

Covid-19 Vaccine Knowledge, Attitudes, Beliefs and Trusted Information Sources Among Underserved Communities: A Qualitative Study

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ABSTRACT

Vaccination was pivotal in controlling COVID-19 spread during the pandemic, benefiting individuals and communities. However, vaccine ‘hesitancy’ (VH) remains a global issue and a major barrier for to achieving population immunity. Acceptance of the COVID-19 vaccine is complex and influenced by multiple factors including distrust, which often vary among racial and ethnic groups. This in person cross-sectional study included 585 adults who completed a self-administered paper survey. The survey incorporated the adult VH Scale (aVHS) and questions on vaccine status and COVID-19-related knowledge. Zip codes with low vaccine uptake were selected using New York State Department of Health data from Erie and Niagara Counties in Western NY. Researchers collected demographic information along with participants knowledge, attitudes, beliefs, and sources of information about the COVID-19 vaccine. Data was transcribed and analyzed using reflexive thematic analysis and mapped to the Theoretical Domains Framework (TDF). Participants demonstrated limited knowledge about COVID-19 vaccine; 12.7% recognized it as viral, 8.4% as contagious, and only a few knew about respiratory transmission. Attitudes and beliefs about the vaccine and booster varied widely. Trusted sources were health care professionals, government, family, friends, and faith-based organizations. Concerns about vaccine side-effects, distrust, and general hesitancy were frequently mentioned. Findings demonstrated

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trends in published quantitative research. Mapping responses to the TDF and a 5C Model revealed several factors driving VH and vaccine distrust. Public health strategies must emphasize trusted, fact-based communication, promote vaccine literacy, and support informed decision-making for COVID-19 and broader public health initiatives.

KEYWORDS: COVID-19 Vaccine, Medically Underrepresented Populations, Qualitative Study, Vaccine Hesitancy, Western New York

The coronavirus disease 2019 (COVID-19) has highlighted racial and ethnic disparities in COVID-19 outcomes (Hooper et al., 2020). Many underserved communities, particularly those with Black and Latino populations were unduly affected and suffered an unfair burden during the COVID-19 pandemic (Laurencin & McClinton, 2020). As the hospitalization and death rates soared (Shiels et al., 2021), these communities continued to have suboptimal vaccination rates related to socioeconomic and demographic factors (Williams et al., 2022). During the period that this study was conducted, our colleagues (Benson et al., 2024) reported that the New York State Vaccine Tracker (2023) showed lower vaccination rates among Blacks (53.1%), of the more than 70% Western New York (WNY) adults who were vaccinated with at least one dose of the COVID-19 vaccine.

Literature Review

Vaccines are regarded as one of the most outstanding public health achievements of the 20th century, eradicating, eliminating, and controlling various infectious diseases in the U.S. (*Ten Great Public Health Achievements -- United States, 1900-1999*, 1999). However, individuals, groups, and communities still hesitate, refuse, or delay the acceptance of vaccines, a roadblock to achieving population immunity (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015) during the COVID-19 pandemic.

The refusal of vaccine uptake is partly fueled by the overwhelming flood of Internet websites, including social media platforms with disparaging myths, misinformation, and misperceptions about vaccines (Laurencin, 2021). This dilemma of vaccine refusal resurfaced following the detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the etiologic agent that resulted in the coronavirus disease 2019 (COVID-19) was detected in a United States (US) patient early in 2020 (Woolf et al., 2021). As COVID-19 spread across the US, becoming the leading cause of death (Woolf et al., 2021), primarily affecting racially minoritized communities (Yancy, 2020), scientists from around the world collaborated to develop a coronavirus disease 2019 (COVID-19) vaccine expeditiously (Callaway, 2020).

The first COVID-19 vaccine in the United States was released by Pfizer-BioNTech under an Emergency Use Authorization (EUA) by the U.S. Food and Drug Administration (FDA) on December 11, 2020 (Tanne, 2020). While many Americans responded positively to the vaccine, some, including healthcare workers and teachers, were reluctant to be vaccinated (Chen et al., 2022; Ledda et al., 2021; Paris et al., 2021). For various reasons, the COVID-19 pandemic has intensified the vaccine hesitancy debate among U.S. adults (Dubé et al., 2013). Despite this debate, many teachers demonstrated remarkable resilience during and post- COVID-19 pandemic, extending gratitude and emotional support for their students and communities (Baker et al., 2021). Teachers had to reluctantly pivot to changing the classroom culture with the evolving circumstances of online, hybrid and in-person classes despite burnout (Franklin et al., 2021; Shimony et al., 2022). Notably, the vaccine hesitancy gap among racial/ethnic minorities has widened disproportionately (Dubé et al., 2013; Laurencin, 2021).

According to the World Health Organization (WHO), vaccine hesitancy, the delay or refusal to accept vaccines despite their known efficacy and availability, is one of the ten leading threats to global health (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015; *Ten Health Issues WHO Will Tackle This Year*, 2019). The WHO a model of determinants of vaccine hesitancy (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015) is based on three domains: 1) *Contextual influences*, such as socioeconomic, environmental, or political. 2) *Individual or group influences* based on personal perception of the vaccine or influences exerted by the social/peer environment. 3) *Vaccine and vaccination-specific issues* directly linked to the characteristics of the vaccine or the vaccination process (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015). Thus, the complexity and multi-dimensionality of vaccine hesitancy result from the interplay of multiple factors, including personal, cultural, historical, social, and political (Dubé et al., 2013, 2016; Kestenbaum & Feemster, 2015), which vary depending on circumstances such as time, place, and vaccine being offered (Dubé et al., 2016; Salmon et al., 2015). This complicated issue of vaccine hesitancy poses a significant risk to public health (Dubé et al., 2013, 2016; Kestenbaum & Feemster, 2015; Salmon et al., 2015; Thunström et al., 2021). There are multiple reasons for vaccine refusal, including a lack of awareness or understanding of vulnerabilities and seriousness of vaccine-preventable diseases, lack of trust in health care providers, social norms, distrust of the healthcare system, biomedical research, government policy, religion, cultural values, limited knowledge and understanding of vaccine safety and efficacy, and fear of, or uncomfortable with needles (AuYoung et al., 2023; Dubé et al., 2013, 2016; Gust et al., 2005; Kestenbaum & Feemster, 2015; Love & Love, 2021; Salmon et al., 2015; Thunström et al., 2021).

In addition, structural, environmental, and social determinants such as socioeconomic factors, health behaviors, healthcare, and built and natural environments associated with racial/ethnic minorities and communities with limited resources contribute to “vaccine hesitancy” and less favorable health outcomes (AuYoung et al., 2023; Salgado et al., 2020). During the COVID-19 pandemic, the historical inequities in various minority populations surfaced (AuYoung et al., 2023; Hildreth & Alcendor, 2021). These historical inequities are embedded in and are shaped by long-standing distrust in a healthcare system that fuels untrustworthiness (Best et al., 2021). There is a critical need to unravel the root causes of these types of social injustices and to approach these unique populations with culturally and communicatively appropriate solutions to encourage and lessen the disparities in vaccine uptake (AuYoung et al., 2023; Hildreth & Alcendor, 2021).

To promote vaccine uptake in racial and ethnic minorities who lack sufficient resources, hosting community conversations (focus groups) through responsive communication to engage stakeholders (community members, community leaders, etc.) to inquire about the community’s needs, followed by the implementation of targeted interventions and prioritizing culturally relevance to build long-term, trustworthy relationships to improve equity and health outcomes is imperative (Franklin et al., 2021).

; it is distinct to sub-groups within populations (Andrasik et al., 2021). Therefore, it was imperative to investigate the reasons for the COVID-19 vaccine refusal that would allow for conversations to unravel the root causes that lead to economic and social inequities while simultaneously unveiling the environmental and social determinants that are roadblocks to vaccine acceptance (AuYoung et al., 2023; Larson et al., 2015; Salgado et al., 2020). Although vaccination has benefited both individuals and society (Bloom et al., 2021; Orenstein & Ahmed, 2017), vaccine hesitancy (Lane et al., 2018; MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015) was one of the essential reasons that delayed population/community immunity in the US and globally (Chaney & Lee, 2022; Hildreth & Alcendor, 2021; Piraveenan et al., 2021). Addressing

the underrepresentation of populations with less equitable access to healthcare services, including vaccine trials and research (Hildreth & Alcendor, 2021), might be a feasible step toward mitigating the distrust that fuels what is referred to as “vaccine hesitancy.” Some authors allude to the fact that using the term “vaccine hesitancy” in underserved populations that lack confidence in a system that has historically failed them and continues to do so carries a negative nuance and blame, giving way to the term “vaccine distrust” (Madorsky et al., 2021). Research has focused on various factors to understand vaccine hesitancy in medically underserved populations fully. For example, studies suggest that successful vaccination programs are impacted by public trust and vaccine acceptance (Dror et al., 2020; Gayle et al., 2020), which is influenced by varying information sources (Benson et al., 2024) and demographic and geographical disparities (Malik et al., 2020).

In the quantitative counterpart to this work, the researchers found mixed reasons among vaccinated and unvaccinated/unboosted participants for accepting or rejecting the COVID-19 vaccine in this Western New York (WNY) medically underserved population (Benson et al., 2024). In parallel, qualitative studies are imperative to exploring the depth of determinants that drive decisions to comply with public health interventions, such as vaccinations (Cooper et al., 2021).

This critical qualitative approach may help us better understand what influences vaccine hesitancy (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015) and distrust and inform public health interventions, such as community engagement (Madorsky et al., 2021). Conversations that include trusted fact-based health literacy information, vaccine education, and addressing the environmental and social issues may contribute to higher vaccine trust and acceptance beyond the COVID-19 vaccine in populations with less equitable access to health and healthcare services (medically underserved) who continue to encounter health disparities that persist across the healthcare continuum. Moreover, the determinants of vaccine hesitancy, including the study population’s vaccine hesitancy behavior and associated psychological factors such as attitudes and beliefs, in combination with knowledge about the COVID-19 vaccine, should be included in the vaccine hesitancy conversation to inform future strategies for improving vaccine uptake.

This work aimed to identify areas within Western New York (Erie and Niagara counties) through selected zip codes to explore participants’ information sources and better understand factors influencing knowledge, attitudes, and beliefs related to COVID-19 vaccine hesitancy and distrust in communities that have less equitable access to health and health care services.

Methods

The study was conducted in Western New York (WNY), where researchers used data from the New York State Department of Health to identify and select locations for data collection by zip codes where vaccination rates were low. At every site, based on accessibility a sample of adults were recruited to complete a survey regarding vaccine hesitancy. Data were collected between July and November 2022 at 10 churches, seven community centers, two community events, and a food pantry in Erie and Niagara Counties. Participants qualified to participate if they met the following criteria: were at least 18 years old, could read, write, and speak English. The detailed “Methods” are outlined in a prior publication (Benson et al., 2024), that includes some of the authors (colleagues) of this work. Their findings indicate that vaccination status is influenced by health care provider guidance and family guidance, while clinical research influenced booster status among their study participants. In addition, they state that trust in COVID-19 vaccine acceptance is driven by public health interventions that focus on tailored vaccine education that promote sound decision-making concerning COVID-19 vaccine.

Context

This study is the qualitative counterpart and continuation of a mixed methods study, for which the quantitative work has been published (Benson et al., 2024). The work outlined herein is also the initial part of an ongoing project investigating why people lack interest in recommended public health interventions such as the COVID-19 vaccine or booster. The ideas and conclusions from this study will facilitate future applied design research, such as creating a multimedia application (app) to address health literacy, a social determinant of health, and support preventive approaches for populations with less equitable access to health and health care services. In addition, the findings of this ongoing work will be shared with and directly benefit the study participants.

Study design and setting

A cross-sectional, multilocation paper survey was conducted between July and November 2022 by administering semi-structured interviews with participants in communities with low vaccine rates in Erie and Niagara counties of WNY. Research assistants transferred and logged the data into an Excel spreadsheet. All participants' identifying information was removed. The lead author (GF) analyzed the Excel spreadsheet using reflexive Thematic Analysis (TA) (Braun & Clarke, 2006, 2019, 2021; Byrne, 2022; Campbell et al., 2021). Notes were made for subsequent qualitative analysis, which was inductive and linked to the Theoretical Domains Framework (TDF) (Atkins et al., 2017; Cane et al., 2012; McGowan et al., 2020; Michie et al., 2005). This comprehensive theoretical framework includes 14 domains, seven of which were related to this qualitative research to further analyze and assess vaccine hesitancy behavioral determinants (Atkins et al., 2017; McGowan et al., 2020). To address vaccine hesitancy and promote vaccine hesitancy behavior change, the current study combines participants' vaccine hesitancy behavior by mapping the constructs found in our research to the Theoretical Domains Framework (TDF).

