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COVID-19 Vaccine Literacy Among Black Pregnant and Postpartum Women in the USA

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Abstract

Background Black pregnant and postpartum women in the USA are disproportionately affected by the COVID-19 pandemic yet have low vaccination coverage rates. Low levels of vaccine literacy contribute vaccine hesitancy and low vaccination rates, especially in racialized populations that face multiple dimensions of systemic racism and inequalities in access to quality health information and services. Guided by the Public Health Critical Race Praxis, we examined COVID-19 vaccine literacy and information sources among Black pregnant and postpartum women.

Methods We conducted semi-structured in-depth interviews with 22 Black pregnant and postpartum women living in Greater Philadelphia from November 2022 to May 2023. Interviews were transcribed and thematically analyzed using NVivo version 14.

Results Participants' mean age was 33.5 years; 17 had a college or graduate degree. Six women had Medicaid coverage during pregnancy; eight women received at least one form of public assistance during the pandemic. Four themes were identified: (1) perceptions of vaccine safety and efficacy, (2) vaccination information sources, (3) drivers of mistrust in vaccine information and hesitancy, and (4) participants' recommendation for improving COVID-19 vaccine literacy.

Conclusion Efforts to address inequities in COVID-19 outcomes must include the provision of accurate health information addressing the specific concerns of marginalized populations through trusted sources. Due to the importance of health care providers as trusted sources of COVID-19 and vaccine information, there is a need for such information provision to take an empathetic and person-centered approach that focuses on the specific concerns of Black pregnant and postpartum persons.

Keywords COVID-19 · Black women · Pregnancy and breastfeeding · COVID-19 vaccine literacy · COVID-19 vaccine information · COVID-19 vaccine hesitancy · USA

Abbreviation

PHCRP Public Health Critical Race Praxis

Introduction

Vaccine literacy refers to a person's knowledge, attitudes, and skills related to vaccines [1, 2]. It includes the ability to find, understand, and evaluate vaccine information from various sources to make informed decisions about vaccination [2]. Pregnant and postpartum women with high vaccine literacy are more likely to have positive attitudes towards COVID-19 vaccination and make informed decisions to protect themselves and their babies [3]. The emergence of COVID-19 has had a devastating impact on health, with pregnant and postpartum women facing a heightened risk of severe illness, hospitalization, and complications [4]. Studies have shown that COVID-19 infection in pregnancy is associated with complications like premature birth, low birth weight, and even death compared to those not infected with the virus [5–9]. Vaccination has emerged as one of the most effective strategies to prevent severe illness, hospitalization,

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and death from COVID-19 [10]. However, low vaccine literacy and vaccine hesitancy remain significant barriers to achieving optimal vaccination rates, particularly among pregnant and postpartum women of color [11].

The subject of vaccine literacy and COVID-19 vaccination remains highly relevant today, both in the USA and globally, for several reasons. First, although the acute phase of the COVID-19 pandemic has subsided, the virus continues to circulate, with new variants emerging periodically. COVID-19 vaccination now follows a seasonal approach, like flu shots, to prevent severe illness, hospitalization, and death [10]. Pregnant individuals remain a key population for vaccination efforts due to their increased vulnerability to severe outcomes from respiratory illnesses, including COVID-19, influenza, and respiratory syncytial virus (RSV) [4, 12]. Vaccination during pregnancy not only protects the pregnant person but also provides critical passive immunity to the newborn, reducing the risk of severe illness in early infancy [3]. Second, vaccine hesitancy remains a significant public health challenge, particularly in the context of routine vaccinations for COVID-19, influenza, and RSV, which are now recommended for pregnant individuals [10]. Despite the availability of these vaccines, vaccination rates among pregnant populations remain suboptimal, with disparities further exacerbated among Black pregnant and postpartum women [11]. Addressing vaccine hesitancy is crucial to achieving high vaccination coverage and ensuring equitable protection against preventable illnesses. Black pregnant and postpartum women in the USA have been disproportionately affected by the COVID-19 pandemic [12, 13]. Whereas Black people constituted less than 15% of the total population in the USA, in the year 2020, they represented 25% of the confirmed COVID-19 cases and 39% of the documented COVID-19-related fatalities [14, 15]. Further, compared to other racial groups, Black women experience higher rates of hospitalization, ICU admission, and death from COVID-19 [12]. These disparities are rooted in complex social factors and structural barriers, including historical and ongoing systemic racism and inequalities in access to quality healthcare, healthy living environments, and reliable information [16]. These factors contribute to increased vulnerability to COVID-19 infection due to a disproportionate burden of chronic diseases and pre-existing health conditions for COVID-19 infection and adverse maternal-child health outcomes [16]. The data on maternal outcomes reveals substantial racial and ethnic differences, which was further increased by the COVID-19 pandemic. From 2019 to 2021, the maternal mortality rate for non-Hispanic Black women increased from 44.0 to 69.9 per 100,000 live births. This rate is significantly greater than the mortality rate experienced by non-Hispanic White women throughout the pandemic, which rose from 17.9 to 26.6 per 100,000 live births [17].

Several studies have explored the relationship between vaccine literacy and vaccination uptake across various populations [18–21]. Research consistently demonstrates a positive correlation between vaccine knowledge and attitudes towards vaccination. Individuals with higher vaccine literacy are more likely to trust vaccines, understand their benefits and risks, and ultimately choose to get vaccinated [22]. Emerging research on COVID-19 vaccines reinforces explicitly these findings [18], suggesting that vaccine literacy is crucial in overcoming vaccine hesitancy and increasing vaccine confidence during the pandemic [2, 18]. Contrarily, changing information about vaccination recommendations for pregnant and postpartum women created confusion and may have impede vaccine confidence, mostly in marginalized populations, especially among Black people who have experienced and continue to experience systemic racism and exclusion in social services and health care [23–25]. Consequently, COVID-19 vaccination rates are lower among pregnant and postpartum people, and even more so in Black pregnant and postpartum individuals [26].

Similar to other recommended maternal and infant vaccines, pregnant and parenting people rely on various sources for information on COVID-19 vaccines [3]. Trusted healthcare providers, including obstetricians, pediatricians, and midwives, are often considered primary sources of information [27, 28]. However, women also seek information through personal networks, social media, and community resources [29]. The credibility and quality of information can vary significantly across these sources. Social media, for example, can be a breeding ground for misinformation and disinformation, further complicating vaccine literacy and the decision-making process for pregnant and postpartum women [30]. Research also reveals racial disparities in COVID-19 vaccine literacy and information access [31]. Black communities in the USA often have lower access to reliable and quality healthcare [32, 33], which translate to fewer opportunities to receive accurate and up-to-date information on COVID-19 vaccines from trusted providers. Additionally, historical mistrust in the medical system and experiences of unethical biomedical research practices further contribute to mistrust of the health system and vaccine hesitancy in Black communities [31].

This study examined COVID-19 vaccine literacy and information sources among Black pregnant and postpartum women. We hypothesize that Black pregnant and postpartum women face unique challenges regarding COVID-19 vaccine literacy and information access. These challenges may significantly influence their decision-making processes and hesitancy towards COVID-19 vaccination. By understanding the factors influencing vaccine literacy among Black pregnant and postpartum people, tailored interventions can be developed to address information gaps, improve vaccine

literacy, and ultimately increase COVID-19 vaccination rates in this population.

