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COVID-19 Information Sources and Potential Influence to Testing Behavior and Attitudes of COVID-19 in Community Members Impacted by Diabetes

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2021

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An abstract of
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Abstract

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By Xiao Bin Zhu

Health information communication has been important during the coronavirus disease pandemic, also known as COVID-19. Information dissemination on the progression of the disease, epidemiology, testing, and prevention has been a critical part of efforts to control the pandemic. In the age of advanced technology, information spread at a rate faster than ever before. In an effort to understand how different information sources can impact people's attitudes toward COVID-19 and behaviors towards COVID-19 testing, specifically in populations impacted by diabetes (people living with diabetes, at risk of diabetes, and caregivers), this study employed a mixed-method approach to investigate people's information source and then further investigate the reasonings and other factors that may impact their testing behavior and attitudes. This study utilized a survey to gather quantitative data on information sources and the level of trust from participants at baseline and three-month follow-up. Then, these participants were contacted to be interviewed at baseline, and another time during a three-month follow-up. Results showed that participants trust healthcare professionals, some news sources (specifically local news), the CDC, and other US government information sources. However, trust in these information sources does not lead to testing behavior, rather, it is the combination of the information and the evaluation of risks due to other factors, such as exposure and symptoms that influence testing. In addition, social opportunities are also a facilitator of testing. Although social media was shown as an untrustworthy source, it still facilitates information flow, assists in spreading messages to a wider audience, and for participants to obtain home tests.

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Introductory Chapter

Since the start of the COVID-19 pandemic, research has been ramped up in an effort to rapidly identify the best ways to control and treat COVID-19 infections. Some of the tools that were rolled out are COVID-19 testing and vaccination. There have been studies on hypothetical situations where people were asked about their views and opinions of emerging infectious disease and vaccines, as well as studies investigating the relationship between COVID-19 information, health information uptake, and health behaviors (Henrich & Holmes, 2010) (Ali et al., 2020). However, there has been little research done to understand the reasons behind such information intake, trust, and its impact on the public's health prevention behaviors, especially within the context of COVID-19. **The overall goal of this study is to use a mixed-method approach to investigate the association between the level of trust in information sources and its impact on health behaviors.** This includes COVID-19 testing and vaccination, and general attitudes towards COVID-19, specifically with populations impacted by diabetes (with, at risk for, or caring for someone with diabetes), and within that, those living with diabetes.

The **specific aims** of the study are to identify reasons behind trust in information sources, how this trust may impact individuals' health behaviors in testing and vaccination as well as their attitudes towards COVID-19. Although other studies have used qualitative data alone to describe the associations between COVID-19 information and the likelihood of vaccine uptake (Park et al., 2021), studies have not explored the reasons behind primary information sources and how they led the participants to be more likely to participate in vaccine uptake. In this study, we will be looking at both quantitative results of testing as a result of information sources and investigating how it relates to testing and vaccination in the qualitative portion of the study.

Literature Review:

In this literature review, introduction to the COVID-19 infection and its epidemiology will be presented. In addition, decision making and associated health prevention methods are also important to be considered especially during the time of a pandemic. How health information is disseminated and perceived by the public can impact the public's decision for health behaviors. Lastly, the methods and the theory that will be used for this study will be introduced.

COVID-19 Infection and Epidemiology

The coronavirus disease of 2019 or COVID-19 pandemic, swept across the globe in 2020 after it was discovered in Wuhan, China in December of 2019, and the rate that it was spreading was unprecedently fast that the World Health Organization declared a global pandemic by March 2020 (Cucinotta & Vanelli, 2020). COVID-19 impacted people's daily lives drastically, and the healthcare industry experienced burnout more than they ever have before (Sexton et al., 2022).

The COVID-19 infection is caused by the SARS-CoV-2 virus, a virus that belongs to the coronavirus family that can cause a variety of mild to severe symptoms and potentially further develop into pneumonia and possibly death (Ciotti et al., 2020). For those who have certain medical conditions such as diabetes, they are at higher risk of developing severe illnesses and complications that may lead to death with COVID-19 infections (Centers for Disease Control and Prevention, 2020). As of the origin of the start of COVID-19 pandemic, although there is very little debate that it started in China, but there have been multiple theories to how it started, the main two theories were that it was a leak from a lab or that it was a zoonotic event from the seafood market both in Wuhan (Rogers, 2022) (Ciotti et al., 2020). COVID-19 is mainly spread through droplet transmission with evidence that RNA of the virus can be detected in surfaces

where confirmed COVID-19 cases came in contact with 97.5% of infected individuals would develop symptoms within 12 days of infection (Ciotti et al., 2020). As of March 2023, the WHO has reported more than 760 million confirmed cases worldwide, and more than 6.8 million deaths due to COVID-19 infections (World Health Organization, 2023). Within those numbers, in the US, there has been more than 102 million confirmed cases and more than 1.1 million deaths (Kaiser Family Foundation, 2021). These data are alarming to public health officials, and many strategies were implemented to prevent COVID-19 infections in the general population, including testing and vaccinations.

Prevention Measures and Decision Making

In an effort to combat COVID-19, the US government has ramped up testing efforts and vaccination across the country; however, it is still up to the public to decide if they are to be tested and to obtain vaccinations (The White House, 2021). There are many factors that people consider when making health decisions that depends on the information that was received, and the emotions and biases each individual has. A study that presents two hypothetical surgeries options to participants to treat colon cancer found that majority of the participants chose the surgery that would result in no complications but a higher death rate after evaluating the surgery with less death rates would result in some complications that they may have to live with (Amsterlaw et al., 2006). This shows that individuals would evaluate the cost and benefits of the results before making health decisions as there are certain trade-offs to living, some may not want to choose the options that may lead to the highest survival rate. Another study that randomized over 200 women into two groups with different hypothetical breast cancer risk indicate their likelihood of taking a risk-reduction pill and their perception of risk reduction provided by the pill changed depending on perceived risk (Fagerlin et al., 2007). The results

show that if the participant's hypothetical risk was above the average, they will be more likely to take the pill and think that it will reduce their risk compared to the group that their hypothetical risk was below the average. These studies have shown that there are many cognitive processes that are involved to make decisions regarding their health, and the availability of information is critical in the decision-making process.

Technology, Health Information Dissemination, and Health Behaviors

Disease management information can be spread by various sources and providers that the public encounters, but it is ultimately up to the public to adhere to guidelines and recommendations. The current era of technology allows information to be distributed at a rate faster than ever before; this includes information about the COVID-19 pandemic. The internet became such a powerful tool to both distribute and receive information. However, not all of the information present on the news or on the web are congruent and in agreement (Agley & Xiao, 2021). Fake news, conspiracy theories, and misinformation has also been spread widely to the public across the world and the public sometimes has difficulty in deciding which information is correct and what to believe; this phenomenon is called the COVID-19 infodemic by the WHO's director-general, Tedros Adhanom Ghebreyesus (The Lancet Infectious Diseases, 2020). Simultaneously, COVID-19 information changed at a fast pace as public health and healthcare professionals learned new information (The Lancet Infectious Diseases, 2020).

Reasons for the mismatch between health information and behaviors are varied. In a previous qualitative study in Canada published in 2010, researchers recruited various groups of participants (university students, immigrant, people of different racial minorities, parents, and healthcare workers) to participate in focus group discussions on perceived risk for a hypothetical emerging infectious disease. Participants reported that they believe that a new vaccines and drugs

manufactured to combat this disease would have safety concerns because they are likely developed at a faster rate than drugs typically are developed (Henrich & Holmes, 2010). These concerns and information have been present and delivered during the current pandemic of COVID-19 (CDC, 2022) (Wadman, 2021). In terms of information sources, the authors mentioned that new technology plays a critical role in distributing information. Many participants admit that they perceive information from the mainstream media as untrustworthy, but it is important to make the public aware of the pandemic; many trusts their healthcare provider and voice of authority such as the CDC (Henrich & Holmes, 2010).

