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Barriers to equitable COVID-19 booster uptake among adults aged 50 and older in the UK: psychological factors and misinformation influencing vaccine hesitancy

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Abstract

Background The booster dose was developed to enhance protection against emerging strains of SARS-CoV-2. However, disparities in booster dose uptake persist, particularly among ethnic minority groups and socioeconomically disadvantaged populations, exacerbating existing health inequalities. Addressing these inequities is critical to ensuring equitable vaccine access and achieving global health security. The TRUST study aimed to bridge this gap by improving the effectiveness of future booster dose campaigns targeting specific audiences.

Methods Individuals aged 50 and above who had declined the booster dose and resided in London ($n=15$) and the West Midlands ($n=15$) were invited to participate in online qualitative interviews. These interviews delved into participants' attitudes towards COVID-19 vaccine booster doses and their encounters with misinformation related to COVID-19. Zoom recordings were transcribed using Otter.ai and subsequently imported into NVivo V.12 for thematic analysis.

Results Analysis revealed four primary themes: 'Vaccine production and administration', 'Health misinformation and beliefs', 'Personal circumstances and social influences', and 'Policy and logistical factors'. Key factors influencing vaccine hesitancy included mistrust in vaccine manufacturing, lack of culturally tailored communication, and logistical barriers to access. The role of social determinants emerged, as significant contributors to disparities in booster dose uptake.

Conclusion Future booster dose campaigns must integrate equity-driven approaches to overcome vaccine hesitancy and increase uptake among underrepresented populations. By prioritizing transparent communication about vaccine manufacturing and regulatory processes, these campaigns can build trust in the vaccine's safety and efficacy. Addressing misinformation with culturally sensitive messages tailored to diverse communities will help dispel misconceptions. Additionally, leveraging various communication channels will ensure that the messages reach and resonate with all audience segments. Establishing robust monitoring and adaptation mechanisms will enable timely responses to public sentiment and emerging concerns, ultimately

ensuring that vaccine distribution strategies contribute to health equity rather than perpetuate disparities.

Keywords Vaccine access equity, Vaccination reluctancy, COVID-19, Cognitive factors, Bias, Reasoning, Emotions

1 Background

The world, including the UK, was profoundly impacted by SARS-CoV-2 (COVID-19), the devastating viral disease affecting the respiratory system that began spreading across Europe in 2020 [1]. From a societal perspective, COVID-19 significantly disrupted the UK economy, supply chain, education, plus travel and tourism [2–4]. However, its effects were not evenly distributed, with certain communities experiencing a disproportionate burden due to pre-existing health and social inequities. One study revealed that areas such as Tower Hamlets in London and Wolverhampton in the West Midlands were more susceptible to COVID-19, experiencing a more severe impact due to pre-existing health and social inequalities, such as higher rates of chronic conditions (e.g., diabetes, cardiovascular disease), overcrowded housing, and reduced healthcare access [5]. To manage the spread of COVID-19, the UK government imposed lockdown periods from March 2020 to March 2021. Whilst one modelling study [6] found the lockdowns prevented thousands of deaths in England and Wales, they also revealed underlying structural inequalities, as disadvantaged communities faced greater barriers to healthcare access and vaccination. An alternative solution emerged as more effective: COVID-19 vaccines were estimated to have prevented 100,000 + deaths during the same period [7].

As new strains of the SARS-CoV-2 virus emerged, different manufacturers in the United Kingdom (UK) introduced a booster dose of the COVID-19 vaccine in September 2021 to provide individuals with extra health protection [8]. Individuals aged 50 + years were prioritised for booster doses due to their increased risk of severe disease [9]. The UK government recommended that the booster dose should be administered six or more months after the primary vaccination, with this waiting period halved to three months at the end of November 2021 [8]. The initial booster dose was free, with 50 + year old individuals able to access them by contacting a local community pharmacy or by receiving an invitation from the GP [10]. The booster dose vaccine is administered across pharmacies, hospital hubs, GP practises and vaccine centres [10].

Upon initial review, the UK's vaccination programme appeared successful as, on average, people aged 75 + years received six doses, and people aged 50–74 years received four doses [5]. However, these figures were somewhat misconstrued due to differences in vaccine uptake across ethnicity and socioeconomic status. For example, the same report found vaccination uptake for people aged 75 + years to be split across ethnic groups: 90% White, 67% mixed, 56% South Asian, and 49% Black. Additionally, other studies also found lower educational qualifications and socioeconomic positions increased booster dose hesitancy [11]. Vaccine hesitancy is commonly defined as a delay in acceptance or refusal of vaccination despite availability of vaccination services. According to the World Health Organization, hesitancy is influenced by factors such as confidence (trust in vaccine safety and effectiveness), complacency (perceived low risk of the disease), and convenience (accessibility of vaccines), known as the '3Cs' model [12]. More recent frameworks, such as the '5 C' model [13], further expand these determinants to include constraints, calculation, and collective responsibility, thereby capturing a broader range

of cognitive and social influences on vaccine decision-making [14]. These inequalities emphasized a need to identify factors associated with COVID-19 booster dose intentions, specifically in underrepresented populations. Structural barriers—including limited healthcare access, vaccine misinformation, and logistical challenges—played a critical role in shaping vaccine decisions, particularly among underrepresented groups [15, 16]. However, there is limited qualitative research examining attitudes toward COVID-19 booster doses among adults, particularly in ethnic minority populations [17].

