as foreign-born, residing outside of their country of birth. An ethnic minority group was defined as a group of people with a shared culture, tradition, language, history, living in a country where most people are from a different ethnic group, and will include migrants/foreign-born populations alongside individuals born in the host country. Where studies reported a general population sample, results about migrant/ethnic minority groups within that sample were eligible for inclusion. No papers were excluded based on language or geographical origin. Studies were excluded if it was not possible to determine whether individual(s) in the population studied were migrants or from an ethnic minority group.

Data Extraction, critical appraisal, and synthesis

Data extraction was completed independently by two researchers (MRP and LG) using a piloted, structured data extraction sheet in Microsoft Excel and data were collated and assessed using narrative synthesis. Outcomes were extracted as reported. Risk of bias was assessed independently by two researchers (LG, MRP) using the Quality assessment for Survey Studies in Psychology for Surveys (Q-SSP)[23] for quantitative studies. The twenty items on this scale can be rated as "yes", or "no", "not stated clearly", or "not applicable". Scores are calculated by dividing the "yes" answers by the total number of applicable items, with scores over 70% indicating "acceptable" quality. The Critical Appraisal Skills programme (CASP) checklist was used for qualitative studies[24]. The ten items can be rated 'yes', 'can't tell' or 'no'. We rated the

CASP by dividing the "yes" answers by the total number of applicable items, with a score of over 60% indicating "acceptable" quality. We did not exclude any papers on the basis of quality.

Patient and public involvement

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

Results

Overview of data sources

Following de-duplication, 1849 unique data sources were identified and screened and ultimately 129 were full-text screened. 21 data sources were included in the final analysis (Figure 1). Six studies were conducted in the UK[25-30] , two were jointly conducted in the UK and US[31 32]. An additional eight studies were conducted in the US,[33-40] and one each in China,[41] Jordan,[42] Qatar,[43] and Turkey.[44] Eight studies reported on migrants,[28 30 33 41-45] including migrants in the host countries of China[41], Jordan[42], Quatar,[43] Turkey[44], and the US[33] and UK[28 30], and one study involved predominantly migrants from Venezuela residing in other countries.[45] Nine studies reported about a specific ethnic minority or group (Latino individuals,[33 35 37 38] Black American citizens,[36 40], Jain community members[29] and Syrian migrants[42 44]). Seven studies reported about ethnic minority groups generally[25-27 31 32 34 39]. A survey design was the most common design, used in half of included studies.

Characteristics of included studies are presented in Table 2, including the risk of bias assessment scores. Quality scores ranged from 76% to 90% for included papers, suggesting acceptable quality of all included data sources where quality assessment was applicable. Figure 2 shows the geographical location of data sources, highlighting the absence of published and unpublished data on this topic from most regions of the world.

Table 2: Characteristics of included studies

Included study	Location of study	Study design	Population under study	Sample size	Quality rating*
Alabdulla 2021[43]	Qatar	Survey	Non-Qatari residents	7821	76%[1]
Allington 2021(a)[27]	UK	Survey	Non-White ethnic groups	4343	82%[1]
Allington 2021(b)[32]	UK	Survey	Non-White ethnic groups	8988	89%[1]
Behbahani 2020[33]	US	Organisational case study	Latino migrants	N/K	N/A[1]
Campos-Castillo 2020[34]	US	Survey	Non-White ethnic groups	10,510	88%[1]
Cervantes 2021[35]	US	Qualitative interviews with thematic analysis	Low-income Latino individuals	60	90%[3]
Chandler 2020[36]	US	Qualitative interviews with thematic analysis	Black women (18-31yrs)	15	90%[3]
Crawshaw 2021[28]	UK	Evidence synthesis linked to outputs from participatory workshops with migrants	International migrants	N/K	N/A[2]
Despres 2020[37]	US	Organisational case study	Latino community living in America	N/K	N/A[2]
Danish Refugee Council (DRC) 2020[44]	Turkey	Survey	Syrian refugees in South-East Turkey	774	82%[1]
Hamadneh 2021[42]	Jordan	Survey	Syrian refugee mothers	389	78%[1]
Lockyer 2021[25]	UK	Qualitative interview; reflective thematic analysis	People from different ethnic groups in Bradford	20	90%[3]
Loomba 2021[31]	UK & USA	Randomised controlled experiment	Other ethnic groups than White	4,000 (UK) 4,001 (US)	N/A[2]
Moyce 2020[38]	US	Qual interviews narrative synthesis	Latino individuals	14	90%[3]
Paul 2021[26]	UK	Repeated measures survey; cohort study	Other ethnic groups than White	32,361	89%[1]
Regional Inter-agency coordination platform (R4V) 2021[45]	Any host county for migrants from Venezuela	Survey	Predominantly migrants from Venezuela	334	90%[3]
Vekemans 2021[29]	UK	Organisational case study	Jain community members	25,000 estimate	N/A[2]
Viswanath 2021[39]	US	Survey	Non-White ethnic groups	1012	78%[1]
Wang 2020[41]	China	Survey	International migrants	1,426	78%[1]
Woko 2021[40]	US	Survey	Black American citizens	1,074	77%[1]
Deal 2021[30]	UK	Qualitative in-depth interview study	Precarious migrants (asylum seekers, undocumented migrants, refugees)	32	90%[3]

*Scores were calculated on both scales by dividing the "yes" answers by the total number of applicable items.
[1] Quality assessment for Survey Studies in Psychology for Surveys (Q-SSP) Checklist for surveys
[2] N/A = not applicable due to research item design.
[3] Critical Appraisal Skills programme (CASP) checklist

Use of social media platforms as a source of information about COVID-19

For some migrants and ethnic minority groups, consistent use of social media platforms for sharing and receiving COVID-19-related health information was reported in several included studies[30 35-37 41-43 45 44]. Social media was reported to be the preferred source of information about COVID-19 for international migrants in China (WeChat was used by 94.5% of respondents for COVID-19 information).[41] Among 389 Syrian refugee mothers in Jordan[42], Facebook and WhatsApp were the main sources of information for 87% and 69% of respondents respectively for COVID-19 information; with 21% indicating that they accessed information from professional databases or government websites, and 53% via television (this survey was circulated via Facebook and WhatsApp). Migrants from Venezuela (residing in numerous countries) reported Facebook and WhatsApp were their two primary sources of information about COVID-19 in a survey of 334 migrants[45]. A survey of 774 refugee households in Southeast Turkey[44] found the majority (75%) obtained COVID-19 information from Facebook, YouTube, Twitter and the internet in general, 15% via SMS/WhatsApp messages, followed by radio/TV (64%) and members of their community/family (34%); only 10% reported getting information from NGO/UN sources. This study concluded that the heavy reliance on social media for information may expose a sizeable proportion of refugee households to fake or inaccurate information. In a US study of Black women aged 18-31 years, 58% of respondents reported using social media (Instagram and Facebook) to obtain COVID-19 information[36]. Participants from the US Latino community described relying on social media for information about the pandemic[35]. In Qatar, migrants reported they preferred to find out about COVID-19 using their own personal research or searching for information, including using social media as a source[43]. A study of precarious migrants (asylum seekers, undocumented migrants) in the UK found many relied on social media (WhatsApp groups, Facebook) for information on the pandemic and the ongoing vaccination programme[30].

A key theme emerging in one UK study of ethnic minority groups[25] was that the "avalanche" of information surrounding COVID-19 had led to interviewees feeling overwhelmed and confused: participants reported using a variety of sources of information, including TV, radio, news stations in Pakistan, India, Slovakia, and Poland, online newspapers, Facebook, WhatsApp, Twitter, Google, and medical journals. A number of these participants said they dismissed some stories encountered on WhatsApp and Facebook; however, the sheer volume of messages coupled with the fact that people they trusted were sharing them, proved difficult to ignore, with participants raising concerns about how quickly social media stories were shared. One study exploring the views of US Latinos reported that they consulted national and local news reports for information about COVID-19 and many reported that they got their news from Spanish-language news due to difficulty in understanding news in English; some received their news from social media sources, including Facebook, but expressed caution around messages from social media as there was no way to ensure the accuracy of the reports.[38]

According to one study, member of ethnic minority groups were also more likely to post COVID-19 content on social media than White individuals[34], with respondents who identified as Black (odds ratio [OR] 1.29, 95% CI 1.02-1.64; P=.03), Latino (OR 1.66, 95% CI 1.36-2.04; P<.001), or other races/ethnicities (OR 1.33, 95% CI 1.02-1.72; P=.03) had higher odds than respondents who identified as White of reporting posting COVID-19 content on social media.

Drivers of social media reliance

Studies reported that some migrant and ethnic minority groups turned to social media due as a result of a need for connection and to acquire accessible information from people they considered to be reliable sources. For the Latino community in the US, faith and community bonds were valued ways of coping with the difficulties of the pandemic which included feelings of social isolation, stress, and uncertainty and – according to one study – social media facilitated these connections in a virtual space[38]. The Jain community in London used social media to communicate news and knowledge about COVID-19 and stay connected online, with

events moving to a virtual space; individuals reportedly benefited from and were grateful for this community use of social media[29].

Several studies highlight concerns that some migrant and ethnic minority groups were unable to find official information in their host country in their native language about various aspects of COVID-19, hence their reliance on social media[25 28 30 41 44]. For example, a UK study of precarious migrants (asylum seekers, undocumented migrants) reported that those feeling most abandoned or scared due to a lack of understandable, clear official information in the early stages of the pandemic were more likely to rely on word-of-mouth or social media (WhatsApp groups, Facebook) for information, including around the vaccination programme[30]. One study of international migrants in China (94.5% of whom preferred social media for news about COVID-19) had lower rates of correct knowledge about COVID-19 compared to rates reported for Chinese residents[41]. The authors speculate that this might be due to a lack of available public health information in a range of languages.

Other studies showed positive associations with use of social media and access to information. One study highlighted that social media can support migrants to navigate the complex medicolegal context of their host countries by accessing information about public health measures and how to access medical help[33]. Social media use was associated with improved knowledge about COVID-19 and how to stay safe, in studies of Syrian refugee mothers[42] and US Latinos[37]. In another study specifically curated, culturally relevant digital content was considered to be an effective health promotion tool to share knowledge about practical actions to be taken to address the inequitable impact of the pandemic on US Latinos[37].

Misinformation and social media use

A summary of some of the key misinformation narratives identified in studies are provided in Table 3. Some studies made links between social media and circulating misinformation in migrant and ethnic minority groups. For example, a UK cohort study found that both belonging

to an ethnic minority group and socioeconomic disadvantage was associated with both exposure to misinformation about vaccines, and mistrust in information about COVID-19[26]. A study of Syrian refugee mothers in Jordan, who reported receiving most of their COVID-19 information through social media, identified some erroneous beliefs about pregnancy, COVID-19 and breast milk[42]. A UK study among ethnic minority groups reported that participants encountered a range of misinformation, usually through social media sources and that vaccine hesitancy could be attributed to safety concerns, negative stories and personal knowledge, all of which had been amplified by recent exposure to misinformation via social media[25]. Myths identified included the idea that health professionals at the local hospital were injecting people with COVID-19 or killing people with the COVID-19 vaccine; there were wider beliefs reported about vaccines containing a microchip; making people infertile, or that vaccines are being tested on ethnic minority individuals[25]. These participants described the dilemma of not knowing what to trust or who to listen to, including the videos /posts that appeared to be from trusted professionals; therefore, they could not entirely dismiss negative stories circulating via social media and elsewhere.