Since the start of the COVID-19 pandemic, there has been continuous research done to better understand the disease, as well as documenting sources of information and how they impact public behavior. A cross-sectional study researched the trends and predictors of COVID-19 information sources and knowledge and belief of the pandemic that surveyed US adults recruited through social media that showed that trust in information sources can differ across different age groups and gender, and can change over time (Ali et al., 2020). While another study looked at COVID-19 perceived severity and vaccine uptake based on the primary source of information about COVID-19 among Medicare beneficiaries (Park et al., 2021). This study directly links the sources of information to behaviors in vaccine uptake that showed significance in the likelihood of obtaining the vaccine in different groups of participants with different trusted information sources. These studies have offered perspective on general trends within the population of the study samples but were unable to offer reasons behind certain behaviors such as the likelihood of vaccine uptake as influenced by the information sources. While these studies are large quantitative studies that showed significance with COVID-19 information sources,

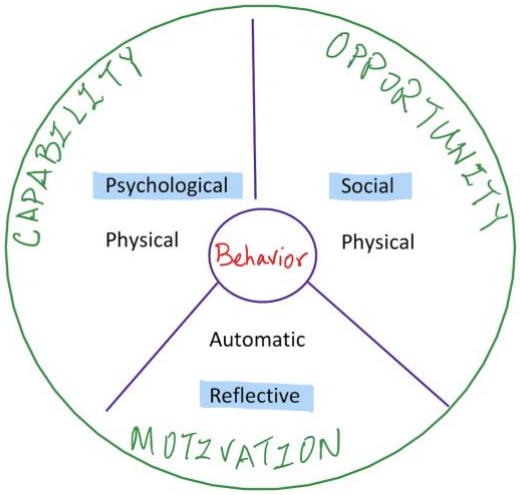
knowledge, and vaccine behaviors, there has been little research with qualitative methods in COVID-19 information sources and behavior in the US.

Introduction to Methods and the COM-B Theory

A convergent mixed method study in Pennsylvania was one of the first mixed method studies in the US that focused on COVID-19 information and knowledge (Van Scoy et al., 2021). This study was able to provide a richer understanding of the barriers to following CDC recommendations, concerns about COVID-19, and the way that information has been delivered to the public; in addition, the authors explored other themes including information sources and trust (Van Scoy et al., 2021). However, with the design of the study's qualitative questions, there was no direct linkage between behavior such as testing and vaccination with sources of information. With this research study, we triangulated information sources to describe the impacts that sources of information can have on behaviors of testing and vaccination with a sequential explanatory mixed method study design specifically in people living with diabetes.

We used the Capability, Opportunity, and Motivation Behavior (also abbreviated as COM-B) model to describe health behaviors around COVID-19 testing and information acquisition. The COM-B model is a framework that considers capability, motivation, and opportunity and how all three components can impact each other and behavior, at the same time, behavior can also impact the three components with figure 1 shown below (Michie et al, 2011).

Figure 1: COM-B Components (Emphasis highlighted in blue in this study)



[1]

The capability component has both the individual's psychological and physical capacity components, motivation includes goals and conscious decision-making along with any other processes that influence behavior, and opportunity contains factors in the environment and any others that are not within the individual (Michie et al, 2011). Using the COM-B model, we are able to evaluate both the internal and external factors that influence behavior and also examine how behavior impacted these factors that resulted in further behavior changes. This model allows for flexibility and understanding that multiple different component combinations can direct behavior.

Using a sequential mixed methods protocol, we will be able to investigate the data quantitatively and support with qualitative data and analysis. Quantitively, we will describe trends within a large sample population of people impacted by diabetes living in the state of Georgia, United States. This is specifically people living with diabetes, people who are at risk of diabetes, and/or people who are caregivers to people with diabetes with their information source and testing and vaccination behavior, and then delve deeper into the details of internal and

[1] Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(42). https://doi.org/10.1186/1748-5908-6-42

external factors influencing these reported behaviors using data from in-depth interviews. In other words, a quantitative survey will measure the trust levels in each resource and type, with qualitative in-depth interviews of participants discussing their reasons for trusting or distrusting certain resources and how that influence their behaviors in testing and vaccination. Some of the benefits of choosing a mixed methods protocol are it allows participants to emphasize their experiences, creates a variety of evidence and answers questions that neither quantitative nor qualitative methods can answer alone (Shorten & Smith, 2017). In addition, the sequential explanatory design provides an opportunity to refine the analysis with the qualitative results in addition to the general data provided by the quantitative data (Ivankova et al., 2006). The main goals of this research project are to determine if information flow and the trustworthiness of a source predict testing and vaccination behavior during the COVID-19 pandemic, thus further evaluating it in real-time emerging infectious disease.

Methods:

Data

The data is collected as part of the Project Promoting Engagement and COVID-19 Testing for Health, also known as Project PEACH. Project PEACH's goal is to understand different perspectives on beliefs about COVID-19 and COVID-19 testing among at-risk community members living in the state of Georgia, specifically those impacted by diabetes. It also aims to understand how messaging around COVID-19 impacts uptake of COVID-19 testing and other health information related to diabetes.

Participant inclusion criteria are: at least 18 years of age, living in Georgia, and meet at least one of the criteria listed: have been diagnosed with diabetes or pre-diabetes, are at risk for diabetes (i.e., overweight/obese, high blood pressure, chronic kidney disease), have a family history of diabetes, are living with someone who has diabetes, and/or are a caregiver of someone with diabetes. Participants that met the inclusion criteria were recruited through large in-person social events, social media platforms such as Facebook, word of mouth, and flyers on Emory University's campuses and at community partner sites (e.g., community centers, federally qualified health centers).

First, participants were invited to fill out a baseline survey online after they have filled out a brief screening questionnaire that determined their eligibility. Then individuals were invited for an in-depth interview to better understand the reasons for behavior toward testing and information trustworthiness. Three months later, the participants received another link to invite them to participate in a follow-up survey that is similar to the first baseline survey and invited them for a follow-up in-depth interview. Participants were compensated for their participation each time they filled out a survey or conducted an interview. Survey data was collected via the

RedCAP software developed by Vanderbilt University. Each survey is authenticated by one of the research team members to ensure authentic responses and each participant can only answer each of the baseline and follow-up surveys once to be counted in the responses. The authentication process was done using address and phone number verification processes with online tool Whitepages. A research team member would enter the participant's name into the tool and match the address and the phone number that is on Whitepages. If there is no match, the research member would look through the survey responses to ensure that survey responses are real, with correct corresponding responses from the eligibility portion and the actual survey. For example, if one answered yes to if they are prediabetic or diabetic in the eligibility form, in the survey they must have selected yes to either prediabetes or diabetes as one of the conditions. Multiple aspects were considered before determining if a survey was authentic, it is only marked fraudulent if there have been three or more red flags. However, all surveys were marked authentic if they were completed with a research team member and/or they were completed in person at a community event. Furthermore, were able to call the study's line to ensure their responses were collected and counted for.

The surveys included multiple choice or multiple select questions covering the following categories: 1) COVID-19 testing, frequency of testing, attitudes towards testing, testing results, reasons for testing; 2) vaccination status, reasons for vaccination, attitudes towards vaccination; 3) trust in numerous information sources; 4) concerns about COVID-19 (open response); 5) pre-existing conditions that increase the risk of COVID-19 infection severity such as hypertension, diabetes, etc.; 6) diabetes care management and other health needs and impacts of the pandemic on diabetes prevention/care; 7) demographic information; and 8) how has COVID-19 pandemic impacted healthcare and basic necessities such as transportation, ability to obtain adequate

amount of foods and healthcare. The surveys were collected online where participants can access the survey through a website URL or a QR code on an internet capable device.