Characteristics of the study population

Study participants comprised adults 18 and older recruited through a cross-sectional survey conducted from July to November 2022. The study aimed to tease out and understand the reasons for vaccine hesitancy. Using a validated instrument, the study investigated participants' trusted information sources and their knowledge, attitudes, and beliefs about COVID-19 (SARS-CoV-2) vaccine. Short-response questions were included in the survey to glean more profound insights into vaccine hesitancy. Locations for data collection were strategically chosen based on vaccination rates, focusing on zip codes with rates below 70%. The recent estimation or targeted threshold for achieving COVID-19 herd/population immunity to cease transmission and stop pathogen spread is 60-75% (Yenew et al., 2023).

Data collection

This manuscript uses data from a project conducted by Rethink WNY Community Health Collaborative. The study was conducted using cross-sectional paper surveys, each taking approximately 5 minutes to complete. A purposive sampling method was employed to recruit participants. Adults at least 18 years old who could read, write, and speak English were eligible. The research team member screened potential participants for eligibility using paper forms. Once deemed eligible, participants were invited to participate in semi-structured interviews. The interviews were conducted in settings within the chosen locations to ensure confidentiality and

comfort. Each session was facilitated by trained researchers who followed a structured interview guide to explore participants' sources of information and to understand knowledge, attitudes, beliefs, and experiences related to COVID-19 vaccination. Participants were compensated for their time with a \$25 gift card from either Tops Friendly Market or Walmart. The Institutional Review Boards granted a waiver of written informed consent at the University at Buffalo and Niagara University (STUDY00006009)

Study Participants' Interview Procedure and Vaccination Hesitancy Survey

Utilizing our research team's multidisciplinary background, a cross-sectional survey was developed from which the qualitative study questions were analyzed. Some of the authors of this qualitative article have outlined and described the details of the study participants' interview procedure in a quantitative publication (Benson et al., 2024). The study team ensured participant anonymity and conducted a brief interview. Initially, the plan was to conduct focus group interviews with individuals who had not received the COVID-19 vaccine. However, the research team recognized the importance of understanding vaccinated and unvaccinated individuals' knowledge, attitudes, beliefs, trust, and safety concerns regarding the COVID-19 vaccine.

Consequently, the instrument, including the Adult Vaccine Hesitancy Survey (aVHS), was revised to allow all adults aged 18 and older to participate, regardless of their self-reported vaccination status. Including open-ended qualitative questions [Appendix 1] enables us to explore and gather in-depth insights into personal experiences and perceptions regarding vaccination. The survey [Appendix 1] also provided an opportunity for participants to ask any further questions they may have about COVID-19.

Data Management

Data were collected using paper surveys, and research assistants entered the data into an Excel sheet. All cleaned data were later imported into and stored in the Research Electronic Data Capture (REDCap), a web-based software created and widely used for research data capture and management (Harris et al., 2009; Harvey, 2018) created by Frontier Science Research Foundation. A data entry plan was established, where 30% of surveys were randomly selected to ensure accuracy between paper surveys and the Excel sheet. The trend of error was 1.88%. The research team resolved any discrepancies. Details of the data management have been previously published (Benson et al., 2024).

Qualitative Data Analysis

We collected 483 written paper responses to our open-ended questions on the cross-sectional survey. SR, SW, and BB (acknowledgements) transcribed their responses verbatim and logged them into an Excel spreadsheet. Authors GF and SR independently analyzed the Excel spreadsheet data, and to minimize bias, they met several times to discuss and affirm the initial themes and subthemes. All responses to each qualitative survey item were reviewed. A reflexive thematic analysis (Braun & Clarke, 2006, 2019, 2021; Byrne, 2022; Campbell et al., 2021), led by the first author (GF), was carried out, and participants' responses were grouped by three primary and four sub-thematic perceived similarities. Any comment about the COVID-19 vaccine or booster doses was considered a 'statement' and labeled as such. Off-topic or irrelevant statements were excluded. Researchers GF and SR agreed on using intersubjectivity (Dallmayr, 1980), discussed it, and decided that quotes easily mapped to themes and subthemes were best to include.

Subsequently, a previously validated, adaptable approach, inductive analysis (Braun & Clarke, 2006), was implemented. The principal investigator (GF) established and mapped the quotes to the initial themes and subthemes and then aligned and structured them following the TDF. A diverse set of quotes spanning several TDF continuum of domains and trusted sources for vaccine acceptance (i.e., trust, contingent acceptance, ‘hesitancy’ or distrust, and anti-vaccine) were included. A consensus of all authors validated the results.

Information about the words and phrases for each question from the initial Excel spreadsheet was transferred to a self-defined question-specific Word document. Using the word count function (shift+command+H), we looked at the number of times a word or phrase appeared in the participant’s responses to each survey item. Using those counts/numbers, we created Excel graphs corresponding to the word-phrase category of interest. Irrelevant or off-topic responses were not taken into consideration in this work. To find the ‘n’ of all responses in the Excel spreadsheet, we used “=COUNTIF (column first:last,”*)” (i.e., AH1:AH 500,”*). We included the participants who responded, “don’t know,” “no information will help,” “none” etc. to underscore the extent of COVID-19 vaccine limitation expressed by participants. Those who responded ‘prefer not to answer’ were excluded from this analysis.

Rigor

Data were collected from the participants living in different zip codes in Erie and Niagara County. Participants’ responses were validated through member checking. Detailed descriptions of the study context and procedures were provided to aid transferability. Data visualization and analysis continued until no new themes emerged to ensure this work’s comprehensive findings.

Vaccination status

The sampled adults aged 18 years and older reported whether they received a COVID-19 vaccine and the type (Johnson & Johnson [Janssen], Moderna, Pfizer) of vaccine or if they received a COVID-19 vaccine but did not know the kind. Participants also reported whether they received a COVID-19 booster dose and the type (Johnson & Johnson [Janssen], Moderna, Pfizer) or a booster dose but needed to know the kind.

Ethics

Institutional Review Board Statement: The University at Buffalo and Niagara University Institutional Review Boards approved the work outlined in this manuscript according to the Declaration of Helsinki guidelines (STUDY 00006009) with a waiver of written informed consent.

Informed consent Statement

Before enrollment in the study, participants were provided with a detailed informed consent form outlining participation’s purpose, procedures, risks, and benefits. The consent form emphasized voluntary participation and the right to withdraw from the study at any time without repercussion. Participants were informed of the potential risks associated with breach of confidentiality and discomfort during survey completion, and measures taken to minimize these risks were explained. Participants were assured of the privacy and secure handling of their data. The informed consent process ensured that participants could ask questions and seek clarification before making an informed decision about their involvement in the study.

Recruitment

The New York State Department of Health's COVID-19 vaccine tracker was used to identify populations in areas within zip codes with disparate vaccine outcomes between July and November 2022. Surveys were administered across various community settings, including churches, food pantries, and community centers. The strategic goal was to include ethnic minorities and urban, suburban, and rural zip codes within Erie and Niagara counties. Predominantly, respondents were from zip codes 14305 in Niagara County and 14211, 14210, 14218, and 14215 in Erie County, known to house populations with less equitable access to health and healthcare services, considered medically underserved.

Data Availability Statement

The datasets generated and analyzed during the current study are not publicly available due to privacy and confidentiality concerns. However, anonymized data may be available from the corresponding author upon reasonable request and with permission from the University at Buffalo and Niagara University's Institutional Review Boards. Requests for data access should be directed to [Dr. Gillian Franklin] at [gfrankli@buffalo.edu].

Findings

Characteristics of study participants

599 surveys were collected from 20 sites, 297 from nine Erie County sites, and 302 from 11 Niagara County sites. Of the 585 study participants, the vaccine demographics questionnaire was available to 487, and 483 responded. Among the 483 study participants who responded, aged 18-80, the median age was 52 years. In this study population, 62.7% (303/483) self-identified as females, 54.7% (264/483) self-identified as Black or African American, 54.7% (264/483) self-identified as non-Hispanic/Latino/Latina/Latinx and 84.5% (408/483) were vaccinated or 15.5% (75/483) were unvaccinated (Table 1).

Table 1*Study respondents' characteristics (n = 483)*

Variables		Unvaccinated N = 75 (15.53%)	Vaccinated N = 408 (84.47%)
Gender			
Female	303	44 (14.52)	259 (85.48)
Male	172	31 (18.02)	141 (81.92)
Transgender	3	-	3 (100)
Non-conforming, non-binary, or genderqueer	1	-	1 (100)
Agender	1	-	1 (100)
I prefer not to answer	1	-	1 (100)
Other	2	-	2 (100)
Age			
18-24	40	7 (17.5)	33 (82.5)
25-34	65	16 (24.62)	49 (75.38)
35-44	80	23 (28.75)	57 (71.25)
45-54	88	9 (10.22)	79 (89.77)
55-64	102	8 (7.84)	94 (92.15)
65-74	69	6 (8.70)	63 (91.30)
75+	27	3 (11.11)	24 (88.88)
Race			
American Indian or Alaskan Native	14	-	14 (100)
Asian			
Black or African American	9	1 (11.11)	8 (88.88)
Native Hawaiian or other Pacific Islander	264	35 (13.26)	229 (86.74)
White	4	2 (50.00)	2 (50.00)
I Prefer not to answer	128	22 (17.19)	106 (83.81)
Multiple Races	11	2 (18.18)	9 (81.82)
Other	31	11 (35.48)	20 (64.52)
	20	2 (10.00)	18 (90.00)
Ethnicity (Hispanic)			
Yes	42	5 (11.90)	37 (88.10)
No	384	59 (15.36)	325 (84.64)
I prefer not to answer	21	6 (28.57)	15 (71.43)
WNY Region (n=585)			
		Unvaccinated	Vaccinated
Vaccine status	Total	Study sample, n (%)	Study sample, n (%)
Erie	286	46 (16.08)	240 (83.92)
Niagara	299	50 (16.72)	249 (83.28)

4.2 | Study participants' knowledge, attitudes, and beliefs towards COVID-19 vaccine vaccination and trusted information sources

Participants 18 years and older reported whether they received a COVID-19 vaccine and the type (Pfizer, Moderna, or Johnson & Johnson (Janssen), or whether they received a COVID-19 vaccine but did not know the kind of COVID-19 vaccine they received. Qualitative data analysis revealed that participants expressed varied knowledge, attitudes, and beliefs about the COVID-19 vaccine and varying trusted information sources related to COVID-19. Three main themes and four sub-themes (Figure 1) emerged.