Table 3: Examples of circulating misinformation on social media platforms relating to COVID-19 (2020), reproduced and compiled from Loomba et al[31] and Lockyer et al.[25]

Misinformation identified	Source	Engagement[1]	Reach[2]
"Scientists have expressed doubts over the effectiveness of a COVID-19 vaccine that has been rushed to human trials, after all the monkeys used in initial testing later contracted COVID-19."	Twitter	1.59K	1.5m
"The new vaccine for COVID-19 will be the first of its kind EVER. It will be an mRNA vaccine which will literally alter your DNA. It will wrap itself into your system. You will essentially become a genetically modified human being"	Twitter	27	19.6K
"They said it was just to flatten the curve. Now it's a battle for human survival." The only must-see action thriller for 2020. Starring: Bill Gates, Anthony Fauci, Chris Witty, Matt Hancock. Guest mask appearances: Clintons, Boris Johnson, Nicola Sturgeon, Joe Biden & Tedros. [Graphic featuring Mr. Bill Gates with the following quote.] "If we do a really good job with vaccines, we can reduce population by up to 15%. But if we create a worldwide pandemic first, killing people and making many of the survivors sterile, then create the vaccine, we may achieve the Georgia Guidestones 1st commandment!"	Twitter	11	1.49K
Something is very fishy about all this indeed. "A VIRUS WITH A 99.6% SURVIVAL RATE FOR PEOPLE UNDER 70 BUT THE ENTIRE WORLD NEEDS TO TAKE A VACCINE? I'M NO SHERLOCK HOLMES BUT SOMETHING'S FISHY ABOUT ALL THAT……."	Twitter	N/K[2]	32.5K
"Big Pharma whistle-blower: '97% of corona vaccine recipients will become infertile'"	Twitter	6.95K	336K

"I've been in Twitter jail for the last 12 hours for posting a link to a peer reviewed scientific study published in Vaccine showing that in military personnel prior receipt of the flu shot increased COVID-19 risk by 36%. Censorship is vile & unAmerican."	Twitter	25.1K	1.41K
"So we know for a fact that the flu vaccine worsens COVID-19 symptoms. So what are they mandating now? The flu vaccine, of course."	Facebook	NK	NK
"PREPARING THE PROPAGANDA BLITZ. Yale University and the U.S. government are running clinical trials to develop propaganda messaging to persuade Americans to take experimental, genetically engineered, unlicensed, "Warp Speed," zero liability, expedited vaccines with limited short duration safety testing. Researchers compared reactions in 12 focus groups using "guilt, embarrassment, bravery, anger, trust" and "fear" to overcome vaccines hesitancy"	Instagram	28.2K	NK
➢ COVID-19 is not real, it is an effort to control society ➢ COVID-19 has been manufactured by China or other governments for control purposes ➢ COVID-19 is caused by 5G ➢ COVID-19 has been invented to make people use contactless payments so that the government can track individuals ➢ COVID-19 testing gives so many false positives that it is ineffective and you should not self-isolate ➢ COVID-19 exists but is not as virulent as the government says it is ➢ If children test positive for COVID-19 during school hours, they can be taken away into care and will not be able to see their parents until they test negative ➢ The COVID-19 vaccine contains a chip that will track individuals, stop them travelling etc ➢ The COVID-19 vaccine will make people infertile and is an attempt to reduce the population, particularly targeted at people from BAME communities ➢ BAME people are being used as 'guinea pigs' to test out the COVID-19 vaccine ➢ The COVID-19 vaccine has been developed and approved too quickly and has not been fully tested ➢ The COVID-19 vaccine will negatively disrupt your natural immune system ➢ Herbal remedies will be more effective than the COVID-19 vaccine	Multiple platforms/ unknown	NK	NK

1 Engagement measures the number of likes and retweets.
2 Reach measures the number of followers and thus potential audience size.
NK=Not known.

In a study of 60 Latinx adults hospitalised for COVID-19 in the US, many participants reported that they relied on social media for COVID-19 recommendations and described a lack of information and circulating misinformation, with suspicion of the government and immigration departments was a common misinformation theme: "some of us see [COVID] as a tactic for the government to access our documentation status and deport us"[35]. One Mexican male (age 45) in one US study[38] noted: "When someone uploads something to Facebook then no-one believes in it 100%"; a Mexican female (age 33) was also quoted as saying "[I get my information] well through the news, TV, Facebook and all of that…not everything I see is credible".

In a UK qualitative study[25], participants who initially disregarded conspiratorial beliefs found it challenging to maintain their confidence that the rumours were untrue due to a number of factors: (i) receiving many social media messages about them; (ii) receiving messages about them from trusted others; (iii) feeing anxious; and (iv) being under lockdown conditions at home. Participants expressed confusion about which story to trust, and ongoing difficulty identifying information as misinformation and dismissing it. Similarly, another study[36] reported that 79% of female Black Americans interviewed stated that they were confused by the COVID-19 information they'd accessed from any source: "Sometimes I feel unsure about the information that I'm receiving because it's a lot of different things about it. Everybody's not saying the same thing. So, I'm kind of unsure about what to believe".[36]

Social media impact on preventative health measures and vaccine intent

A small number of studies linked social media use with lower participation in preventative measures among migrants and ethnic minority groups. A UK/US survey study found vaccine hesitancy to be associated with informational reliance on social media and membership of an ethnic minority group[27]. A UK qualitative study reported that ethnic minority groups were influenced by anti-vaccine misinformation, including from social media.[25] A UK qualitative study of precarious migrants found that among 23 participants who were hesitant about receiving a vaccine some participants described fears around theories based on misinformation, often originating from social media or word of mouth, with many describing feeling conflicted about which information sources to trust[30]. Community leaders from African, Caribbean, Asian and Eastern Mediterranean migrant groups in London, UK reported substantial COVID-19 vaccine hesitancy due to misinformation circulating on social media and word of mouth combined with a lack of accurate, translated and clear guidance[28]. Similarly, in a US qualitative study of Latino adults, some participants reported encountering a lack of knowledge accompanied by misinformation on social media causing them to dismiss preventative measures[35]. Another US study among Latino people reported that social media acted as a potential deterrent for following some public health measures to prevent infection by allowing people to observe the negative, guideline-breaking behaviours of others in social media posts[38].

On the other hand, a large (8,001 participants) US/UK randomised controlled experiment[31] found no significant differences in the response of different ethnic groups to misinformation in relation to vaccine intent. A large US/UK study[32] found membership of an ethnic minority group was associated with reduced vaccine intention, a relationship which was significant in three out of four studies ($p<0.001$, $n=3890$; $p=0.017$, $n=1663$; $p<0.001$, $n=2237$). The relationship persisted even when use of legacy (print and broadcast media) and frequency of use of social media was controlled for. High levels of social media use was not associated with vaccine intent in any of the three studies exploring this relationship; however, high information reliance on social media was significantly associated with negative vaccine intent ($p=0.028$, $n=2237$), suggesting a reliance on social media for information can make users vulnerable to misinformation. This study did not include interaction terms between ethnicity and information reliance on social media, which could have indicated whether the effect of information reliance on social media on vaccine intent differs by ethnicity.

Good practice in promoting information and countering misinformation

Evidence suggests the important role of strong connections with the local community to identify and counter misinformation and rumours by trusted and valued sources of information. Most studies recommended improving the accessibility of public health information for migrant and ethnic minority communities.[26 28 33 35 36 38-41 45] For example, providing public health information in the media channel preferred by that group[35], in multiple languages[25], and using local, trusted voices delivering specific and targeted messages to counter fake news[25 35]. A strong interest in online, personalised information was identified[37 38]. Where social media was used to share personalised and culturally tailored public health information, it has a positive influence with good health knowledge, health seeking behaviours and vaccine intent[25-28 33 35-37 39-42 45]. Studies indicated the need for culturally tailored health messaging to ensure equitable health knowledge for improving vaccine intent and health seeking behaviours[28 35-37].

More personalised means of health information communication was highlighted as a demand for informational reliance. A national US organisation which provides online health information tailored to the US Latino community found a high level of interest in their COVID-19 curated content, suggesting a strong demand for tailored and culturally relevant material[37]. In a new approach, 'virtual patient navigators', helpers working online, typically using messages to provide individually tailored health information, were made available to Latino migrants through a New York-based communication platform[33].

Working through trusted sources was also emphasised. Providing accurate and tailored information about COVID-19 via trusted community members and organizations was suggested in a study of Black women aged 19-31 years in the US[36].The study recommended that health professionals take an active role collaborating with the community to address inequities that Black women are experiencing in the pandemic[36]. Participants in a randomised controlled study to explore the impact of misinformation on vaccine intent on different populations groups reported finding videos on social media very engaging, especially when delivered in multiple languages by someone in a trusted profession (e.g., doctor/teacher/nurse)[31].

Successful countering myths was reported in a UK study wherein the local council rapidly responded to fake news circulating in the local population (e.g., a rumour about children who test positive in school for COVID-19 being removed from the school and/or their parents until they test clear)[25]. Videos to refute the myth were swiftly posted online in both Urdu and Punjabi, and these were reported to be effective by members of the local population[25]. Additional studies report successfully countering misinformation using a network of patient navigators[33] and community household surveys[25]. Social media use to communicate with family was also reported to be effective in challenging COVID-19 denial misinformation rumours through reporting of lived experience of COVID-19[35].

Discussion

Among migrant and ethnic minority populations in the UK, US, China, Jordan, Qatar, and Turkey we found evidence of consistent use of social media for COVID-19 information, including via WeChat, Facebook, WhatsApp, Instagram, Twitter, YouTube, which may stem from a difficulty in accessing COVID-19 information in their native languages or from sources they trusted. There were both positive and negative associations with social media use reported, with some evidence of circulating misinformation and social media use associated with lower participation in preventative health measures, especially vaccination intent, and finding that will be undoubtedly generalisable to multiple population groups. This is a rapidly evolving field of research, and data are limited, but our work highlights the considerable importance of social media platforms as a source of information and misinformation about COVID-19 for some migrant and ethnic minority populations during the pandemic. Whilst we know social media is used by many people, and misinformation has been circulating widely in the general population, it may be the case that those excluded from national public health responses and/or who faced specific barriers to accurate public health information and support may have been disproportionately impacted. Urgent actions and further research are now needed to better understand use of social media platforms for health information in different population groups, find effective approaches to tackling misinformation, and to seize on opportunities to make better use of social media platforms to support public health communication and improve vaccine uptake globally. Furthermore, the findings highlight the crucial role of locally trusted sources in identifying and tackling misinformation, and underscores the benefits of disseminating personalised and culturally relevant health messages, including via social media.

This review is the first attempt to synthesise global studies exploring the use and impact of social media on migrant and ethnic minority populations during the COVID-19 pandemic. However, it is limited by the availability and quality of the datasets available. We acknowledge the limited geographical scope of included studies, with 16 of 21 studies focused on migrant and ethnic minority populations residing in the UK and US and no data at all from low-income

countries. We acknowledge that definitions and terms pertaining to migrants and ethnic minorities and social media are used inconsistently in research; this is an ongoing challenge within the field, which has previously been evidenced in similar reviews, and may mean we have missed papers. This was mitigated against by searching the published and grey literature more widely. In addition, we acknowledge that migrants and ethnic minorities are a highly diverse group with a range of health and socioeconomic situations making it hard to generalise; however there is evidence in several contexts that these populations may have been disproportionately impacted by the COVID-19 pandemic[14 16 46].

The findings of our review have been confirmed by more recent studies. For example, a survey of migrants in Greece found their main source of information about the vaccine was via social media platforms and the internet in general, and that vaccine hesitancy was linked to a lack of adequate information and driven by fear, anxiety, exposure to negative news and misinformation[47 48]. In Turkey, a 2021 survey and feedback mechanism in refugee communities found information gaps, misconceptions, and rumours about COVID-19 vaccines circulating mainly by word of mouth and on social media, undermining health information[49]. In a recent study of Venezuelan migrants in Latin America, 70% said they had access to a mobile phone, with the main communication channels being WhatsApp and Facebook, yet half said they felt uninformed[50]. We also found that some migrants and ethnic minorities used diaspora media as a source of COVID-19 related information during the pandemic, which merits further consideration in terms of understanding how to better engage these groups in preventative health care and vaccination, and has been previously reported in studies as influencing views and beliefs around vaccination[51]. Misinformation on social media correlated negatively with vaccine intention and our findings align with other research in this area and will undoubtedly be relevant to many other population groups[2 7 30]. A recent study among migrants and nationals in Qatar acknowledged 'personal research' via social media as important to them for seeking information about COVID-19 vaccines, underlining the key role social media has in influencing people's attitudes towards vaccine uptake[52].