Methods

Theoretical Framework

This descriptive qualitative study was part of a larger study developed to understand the overall experiences of Black pregnant and postpartum women during the COVID-19 pandemic, including their vaccination experiences. The study was guided by the Public Health Critical Race Praxis (PHCRP), which builds on the fundamental principles of critical race theory [34]. Race consciousness and awareness of the impact of racialization on how society works are central to the PHCRP [35]. The PHCRP has four overlapping phases, which are not necessarily linear: contemporary race relations, knowledge production, conceptualization and measurement, and action [34, 35]. The use of the PHCRP as an organizing framework in all aspects of this study enabled the application of a critical lens to elucidate how racism affects the production and dissemination of COVID-19 and vaccine information, access to the information, trust in the information, and vaccine literacy, which ultimately influences vaccine acceptance or hesitancy, and vaccine literacy recommendations among Black pregnant and postpartum women, who already experience disproportionately high burdens of maternal and infant mortality and morbidity, and COVID-19 mortality [36–39].

Study Setting and Participants

The study site was the Philadelphia Metropolitan area, also known and hereafter referred to as Greater Philadelphia, which comprises Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Southeastern Pennsylvania; Burlington, Camden, Gloucester, and Mercer counties in Southern New Jersey; and New Castle County in Northern Delaware. The largest city in the study area is Philadelphia, one of the 10 largest cities in the USA, which also has very high rates of poverty and social deprivation [40]. Philadelphia remains a highly segregated large city, given the history of racial segregation and redlining, which continue to have negative impacts on access to quality education and economic opportunities, exposure to environmental and household toxins, violence and policing, and access to healthy food sources and options [36, 41]. These factors ultimately affect other social determinants of health and are at the root of racial/ethnic disparities in health and health outcomes, including maternal and child morbidity and mortality [37, 41].

We purposively recruited participants meeting the study eligibility criteria, namely (a) self-identification as a Black woman or pregnancy capable person; (b) between the ages of 18 and 49 years; (c) experienced at least one pregnancy from March 2020 to May 2023; (d) received at least one dose of COVID-19 vaccine preconceptionally, during pregnancy, or postpartum; and (e) reside in Greater Philadelphia as defined earlier. Consistent with the theoretical framework, the PHCRP, we prioritized the inclusion of individuals who had received at least one dose of COVID-19 vaccine to explicate, from a strength-based lens, the perspectives underlying the complex and intersecting relationships among vaccine literacy, trust in vaccine information, hesitancy, and acceptance in Black peripartum women. Moreover, this inclusion criterion challenges the dominant narratives Black people not accepting COVID-19 vaccination, while also centering the voice and narratives of individuals who accepted the vaccine.

We used various activities to identify and recruit eligible study participants, including referrals from community members and organizations, distribution of recruitment flyers in strategic locations (e.g., doctor's offices, baby product stores, child daycare centers, community-based organizations, churches), and online advertising via Facebook and Instagram. Interested individuals who potentially met the inclusion criteria, upon reaching out to the study team, were screened to confirm eligibility.

Data Collection

Participants who met the eligibility criteria participated in in-depth interviews, guided by a semi-structured interview guide developed by the study team and some community members with the lived experiences of key study concepts (i.e., Black reproductive-aged women, currently pregnant or postpartum since COVID-19, received at least one dose of COVID-19 vaccine, and lived in Greater Philadelphia. The interview guide was developed with significant input and feedback from a select group of community members with lived experience of the concepts being studied, to ensure appropriateness and relevance to the study participants. Co-creating the interview guide with participants who have lived experiences enhances the quality and relevance of the research for policy and practice [42]. The interview guide included several topics and discussion items ranging from the perceptions, awareness, and knowledge about COVID-19; experiences of COVID-19 infection; pregnancy and maternal health care experiences; thoughts and perceptions about COVID-19 vaccine safety and acceptance; and vaccination experiences. Interviews were conducted by three members of the research team from November 2022 to May 2023 and lasted 45–60 min. Interviews were conducted by three of the authors, depending on participants' preferences,

in person ($n = 2$) and virtually via Zoom ($n = 20$). With the participants' permission, the interviews were audio-recorded. The audio files were reviewed periodically during data collection to check for saturation (when new information was no longer identified) [43]. Information saturation was attained by the 20th interview; therefore, we stopped interviewing after the 22nd interview.

Data Analysis

The audio files of the interviews were transcribed verbatim. The transcripts were reviewed and compared with the audio files for accuracy and then de-identified. Two members of the study team each independently coded a subset of two transcripts and developed an initial codebook in NVivo version 14. Through discussion, the two researchers clarified and harmonized the initial codes as needed and thereafter shared the modified codebook and remaining transcripts with the rest of the authors, to complete the coding. The codebook was modified during coding of the remaining transcripts. During the data collection and analysis, the team reflexively examined the data and met frequently to clarify and resolve discrepancies in coding and interpretation.

The data were inductively analyzed using a thematic approach, following the six-step process developed by Braun and Clarke [44]. Specifically, in the first step, all authors read the transcript multiple times to familiarize themselves with the data. Second, we used an open coding approach to label relevant text and create initial codes. Third, we reviewed patterns across the codes to generate themes. Fourth, two authors reviewed the codes and themes for consistency and resolved differences via discussion. Fifth, the themes were shared with the rest of the authors and selected study participants for feedback. Sixth, all authors participated in writing up the results of the study [44]. Upon identification of themes, we shared the preliminary findings with the participants to refine interpretation, via a newsletter, which was distributed via email to participants who consented to receive future communication from the research team. We invited comments and feedback on the findings through different forums, including a group discussion, which was attended by seven participants. Three participants provided comments via email and one via phone call. Participants' comments and feedback were used to finalize the analysis and interpretation of the findings.

Ethical Considerations

The study was approved by the Institutional Review Board (IRB) of the first author's university (Ref. 22–08 - 02). Before interviewing, eligible participants provided written ($n = 2$) or verbal ($n = 20$) informed consent to participate in the study. Participants were informed that they could decline to respond to any question or end the interview at any time without negative consequences. Participants were also provided with information on support lines they could call if they experienced discomfort due to their participation in the study. Consent information was stored separately from interview records and transcripts. Audio records were deidentified before transcription of the data, and study data were accessible to the research team only. Upon completion of interviewing, each participant received a $25 gift card in appreciation for their time. The results are reported in aggregates, and pseudonyms are used to identify participants' illustrative quotes.

Results

Sociodemographic Characteristics of Respondents

Of the 22 women interviewed, 17 had a college or graduate degree. Seventeen participants were employed. Six of the women received health care coverage during pregnancy through Medicaid; eight women received at least one form of public assistance during the pandemic. The mean age of participants was 33.5 years; 14 were married. There were three Muslims, one Jews, one Spiritual, and 17 Christians among the participants. There were a total of 28 pregnancies resulting in 22 live births, two abortions, and two miscarriages. Two participants were pregnant during the interviews.

Themes Identified

We identified four main themes: perceptions of vaccine safety and efficacy, information sources, drivers of mistrust in vaccine information and hesitancy, and participants' recommendations for improving COVID-19 vaccine literacy. Below, we describe each theme and provide illustrative quotes from participants.

Theme 1: Perceptions of Vaccine Safety and Efficacy

Study participants described different perceptions about the safety and efficacy of the COVID-19 vaccine.

Vaccine Safety Concerns

Although the study participants had received at least one dose of the vaccine based on inclusion criteria, not all participants believed the vaccine was safe. Several participants expressed safety concerns about the vaccine stemmed from the speed with which it was developed and rolled out.

