

ARTICLE

The vaccine hesitancy continuum among hesitant adopters of the COVID-19 vaccine

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Abstract

Vaccination is a strategy for mitigating the impact of coronavirus disease 2019 (COVID-19) at both the individual and population levels. Vaccine hesitancy is identified as a significant threat to global health by the World Health Organization (WHO). Vaccine hesitancy has been theorized as a continuum encompassing a range of attitudes, beliefs, emotional orientations, ideologies, and health-seeking behaviors. Individuals who received the COVID-19 vaccine but also indicated some level of hesitancy about vaccination, or “hesitant adopters,” remain an understudied group. This study uses a qualitative descriptive design to understand motivations to receive the COVID-19 vaccine among hesitant adopters at various self-reported levels of hesitancy. We conducted interviews with hesitant adopters ($n = 49$) to analyze the elements of vaccine hesitancy corresponding to reported levels of COVID-19 vaccine hesitancy (i.e., “little hesitant,” “somewhat hesitant,” and “very hesitant”). Concerns about side effects are shared across the continuum but are articulated differently at each level of hesitancy. The “little hesitant” relate fears of side effects to their health and a lack of clear information to inform their health decision making, whereas the “very hesitant” articulate the risks of side effects within the frame of conspiracies related to the development, approval, and economics of the COVID-19 vaccine. Additionally, conspiracy theories generally increase in salience across the continuum, with the “very hesitant” reporting conspiracy theories as the most salient element of vaccine hesitancy. This research presents opportunities for developing targeted interventions for different levels of vaccine hesitancy.

Study Highlights

WHAT IS THE CURRENT KNOWLEDGE ON THE TOPIC?

Prior research has documented that coronavirus disease 2019 (COVID-19) vaccine hesitancy is influenced by several elements, including fears of side effects and adverse events, the speed of the development and approval process, health literacy, and misinformation/disinformation. However, no studies have explored the difference in these influences across a hesitancy continuum.

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WHAT QUESTION DID THIS STUDY ADDRESS?

This study analyzes patterns in vaccine hesitancy toward the COVID-19 vaccine among hesitant adopters along a vaccine hesitancy continuum: “little hesitant,” “somewhat hesitant,” and “very hesitant.”

WHAT DOES THIS STUDY ADD TO OUR KNOWLEDGE?

This is the first study to explore differences in hesitancy along the vaccine hesitancy continuum for COVID-19 vaccines. We describe specific concerns among the vaccine hesitant and patterns of attitudes and beliefs about the COVID-19 vaccine associated with different levels of hesitancy, demonstrating COVID-19 vaccine hesitancy is not monolithic. We show fear of potential side effects is shared across the continuum. However, concern for side effects is associated with personal health concerns and a lack of information for the “little hesitant,” whereas conspiracy theories about COVID-19 and vaccines are major drivers of hesitancy for the “very hesitant.”

HOW MIGHT THIS CHANGE CLINICAL PHARMACOLOGY OR TRANSLATIONAL SCIENCE?

This study can inform targeted interventions addressing hesitancy based on the level of hesitancy along the hesitancy continuum.

INTRODUCTION

Severe acute respiratory syndrome coronavirus 3 (SARS-CoV-2), the agent of coronavirus disease 2019 (COVID-19), was first detected in a patient in Wuhan, China, in December 2019. Since the emergence of the COVID-19 pandemic, more than 88 million COVID-19 cases have been confirmed in the United States.¹ Vaccination is an effective strategy for mitigating the impact of COVID-19 at the individual and population levels.²⁻⁴ Rates of vaccination have slowed in recent months,⁵ and COVID-19-related public health protections, including mask mandates, have ended in many areas.⁶ Early evidence suggests COVID-19 vaccine hesitancy has and will continue to affect the uptake of COVID-19 boosters,⁷ and the numbers of vaccinated Americans seeking booster doses comprises fewer than 50% of fully vaccinated Americans.⁸ With the emergence of multiple COVID-19 Variants of Concern,⁹⁻¹¹ the loosening of public health protective policies,^{12,13} and rising COVID-19 infection rates globally,^{9,14-16} understanding vaccine hesitancy and increasing vaccine uptake remain critical to public health efforts aimed at minimizing COVID-19 morbidity and mortality.

Vaccine hesitancy is identified as a significant threat to global health by the World Health Organization (WHO).^{17,18} Vaccine hesitancy has been theorized as a continuum, which encompasses a range of attitudes, beliefs, emotional orientations, ideologies, and various health-seeking behaviors.^{17,19,20} However, empirical research often conflates the attitude of vaccine hesitancy with vaccination behavior.²¹⁻²⁵ Emerging research has been careful to distinguish between the attitude of hesitancy and

the behavior of vaccination and has demonstrated many individuals who receive the COVID-19 vaccine also report some level of hesitancy about vaccines. For example, Willis et al.²⁵⁻²⁸ found that 60% of recently vaccinated individuals reported some level of vaccine hesitancy. The literature documents a range of elements in COVID-19 vaccine hesitancy, including fears of side effects and adverse events,^{29,30} the speed of the development and approval process,^{30,31} health literacy,²⁹ and an “infodemic” that includes the spread of misinformation and disinformation about COVID-19 and vaccines.³¹⁻³³ Conspiracy theories and conspiratorial thinking are linked to diminished trust in medical/scientific authorities and government³⁴ and low assessments of health risks from COVID-19.³⁵ The literature documents that some conspiracy theories attribute aspects of the pandemic and/or COVID-19 vaccine to influential individuals or institutions acting for their benefit, often against the common good.^{32,36}