The European Centre for Disease Prevention and Control (ECDC) and other public health bodies have raised concerns around barriers to public health information among migrant populations and ethnic minority groups residing in Europe and other high-income countries during the pandemic[14 15]. Public health guidance in some countries was not initially tailored to the needs of migrant and ethnic minority groups[18 53-55]. A review of the availability of government produced risk communications across Council of Europe member states in June 2021 found only 48% (23/47) of countries translated COVID-19 information into at least one migrant language, with information on testing or healthcare entitlements in common migrant languages only found in 6% (3/47), suggesting individuals not able to access information in the host country language may have been excluded to some extent from governments' public health messaging[18]. In Denmark, a series of qualitative interviews with migrants found that they felt uncertain regarding government guidance for COVID-19; although written material was translated into 19 languages, it was not effectively disseminated[56]. In Montreal, Canada, there were delays to publishing official multilingual fact sheets on COVID-19 guidelines, and information phone lines only operate in French and English; those who had arrived most recently, had lower language (French/English) ability or lower literacy had more difficulty accessing local COVID-19 information[57]. Lack of English or French language at the time of immigration to Canada were associated with lower rates of testing and higher percent positivity for COVID-19 in recently arrived adult immigrants and refugees[58]. A study among refugees and migrants in deprived areas in Greece found that migrants may have difficulties understanding public health messaging due to cultural and language barriers.[18 54 59] Merely translating public health information is not likely to be sufficient; information needs to be tailored and targeted so it is conveyed in ways that resonate with the target population. A range of key resources and guidelines on risk communication and engagement strategies for COVID-19 public health responses, including vaccination, among marginalised populations globally are available, as well as a social media toolkit for healthcare practitioners (https://www.who.int/publications/m/item/a-social-media-toolkit-for-healthcare-practitioners---desktop)[60-62]. However, it will be vitally important that the lessons learned around

communication of public health information to marginalised groups during the pandemic are meaningfully carried forward.

Where social media is used to share personalised and culturally tailored public health information, it has a positive correlation with good health knowledge, health seeking behaviours and vaccine intent[37 42] Our research shows the need for culturally tailored health messaging to ensure equitable health knowledge and to improve vaccine uptake, by accurate public health messaging through trusted sources of information[28 35-37]. We make a number of recommendations for policy and practice (Table 4), which include the need for systematic monitoring of information and attitudes circulating on social media[63], as well as timely rebuttal of misinformation from trusted professionals. Several resources are now available to support addressing misinformation about COVID-19 vaccines as well as fostering demand for vaccines.[64-66]

There is a stark lack of data on social media use from low and middle-income countries, which merits greater consideration as COVID-19 vaccination gathers pace in these contexts. In addition, more evidence is needed to examine the role social media platforms play in positively or negatively influencing health behaviours such as vaccine intent and uptake for COVID-19 in all populations (including other excluded groups eg, homeless, internally displaced people/IDPs). Social media is an important source of health information for some migrant and ethnic minority communities and tacking misinformation needs to be done using this medium given the lack of trust in government messaging in some of these communities[67]. Our findings are consistent with those of others working in this field, which show that social media can have a crucial role in disseminating health information, tackling infodemics and misinformation[4]. There is an opportunity now to more effectively use social media to make vaccine intent desirable, appealing and normative among migrants and ethnic minority groups. There is an urgent need to address infodemic-related challenges in a rapidly changing information environment, including real-time monitoring of social media messages and misinformation and the development of online tools to fight disinformation, with a focus on collecting stratified

population data to enable targeted and tailored responses. Robust interventions relying on behavioural science to tackle misinformation using social media and evaluations are a plausible next step to address immunisation challenges for COVID-19 vaccines but also routine vaccines. Building trust in public health messaging, identifying information gaps, finding innovate ways of disseminating health information, and detecting and responding to misinformation as it emerges remain a priority for public health[67 68].

Table 4: Key messages and recommendations

- Social media is an important source of health information for some migrant and ethnic minority communities, who may face barriers to accurate public health information, health, and vaccinations systems. More evidence is urgently needed to examine the role social media platforms play in positively or negatively influencing health behaviours such as vaccine intent and uptake for COVID-19 in marginalised populations.
- There is a stark lack of data on social media use from low and middle-income countries which merits greater consideration as COVID-19 vaccination gathers pace in these contexts.
- More emphasis must be placed on exploring opportunities for sharing and transmitting accurate information via social media platforms, for example, to make vaccine intent desirable, appealing and normative.
- Use of diaspora media by migrant populations, as a source of COVID-19 related information during the pandemic and for other health information, merits further research and greater consideration when designing and delivering public health interventions.
- Proactively monitor social media platforms and other media sources to identify anti-vaccine sentiment, misinformation, fake news, and rumours, and address them in real-time.
- There is a need to promote targeted and tailored health information to marginalised populations who face access barriers to health and vaccination systems, through

preferred and trusted sources and channels of information including social media platforms, and to ensure investment in workforce and infrastructure to support this.

- Engage with and involve communities in developing culturally specific messages and approaches, and support community-driven initiatives to identify at-risk groups, map local influencers, and define content for locally meaningful communication campaigns. Facilitate partnership working at the local level through involvement of diverse stakeholders and ensure community partners are recognised and reimbursed for their contributions and expertise.
- Social media platforms should exercise more accountability and sign pledges to systematically track and remove harmful content that undermine public health measures, particularly during a public health crisis. The public must be empowered to identify and flag misinformation on social media
- Public health bodies and healthcare professionals should avoid a narrow focus on misinformation and a one-way communication of 'more accurate' information. They should seek to understand the underlying causes of exposure to and belief in misinformation including genuine knowledge void, access barriers and health literacy.
- Lessons must be learned around shortfalls in the communication of public health information to marginalised groups during this pandemic. Importantly, countries should gather and evaluate innovations and models of best practice in this area, which must be meaningfully carried forward to strengthen uptake of routine vaccinations and other public health interventions.

Conflicts of Interests

All authors report nothing to declare.

Data availability statement

All data used in the systematic review are appropriately referenced and available online in the sources cited.

Ethics statements

Not applicable.

Patient consent for publication

Not applicable.

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Author Contributions

The study was conceptualised by SH, and the protocol and research question were developed by SH, LPG and MRP. Searches were developed by MRP and LG, with input from SH and SEH. Screening was done by LPG and MRP. Data extraction and analysis was done by LPG and MRP, with input from SH. The first draft of the manuscript was produced by LG, MRP, and SH, and developed with KH and TV, who all contributed to interpretation of the results. All authors commented upon and approved the final manuscript. SH is guarantor of this study.

Disclaimer

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Competing interests None declared.

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67. Vandrevala, Hendy, Hanson, Alidu & Ala (2022). Unpacking COVID-19 and Conspiracy Theories in the UK Black Community. Pre-print. .
68. Vandrevala T, et al. "It's possibly made us feel a little more alienated': how people from ethnic minority communities conceptualise COVID-19 and its influence on engagement with testing. Jan 3, 2022 https://doi.org/10.1177%2F13558196211054961.

Figure 1: PRISMA diagram of included studies

Figure 2: Regional distribution of included data sources

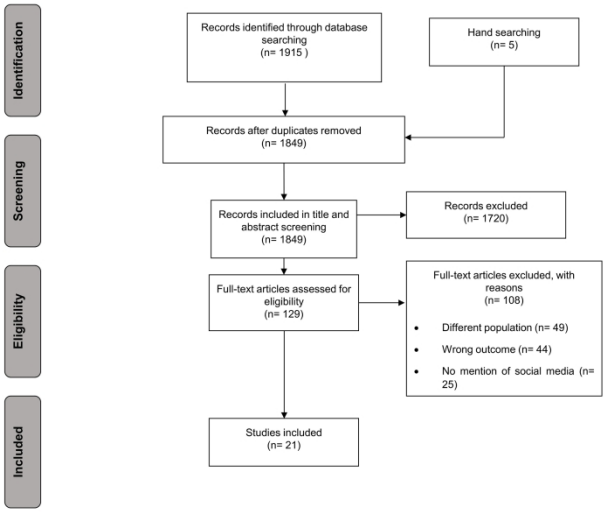

Figure 1 PRISMA diagram of search results

169x95mm (600 x 600 DPI)

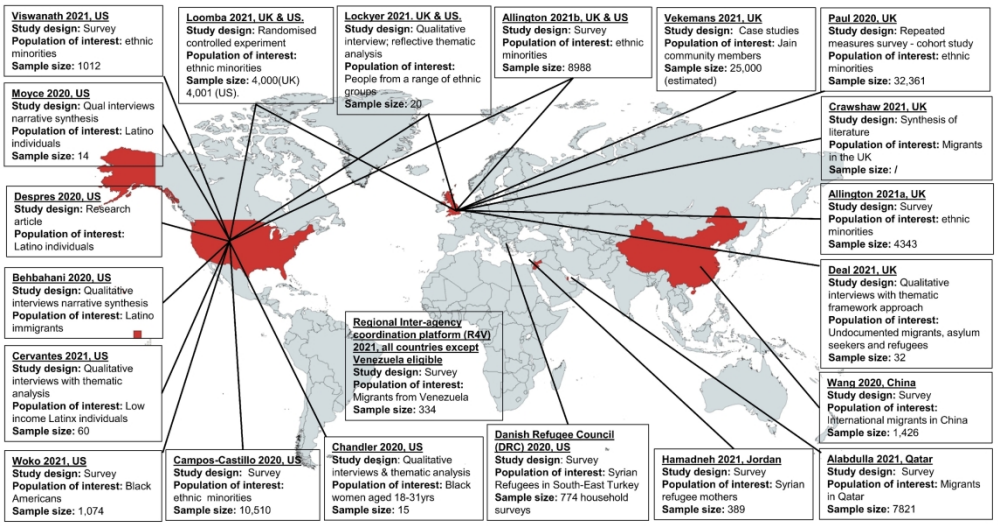

Figure 2 Regional distribution of included data sources

128x72mm (600 x 600 DPI)

Supplementary file 1

Online supplement 1: Boolean search terms

Migrant and ethnic minorities	Ancest* OR Diaspor* OR ethnic* OR Ethnoc* OR Ethnog* OR "Identity politics" OR Ingroups OR outgroups OR Intersectionality OR Kinship OR "Minority group*"~3 OR "minority population*"~2 OR minorities OR Multicultu* OR Polyethnic* OR "Population genetics" OR Race OR races OR racial OR Tribe* OR latino*) OR AB:(Ancest* OR Diaspor* OR ethnic* OR Ethnoc* OR Ethnog* OR "Identity politics" OR Ingroups OR Outgroups OR Intersectionality OR Kinship OR "Minority group*"~3 OR "minority population*"~2 OR minorities OR Multicultu* OR Polyethnic* OR "Population genetics" OR Race OR races OR racial OR Tribe* OR latino*) OR "afro american*"~3 OR BAME OR latino* OR roma OR romani OR refugee* OR immigrant* OR “migrant” OR "displaced person" OR "displaced persons" OR "social determinant*"~2 OR "latin population" OR "latin group*" OR "people of color" OR "people of colour"
Social media	social media OR social network OR online communit* OR online discuss* OR online communicat* OR online post OR messag* OR chat OR media OR misinformat* OR disinformat* OR malinformat* OR fake new* OR twitter OR whatsapp OR tweet OR post OR instagram OR reddit OR weibo OR sina OR youtube OR tiktok OR snapchat OR pinterest OR likee OR sharechat OR discord OR kuaishou OR wechat OR weixin OR qq OR telegram OR quora OR mobile app OR blog OR podcast OR hashtag OR antivax* OR vaccine hesitanc* OR web 2.0 OR online