> I had significant reservations about the vaccines due to their expedited development, I was worried about

how fast they came up with it [vaccine] as well. Not properly testing it and everything. (Carol)

Despite beliefs that the vaccine was developed too quickly, some participants expressed beliefs that the vaccine was efficacious in preventing severe illness and death.

They made [the] vaccine too fast, but many people are not getting sick because they are getting the vaccine and the booster. (Cindy)
I just felt like I had to take the vaccine because if you don't try, you might have the virus and just die. (Mina)

Some women thought the COVID vaccine was still too new to understand the potential long-term effects and; as a result, they were uncomfortable about taking more booster doses although they had received the primary vaccine doses.

I was worried that since it was so new, that the vaccine was created so fast that it could have long term effects that no scientist or doctor would be aware of, until it was too late. (Sarah)

Vaccine-Specific Concerns

When asked about their perceptions of the different vaccines, available in the USA at the time of the study, participants had mixed feelings about the Johnson & Johnson COVID vaccine.

I would never get the Johnson and Johnson vaccine, and I would never have my daughter get the Johnson and Johnson vaccine. I just think that because that vaccine had more issues, it's just safer to stay away from that particular vaccine. (Zara)

Overall, study participants expressed more positive feelings about the Bio-N-Tech-Pfizer and Moderna vaccines than the Johnson & Johnson vaccine.

There seems to be like less confidence in the Johnson and Johnson vaccine for some reason, and I'm not sure if it's because Johnson and Johnson was coming off of, um, the whole lawsuit about their powder. Oh, well, I feel like that had a lot to do with it. But it just seemed like there was less confidence in the Johnson and Johnson vaccine. (Jessica)
Oh. [I didn't want] Johnson and Johnson, because it was only one shot, so I felt like I wanted to be double protected (Malika)

Some of the reasons provided for the lack of confidence in the Johnson & Johnson vaccine included recent lawsuits and settlements involving the Johnson and Johnson talcum powder, the single dose COVID vaccine compared to the other two-dose vaccines, early reports of serious side effects, and the single dose schedule of the vaccine.

So, I did get the Johnson and Johnson [vaccine]. I got it because of just the one dose, and I didn't want to have to keep going back and forth. Regretted it afterward because of everything that you know started coming out kind of about Johnson and Johnson. (Tia)
I didn't wanna get that one [Johnson & Johnson]. My perception of Johnson and Johnson is not as positive as Moderna and Pfizer. Um, I believe it was recalled if I remember correctly. And, um, I remember there being a lot of issues with it, so that made me just wanna steer clear of that particular vaccine [Johnson & Johnson]. (Rachel)

Similar to the primary doses of the respective vaccine, participants expressed mixed feelings about the booster doses of the respective vaccines. Some people felt more confident about the safety of the booster because more time had passed between the time the vaccines were developed and when booster doses were administered. Yet other participants expressed confidence in the booster doses and had already received or were planning to get them.

I felt like the boosters were especially safe because there had been so much time that they had time to like, you know, test it, or whatever they needed to do to ensure that it was safe. (Malika)
… I have gotten boosters of Pfizer, and if there was another booster that I need to get, I think there is a third one out. But I'm comfortable with getting Pfizer. (Rachel)

Unfavorable perceptions of the booster doses also seemed to be related to the mixed messaging and frequently changing recommendations of additional booster doses. As Halima and Malika put it:

The people that have taken the first dose of vaccine, they have to take the second dose, and they have to take the third dose, and so on. What we should have to know as a community is information about each one of the vaccines, and if I have to take one, I don't know why I have to take 3 [doses]… yeah (Halima)
…The quick roll out of the vaccine, and not knowing how many doses you were going to need right. Like, so, initially, it started out with "you need 2 doses." And then they're like, "oh, we need to give you another vaccine in like in 3 weeks or something." So, honestly, I was concerned about the efficacy of them [vaccine]. (Malika)

Concerns About Vaccine Safety in Pregnancy and Breastfeeding

Participants expressed serious concerns about the safety of the vaccine for pregnant and breastfeeding individuals and their infants. For some individuals, their concerns were related to lack of information on the safety of the vaccine in pregnant or breastfeeding people. According to Shayla, she decided to wait until after giving birth before she got vaccinated.

> Well, I decided to wait until after I gave birth … I can't say that it was at the suggestion of anybody other than just feeling more comfortable about it. Once he was no longer in my belly, um, I guess, because once he was physically here and I could see him and touch him, I would be more able to see if something were happening to him based on anything he was getting from my breast milk versus me getting the vaccine while I was pregnant, and not being able to see. (Shayla)

Other participants' concerns revolved around the lack of studies about possible long-term adverse effects of the vaccine on pregnant people and young children.

> Yeah, so I was a hundred percent against it [COVID vaccine]. Honestly, um, because … at that time there were no studies for children, five and under. So, I didn't understand why, it would be okay for me to get it, being pregnant…and also breastfeeding, you know, with the understanding that almost everything that I ingest, eat, or anything of that nature will transfer through my milk. (Linda)
>
> Yes, so I was nervous because I didn't know how the vaccine would affect breastfeeding moms, and like how it would affect your child developmentally. Like at a year, it's a really pivotal point for an infant, so I was definitely concerned about cognitive and developmental implications. (Tasha)

Theme 2: Vaccination Information Sources

Another area of discussion was how participants acquired information on COVID-19 illness and vaccination, the sources of such information, and their trust in the information.

Seeking Vaccine Information

Several participants believed they did not have adequate information to make informed decisions about COVID-19 and the vaccination.

> The experience of worrying, of fear, it is worse than getting the disease itself. Yeah, because one of the things [is] that we don't have, like, comprehensive information about [COVID-19 vaccine]. (Halima)

Conversely, some participants thought there was abundant information available but not all was accurate or reliable. As a result, they took personal responsibility to educate themselves about the vaccine to form an opinion because of the abundance of vaccine misinformation.

> You know, we [Black people] are not trusting of the vaccines because of other things that have been administered in our communities that may have not been beneficial for us. Especially in a Black community, so we're very cautious when it comes to vaccines. And, you know, we're not as educated, but I really educated myself on the vaccines… and my family… from my trusted doctors, and then it's like, literally we didn't take it until we knew that my doctor trusted it. (Julia)
>
> There was a ton of information on the COVID vaccine, and you really just had to use your own devices to figure out what sources were accurate, and what sources would be providing um trusted, like credible information, and what sources weren't. You would have to do your due diligence to read it and see if it made sense to you. If there was science backing it, or if it was just like some type of, I don't know social media stuff. (Jessica)

A few women relied solely on informal sources of information, admitting to not carrying out any additional research to find reliable and accurate information.

> I literally didn't do any research on it [COVID vaccine], but you know in a hospital you are always hearing about the pros and the cons of the vaccine and from people who were for it and people who were against it. (Whitley)
>
> When I went to go get my Covid vaccine. I just called somebody up. You know somebody that I trusted. They told me, you know, get Pfizer, so I just went with that. (Deja)

Mass Media, Including Web Pages, Social Media, and Government Briefings

Some study participants recounted getting COVID-19 and vaccination information from different media sources. Some women reported using social media to find information about COVID-19 and vaccination.

> Social, mostly social media. I don't really watch the news like this: a majority, social media. Just people talking, you know, being outside. (Deja)
>
> I look at social media like Instagram, Twitter, TikTok and all that kind of stuff, Facebook. That's what I con-

> sider social media. But like I said, sometimes I'm like out of it, so I don't know, but so I do use other sites right like there's um there's a baby list, app…baby websites that I go on, and sometimes I look up their blogs. People ask it for questions. I look at it. I do look at some ways that people respond. (Diana)

Other women stated that they sought information from official government websites such as the CDC. Others did their own research using keywords in search engines such as Google.