Hesitant adopters of the COVID-19 vaccine remain an understudied group, yet they represent a critical population as they provide insight into factors motivating vaccination behaviors among the hesitant. Few studies have explored what characterizes individuals who express some degree of vaccine hesitancy and still get vaccinated. Prior quantitative research focused on the hesitancy continuum presents various thoughts and beliefs associated with vaccine hesitancy, but these studies do not relate beliefs to specific levels of hesitancy.^{19,37-39} The authors are unaware of any studies which characterize vaccine beliefs according to individuals' level of hesitancy. The present study aims to fill this gap in the

literature with an analysis of the patterns of attitudes toward the COVID-19 vaccine found at each level of the vaccine hesitancy continuum.

METHODS

Study approach and design

This study uses a qualitative descriptive design⁴⁰ to understand motivations to receive the COVID-19 vaccine among hesitant adopters at various self-reported levels of hesitancy. Quantitative descriptive data are provided to describe the sample. All study materials and procedures were approved by the University of Arkansas for Medical Sciences Institutional Review Board (#263020).

Study sample: Participant recruitment, consent, and remuneration

Online survey data were collected from 2022 adults in the United States between September 17, 2021, and October 3, 2021. Participants were initially recruited through email from an online registry of research volunteers across the United States. Inclusion in the survey included being 18 years of age or older and living in the United States.

Among the 2022 survey participants, 1138 (56%) individuals indicated they would be willing to participate in follow-up qualitative interviews. Inclusion criteria for qualitative interview participation included reporting some level of vaccine hesitancy (“little hesitant,” “somewhat hesitant,” and “very hesitant”) in the survey, indicating that they had received at least one dose of the COVID-19 vaccine, and agreeing to follow-up contact for participation in qualitative interviews. Potential participants were randomly ordered, and the first 225 men and 225 women were emailed an invitation to participate and schedule an interview. The first 25 men and 25 women to commit to a scheduled interview time were interviewed for this study.

Instruments

Quantitative survey items collected participants' self-reported level of hesitancy about the COVID-19 vaccine and sociodemographic information, among other topics. Sociodemographic survey questions were drawn from validated sources, such as the Behavioral Risk Factor Surveillance Survey.⁴¹ Other survey questions were related to COVID-19 vaccine hesitancy. For consistency across interviews, we developed a semi-structured interview guide

focused on understanding participants' COVID-19 vaccine hesitancy.

Data collection

Data were collected from 50 participants using individual qualitative interviews. One interview participant was excluded from the analysis because they did not meet the inclusion criteria of reporting some level of vaccine hesitancy, providing a final sample of 49 participants. All study staff conducting interviews had experience facilitating interviews and participated in training sessions for this study. These training sessions included three mock interviews. Interviewers included two women and three men. Interviews varied in length and ranged between 5 and 30 min in length. Interviews were conducted with a secure video conferencing platform and/or telephone.^{42,43} Zip code and county information were collected from all participants to document the broad geographic distribution of participants.

Qualitative data analysis

All interviews were conducted in English, and recorded interviews were transcribed verbatim. De-identified transcripts were uploaded to MAXQDA 2020 for analysis.⁴⁴ Three qualitative researchers reviewed and analyzed all interview transcripts. These researchers created a codebook with emergent primary and secondary codes used to interpret the meaning and assign labels to segments of the transcripts.^{45–47} Segments of text were coded by the first author, with confirmation-coding analysis performed by five additional qualitative researchers. Initial codes were refined, and the codebook was revised four times to reach a consensus on codebook structure and identify emergent themes. Any divergences in the interpretation of data, or the classification of coded segments, were discussed by the research team using a consensus model. The research team critically reviewed the data, analysis summaries, codebook, and all coded segments to ensure data saturation, analytic rigor, and reliability.⁴⁸ After the coding period, the authors used MAXQDA 2020 to generate code frequencies for each level of COVID-19 vaccine hesitancy. Frequency percentages were calculated to highlight the prevalence of themes among coded segments relative to the self-reported level of COVID-19 vaccine hesitancy. Exemplary quotes were identified to represent and elaborate thematic domains. Participants' statements often included multiple codes within a single answer, and quotes were presented with the theme they best represent. The most illustrative quotes for each thematic domain are presented.

RESULTS

Descriptive sociodemographic frequencies and percentages were calculated for the study sample ($n = 49$) and are presented in [Table 1](#). Within the sample, 55% ($n = 27$) reported being “a little hesitant” about the COVID-19 vaccine, 24% ($n = 12$) reported being “somewhat hesitant,” and 20% ($n = 10$) reported being “very hesitant.” The sample was 51% men and 49% women. The sample was racially and ethnically diverse, with participants identifying themselves as Black ($n = 17$), White ($n = 12$), Asian ($n = 9$), American Indian or Alaska Native ($n = 2$), and

Native Hawaiian or Pacific Islander ($n = 1$). Most of the sample (76%) reported having attained a bachelor's degree or a graduate degree. The sample was also widely distributed geographically across the continental United States, with participants living in the Northeast (24%), Midwest (12%), South (43%), and West (20%).