Semi-structured in-depth interviews were conducted for participants who accepted the invitation and satisfied the eligibility criteria. Interview topics included diabetes management before and during the COVID-19 pandemic, trusted and distrusted information sources regarding COVID-19, perceptions of risk of COVID-19, perceptions and experiences to COVID-19 commercial testing, home testing, and vaccinations, and social media engagement. In-depth interviews were conducted by the research project team members, mainly by the project coordinators, and some by graduate research assistants. Interviews lasted between 30 minutes to an hour and were conducted via Zoom and the audio was recorded during the interview so it can be later transcribed. In-depth interviews were transcribed using a HIPAA-compliant, profession transcription service, and all interview recordings and transcripts were uploaded to the research team's workspace on Microsoft Teams.

Research protocols, data collection tools, and consent documents were approved by the Institutional Review Board at Emory University (IRB ID: STUDY00001904). Prior to completing the survey, participants were required to read and complete an online e-consent form to agree to participate in the study. Once the consent form is completed and received, they were screened for eligibility to determine if they met the criteria to participate in this study. On the eligibility form, the participants were asked if they were willing to be contacted for an interview. Therefore, the interview sampling frame came from those who were eligible and willing to be contacted. Prior to the interview, participants also completed another e-consent form and a short survey similar to the eligibility form of the survey.

Quantitative Data Analysis

Variables

Table A: Variable used in statistical analysis with corresponding changes and recodes from survey data.

Variables				Description and Coding of Input Values (if applicable)
Name (code in data analysis)	Description	Original Code from Survey	#, definition=final input values in analysis (if applicable)	
	Independent Variables			
Health_prof	Trust in your doctor or healthcare provider (trust_doc)	Trust_doc	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
Faith	Trust in your faith leader	Trust_flead	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
Close_person	Trust in your close friends → Trust in your family members →	Trust_fam Trust_hhhhh	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
Colleague	Trust in people you go work or class with or other people you know	Trust_coll	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
News	Trust in news on the radio→ Trust in news online → Trust in news on TV→ Trust in news on Newspapers→	Trust_news Trust_ooooo Trust_jjjjj Trust_pppp	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
Social	Trust in your contacts on social media	Trust_social	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
US	Trust in the US government → Trust in the US Coronavirus task force →	Trust_usgov Trust_cortf	0, not at all; 1, a little; 4, don't know; 99, prefer not to answer=0	0→do not trust
			2, somewhat; 3, a great deal=1	1→trust
Age_yrs	Age	Age_yrs	<18 and >200, survey incomplete coded as .	. → missing

Diabetes	Diabetes status of participant	Cc_diabetes CC_diabetes_2	Survey incomplete coded as .	0 → do not have diabetes
				1 → have diabetes
				. →missing
Vaccine	Have you received a COVID-19 vaccine	Covid_vaccine	335, I have not received the vaccine yet, but have an appointment scheduled; 99, no; 0, don't know; 98, prefer not to answer =0	0 → not vaccinated
			1, yes I have received the first dose; 333, yes I have received the first and second dose; 334, yes I have received the one and only dose (J&J) =1	1 → vaccinated
Family Income	Total household income before tax in 2019	Family_income	Survey incomplete coded as .	. →missing
Race	Race of participant	Race_ethn_race___1	American Indian/Alaska Native =1	1 → yes
		Race_ethn_race___2	Black =1	1 → yes
		Race_ethn_race___3	Asian =1	1 → yes
		Race_ethn_race___4	Native Hawaiian/Pacific Islander =1	1 → yes
		Race_ethn_race___5	White =1	1 → yes
		Race_ethn_race___15	Other =1	1 → yes
		Race_ethn_race___99	Prefer not to answer and survey incomplete =.	. →missing
Ethnicity	Hispanic, Latino, or of Spanish origin	Race_ethn_hispanic	Non-Hispanic/Latino/Spanish =0	0 → non-Hispanic
			Hispanic/Latino/Spanish =1	1 → Hispanic
			Prefer not to answer =99 Survey incomplete	. →missing
Gender	Gender of participant	Gender_identity_term	Man =0	0 → man
			Woman =1	1 →woman

			Other =2, 3, 4, 5, 6, 7, 96	2, 3, 4, 5, 6, 7, 96 →other
			Prefer not to answer=99 Survey incomplete	. → missing
	Outcome/Dependent Variable			
Test	Have you ever been tested for COVID-19	Tested_for_covid Covid_test	2, no; 98, don't know; 99, prefer not to answer =0	0 → not tested
			1, yes only once; 333, yes multiple times =1	1 → tested

For the purpose of this analysis, the main dependent variable that was examined was whether or not participants tested for COVID-19. For the quantitative analysis, for testing, the participants were asked if they were tested for COVID-19 with the options of yes, only once; yes, multiple times; no; don't know; and prefer not to answer. We categorized the answer choices into three different categories, with yes, only once and yes, multiples times coded as yes (1), and no as no (0).

The main independent variable of interest is the sources of information and the trustworthiness of the information that the participants perceived them to be. There are a total of twelve information sources to consider in the data (your doctor, your faith leader, your close friends, your family members, people you go to work or class with, or other people you know, news on the radio, news online, news on TV, news in newspapers, your contacts on social media, the US government, the US Coronavirus task force). Each information source response was recoded into trust and not trust, with a great deal and somewhat both coded as trust (1), and a little and not at all coded as do not trust (0). Then, the different sources are further collapsed into seven categories: healthcare provider (your doctor), religious leaders (your faith leader), close persons (your close friends, family members), colleagues (people you go to work or class with or other people you know), news (news on the radio, online, on the TV, and in newspapers), social

media (contacts on social media), and US government (US government, and the US Coronavirus task force).

Age, socioeconomics, race, ethnicity, gender, diabetes, and vaccination variables are included in the analysis to test for covariate effects on the models. The variable that represents the socioeconomics is the information on the total household income before taxes in 2019 (less than $15,000, $15,000-19,999, $20,000-24,999, $25,000-34,999, $35,000-49,999, $50,000-74,999, $75,000-99,999, $100,000 and above, and prefer not to answer). Race is reported using American Indian or Alaska Native, Black or African American, Asian, Native Hawaiian, or other Pacific Islander, White, some other race, and prefer not to answer. Ethnicity is reported as Hispanic, Latino, or Spanish origin as one group, and not Hispanic, Latino, Spanish origin, and prefer not to answer as the other group. Gender is reported in three groups. One group as man, one group as woman, and the third group as any other gender. Then for vaccination against COVID-19, the participants were presented with the following options in the survey: yes, I have received the first dose; yes, I have received the first and second dose; yes, I have received the first and only dose (i.e. Johnson & Johnson); I have not received the vaccine yet, but have an appointment scheduled; no; don't know; and prefer not to answer. The first three options were coded as yes (1) since they all have had at least one dose of the vaccine and thus participating in prevention strategies of COVID-19, and the choices of both I have not received the vaccine yet but have an appointment scheduled, and no are both coded as no (0) as they have yet to engage in vaccination. All answers to any question with don't know and prefer not to answer are coded as missing data and excluded from the analysis. In addition, incomplete surveys are excluded entirely from the sample as not all domains of data are completed for those questionnaires and can further lead to biased estimates and invalid conclusions.

Statistical Analysis

To determine if the primary sources of information on COVID-19 and the trustworthiness of the information perceived by the participants impact COVID-19 testing behavior, logistic regression analysis was performed for each category of sources as previously stated regarding testing. Then, vaccination status, age, diabetes, and socioeconomics variables were included in the model as covariates to test if the relationships differed with these variables included. Next, in order to examine if there is a difference with testing behaviors between different race, ethnicity, and gender groups, two analysis of variance (ANOVA) was performed by comparing the means of testing between different race and gender groups accordingly. Before ANOVA was performed, Levene's test was performed to ensure that the criteria for homogeneity was met, otherwise, Welch's ANOVA was used. If there were significance differences between groups, post hoc analysis was performed to determine the location of the differences. Then similar analysis was performed for the followed-up survey data. Odds ratios are compared from baseline to follow-up to assess the changes, if there are any, from baseline to follow-up by the participants.