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	P1 on bottom right hand side numbering
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	P2,3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	P3-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	P6,P7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	P6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	P6 and Supplementary File 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	P6,7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	P6,7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	P7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	P7,8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	P7,8
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	P7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	N/A
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	N/A
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	P7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A – NOT DONE

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
			FORMALLY.
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A – NOT DONE.
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A – NOT DONE , NOT SUITABLE FOR THIS STUDY
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A – NOT DONE, NOT SUITABLE FOR THIS STUDY
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	FIGURE 1 IS REFERRED TO ON PAGE 8
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A – NOT DONE , NOT NEEDED HERE.
Study characteristics	17	Cite each included study and present its characteristics.	P8-9
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	P9
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	P10-P17; NOTE QUALITATIVE STUDIES ALSO INCLUDED
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	P10-17
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A – NOT QUANT SYNTHESIS
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A – NOT QUANT SYNTHESIS
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A – NOT QUANT

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
			SYNTHESIS
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A – NOT QUANT SYNTHESIS
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A – NOT QUANT SYNTHESIS
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	P18-20
	23b	Discuss any limitations of the evidence included in the review.	P18
	23c	Discuss any limitations of the review processes used.	P18-20
	23d	Discuss implications of the results for practice, policy, and future research.	P18-23
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	P3
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	P6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A, NO AMENDMENTS
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	P24
Competing interests	26	Declare any competing interests of review authors.	P25
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	P23

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
For more information, visit: http://www.prisma-statement.org/

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The use of social media platforms by migrant and ethnic minority populations during the COVID-19 pandemic: a systematic review

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The use of social media platforms by migrant and ethnic minority populations during the COVID-19 pandemic: a systematic review

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Abstract

Objective Migrants and ethnic minority groups have been disproportionately impacted by COVID-19 and have lower levels of vaccine uptake in some contexts. We aimed to determine the extent and nature of social media use in migrant and ethnic minority communities for COVID-19 information, and implications for preventative health measures including vaccination intent and uptake.

Design A systematic review of published and grey literature following the PRISMA guidelines. We searched databases including Embase, Web of Science, PubMed NIH, CINAHL, facilitated through the WHO Global Research on COVID-19 database from 31/12/2019 to 9/6/2021.

Eligibility Criteria for study selection Research reporting the use of social media by migrants and/or ethnic minority groups in relation to COVID-19.

Data extraction We extracted data on key outcomes, study design, country, population under study, and sample size.

Results 1849 unique records were screened, and 21 data sources included including populations in the UK, US, China, Jordan, Qatar, and Turkey. We found evidence of consistent use of a range of social media platforms for COVID-19 information in some migrant and ethnic minority populations (including WeChat, Facebook, WhatsApp, Instagram, Twitter, YouTube), which may stem from difficulty in accessing COVID-19 information in their native languages or from trusted sources. Some evidence suggested circulating misinformation and social media use may be associated with lower participation in preventative health measures, including vaccine intent and uptake, findings which are likely relevant to multiple population groups.

Conclusions Social media platforms are an important source of information about COVID-19 for some migrant and ethnic minority populations. Urgent actions and further research are now needed to better understand effective approaches to tackling circulating misinformation, and to seize on opportunities to better use social media platforms to support public health communication and improve vaccine uptake.

Registration This study has been registered with PROSPERO;(CRD42021259190).

Strengths and Limitations of this study

- Comprehensive systematic review methods were used, following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

- Both published and grey literature were searched and papers from all countries and all regions were included, allowing available evidence to be synthesised.
- We acknowledge the limited geographical scope of included studies, with and no data from low-income countries.

Introduction

The pandemic has been accompanied by an infodemic, defined as an excess of information during a disease outbreak – including false or misleading information in digital and physical environments[1] – that makes it difficult to distinguish reliable information from misinformation including disinformation (deliberate misinformation) and conspiracy theories. The World Health Organization (WHO) highlights that in all communities, infodemics cause 'confusion and risk-taking behaviours that can harm health…it leads to mistrust in health authorities and undermines the public health response, and can intensify or lengthen outbreaks'[1]. The rapid expansion of internet and social media use, in particular, in recent years (including platforms such as Twitter, WhatsApp, and YouTube; Table 1) has meant that both useful and potentially harmful health information can spread rapidly. Although social media can be used to disseminate factual, appropriate and useful information, a large proportion of the most popular COVID-19 videos on YouTube, for example, have been found to contain misinformation, or no factual information, reaching millions of people worldwide[2 3]. YouTube is considered a major platform for information concerning the control of COVID-19, but most COVID-19 videos were of 'undesirable quality' containing few government/public health recommendations according to a recent study[4]. A review of YouTube videos on general vaccination found 65% expressed anti-vaccination sentiment[5], with anti-vaccine posts more likely to be recirculated on Twitter[2]. The spread of misinformation and disinformation has been highlighted as a major risk to ending the COVID-19 pandemic – including undermining trust in vaccines[6] – with researchers highlighting links between misinformation on social media and public doubts around vaccine safety, self-reported compliance with public health guidelines, and intent to vaccinate[7 8].

Table 1: Popular social media platforms
Statistics from Statistica (2021) [9]

Platform	Primary Feature	Country of origin	Organisation	Users	Notes
YouTube	Online video sharing and social media platform. Free to use.	US	Google	Approximately >2 billion monthly	Searchable.
WhatsApp	Messaging platform, allows users to send text messages and voice messages, make voice and video calls, and share images, documents, user locations, and other content. Free to use.	US	Meta	Approximately >2 billion monthly	Not searchable. Groups can have 512 users in them.
Instagram	Photo and video sharing social networking site. Free to use.	US	Meta	Approximately 1 billion monthly	Searchable. Some content is limited to connections only.
Facebook	Social networking service, allows messaging, image and video sharing, marketplace online shopping, live video sharing. Free to use.	US	Meta	2.89 billion active monthly	Searchable. Some content is limited to connections only.
WeChat	Instant messaging, social media, mobile payment. Free to use.	China	Tencent Holdings Limited	1.25 billion monthly	Searchable. Some content is limited to connections only.
TikTok (Known in China as Douyin)	Video sharing focused on short form videos (15 seconds – 3 minutes). Free to use.	China	ByteDance	837 million monthly active	Searchable. Some content is limited to connections only.
Snapchat	Photo sharing multimedia app with video features. Free to use.	US	Snap Inc.	347.3 million monthly active	Searchable. Some content is limited to connections only.
Twitter	Microblogging focused on short messages known as 'tweets'. Live chat event function Tweetchat.	US	Twitter Inc.	330 million monthly active	Searchable. Some content is limited to followers only.

Although social media platforms are commonly used in the general population, and patterns of use are complex across different population groups[8 10], some migrant and ethnic minority groups – who may experience barriers to accessing health information and health systems – may be more reliant on social media and the internet as

a source of health information. These communities may also draw on diaspora media as a source of health information[11]. The COVID-19 pandemic has disproportionately impacted and exacerbated inequalities faced by migrants and ethnically diverse communities - ethnic minority groups (including some migrant populations) were are higher risk of contracting, being hospitalised with, and dying from COVID-19[12 13 11 14-16]. They are also more likely to be vaccine hesitant - with lower take-up of preventative health measures, such as vaccines, noted in some groups due to a range of personal, societal, and physical barriers[13 15 17]. Some migrant and ethnic minority communities may be more exposed to social media misinformation because of access barriers to accurate information (eg, from official government sources)[18 19], due to restricted eligibility and access to services, language barriers, and low health literacy. However, little is known about the extent and nature of social media use in these populations, nor the impact that social media use has had on preventative health measures during the pandemic, including COVID-19 vaccine uptake. In addition, there is an opportunity now to explore the extent to which social media platforms could be better used to support information sharing and promote public health messaging in marginalised communities during the pandemic and beyond.

We therefore did a systematic review to explore and assess the extent and nature of social media use by migrant and ethnic minority groups to access COVID-19 health information, the extent to which misinformation on social media may have influenced views about COVID-19 preventative measures including vaccination intention and uptake, and to explore good practice.

Methods

Search Strategy

The review was registered with PROSPERO (CRD42021259190)[20] and followed PRISMA guidelines[21]. The study protocol is in the PROSPERO registration. A Boolean search strategy was developed containing terms relating to migrants, ethnic minorities, COVID-19, social media, and misinformation (see Supplementary file 1). We included papers covering any prevention topic, including social distancing, hand washing, mask wearing, testing, isolation, test and trace activities and vaccination. We searched the following databases: Embase, Web of Science, Oxford Academic Journals, PubMed NIH, Clinical Trials, China CDC MMWR, CDC reports, ProQuest Central (Proquest), CINAHL, Africa Wide Information (Ebsco), Scopus, PsycInfo, CAB Abstracts, Global Health, J Stage, Science Direct, Wiley Online Journals, JAMA Network, British Medical Journal, Mary Ann Liebert, New England Journal of Medicine, Sage Publications, Taylor and Francis Online, Springer Link, Biomed Central, MDPI, ASM, PLOS, The Lancet, Cell Press, and pre-print sites chemRxiv, SSRNbioRxiv, and medRxiv. This was facilitated

through the WHO Global Research on COVID-19 database. We searched records from the date the WHO was first informed of COVID-19,31/21/2019,[22] to 9/6/2021 (https://search.bvsalud.org/global-literature- on-novel-coronavirus-2019-ncov/). The WHO's COVID-19 Database[23], is a daily updated multilingual resource of all literature (peer-reviewed literature, pre-prints and grey literature) pertaining to COVID-19.

Records were imported to Rayyan QCRI[24]. Both title and abstract screening and full text screening were conducted independently by two reviewers (MR-P and LG) using Rayyan QCRI[24]. Additional relevant papers and grey literature (e.g. from third-sector organisation websites) were identified using hand searching including backwards and forwards citation tracking.

Selection criteria and primary outcomes

Papers reporting the use of social media platforms and implications for preventative health measures and vaccination intent of migrants and/or ethnic minority groups to COVID-19 globally were eligible. All types of COVID-19 preventative health measures, including social distancing, hand washing, mask wearing, testing, isolating, tracing close contacts of people who have COVID-19, alongside preventative measures based on misinformation were included. To include all available evidence, all types of scientific articles, reports and commentaries, editorials, correspondence letters were eligible for inclusion. Social media platforms were defined as any medium whereby content (including images, videos, and messages) is circulated to the general public and may include YouTube, Facebook, Twitter, TikTok, and Snapchat. 'Migrants' were defined as foreign-born, residing outside of their country of birth. An ethnic minority group was defined as a group of people with a shared culture, tradition, language, history, living in a country where most people are from a different ethnic group, and will include migrants/foreign-born populations alongside individuals born in the host country. Where studies reported a general population sample, results about migrant/ethnic minority groups within that sample were eligible for inclusion. No papers were excluded based on language or geographical origin. Studies were excluded if it was not possible to determine whether individual(s) in the population studied were migrants or from an ethnic minority group.

Data Extraction, critical appraisal, and synthesis

Data extraction was completed independently by two researchers (MRP and LG) using a piloted, structured data extraction sheet in Microsoft Excel. Fields in the data extraction sheet included author and year, dates for data collection, location of study, location of population of interest, whether qualitative methods were used, whether quantitative methods were used, study design, whether there was an intervention, the type of intervention,

methodology, population of interest, further information about population, sample size, type of social media, misinformation type, participant recruitment strategy, and all outcomes. Outcomes were extracted as reported. Risk of bias was assessed independently by two researchers (LG, MRP) using the Quality assessment for Survey Studies in Psychology for Surveys (Q-SSP)[25] for quantitative studies. The twenty items on this scale can be rated as "yes", or "no", "not stated clearly", or "not applicable". Scores are calculated by dividing the "yes" answers by the total number of applicable items, with scores over 70% indicating "acceptable" quality. The Critical Appraisal Skills programme (CASP) checklist was used for qualitative studies[26]. The ten items can be rated 'yes', 'can't tell' or 'no'. We rated the CASP by dividing the "yes" answers by the total number of applicable items, with a score of over 60% indicating "acceptable" quality. We did not exclude any papers on the basis of quality. The selection of risk of bias rating instruments were finalised once we had a complete list of the type methods used in the included studies. We used a mixed methods[27] narrative synthesis[28] approach, synthesising the qualitative and quantitative data together by theme.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research, however, three of the authors are from racially minoritized groups and three authors are migrants living in the UK.