To address the gap in understanding booster dose attitudes, the TRUST study (Thematic Analysis Research to Unravel Hidden Signals to Measure Attitudes Towards Vaccine Boosters) was conducted. This study aimed to explore and understand the underlying factors influencing COVID-19 booster dose uptake through a qualitative approach. The development of the interview guide was informed by established behavioural science frameworks, particularly drawing on constructs such as attitudes, social norms, and perceived behavioural control, which are recognized as critical determinants of health-related decision-making [18]. Additionally, the design was guided by broader behavioural science principles that emphasize the systematic identification of cognitive, emotional, and contextual factors influencing behaviour [19], ensuring a comprehensive exploration of vaccine hesitancy. The study employed a strategic data collection method focusing on participants from two socioeconomically deprived areas in the UK—West Midlands and London. These regions, characterised by high ethnic diversity and significant impacts from SARS-CoV-2 (COVID-19 [20, 21]), served as the basis for the analysis of booster dose uptake. The qualitative approach aimed to gather in-depth insights into the attitudes, beliefs, and barriers faced by individuals in these communities, specifically addressing a gap in prior literature, which has rarely explored booster dose hesitancy among adults aged 50 and above residing in socioeconomically deprived UK regions. This study delved into the cognitive factors and reasoning patterns behind individuals' choices to receive or reject COVID-19 booster doses, focusing on aspects not adequately covered in previous literature. The study aimed to provide evidence-based insights for designing equitable, community-centred vaccine campaigns that promote health security and reduce inequalities.

2 Methods

2.1 Study design

This study employed a descriptive and inductive qualitative design using semi-structured interviews. This study was conducted across two geographical locations: London (particularly South and East London) and the West Midlands (particularly Wolverhampton) [22]. These areas were chosen based on their low uptake rates (Fig. 1) for the booster dose [7].

The Prolific Academic demographic pre-screen tool was used to select participants from these areas, with priority given to individuals from an ethnic minority background and with lower levels of educational achievement. Prolific Academic is the world's largest community of people interested in scientific research. We used this platform to advertise the present study and recruit eligible participants. Upon registration, Prolific users enter detailed socio-demographic information. This allowed us to target and invite eligible participants to the present study using the Prolific internal recruitment system. Participants who expressed an interest in the study were then invited to take part in a

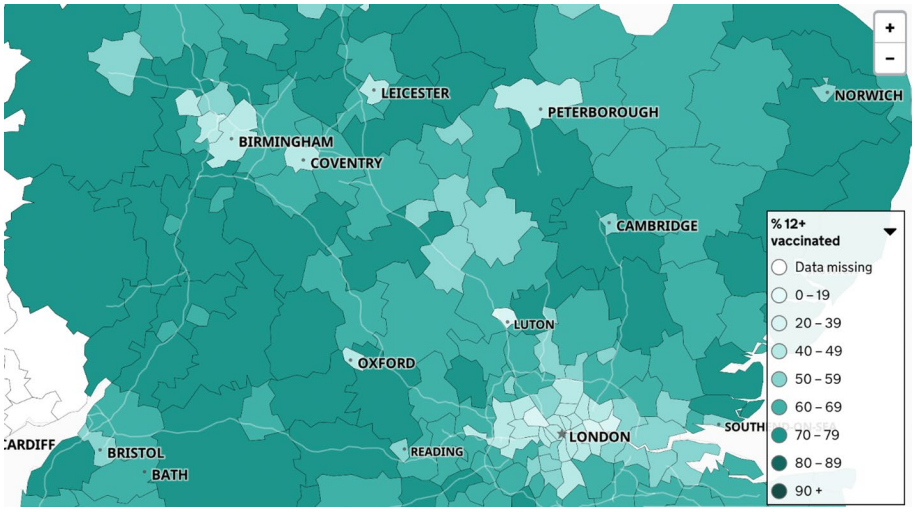


Fig. 1 Overview of COVID-19 booster dose uptake in the UK: Percentage of individuals aged 12 + who received a booster dose as of 13 December 2023. Participants in this study were from two socioeconomically deprived areas: Wolverhampton (North West of Birmingham; 47.7%) and Croydon (South London; 39.6%). (Source: coronavirus.gov.uk)

1–2 h interview slot via Calendly. Participants were financially compensated (£50) upon interview completion.

The study protocol was conducted in compliance with all relevant ethical guidelines and regulations, including the Declaration of Helsinki and the General Data Protection Regulation (GDPR). Ethical approval was obtained from the Ethics Committee of St. Mary's University Twickenham, London (United Kingdom) on 15 May 2023 (Approval code: SMU_ETHICS_2022-23_273). All participants provided written informed consent before taking part in the study, and participants additionally consented to the use of their anonymised data in resulting publications. All authors provided consent for the publication of this manuscript.

Participants were included if they met the following criteria: aged 50 + years; had not yet received a COVID-19 booster dose; contributed to an appropriate spread in terms of geographic and socio-economic status; and able to speak in English. Individuals were excluded from the study if they were unable to provide written informed consent. We asked participants to provide informed, written consent before joining the study. Ethical approval for this study has been obtained from St Mary's University, Twickenham (approval code: SMU_ETHICS_2022-23_273). Clinical trial number: not applicable.

A semi-structured interview guide was developed that included questions on participants' perceptions of, and attitudes towards, COVID-19 booster doses plus interactions with misinformation during COVID-19. Participants were also asked questions seeking socio demographic information and verbally confirmed their original COVID vaccination status during the interview. The interview guide included original, newly developed questions, which had not been published or used elsewhere (Appendix 1).

All semi-structured interviews were conducted online via Zoom from August-November 2023.

2.2 Data analysis

Participant interviews were recorded via Zoom and then saved as an audio file. Otter.ai software was used to transcribe all audio files, with the resulting transcript cleaned by an independent researcher. Two independent researchers read the transcripts at different timepoints to gain a familiarity and understanding of the data. NVivo V.12 Plus software was used to import, organise and explore transcripts for thematic analysis [23]. An iterative process was used to identify label data and create new categories to establish emerging themes. Text in each transcription was divided into shortened units and labelled as a "node" to ensure information is conveyed authentically. Each node was analysed and grouped into comparable categories, which were then grouped into subthemes and final themes. Categories were then coded as "general" (all or all but one case), "typical" (half or more than half of the cases) and "variant" (less than half of the cases). Please see Appendix 2 and 3 for a visual representation of how we conducted the analysis on NVivo. Two independent researchers conducted the coding, category grouping and thematic analyses to maintain inter-rate reliability. Any differences of opinion between the two independent researchers were resolved in a group meeting to prevent researcher bias.