Fig. 1. Study participants' knowledge, attitudes, and beliefs towards trusted COVID-19 information sources with associated color-coded primary themes, emergent subthemes, and corresponding excerpts from quotes

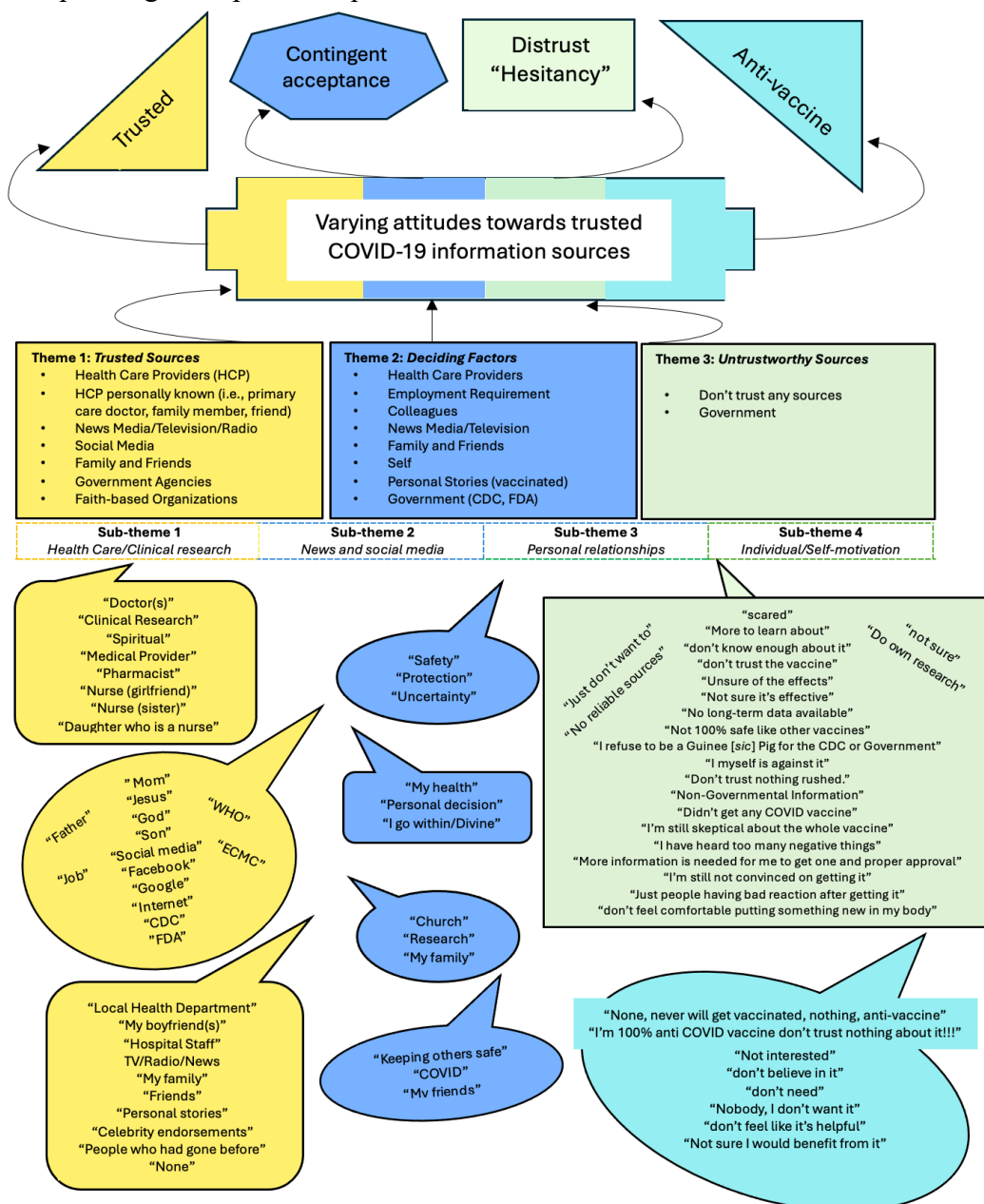


Table 2 shows examples facilitators and barriers to vaccine acceptance, knowledge, attitudes, and beliefs within each theme linked to seven of the Theoretical Domains Framework (TDF) determinants associated with the COVID-19 vaccine and vaccine booster. Additional participant quotes/responses can be found in Appendix B,

Theoretical Domains Framework (TDF) Domain Association

Table 2

Theoretical Domains Framework (TDF) determinants associated with COVID-19 vaccination and booster acceptance related to information sources among study respondents

<i>The seven (7) themes/domains that respondents' quotes were frequently associated with, from most to least</i>	<i>Facilitators</i>	<i>Barriers</i>
1. Social influences, support, norms, pressure (i.e., What roles do personal/interpersonal/professionals play in the study respondents' decisions to accept/not accept a COVID-19 vaccine or booster dose? Who are their social influences/support and how does that affect what they do? What are their sources of information, positive/negative?)	Family, friends, health care professionals (HCP), personal stories, Social media (Facebook, Google, other Internet sources) News media (TV, radio) Government (CDC, FDA, WHO, local health department)	Family, friends, health care professionals, personal stories Government
Selected Quotes	"CPA, Doctor, Social Pressure" "I am a registered ICU nurse" "I did my own research" "My father who is a doctor" "My pharmacist" "My doctor" "TV, family, friends" "Work" "My job" "Local church" "Schools" "Facebook/news" "Internet" "Google" "News, paper, social media" "On TV and on my phone" "Hospital" "Community Health Center" "Health department" "Media, NY State, CDC, "Dr. Faucci [sic]"	"Don't think it will make any difference/Friend [sic] and family that got vaccine were sicker than me when they go it" "I heard too many negative reviews" "I don't think it works because someone got the vaccine and still died from it" "I 100% Anti covid vaccine don't trust nothing about it!!!" "don't want the side effects, I'm scared of needles" "I don't believe in modern day medicine" "All the side effects this gov. tried to cover up" "Because its [sic] not a proven vaccine, basically anyone taking it is part of a study (A Gunee [sic] Pig)" "I feel it isn't truly approved, money made it move too fast" "The vaccine is new, not enough science and data" Hesitant/Anti-vaccine Limited accessibility and availability to the COVID-19 vaccine/booster
2. Environmental context, resources, and stressors (i.e., What factors in the study respondents' environment influence their decisions about getting or not getting a COVID-19 vaccine or booster dose?) Q23 (n = 142): When asked, what information will help you decide to get vaccinated?	Behavioral or other cues to action (i.e., trust in clinical research studies and information sources (government, health care providers, family, friends, job, social & news media) about the COVID-19 vaccine/booster Access to places that offered the COVID-19 vaccine/booster	

Selected Quotes

“need if for a job” | “I wouldn’t been [sic] able to work”
“my pastor shared how terribly sick he was”
“CDC information”
“news of death”
“doctor” “prayer”
“primary doctor, CDC, news, school district”
“more test [sic] less death”
“knowing how accurate the vaccine is and how it will protect myself and family”
“F.D.A. aproved [sic]”
“more safe research”
“TV, My church, my doctor”

“no information will help me”
“only if it’s mandatory”
“none!! I’m 100% against this vaccine”
“I won’t receive it, I don’t believe it helps in any way”
“I feel it will harm me”
“I Don’t Know”
“not sure”
“none”

3. Knowledge of condition, science, procedures (i.e., Study respondents’ awareness about the COVID-19, COVID-19 vaccine/booster and vaccine/booster process, and how does that influence their decisions)

Gained *adequate* knowledge about COVID-19 and the COVID-19 vaccines/boosters (i.e., general knowledge)

No knowledge gained about COVID-19 and the COVID-19 vaccines/boosters (i.e., general knowledge)

Selected Quotes

“Spread through respiratory droplets/particles”
“Highly contagious”
“It is a virus”
“It can kill you”
“Man maid [sic]and intentionally released
“It represents a mutation”
“SARS started in 2019”
“It’s rampant”
“It helps you to not get COVID-19”
“It can cause short or long term health problems”
“What was distributed from CDC”
Q25 & Q 32 (n = 383 & n = 383, respectively).

“Nothing”
“Not much”
“Not sure”
“Not much besides the theories”
“Unsure”
“Don’t know too much info”
“IDK”
“I can’t recall”
“Nothing really because I don’t care”

4. Beliefs about consequences & capabilities (i.e., What are the positive/negative outcomes from study respondent’s actions related to COVID-19, COVID-19 vaccine or booster and how the outcome of these actions may influence their future decisions?)

When asked, “If you have received your first vaccination/booster, why did you decide to receive the vaccine/booster?”

Attitudes

Perceived benefits (i.e., confidence, positive outlook, and belief in the protective effect of the COVID-19 vaccine/booster (e.g., will protect family friends, colleagues, etc.)

Q21 & Q28 (n = 69 & n = 115, respectively).

When asked, “If you have not been vaccinated/boosted, why have you decided not to receive the vaccine/booster at this time?”

Perceived severity and Perceived susceptibility (i.e., Respondents’ fears, concerns, and distress about the COVID-19 vaccine)

1. Side-effects/safety
2. Beliefs that vaccine is unnecessary
3. Vaccine development rushed

“because I want to make sure it is safe”
“not safe”
“had 1st shot only, had bad reaction”
“allergic to ingredients”
“I am allergic to vaccines”

Selected Quotes

“Vaccine to save lives”
“for my family”
“for my health and grandkids”
“to spend time with my family”
“keep me my family safe”
“why not?? Covid is life

threatening!”
 “yes – I got sick myself – and to protect my family and co-workers”
 “I did not want to get sick”
 “because I did research and prayed about it”
 “because I’ve been vaccinated all my life why stop now”
 “believe in it”
 “friend got sick at work”
 “don’t want to get sick with covid”
 “my doctor told me too [sic] (personal reason)”
 “mainly to travel”
 “health care worker”
 “for my own protection”
 “my doctor said it will be best because I have underline [sic] conditions I have received all 4, it was best for me because I have family members that have dies”
 “kidney transplanted”
 “the science indicated that it would protect me from the worst ravages of the disease”
 “CDC recommendation”
 “I didn’t want to get covid”
 “my pastor sugested [sic] I do so”
 “history in America”
 “I received the vaccination because I believed the doctors that recommended it”

“The vaccine is new, not enough science and data”
 “Vaccines are rushed out. All other vaccines only need to be boosted yearly or longer.”
 “I don’t believe the vaccine [sic] helps”
 “I don’t trust nothing rushed”
 “I did not receive the vaccine”
 “heard the affects it was having on others and I didn’t want to get it”
 “I don’t believe in modern day medicine”
 “I have heard too many negative reviews”
 “do not believe in vaccines”
 “anti vaccine”[sic]
 “don’t apply”
 “I don’t like shots”
 “Don’t think it will make a difference/Friend and family that got vaccine were sicker that [sic] me when they got it”
 “I know it would help me not to get it”

5. Social/Professional Role and Identity (i.e., How does respondents’ personal role and responsibility as ‘community’ members in varying settings influence their decision to accept/not accept the COVID-19 vaccine/booster?)

Getting vaccinated is a *social responsibility* to protect the ‘community’

No social responsibility to accept the COVID-19 vaccine/booster

COVID-19 vaccine/booster was mandatory (i.e., job security)

6. Reinforcement/Incentives/Rewards (i.e., How positive/negative past experiences influence respondents’ decisions about receiving/not receiving the COVID-19 vaccine or booster.)

Selected Quotes

“Yes, two vaccinations and two boosters. Seen too many deaths and illnesses”
 “My mother being HIV positive”
 “news of death”
 “get vaccinated-I’m a diabetic-also I have a daycare at my home”
 “when you hear about all the sick people”

“I had the virus so I got vaccinated”
 “none truth would help”
 “If I know I won’t get sick I will get it”

7. Emotion: Anxiety, fear, stress, depression (i.e., What are the experiences, behaviors, or physiological factors that the study respondents used to deal with a personal COVID-19 matter or the COVID-19 pandemic event itself and how these influenced the respondents’ decisions about

receiving/not receiving the COVID-19 vaccine or booster.)

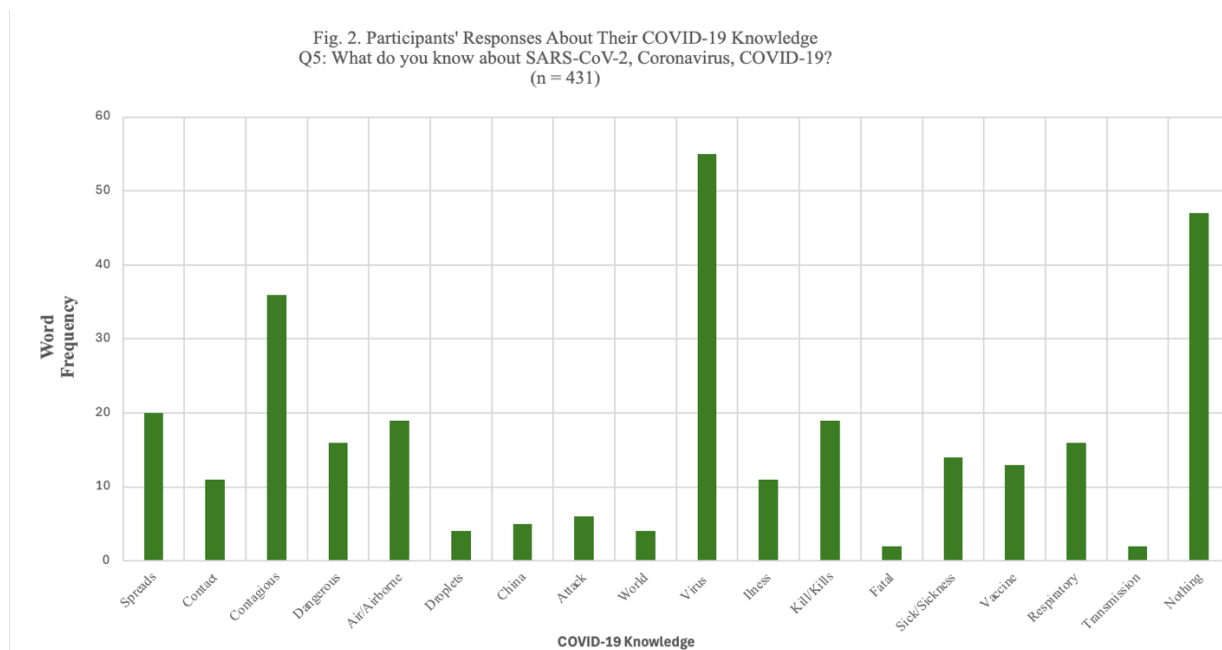
Selected Quotes

"If I know I won't get sick I will get it"
"when my pastor shared how terribly sick he was"
"news of death"
"Most dangerous for older people with health conditions"
"It can kill you"
"when you hear about all the sick people"

"Not sure"
"Unsure"
"Don't know too much info"
"IDK"
"I can't recall"
"Nothing really because I don't care"

COVID-19 – Corona virus disease 2019
 CDC – Centers for Disease Control and Prevention
 FDA – Food and Drug Administration
 WHO – World Health Organization
 PCP – primary care physician
 HCP – health care provider
 CPA – Certified Public Accountant
 IDK – I don't know

In Figure 2, participants' answers to **question 5** about SARS-CoV-2, Coronavirus, and COVID-19 knowledge were summarized in the following frequently occurring word themes.