Results

Overview of data sources

Following de-duplication, 1849 unique data sources were identified and screened and ultimately 129 were full-text screened. 21 data sources were included in the final analysis (Figure 1). Six studies were conducted in the UK[29-34] , two were jointly conducted in the UK and US[35 36]. An additional eight studies were conducted in the US,[37-44] and one each in China,[45] Jordan,[46] Qatar,[47] and Turkey.[48] Eight studies reported on migrants,[32 34 37 45-49] including migrants in the host countries of China[45], Jordan[46], Quatar,[47] Turkey[48], and the US[37] and UK[32 34], and one study involved predominantly migrants from Venezuela residing in other countries.[49] Nine studies reported about a specific ethnic minority or group (Latino individuals,[37 39 41 42] Black American citizens,[40 44], Jain community members[33] and Syrian migrants[46 48]). Seven studies reported about ethnic minority groups generally[29-31 35 36 38 43]. A survey design was the most common design, used in half of included studies.

Characteristics of included studies are presented in Table 2, including the risk of bias assessment scores. Quality scores ranged from 76% to 90% for included papers, suggesting acceptable quality of all included data sources

where quality assessment was applicable. The most common shortcomings for studies related to reporting about the ethics and participants. None of the included studies were preprints.

Supplementary material 2 shows the geographical location of data sources, highlighting the absence of published and unpublished data on this topic from most regions of the world.

Table 2: Characteristics of included studies

Included study	Location of study	Study design	Population under study	Type of publication	Main topic of the paper	Sample size	Quality rating*
Alabdulla 2021[47]	Qatar	Cross-sectional survey	Non-Qatari residents	Peer reviewed journal	Vaccine hesitancy	7821	76%[1]
Allington 2021(a)[31]	UK	Cross-sectional survey	Non-White ethnic groups	Peer reviewed journal	Vaccine attitudes, trust and COVID-19 information source as predictors of vaccine hesitancy	4343	82%[1]
Allington 2021(b)[36]	UK	Cross-sectional survey	Non-White ethnic groups	Peer reviewed journal	Media usage predicts intention to be vaccinated against COVID-19	8988	89%[1]
Behbahani 2020[37]	US	Organisational case study	Latino migrants	Peer reviewed journal	Helping vulnerable migrant populations in the COVID-19 crisis	N/K	N/A[1]
Campos-Castillo 2020[38]	US	Cross-sectional survey	Non-White ethnic groups	Peer reviewed journal	Racial and ethnic digital divides in posting COVID-19 content on social media	10,510	88%[1]
Cervantes 2021[39]	US	Qualitative interviews with thematic analysis	Low-income Latino individuals	Peer reviewed journal	Experiences of Latinx individuals hospitalized for COVID-19 - misinformation and disbelief	60	90%[3]
Chandler 2020[40]	US	Qualitative interviews with thematic analysis	Black women (18-31yrs)	Peer reviewed journal	Evaluating the perspectives and sources of information of Black women about COVID-19	15	90%[3]
Crawshaw 2021[32]	UK	Evidence synthesis linked to outputs from participatory workshops with migrants	International migrants	Peer reviewed journal	Vaccine hesitancy and barriers to COVID-19 vaccination in migrants	N/K	N/A[2]
Despres 2020[41]	US	Organisational case study	Latino community living in America	Peer reviewed journal	A digital content curation model to challenge the inequitable impacts of COVID-19 on U.S. Latinos.	N/K	N/A[2]
Danish Refugee Council (DRC) 2020[48]	Turkey	Cross-sectional survey	Syrian refugees in South-East Turkey	Research- based needs assessment report	The impact of COVID-19 on refugees in South-East Turkey	774	82%[1]
Hamadneh 2021[46]	Jordan	Cross-sectional survey	Syrian refugee mothers	Peer reviewed journal	Knowledge and attitudes about COVID-19 among Syrian refugee women in Jordan	389	78%[1]
Lockyer 2021[29]	UK	Qualitative interview; reflective thematic analysis	People from different ethnic groups in Bradford	Peer reviewed journal	COVID-19 misinformation and vaccine hesitancy in context	20	90%[3]
Loomba 2021[35]	UK & USA	Randomised controlled experiment	Other ethnic groups than White	Peer reviewed journal	The impact of COVID-19 vaccine misinformation on vaccination intent	4,000 (UK) 4,001 (US)	N/A[2]
Moyce 2020[42]	US	Qual interviews narrative synthesis	Latino individuals	Peer reviewed journal	Perceptions of COVID-19, news about COVID-19 and approaches to protecting health	14	90%[3]
Paul 2021[30]	UK	Repeated measures survey; cohort study	Other ethnic groups than White	Peer reviewed journal	Attitudes towards COVID-19 vaccines, vaccine intent and implications for public health messaging	32,361	89%[1]
Regional Inter-agency coordination platform (R4V) 2021[49]	Any host county for migrants from Venezuela	Cross-sectional survey	Predominantly migrants from Venezuela	Research-based report	The difficulties encountered by refugees and migrants in the COVID-19 infodemic. Misinformation and vaccine hesitancy.	334	90%[3]

Vekemans 2021[33]	UK	Organisational case study	Jain community members	Peer reviewed journal	The re-location of the Jain community into the digital realm during the COVID-19 pandemic	25,000 estimate	N/A[2]
Viswanath 2021[43]	US	Cross-sectional survey	Non-White ethnic groups	Peer reviewed journal	Individual and social determinants of COVID-19 vaccine uptake	1012	78%[1]
Wang 2020[45]	China	Cross-sectional survey	International migrants	Peer reviewed journal	COVID-19 knowledge, attitudes and sources of knowledge among international migrants in China	1,426	78%[1]
Woko 2021[44]	US	Cross-sectional survey	Black American citizens	Peer reviewed journal	The role of beliefs and trust in COVID-19 information sources in low COVID-19 vaccination intention among Black Americans	1,074	77%[1]
Deal 2021[34]	UK	Qualitative in-depth interview study	Precarious migrants (asylum seekers, undocumented migrants, refugees)	Peer reviewed journal	Action points to promote the equitable uptake of COVID-19 vaccinations for precarious migrants	32	90%[3]

*Scores were calculated on both scales by dividing the "yes" answers by the total number of applicable items.

[1] Quality assessment for Survey Studies in Psychology for Surveys (Q-SSP) Checklist for surveys

[2] N/A = not applicable due to research item design.

[3] Critical Appraisal Skills programme (CASP) checklist

Use of social media platforms as a source of information about COVID-19

For some migrants and ethnic minority groups, consistent use of social media platforms for sharing and receiving COVID-19-related health information was reported in several included studies[34 39-41 45-47 49 48]. Figure 2 highlights quantitative datasets showing use of social media for information about COVID-19. Social media was reported to be the preferred source of information about COVID-19 for international migrants in China (WeChat was used by 94.5% of respondents for COVID-19 information).[45] Among 389 Syrian refugee mothers in Jordan[46], Facebook and WhatsApp were the main sources of information for 87% and 69% of respondents respectively for COVID-19 information; with 21% indicating that they accessed information from professional databases or government websites, and 53% via television (this survey was circulated via Facebook and WhatsApp). Migrants from Venezuela (residing in numerous countries) reported Facebook and WhatsApp were their two primary sources of information about COVID-19 in a survey of 334 migrants[49]. A survey of 774 refugee households in Southeast Turkey[48] found the majority (75%) obtained COVID-19 information from Facebook, YouTube, Twitter and the internet in general, 15% via SMS/WhatsApp messages, followed by radio/TV (64%) and members of their community/family (34%); only 10% reported getting information from Non-governmental organisations (NGO)/United Nations (UN) sources. This study concluded that the heavy reliance on social media for information may expose a sizeable proportion of refugee households to fake or inaccurate information. In a US study of Black women aged 18-31 years, 58% of respondents reported using social media (Instagram and Facebook) to obtain COVID-19 information[40].

Participants from the US Latino community described relying on social media for information about the pandemic[39]. In Qatar, migrants reported they preferred to find out about COVID-19 using their own personal research or searching for information, including using social media as a source[47]. A study of precarious migrants (asylum seekers, undocumented migrants) in the UK found many relied on social media (WhatsApp groups, Facebook) for information on the pandemic and the ongoing vaccination programme[34].

A key theme emerging in one UK study of ethnic minority groups[29] was that the "avalanche" of information surrounding COVID-19 had led to interviewees feeling overwhelmed and confused: participants reported using a variety of sources of information, including TV, radio, news stations in Pakistan, India, Slovakia, and Poland, online newspapers, Facebook, WhatsApp, Twitter, Google, and medical journals. A number of these participants said they dismissed some stories encountered on WhatsApp and Facebook; however, the sheer volume of messages coupled with the fact that people they trusted were sharing them, proved difficult to ignore, with participants raising concerns about how quickly social media stories were shared. One study exploring the views

of US Latinos reported that they consulted national and local news reports for information about COVID-19 and many reported that they got their news from Spanish-language news due to difficulty in understanding news in English; some received their news from social media sources, including Facebook, but expressed caution around messages from social media as there was no way to ensure the accuracy of the reports.[42] Language barriers were also reported in the Syrian refugee population in South-East Turkey, who typically prefer information in Arabic,[48] the Latino population in the U.S,[37 39 41] for people from a range of ethnic groups in Bradford[29] and for international migrants.[32]

According to one study, members of ethnic minority groups were also more likely to post COVID-19 content on social media than White individuals[38], with respondents who identified as Black (odds ratio [OR] 1.29, 95% CI 1.02-1.64; P=.03), Latino (OR 1.66, 95% CI 1.36-2.04; P<.001), or other races/ethnicities (OR 1.33, 95% CI 1.02-1.72; P=.03) had higher odds than respondents who identified as White of reporting posting COVID-19 content on social media.

Drivers of social media reliance

Studies reported that some migrant and ethnic minority groups turned to social media as a result of a need for connection and to acquire accessible information from people they considered to be reliable sources.[33 42] For the Latino community in the US, faith and community bonds were valued ways of coping with the difficulties of the pandemic which included feelings of social isolation, stress, and uncertainty and – according to one study – social media facilitated these connections in a virtual space[42]. The Jain community in London used social media to communicate news and knowledge about COVID-19 and stay connected online, with events moving to a virtual space; individuals reportedly benefited from and were grateful for this community use of social media[33].

Several studies highlight concerns that some migrant and ethnic minority groups were unable to find official information in their host country in their native language about various aspects of COVID-19, hence their reliance on social media[29 32 34 45 48]. For example, a UK study of precarious migrants (asylum seekers, undocumented migrants) reported that those feeling most abandoned or scared due to a lack of understandable, clear official information in the early stages of the pandemic were more likely to rely on word-of-mouth or social media (WhatsApp groups, Facebook) for information, including around the vaccination programme[34]. One study of international migrants in China (94.5% of whom preferred social media for news about COVID-19) had lower rates of correct knowledge about COVID-19 compared to rates reported for Chinese

residents[45]. The authors speculate that this might be due to a lack of available public health information in a range of languages.

Other studies showed positive associations with use of social media and access to information. One study highlighted that social media can support migrants to navigate the complex medicolegal context of their host countries by accessing information about public health measures and how to access medical help[37]. Social media use was associated with improved knowledge about COVID-19 and how to stay safe, in studies of Syrian refugee mothers[46] and US Latinos[41]. In another study specifically curated, culturally relevant digital content was considered to be an effective health promotion tool to share knowledge about practical actions to be taken to address the inequitable impact of the pandemic on US Latinos[41].