3 Results

We recruited 30 individuals from London ($n = 15$) and the West Midlands ($n = 15$). The median participant age for those recruited from London was 55 years and 59 years for West Midlands. Most participants were female in both London (10/5) and West Midlands (9/6). Regarding education levels, most participants were "higher" (LDN = 8; WM = 8), followed by "Compulsory" (LDN = 4; WM = 6) and "Further" (LDN = 3; WM = 2). Full breakdown of participant characteristics can be found in Table 1.

Several of the identified themes—such as mistrust in vaccine production, logistical barriers to access, and reliance on misinformation sources—are reflective of deeper structural and systemic inequities, particularly those affecting socioeconomically disadvantaged and ethnically diverse populations.

The categories of and their codes (general, typical, or variant) are displayed in Table 2. In the following sections, we focus on the results from each of the five primary themes.

3.1 Themes

3.1.1 Vaccine production and administration

Vaccine production was a key emerging theme from discussions about booster dose hesitancy. Many participants expressed their concern about how and why the booster dose was manufactured, with particular emphasis on the speed of its rollout, the ethical priorities of pharmaceutical companies, and mix-matching booster doses. These concerns reflect broader systemic issues related to transparency, trust in health institutions, and the commercialization of public health interventions, which disproportionately impact marginalized groups with historical experiences of medical mistrust. This theme was especially relevant in the context of prior experience with pharmaceutical companies, levels of epistemic trust, and health beliefs.

"I think the vaccine in general for me is something that is a bit of a lottery. It's something that felt … rushed." West Midlands participant 15.

Table 1 Frequency table of full participant sociodemographic characteristics

Sociodemographic characteristic	Category	Frequency (*n*)
Location	London	15
	West Midlands	15
Gender	Female	21
	Male	9
Age Group	50–59	19
	60–69	9
	70+	2
Education Level	Compulsory	7
	Further	6
	Higher	17
Occupation (Current)	University Lecturer	3
	Healthcare (including Nurse Manager)	2
	Civil Service	2
	Finance & Banking	2
	People Manager	2
	Other professional (e.g., artist, TV)	4
	Social care/community roles	3
	Retail	3
	Teaching	1
	Unemployed/Retired	7
	Other	1
Living Situation	House	21
	Flat/Apartment	5
	Flat rental	4
	Social housing	1
Religious Belief System	Christian	9
	None	7
	Agnostic	4
	Jewish	1
	Islamic	2
	Buddhism	1
	Hinduism	1
	Atheist	1
Ethnicity	White (including British/Irish)	19
	Black Caribbean	4
	Black African	2
	Bangladeshi	1
	Pakistani	1
	Indian	1
	Mixed ethnicity	2
Long-term Health Condition	Yes	17
	No	12
	None reported	1
General Health Rating	Very good	4
	Good	14
	Average	7
	Bad	2
Received initial COVID-19 vaccine*	Yes	21
	No	9

*All participants provided verbal confirmation of their original COVID vaccination status during interviews

Table 2 List of themes and categories

Themes	Category	Frequency
Vaccine production and administration	Manufacturing	General
	Mix-matching doses	Typical
	Needle phobia	Variant
	Prior vaccination experience	Variant
	Side effects	Typical
	Vaccine efficacy	Variant
Health misinformation and beliefs	Pre-existing health beliefs	Typical
	Health knowledge	Typical
	Health misinformation	Variant
	Information sources	Typical
	Public health messaging	Variant
	Lack of healthcare knowledge	Variant
Personal circumstances and social influences	Comorbidities	Variant
	Conspiracy theories	Variant
	The role of family and friends	General
	Influential figures	Variant
	Ethnicity	Variant
Policy and other logistical factors	Policy and UK Government	Typical
	Lockdown	Variant
	Logistics	Typical

"It was a lot about targets and finances, profits for pharmaceutical companies… I don't think it was in any way related to people's health and well-being, in my opinion." London participant 4.

Many participants also described vaccine administration as a key underlying factor of booster dose hesitancy, particularly when considering side effects, vaccine efficacy, and prior vaccination experience. Side effects were a common occurrence when participants received the original COVID-19 vaccine, with this negative experience contributing to their refusal of the booster dose. Negative prior experiences, amplified by limited culturally sensitive communication about vaccine safety, highlight how systemic barriers in public health messaging can deepen mistrust and hesitancy, particularly among vulnerable populations.

This viewpoint was also supported by friends and family who experienced adverse reactions to the booster dose. Regularly receiving the booster dose on a seasonal basis also called into question the effectiveness of the booster dose. Additionally, some participants had a needle phobia which re-enforced their belief that the booster dose was not necessary.

Ultimately, these experiences led participants to believe that the booster dose did more harm than good and was not worth taking due to the limited amounts of health protection offered.

"I didn't react that well… I was quite weak after that first jab. So that probably didn't help in my thinking that I would be keen for the booster." London participant 1.

"My partner, interestingly, has had his boosters, but it didn't seem to make any difference. He got COVID as well." London participant 12.

Another issue is that I've got a phobia of needles as well, so you know, that plays a part in my decision. You know, I'd only take it if they're 100% necessary, and I didn't feel that this was 100% necessary." West Midlands participant 10.

3.1.2 Health misinformation and beliefs

We asked participants a range of questions about health misinformation. Some participants felt that the amount of information on COVID was overwhelming and confusing. The quality of information would often differ between platforms, with social media sites (e.g., Facebook, YouTube, and Twitter) often used by participants to gain an alternative viewpoint, whereas more traditional media outlets (e.g., newspapers, TV, and radio) and research platforms (e.g., BMJ and PubMed) typically provided more trustworthy information. Additionally, participants also described a lack of diversity and cultural appropriateness in public health messaging which further contributed to their refusal to take the COVID vaccine.

The uneven distribution of reliable information, combined with unequal digital literacy, represents a structural barrier that can exacerbate confusion and vaccine hesitancy, especially in communities with historically lower access to health education resources.

"I was looking at the BBC News website, and possibly the NHS website as well, sort of trusted sources that I would go to". West Midlands participant 10.

"Social media is a good way to look at different views". West Midlands participant 8.