The most common words were virus, contagious, air/airborne, kill/kills, and nothing. The following are sample quotations for the most frequently occurring word(s).

Virus

The most common emergent theme from the 431 participant responses on COVID-19 knowledge is that COVID-19 is a virus 55 (12.76%). This response ranged from simple to more complex statements as follows.

“it is a virus”

“virus that kills”

“viral replication immune superactivity [sic] and pulmonary destruction”

“novel virus related to SARS that was first seen in Wuhan, China. Mutates easily, several variants now.”

“If you have a compromised immune system, then its [sic] more likely to fail fighting these viruses”

Nothing

The following most common response in this theme about participants' COVID-19 knowledge is “nothing,” 47/431 (10.9%) of the respondents stated that they knew nothing about COVID-19, SARS-CoV-2, the COVID-19 pathogen.

“nothing”

“nothing (very little)”

“I do not know anything about SARS.”

“nothing really because I don't care”

“Nothing really because I don't care”

Contagious and Spread

Some participants feared COVID-19 and its ability to spread from person to person. These were the third (36/431; 8.35%) and fourth (20/431, 4.64%) most common emergent themes from the participants' overall knowledge about COVID-19.

“It's highly contagious”

“Spread by droplets”

“It is/can be deadly, its [sic] contagious, effected [sic] black [sic] people at higher rates, said to have started in China from bats, world wide [sic] impact, all ages, masks may reduce chance of infection”

“Virus [sic], spike proteins, spread aom [sic] respiratory droplets, mRNA”

“They are all contagious [sic] can seriously effect [sic] immune compromised people”

“Can be deadly to certain people and children, easily spread”

Air/airborne

In the quote examples below, participants (19/431; 4.4%) knew that the virus is airborne and that respiratory droplets can spread it.

*“Killed too many people. It is a respiratory virus that is highly contagious. Airborne”
“it is airborne pathogen”*

“respiratory virus, airborne, + contact transmission, quarantine”

“it’s a virus easily transmissible through air. It can cause severe harm even when treated”

Kill/kills

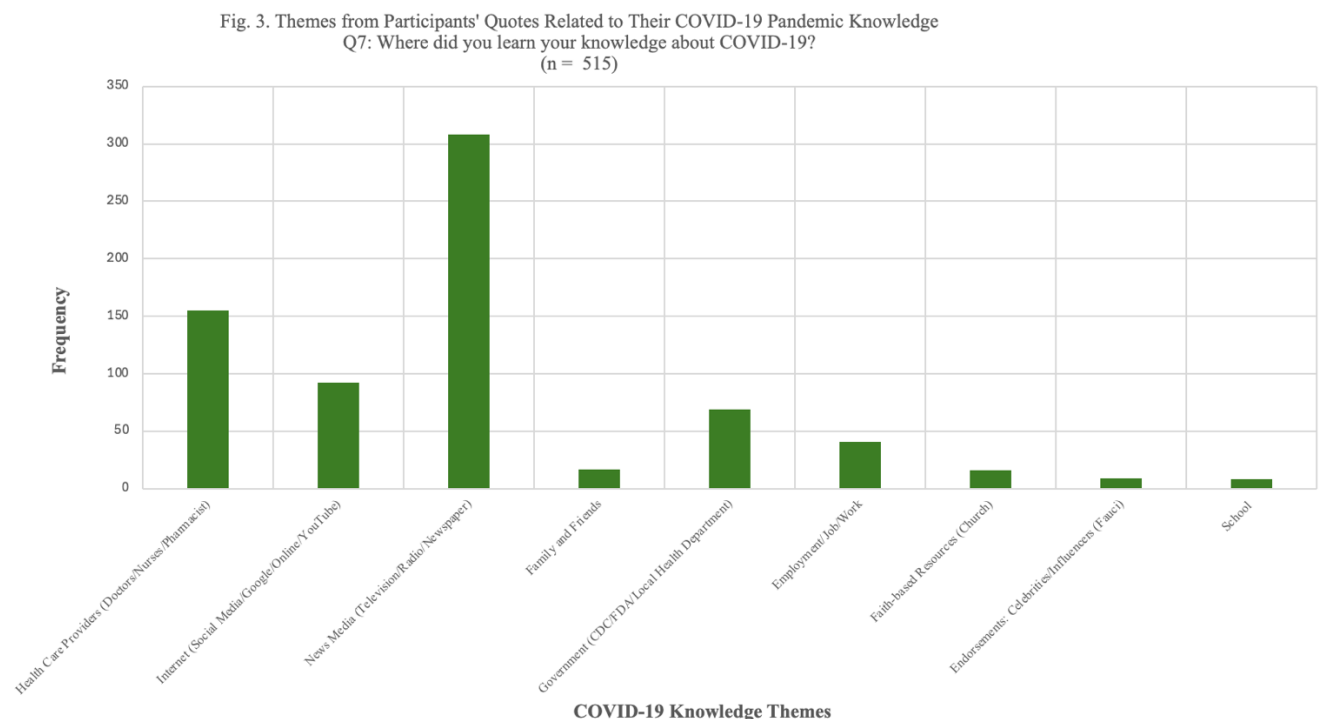
Participants (19/431; 4.4%) expressed the fear of death and expressed the impact of COVID-19 on people that they know.

“A virus that kills”

“I know it could kill us”

“it is a constantly changing virus that has killed millions worldwide”

Figure 3: Participants’ self-reported knowledge (question 7) about COVID-19 was obtained from the following sources: from most to least common cited (news media, health care providers, Internet sources, government, place of employment, family & friends, faith-based organizations, celebrity endorsements, and higher educational organizations).



News

Media

The news media (television, radio, newspaper) was the most prominent theme (308 times out of 515 responses; 59.8%) that emerged when analyzing the participants' responses to where they obtained knowledge related to the COVID-19 pandemic.

"TV, doctors books work news"

"Television, online news, newspaper, coworkers"

"community, public news, social media, and my own personal research"

"News CNN/Headline News/Buffalo News/Dr. Facci [sic] and colleagues [sic], nurses, doctors"

Health Care

Health care providers (doctors, nurses, pharmacists/pharmacies) were the second most common theme that emerged from the analysis of participants' self-reported knowledge about the COVID-19 pandemic, mentioned 155 times out of 515 responses (30%).

"news on TV + health care providers"

"at my primary doctor"

"my pharmacist"

"Doctor relative in health care"

"from doctors nurses people who have had COVID-19"

"doctor's office, pharmacy and work"

Internet/Web-based Sources

In 515 responses, participants mentioned Google, social media sites (Facebook, Twitter), and other online resources 92 times (17.8%) as places where they obtained knowledge related to COVID-19.

"Internet research"

"Google"

"Twitter"

"Facebook, news"

"The news/Youtube/Google news docs"

“I research all information literature google. I self educate [sic] myself and disagree with a lot Fauci say”

US Government

The study participants mentioned government sources, including the Centers for Disease Prevention and Control (CDC), the US Food and Drug Administration (FDA), and local health departments, 69 of 515 times (13.4%) as sources of knowledge, and the United States Department of Veterans Affairs (V) was mentioned once.

CDC, News Outlet, NYSDOH, health depts, research”

“Dr. News Internet state County Health Dept.”

“CDC and Erie County Health Department”

“Media, Internet, School, CDC, FDA”

“at the doctor’s office on TV”

“VA, news, youtube [sic], church”

Employment

Multiple participants self-reported their job or work (39 times of 515 responses, 7.52%) as a source of knowledge related to the COVID-19 pandemic.

“my job”

“my job as a respiratory therapist”

“I work at Buffalo General Hospital and learned through the pandemic”

“I work in nursing”

“work”

Other

Other self-reported sources of participants’ knowledge include family and friends (17/515; 3.3%), faith-based organizations, i.e., churches (16/515; 3.1%), schools (8/515; 1.5%), endorsements by Dr. Fauci (9/515; 1.55%), and the World Health Organization (WHO) was mentioned once.

“my father who is a doctor”

“my wife who is a nurse”

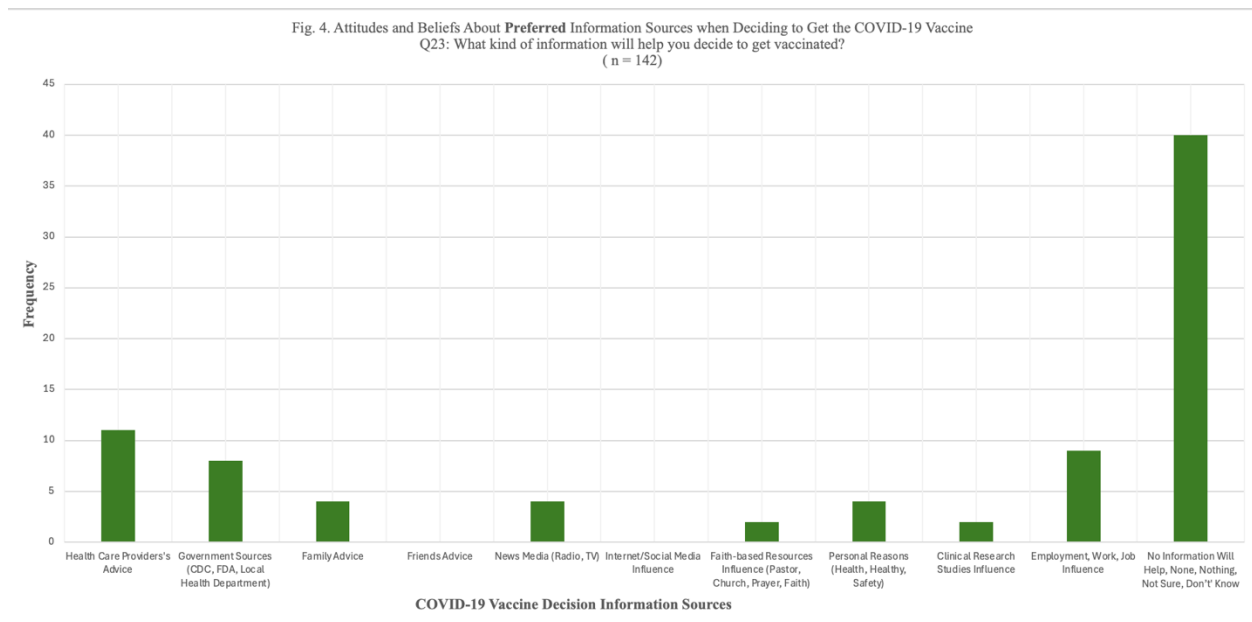
“the doctors and mother”

“Internet, doctors, professors”

“CDC, News, Doctor, WHO, Health Department”

“Second Baptist Church”

Participants' attitudes and belief responses varied when asked about their preferred information sources in deciding to get vaccinated (**Q23**, Figure 4) and the influential information sources that assisted them in making their COVID-19 vaccine decision (**Q26**, Figure 5).