I just went to those types of reputable sites and then I just tried to talk to people. (Diana).

> I mostly just went to Google and typed in the different vaccines' names...and I did like readings and then I read on CDC as well. (Ebony)

Academic and Professional Sources

Several women in this study relied on professional sources, including academic sources and health care providers, e.g., obstetricians and nurses from who they were receiving pregnancy care, and pediatricians and community-based organizations during the postpartum period, for information on COVID-19 and the vaccine.

> I just went to websites that said they were either CDC approved or had information about the clinical trials. I don't understand all of the terminology, but I read as much as I could to understand. (Diana)
> I guess I'd say my OB [obstetrician] was a big proponent of it [COVID vaccination]. Um, but, you know, I go to the Breastfeeding Resource Center. Um, that's also how I got this [vaccine] information. (Diana)

For Julia, she recalled using Dr. Ala Stanford's recommendations as her guide and source of information on the pandemic and vaccination.

> I actually, you know, was following Dr. Ala Stanford, you know, in her recommendations, because she really fights for the Black community, and that was so important for me too. (Julia)

Theme 3: Drivers of Mistrust in Vaccine Information and Hesitancy

History of Medical Abuse of Black People

Participants expressed different levels of trust/mistrust in the sources of information they had access to, related to both COVID-19 infection and the vaccine. Some participants had less trust in information coming from government sources than other sources such as their own research, health care providers, and friends and family. Importantly, some participants based their mistrust of government on racist medical and research practices performed on Black people in the USA, including the Tuskegee study.

> It [mistrust] goes to the history of letting people be vaccinated and being lied to. And so, I think that they go to the history about the, you know, like the Tuskegee Experiment and things like that. And so not trusting government, not trusting government vaccine…But I think it's the anti-trust, and especially from let's say, like my parents or my grandparent's generation, because they lived through the Tuskegee Experiment, and they remember it, like we heard about it, but they actually saw the effects of that. (Malika)

Other participants did not trust the medical system. Furthermore, some participants said they did not trust anything coming from white people to Black people. Again, the underlying reasons for these feelings are rooted in racist and unethical medical practices directed at Black people.

> Um, I think, in the Black/African American community, I think that there's a lot of mistrust in the medical world... Frankly, it's probably warranted with some of the things that we know with Henrietta Lacks, people doing different things. So, I think, in my community, just as a Black person, African American, I struggle. (Destiny)
> Black people don't trust anything that comes from white people. No offense, but this is the true thing about white people, especially when it comes to vaccines, especially back in the eighties and the nineties, when they used to give people… Black people things. Talking about vaccines or treatment, but really, really, they're giving them … all these different infections. (Ebony)

Some participants discussed mistrust of the medical system based on inequalities in the quality of healthcare services that Black people get, as contributory to their mistrust in the vaccine information.

> I think that doctors have to build a better community around like African Americans to show, like, to build their trust because it seems that um, you know, in the Black community the doctors are not, um, as willing to assist African Americans and we just don't get the same quality healthcare as other ethnicities. (Whitley)

Controversies in Circulating Vaccine Information

Participants' narratives included controversial and mixed information concerning the vaccine from multiple sources being circulated.

…. heard a lot of controversies around covid 19, a lot of information & misinformation. Got information from media. Medical Doctors and felt like nothing was confirmed, whether it is hurting or helping, nothing definitive…whether the Covid vaccine is helpful. (Mary)

There's a side that believes. I believe it's a vaccine that is safe because vaccines have been around for a long time. This vaccine was just, adjusted to meet the needs of covid-19, so it was safe. And then you have the other side who is saying that it is dangerous to…Black people, like, you know how black people have been um, uh, tested on before, so a lot of Black people thought that it wasn't safe. I've heard that we don't know enough about it, so like the Covid 19 shot could actually, adversely affect you in the long run, so those are kind of like the general things that I've heard from both sides about the vaccines. (Zara)

For some participants, their mistrust of the vaccine information was based on rampant conspiracies around the vaccine's impact on fertility.

You know, just like news kind of TV shows like. I'm not really big into Facebook. I don't really like the Facebook scrolling…I have, like Some family members who decided not to get the vaccine, and they mentioned their concerns about impacts on fertility. you know. So, it was around. It was enough to float around to get back to me when I'm not really like a Facebook checker [user]. Yeah. So, I guess it was out there enough. (Destiny)

Other participants expressed reservations based on some conspiracy beliefs that the COVID-19 vaccine was being forced on them by the state, and they felt helpless to fight back due to stereotypical narratives of Black people being unwilling to save each other. Ebony expressed her reasons for hesitancy as follows:

So, I just feel like they be trying to find people in this country and every other country that forces people to take vaccine. Just…they try to find another way to pretty much get you to put something in your system. This is placed in your system, but we can't fight it. Because why? If we fight it, they say we [Black people] are not working to save each other's lives. Then they want to say you're being loud. Black people [are] being uncivil, so you got to take it. (Ebony)

Health Provider's Role

Information given or not given by health providers also played a role in participants' trust/mistrust of vaccine information and hesitancy.

Literally, we didn't take it until we knew that my doctor trusted it. (Shayla).

But talking to the pediatrician as well as talking to my prenatal provider. You know my OB [obstetrician], um, and also a friend who also, gave birth in 2022… and she got hers [vaccine], you know, I guess, based on that, I felt a little bit more comfortable with the concept, um, of getting the vaccine (Diana)

Some participants decided to use a "wait and see" approach or for their doctor's recommendation before they felt ready to get the vaccine.

My doctor… she didn't recommend it at first, and then for a while. And so, then she says there's other ways to stay healthy, so I've never contracted the virus. She didn't recommend it to any of her patients. She didn't trust it yet. (Julia)

I was worried that since it was so new, that the vaccine was created so fast that it could have long term effects that no scientist or doctor would be aware of, until it was too late. I was very cautious and wary about receiving the vaccine, which is why I didn't get it initially in the beginning of 2021 … I waited another 8 months to receive the vaccine just to see how everybody was doing who took the vaccine. (Sarah)

According to Linda, conflicting information from her health care provider was an issue that contributed to her hesitancy and delaying her vaccination, as she waited until the vaccine was mandated by her job.

So, my doctor recommended that I, well, first they totally said to hold off on it, and then they later came back and told me to get it, So I was hesitant and waited even longer to get the vaccine. Honestly, what made me get it was my job made it mandatory. (Linda)

For Diana, her hesitancy to get the vaccine was related to difficulties she had experienced with conception.

So, while I was pregnant, um, as it was something that I wanted for a really long time, and I really worked hard to get pregnant. I just chose not to get … boosted while pregnant. I have no reason to be honest. I have no educational reason why I did it… It probably was a purely emotional decision and choice, but I did make a conscious choice not to be boosted while pregnant, although my doctors [said that] it's totally fine. (Diana)

Theme 4: Recommendations for Improving Vaccine Literacy

In improving vaccine literacy among Black people, participants made various suggestions on how this could be achieved.

Health Education

To address the trust issues among communities of color, transparency and honesty in sharing information about the risks and benefits of the vaccine were noted as very important.