"It's very tricky, you know, as just a regular person to feel that you're informed. Because there's so many contradictory messages out there." West Midlands participant 3.

"I only went on the government website and the NHS. I'm not a big social media person." London participant 10.

"I used to watch Chris Witty and the other guy, Vons. It was just a host of men with grey hair telling you to get vaccinated., I wouldn't listen to it". London participant 10.

Health beliefs emerged as another important theme on vaccine hesitancy. Health beliefs encompass the attitudes, perceptions, and understandings individuals or communities hold regarding health-related concepts, including scientific processes. Most participants believed that their natural immunity and good health would offer sufficient protection against COVID, thus reducing the need for a booster dose. This reliance on personal health beliefs rather than institutional advice underscores how systemic inequities in trust-building and culturally responsive communication can lead to disparities in health behaviours. A few participants also mentioned that they never received the original COVID vaccinations and therefore did not take the booster dose.

"I wouldn't have probably had the first few vaccines, and it was only because of my elderly parents and things like that, not just my own parents but my wife's parents as well. Because I personally feel I have quite a good immune system. And I know a couple of people who I work with that haven't taken even the first two jabs." London participant 1.

"I've never taken the COVID Jab anyway. I'm a little bit sceptical and suspicious." London participant 2.

3.1.3 Personal circumstances and social influences

Most participants mentioned that a combination of social and personal influences had an impact on their decision to refuse the booster dose. In relation to this theme, participants discussed the role of family and friends, as well as comorbidities, conspiracy theories, and influential public figures.

"So from family members and friends now? none of them want the booster. So we're sort of all singing from the same hymn sheet. So there has been no pressure you know for any of us to actually have the booster". London participant 4.

"I've spoken to people that now believe … that it is a big conspiracy, because the government weren't taking it seriously. So it's almost backed up their beliefs that it isn't real". West Midlands participant 15.

"Novak Djokovic, the tennis player. Now, he relates to this quite heavily. He's an advocate of not having any of the vaccinations. Now he's an elite sportsman and he doesn't want to have any chemicals in his body which could potentially affect him in his performance in some way, whether it's to do with his sporting prowess or his general health and fitness. So I can kind of see his point of view." West Midlands participant 12.

Interestingly, a few participants were concerned about how their decision to refuse the booster would influence the health behaviours of close family members with comorbidities.

"I am really glad they will offer (the booster dose) it to my husband. And I think he will have it. Whether he'll be influenced by me not having it I don't know. But because his condition is quite bad with his breathing I think he will have it. But I'm glad I haven't got that." West Midlands participant 11.

Participants from minority ethnic groups (e.g., Bangladeshi, Pakistani and Black African) described how their ethnicity contributed to their refusal of the booster dose. Some participants felt that their health status and ethnicity may result in side-effects, contributing to greater hesitancy to receive the booster dose.

"At the beginning of the pandemic, I felt I was considered high risk due to my health, weight, and (Black Caribbean) ethnicity. I was scared to take it, thinking what if I react badly." London participant 8.

Religious and cultural beliefs further influenced booster dose hesitancy, with participants expressing uncertainty about whether the booster dose's design and manufacturing was compliant with their faith. Additionally, public health messaging was viewed as overly generic and inaccessible for those with limited English proficiency. As one Bangladeshi participant from London described:

"Because we're Muslim, we had to also look at what is it made with. Is it compliant with our religious beliefs?… we were very unsure if it was religiously appropriate or not" and "… the messages and support were not tailored to ethnic communities… even the logistics… it was very generic… my aunt doesn't speak a word of English" London participant 3.

3.1.4 Policy and other logistical factors

A few participants mentioned government and professional policy to influence their vaccine hesitancy. This topic of discussion focused on the mandatory requirement to receive the original vaccinations set by the UK government (for travel purposes) or workplaces such as the NHS, alongside the nationwide lockdown periods. Participants expressed their dissatisfaction with these policies, with some even viewing it as an infringement of their human rights whilst others believed that the "herd immunity" approach adopted by countries such as Sweden, would have produced greater health protection.

"There was tremendous pressure at work (NHS). I could lose my job if I didn't take it. I had people come at me from all sides in a very aggressive manner and but also the biggest act and that didn't even faze me, the biggest factor for me was not being able to see my family. And that's the only reason why I actually took the vaccines was I needed to travel to see my family." London participant 4.

"We are supposed to have a liberal country. People have fought and died you know, including members of my family were in the military and they will be absolutely rolling over in their graves to see that we were actually forced to take vaccines you know and not given not given a choice. And it created such an atmosphere and workspaces, there was tremendous amounts of bullying, tremendous amounts of pressure. And I can honestly say I was traumatised by it." London participant 11.

"You're talking about herd immunity, aren't you? So if you look at the Swedish model, they went for herd immunity. And at first they had more deaths than we did. But I've read some research, actually only last week, that says, overall, Sweden per capita did better than we did." West Midlands participant 13.

Logistical factors, such as travel to the COVID vaccination facility, was another reason behind participants' decision to refuse the booster dose.

"The access points for the booster vaccines were terrible. It was terrible. Because it was just like you know, people were sent like miles away, they had to travel miles. That was a common experience of a few people I've spoken where they had to take like two or three buses in order to get one" London participant 9.

4 Discussion

The study aimed to identify the factors that underpin predictors of hesitancy to receive a COVID-19 booster dose. Several of the identified themes—such as mistrust in vaccine production, logistical barriers to access, and reliance on misinformation sources—appear to reflect broader structural and systemic inequities that are known to affect socioeconomically disadvantaged and ethnically diverse populations. Although our study did not stratify participants by demographic characteristics, the diversity within our sample allowed us to capture a range of experiences that are consistent with existing evidence on health inequities. In the following sections, we explore several key themes that emerged from the data and offer psychological interpretations.