Although health care providers 7.74% (11/142), employment 6.34% (9/142), and the government 5.63% (8/142) were the top three preferred information sources for deciding to get a COVID-19 vaccine, 28.1% (40/142) of the participants indicated that nothing or no information sources were preferred. The following quotes are from question 23.

“Health provider, church, communities”

“doctor, news”

“the info from the doctor”

“work”

“keeping my job”

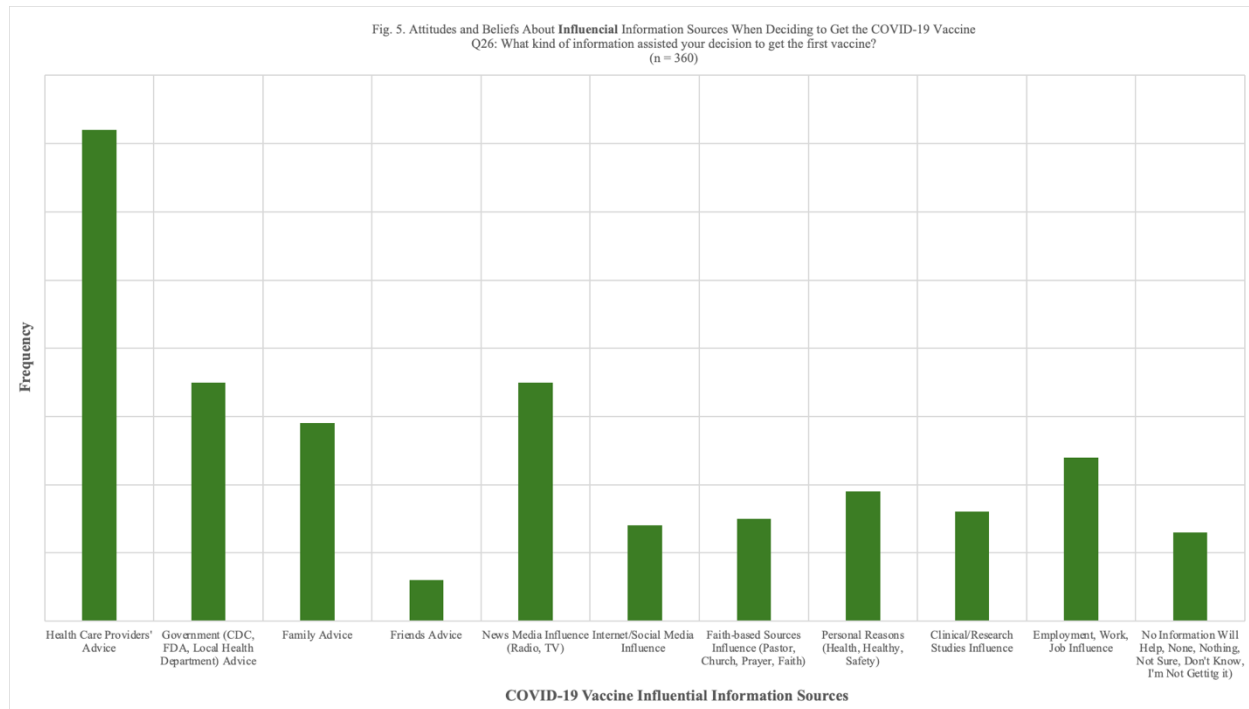
“my job required it N/A”

“nothing I’m not getting the booster”

“none”

“don’t need any”

“factual information by reliable [sic] sources”



Similarly, when asked in question 26 (Figure 5) about the information sources that were influential in their decision to get their first COVID-19 vaccine, participants cited health care providers 20% (72/360), government sources 9.72% (35/360), news media 9.72% (35/360), family advice 29/360, and employment influence 6.67% (24/360) as the top reasons for their decision. The following are direct quotes from question 26.

“the Drs., and news”

“Pharmacy/Pharmacist consultant”

“CDC, Doctor, Research”

“I was mandated/forced to stay a registered nurse”

“information from CDC and friends”

“government studies”

“healthcare/gov’t”

“safety pamphlets at work when it was mandated”

“Working for the New York State Department of Health”

“my faith. we [sic] prayed on it. I receive flu vaccines every year family”

“internet, local news, friends+family [sic]”

“Research, independent studies, healthcare provider”

“my job”

“My job and safety of my children”

Fig. 6. Attitudes and Beliefs About **Preferred** Information Sources when Deciding to Get the COVID-19 Vaccine Booster
Q30: What kind of information will help you make the decision to get the booster?
(n=184)

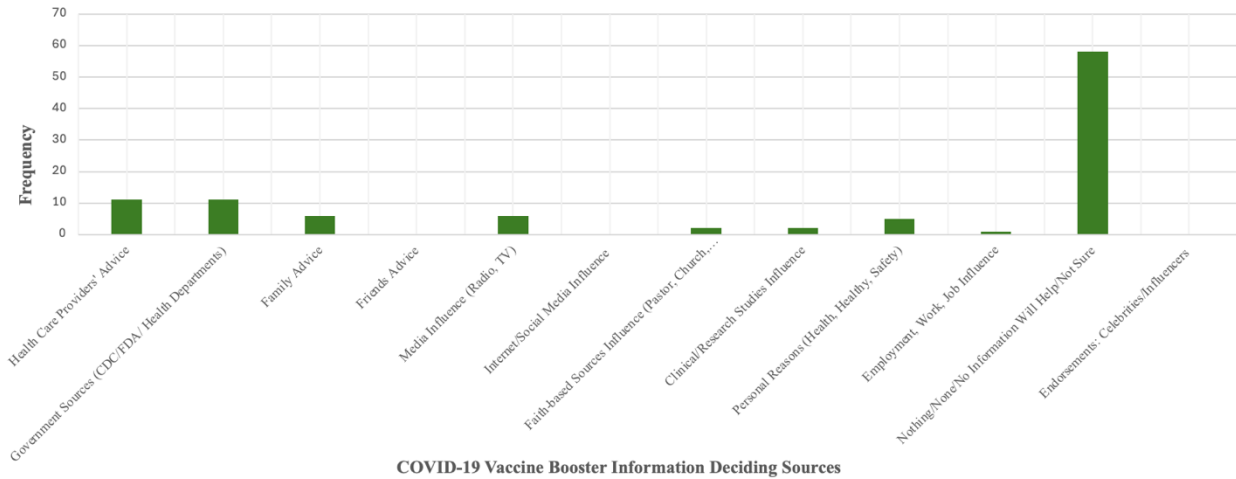
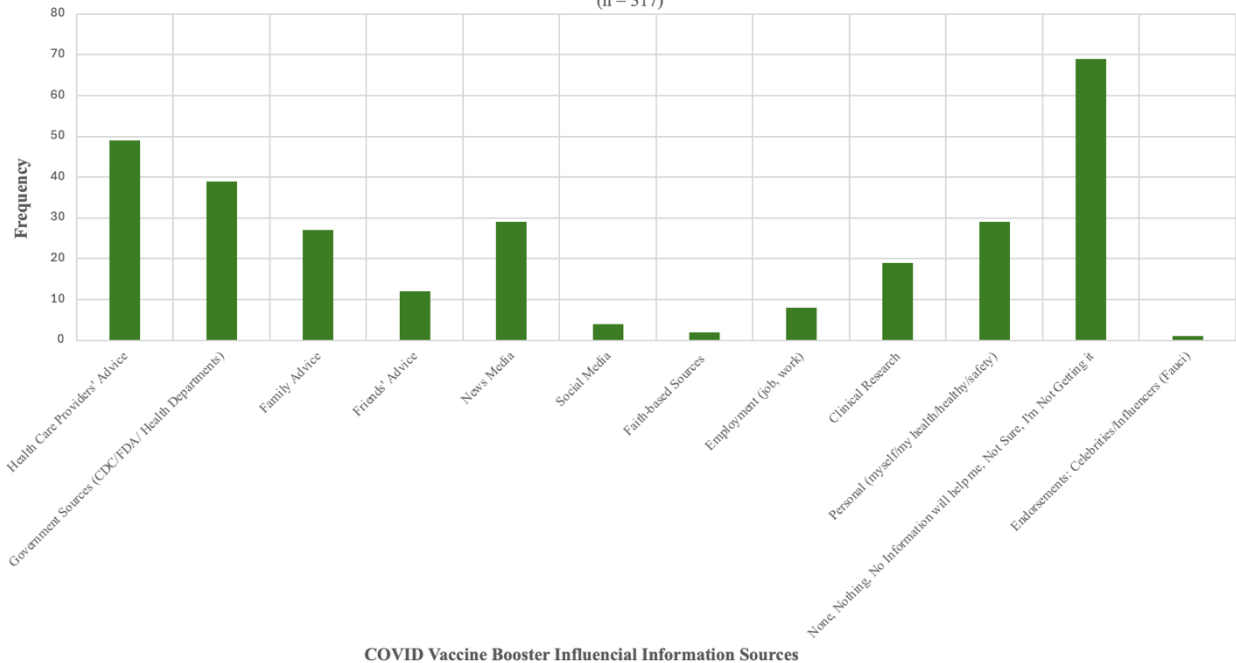


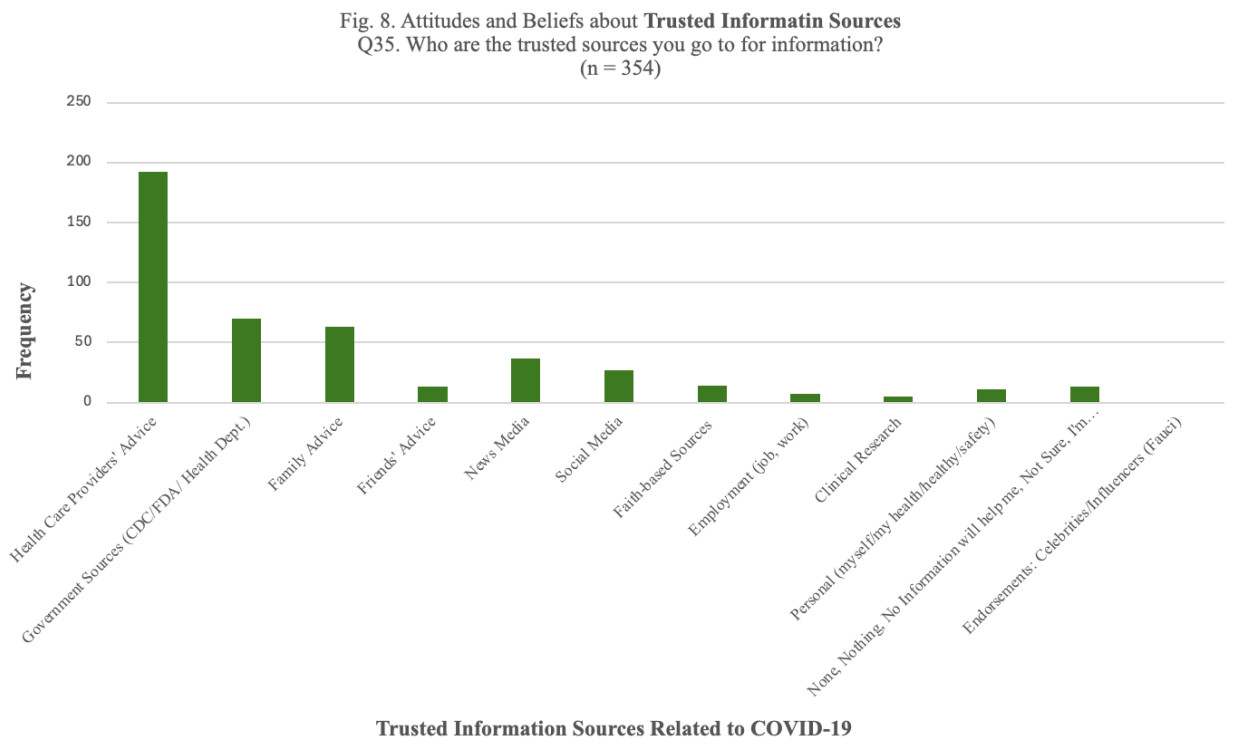
Figure 6 (Q30) shows that 31.5% (58/184) of the participants indicated that they had no preferred information sources that assisted them in deciding to get the COVID-19 vaccine booster, although others indicated that health care providers and government sources were preferred. The following are quotes from question 30.