> I think sort of educating, um, would be helpful with just the benefits, not only just the benefits, but maybe the um, side effects, and things that may not go right Don't just talk about the benefits Sort of being honest and open and trustworthy. (Shayla)
> Just awareness, and a kind of de-escalation of fear about what it is, and what it does and what it does not. I think that would be probably more effective because the kind of stuff that you hear, like, they're just trying to wipe out our population. I'm like it makes no sense. (Susan)

Role of the Church in Health Education and Promotion

The church, as an organized body, was noted to play a very important role in the lives of Black communities and could therefore address the trust issues faced by these communities. Engaging the church was presented as an important avenue for improving vaccine literacy, particularly among older people:

> I've heard of a lot of churches promoting like a Covid vaccination, even hosting like a day for people to get vaccinated, bringing in like doctors and nurses to vaccinate people who currently do not have the vaccine. Yeah, the Church could be a great support system to raise awareness about the vaccine, and about how prevalent hope still is, even if the news isn't, even if it's not being cycled in the news. (Sarah)
> Um, you know I know that a lot of elderly black people they believe in like their churches and communities, and you know some things like that can really help in some ways. Not that churches should be about pushing people to get the vaccine. (Diana)

Community Initiatives

Other suggestions included employing a community-wide approach, as seen in some places, or having respected persons of color step forward to speak out or take action:

> The East Coast was very proactive. They were very like It was all on the news. It was a lot of people, a lot of like leadership, you know. Government folks really recommend it. There were a lot of advertisements around getting the vaccination (Destiny)
> We have to find ways to focus on providing confidence in medicine in the medical community, and I think ways that we can do that is by having people that look like us communicate with us a bit more. (Diana).

Self-Empowerment/Care

Improving vaccine literacy through personal effort in research was considered an option by a participant. Some participants described using this approach when deciding to take the vaccine.

> As far as information, I think there's a bunch of information out there. I think that we all have been given the information. I think that, you know, other than that, like, we just need to make sure we're doing our due diligence with research and everything like that, but as far as what's already out there, there's already a bunch of information out there. (Rachel)

Vaccination Requirements

On the one hand, a participant suggested that to avoid backlash and not arouse suspicion, there should not be coercion in the requirement for vaccine uptake; it should be voluntary.

> So, like, they shouldn't force people to get it. (Deja)

On the other hand, another participant suggested encouraging vaccine uptake by using a vaccine certificate for mobility or access to services.

> Make it like compulsory to have a certificate or you cannot travel or these types of things in our community. I think this is the thing that will encourage people to do because they do not even care about themselves. If they make services inaccessible to them without a certificate, then people will go to get the vaccine. (Halima)

Discussion

We explored COVID-19 vaccine literacy in Black pregnant and postpartum US women from a critical perspective. Our findings provide insights into how Black pregnant and postpartum women sought and made sense of vaccine information and the potential impact on vaccine hesitancy. The use of the PHCRP [34] in this study enabled us to critically

elucidate the active role Black pregnant and postpartum women took in seeking accurate and reliable information about the pandemic and COVID-19 vaccination from the various sources of information and how they navigated prevalent misinformation and disinformation during the pandemic and following the introduction of the COVID-19 vaccine at population level. Consistent with our hypothesis, it is worth noting that several factors influence vaccine literacy, which is the ability to find, comprehend, and assess vaccine information from various sources to make informed decisions about vaccination [19]. This study contributes to the knowledge on COVID-19 vaccine literacy in a population that is disproportionately affected by disparities in maternal morbidity and mortality, COVID-19 infection, yet, has one of the lowest vaccination rates in the country [19, 37, 39].

Our key findings revealed participants' perspectives on the COVID-19 vaccine and its safety and efficacy, especially in pregnancy and breastfeeding. As was similarly noted in earlier studies [45–48], the safety and efficacy concerns in pregnancy and the postpartum period impacted the decision-making process for study participants. Although all our participants were vaccinated due to study inclusion criteria, the initial lack of information was a paramount concern, as well as the mixed information on specific vaccines' safety and efficacy, directly supporting our hypothesis. In a study in the Midwest US by Redmond and colleagues (2022), limited hesitancy was linked to safety and efficacy concerns for pregnant persons, themselves, and their unborn child [49]. Globally, negative information about the vaccine caused a high level of vaccine hesitancy among this population of women [46, 50]. It is important to emphasize that people of color have several reasons to be concerned about the safety and efficacy of a novel medical intervention. Moreover, due to historical and contemporary medical and research abuses in Black populations, they require even more convincing [51, 52]. A patient's readiness to receive medical treatment relies on the quality of information given, as understanding the risks and benefits enables them to make well-informed decisions [53]. Vaccine mistrust rooted in community experiences of racism could be seen not as a rejection of protective health measures, but rather as a demonstration of dedication to ensuring health protection [51]. Messages of the health protection benefits that COVID-19 vaccination confers on individuals and communities resonates deeply with people of color [48, 51]. Interventions that focus on improving the vaccine science and safety literacy can enhance the perceived behavioral control and vaccine uptake by Black women [54].

The data also highlighted participants' thoughts about access to COVID-19 and vaccine information, including the various sources from which they sought information about the vaccine and how they made sense of the vaccine misinformation and disinformation that was and continues to be rampant. Specifically, while some noted the absence of adequate information, others described the abundance of conflicting information and had to resort to personal research to decipher what was accurate in making their decision. In our study, information sources varied from personal agency, health providers, and different mass media sources to government briefings. Previous studies have reported heavy reliance on social media as a result of lack of trust in government information, and health providers being the most credible sources of information [54, 55]. Health providers as information sources were an important part of vaccine literacy in the current study. This was similarly reported as a key avenue of vaccination literacy and promotion, particularly if done by a provider of color and community members [52]. Additionally, the most influential sources of education on vaccine acceptance during pregnancy were those provided by institutions, followed by verbal education from family members. Institutional sources were verbal and written education from trusted healthcare providers and clinical facilities [56]. In providing health education, health institutions and health providers stand in the best position of trust, and their recommendations are usually taken seriously for vaccine uptake [57].

Furthermore, in mitigating trust issues, our study highlighted the strategic role of religious bodies, namely the church, and community-based initiatives in promoting in health literacy for vaccine uptake by persons of color. The success of church-based health promotion interventions in improving health literacy is well documented [58, 59]. The Black church is widely known to contribute to the shaping of individual and community resilience in the face of social hostility that dates back to Trans-Atlantic Slavery era [60, 61]. In earlier days, the church was also known, among other roles, for its socio-educational functions that still persist to this day [61]. The Black church has the ability to adopt culturally sensitive approaches that resonate with the struggles of persons of color [60]. Community-led health promotion interventions by trusted influential Black individuals were also seen as credible sources of advocacy in driving vaccine literacy and acceptance. This was similarly noted by Bogart and colleagues (2021) [62]; however, the authors noted that such individuals should not have received any financial gain from the vaccine. A strategy that approaches delivery of information through these channels is highly recommended; hence, they should be repositioned to support vaccine literacy in the future.

We also found that several factors led to mistrust in vaccine information and hesitancy. Vaccine-specific hesitancy due to conflicting information about brands and manufacturers of vaccines was noted by our study participants. News media reports of alarm raised by public health agencies, for certain vaccine brands, of rare, but adverse effects may have induced some hesitancy [63]. Linked to the conflicting

information about the brand was the safety and efficacy issue for pregnant and postpartum women. Additionally, the conspiracy theories that were circulating during the pandemic were raised as concerns by our participants. One of these was the race-based conspiracy theory suggesting that variations in the vaccine based on skin color were a targeted effort to sterilize people of color and racialized individuals [62]. Studies noted that conspiracy theories negatively impacted vaccine uptake [64, 65], while health literacy had a positive effect [65]. As earlier mentioned, historical medical abuses against Black and racialized people fueled these key points of contention. Mistrust in government and absence of transparency is a key driver of vaccine hesitancy for Black American; this has been further aggravated by systemic bias and racism while seeking health care [52, 62].