4.1 Influence of COVID-19 booster dose production and rollout

We asked participants about how vaccine production and administration contributed to their decision to refuse the booster dose. This theme had the joint-most number of categories and the largest volume of text in the interviews, with vaccine manufacturing emerging as the only general category. This theme was expressed by all participants across both geographical locations and highlights a number of concerns especially among ethnic minority groups with historical experiences of medical discrimination, further fuelled vaccine hesitancy [24]. These include the ethical priorities of pharmaceutical companies (e.g., profit over people), lack of safety due to the speed of the COVID-19 vaccine rollout, and scepticism caused by a perceived lack of transparency in the manufacturing and regulatory processes. Similar results are also reported by other studies on vaccine hesitancy [15, 16]. In particular, one qualitative project linked concerns about rollout speed with difficulty understanding the pace and potential implications on vaccine safety [25]. Addressing these concerns may be an effective way for future booster dose campaigns to alleviate a number of fears surrounding vaccine manufacturing.

Two typical themes also emerged from this domain: side-effects and mix-matching doses. Here, participants were fearful of experiencing an adverse reaction after receiving the booster dose and/or doses from different pharmaceutical companies. Several

reasons explain this outcome. These include the unexpected side effects when taking the original COVID-19 vaccine(s), witnessing adverse reactions among close family and friends, and a fear of long-term health implications after taking the booster dose. Our findings are supported by existing research [26, 27] and explained with more nuance by using a psychological concept known as "pharmacophobia." Pharmacophobia describes a fear of experiencing adverse side effects when taking a pharmaceutical product [28]. Symptoms can be equally present among undiagnosed individuals, with literature finding it a predictor of vaccine hesitancy [28]. Addressing pharmacophobia may therefore present a possible method to alleviate fears of potential side effects and improve vaccine willingness.

Lastly, vaccine efficacy, prior vaccination experience, and needle phobia were the three variant categories in this domain. First, several participants expressed their concern about the levels of health protection provided by the booster dose. This result was unsurprising as other studies also found the unreliability of clinical trials to be a significant factor in COVID vaccine refusal [29]. Second, a few mentioned that they refused to take the booster dose as they do not take vaccines in general. For instance, one study found nearly half (48.2%) of participants who typically refused the flu vaccine also declined the COVID-19 vaccine [30]. Vice versa, one study found participants who had received the flu vaccine were 5.18 times more likely to take the COVID-19 vaccine [31]. This suggests that improved general vaccination behaviours may lead to positive spillover effects [32], and it is no surprise that the UK now offers the booster dose and flu jab together [21]. Last, two participants from West Midlands found the process of injecting the vaccine to be too distressing. This outcome is supported by relevant literature, which finds a fear of medical procedures (notably vaccine injection) to be a significant determinant of COVID-19 vaccine hesitancy [33].

4.2 Healthcare misinformation and beliefs

We asked participants a range of questions about their existing healthcare knowledge and beliefs. Those with limited access to reliable health information were more likely to endorse misinformation, exacerbating disparities in vaccine uptake. As participants were sourced from socially deprived locations, we can assume that this may have been exacerbated by a low socioeconomic status [34]. This domain had the equal-most number of categories, with three typical themes reported. These included pre-existing health beliefs, healthcare knowledge, and information sources. First, some participants felt that their natural levels of immunity provided adequate health protection against COVID, thus reducing a need for a vaccine. This outcome is supported by one study, which found nearly half (44.7%) of participants suggesting that natural immunity may be better than a vaccine [11]. Second, some participants felt overwhelmed and confused by the amount of information on COVID. The concept of "information overload" has been known to cause COVID vaccine hesitancy, with this relationship mediated by cyberchondria and perceived vaccine risk [35]. Last, participants used a range of information sources to learn about COVID. Social media sites were often used to gain alternative perspectives, whereas more traditional media outlets and research journals provided more reliable information. One study observed social media sites to increase COVID-19 vaccine hesitancy, whilst the opposite effect was reported for institutional websites [36]. Most debates on social media are reported as anti-vax and sharing false information [37, 38].

To reduce vaccine hesitancy, greater emphasis must be placed on sharing scientifically reliable information on social media, in addition to encouraging the use of institutional websites.

The only variant themes that appeared in this domain were healthcare misinformation, public health messaging, and lack of healthcare knowledge. The relationship between misinformation and vaccine hesitancy is complex [39] as literature associates different types of misinformation with unique vaccine hesitancy-related attitudes [40]. Notably, this relationship is strongest when involving politics, religion, and media. When these types of misinformation are present, medical and scientific approaches may not be adequate. Participants also mentioned that the lack of cultural appropriateness in public health messaging contributed to their vaccine hesitancy. This outcome matches the results of other studies, in which a more generalised approach to public health messaging typically resulted in a particular lack of synergy with Black communities, certain religious groups, and people living in deprived areas [27, 41]. Ensuring cultural appropriateness in future booster dose campaigns may be an effective way to mitigate these disparities. Lastly, only two participants described a lack of healthcare knowledge to influence vaccine hesitancy, with other studies reporting similar results [42, 43].

4.3 Vaccine hesitancy on a personal level

We asked participants about how personal circumstances and social influences impacted vaccine hesitancy. Here, family and friends emerged as the only general category in this domain, whereby participants mentioned a lack of pressure within their inner circle to get vaccinated as all collectively agreed to refuse the booster dose. Similar findings were also reported in one qualitative study where these types of discussion would typically result in lower trust in the government, plus more doubts about vaccine safety and efficacy [44]. Additionally, some participants only received the original vaccine when it was a mandatory requirement to see vulnerable family members. This reason for vaccination is also reported by Giebel et al. [45]. We also found that the link between vaccine hesitancy and the influence of family and friends is bi-directional. For instance, participants mentioned that they refused to share their true vaccine intentions due to fears of being bullied by peers. Whilst participants still refused the booster dose in light of this social stigma, literature finds it to be a common catalyst for unwanted COVID vaccination [46, 47].

Whilst no typical responses were documented, we found three variant responses in this domain. These included comorbidities, conspiracy theories, and influential figures. Some participants believed that the booster dose may negatively interact with existing health conditions. This result was expected as literature finds, on average, one in five individuals with serious comorbidities to report vaccine hesitancy [48]. Conspiracy theories also contribute to vaccine hesitancy, with one study finding it to have the largest effect [49]. Three participants also stated that the seemingly anti-vax views shared by public figures re-enforced their stance to not take the booster dose. Additionally, three participants mentioned Novak Djokovic's stance against COVID vaccination [50], which implies that the prominence of certain public figures may encourage individuals to align with their viewpoints.