Fig. 7. Attitudes and Beliefs About **Influential** Information Sources When Deciding to Get the COVID-19 Vaccine Booster
Q33: What kind of information assisted your decision to get a booster shot?
(n = 317)



Similarly, Figure 7 (Q 33), 15.5% (49/317) of participants were influenced by health care provider's advice, 12.3% (39/317) government sources, including CDC, FDA, local health departments, 9.1% (29/317), by the news media, 9.1% (29/317) personal reasons, and 8.6% (27/317) by family. Yet, a significant portion of the participant responding to this question, 21.8%

(69/317), indicated that nothing and no information sources would help influence their decision to get the COVID-19 vaccine booster.



When asked about trusted information sources, participants go to for COVID-19 vaccine-related information, in question 35 (Figure 8), more than half of the respondents to this question cited health care providers (54.2%) (192/354) as their trusted information source. Additionally, government sources 19.8% (70/354), including the Centers for Disease Control and Prevention (CDC), the Food and Drug Administration (FDA), family 17.8% (63/354), the news media 10.5% (37/354), and social media advice 7.6% (27/354).

Determinants of Vaccine Trusted Information Sources: An Expansion of the WHO's SAGE 3Cs Model and Adaption of Hardin et al.'s 5C Model to our Proposed 5Cs Model

The World Health Organization's (WHO's) Strategic Advisory Group of Experts (SAGE) 3Cs Vaccine Hesitancy Model, confidence, convenience, and complacency are suggested to emerge when participants (1) exhibit apprehension or low *confidence* in the safety, effectiveness, and organization recommending and offering the vaccine; (2) perceive that vaccine access is not *convenient* or affordable, and (3) are *complacent*, skeptical about the severity of the vaccine-preventable disease, there is no vaccination requirement for prevent of infection and transmission, and that possible consequences overshadow the benefits of any vaccine (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015). We suggest a modification for an additional version with decisional *conflict* (Hiroyama et al., 2023), a new 'C' to align with our findings and to complement the adapted 5C model, with the named dimensions: *community* and *communication* (Hardin et al., 2023) and the WHO's SAGE 3Cs model with the named dimensions: *convenience* and *confidence* (MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015), that can be used as a guide to analyzing vaccine determinants (Table 3).

Table 3

*Determinants of Vaccine Hesitancy: Comparison of WHO's 3C Model to a Proposed 5C Model
Based on the Qualitative Findings in this Study*

<i>WHO 3Cs²</i>	<i>Franklin, et al. (this study) 5Cs:</i>
1. Confidence: <i>an individual's level of dis/trust in the effectiveness and safety of COVID-19 vaccine or booster, in the people and/or organizations administering or providing it, and the motivating factors of policy-makers decisions related to the needed vaccines</i>	Confidence: <i>an individual's level of dis/trust in the COVID-19 vaccine or booster, and the people and/or organizations administering or providing it (WNY), and the motivating factors of policy-makers decisions related to the needed vaccines</i>
2. Convenience: <i>the relative ease or availability affordability, and accessibility of getting vaccinated with the COVID-19 vaccine or booster; real and/or perceived quality of service; cultural appropriate context</i>	Convenience: <i>the relative ease or availability affordability, and accessibility of getting vaccinated with the COVID-19 vaccine or booster; real and/or perceived quality of service; cultural appropriate context (WNY)</i>
3. Complacency: <i>Perceived lack of necessity, with the mindset that vaccine-preventable diseases are minimal, and vaccinations are perceived as not a necessary preventive action</i>	Conflict (decisional): <i>(not complacency) –participant's vulnerability and ambivalence to delay decision-making even with adequate and trusted COVID-19 vaccine or booster information sources and the uncertainty that aligns with receiving conflicting messages about COVID-19 and the COVID-19 vaccine and booster (we propose decisional <u>conflict</u> this instead of complacency, which implies an individual's lack of understanding or awareness about something)</i>
4.	Communication: <i>trusted information sources and methods an individual may have used to capture, aggregate, research, and learn new information about the COVID-19 vaccine and vaccine booster</i>
5.	Community influences: <i>Community resources used to build confidence and courage in a person's willingness to begin to put trust in a historically broken system to be vaccinated to protect themselves, and their community</i>
<i>Adapted from Hardin et al., 2023⁵⁰</i>	

Like other models (Hardin et al., 2023; MacDonald & SAGE Working Group on Vaccine Hesitancy, 2015), we've identified five emerging determinant themes from our participants' responses confidence, convenience, conflict, community influences, and communication (Figure 9, Table 3): *confidence* and *convenience*, the two themes named in the WHO's 3Cs model complement the findings in our study. We adjusted the WHO's third C, *complacency*, with the term *conflict*, a recurring theme that was identified in our work, relating to decisional conflict aligned with factors that could influence vaccine hesitancy. We adopted two themes from a 5C model (Hardin et al., 2023), *community influences*, and *communication*, for our modified 5C model, recurring themes noted in our work from participants' knowledge, attitudes, and beliefs related to trusted information sources of the COVID-19 vaccine or booster and mapped participants' reported concerns influencing their vaccine decisions. The findings in this study confirm that participants were conflicted about their decision to receive or not to receive the COVID-19 vaccine or booster, in addition to expressing their concerns, fears, anxiety, and stress related to receiving conflicting information rather than complacency about the status quo.

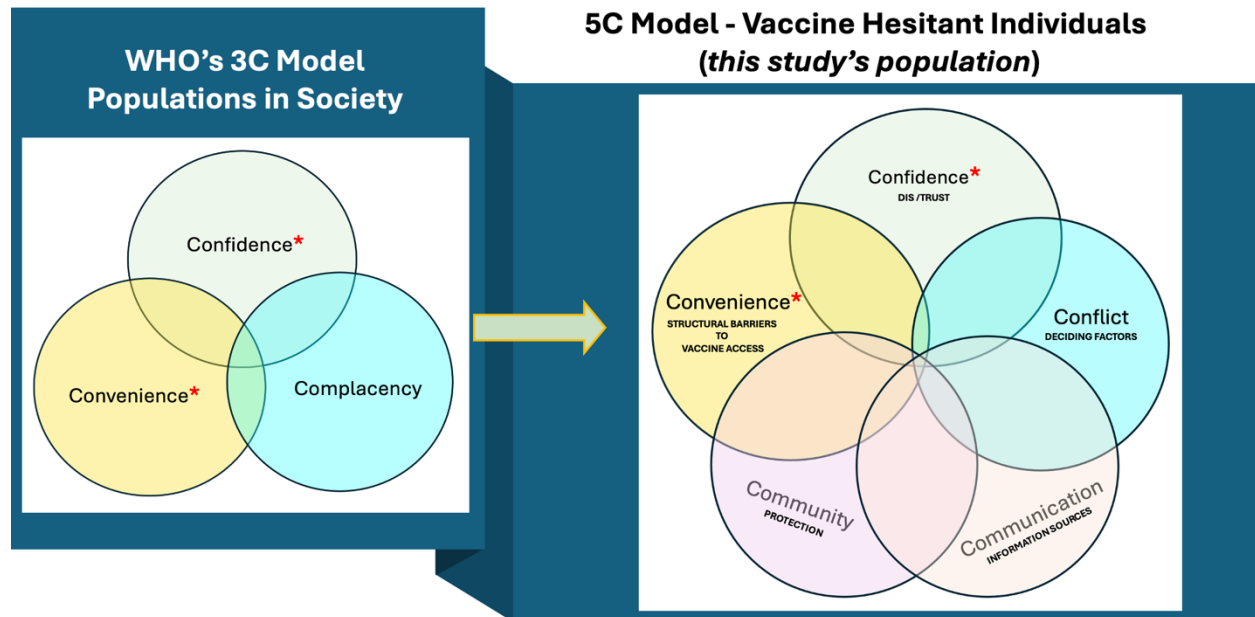


Fig. 9. WHO's 3C Model in Comparison to a Proposed 5C Model (red **asterisk** indicates themes common to both models).

Discussion

COVID-19 (coronavirus disease 2019) is a disease caused by SARS-CoV-2. The goal of this study was to explore reasons for diminished vaccine uptake and identify the reasons for lower vaccination rates in low-income, zip codes of WNY communities which may include racially minoritized individuals, and urban and rural participants. We asked the participants to specify factors influencing their decisions to give up the COVID-19 vaccination or booster shots (See Appendix A for the questions used in this study). Looking at the participants' responses, about their knowledge, attitudes, and beliefs toward the COVID-19 vaccine, overall, we found that some trusted information sources were significant, these trusted sources varied among the participants in their decision to accept or refuse the vaccine. Health care providers (primary care doctors, pharmacists, nurses), news and social media, government agencies (CDC, FDA), and family and friends were influential in the participants' decision-making, as indicated by statements such as "my doctor," "my pharmacist," "CDC information," "health department," and "TV, family, friends." On the contrary, some participants did not trust any sources, including the government, as indicated by "I refuse to be a Guinee [sic] Pig for the CDC or government," "I'm 100% Anti [sic] covid vaccine don't trust nothing about it!!!," and "no reliable sources." Additionally, our work revealed that several respondent quotes are aligned with myths, misconceptions, and misinformation about the COVID-19 vaccine or booster. "I am spiritually gifted (dreams and visions since childhood). I know that its [sic] meant to kill." COVID-19 misconceptions are common among certain populations (Kreps et al., 2021) and misinformation about COVID-19 is prevalent across the continuum of media sources (Malik et al., 2020). Some participants described COVID-19 as an illness like the common cold or flu. "SARS CoV-2 is the common cold that has been modified into COVID-19 and natural immunity and healthy living is the way to avoid complications from both" and "It is a virus like cold/flu severe + [sic] can hospitalize and or kill you." This misconception among others was widespread during the pandemic (CDC, 2025; Kricorian et al., 2022). Moreover, many Americans experienced and expressed frustration and anger because of changing and inaccurate information during the COVID-19 pandemic (Gallotti et

al., 2020; Li et al., 2020). There was no consensus on the illnesses and disease(es) related to COVID-19 or how to effectively deal with the difficult situation. In this study, quotes that are aligned with frustration and inaccurate information sources also emerged from respondents. When asked about preferred information sources in deciding to get vaccinated, examples are *“factual information by reliable [sic] sources”* and *“I research all information literature google. I self educate [sic] myself and disagree with a lot Fauci say.”* In the US, historically marginalized populations, especially under-represented and ethnic minorities, race, and ethnicity play a role in who gets optimal healthcare services, including vaccine distribution, specifically during the COVID-19 pandemic (Boserup et al., 2020; Hernandez et al., 2022; Tirupathi et al., 2020) when things became more apparent. Our study, in conjunction with other investigations, suggests that patterns of vaccine hesitancy are influenced by multiple factors (Dubé et al., 2013, 2016; Kestenbaum & Feemster, 2015), including a person’s racial and ethnic backgrounds (Gardiner et al., 2021; Thompson et al., 2021; Willis et al., 2021) and trust (Jaiswal & Halkitis, 2019; Restrepo & Krouse, 2022; Thompson et al., 2021; Webb Hooper et al., 2021). Participants’ comments related to trust include the following *“I’m 100% anti COVID [sic] vaccine don’t trust nothing about it!!! [sic],” “don’t trust the vaccine,” “don’t trust nothing rushed,” “I’m still skeptical about the whole vaccine,” “history in America,”* and *“All the side effects this gov. tried to cover up.”* The medical distrust expressed by people of color, particularly Black and African Americans, may imply a breakdown in their trust in the healthcare system and can be flagged as an early warning sign for those less likely to avail themselves of medical services. Our findings from this study can be used for targeted interventions, such as promoting health literacy with clear, fact-based information on vaccines to begin to eliminate myths and misinformation about vaccines, and the healthcare system. Additionally, the findings can be incorporated into public health campaigns and program development and for other informational purposes, personalized to address the barriers and concerns faced by Western New Yorkers to promote communication, health behavior change, and increase vaccine acceptance (Feemster, 2020; Hong, 2023; Servaes & Malikhao, 2010). For example, warning systems for organizations to register patients upstream for educational programs to help them better use healthcare resources to their advantage. Furthermore, this data type can be used as a screening test for noncompliance in hesitancy towards vaccinations, a long-standing issue, annual well-women examinations, colonoscopies, and other health maintenance examinations to encourage good health behaviors and well-being throughout a life course. Collectively, improving health behaviors, correcting misconceptions and myths, and promoting good health are impactful on society (Milionis et al., 2023). The societal impact that aligns with the public knowledge of the geographic location of the first COVID-19 case originating in China is indisputable (J. D. Bloom et al., 2021; Troiano & Nardi, 2021). A few study respondents commented on the international origin of COVID-19 and its spread to the USA. *“novel virus related to SARS that was first seen in Wuhan, China. Mutates easily, several variants now”* and *“It is/can be deadly, its [sic] contagious, effected [sic] black [sic] people at higher rates, said to have started in China from bats, world wide [sic] impact, all ages, masks may reduce chance of infection”* This study’s results additionally revealed that not only does distrust of the healthcare system, myths, and misinformation fuel behavior on the continuum of vaccine hesitancy but also fear of side effects, concerns about modern technological applications, and confusion about trusted information are fundamental factors in addressing society’s concerns about vaccines, in this case the COVID-19 vaccine (Akel et al., 2021; Benson et al., 2024; Milionis et al., 2023; Toney & Ishack, 2020).