Consistent with the PHCRP which was used an organizing framework for the study [35, 35], we interpreted the study findings with participants and also sought their thoughts on how to enhance access to and build trust in vaccine information. Key recommendations from participants were to address racial trust issues using trusted organized bodies and Black individuals. Central to this, as earlier mentioned, was the recognized role of the Black church as a trustworthy institution that can be positioned to provide health education. Increasing the variety of options for where to take the vaccine was also noted. Bogart et al. (2021), in their study, noted that non health facilities, including pharmacies, drive thru and pop-up venues, and community centers were more trusted locations than health care institutions. Despite the split opinions on making vaccine uptake voluntary, making the vaccine mandatory will be counterproductive considering the historical mistrust of government and medical injustices to Black people, coupled with legitimate concerns of safety and efficacy in pregnancy and postpartum. It is worth noting that our participants demonstrated personal agency in improving their vaccine literacy to guide their decision-making and suggested same as a way of addressing vaccine hesitancy. Efforts should rather focus on improving health literacy in line with the bioethics' principle of autonomy in making informed decisions. Further, in addressing the trust issues, race-concordant health care providers was suggested as trusted providers of health information. Black health professionals could leverage their networks to develop culturally sensitive health communication campaigns and messages aimed at increasing vaccine literacy, acceptance, and uptake in Black communities [54].

Strengths and Limitations

This study contributes to the existing literature on COVID-19 vaccination literacy and hesitancy among Black pregnant and postpartum women. Although the role of vaccine literacy in routine immunization hesitancy is known [1, 2, 18, 20], this topic is underrepresented in the research on COVID-19 vaccination, especially in racialized populations that have below average vaccination rates due to systemic bias and discrimination on the bases of several intersecting structural and social factors. Further, the use of a critical lens as an organizing framework for this study enabled the elucidation of key influences on vaccine education and literacy in Black pregnant and postpartum people, grounded in their lived COVID-19 experiences.

The findings of this study are limited by certain factors. First, our findings do not represent the experiences of all Black pregnant and postpartum women in the USA, especially those who may not have received the COVID-19 vaccine; rather, they speak to the experiences of mostly well-educated Black women, who, despite their reservations about safety, received at least one dose of the COVID-19 vaccine. Considering the possibility of future pandemics, these findings can help improve the tailoring and dissemination of accurate and science-backed information to enable racialized and under-vaccinated populations make informed decisions about their health.

Conclusion and Implications

Findings of the current study provide insights into information seeking and sense-making of vaccine information and the potential impact of COVID-19 vaccine literacy on hesitancy among Black pregnant and postpartum women. Specifically, we identified four themes—vaccination information sources, perceptions of vaccine safety and efficacy, drivers of mistrust in vaccine information and hesitancy, and participants' recommendations for improving vaccine literacy. Our findings have implications for efforts to close the equity gaps in COVID-19 outcomes in Black and other marginalized populations. Specifically, these findings highlight the personal agency of Black pregnant and postpartum women to find accurate COVID-19 vaccination information from credible sources and how they made use of the same information to take action to protect their and their baby's health. Amidst the stress of bearing a disproportionate burden of maternal morbidity and mortality and trying to survive a pandemic, these women assumed added responsibilities to find correct information from trusted sources, given the prevalent misinformation and disinformation about COVID-19 and the vaccination [13, 39, 66, 67]. Efforts to address inequities in COVID-19 outcomes must include the provision of accurate health information addressing the specific concerns of marginalized populations through trusted sources [48, 68] as well as multi-level interventions to address the underlying structural and policy determinants of disparities in COVID-19 vaccine literacy. Importantly, due to the central role of health care providers as trusted sources of COVID-19 and vaccine information, there is a need for such information

to take an empathetic and person-centered approach that focuses on the specific concerns of Black pregnant and postpartum persons due to the mistreatment of racialized birthing people, rather than one that maintains the status-quo and disregards their vaccine safety concerns.

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Author Contribution Comfort Z. Olorunsaiye and Dejenaba Gordon contributed to the study's conceptualization and design and data collection. Comfort Z. Olorunsaiye, Dejenaba Gordon, Hannah M. Degge, and Augustus Osborne conducted the data analysis and interpretation. Dejenaba Gordon led the community engagement activities. Comfort Z. Olorunsaiye, Hannah M. Degge, and Augustus Osborne wrote the first draft of the manuscript, and all authors commented on the manuscript drafts. Dejenaba Gordon critically revised the manuscript. All authors read and approved the final manuscript version for submission.

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Data Availability The participants in this study did not give written consent for their data to be shared publicly, so the supporting data is not available.

Declarations

Ethics Approval and Consent to Participate The study was approved by the IRB of Arcadia University ((Ref. 22–08 - 02). Informed consent was obtained from all individual participants included in the study.

Consent for Publication The authors affirm that human research participants provided informed consent for publication of the study findings.

Competing Interests The authors declare no competing interests.