Overview of qualitative themes

Three primary themes defining COVID-19 vaccine hesitancy emerged during the analysis of participant interviews: vaccine safety, freedom of choice, and complacency. The primary theme of vaccine safety includes a discussion of general concerns about the safety of the vaccines, including reasons participants identified that created doubts about the safety of the COVID-19 vaccine. Freedom of choice collects participant discussions of hesitancy related to individual freedom of choice or social pressure to vaccinate. The primary theme of complacency included participant hesitancy related to individual health and perceptions the vaccine was an unnecessary precaution or an unnecessary risk compared to a perceived low level of risk from COVID-19 infection. Within the primary theme of vaccine safety, five secondary themes were identified: side effects/adverse reactions, speed of vaccine development/approval, lack of information about vaccines, histories of exploitation, and conspiracy theories. Within the primary theme of freedom of choice, two secondary themes were identified: free to choose and social pressure to vaccinate. Within the primary theme of complacency, two secondary themes were identified: strong immune system and low risk to self. These themes were not equally distributed within each of the three levels of hesitancy, with the frequency of themes showing distinct differences in the salience of these factors, as well as in the framing of these issues based on the participant's level of COVID-19 vaccine hesitancy. Primary and secondary themes, and the frequencies of coded segments at each level of hesitancy, are reported in [Table 2](#).

TABLE 1 Sample characteristics of hesitant adopters ($n = 49$)

	Frequency	Percent (%)
Hesitancy level		
A little hesitant	27	55.10
Somewhat hesitant	12	24.49
Very hesitant	10	20.41
Age		
18–24	3	6.12
25–34	10	20.41
35–44	11	22.45
45–54	14	28.57
55–64	5	10.20
65+	6	12.24
Gender		
Man	25	51.02
Woman	24	48.98
Race/Ethnicity		
Asian	9	18.37
Black	17	34.69
Hispanic	8	16.33
AIAN	2	4.08
NHPI	1	2.04
White	12	24.49
Education		
High school or less	4	8.16
Some college/no degree	7	14.29
Associate degree	1	2.04
Bachelor's or graduate degree	37	75.51
Region		
Northeast	12	24.49
Midwest	6	12.24
South	21	42.86
West	10	20.41

Abbreviations: AIAN, American Indian and Alaska Native; NHPI, Native Hawaiian or Pacific Islander.

COVID-19 vaccine hesitancy for the “little hesitant”

Participants who were “a little hesitant” about the COVID-19 vaccine described their hesitancy in distinct ways compared to participants with higher levels of hesitancy, although there are overlaps in the basic themes across all levels of hesitancy. The most commonly reported themes for the “little hesitant” were within the primary theme of vaccine safety. For the “little hesitant,” the most frequently described reasons for hesitancy were possible side effects and adverse

TABLE 2 Primary and secondary themes

Primary themes	Secondary themes	“Little hesitant” ^a	“Somewhat hesitant” ^a	“Very hesitant” ^a
Vaccine safety	Side effects/adverse reactions	40.2	50.0	22.0
	Speed of vaccine development/approval	26.5	19.2	13.6
	Lack of information about vaccines	8.8	13.5	3.4
	Histories of exploitation	2.9	1.9	0.0
	Conspiracy theories	1.0	7.7	30.5
Freedom of choice	Free to choose	8.8	1.9	11.9
	Social pressure to vaccinate	3.9	1.9	3.4
Complacency	Strong immune system	4.9	3.8	8.5
	Low risk to self	2.9	0.0	6.8

^aColumns show percentages of coded data segments for each theme among all participants reporting each level of hesitancy.

reactions to the vaccine (40.2%). Uniquely from those with higher levels of hesitancy, these concerns were most often associated with personal medical histories or underlying conditions. The speed of the development and approval process was also a source of concern for “little hesitant” participants (26.5%). These concerns were often linked to potential side effects and adverse reactions or the lack of information to inform vaccine decision making (8.8%). The “little hesitant” participants also mentioned histories of medical testing and exploitation (2.9%), such as the well-known Syphilis Study at Tuskegee, as informing general hesitancy toward the COVID-19 vaccine. A single “little hesitant” participant presented a conspiracy theory regarding the profit motives of politicians as being a source of hesitancy about the vaccine (1.0%).

The primary theme of freedom of choice (12.7%) also emerged from analysis of the vaccine hesitancy of “little hesitant” participants. Participants expressed hesitancy about government and private company vaccine mandates, travel restrictions based on vaccination status, and similar issues (8.8%). Closely related, participants mentioned that their vaccine hesitancy incorporated fears for the way that social and peer pressure forced decisions to vaccinate (3.9%).

Among “little hesitant” participants, there was some hesitancy related to the desire for individuals to make informed health decisions about the vaccine, based on personal circumstances. These participants described hesitancy as a feeling that vaccination was personally unnecessary for them, as part of their own health-seeking behaviors. The focus on individual health also included describing their immune systems as robust and capable of protecting them from infection (4.9%) and expressing belief in personal low risk of the worst health outcomes from COVID-19 infection (2.9%). Theme frequencies for the “little hesitant” participants are presented in [Table 2](#). [Figure 1](#) presents a comparison of code frequencies of secondary themes for each level of