Misinformation and social media use

A summary of some of the key misinformation narratives identified in studies are provided in Table 3. Some studies made links between social media and circulating misinformation in migrant and ethnic minority groups. For example, a UK cohort study found that both belonging to an ethnic minority group and socioeconomic disadvantage was associated with both exposure to misinformation about vaccines, and mistrust in information about COVID-19[30]. A study of Syrian refugee mothers in Jordan, who reported receiving most of their COVID-19 information through social media, identified some erroneous beliefs about pregnancy, COVID-19 and breast milk[46]. A UK study among ethnic minority groups reported that participants encountered a range of misinformation, usually through social media sources and that vaccine hesitancy could be attributed to safety concerns, negative stories and personal knowledge, all of which had been amplified by recent exposure to misinformation via social media[29]. Myths identified included the idea that health professionals at the local hospital were injecting people with COVID-19 or killing people with the COVID-19 vaccine; there were wider beliefs reported about vaccines containing a microchip; making people infertile, or that vaccines are being tested on ethnic minority individuals[29]. These participants described the dilemma of not knowing what to trust or who to listen to, including the videos /posts that appeared to be from trusted professionals; therefore, they could not entirely dismiss negative stories circulating via social media and elsewhere.

Table 3: Examples of circulating misinformation on social media platforms relating to COVID-19 (2020), reproduced and compiled from Loomba et al[35] and Lockyer et al.[29]

Misinformation identified	Source	Engagement[1]	Reach[2]
"Scientists have expressed doubts over the effectiveness of a COVID-19 vaccine that has been rushed to human trials, after all the monkeys used in initial testing later contracted COVID-19."	Twitter	1.59K	1.5m
"The new vaccine for COVID-19 will be the first of its kind EVER. It will be an mRNA vaccine which will literally alter your DNA. It will wrap itself into your system. You will essentially become a genetically modified human being"	Twitter	27	19.6K
"They said it was just to flatten the curve. Now it's a battle for human survival." The only must-see action thriller for 2020. Starring: Bill Gates, Anthony Fauci, Chris Witty, Matt Hancock. Guest mask appearances: Clintons, Boris Johnson, Nicola Sturgeon, Joe Biden & Tedros. [Graphic featuring Mr. Bill Gates with the following quote.] "If we do a really good job with vaccines, we can reduce population by up to 15%. But if we create a worldwide pandemic first, killing people and making many of the survivors sterile, then create the vaccine, we may achieve the Georgia Guidestones 1st commandment!"	Twitter	11	1.49K
Something is very fishy about all this indeed. "A VIRUS WITH A 99.6% SURVIVAL RATE FOR PEOPLE UNDER 70 BUT THE ENTIRE WORLD NEEDS TO TAKE A VACCINE? I'M NO SHERLOCK HOLMES BUT SOMETHING'S FISHY ABOUT ALL THAT……"	Twitter	N/K[2]	32.5K
"Big Pharma whistle-blower: '97% of corona vaccine recipients will become infertile'"	Twitter	6.95K	336K
"I've been in Twitter jail for the last 12 hours for posting a link to a peer reviewed scientific study published in Vaccine showing that in military personnel prior receipt of the flu shot increased COVID-19 risk by 36%. Censorship is vile & unAmerican."	Twitter	25.1K	1.41K
"So we know for a fact that the flu vaccine worsens COVID-19 symptoms. So what are they mandating now? The flu vaccine, of course."	Facebook	NK	NK
"PREPARING THE PROPAGANDA BLITZ. Yale University and the U.S. government are running clinical trials to develop propaganda messaging to persuade Americans to take experimental, genetically engineered, unlicensed, "Warp Speed," zero liability, expedited vaccines with limited short duration safety testing. Researchers compared reactions in 12 focus groups using "guilt, embarrassment, bravery, anger, trust" and "fear" to overcome vaccines hesitancy"	Instagram	28.2K	NK
➢ COVID-19 is not real, it is an effort to control society ➢ COVID-19 has been manufactured by China or other governments for control purposes ➢ COVID-19 is caused by 5G ➢ COVID-19 has been invented to make people use contactless payments so that the government can track individuals ➢ COVID-19 testing gives so many false positives that it is ineffective and you should not self-isolate ➢ COVID-19 exists but is not as virulent as the government says it is ➢ If children test positive for COVID-19 during school hours, they can be taken away into care and will not be able to see their parents until they test negative ➢ The COVID-19 vaccine contains a chip that will track individuals, stop them travelling etc ➢ The COVID-19 vaccine will make people infertile and is an attempt to reduce the population, particularly targeted at people from BAME communities ➢ BAME people are being used as 'guinea pigs' to test out the COVID-19 vaccine ➢ The COVID-19 vaccine has been developed and approved too quickly and has not been fully tested ➢ The COVID-19 vaccine will negatively disrupt your natural immune system ➢ Herbal remedies will be more effective than the COVID-19 vaccine	Multiple platforms/ unknown	NK	NK

1 Engagement measures the number of likes and retweets.
2 Reach measures the number of followers and thus potential audience size.
NK=Not known.

In a study of 60 Latinx adults hospitalised for COVID-19 in the US, many participants reported that they relied on social media for COVID-19 recommendations and described a lack of information and circulating misinformation, with suspicion of the government and immigration departments was a common misinformation theme: “some of us see [COVID] as a tactic for the government to access our documentation status and deport us”[39]. One Mexican male (age 45) in one US study[42] noted: “When someone uploads something to Facebook then no-one believes in it 100%”; a Mexican female (age 33) was also quoted as saying “[I get my information] well through the news, TV, Facebook and all of that…not everything I see is credible”.

In a UK qualitative study[29], participants who initially disregarded conspiratorial beliefs found it challenging to maintain their confidence that the rumours were untrue due to a number of factors: (i) receiving many social media messages about them; (ii) receiving messages about them from trusted others; (iii) feeing anxious; and (iv) being under lockdown conditions at home. Participants expressed confusion about which story to trust, and ongoing difficulty identifying information as misinformation and dismissing it. Similarly, another study[40] reported that 79% of female Black Americans interviewed stated that they were confused by the COVID-19 information they’d accessed from any source: "Sometimes I feel unsure about the information that I’m receiving because it's a lot of different things about it. Everybody's not saying the same thing. So, I’m kind of unsure about what to believe".[40]

Social media impact on preventative health measures and vaccine intent

A small number of studies linked social media use with lower participation in preventative measures among migrants and ethnic minority groups. A UK/US survey study found vaccine hesitancy to be associated with informational reliance on social media and membership of an ethnic minority group[31]. A UK qualitative study reported that ethnic minority groups were influenced by anti-vaccine misinformation, including from social media.[29] A UK qualitative study of precarious migrants found that among 23 participants who were hesitant about receiving a vaccine some participants described fears around theories based on misinformation, often originating from social media or word of mouth, with many describing feeling conflicted about which information sources to trust[34]. Community leaders from African, Caribbean, Asian and Eastern Mediterranean migrant groups in London, UK reported substantial COVID-19 vaccine hesitancy due to misinformation circulating on social media and word of mouth combined with a lack of accurate, translated and clear guidance[32]. Similarly, in a US qualitative study of Latino adults, some participants reported encountering a lack of knowledge accompanied by misinformation on social media causing them to dismiss preventative measures[39]. Another US

study among Latino people reported that social media acted as a potential deterrent for following some public health measures to prevent infection by encouraging rule-breaking behaviour through socially normalising such behaviour by enabling people to observe the negative, guideline-breaking behaviours of others in social media posts[42].

On the other hand, a large (8,001 participants) US/UK randomised controlled experiment[35] found no significant differences in the response of different ethnic groups to misinformation in relation to vaccine intent. A large US/UK study[36] found membership of an ethnic minority group was associated with reduced vaccine intention, a relationship which was significant in three out of four studies ($p<0.001$, n=3890; $p=0.017$, n=1663; $p<0.001$, n=2237). The relationship persisted even when use of legacy (print and broadcast media) and frequency of use of social media was controlled for. High levels of social media use was not associated with vaccine intent in any of the three studies exploring this relationship; however, high information reliance on social media was significantly associated with negative vaccine intent ($p=0.028$, n=2237), suggesting a reliance on social media for information can make users vulnerable to misinformation. This study did not include interaction terms between ethnicity and information reliance on social media, which could have indicated whether the effect of information reliance on social media on vaccine intent differs by ethnicity.

Good practice in promoting information and countering misinformation

Evidence suggests the important role of strong connections with the local community to identify and counter misinformation and rumours by trusted and valued sources of information. Most studies recommended improving the accessibility of public health information for migrant and ethnic minority communities.[30 32 37 39 40 42-45 49] For example, providing public health information in the media channel preferred by that group[39], in multiple languages[29], and using local, trusted voices delivering specific and targeted messages to counter fake news[29 39]. A strong interest in online, personalised information was identified[41 42]. Where social media was used to share personalised and culturally tailored public health information, it has a positive influence with good health knowledge, health seeking behaviours and vaccine intent[29-32 37 39-41 43-46 49]. Studies indicated the need for culturally tailored health messaging to ensure equitable health knowledge for improving vaccine intent and health seeking behaviours[32 39-41].

More personalised means of health information communication was highlighted as a demand for informational reliance. A national US organisation which provides online health information tailored to the US Latino community found a high level of interest in their COVID-19 curated content, suggesting a strong demand for

tailored and culturally relevant material[41]. In a new approach, 'virtual patient navigators', helpers working online, typically using messages to provide individually tailored health information, were made available to Latino migrants through a New York-based communication platform[37].

Working through trusted sources was also emphasised. Providing accurate and tailored information about COVID-19 via trusted community members and organizations was suggested in a study of Black women aged 19-31 years in the US[40].The study recommended that health professionals take an active role collaborating with the community to address inequities that Black women are experiencing in the pandemic[40]. Participants in a randomised controlled study to explore the impact of misinformation on vaccine intent on different populations groups reported finding videos on social media very engaging, especially when delivered in multiple languages by someone in a trusted profession (e.g., doctor/teacher/nurse)[35].

Successful countering myths was reported in a UK study wherein the local council rapidly responded to fake news circulating in the local population (e.g., a rumour about children who test positive in school for COVID-19 being removed from the school and/or their parents until they test clear)[29]. Videos to refute the myth were swiftly posted online in both Urdu and Punjabi, and these were reported to be effective by members of the local population[29]. Additional studies report successfully countering misinformation using a network of patient navigators[37] and community household surveys[29]. Social media use to communicate with family was also reported to be effective in challenging COVID-19 denial misinformation rumours through reporting of lived experience of COVID-19[39].

Discussion

Among migrant and ethnic minority populations in the UK, US, China, Jordan, Qatar, and Turkey we found evidence of consistent use of social media for COVID-19 information, including via WeChat, Facebook, WhatsApp, Instagram, Twitter, YouTube, which may stem from a difficulty in accessing COVID-19 information in their native languages or from sources they trusted. There was some evidence of circulating misinformation and social media use associated with lower participation in preventative health measures, especially vaccination intent, and finding that will be undoubtedly generalisable to multiple population groups. This is a rapidly evolving field of research, and data are limited, but our work highlights the considerable importance of social media platforms as a source of information and misinformation about COVID-19 for some migrant and ethnic

minority populations during the pandemic. Whilst we know social media is used by many people, and misinformation has been circulating widely in the general population, it may be the case that those excluded from national public health responses and/or who faced specific barriers to accurate public health information and support may have been disproportionately impacted. Urgent actions and further research are now needed to better understand use of social media platforms for health information in different population groups, find effective approaches to tackling misinformation, and to seize on opportunities to make better use of social media platforms to support public health communication and improve vaccine uptake globally. Furthermore, the findings highlight the crucial role of locally trusted sources in identifying and tackling misinformation, and underscores the benefits of disseminating personalised and culturally relevant health messages, including via social media.