4.4 The role of the UK government and policy

Lastly, we looked at the role of the UK government as we were curious to learn about how policy impacted vaccine hesitancy. Despite the UK government playing a central role in the public health messaging of the booster dose, no general theme emerged in this category. Instead, policy and UK government appeared as a typical theme. Participants reported dissatisfaction with the mandatory requirement to receive the original vaccinations set by the UK government (for travel purposes) or workplaces such as the NHS. This outcome was somewhat expected as studies have found mandatory COVID-19 vaccination to increase public mistrust in government and vaccine hesitancy, with some individuals describing it as an infringement of human rights [51].

The lockdown periods appeared as another typical theme in this domain. Here, participants questioned the level of health protection provided by the lockdowns, particularly in comparison to the "herd immunity" approach adopted by other European countries such as Sweden, which produced favourable results [52]. Participants also raised concerns about the negative impact that this had on psychological wellbeing. Most participants described the lockdown periods as unnecessary and counterproductive, leading to increasing mistrust in the UK government and eventual vaccine hesitancy.

4.5 Psychological interpretations of key themes

4.5.1 Vaccine production and administration

Participants' previous encounters, as well as those of their friends and family, with side effects from the original COVID-19 vaccine strongly influenced their hesitation towards the booster dose. The vividness and ease of recalling these negative experiences likely played a pivotal role in their decision-making, aligning with the availability heuristic [53]. This bias refers to the tendency of individuals to base their judgments and decisions on information that is easily accessible or readily available in their memory [53]. These persistent concerns about side effects and efficacy from these past incidents might disproportionately shape their perceptions of the risks and benefits associated with the booster dose, potentially impacting their decision to accept or decline it in vaccination. This bias could lead individuals to give undue importance to negative memories or easily remembered information, influencing their overall judgment regarding vaccination.

4.6 Health misinformation and beliefs

The concept of Epistemic Trust emerged as a critical factor influencing individuals' behaviours and attitudes towards COVID-related information and vaccination. Epistemic Trust refers to the confidence or trust people place in the sources providing them with knowledge or information. It directly impacts their beliefs, decision-making, and actions based on the information received [54].

The perception and definition of science can also be conceived as a health belief that impacted vaccination and is related to the theme: "Vaccine production and vaccination". The understanding of science, particularly in relation to health, forms a part of these beliefs. For instance, beliefs about scientific methods, such as whether science requires time and rigorous testing to achieve reliable results, constitute a health-related belief. This viewpoint influences decisions concerning healthcare practices, treatments, and preventive measures. For generations, our communities have passed down a story that science demands time and patience—a tale ingrained within the collective unconscious.

This narrative highlights the understanding that scientific discoveries often unfold gradually, necessitating meticulous research and careful consideration. However, the advent of the COVID-19 vaccine presented a contrasting narrative, telling a story of science's rapid pace. It conveyed the message that swiftness in scientific innovation equates to precision. It conveyed the message that swiftness in scientific innovation equates to precision. However, this updated narrative has not yet been fully absorbed into people's existing cognitive schemas, as many individuals remain anchored to long-standing beliefs that scientific processes require lengthy development to be reliable [17]. As such, the transition from the belief in science as a deliberate, time-consuming process to one characterised by rapidity and precision is a shift that has not fully permeated this shared realm of our community's unconscious beliefs and values.

4.7 Personal circumstances and social influences

Social and personal influences intersect with broader systemic issues, as individuals embedded in communities with higher exposure to misinformation, lower access to healthcare, and historical medical neglect may face compounded barriers to vaccine uptake. In these responses, the presence of the "bandwagon effect" is apparent [55]. Participants' comments reveal a shared consensus within their social circles or influential figures about refusing the booster dose. This alignment with the beliefs and choices of those around them fosters a sense of unity within the group. For instance, one participant noted the lack of pressure within their circle to get vaccinated, indicating collective agreement in rejecting the booster dose. Additionally, mentioning Novak Djokovic's anti-vaccination stance highlights how people may align their views with influential figures, influenced by their prominence. Moreover, some participants expressed concerns about potentially impacting the health decisions of family members, suggesting a worry about conforming to the group's decisions. These instances illustrate the influence of group beliefs on individual decision-making, showcasing the impact of the bandwagon effect or groupthink on attitudes towards vaccination.

4.8 Policy and other logistical factors

The psychological aspect apparent here is "reactance." This occurs when individuals feel their freedom or independence is being restricted, leading to a strong emotional reaction against perceived control [56]. Mandatory vaccination policies and logistical barriers such as limited access points disproportionately affect individuals from lower socioeconomic backgrounds, reflecting systemic inequities in healthcare accessibility and autonomy. These systemic issues contribute significantly to vaccine hesitancy among marginalized groups. In this case, participants showed dissatisfaction with government and workplace policies mandating vaccination, feeling it infringed upon their rights. They expressed resistance due to the pressure felt, trauma, and perceived bullying in their workplaces. Additionally, logistical issues like travel inconvenience to vaccination sites also influenced their reluctance to get the booster dose. Overall, reactance played a role in their resistance to enforced vaccination policies and practical.