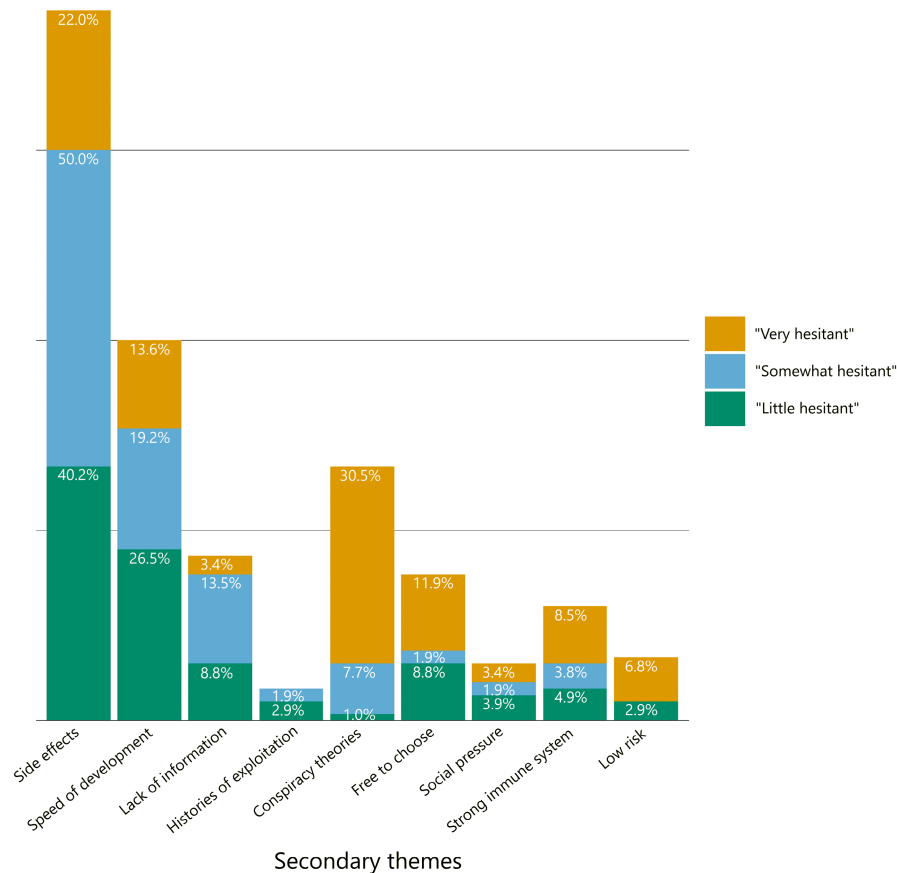
hesitancy. Exemplary quotes for secondary themes are presented in [Table 3](#).

COVID-19 vaccine hesitancy for the “somewhat hesitant”

Participants describing themselves as “somewhat hesitant” about the COVID-19 vaccine presented major concerns of vaccine safety, especially side effects and adverse reactions (50.0%), which is similar to the “little hesitant” participants. The speed of the development and approval process was the second most frequently mentioned source for vaccine hesitancy among the “somewhat hesitant” (19.2%), followed by difficulties with finding and understanding information from trustworthy sources of information (13.5%). A major divergence between the “little hesitant” and “somewhat hesitant” participants is the increased focus on conspiracies related to the vaccine (7.7%). The “somewhat hesitant” related their hesitancy to conspiracies more than seven times as frequently as participants at the “little hesitant” level.

“Somewhat hesitant” participants were less likely to relate vaccine hesitancy to freedom of choice on vaccination (3.8%) and were less likely to express that vaccination was unnecessary (3.8%) than the “little hesitant.” Hesitancy for the “somewhat hesitant” centered on personal risk from vaccines, with the speed of the vaccine development and lack of clear information about the approval process supporting their COVID-19 vaccine hesitancy. The importance of clear information from trusted sources on vaccines and the development/approval process was also demonstrated in the frequency with which these participants noted hesitation related to the difficulty in finding and parsing information about the vaccine. Theme frequencies for the “somewhat hesitant” participants are presented in [Table 2](#). [Figure 1](#) presents a comparison of

FIGURE 1 Frequencies of secondary themes for all levels of hesitancy.



code frequencies of secondary themes for each level of hesitancy. Exemplary quotes for secondary themes are presented in [Table 4](#).

COVID-19 vaccine hesitancy for the “very hesitant”

Whereas the most frequent theme for the “very hesitant” was vaccine safety, the “very hesitant” articulated vaccine hesitancy distinctly from both the “somewhat hesitant” and the “little hesitant.” The “very hesitant” were highly focused on conspiracy theories around COVID-19 and the COVID-19 vaccines (30.5%), and this was the most frequently mentioned secondary theme. The “very hesitant” often mentioned their concern with side effects and adverse reactions (22.0%) when describing the major sources for their hesitancy. This further differentiates their hesitancy from the vaccine hesitancy present at the lower levels. The speed of development (13.6%) was also noted by the “very hesitant” as a major aspect of their hesitancy, but as with the concern with side effects and adverse reactions, the development of the vaccine was also frequently related to conspiracy theories.

Primary themes of the freedom of choice and complacency were more frequently reported among the

“very hesitant” than at the “somewhat hesitant” level. Interestingly, these concerns were most closely matched in focus when compared to the “little hesitant” participants. The “very hesitant” were more concerned with being free to choose (11.9%) to be vaccinated, but were interestingly not as focused on the role of social pressure to vaccinate (3.4%). For the “very hesitant,” they also framed their hesitancy around the strength of their own immune systems (8.5%) and the lack of risk posed by COVID-19 infection (6.8%) more frequently than either the “little hesitant” or the “somewhat hesitant.” Theme frequencies for the “very hesitant” participants are presented in [Table 2](#). [Figure 1](#) presents a comparison of code frequencies of secondary themes for each level of hesitancy. Exemplary quotes for secondary themes are presented in [Table 5](#).