The two sample T-test was performed to assess differences between means, if any, between the two ethnicity groups: Hispanic, Latino, or of Spanish origin, and those who are not. T-test was performed here because there are only two groups' means that are being compared here.

Qualitative Analysis

For qualitative research aims, each transcript was summarized by one of several research team members using rapid assessment procedures (RAP) documented on a word document sheet,

also called, RAP sheets. Before the process of summary, quality checks with the interview transcripts and the interview recording were performed to ensure that interview content were correctly transcribed and any identifying information is redacted from each transcript.

The qualitative core team members developed the RAP sheets to follow the in-depth interviews to create domains for information collection and appropriate analysis. The domains were: pre-COVID healthcare concerns and/or diabetes management, impact of COVID-19 on diabetes care and management, COVID-19 trusted and distrusted sources of information, perceptions of risk related to COVID-19, perceptions and experiences with COIVD-19 testing, perceptions and experiences with COVID-19 vaccinations, and other comments. Each of the domain contains short descriptions to guide the team members to understand what type of information fits under each domain. Then each of the interviews were read through individually by a research team member and information were summarized accordingly under each fitted domain in a RAP sheet. All of the RAP sheets were added to a Microsoft Teams work space to be shared with the rest of the research team.

Then a research team member facilitated the transferring of data from RAP sheets to an excel matrix for further analysis; however, due to the technical challenges of navigating the excel matrix, the qualitative analysis team developed a codebook to be used in MAXQDA for further qualitative analysis. The codes that were developed were based on the COM-B model and the research questions that we aimed to answer. The codes are divided into four main categories: capability, opportunity, motivation, and other codes that focused on information sources and preventative behaviors.

For the purpose of this research paper, the RAP sheets of all of the interviews with persons living with diabetes with follow-up interviews were further coded with MAXQDA

software and analyzed to understand themes and patterns across the participants to better understand the motives and purpose behind testing and vaccination behaviors. The codes that were used in this analysis were psychological capability, defined as knowledge or psychological skills, strength, or stamina to engage in the necessary mental processes; social opportunity, defined as opportunity afforded by interpersonal influences, social cues, and cultural norms that influence the way that we think about things; reflective motivation that is defined as the reflective processes involving plans (self-conscious intentions) and evaluations (beliefs about what is good and bad). In the other codes, the codes used were information sources, defined as where are people getting their information from; media influence, defined as the influence of different informational sources on a person's attitudes towards COVID-19 and COVID-19 testing, and vaccination, defined as participant's vaccination status and attitudes towards COVID-19 vaccinations. These codes were chosen to focus on the impact that trusted and distrusted information sources may have on participants. Direct quotes are reported as well to support analysis. Qualitative analysis allows further understanding of if certain information perceived trust impacts participants and their views on obtaining COVID-19 tests and vaccinations.

Results:

Demographic Information:

The final sample for analysis included 11968 participants for the baseline survey, which was 78.85% of those who have started the baseline survey, and 2566 participants for the follow-up survey which was 16.91% of those asked to complete the follow-up survey due to loss to follow-up. The sample average in age was 39.42 years with a median total household income before tax in 2019 to be between $50,000-74,999. The age and household income information were collected only in the baseline survey and therefore reported based on the baseline survey sample population. Among the sample population, 35.75% of those completed the baseline survey identified as people living with diabetes, and 22.81% in completed follow-up survey. The race group composition of both surveys was similar such that Blacks and Whites made up of the most of the sample population with 45.31% Blacks and 44.87% Whites in the baseline survey sample and 48.46% Blacks and 38.49% Whites in the follow-up sample. American Indian and Alaskan Natives, Asians, Native Hawaiian and Pacific Islanders, and other race groups each make up either about or less than 5% in each of its individual categories for both baseline and follow-up. In ethnicity groups, 10.77% of participants are Hispanic, Latino, or of Spanish origin in baseline surveys, and 8.41% in follow-up surveys. In gender groups, for the baseline survey, 45.63% identify as man, 53.33% identify as woman, and 0.84% identify as other genders. For the follow-up survey, 35.80% identify as man, 53.61% identify as woman, and 0.75% identify as other genders. All of the demographic information is presented in Table 1.

COVID-19 Testing and Information Sources

In both samples, COVID-19 testing and vaccination behaviors were high, 88.63% reported COVID-19 testing at baseline, 93.72% reported COVID-19 testing at follow-up, and

87.38 % and 90.14% reported vaccination at baseline and follow-up, respectively. When asked about how much they trust in each of the sources to provide them with correct information about COVID-19, the participants responded with overall trust in their healthcare professionals (82.50% baseline, 93.10% follow-up), family and close friends (76.69% in baseline and 78.06% in follow-up), and US government, including the Coronavirus Task Force (79.47% for baseline and 80.75% for follow-up) information sources were high across both baseline and follow-up samples. Participants trust their social media contacts the least (43.37% for baseline and 31.72% for follow-up), followed by colleagues, also known as the people they go to work or class with or other people they know (55.07% for baseline and 51.56% for follow-up), their faith leaders (56.15% for baseline and 53.70% for follow-up), and news sources (72.93% for baseline and 69.17% for follow-up).

Quantitative Results: Statistical Analysis:

Information Source Variables Logistic Regression Models

Baseline

The resulting Model 1 (from baseline data information source variables only) contained five of the seven significant information source variables and thus included in the model with a significance level of 0.05. Health professionals (OR=0.557, 95% CI: 0.486-0.638), family and close friends (OR=0.700, 95% CI: 0.612-0.800), news (OR=0.730, 95% CI: 0.632-0.844), and US government sources (OR=0.827, 95% CI: 0.713-0.960), all had an OR less than 1. Although there is a high percentage of trust among health professionals, family and friends, the news, and the US government (all over 70%), the ORs show that these information sources have a lower testing behavior for COVID-19. On the contrary, the information source for social media

contacts has an OR of 1.297 (95% CI: 1.141-1.474), which predicts greater COVID-19 testing behavior, but the social media trust percentage is less than 50% within the baseline survey participants.

To assess any covariate effects with age, vaccine status, family income, and diabetes status, these variables were added to generate Model 2. With these added covariates, four of the information source variables remained significant, the US government variable became insignificant. In the covariates, age, vaccine status, and diabetes status were also significant. The ORs for health professionals (OR=0.625, 95% CI: 0.536-0.728), family and friends (OR=0.705, 95% CI: 0.608-0.818), and news (OR=0.795, 85% CI: 0.678-0.933) still remained less than 1, and the social media contacts' OR remained greater than 1 (OR=1.257, 95% CI: 1.095-1.443), meaning these variables still predict COVID-19 testing behavior in the same direction as Model 1 that only assessed the direct effects of information sources. In the covariates, age (OR=1.008, 95% CI: 1.002-1.013) and diabetes status (OR=1.512, 95% CI: 1.327-1.721) both have an OR greater than 1, indicating that an increase in age, and being diagnosed with diabetes increases the behavior for COVID-19 testing. On the other hand, vaccine status has an OR less than 1 (OR=0.190, 95% CI: 0.164-0.221), showing that being vaccinated against COVID-19 decreases the behavior to get tested.

Comparing the model fit of the two models for baseline data, area under the curve (AUC) values (Model 1=0.604, Model 2=0.709), as well as the Hosmer-Lemeshow chi-square p-values (Model 1=0.0154, Model 2=0.0001), and the Akaike information criterion (AIC) values (Model 1=8294.155, Model 2=6914.636) were considered for the two models. These statistics show Model 2 is a better model to be considered than Model 1.