4.9 Possible directions for future booster dose campaigns

Based on the categories, subthemes and themes that the present study identified, we are able to target the relevant literature and produce a number of evidence-based

recommendations on how to address vaccine hesitancy and tailor future booster dose campaigns to specific audiences. To ensure equity, these strategies must not only aim to increase uptake overall but also prioritise access, trust, and cultural relevance for historically underserved and marginalised groups. Addressing systemic barriers and social determinants of vaccine access must be central to these interventions. Social determinants of vaccine access refer to the non-medical factors that influence an individual's ability to receive vaccination, including socioeconomic status, education level, language barriers, transportation availability, and trust in healthcare systems. Equitable interventions acknowledge and actively address these disparities by providing resources and messaging that are tailored, inclusive, and accessible to communities most at risk of being left behind. For instance, in our study, family and friends had a profound impact on participants' decision to decline the COVID-19 booster dose. This decision may be influenced by the conversations participants had with vaccine-hesitant family members and friends, who could have projected their own COVID-related conspiracy beliefs, such as anti-vax views. Literature finds anti-vax views to be closely associated with misinformation and increased vaccine hesitancy [57]. Raising awareness on anti-vax views and its contribution to the spread of COVID misinformation should be a key point of consideration for future booster dose campaigns. To ensure equity, public health campaigns must not only counter misinformation broadly but also work within social networks in communities where misinformation is most pervasive, particularly those with lower levels of institutional trust or digital literacy. Social networks can serve as amplifiers of vaccine-related misinformation, particularly in marginalized communities. Given that anti-vax views are more commonly reported amongst diverse populations [58], this could be an effective route to addressing vaccine hesitancy among specific audiences.

Vaccine manufacturing was another major reason behind participants refusing the booster dose. In particular, participants raised questions about the ethical priorities of pharmaceutical companies and booster dose safety. One evidence-based way to address these issues is through public health messaging [59]. First, we recommend re-writing the narrative that pharmaceutical company's priorities monetary profit over tackling health inequalities [59]. This can lead to mistrust, whilst also being untrue given their substantial involvement in the COVID-19 crisis. Equitable messaging would highlight pharmaceutical efforts that have supported vulnerable communities, especially in low-resource settings, thereby rebuilding trust among populations historically underserved by health system. Public health messaging should emphasize these initiatives, particularly those helping the most vulnerable populations [60] to challenge misconceptions and build trust in the industry's commitment to tackling health inequalities. Additionally, safety concerns due to the speed of the COVID-19 vaccine rollout can be alleviated by bringing more transparency in the manufacturing and regulatory processes.

Furthermore, participants cited healthcare misinformation as a key factor underlying vaccine hesitancy. Most healthcare misinformation is spread via social media, which is unsurprising given the large online community of anti-vaxxers [61] and lack of medical professionals using these sites [62]. The lack of authoritative voices from the scientific community creates an environment with little quality control and accountability, and so it is unsurprising that many people experience confusion when trying to learn about the booster dose. Involving authoritative figures from the scientific community into these discussions may help establish more reliable and trustworthy sources of information

[63]. Additionally, to be equitable and more synergistic with diverse populations, public health campaigns must incorporate culturally competent strategies that reflect the values, languages, and concerns of different communities [64]. This may result in these groups becoming more scientifically informed and less likely to spread misinformation within their social circles. This not only increases understanding but shows respect for lived experiences, making individuals more likely to trust and act on the information provided. Community-driven initiatives should be prioritized. Partnering with religious institutions, local advocacy groups, and trusted figures—such as community health workers—can help dispel misinformation and improve vaccine confidence. These locally embedded strategies ensure that outreach is not only widespread, but context-sensitive and inclusive—key markers of equity in public health communication.

4.10 Limitations

Our results should be viewed in light of certain limitations. First, we were only able to confirm that participants had not received the booster dose through written consent. Whilst providing evidence of vaccination status via the NHS app may be more official, all participants stated that they had never downloaded or used the NHS app. Second, while an in-depth analysis of how views on the original vaccine compare to the booster dose would have been interesting, it was not the primary focus of the present study. Nonetheless, participants perceived both types of vaccinations similarly. Third, despite prioritising individuals with lower levels of education, our participants had a wide range of education levels. This may have been due to using only one recruitment platform, however, given the overlap in participant responses, we can assume that reasons underlying booster dose refusal may be universal. Fourth, most participants were White, and whilst we managed to gain interesting cultural insights on the booster dose by individual from minority ethnic groups, we recommend future research gives further focus to the views of diverse audiences. Furthermore, as participation required sufficient English proficiency to complete an online interview, individuals with limited English language skills—who are often disproportionately represented among certain ethnic minority groups—may have been excluded. This may have restricted the diversity of perspectives included and limited the generalisability of findings to non-English-speaking populations.

5 Conclusions

In our study, qualitative interviews with a diverse cohort revealed key insights into the factors influencing individuals' decisions to refuse the COVID-19 booster dose and original vaccines. Notably, transparency in vaccine manufacturing emerged as crucial, emphasising the need to increase transparency throughout the entire manufacturing process, from development to distribution, and provide clear information on regulatory approvals, quality control measures, and safety protocols. Additionally, addressing healthcare misinformation and beliefs was identified as paramount, necessitating the enhancement of cultural appropriateness in public health messaging. Education on vaccine development and safety played a vital role, with recommendations to clarify misconceptions regarding profit prioritisation over safety and highlight rigorous safety protocols during development and manufacturing. To alleviate concerns about vaccine efficacy, the study emphasised the importance of sharing real-world data and success

stories of booster dose recipients. Furthermore, the necessity of tailored messaging for specific audiences was underscored, urging the utilisation of diverse communication channels to reach various communities effectively. Continuous monitoring and adaptation were deemed essential, urging the establishment of feedback mechanisms to monitor public sentiment and address concerns promptly. Collaboration with public health authorities was advocated, promoting peer-to-peer communication and encouraging sharing positive vaccination experiences. Lastly, the importance of research and evidence-based communication was highlighted, suggesting the utilisation of evidence-based information to enhance credibility and trustworthiness in communication efforts.

Appendix 1: Interview questions

PART 1- demographic information

1. What is your age?
2. What is your gender?
3. Highest level of education achieved?
4. Current occupation?

    a. How long have you been in this role?

5. Which is your postcode (optional)?
6. Are you suffering from any long-term or chronic health conditions?
7. How is your health, in general?

PART 2-

1. **What are your perceptions about Covid-19 vaccination booster?**

Prompts.

a. Can you tell me if the Covid-19 vaccine booster is safe, in your opinion?
b. Can you tell me if the Covid-19 vaccine booster is useful, in your opinion?
c. What is the reason for proposing such a vaccination to you?