DISCUSSION

This study documents nuanced elements of the vaccine hesitancy continuum for hesitant adopters of the COVID-19 vaccine. Participants self-reported their hesitancy as being “a little hesitant,” “somewhat hesitant,” and “very hesitant.” Although the primary themes defining COVID-19 vaccine hesitancy were consistent, the

TABLE 3 Exemplary quotes for “little hesitant” participants

Primary theme	Secondary theme	Exemplary quote
Vaccine safety	Side effects/ adverse reactions	I was a little worried just because you don't 100% know what you're getting when you get this medication. You don't know how you're going to react to it. My big fear was that I would have an adverse reaction to it. (#1252, 32-year-old African American woman)
		I was a little bit hesitant at first. I wasn't sure I wanted to do it because like a lot of people, you know, it was new and there was some talk about side effects. (#191, 65-year-old White woman)
	Speed of vaccine development/ approval	I think developed within less than a year. Right? Because when the proverbial shit hit the fan out in [...] March of 2020 and then [there is] already a vaccine in December of 2020 and I believe with all other vaccines they go through multiple years of being trialed. This was just very, very quick. I think nine months. So, there's just a bit of hesitancy from you. (#15, 33-year-old White man)
		I thought it came out a little fast. So, I was a little hesitant. (#74, 45-year-old White woman)
	Lack of information about vaccines	If the original data were available, I would like to see that. At the point, it's difficult to get that piece of information. Specially, I like to see the data that is particularly related to me or like maybe my age, my gender, or any. It's not easy to get that information because we're just anyone. (#1200, 45-year-old Asian man)
		I guess I was still a little hesitant just because in my mind, because I didn't know as much. (#1901, 33-year-old Hispanic man)
Histories of exploitation	It's unfortunate because I think it has a lot of historical context of experimentation that were done on Black people after slavery was over. People still hold on to that. (#1252, 32-year-old African American woman)	
	[There is hesitancy for people like me] because of situations like in Los Angeles, in Chicago, and in New York years ago when they were vaccinating, they were given African Americans the placebo. The Tuskegee thing. (#1957, 48-year-old African American man)	
Conspiracy theories	Yeah. I'm in my early 20s and there were some rumors circulating that the vaccine might lead to fertility issues later. And, the more I dug into it, the more it seemed unsubstantiated, but that was kind of a fear, or fear might be a strong word, just something I had heard before I got the vaccine. (#1675, 22-year-old Asian woman)	
Freedom of choice	Free to choose	Freedoms lost. All kinds of questions come into play then if you start forcing people to do things like that. You're not going to be able to tie people down and give them the shot...That's their choice and they have legitimate reasons or even not legitimate reasons for not getting the vaccine that's up to them. (#191, 65-year-old White woman)
		I think that goes back to the whole American freedom thing. I want to be free to do what I choose to do, and I think there's some people just feel like, okay, government's pushing this too hard, so I don't want to do it just as it pushed back on it. (#2863, 47-year-old White man)
Social pressure to vaccinate	Social pressure to vaccinate	Whether that's the case, we'll see but anytime you have government or media pushing you to do something, there always some skepticism. (#1248, 52-year-old Asian man)
		It's just a general feeling from the media that if you don't get it, then there's something wrong with the way you're thinking. And that seems to be prevalent in the whole country, more and more. And then our own president has been making comments about people who aren't vaccinated; how we're holding up the country moving forward, [...] the unvaccinated are the ones who are preventing the country from getting back to normal. And a lot of the problems we're having are their fault. And, and then they had advertisements on television here in Oregon. From a nurse, excuse me, who said, you know, it's your choice. And to get, do the research, look into it, and then make your choice. But that's not really the truth. And in a way, it is your choice. You can decide what to do with it, except in this situation. [...] I just don't feel that that's true. So, I don't want that atmosphere of judging and condemning, even from our own leadership and our own government. (#191 65-year-old White woman)
Complacency	Strong immune system	I consider myself healthy, my family is healthy. We have strong immune systems. I wasn't really worried about us but just thinking about other people that have been catching COVID and just how it's... it can be deadly for some people. (#394, 41-year-old African American woman)
		I am relatively young. I don't have the underlying health conditions. So, given the numbers, I didn't think so much that I would be affected by it. If I were to contract the virus, but the people around me. So, I'm more concerned than, for the people around me than I am, if you will for myself. (#15, 33-year-old White man)
	Low risk to self	Only if you see that the benefit is more than the risk, then it makes sense to go ahead with this vaccine. (#1200, 45-year-old Asian man)

Abbreviation: COVID, coronavirus disease.