References

1. Cadeddu C, Regazzi L, Bonaccorsi G, Rosano A, Unim B, Griebler R, et al. The determinants of vaccine literacy in the Italian population: results from the health literacy survey 2019. Int J Environ Res Public Health. 2022;19:4429.
2. Biasio LR, Zanobini P, Lorini C, Bonaccorsi G. Perspectives in the development of tools to assess vaccine literacy. Vaccines. 2024;12:422.
3. Huang L, Riggan KA, Ashby GB, Rivera-Chiauzzi EY, Allyse MA. Pregnant and postpartum patients' views of COVID-19 vaccination. J Community Health. 2022;47:871–8.
4. Virk S, Gangu K, Nasrullah A, Shah A, Faiz Z, Khan U, et al. Impact of COVID-19 on pregnancy outcomes across trimesters in the United States. Biomedicines. 2023;11:2886.
5. Kolker S, Biringer A, Bytautas J, Blumenfeld H, Kukan S, Carroll JC. Pregnant during the COVID-19 pandemic: an exploration of patients' lived experiences. BMC Pregnancy Childbirth. 2021;21:851.
6. dos Santos APB, Vicente CR, Cola JP, Tanaka LF, Garbin JRT, Dell'Antonio LS, et al. The impact of COVID-19 on maternal death and fetal death, a cohort study in Brazil. PLoS ONE. 2023;18:e0290343.
7. Gholami R, Borumandnia N, Kalhori E, Taheri M, Khodakarami N. The impact of COVID-19 pandemic on pregnancy outcome. BMC Pregnancy Childbirth. 2023;23:811.
8. Yang R, Mei H, Zheng T, Fu Q, Zhang Y, Buka S, et al. Pregnant women with COVID-19 and risk of adverse birth outcomes and maternal-fetal vertical transmission: a population-based cohort study in Wuhan. China BMC Med. 2020;18:330.
9. Allotey J, Fernandez S, Bonet M, Stallings E, Yap M, Kew T, et al. Clinical manifestations, risk factors, and maternal and perinatal outcomes of coronavirus disease 2019 in pregnancy: living systematic review and meta-analysis. BMJ. 2020;370:m3320.
10. Rahmani K, Shavaleh R, Forouhi M, Disfani HF, Kamandi M, Oskooi RK, et al. The effectiveness of COVID-19 vaccines in reducing the incidence, hospitalization, and mortality from COVID-19: a systematic review and meta-analysis. Front Public Health [Internet]. 2022 [cited 2024 Jul 31];10. Available from: https://www.frontiersin.org/journals/public-health/articles/https://doi.org/10.3389/fpubh.2022.873596/full
11. Takahashi Y, Ishitsuka K, Sampei M, Okawa S, Hosokawa Y, Ishiguro A, et al. COVID-19 vaccine literacy and vaccine hesitancy among pregnant women and mothers of young children in Japan. Vaccine. 2022;40:6849–56.
12. Njoku A, Evans M, Nimo-Sefah L, Bailey J. Listen to the whispers before they become screams: addressing Black maternal morbidity and mortality in the United States. Healthcare. 2023;11:438.
13. Dahl AA, Yada FN, Butts SJ, Tolley A, Hirsch S, Lalgondar P, et al. Contextualizing the experiences of Black pregnant women during the COVID-19 pandemic: 'it's been a lonely ride.' Reprod Health. 2023;20:124.
14. Hill L, Published SA. COVID-19 cases and deaths by race/ethnicity: current data and changes over time [Internet]. KFF. 2022 [cited 2024 Jul 31]. Available from: https://www.kff.org/coronavirus-covid-19/issue-brief/covid-19-cases-and-deaths-by-race-ethnicity-current-data-and-changes-over-time/. Accessed 31 Jul 2024.
15. Gould E, Wilson V. Black workers face two of the most lethal preexisting conditions for coronavirus—racism and economic inequality | Policy Commons. [cited 2024 Jul 31]; Available from: https://policycommons.net/artifacts/1409559/black-workers-face-two-of-the-most-lethal-preexisting-conditions-for-coronavirus-racism-and-economic-inequality/2023822/. Accessed 31 Jul 2024.
16. Singu S, Acharya A, Challagundla K, Byrareddy SN. Impact of social determinants of health on the emerging COVID-19 pandemic in the United States. Front Public Health [Internet]. 2020 [cited 2024 Jul 31];8. Available from: https://www.frontiersin.org/journals/public-health/articles/https://doi.org/10.3389/fpubh.2020.00406/full
17. Hoyert DL. Maternal mortality rates in the United States, 2021 [Internet]. 2023 [cited 2024 Jul 31]. Available from:https://www.cdc.gov/nchs/data/hestat/maternal-mortality/2021/maternal-mortality-rates-2021.htm. Accessed 31 Jul 2024.
18. Zhang E, Dai Z, Wang S, Wang X, Zhang X, Fang Q. Vaccine literacy and vaccination: a systematic review. Int J Public Health. 2023;68:1605606.
19. Biasio LR, Lorini C, Zanobini P, Bonaccorsi G. The still unexplored mediating role of vaccine literacy. Hum Vaccines Immunother. 2024;20:2310360.
20. Isonne C, Iera J, Sciurti A, Renzi E, De Blasiis MR, Marzuillo C, et al. How well does vaccine literacy predict intention to vaccinate and vaccination status? A systematic review and meta-analysis. Hum Vaccines Immunother. 2024;20:2300848.
21. Fenta ET, Tiruneh MG, Delie AM, Kidie AA, Ayal BG, Limenh LW, et al. Health literacy and COVID-19 vaccine

acceptance worldwide: a systematic review. SAGE Open Med. 2023;11:20503121231197868.
22. Maki W, Ishitsuka K, Yamaguchi K, Morisaki N. Vaccine literacy, COVID-19 vaccine-related concerns, and intention to recommend COVID-19 vaccines of healthcare workers in a pediatric and maternity hospital: a cross-sectional study. Vaccines. 2022;10:1482.
23. Ogueji IA, DemokoCeccaldi BM, Okoloba MM, Maloba M, Adejumo AO, Ogunsola OO. Black people narrate inequalities in healthcare systems that hinder COVID-19 vaccination: evidence from the USA and the UK. J Afr Am Stud. 2022;26:297–313.
24. AuYoung M, Rodriguez Espinosa P, Chen W, Juturu P, Young M-EDT, Casillas A, et al. Addressing racial/ethnic inequities in vaccine hesitancy and uptake: lessons learned from the California alliance against COVID-19. J Behav Med. 2023;46:153–66.
25. Rubin R. Pregnant people's paradox—excluded from vaccine trials despite having a higher risk of COVID-19 complications. JAMA. 2021;325:1027–8.
26. Obasanya M, Igenoza O, Gupta S, McElroy K, Brannon GE, Brown K. Racial and ethnic differences in maternal and child COVID-19 vaccination intent among pregnant and postpartum women in the USA (April–June 2020): an application of health belief model. J Racial Ethn Health Disparities. 2023;10:2540–51.
27. Daşıkan Z, Ekrem EC, Kıratlı D. COVID-19 vaccine acceptance among pregnant, lactating, and nonpregnant women of reproductive age in Turkey: a cross-sectional analytical study. Disaster Med Public Health Prep. 2023;17:e505.
28. Lamptey E. Overcoming barriers to COVID-19 vaccination of pregnant women. Gynecol Obstet Clin Med. 2022;2:29–33.
29. Garrett C, Aghaei A, Aggarwal A, Qiao S. The role of social media in the experiences of COVID-19 among long-hauler women: qualitative study. JMIR Hum Factors. 2024;11:e50443.
30. Wright EM, Matthai MT, Meyer E. The influence of social media on intrapartum decision making: a scoping review. J Perinat Neonatal Nurs. 2019;33:291.
31. Morgan KM, Maglalang DD, Monnig MA, Ahluwalia JS, Avila JC, Sokolovsky AW. Medical mistrust, perceived discrimination, and race: a longitudinal analysis of predictors of COVID-19 vaccine hesitancy in US adults. J Racial Ethn Health Disparities. 2023;10:1846–55.
32. Roat C, Webber-Ritchey KJ, Spurlark RS, Lee Y-M. Black Americans receiving the COVID-19 vaccine and effective strategies to overcome barriers: an integrative literature review. J Racial Ethn Health Disparities. 2023;10:2577–87.
33. Restrepo N, Krouse HJ. COVID-19 disparities and vaccine hesitancy in Black Americans: what ethical lessons can be learned? [Internet]. 2022 [cited 2024 Jul 31]. Available from: https://journals.sagepub.com/doi/full/ , https://doi.org/10.1177/01945998211065410?casa_token=G4esPNi54CkAAAAA%3AxkzmQixbL4nR9mSFZs5uDQwZP3NTe7gEenc_skMQMnI190qF5obrUOM5cluraXfSSCqjLp1v3cUQ. Accessed 28 Jul 2024.
34. Ford CL, Airhihenbuwa CO. Critical race theory, race equity, and public health: toward antiracism Praxis. Am J Public Health. 2010;100:S30–5.
35. Ford CL, Airhihenbuwa CO. The public health critical race methodology: praxis for antiracism research. Soc Sci Med. 2010;71:1390–8.
36. Barber S, Headen I, Branch B, Tabb L, Yadeta K. COVID-19 in context: racism, segregation, and racial inequities in Philadelphia [Internet]. Drexel Univ. Urban Health Collab. 2020 [cited 2024 Apr 27]. Available from: https://drexel.edu/uhc/resources/briefs/Covid-19 in Context/. Accessed 27 Apr 2024.
37. Burris HH, Mullin AM, Dhudasia MB, Flannery DD, Mukhopadhyay S, Pfeifer MR, et al. Neighborhood characteristics and racial disparities in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) Seropositivity in Pregnancy. Obstet Gynecol. 2022;139:1018.
38. Gee GC, Ford CL. Structural racism and health inequities: old issues, new directions. Du Bois Rev Soc Sci Res Race. 2011;8:115–32.
39. Gur RE, White LK, Waller R, Barzilay R, Moore TM, Kornfield S, et al. The disproportionate burden of the COVID-19 pandemic among pregnant Black women. Psychiatry Res. 2020;293:113475.
40. Cooper K. Philadelphia is 'America's poorest big city.' Here's what that actually means [Internet]. WHYY. [cited 2024 May 3]. Available from: https://whyy.org/articles/philadelphia-americas-poorest-big-city-poverty/. Accessed 31 May 2024.
41. Maternal mortality report finds non-Hispanic Black women represent 73% of pregnancy-related deaths in Philadelphia [Internet]. Philadelphia, PA: City of Philadelphia Department of Public Health; 2024 Feb. Available from: https://www.phila.gov/2021-03-23-maternal-mortality-report-finds-non-hispanic-black-women-represent-73-of-pregnancy-related-deaths-in-philadelphia/. Accessed 31 Jul 2024.
42. Redman S, Greenhalgh T, Adedokun L, Staniszewska S, Denegri S. Committee on behalf of the C of KCS. Co-production of knowledge: the future BMJ. 2021;372:n434.
43. Francis JJ, Johnston M, Robertson C, Glidewell L, Entwistle V, Eccles MP, et al. What is an adequate sample size? Operationalising data saturation for theory-based interview studies. Psychol Health. 2010;25:1229–45.
44. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3:77–101.
45. Simmons LA, Whipps MDM, Phipps JE, Satish NS, Swamy GK. Understanding COVID-19 vaccine uptake during pregnancy: 'hesitance', knowledge, and evidence-based decision-making. Vaccine. 2022;40:2755–60.
46. Maisonneuve E, Gerbier E, Tauqeer F, Pomar L, Favre G, Winterfeld U, et al. Determinants of vaccination and willingness to vaccinate against COVID-19 among pregnant and postpartum women during the third wave of the pandemic: a European multinational cross-sectional survey. Viruses. 2023;15:1090.
47. Gencer H, Özkan S, Vardar O, Serçekuş P. The effects of the COVID 19 pandemic on vaccine decisions in pregnant women. Women Birth. 2022;35:317–23.
48. Gutierrez S, Logan R, Marshall C, Kerns J, Diamond-Smith N. Predictors of COVID-19 vaccination likelihood among reproductive-aged women in the United States. Public Health Reports®. 2022;137:588–96.
49. Redmond ML, Mayes P, Morris K, Ramaswamy M, Ault KA, Smith SA. Learning from maternal voices on COVID-19 vaccine uptake: perspectives from pregnant women living in the Midwest on the COVID-19 pandemic and vaccine. J Community Psychol. 2022;50:2630–43.
50. Bhattacharya O, Siddiquea BN, Shetty A, Afroz A, Billah B. COVID-19 vaccine hesitancy among pregnant women: a systematic review and meta-analysis. BMJ Open. 2022;12:e061477.
51. Padamsee TJ, Bond RM, Dixon GN, Hovick SR, Na K, Nisbet EC, et al. Changes in COVID-19 vaccine hesitancy among Black and White individuals in the US. JAMA Netw Open. 2022;5:e2144470.
52. Harris OO, Perry TE, Johnson JK, Lichtenberg P, Washington T, Kitt B, et al. Understanding the concept of trust and other factors related to COVID-19 vaccine intentions among Black/African American older adults prior to vaccine development. SSM - Qual Res Health. 2023;3:100230.
53. Bergus GR, Levin IP, Elstein AS. Presenting risks and benefits to patients. J Gen Intern Med. 2002;17:612–7.
54. Zelaya CM, Francis DB, Williams LB. Understanding COVID-19 vaccine knowledge, beliefs, and trusted information sources