Follow-up

From the follow-up data, Model 3 was generated with only the direct effect of information sources. From the selection of the variables by the 0.05 significance level, only two out of the seven variables were significant: the health professionals (OR=0.406, 95% CI: 0.242-0.681) and the US government source variable (OR=0.617, 95% CI=0.410-0.928). Similar to the baseline Model 1, both of these variables have an OR less than 1. There was a higher percentage of trust in both of these sources in the follow-up data, the ORs were less in Model 3 compared to Model 1 with the same variables.

In Model 4, the same covariates of age, vaccination status, family income, and diabetes were added like the baseline Model 2. However, with these covariates, the two variables, health professionals and the US government, became insignificant. In addition, no other information source variables were significant with these covariates. However, within the covariates, age, and vaccination status were significant. These trends continued in the follow-up data from the baseline data such that age has an OR of 1.035 (95% CI: 1.020 -1.049) indicating a slightly higher OR compared to baseline (OR=1.008). Vaccination has an OR of 0.103 (95% CI: 0.065-0.162), with a higher vaccination rate, there is less likelihood of the behavior of COVID-19 testing, and the OR is slightly lower than baseline (OR=0.190).

Comparing the model fit of the two models for the follow-up data, area under the curve (AUC) values (Model 3=0.575, Model 4=0.777), as well as the Hosmer-Lemeshow chi-square p-values (Model 3=0.5610, Model 4=0.1063), and the Akaike information criterion (AIC) values (Model 3=1086.694, Model 4=866.097) were considered for the two models. These statistics show Model 4 is a better model to be considered than Model 3.

Race, Gender, and Ethnicity Comparisons:

Baseline:

To examine if there are significant differences in the means of COVID-19 testing, Welch's ANOVA shows that in baseline data, while there is significance between race groups shown with a p-value of .0087, but upon further testing to determine the location of the difference, there were no significant differences observed between any race groups. However, the two-sample t-test shows significant differences between the Hispanic and non-Hispanic groups in the baseline data. Although equal variances cannot be assumed, the resulting p-value for the t-test was still less than 0.05 which gives sufficient evidence to state that there are significant differences between the two ethnic group means for COVID-19 testing. The difference showed that the Hispanic group mean was higher than the non-Hispanic group mean by 0.0249 points. There were no differences in the group means between the three gender groups (man, woman, and other) in the baseline data.

Follow-up:

While the follow-up data did not show any significant differences between group means for ethnicity groups and gender groups, there were significant differences between race groups. The post-hoc test showed the group means differences located between the Asian and Black populations of the follow-up data, and also between Black and White populations where both Asian (mean=0.9837) and White (mean=0.9644) groups have a significantly higher mean compared to Blacks (mean=0.9140). This shows that the Black population's testing behavior is lower than White and Asian groups.

Tables:

Table 1: Descriptive Statistics of Subjects Demographics

Variable	Overall N	Mean (SD)	Median	Min	Max
Age[1]	11945	39.42 (12.31)	38.00	18.00	94.00
Total household income[2]	11124	N/A	$50,000-$74,999	>$15,000	≤$100,000
	N (%) -B-L	**N (%) – F-U**			
Baseline	11968 (78.85%)	N/A			
Follow-up	N/A	2566 (16.91%)			
Test -yes	10606[3] (88.63%)	2208[13] (93.72%)			
Diabetes -yes	4191[4] (35.75%)	580[14] (22.81%)			
Vaccinated- yes	10457[5] (87.38%)	2313[15] (90.14%)			
Health professional	9873[6] (82.50%)	2389[16] (93.10%)			
Faith leaders	6719[7] (56.15%)	1378[17] (53.70%)			
Family and close friends	9178[8] (76.69%)	2003[18] (78.06%)			
Colleagues	6590[9](55.07%)	1323[19] (51.56%)			
Social	5190[10] (43.37%)	814[20] (31.72%)			
News	8727[11] (72.93%)	1775[21] (69.17%)			
U.S.	9510[12] (79.47%)	2072[22] (80.75%)			

		Overall N (%)		**COVID-Tested (yes) N (%)**		**Diabetes yes N (%)**		**Vaccinated yes N (%)**	
		B-L	F-U	B-L	F-U	B-L	F-U	B-L	F-U
Race[23]	American Indian/Alaska Native	380 (3.27%)	85 (3.40%)	349 (3.38%)	78 (3.62%)	109 (2.64%)	22 (3.89%)	324 (3.17%)	78 (3.45%)
	Asian	297 (2.55%)	132 (5.29%)	264 (2.55%)	121 (5.62%)	44 (1.07%)	13 (2.30%)	266 (2.60%)	128 (5.66%)
	Black	5271 (45.31%)	1210 (48.46%)	4710 (45.57%)	989 (45.96%)	1508 (36.53%)	252 (44.52%)	4601 (45.03%)	1054 (46.64%)
	Native Hawaiian/Pacific Islander	85 (0.73%)	32 (1.28%)	80 (0.77%)	30 (1.39%)	24 (0.58%)	8 (1.41%)	73 (0.71%)	29 (1.28%)

	White	5220 (44.87%)	961 (38.49%)	4607 (44.58%)	868 (40.33%)	2384 (57.75%)	262 (46.29%)	4627 (45.29%)	910 (40.27%)
	Other	381 (3.27%)	77 (3.08%)	325 (3.14%)	66 (3.07%)	59 (1.43%)	9 (1.59%)	326 (3.19%)	61 (2.70%)
Ethnicity[24]	Hispanic/Latino	1258 (10.77%)	211 (8.41%)	1145 (11.04%)	191 (8.82%)	244 (5.93%)	47 (8.30%)	1084 (10.57%)	189 (8.32%)
	Non-Hispanic/Latino	10420 (89.23%)	2297 (91.59%)	9225 (88.96%)	1974 (91.18%)	3873 (94.07%)	519 (91.70%)	9180 (89.43%)	2084 (91.68%)
Gender[25]	Man	5435 (45.63%)	910 (35.80%)	4808 (45.52%)	815 (37.27%)	2021 (48.37%)	233 (40.81%)	4853 (46.55%)	840 (36.63%)
	Woman	6376 (53.33%)	1613 (63.45%)	5663 (53.61%)	1354 (61.91%)	2125 (50.86%)	334 (58.49%)	5492 (52.68%)	1434 (62.54%)
	Other genders	100 (0.84%)	19 (0.75%)	92 (0.87%)	18 (0.82%)	32 (0.77%)	4 (0.70%)	81 (0.78%)	19 (0.83%)

[1]3233 missing data points.
[2]4054 missing data points.
[3]3211 missing data points.
[4]3456 missing data points.
[5-12]3211 missing data points.
[13]12822 missing data points
[14]12635 missing data points
[15-22]12612 missing data points
[23]3544 missing data points.
[24]3500 missing data points.
[25]3267 missing data points.
SD= standard deviation
Age= age of participant at the time of survey
Total household income = 2019 total household income before taxes
B-L = Baseline survey
F-U = Follow-up survey

Table 2: Baseline Logistic Regression Models: Model 1: predicting COVID-19 Testing (test) from information source variables (health professional, family and close friends, colleagues, US government, faith leaders, social media contacts, and news selected from stepwise selection) and adjusted model (Model 2) with age, vaccination status, total household income in 2019 before taxes (family income), and diabetes.