This review is the first attempt to synthesise global studies exploring the use and impact of social media on migrant and ethnic minority populations during the COVID-19 pandemic. However, it is limited by the availability and quality of the datasets available. We acknowledge the limited geographical scope of included studies, with 16 of 21 studies focused on migrant and ethnic minority populations residing in the UK and US and no data at all from low-income countries. It may be that the lower availability of research funding in low-income countries may explain the lack of studies from these countries. We acknowledge that definitions and terms pertaining to migrants and ethnic minorities and social media are used inconsistently in research; this is an ongoing challenge within the field, which has previously been evidenced in similar reviews, and may mean we have missed papers. This was mitigated against by searching the published and grey literature more widely. We also acknowledge that as many of the surveys didn't formally report whether the social media feeds their responders were following were from 'official' sources, such as government or non-governmental organisations or from 'unofficial' sources, such as friends, relatives, or accounts simply with many followers, though the included datasets and further qualitative work our groups is currently doing in the UK suggest they will be predominantly unofficial sources, with government public health teams in several countries very slow to make effective use social media as a platform of communication at the start of the pandemic. A further limitation is that there were insufficient studies to reliably compare use of social media across type of migrants (refugees/asylum seeker, undocumented migrants), and future research should explore this. We acknowledge that migrants and ethnic minorities are a highly diverse group with a range of health and socioeconomic situations making it hard to generalise; however there is evidence in several contexts that these populations may have been disproportionately impacted by the COVID-19 pandemic[14 17 50].

The findings of our review have been confirmed by more recent studies. For example, a survey of migrants in Greece found their main source of information about the vaccine was via social media platforms and the internet in general, and that vaccine hesitancy was linked to a lack of adequate information and driven by fear, anxiety, exposure to negative news and misinformation.[51 52] In Turkey, a 2021 survey and feedback mechanism in refugee communities found information gaps, misconceptions, and rumours about COVID-19 vaccines circulating mainly by word of mouth and on social media, undermining health information[53]. In a recent study of Venezuelan migrants in Latin America, 70% said they had access to a mobile phone, with the main communication channels being WhatsApp and Facebook, yet half said they felt uninformed[54]. We also found that some migrants and ethnic minorities used diaspora media as a source of COVID-19 related information during the pandemic, which merits further consideration in terms of understanding how to better engage these groups in preventative health care and vaccination, and has been previously reported in studies as influencing views and beliefs around vaccination[55]. Misinformation on social media correlated negatively with vaccine intention and our findings align with other research in this area and will undoubtedly be relevant to many other population groups[2 7 34]. A recent study among migrants and nationals in Qatar acknowledged 'personal research' via social media as important to them for seeking information about COVID-19 vaccines, underlining the key role social media has in influencing people's attitudes towards vaccine uptake[56].

The European Centre for Disease Prevention and Control (ECDC) and other public health bodies have raised concerns around barriers to public health information among migrant populations and ethnic minority groups residing in Europe and other high-income countries during the pandemic[14 15]. Public health guidance in some countries was not initially tailored to the needs of migrant and ethnic minority groups[19 57-59]. A review of the availability of government produced risk communications across Council of Europe member states in June 2021 found only 48% (23/47) of countries translated COVID-19 information into at least one migrant language, with information on testing or healthcare entitlements in common migrant languages only found in 6% (3/47), suggesting individuals not able to access information in the host country language may have been excluded to some extent from governments' public health messaging[19]. In Denmark, a series of qualitative interviews with migrants found that they felt uncertain regarding government guidance for COVID-19; although written material was translated into 19 languages, it was not effectively disseminated[60]. In Montreal, Canada, there were delays to publishing official multilingual fact sheets on COVID-19 guidelines, and information phone lines only operate in French and English; those who had arrived most recently, had lower language (French/English) ability or lower literacy had more difficulty accessing local COVID-19 information[61]. Lack of English or French language at the

time of immigration to Canada were associated with lower rates of testing and higher percent positivity for COVID-19 in recently arrived adult immigrants and refugees[62]. A study among refugees and migrants in deprived areas in Greece found that migrants may have difficulties understanding public health messaging due to cultural and language barriers.[19 58 63] Merely translating public health information is not likely to be sufficient; information needs to be tailored and targeted so it is conveyed in ways that resonate with the target population. A range of key resources and guidelines on risk communication and engagement strategies for COVID-19 public health responses, including vaccination, among marginalised populations globally are available, as well as a social media toolkit for healthcare practitioners (https://www.who.int/publications/m/item/a-social-media-toolkit-for-healthcare-practitioners---desktop)[64-66]. However, it will be vitally important that the lessons learned around communication of public health information to marginalised groups during the pandemic are meaningfully carried forward.

Where social media is used to share personalised and culturally tailored public health information, it has a positive correlation with good health knowledge, health seeking behaviours and vaccine intent[41 46] Our research shows the need for culturally tailored health messaging to ensure equitable health knowledge and to improve vaccine uptake, by accurate public health messaging through trusted sources of information[32 39-41]. We make a number of recommendations for policy and practice, which include the need for systematic monitoring of information and attitudes circulating on social media[67], as well as timely rebuttal of misinformation from trusted professionals (see box 1). Several resources are now available to support addressing misinformation about COVID-19 vaccines as well as fostering demand for vaccines.[68-70]

There is a stark lack of data on social media use from low and middle-income countries, which merits greater consideration as COVID-19 vaccination gathers pace in these contexts. Studies from high income countries are also limited, with the majority of studies focused on the USA and UK. In addition, more evidence is needed to examine the role social media platforms play in positively or negatively influencing health behaviours such as vaccine intent and uptake for COVID-19 in all populations (including other excluded groups eg, homeless, internally displaced people/IDPs). Social media is an important source of health information for some migrant and ethnic minority communities and tackling misinformation needs to be done using this medium given the lack of trust in government messaging in some of these communities[71]. Our findings are consistent with those of others working in this field, which show that social media can have a crucial role in disseminating health information, tackling infodemics and misinformation[4]. There is an opportunity now to more effectively use social media to make vaccine intent desirable, appealing and normative among migrants and ethnic minority groups.

There is an urgent need to address infodemic-related challenges in a rapidly changing information environment, including real-time monitoring of social media messages and misinformation and the development of online tools to fight disinformation, with a focus on collecting stratified population data to enable targeted and tailored responses. Robust interventions relying on behavioural science to tackle misinformation using social media and evaluations are a plausible next step to address immunisation challenges for COVID-19 vaccines but also routine vaccines. Building trust in public health messaging, identifying information gaps, finding innovate ways of disseminating health information, and detecting and responding to misinformation as it emerges remain a priority for public health[71 72].

Box 1: Key messages and recommendations

- Social media is an important source of health information for some migrant and ethnic minority communities, who may face barriers to accurate public health information, health, and vaccinations systems. More evidence is urgently needed to examine the role social media platforms play in positively or negatively influencing health behaviours such as vaccine intent and uptake for COVID-19 in marginalised populations.
- There is a stark lack of data on social media use from low and middle-income countries which merits greater consideration as COVID-19 vaccination gathers pace in these contexts.
- More emphasis must be placed on exploring opportunities for sharing and transmitting accurate information via social media platforms, for example, to make vaccine intent desirable, appealing and normative.
- Use of diaspora media by migrant populations, as a source of COVID-19 related information during the pandemic and for other health information, merits further research and greater consideration when designing and delivering public health interventions.
- Proactively monitor social media platforms and other media sources to identify anti-vaccine sentiment, misinformation, fake news, and rumours, and address them in real-time.
- There is a need to promote targeted and tailored health information to marginalised populations who face access barriers to health and vaccination systems, through preferred and trusted sources and channels of information including social media platforms, and to ensure investment in workforce and infrastructure to support this.

- Engage with and involve communities in developing culturally specific messages and approaches, and support community-driven initiatives to identify at-risk groups, map local influencers, and define content for locally meaningful communication campaigns. Facilitate partnership working at the local level through involvement of diverse stakeholders and ensure community partners are recognised and reimbursed for their contributions and expertise.
- Social media platforms should exercise more accountability and sign pledges to systematically track and remove harmful content that undermine public health measures, particularly during a public health crisis. The public must be empowered to identify and flag misinformation on social media
- Public health bodies and healthcare professionals should avoid a narrow focus on misinformation and a one-way communication of 'more accurate' information. They should seek to understand the underlying causes of exposure to and belief in misinformation including genuine knowledge void, access barriers and health literacy.
- Lessons must be learned around shortfalls in the communication of public health information to marginalised groups during this pandemic. Importantly, countries should gather and evaluate innovations and models of best practice in this area, which must be meaningfully carried forward to strengthen uptake of routine vaccinations and other public health interventions.

Conflicts of Interests

All authors report nothing to declare.

Data availability statement

All data used in the systematic review are appropriately referenced and available online in the sources cited.

Ethics statements

Not applicable.

Patient consent for publication

Not applicable.

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Author Contributions

The study was conceptualised by SH, and the protocol and research question were developed by SH, LPG and MRP. Searches were developed by MRP and LG, with input from SH and SEH. Screening was done by LPG and MRP. Data extraction and analysis was done by LPG and MRP, with input from SH. The first draft of the manuscript was produced by LG, MRP, and SH, and developed with KH and TV, who all contributed to interpretation of the results. All authors, including AD, AFC, SEH, FK, JC, AA and MR commented upon and approved the final manuscript. SH is guarantor of this study.

Disclaimer

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Competing interests None declared.

Figure 1: PRISMA Diagram

Figure 2: Data on use of social media platforms as a source of information about COVID-19