among Black women in Kentucky: implications for vaccine uptake. J Health Commun. 2023;28:680–8.
55. Zhang R, Qiao S, McKeever BW, Olatosi B, Li X. Listening to voices from African American communities in the southern states about COVID-19 vaccine information and communication: a qualitative study. Vaccines. 2022;10:1046.
56. Mitchell SL, Schulkin J, Power ML. Vaccine hesitancy in pregnant Women: a narrative review. Vaccine. 2023;41:4220–7.
57. Razzaghi H. COVID-19 vaccination coverage among pregnant women during pregnancy — eight integrated health care organizations, United States, December 14, 2020–May 8, 2021. MMWR Morb Mortal Wkly Rep [Internet]. 2021 [cited 2024 May 3];70. Available from:https://www.cdc.gov/mmwr/volumes/70/wr/mm7024e2.htm. Accessed 3 May 2024.
58. Tucker CM, Kang S, Ukonu NA, Linn GS, DiSangro CS, Arthur TM, et al. A culturally sensitive church-based health-smart intervention for increasing health literacy and health-promoting behaviors among Black adult churchgoers. J Health Care Poor Underserved. 2019;30:80–101.
59. Muvuka B, Combs RM, Ayangeakaa SD, Ali NM, Wendel ML, Jackson T. Health literacy in African-American communities: barriers and strategies. HLRP Health Lit Res Pract. 2020;4:e138–43.
60. Baxter K, Medlock MM, Griffith EEH. Hope, resilience, and African-American spirituality. In: Medlock MM, Shtasel D, Trinh N-HT, Williams DR, editors. Racism Psychiatry Contemp Issues Interv [Internet]. Cham: Springer International Publishing; 2019 [cited 2024 Jul 31]. p. 141–56. Available from: https://doi.org/10.1007/978-3-319-90197-8_8
61. Allen SE. Is the Black church dead?: religious resilience and the contemporary functions of Black Christianity. Religions. 2023;14:460.
62. Bogart LM, Dong L, Gandhi P, Ryan S, Smith TL, Klein DJ, et al. What contributes to COVID-19 vaccine hesitancy in Black communities, and how can it be addressed? [internet]. RAND Corporation; 2021 Mar. Available from: https://www.rand.org/pubs/research_reports/RRA1110-1.html. Accessed 30 Jul 2024.
63. Merkley E, Loewen PJ. The correlates and dynamics of COVID-19 vaccine-specific hesitancy. Vaccine. 2022;40:2020–7.
64. Latkin CA, Dayton L, Miller JR, Yi G, Jaleel A, Nwosu CC, et al. Behavioral and attitudinal correlates of trusted sources of COVID-19 vaccine information in the US. Behav Sci. 2021;11:56.
65. Cénat JM, Farahi SMMM, Dalexis RD, Yaya S, Caulley L, Chomienne M-H. COVID-19 vaccine uptake, conspiracy theories, and health literacy among Black individuals in Canada: racial discrimination, confidence in health, and COVID-19 stress as mediators. J Med Virol. 2024;96:e29467.
66. Chandler R, Guillaume D, Parker AG, Mack A, Hamilton J, Dorsey J, et al. The impact of COVID-19 among Black women: evaluating perspectives and sources of information. Ethn Health. 2021;26:80–93.
67. Rasmussen SA, Jamieson DJ. Pregnancy, postpartum care, and COVID-19 vaccination in 2021. JAMA. 2021;325:1099–100.
68. Balasuriya L, Santilli A, Morone J, Ainooson J, Roy B, Njoku A, Mendiola-Iparraguirre A, Duffany KO, Macklin B, Higginbottom J, Fernández-Ayala C. COVID-19 vaccine acceptance and access among Black and Latinx communities. JAMA Netw Open. 2021;4(10):e2128575.