	Model 1 Direct Effect of Information Sources.					**Model 2** Effect of information sources adjusted for age, Family income, and vaccine.				
Predictors	*B (SE_B)*	*OR*	*p-value*	*95% CI OR LB*	*95% CI OR UB*	*B (SE_B)*	*OR*	*p-value*	*95% CI OR LB*	*95% CI OR UB*
Intercept	-1.0841(.0749)		<.0001			-0.5375(.1519)		.0004		
Health Professionals	-0.5855(.0693)	.557	<.0001	.486	.638	-0.4701(.0779)	.625	<.0001	.536	.728
Family and/or friends	-0.3572(.0685)	.700	<.0001	.612	.800	-0.3490(.0755)	.705	<.0001	.608	.818
Social Media Contacts	0.2597(.0653)	1.297	<.0001	1.141	1.474	0.2287(.0705)	1.257	.0012	1.095	1.443
News	-0.3148(.0738)	.730	<.0001	.632	.844	-0.2292(.0817)	.795	.0050	.678	.933
US government	-0.1896(.0760)	.827	.0126	.713	.960	-0.00192(.0859)	.998	.9822	.843	1.181
Age						0.00757(.00277)	1.008	.0063	1.002	1.013
Vaccine						-1.6581(.0750)	.190	<.0001	.164	.221
Family income						-0.00003(.0152)	1.000	.9982	.971	1.030
Diabetes						0.4131(.0664)	1.512	<.0001	1.327	1.721
HL test	$\chi^2_{(8)}$ = 15.7093		.0154			$\chi^2_{(8)}$ = 31.1799		.0001		
AUC	0.604					0.709				
AIC	8294.155					6914.636				

Health professional: trust in healthcare professionals
Family and friends: trust in participants' family and close friends, people that they value the most.
Social Media Contacts: trust in people participants know/interact through social media platforms.
News: trust in news on the radio, TV, online, and newspapers.
US government: trust in US government and Coronavirus Task Force
Age: age of participants
Vaccine: vaccination status against COVID-19 (0=not vaccinated, 1=vaccinated)
Family income: total household income in 2019 before taxes
Diabetes: diabetes status of participants (0=not diabetic, 1=diabetic)

B = beta estimate
OR = Odds ratio
CI = Confidence interval
HL = Hosmer and Lemeshow Test
AUC = area under the curve = C-statistic
AIC = Akaike's 'An Information Criterion'
Outcome = test (0=NO, 1=YES) tested for COVID-19.

Table 3: Follow-up Data Logistic Regression Models: Model 3: predicting COVID-19 Testing (test) from information source variables (health professional, interpersonal connections, US government, faith leaders, social media contacts, and news selected from 0.05 significance level) and adjusted model (Model 2) with age, vaccination status, and total household income in 2019 before taxes (family income).

	Model 3 Direct Effect of Information Sources.					**Model 4** Effect of information sources adjusted for age, Family income, and vaccine.				
Predictors	*B (SE$_B$)*	*OR*	*p-value*	*95% CI OR LB*	*95% CI OR UB*	*B (SE$_B$)*	*OR*	*p-value*	*95% CI OR LB*	*95% CI OR UB*
Intercept	-1.5270(.2243)		<.0001			-2.0125(.4133)		<.0001		
Health Professionals	-0.9025(.2644)	.406	.0006	.242	.681	-0.1675(.3351)	.846	.6171	.439	1.631
US government	-0.4833(.2085)	.617	.0204	.410	.928	0.1606(.2589)	1.174	.5352	.707	1.950
Age						0.0340(.0072)	1.035	<.0001	1.020	1.049
Vaccine						-2.2771(.2342)	.103	<.0001	.065	.162
Family income						-0.0694(.0424)	.933	.1019	.859	1.014
Diabetes						0.0286(.2243)	1.029	.8985	.663	1.597
HL test	$\chi^2_{(8)}$ = 0.3379		.5610			$\chi^2_{(8)}$ = 13.1655		.1063		
AUC	0.575					0.777				
AIC	1086.694					866.097				

Health professional: trust in healthcare professionals
US government: trust in US government and Coronavirus Task Force
Vaccine: (0=not vaccinated, 1=vaccinated)
Family income: total household income in 2019 before taxes
Diabetes: diabetes status of participants (0=not diabetic, 1=diabetic)

B = beta estimate
OR = Odds ratio
CI = Confidence interval
HL = Hosmer and Lemeshow Test
AUC = area under the curve = C-statistic
AIC = Akaike's 'An Information Criterion'
Outcome = test (0=NO, 1=YES) tested for COVID-19.

RACE Groups Comparisons:

Baseline:

Table 4: Baseline Data Levene's Test for Homogeneity on Race Groups

Levene's Test for Homogeneity of Test Variance ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Race	5	0.8397	0.1679	2.82	0.0150
Error	11628	692.5	0.0596		

DF = degrees of freedom

Table 5: Welch's ANOVA for Baseline Data Comparison between Race

Assumption of homogeneity unmet.

Welch's ANOVA for Test2			
Source	**DF**	**F Value**	**Pr > F**
Race	5.00	3.12	.0087
Error	587.9		

DF = degrees of freedom

Baseline:

Table 6: Follow-up Data Levene's Test for Homogenity on Race Groups:

Levene's Test for Homogeneity of Test2 Variance ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Race	5	1.3097	0.2619	6.26	<.0001
Error	2287	95.6281	0.0418		

Table 7: Welch's ANOVA for Follow-Up Data for assumption of homogeneity unmet.

Welch's ANOVA for Test2			
Source	**DF**	**F Value**	**Pr > F**
Race	5.00	6.85	<.0001
Error	183.6		

Table 8: Differences in Means between Blacks and Asians and Blacks and Whites

Least Square Means		
Race	**Test 2 Mean**	**Pr > t (Compared to Black Group)**
Black	0.9140	N/A
Asian	0.9837	0.0268
White	0.9644	<.0001

GENDER Groups Comparisons

Baseline:

Table 9: Baseline Data Levene's Test for Homogeneity on Gender Groups

Levene's Test for Homogeneity of Test Variance ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Gender	2	0.0941	0.0471	0.78	0.4568
Error	11908	715.1	0.0601		

DF = degrees of freedom

Table 10: Baseline ANOVA Comparing Test Means Between Gender Groups

Analysis of Variance for Test					
Sources	**SS**	**DF**	**Mean Square**	**F**	**p-value**
Gender	0.1477	2	0.0738	0.74	0.4792
Error	1195.2955	11908	0.1004		
Corrected total	1195.4432	11910			

DF = degrees of freedom
SS = Sums of squares

Follow-up:

Table 11: Follow-Up Data Levene's Test for Homogeneity on Gender Groups

Levene's Test for Homogeneity of Test Variance ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
Gender	2	0.0310	0.0155	0.34	0.7094
Error	2331	105.1	0.0451		

DF = degrees of freedom

Table 12: Follow-Up ANOVA Comparing Test Means Between Gender Groups

Analysis of Variance for Test					
Sources	**SS**	**DF**	**Mean Square**	**F**	**p-value**
Gender	0.0403	2	0.0202	0.34	0.7110
Error	137.7013	2331	0.0591		
Corrected total	137.7416	2333			

DF = degrees of freedom
SS = Sums of squares

ETHNICITY Groups Comparisons:

Baseline:

Table 13: Baseline Equality of Variances

Equality of Variances				
Method	**Num DF**	**Den DF**	**F Value**	**Pr > F**
Folded F	10419	1257	1.24	<.0001

DF = degrees of freedom

Table 14: Baseline T-Test Comparing Test Means Between Ethnicity Groups

T Test Procedure Comparing Means of Two Ethnicity Groups								
Ethnicity	**Method**	**Mean**	**95% CL Mean**	**SD**	**Variances**	**DF**	**T Value**	**Pr>|t|**
Hispanic (1)		0.9102	(0.8944 ,0.9260)	0.2860	N/A	N/A	N/A	N/A
Non-Hispanic (2)		0.8853	(0.8792, 0.8914)	0.3187	N/A	N/A	N/A	N/A
Diff (1-2)	Pooled	0.0249	(0.0064, 0.0433)	0.3153	Equal	11676	2.64	.0083
Diff (1-2)	Satterhwaite	0.0249	(0.0079, 0.0418)		Unequal	1657.4	2.87	.0041

SD = standard deviation
DF = degrees of freedom

Follow-up:

Table 15: Follow-up Equality of Variances

Equality of Variances				
Method	**Num DF**	**Den DF**	**F Value**	**Pr > F**
Folded F	204	2099	1.13	.2098

DF = degrees of freedom

Table 16: Follow-Up T-Test Comparing Test Means Between Ethnicity Groups

T Test Procedure Comparing Means of Two Ethnicity Groups								
Ethnicity	**Method**	**Mean**	**95% CL Mean**	**SD**	**Variances**	**DF**	**T Value**	**Pr>|t|**
Hispanic (1)		0.9317	(0.8969 ,0.9665)	0.2529	N/A	N/A	N/A	N/A
Non-Hispanic (2)		0.9400	(0.9298, 0.9502)	0.2375	N/A	N/A	N/A	N/A
Diff (1-2)	Pooled	-0.0083	(-0.0426, 0.0260)	0.2389	Equal	2303	-0.47	.6353
Diff (1-2)	Satterhwaite	-0.0083	(-0.0445, 0.0280)		Unequal	240.49	-0.45	.6527

SD = standard deviation
DF = degrees of freedom

Qualitative Results

A total of nine participants living with diabetes (PLWD) completed both baseline and follow-up interviews. The participants' age ranged from 30 to 66 years old. Six of the participants were Black, two were White, and one was mixed race. All of the participants were Non-Hispanic/Latino/or of Spanish origin. Six were females, and three were males. Four out of the nine participants also have other conditions such as high blood pressure, high cholesterol, and kidney disease. Two of the participants are also cancer survivors.

Psychological Capability

Psychological capability is defined as knowledge or psychological skills, strength, or stamina to engage in the necessary mental processes.

Baseline

Participants' knowledge about how COVID-19 impacts the health of people who are at risk for health complications is clear, especially when it comes to knowledge about diabetes. All but three of the participants state that their concern due to COVID-19 infections is heightened due to the fact that they are more at risk for additional health complications:

"I feel like the people who've died and things like that have COVID morbidity. So there's something else -- not all of the cases -- of course -- but a lot of the cases, it's someone who's obese or they have other health conditions. So I think that that complicates it." (PLWD 412, 226-229).

Knowledge about how and where to get tested is common among participants. All except for one have gotten tested at one or more locations. Most participants state that it is necessary to test when exposed to someone with a positive COVID-19 test, and if they are experiencing symptoms. There were two participants who stated that it is important to get tested regularly even without symptoms, one states that it is because some may be asymptomatic carriers, and the other mentioned that regular testing is important to control the pandemic (PLWD 412 & 402).

Being able to search for information about COVID-19 was discussed with three participants. Two participants researched information online about COVID-19 as a tool to verify information that they have seen or heard on the news and/or on social media (PLWD 409 & 415). The third participant researched vaccine history and compared and contrasted vaccine hesitancy from the history of polio vaccines and COVID-19 vaccines.

Most participants understand the benefits of employing COVID-19 prevention strategies such as masking, staying in their homes unless they absolutely need to leave, and vaccinations. All but two of the participants mentioned using masks to protect themselves, some also mentioned staying in the house as much as they can unless they absolutely have to leave, and most except of two are vaccinated as a protection measure against COVID-19 infections. It is also worth noting that the two participants who were not vaccinated understand that vaccination can be beneficial against COVID-19 infections:

"They've had it both, because they also have diabetes, both of them as well. My dad has high blood pressure. They all have things that they [inaudible] low immune system, so they felt like the vaccine would be very helpful. I'm just really nervous about the side effects and everything

like that. So even though they've been trying to push it on me, I don't fully agree with it just yet. I'm kind of waiting to see and how it goes first." (PLWD 407, 320-328).

Follow-up

In the follow-up interviews, about half of the participants still mentioned the understanding that at-risk groups like people living with diabetes, old age, and immunocompromised can experience severe symptoms and infections they were infected with COVID-19 infections. A third of the participants also stated searching for COVID-19 information to understand sources and the information presented to them and verifying each source is still important.

Over half of the participants were tested using a clinic, testing center, or pharmacy (not a home test) since the baseline interview; however, all of them have obtained a home test. All but one has used a home test, and one stated that it was difficult to use, one had some confusion, but the rest of the participants tested with the instructions provided without any issues:

"It's not -- I mean, it wasn't complicated at all. You just have to read the directions before you start and then it tells you step by step and it tells you what to look for once you have put the solution on the card and then you swab both sides of your nostrils and then you put it in there and then you leave it for 15 minutes and you're supposed to get -- if you get two lines, you're positive. If not, you're negative." (PLWD 402, 346-353).

Other prevention strategies that participants have mentioned as benefits include keeping up with boosters, evaluating risks and benefits before going out and determining in what circumstances to social distance and wear a mask:

"I don't know, I tell you I went to Las Vegas in July, I wore my mask on the airplane and through the airport, I think and -- but I went there to go to a concert and I didn't wear it and the lady next to me kept coughing and I was so grossed out at her coughing and I was like, what the heck is wrong with you? Like you need to go home. I was just thinking, can you change seats with your boyfriend? I'm so over your coughing, but at the same time, I didn't have a mask. So, it was like I'm grossed out trying to enjoy the concert, people are belting out tunes to their heart's desire. I'm grossed out, but I'm also unprepared." (PLWD 412, 450-458).

Social Opportunity

Social opportunity is defined as opportunity afforded by interpersonal influences, social cues, and cultural norms that influences the way that we think about things.

Baseline

People that participants value the most in their lives (such as close family and friends) and/or those living in the same household were all discussed during the interview. All of the participants had some social opportunity regarding testing with the people that are the most important to them. For the participant who has not had a test, the people that are important to him tested for COVID-19. For one participant although they tested, their children, who are the most important people to the participant did not test but expressed interest in testing at one point. All

other participant has been tested and their family members and people who are the most important them have also been tested at some point.

Follow-up

There were two participants that did not have any segments coded for the social opportunity code in follow-up interviews. One participant did not have any social opportunities for testing as none of their children, who are the most important person to the participant, have been tested either using a home test or testing in sites. The rest of the participants all had social opportunities for testing, and most of them discussed social opportunities in terms of home tests. One participant received their home test from their in-laws, and another participant helped an older neighbor to take a home test. Another participant obtained home tests because their daughter made the recommendations to secure some, while another participant went to get tested with both home tests and through a pharmacy because their wife had suggested testing.

"Family is very supportive of testing, no one would stop the participant from getting tested. They are also are proponent for testing and think it's important to do just to make sure everything is clear especially for people who have underlying conditions or compromised immune systems." (PLWD 409).

Reflective Motivation

Reflective motivation is defined as reflective processes involving plans, such as self-conscious intentions and evaluations such as beliefs about what is good and bad.

Baseline

Reflective motivation involves the individual's reflective processes and evaluations and their beliefs on what is right and wrong. Two of the participants think that there is no reason to test if they were isolated and staying in the house:

"Because during the lockdown phase and after that, it's been easier to just routines to stay -- to stay isolated, to stay -- just try and maintain personal distance, personal safety, I guess. And it's just not been a -- just have not had a concern that I felt needed to get tested." (PLWD 408, 351-354).

Most participants also believe that one should test when exhibiting symptoms. More than half of the participants believe that it is necessary to test after exposure to someone who tested positive for COVID-19, even if it is an indirect exposure (i.e they can in contact with someone who came in contact with someone else who tested positive), as it is beneficial to the public to prevent spread:

"After I found out, my husband and I both got tested because we were, like, well, we don't want to be handing this off to anybody else if we're carrying it around, but we don't have symptoms because we've both been vaccinated twice." (PLWD 409, 537-539)

Follow-up

In the follow-up interviews, participants reflected on and evaluated COVID-19 testing and prevention strategies with the following results: more than half of the participants believe that it is important to test if they have symptoms and if they have exposure to someone who

tested positive for COVID-19. There was one participant who stated that they do not think they will test if they have symptoms now due to a false sense of security that they would not be infected with COVID-19 because they have obtained the vaccine. However, they still tested previously when they had symptoms because their daughter tested positive at school.