TABLE 4 Exemplary quotes for “somewhat hesitant” participants

Primary theme	Secondary theme	Exemplary quote
Vaccine safety	Side effects/adverse reactions	So, I was [eligible] that first round. I don't think I did it then. In fact, I didn't because I just wasn't sure. You know that was at the time when there was all of that discussion about how safe is it, long term effects. And then I heard people say it was painful, and they couldn't use their arm. [...] So somewhere down the line, I made an appointment. And then I didn't go. I'm still apprehensive and I was telling my daughter that I made this appointment and I didn't go and she was like, "Why didn't you?" And I was like, "I just don't know. There was a lot of fear." (#881, 71-year-old African American woman) I was hesitant about the COVID vaccine. And that was the only reason I was hesitant was, I didn't want to end up back in that boat [of Guillain-Barre syndrome attributed to flu vaccination]. I felt that it was a good thing to do. But if it was going to put me back in a bed, I wasn't going to do it. I'm all for helping the society, but I also got to think about me, too. (#636, 48-year-old White man)
	Speed of vaccine development/ approval	Well, I'm sure you've heard this before, but they were developed so quickly that you kind of tend to think you don't know whether you can trust what comes out. (#303, 70-year-old White woman) I think it is just the normal timeframe and the research that it takes to cover all the areas of what could be the side effects or the effects of people. And I just felt people felt that is this going to increase an existing issue that I have? Or is it if they test all the areas that normally you have time to do and it comes out with this vaccine so fast, which is the fastest in probably history, I know it was a great thing for the country to display. But also, I think that is what causes concern and the holdback from people. (#1570, 53-year-old African American man)
	Lack of information about vaccines	I mean, it was just a lot of information that I couldn't verify or double check on that was being release, you know, bad news and things. It got hard to tell. (#2841, 36-year-old White man) If they can have real data to show on the journals published, at least well-known publications, for example, like Lancet or the New England Medical Journal, something like that. They should have enough data numbers. [...] (#2194, 40-year-old Asian man)
	Histories of exploitation	There are a lot of African Americans who are hesitant also and that can actually stem back to like the Tuskegee-era time when the government, I believe is the government was experimenting on African Americans. And so, I can understand why we would have that hesitancy, especially like the older people who had lived through that. They passed that story down to their kids and people don't understand how much that affects people down the line, but I could understand that they have that little bit of hesitancy. (#404, 55-year-old Asian woman)
	Conspiracy theories	I was a bit scared at first about it. I was scared about it because I'd heard different things like it'll kill you or it'll cause other things. Or they'll implanted in your skin and someone can trace you. I didn't really know about that one, but I'd heard a lot of things. (#611, 39-year-old African American woman)
Freedom of choice	Free to choose	I don't know about if the mandate should be. I don't know about that. I think that's important, but then people have to choose. (#611, 39-year-old African American woman)
	Social pressure to vaccinate	In order to participate in society now, you almost have to have a vaccine. So, whatever your concerns are, they're just there. (#881, 71-year-old African American woman)
Complacency	Strong immune system	I've never was one that had the flu much at all. I may have had a flu maybe once or twice. And if I do, it's like a 24-h and it's not like a weekly type of thing. So, I don't get sick often. I try to take a lot of vitamins and things to keep my immune system strong. So, I've never had issues with a yearly flu type of thing and I've always seen people that have taken it and some have not, and some have taken it and got sicker in that year with the flu and they took the vaccine. I know my dad. He took it once, and he had a terrible year of just being really sick. So I just always was afraid of the chemicals put in my body, and I feel if I can just eat right and do the natural things to keep my immune system strong. If I was someone who got the flu a lot, I would do it. But I've asked my doctor, and she said, "If you never get the flu, just keep that approach. No reason to get the flu shot for no reason." (#1570, 53-year-old African American man)
	Low risk to self	N/A

Abbreviations: COVID, coronavirus disease; N/A, not applicable.

TABLE 5 Exemplary quotes for “very hesitant” participants

Primary theme	Secondary theme	Exemplary quote
Vaccine safety	Side effects/ adverse reactions	This is not really a vaccination as we used to know, and this is a new technology, something new that's going to mess up your genes or something. (#506, 56-year-old Hispanic man)
		I'm just worry about getting sick from it. Some people have died from it. (#642, 33-year-old White man)
	Speed of vaccine development/ approval	I suspect that it's going to cause damage that they don't know about because they didn't do a proper amount of testing. It should have been tested on rats for a decade before it even started on people. (#2412, 47-year-old White woman)
		I was a little nervous because they were creating it so quickly, and from what I've heard by listening to the news, it normally takes about 18 months to develop a viable solution or vaccine. I was worried that it could possibly have adverse side effects that could affect me in the long haul, and I didn't want to go through that. I wanted them to iron out the kinks first before I was going to take it. (#1546, 53-year-old African American woman)
		Lack of information about vaccines
Histories of exploitation	N/A	
Conspiracy theories		I think, it's definitely, [...] the fact that pharmaceutical companies over-advertised drugs and symptoms and diseases here. Everything is a cause for concern from their point of view, and when COVID hit and a large group of people who are really already suspicious of Big Pharma, they just took it as another way that those companies were pushing the drugs and that was where the resistance hit. And, you know, they just didn't take the science anymore because the science was coming from Big Pharma. (#1565, 35-year-old Asian woman)
		I believe that the process to get it proved was rushed so they don't know what long-term effects are going to be. I believe that anything man-made is carcinogenic, filled with poisons. I have a bad heart, damage to my organs already because of multiple surgeries so I just feel like, I mean it as a joke, a zombie apocalypse. This is going to hurt us like the vaccines for chickenpox cause our kids to have autism. This is going to cause some major damage to us. (#2412, 47-year-old American Indian woman)
		Once a politician is to start mandating that everybody that works for the public, you know for the government, they have to have the shots, and they have to prove that they've gotten two shots. And it's not anymore about public safety, it's just to make sure that [...] I don't think that's the real reason behind [it]. In my opinion, it's all political and economical. (506, 56-year-old Hispanic man)
Freedom of choice	Free to choose	The government is trying to get into their business too much, not giving them the freedom to choose. And I think they've taken that stance, the vaccine is something that the government is forcing on them. And they're pushing against it more because it's going against their freedom. (#1565, 35-year-old Asian woman)
		I like to think that it's been blown out of proportion. There has been some issues, yes, but we've had this before and you know, we somehow managed and we've survived then. You don't have to destroy economies, and destroy jobs, and certainly just to make a point that you have the power to make a mandate to wear masks, and to get shots. (#506, 56-year-old Hispanic man)
	Social pressure to vaccinate	So, unfortunately, if you're going to keep your job, you're going to have to do what they want you to. So, I think that's it, you may elaborate on any of that. (#2744, 30-year-old White man) [The pressure to vaccinate is] like we had that initial push for everyone to get fit, and then the demand died down, so I don't see, I personally don't see the urgency anymore. (#1040, 44-year-old Hispanic woman)