2. **What do you think about the side effects of the vaccination?**

    d. Have you heard of anyone who experienced side effects after receiving a booster dose?

    e. Have you read about side effects after receiving a booster dose? Where?
    f. In your opinion, what type of side effects might you experience?

3. **Is it your opinion that pharmaceutical companies have developed COVID-19 vaccines that are safe and effective?**

    g. Are there any aspects of their work product that do not convince you?
    h. Did you ever have any experience (direct or indirect) related to a pharmaceutical company's work?

4. **If everyone in society maintains preventive measures, do you believe the COVID-19 pandemic can be eliminated without vaccination?**

   i. How did you come to this conclusion? What factors led you to this conclusion?

5. **Do you believe the COVID-19 booster vaccine is different from the other doses?**

   j. In your opinion, is Mix-Matching the booster dose safe and effective?

   k. According to your opinion, why has the government proposed the COVID-19 booster?

6. **In general, where do you obtain information regarding your health?**

   l. Where did you find information regarding the COVID 19 booster?

   m. What your family and friends think about covid 19 booster? How do you know that?

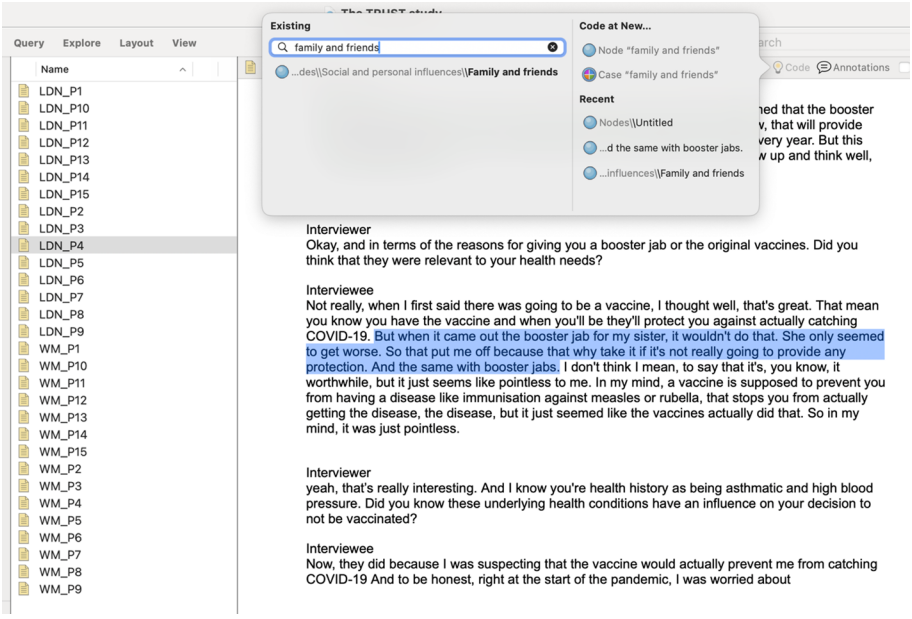
7. **To summarise all the main points of this interview, can you list the main reasons for refusing your booster vaccination?**

FINAL question.

That brings me to the end of my questions, thank you for your time, is there anything you would like to add that hasn't been discussed already?

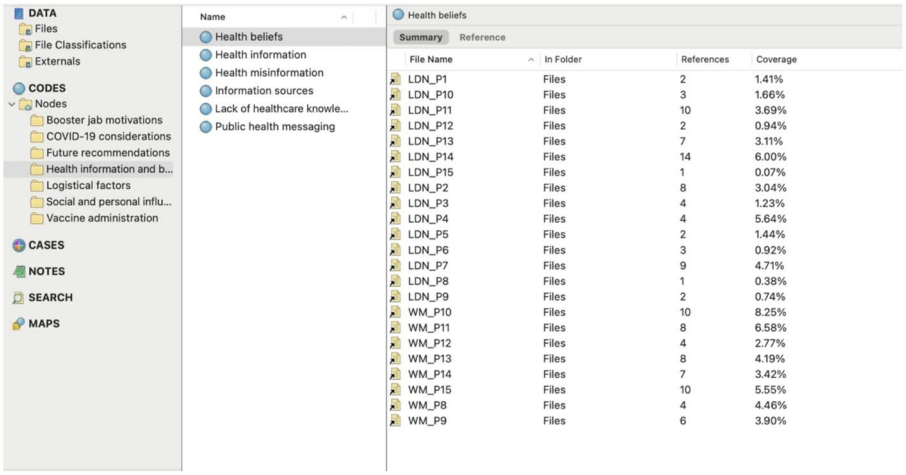
Appendix 2

Visual demonstration of how we used NVivo V12 to highlight relevant text in each transcription as a node and then categorise it under a central theme.



Appendix 3

Visual representation of how NVivo V12 allows you to view the frequency of categories across all interview transcripts. The frequency of each node allows us to categorise it as 'general', 'typical' or 'variant'.



Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12982-025-01163-8.

Supplementary Material 1.

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Author contributions

Contributors: SR obtained funding. SR and SL drafted the manuscript. SR and SL contributed to patients' enrolment. SL performed data collection and data analyses. SR supervised data collection, supervised and contribute to data analyses. MM and SL drafted the first version. All Authors approved the final version.

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Data availability

The data supporting the findings of this study are available within the paper and its Supplementary Information files. Should any raw data files be needed in another format, they are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of St. Mary's University Twickenham, London (United Kingdom). The date of first approval was 15 May 2023, with the approval code SMU_ETHICS_2022-23_273. All participants provided written informed consent before participating in the study. All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional and/or national research committees and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study protocol received approval from the Ethics Committee of St. Mary's University Twickenham, London (United Kingdom) on 15 May 2023 (Approval code: SMU_ETHICS_2022-23_273). All procedures adhered strictly to the tenets of the Declaration of Helsinki.

Consent for publication

All authors provided consent for the publication of this manuscript. Participants provided written consent for their anonymized data to be used in the study and publication.

Informed consent

All participants provided written informed consent before participating in the study.

Competing interests
The authors declare no competing interests.

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