Mapping the participants’ responses to seven of the Theoretical Domain Framework (TDF) determinants (Table 2) solidifies our findings in this study and our colleagues’ quantitative analysis (Benson et al., 2024), in that the most frequently, from highest to lowest coded TDF determinants

associated with COVID-19 vaccination or booster acceptance and the participants' knowledge, attitudes, and beliefs about the information sources including the facilitators and barriers related to the COVID-19 vaccine or booster are their 1) Social influences, including family friends, health care providers, social and news media, and government sources (CDC, FDA, WHO, local health departments) "*Media, NY State, CDC, Internet*" and "*TV, family, friends*", 2) Environmental context and resources (trust in clinical research studies and government, health care providers, family, friends, employment, and social and news media as trusted information sources) "*CDC information*" and "*news of death*", 3) Knowledge (general, scientific, and procedural knowledge about the COVID-19 vaccine or booster) "*Spread through respiratory droplets/particles*," "*Highly contagious*," and "*It is a virus*", 4) Beliefs (consequences and capabilities that shaped the study participants' actions related to COVID-19, COVID-19 vaccine or booster) "*vaccine to save lives*" and "*for my family*" 5) Social and professional roles and identity (participants' roles and responsibilities in protecting the 'community') "*I received the vaccination because it will keep me safe also the people around me and protect the community*," "*Important for public health, at a higher risk for severe disease*," and "*for college and working*", 6) Reinforcement/incentives/rewards (participants commented on positive and negative past experiences that were 'cues to action' or motivated them to accept or reject the COVID-19 vaccine or booster) "*Yes, two vaccinations and two boosters. Seen too many deaths and illnesses*", and 7) Emotions including anxiety, fear, stress, and depression (respondents expressed several experiences that fostered these emotions: "*It can kill you*" and "*don't want the side effects, I'm scared of needles*").

Comparing the main barriers from the WHO's SAGE Working Group's 3C model, that influence vaccine hesitancy to our adopted (Hardin et al., 2023) proposed 5C model barriers (Figure 9, Table 3), it is clear the participants experienced a significant level of decisional *conflict* which directly correlates with delayed decision-making (vaccine hesitancy) (Hiroyama et al., 2023) related to the COVID-19 vaccine or booster, for example, "*I heard too many negative reviews*," "*Too new and people got it and still had Covid*," "*I don't think it works because someone got the vaccine and still died from it*," "*Because its [sic] not a proven vaccine, basically anyone taking it is part of a study (A Gunee [sic] Pig)*," "*I feel it isn't truly approved, money made it move too fast*," "*The vaccine is new, not enough science and data*," and "*Because there still not exactly sure the amount and the boosters (more research)*." Addressing the public's concerns, by supporting decisional *conflict* can be a public health strategy aimed at achieving the goal of successfully and efficiently reducing vaccine hesitancy, by producing messaging that is fact-based and clear about the value of vaccination, as support and value are subsets of decisional conflict (Hiroyama et al., 2023). This study highlights key implications for improving public health strategies to boost vaccine uptake among racial and ethnic minorities. Trust, support, and clear communication are vital to increasing vaccine acceptance. Strengthening trust between healthcare providers and communities can improve vaccine rates and overall health outcomes. Addressing myths and misinformation is essential to protect personal and public health. These findings should inform public health practices aimed at improving individual and population health. Promoting public health requires trust not only in healthcare systems and providers but also in acknowledging historical events that have shaped mistrust. Raising awareness among clinical trainees is crucial for building equitable, informed, and effective health interventions that foster confidence and vaccine acceptance in diverse communities. A suggested starting point for trust-building is incorporating educational intervention(s) in the medical curriculum (Teal et al., 2010) that focuses on the harm that historical events have played in minoritized individuals and marginalized communities that created that distrust in the healthcare system. This distrust was overtly evident during the COVID-19 pandemic (Best et al., 2021). As the virus SARS-CoV-2, responsible for COVID-19, mutates,

new variants will continue to emerge. Therefore, individuals, communities, and populations need to keep up to date with clear, fact-based information from various sources to remain informed about the next steps in the COVID-19 vaccination process.

Strengths and Limitations

Limitations:

Several factors limited our study, first, this was a self-reported study, a cost-effective, practical way to gather information that is not directly observable (i.e., behaviors, attitudes, thoughts and feelings) about participants. However, this research method includes threats to the study's validity by introducing various forms of response bias, including *recall bias* that may have influenced responses to the narrative questions, as participants may not remember past events, and *social desirability bias* in which participants' may craft their responses to make themselves look better to others or may respond 'yes' often (i.e., extreme responding) (Swaidan, 2018). Second, the cross-sectional design of this study captures only a snapshot in time, making assessing changes in knowledge, attitudes, beliefs, or behaviors difficult, and causal relationships are unclear and are not easy to assess (Setia, 2016). Third, the findings cannot be generalized only because this small study involved sites limited to the Erie and Niagara County areas of WNY with a relatively small participant sample. Since the focus was limited to WNY this limits the study's applicability to other geographic areas with different demographic and socioeconomic contexts. Fourth, our participant sample may be biased because specific subgroups within the population may still be underrepresented in our sample. Given that the findings are based on a study population that is racial and ethnocentric, we recognize the importance of replicating this study in non-racial/ethnic minorities is essential. This could have led to the authors potentially missing critical insights into vaccine hesitancy and acceptance. In addition, biases such as social desirability (Bergen & Labonté, 2020) may have influenced some participants to hold back their genuine opinions from the study staff, causing them not to share some barriers to accepting or refusing the COVID-19 vaccine. Fifth, using paper surveys may have introduced errors in data entry despite our efforts to maintain accuracy through random checks. Although interrater consistency was instituted (Gisev et al., 2013), we cannot comment on the objective and subjective components of the chosen participants' phrases, what one author may think is a good or irrelevant phrase may not align with others, and we cannot rule out typographical errors by coders in some of the phrases during the transfer of information from participants notes to the Excel spreadsheet. GF encountered several uncertainties when coding the data to theoretical domains because the interpretation of the theoretical constructs required a level of interpretation in this qualitative coding (Atkins et al., 2017). The results of this study underscore the pivotal role of thought processes in vaccine decision-making. However, it's essential to acknowledge the limitations, including participants' varying levels of knowledge, skills, and decisional conflict in vaccine acceptance. These barriers need to be addressed in future research, and public health interventions. Lastly, our findings can serve as a valuable guide in studies related to vaccine hesitancy.

Despite the limitations, our study has important implications and *strengths*. For example, the study was limited to data analyses based on a small sample that included racial and ethnic minorities limited to the WNY area. However, the information gathered from conducting this cross-sectional study, which included understanding the issues influencing the COVID-19 vaccine hesitancy, such as decisional conflict, establishes preliminary evidence for planning future studies, and can be shared locally, nationally, and internationally and may be helpful to inform larger-scale

studies in similar settings. Additionally, cross-sectional studies are easy to conduct, not time-consuming, inexpensive, and do not require participant follow-up over time (Setia, 2016).

Relevance, Implications, and Recommendations for Public Health Practice

Vaccines are deemed one of the great achievements of medical and public health science (Kennedy, 2020; Koppaka, 2024), yet vaccine hesitancy is listed as one of the top ten threats to global health (Kennedy, 2020; *Ten Health Issues WHO Will Tackle This Year*, 2019). Our study results indicate that although participants' knowledge, attitudes, and beliefs varied when it came to trusted information sources for the COVID-19 vaccine and booster. Vaccine hesitancy and vaccine distrust can have significant consequences for population health outcomes, yet in most instances, several members of society refuse to accept vaccines. Designing targeted public health interventions that include explanations of the value of vaccines, supporting the public with clear, fact-based trusted information sources, addressing health disparities, and focusing on the environmental, structural, and social determinants of health in public health messaging are collective efforts to improve COVID-19 vaccine hesitancy, among other public health interventions.

Conclusions

This qualitative analysis of open-ended survey responses offers valuable insights into the knowledge, attitudes, and beliefs about the COVID-19 vaccine among a medically underserved Western New York population. It highlights variation in trusted information sources—ranging from healthcare professionals and government agencies to family, friends, media, faith-based groups, and celebrities.

The study also reveals widespread distrust in traditional systems, including government and healthcare institutions. Participants' beliefs are shaped by factors like culture, personal experiences, and social context. Due to the complex roots of vaccine hesitancy, simple or superficial solutions are unlikely to be effective.

Findings emphasize that vaccine behavior is influenced by broader economic, structural, and social determinants, along with factors such as confidence, convenience, decisional conflict, community influence, and communication. These insights are critical for shaping future public health programs, especially those aiming to reduce vaccine hesitancy and improve health literacy through targeted, culturally sensitive education.

Therefore, promoting trust, the value of vaccination, and providing substantial support (D. E. Bloom et al., 2021; Hiroyama et al., 2023) to individuals and communities in WNY and globally, in addition to diminishing health disparities by addressing the environmental and social-structural determinants of health, and health behavior changes are vital and essential to vaccine acceptance, mitigating the effects of COVID-19 in underserved populations, and improving health care and health outcomes. Global public health interventions should focus on the many downstream determinants of vaccine hesitancy. COVID-19 became endemic throughout the world – vaccines are important, and people will need to continue to keep up with vaccinations to protect themselves.

Funding

This project was funded by the United States Department of Health and Human Services (DHHS), National Institutes of Health (NIH), National Center for Advancing Translational Science (NCATS) Award # 3UL1TR001412-0853, and the John R. Oishei Foundation (726 Exchange

Street #510, Buffalo, NY 14210). The funders had no role in the study design, data collection or analysis, the decision to publish, or the preparation of the manuscript.

Gillian Franklin is supported by the NIH, NCATS Award # 3UL1TR001412-0853.

CRedit | AUTHORSHIP CONTRIBUTION STATEMENT

Gillian Franklin was the major contributor to the manuscript's writing. All authors read, commented on the drafts, and approved the final manuscript.

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Conflict of Interest Declaration

None of the authors has any conflicts of interest to declare.

Acknowledgments

The authors want to acknowledge the study participants who gave their time and shared their thoughts and experiences to contribute to this work. We thank the following contributors: Rethink WNY Community Health Collaborative, Brian Benson (University at Buffalo), Dr. Laurene M. Tumiel-Berhalter (University at Buffalo), Shunlei Win (University at Buffalo), Dr. Kabir Jalal (University at Buffalo), Dr. Jihnee Yu (University at Buffalo), Dr. J. Bleasdale (University at Florida) Matthew Cole (Frontier Science Foundation), Kaylen Townsend-Kensinger (Niagara University), Tania Islam (Erie County Department of Health), the NY State Public Health Corps Graduate Fellows and the John R. Oishei Foundation. We thank all the other contributors at the participating sites for their enthusiasm and support throughout this project.

I thank my Diversity Supplement mentors and collaborators: Dr. Peter L. Elkin (University at Buffalo), Dr. Yotam Ophir (University at Buffalo), Dr. Saptarshi Chakraborty (University at Buffalo), Pastor K. Pointer (African Heritage Food Co-Op), and Dr. Alison M. Vargovich (University at Buffalo).