TABLE 5 (Continued)

Primary theme	Secondary theme	Exemplary quote
Complacency	Strong immune system	In general, I just don't particularly like taking chemicals or any type of vaccine or medicine, and that was the main reason I thought, you know, my body was strong enough to take care of it if I was going to contract it. (#1565, 35-year-old Asian woman) I don't even [get] the flu shots that they give you yearly. I think my body has the ability to fight viruses by itself, but it became more political thing so. (#506, 56-year-old Hispanic man)
	Low risk to self	I'm a healthy 56-year old man, capable of handling. I mean, I do take certain measures. I still do believe in the social distancing and I'm wearing my mask, which by the way I have in my pocket because I am always just outside. So, I think that's more than enough and it is having common sense. This is not like the zombies are coming and you need to get in. [...] There are some casualties because of the COVID-19. But if you look, if you read between the lines, most of the people that really got sick, they had a compromised health. They were exactly the weight cardiac patients. So, I mean, very few cases, and the numbers are there. Very few cases of healthy people, really healthy people getting it. So, the statistics, you have to read between the lines. And what is the real mortality rate of this thing? (#506, 56-year-old Hispanic man)

Abbreviations: COVID-19, coronavirus disease 2019; N/A, not applicable.

frequency of the elements were mentioned, and the description of each of the elements varied by the level of vaccine hesitancy.

The reasons for hesitancy differed significantly across the vaccine hesitancy continuum, with hesitancy about the COVID-19 vaccine drawn from conspiracy theories being the most frequently mentioned aspect of hesitancy for the “very hesitant,” only the fourth most frequently mentioned aspect for the “somewhat hesitant,” and mentioned only a single time by the “little hesitant.” It has been previously established that conspiracy theories undermine vaccine confidence⁴⁹ and complicate efforts to improve vaccine coverage as a pandemic response.⁵⁰ Our findings expand the current understanding of the role of conspiracy theories and vaccine hesitancy, and these findings may suggest that conspiracy theories are a major driver of COVID-19 vaccine hesitancy especially for the most hesitant individuals.

The “little hesitant” participants, as a whole, were focused on vaccine safety and uncertainty of risks presented by the vaccine. They often were explicitly hesitant due to issues related to their own personal health, which is supported by the literature on the role of health beliefs on vaccine-seeking behaviors.⁵¹ For the “little hesitant,” the role of government/employer mandates and social pressure to vaccinate created hesitancy based on the focus on personal health status. This finding extends the literature and demonstrates factors driving hesitancy exist more as bundles of concerns, rather than single issues.²² Trusted information about the vaccine, presented in clear and direct ways, was also important for the “little hesitant,” who most often desired to make informed health decisions for themselves. The role of information and disinformation have been well-described in the literature.^{27,52,53}

The “somewhat hesitant” described their vaccine attitudes similarly to the “little hesitant,” particularly in their concerns about vaccine safety, the consideration of personal health histories and underlying conditions, and how the COVID-19 vaccine might affect them individually.⁵¹ The role of information, especially the lack of trustworthy information and contradictory information, was even more pronounced among the “somewhat hesitant” in their descriptions of their hesitancy than the “little hesitant.” Information and disinformation about the vaccine were expected elements of vaccine hesitancy; however, it is novel to see an association between the desire for clear, accurate information about the COVID-19 vaccine and specific levels of hesitancy.

The “very hesitant” were the most markedly different from the participants at other levels of hesitancy, with a larger focus on conspiracies related to the safety, speed of development, and approval process of the COVID-19 vaccines. Our findings on the salience of conspiracy theories and hesitancy are supported in the literature on vaccine hesitancy, generally.^{31–35} It is an extension of the current literature to connect high levels of COVID-19 vaccine hesitancy and conspiracy theories, especially among hesitant adopters of the COVID-19 vaccine. The “very hesitant” were also the most likely to relate their hesitancy to ideals of personal freedoms and a desire to not be judged or pressured regarding vaccination. This is consistent with the emerging literature on the role of contemporary constructions of “freedom” on vaccine decision making.^{54–56} This also affects models of health focused on individual decision making.²² The “very hesitant” more frequently reported hesitancy grounded in complacency (i.e., strongly held beliefs in their immune system and general good health being protective from the individual

effects of COVID-19 infection and beliefs that risks from COVID-19 infection are exaggerated). Although the role of health beliefs and complacency (particularly related to immune system function, the functioning of vaccines, and one's personal risk factors) is well-established in the vaccine hesitancy literature,⁵⁷⁻⁶¹ our findings extend the literature, highlighting specific health beliefs that may be critical in understanding higher levels of hesitancy. This is especially critical for efforts to address hesitancy which need to be tailored to address the underlying source and content of these beliefs.