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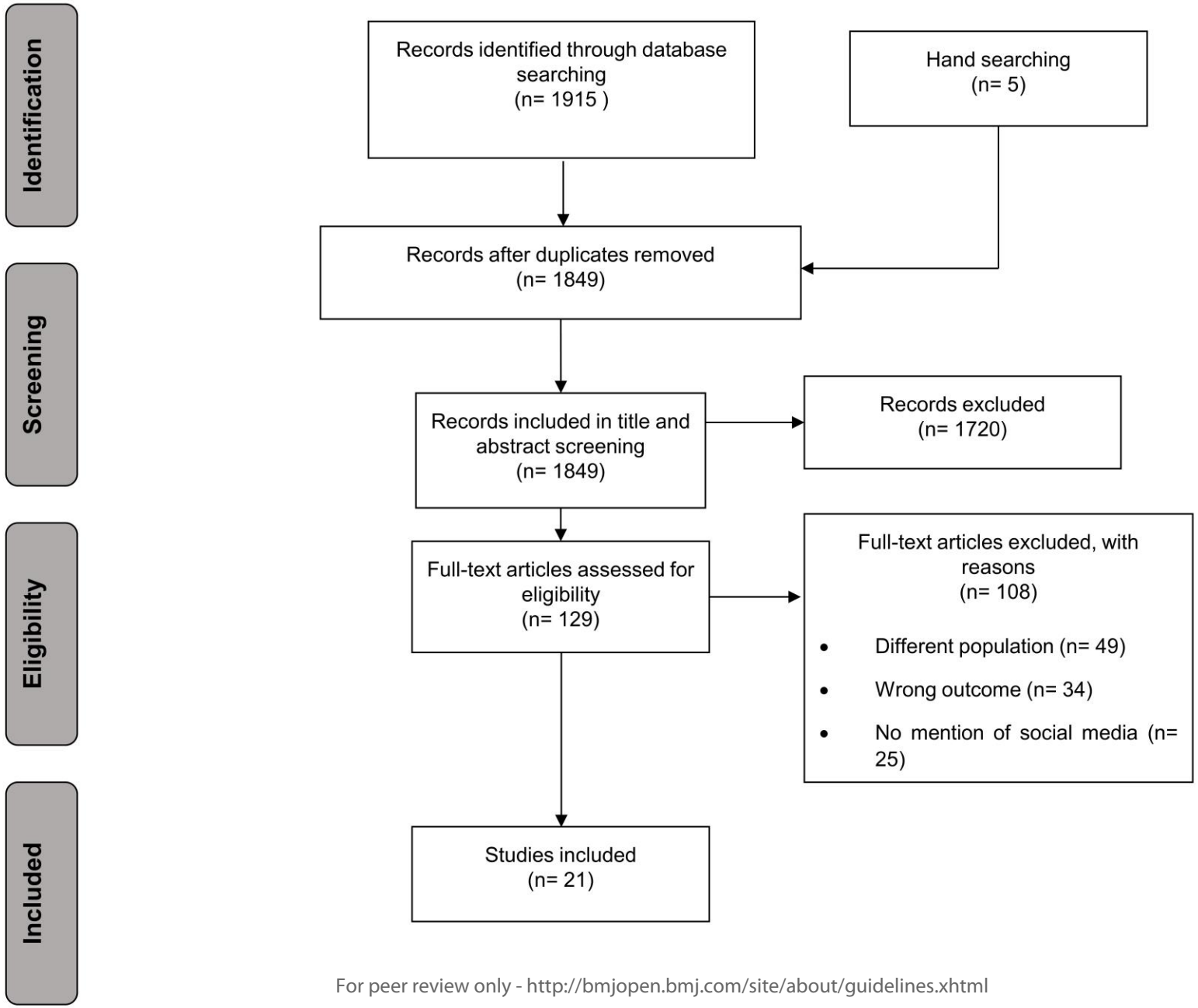
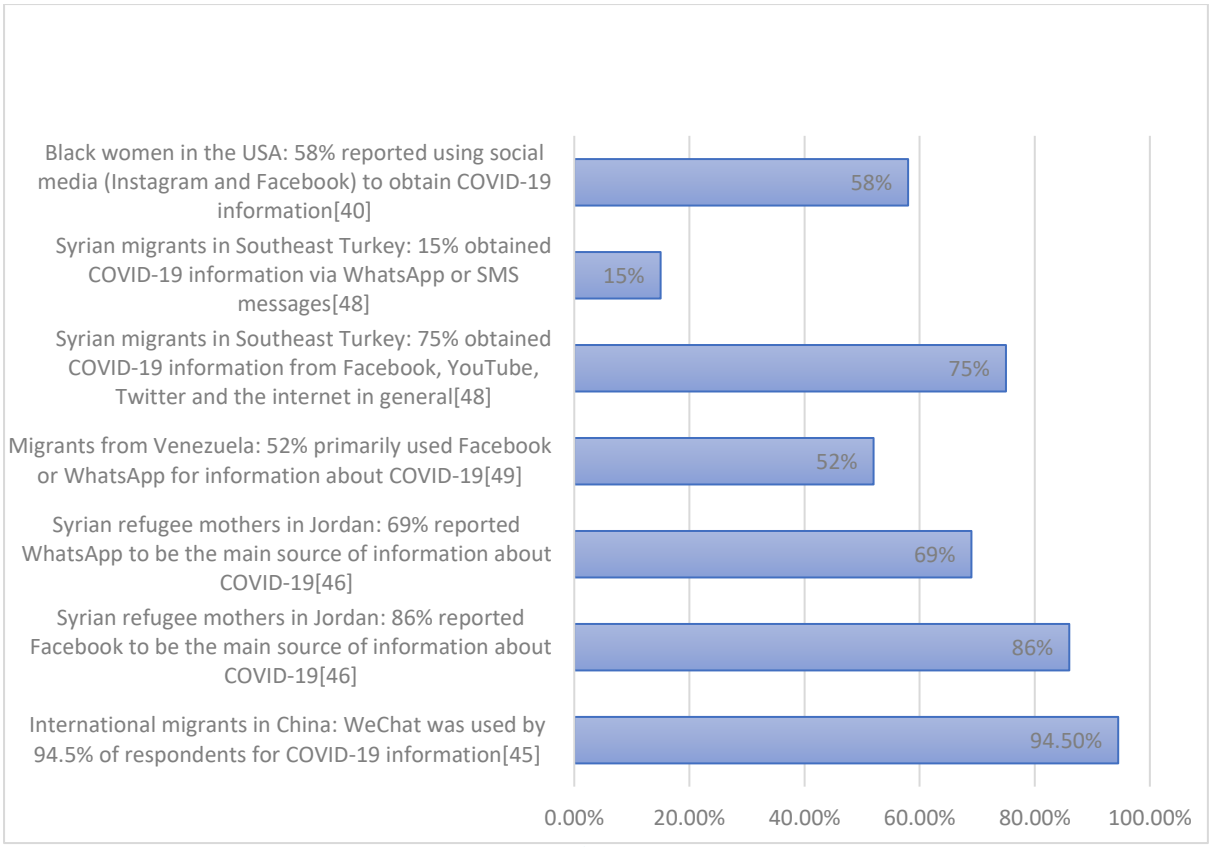

Identification
Screening
Eligibility
Included
Records identified through database searching (n= 1915)
Hand searching (n= 5)
Records after duplicates removed (n= 1849)
Records included in title and abstract screening (n= 1849)
Records excluded (n= 1720)
Full-text articles assessed for eligibility (n= 129)
Full-text articles excluded, with reasons (n= 108)
Different population (n= 49)
Wrong outcome (n= 34)
No mention of social media (n= 25)
Studies included (n= 21)


Black women in the USA: 58% reported using social media (Instagram and Facebook) to obtain COVID-19 information[40]
58%
Syrian migrants in Southeast Turkey: 15% obtained COVID-19 information via WhatsApp or SMS messages[48]
15%
Syrian migrants in Southeast Turkey: 75% obtained COVID-19 information from Facebook, YouTube, Twitter and the internet in general[48]
75%
Migrants from Venezuela: 52% primarily used Facebook or WhatsApp for information about COVID-19[49]
52%
Syrian refugee mothers in Jordan: 69% reported WhatsApp to be the main source of information about COVID-19[46]
69%
Syrian refugee mothers in Jordan: 86% reported Facebook to be the main source of information about COVID-19[46]
86%
International migrants in China: WeChat was used by 94.5% of respondents for COVID-19 information[45]
94.50%
0.00%
20.00%
40.00%
60.00%
80.00%
100.00%

Supplementary file 1

Online supplement 1: Search Strategy

We accessed the WHO COVID-19 Database using the following link:

<https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/>

We used the advanced search available at:

< https://search.bvsalud.org/global-literature-on-novel-coronavirus-2019-ncov/advanced/?lang=en >

We entered the following search terms into separate boxes linked by the 'AND' term. We specified that the following terms must appear in the title, abstract or subject.

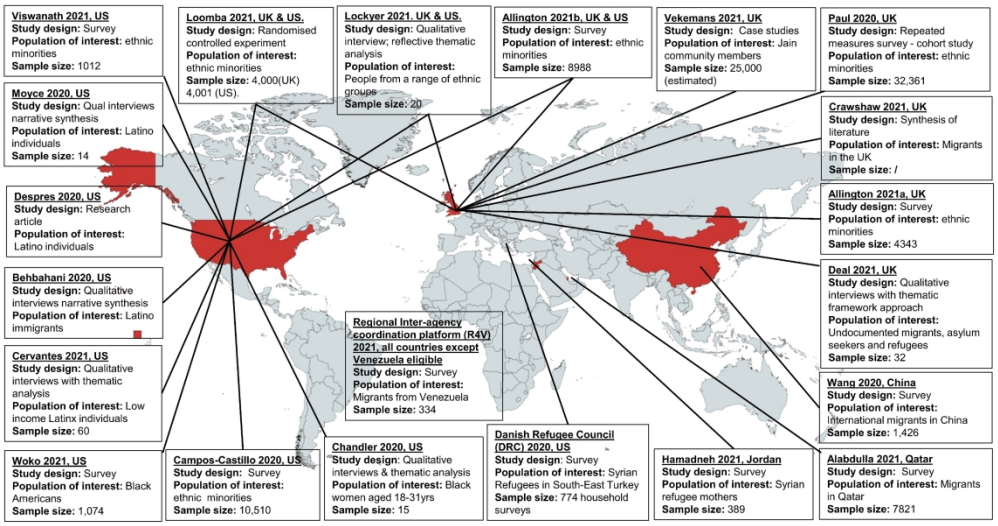
Migrant and ethnic minorities	Ancest* OR Diaspor* OR ethnic* OR Ethnoc* OR Ethnog* OR "Identity politics" OR Ingroups OR outgroups OR Intersectionality OR Kinship OR "Minority group*"~3 OR "minority population*"~2 OR minorities OR Multicultu* OR Polyethnic* OR "Population genetics" OR Race OR races OR racial OR Tribe* OR latino*) OR AB:(Ancest* OR Diaspor* OR ethnic* OR Ethnoc* OR Ethnog* OR "Identity politics" OR Ingroups OR Outgroups OR Intersectionality OR Kinship OR "Minority group*"~3 OR "minority population*"~2 OR minorities OR Multicultu* OR Polyethnic* OR "Population genetics" OR Race OR races OR racial OR Tribe* OR latino*) OR "afro american*"~3 OR BAME OR latino* OR roma OR romani OR refugee* OR immigrant* OR "migrant" OR "displaced person" OR "displaced persons" OR "social determinant*"~2 OR "latin population" OR "latin group*" OR "people of color" OR "people of colour"
AND	AND
Social media	social media OR social network OR online communit* OR online discuss* OR online communicat* OR online post OR messag* OR chat OR media OR misinformat* OR disinformat* OR malinformat* OR fake new* OR twitter OR whatsapp OR tweet OR post OR instagram OR reddit OR weibo OR sina OR youtube OR tiktok OR snapchat OR pinterest OR likee OR sharechat OR

	discord OR kuaishou OR wechat OR weixin OR qq OR telegram OR quora OR mobile app OR blog OR podcast OR hashtag OR antivax* OR vaccine hesitanc* OR web 2.0 OR online

No additional filters or limits were used.

The WHO COVID-19 Database gathers the latest international multilingual scientific findings and knowledge on COVID-19. The global literature cited in the WHO COVID-19 database is updated daily (Monday through Friday) from searches of bibliographic databases, hand searching, and the addition of other expert-referred scientific articles. This database represents a comprehensive multilingual source of current literature on the topic.

The WHO COVID-19 Database draws literature from the following databases: Embase, Web of Science, Oxford Academic Journals, PubMed NIH, Clinical Trials, China CDC MMWR, CDC reports, ProQuest Central (Proquest), CINAHL, Africa Wide Information (Ebsco), Scopus, PsycInfo, CAB Abstracts, Global Health, J Stage, Science Direct, Wiley Online Journals, JAMA Network, British Medical Journal, Mary Ann Liebert, New England Journal of Medicine, Sage Publications, Taylor and Francis Online, Springer Link, Biomed Central, MDPI, ASM, PLOS, The Lancet, Cell Press, and pre-print sites chemRxiv, SSRNbioRxiv, and medRxiv.



128x72mm (600 x 600 DPI)

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	P1 on bottom right hand side numbering
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	P2,3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	P3-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P6
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	P6,P7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	P6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	P6 and Supplementary File 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	P6,7
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	P6,7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	P7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	P7,8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	P7,8
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	P7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	N/A
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	N/A
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	P7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A – NOT DONE

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
			FORMALLY.
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A – NOT DONE.
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A – NOT DONE , NOT SUITABLE FOR THIS STUDY
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A – NOT DONE, NOT SUITABLE FOR THIS STUDY
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	FIGURE 1 IS REFERRED TO ON PAGE 8
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A – NOT DONE , NOT NEEDED HERE.
Study characteristics	17	Cite each included study and present its characteristics.	P8-9
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	P9
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	P10-P17; NOTE QUALITATIVE STUDIES ALSO INCLUDED
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	P10-17
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A – NOT QUANT SYNTHESIS
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A – NOT QUANT SYNTHESIS
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A – NOT QUANT

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
			SYNTHESIS
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A – NOT QUANT SYNTHESIS
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A – NOT QUANT SYNTHESIS
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	P18-20
	23b	Discuss any limitations of the evidence included in the review.	P18
	23c	Discuss any limitations of the review processes used.	P18-20
	23d	Discuss implications of the results for practice, policy, and future research.	P18-23
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	P3
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	P6
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A, NO AMENDMENTS
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	P24
Competing interests	26	Declare any competing interests of review authors.	P25
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	P23

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71
For more information, visit: http://www.prisma-statement.org/