I gratefully acknowledge the assistance of Anbar Nawar who took the time to convert the references over to the American Psychological Association (APA) style.

Most of all, I thank Dr. Timothy Murphy for obtaining the parent grant to the Diversity Supplement through the University at Buffalo, Clinical and Translational Science Institute (CTSI).

Supplementary information and other data related to this article can be found online at (<https://doi.org/10.1007/s10900-023-01319-0>) in the published quantitative analysis by some of the authors of this paper.

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Appendices

Appendix A

Question Number	Qualitative questions from the cross-sectional survey
Q5	1. What do you know about SARS CoV-2, Coronavirus, COVID-19 pathogen? Please describe below
Q7	2. Where did you learn your knowledge about COVID-19? Please describe.
Q10	3. Please describe how people you know were medically impacted by COVID-19, if applicable
Q13	4. Please describe how your family's health was impacted, if applicable
Q16	5. Please describe what happened if there was a serious illness or death in your family, if applicable
Q18	6. Enter the number of individuals who were sick with COVID-19, if applicable
Q20	7. Enter the number of individuals who died, if applicable
Q21	8. If you have not been vaccinated, why have you decided not to receive the vaccine at this time?
Q23	9. What kind of information will help you decide to get vaccinated? Please describe.
Q25	10. If you have received your first vaccination, why did you decide to receive the vaccine? Please describe.
Q26	11. What kind of information assisted your decision to get the first vaccine? Please describe.
Q28	12. If you have not received the vaccine booster, why have you decided not to at this time? Please describe.
Q30	13. What kind of information will help you to make the decision to get the booster? Please describe.
Q32	14. If you have received the vaccine booster, why did you decide to receive it? Please describe.
Q33	15. What kind of information assisted your decision to get a booster shot? Please describe.
Q35	16. Who are the trusted sources that you go to for information? Please describe.
Q37	17. Are there any questions you would like to ask? Please describe below.

Appendix B

Table 2

Theoretical Domains Framework (TDF) determinants associated with COVID-19 vaccination and booster acceptance related to information sources among study respondents

<i>The seven (7) themes/domains that respondents' quotes were frequently associated with, from most to least</i>	<i>Facilitators</i>	<i>Barriers</i>
2. Social influences, support, norms, pressure (i.e., What roles do personal/interpersonal/professionals play in the study respondents' decisions to accept/not accept a COVID-19 vaccine or booster dose? Who are their social influences/support and how does that affect what they do? What are their sources of information, positive/negative?)	Family, friends, health care professionals (HCP), personal stories, coworkers/colleagues, health care professional respondents personally know (doctor, nurse, PCP, pharmacist), celebrities, clinical research studies, personal stories) Social media (Facebook, Google, other Internet sources) News media (TV, radio) Government (CDC, FDA, WHO, local health department) "CPA, Doctor, Social Pressure" "I am a registered ICU nurse" "I did my own research" "My son" "From my Mr." "My husband" "My sister" "My mom told me" "My father who is a doctor"	Family, friends, health care professionals, personal stories Government "Don't think it will make any difference/Friend [sic] and family that got vaccine were sicker than me when they go it" "I heard too many negative reviews" "Too new and people got it and still had Covid" "I don't think it works because"
Quotes		

“The public”
“My cousin”
“My pharmacist”
“My doctor”
“TV, family, friends”
“Work” “My job”
“Local church”
“Schools”
“Facebook/news” | “Internet” | “Google”
“News, paper, social media”
“On TV and on my phone”
“Hospital” | “Community Health Center”
“Health department”
“Media, NY State, CDC, Internet”
“CDC, Johns Hopkins, UB”
“Dr. Faucci [sic]”

2. Environmental context, resources, and stressors (i.e., What factors in the study respondents’ environment influence their decisions about getting or not getting a COVID-19 vaccine or booster dose?)

Q23 (n = 142): When asked, what information will help you decide to get vaccinated?

Quotes

Behavioral or other cues to action (i.e., trust in clinical research studies and information sources (government, health care providers, family, friends, job, social & news media) about the COVID-19 vaccine/booster
Access to places that offered the COVID-19 vaccine/booster

“need if for a job” | “I wouldn’t been [sic] able to work”
“my pastor shared how terribly sick he was”
“CDC information”
“news of death”
“If family members died [sic]”
“getting sick”
“doctor”
“prayer”
“watching my father recover and not wanting anyone else I love go:
“factual information from reliable sources”
“primary doctor, CDC, news, school district”
“more test [sic] less death”
“knowing how accurate the vaccine is and how it will protect myself and family”
“money”
“if I know I won’t get sick I [sic] will get it”
“the proper approval”
“F.D.A. aproved [sic]”
“more safe research”
“thoouough [sic]info on it”
“TV, My church, my doctor”
“Seeing the increasing case numbers”
“long term studies”
“My father’s doctor recommended all of us to get it to protect him”

someone got the vaccine and still died from it”
“I 100% Anti covid vaccine don’t trust nothing about it!!!”
“don’t want the side effects, I’m scared of needles”
“I don’t believe in modern day medicine”
“All the side effects this gov. tried to cover up”
“Because its [sic] not a proven vaccine, basically anyone taking it is part of a study (A Gunee [sic] Pig)”
“I feel it isn’t truly approved, money made it move too fast”
“The vaccine is new, not enough science and data”
“Because there still not exactly sure the amount and the boosters (more research)”
“I had the virus – so I got vaccinated”
Hesitant/Anti-vaccine
Limited accessibility and availability to the COVID-19 vaccine/booster

“no information will help me”
“only if it’s mandatory”
“none!! I’m 100% against this vaccine”
“I won’t receive it, I don’t believe it helps in any way”
“I feel it will harm me”
“I Don’t Know”
“not sure”
“none”

3. Knowledge of condition, science, procedures (i.e., Study respondents' awareness about the COVID-19, COVID-19 vaccine/booster and vaccine/booster process, and how does that influence their decisions)

Quotes

"That the vaccine is harmles [sic]"
"when you hear about all the sick people"
"to live"
"if I have the info I need"
"education"
"Science and data on time"
"more research"
"Government Information"
"sensible, thorough, not-political information"
 Gained adequate knowledge about COVID-19 and the COVID-19 vaccines/boosters (i.e., general knowledge)

No knowledge gained about COVID-19 and the COVID-19 vaccines/boosters (i.e., general knowledge)

4. Beliefs about consequences & capabilities (i.e., What are the positive/negative outcomes from study respondent's actions related to COVID-19, COVID-19 vaccine or booster and how the outcome of these actions may influence their future decisions?)

Quotes

"Spread through respiratory droplets/particles"
"Highly contagious"
"It is a virus"
"It can kill you"
"Multiple symptoms"
"many different virus symtums [sic]"
"Man maid [sic]and intentionally released"
"It represents a mutation"
"Vaccine is very important"
"SARS started in 2019"
"It's rampant"
"It helps you to not get COVID-19"
"its [sic] a 50/50 chance you could die or live"
"SARS CoV-2 is the common cold that has been modified into COVID-19 and natural immunity and healthy living is the way to avoid complications from both"
"It can cause short or long term health problems"
"What was distributed from CDC"
 Q25 & Q 32 (n = 383 & n = 383, respectively).
 When asked, "If you have received your first vaccination/booster, why did you decide to receive the vaccine/booster?"
 Attitudes
 Perceived benefits (i.e., confidence, positive outlook, and belief in the protective effect of the COVID-19 vaccine/booster (e.g., will protect family friends, colleagues, etc.)

"Nothing"
"Not much"
"Not sure"
"Not much besides the theories"
"Unsure"
"Don't know too much info"
"IDK"
"I can't recall"
"Nothing really because I don't care"

Q21 & Q28 (n = 69 & n = 115, respectively).
 When asked, "If you have not been vaccinated/boosted, why have you decided not to receive the vaccine/booster at this time?"

Perceived severity and Perceived susceptibility (i.e., Respondents' fears, concerns, and distress about the COVID-19 vaccine)
 1. Side-effects/safety
 2. Beliefs that vaccine is unnecessary
 3. Vaccine development rushed
"because I want to make sure it is safe"
"not safe"
"had 1st shot only, had bad reaction"
"allergic to ingredients"
"I am allergic to vaccines"

"vaccine to save lives"
"for my family"
"for health reasons"
"my husband, age, health conditions"
"for my health and grandkids"
"to spend time with my family"
"to protect myself + my family"

"keep me my family safe"
"why not?? Covid is life threatening!"
"yes – I got sick myself – and to protect my family and co-workers"
"I did not want to get sick"
"because I did research and prayed about it"
"easy availability – walk in"
"diabetic"
"sunny [sic] mandated it"
"understanding the consequences if not vaccinated"
"because I felt the government was going to make a lot of thing un-accessable [sic] without it"
"because I've been vaccinated all my life why stop now"
"believe in it"
"friend got sick at work"
"don't want to get sick with covid"
"my doctor told me too [sic] (personal reason)"
"mainly to travel"
"first 8 months was scared that I was going to be one of the ones who didn't make it"
"health care worker"
"for my own protection"
"my doctor said it will be best because I have underline [sic] conditions I have received all 4, it was best for me because I have family members that have dies"
"kidney transplanted"
"medical prof. plus the vacc save lives"
"school"
"My wife worked at the health care facility and I decided it was in my family [sic] best interest to do so"
"the science indicated that it would protect me from the worst ravages of the disease"
"CDC recommendation"
"I didn't want to get covid"
"son has health issues I [sic] want to risk his life for me"
"don't want to get sick or die"
"my pastor sugested [sic] I do so"
"history in America"
"I learned people (family) died from not having the vaccine"
"to help stop the spread"
"got sick"
"personal research, advised by PCP"
"I received the vaccination because I believed the doctors that recommended it"
"because I think it is very important for my life and family"
"after being affected"
"research studies"
"I believe it to medical sound to do so [sic]"
"I waited until I felt trials were over"
"to protect myself from 6 feet"

"The vaccine is new, not enough science and data"
"Vaccines are rushed out. All other vaccines only need to be boosted yearly or longer."
"I don't believe the vaccine [sic] helps"
"I don't trust nothing rushed"
"I did not receive the vaccine"
"heard the affects it was having on others and I didn't want to get it"
"I don't believe in modern day medicine"
"I have heard too many negative reviews"
"do not believe in vaccines"
"anti vaccine"[sic]
"don't apply"
"I don't like shots"
"Don't think it will make a difference/Friend and family that got vaccine were sicker that [sic] me when they got it"

"I know it would help me not to get it"

5. Social/Professional Role and Identity (i.e., How does respondents' personal role and responsibility as 'community' members in varying settings influence their decision to accept/not accept the COVID-19 vaccine/booster?)

6. Reinforcement/Incentives/Rewards (i.e., How positive/negative past experiences influence respondents' decisions about receiving/not receiving the COVID-19 vaccine or booster.)

Quotes

7. Emotion: Anxiety, fear, stress, depression (i.e., What are the experiences, behaviors, or physiological factors that the study respondents used to deal with a personal COVID-19 matter or the COVID-19 pandemic event itself and how these influenced the respondents' decisions about receiving/not receiving the COVID-19 vaccine or booster.)

Selected Quotes

Getting vaccinated is a *social responsibility* to protect the 'community'

COVID-19 vaccine/booster was mandatory (i.e., job security)

No social responsibility to accept the COVID-19 vaccine/booster

"Yes, two vaccinations and two boosters. Seen too many deaths and illnesses"
 "My mother being HIV positive"
 "If family members died [sic]
 "news of death"
 "having covid myself the experience was vert [sic] overwhelming"
 "get vaccinated-I'm a diabetic-also I have a daycare at my home"
 "getting sick"
 "when you hear about all the sick people"

"I had the virus so I got vaccinated"
 "none truth would help"
 "If I know I won't get sick I will get it"

"If I know I won't get sick I will get it"
 "when my pastor shared how terribly sick he was"
 "news of death"
 "Most dangerous for older people with health conditions"
 "It can kill you"

"Not sure"
 "Unsure"
 "Don't know too much info"
 "IDK"
 "I can't recall"
 "Nothing really because I don't care"

COVID-19 – Corona virus disease 2019
 CDC – Centers for Disease Control and Prevention
 FDA – Food and Drug Administration
 WHO – World Health Organization
 PCP – primary care physician
 HCP – Health care provider
 CPA – Certified Public Accountant
 IDK – I don't know