Increasing vaccination uptake is necessary for mitigating the effects of the COVID-19 pandemic but is also critical among all vaccine-preventable diseases. Vaccine hesitancy is multifaceted and dynamic and, thus, unlikely to be mitigated through a single strategy or intervention approach.^{62,63} Current literature identifies a range of possible interventions to address vaccine hesitancy, build confidence in vaccines, and promote vaccine-seeking behavior.⁶³⁻⁶⁵ Interventions targeting “thoughts and feelings” about vaccination, social processes, and direct behavior change have been implemented in various forms, but not all interventions are equally effective.⁶³ Our findings suggest that vaccine hesitant individuals' thoughts and feelings about vaccination are dynamic, and it is possible that adapting pre-existing interventions could affect both attitudes and vaccination behavior for individuals with specific levels of hesitancy. Social processes related to vaccination have also been successfully targeted for intervention, such as with the National HPV Vaccination Roundtable⁶³ or various dialogue-based social media interventions.⁶² Social process interventions may also benefit from adaptation and targeting for specific levels across the hesitancy continuum. Finally, interventions that target direct behavior change have been described as reliably effective in increasing vaccination, with ease of access, use of incentives, sanctions, or requirements all showing efficacy in randomized trials.^{63,64,66} Our findings that conspiracies increase in salience alongside increased COVID-19 vaccine hesitancy may indicate that some individuals on the continuum will be most effectively moved to vaccinate through these kinds of interventions.

Overall, our findings in this study are consistent with the literature on COVID-19 vaccine hesitancy, which has catalogued elements of COVID-19 vaccine hesitancy, such as safety concerns,^{30,51,67,68} concerns about the development/approval of the vaccine,^{30,52,68,69} the information and disinformation environment,^{52,53} trust in science and government,^{20,22,60,70} conspiratorial thinking,^{33,35,71} perceptions of freedom,^{55,56,72,73} beliefs about one's immune system and general health,^{58,60} and assessments of risk.^{29,60,74} However, we make the significant contribution of linking specific themes to the levels of vaccine

hesitancy, adding granularity to the well-established concept of vaccine hesitancy as a continuum of thoughts and feelings.^{17,19,20} This study also expands on the growing literature on hesitant adopters of vaccination, reinforcing vaccine hesitancy is not mutually exclusive from the decision to get vaccinated.²⁵⁻²⁸

Limitations

There are limitations to this study. First, as a qualitative study, it only included 49 people. Although this is a large sample for qualitative research and allowed us to reach saturation, these findings may not be generalizable for all hesitant adopters or hesitant non-adopters of the COVID-19 vaccine. Second, the elements of the vaccine hesitancy continuum may change over time and/or in response to the changing context of the COVID-19 pandemic in the United States. Finally, the results may not be exhaustive of all the concerns of hesitant adopters and may not reflect vaccine hesitancy among unvaccinated individuals or vaccine refusers.

CONCLUSION

This study presents the conceptual and thematic elements of vaccine hesitancy for “little hesitant,” “somewhat hesitant,” and “very hesitant” individuals. We present novel findings demonstrating the differences in COVID-19 vaccine hesitancy across the hesitancy continuum. This is the first study to describe the salience of specific concerns among the vaccine hesitant and emphasize the qualitative distinctions and patterns of beliefs about the COVID-19 vaccine. Although there are similarities in the concerns described, we demonstrate vaccine hesitancy is not monolithic. Concerns and how they are articulated by hesitant adopters vary along the continuum of vaccine hesitancy. A critical finding is the potential risk of side effects, a concern shared across the continuum but articulated differently at each level of the continuum. The “little hesitant” relate fears of side effects to their personal health and a lack of clear information to inform their health decision making, whereas the “very hesitant” articulate the risks of side effects within the frame of conspiracies related to the development, approval, and economics of the COVID-19 vaccine. Another important finding is the increasing salience of conspiracy theories along the hesitancy continuum, with conspiracy theories becoming the most salient driver of hesitancy for the “very hesitant.” The granular, qualitative analysis of vaccine hesitancy across the hesitancy continuum extends the scope of the literature while also presenting opportunities for translating these findings into targeted interventions accounting

for distinct elements of hesitancy for different levels of hesitancy. More research is needed to expand our understanding of the vaccine hesitancy continuum for COVID-19 vaccines, as well as other vaccines, among hesitant adopters and hesitant non-adopters of vaccination. It is also important to begin translating these findings into clinical practice and targeted public health interventions to increase vaccine uptake.

AUTHOR CONTRIBUTIONS

R.M., R.S.P., D.E.W., K.C.W., D.H., S.R., A.Y., and P.A.M. wrote the manuscript. R.M., R.S.P., D.E.W., and P.A.M. designed the research. R.M., R.S.P., D.E.W., K.C.W., D.H., and P.A.M. performed the research. R.M., R.S.P., K.C.W., D.H., and P.A.M. analyzed the data.

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CONFLICT OF INTEREST

The authors declared no competing interests for this work.

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