"I probably, if she had not tested positive, honestly, I probably would not have gotten tested. I would've probably called my doctor and said, hey, I'm feeling sick, my asthma, blah, blah, blah. And they may have said come in or they may have said, take a COVID test, come in or we'll do a video appointment. I'll prescribe something online. If you don't feel better, come in, but I would not have probably taken a COVID test. It just never occurred to me it could be COVID, even though, because I just had this false sense of security. You're vaccinated, you're fine, which is completely ridiculous, as we know that's not true." (PLWD 412, 129-136).

While most of them believe and intend to take prevention strategies such as staying up to date with boosters and masking, the level of masking deviated between participants. One mentioned masking almost all the time, while a couple of others only masking if they are in a crowded space and/or in spaces:

"I would say anywhere over ten people. A store would be around people, a Kroger or, a shopping mall, stuff like that, you should definitely mask up." (PLWD 417, 294)

Information Sources

Information sources is where people are getting their COVID-19 information from.

Baseline

The trusted sources listed by the participants in terms of news are smart news, CNN, local news in Georgia, ABC, NBC, TV news, AJC, and HLN news. For organizations, over half of the participants stated that they trust information from the CDC, some mentioned other governmental agencies such as NIH and local health departments and governmental spokespersons such as Dr. Fauci and the Surgeon General. Some other organizations that participants trust are the WHO and Kaiser Permanente. One participant mentioned that they trust their daughter, and some stated that they trust their friends who are in the healthcare industry, as well as healthcare providers, and those with scientific training. There were three participants who will do research on their own, one mentions that they will use research results (online searches) to further verify the accuracy of the information that they encounter.

"It seems like the information can be backed up a lot of times. If I Google something that they're talking about, there's -- it's other articles or different other perspectives about it, but it's not too far from the truth, if it makes sense. It seems like it can be backed up." (PLWD 415, 330-332)

The sources of information that participants trust only to some level are friends, family, and faith leaders. One participant stated that they trust their family regarding social distancing but not on vaccines, demonstrating that trust in one source can be topic specific as well.

"Just about like the delta variant and about being out there with COVID and just having to be careful about being who I'm near and stuff like that. So I do believe the stuff that they say about that and it's just about the vaccine that we see differently on." (PLWD 407, 312-314).

Some participants mentioned that they look at the following sources but does not elaborate on whether or not that they trust these sources: Yahoo news, Gmail news, Morehouse School of Medicine, and Emory University.

There were various information sources that participants do not trust. Social media was mentioned in seven out of the nine participants. However, although they do not trust social media in general because social media information sources are not scientifically grounded, some did state that they still obtain information about COVID-19 on social media and will trust the information on social media if it is posted by their trusted sources such as the CDC. Social media platforms that they brought up include Facebook, Twitter, Instagram, and TikTok. Fox News came up as one of the not trusted information sources for a third of the participants:

"For sources that she does not trust: "I guess I would say Facebook as a whole or like Fox News, that kind of exacerbates things or kind of have their own opinion. I like the facts. I like to know what exactly is happening and what is going on and how it affects me."" (PLWD 407, 268-270).

One participant commented that they do not trust large news organizations in general like CNN and another said they do not trust the government due to their forceful efforts for the public to be vaccinated.

"Because I mean, to be honest, I mean, who really does. Right? So I know this is being recorded, but I'm just being honest. I can't get in trouble for just saying that. But I just think it's -- I think

our U.S. president and his administration is pressuring people. Now he wants companies that have more than 100 people to -- I guess that's in court right now, to be vaccinated. That's against so many people's -- could it be a faith, or whatever, like I just explained to you, my previous health history. I mean, so many factors of why people don't want to get the COVID-19 vaccines and that booster. But I just feel like it's a pressure now. If you get it, you get -- even some places now, you can't go in unless you show proof of vaccination. That's segregation, or singling out people. Really? That's what our society is come to, and our communities, that you can't make a choice not to get something? Because -- for whatever reason. And now you're going to be discarded because you don't do the vaccine or the booster? That's totally not cool, that's just not fair. And that's another -- to me, that's another form of discrimination. And so, that's just how I feel." (PLWD 410, 333-339).

Follow-up

In the trusted information from participants, some of the sources continued to be discussed during the interview when compared to the baseline interviews. Trusted information for news and media includes local news, CNN, ABC, CBS, government TV channels, Apple News, AGC, and NBC. Multiple participants also mentioned the health department and CDC as trusted organizations, one participant trusts Morehouse School of Medicine and Emory University. One participant remained trusted in the information provided by Kaiser Permanente and obtained home tests through them. Family and friends also continued to be a trusted source along with Google searches. One participant changed their masking behavior and stopped wearing masks according to information from their mother-in-law about the ineffectiveness of

the blue medical masks against COVID-19 infections. Some participants stated that they will verify information that they see using google to ensure that they are backed by a trusted source.

In the untrusted sources, Fox news, news headlines alone, and social media are in this category. Many still believe that social media is an untrustworthy information source, however, individuals still consume information on social media, particularly Facebook. Three of the participants found out information about home tests through social media posts or advertisements and obtained the home tests according to those posts by request from the government.

"I still prefer information strictly from them, that way I know and trust where it's coming from. And I do use social media a lot, some of the news sources that are on there as well. I don't know who specifically, but I know sometimes the CDC.gov will come up with an article or something when I'm scrolling through Facebook. And I'll read it on there as well." (PLWD 407, 136-140).

Media Influences

Media influence is defined as the influence of different informational sources on a person's attitudes towards COVID-19 and testing.

Baseline

There is a variety of ways in which information influences participants' behaviors and beliefs. Two of the participants felt that information reported about COVID-19 infections and hospitalizations directly impact their views about risks associated with COVID-19. One of them expressed that their anxiety can go up and down with cases reported:

"…some days we'll have a high hospitalization rate and you hear all these people getting infected. It makes me nervous and creates anxiety and then there's days where it's like you have the low hospital rate and the kids are back in school like normal and everything is just kind of going smoothly, and then it's almost like I forget about it." (PLWD 407, 486-491)

Some participants' testing and vaccination behavior and beliefs were impacted by feedback or information from their information sources. One believes that Kaiser Permanente provides testing and vaccinations but does not force their patients to follow through and felt supported in making their decisions regarding testing and vaccinations. Two participants have seen information on vaccine side effects and lower efficacy with new variants which leads them to not partaking in vaccinations and/or boosters. Another participant tested positive for COVID-19 but then received calls and information from the local health department and thus influenced his behavior to follow quarantine instructions that were provided.

Follow-up

In the follow-up interviews, several participants stated that their preventative behaviors will be impacted by the information obtained from their information source. One participant will continue to follow the guidance of their doctors and scientists, and the others mentioned following updated preventative measures from the local news and CDC continuously. In regard to testing, one participant described that the TV commercials were effective in persuading people to obtain home tests from the government, while the other has heard the news that tests from clinics and pharmacies may come out with false positives and negatives that led them to prefer

testing twice to ensure there are no false results.

Vaccinations

Vaccination is defined as the participant's status on COVID-19 vaccination and their attitudes towards vaccinations.

Baseline

In the baseline interview, seven out of the nine participants discussed that they have gotten vaccinated. Some were vaccinated due to their doctors' recommendations, for most of the participants who were vaccinated also had social and family support such that most people in their families and households were also vaccinated. Participants believe that obtaining the vaccine allows protection against COVID-19 infections. There was one participant who was vaccinated but is hesitant about getting the booster due to the new COVID-19 variant at the time, Omicron, and news and research about how vaccines are not as effective on this variant and believes that there is not enough research done about vaccines and boosters.

The two participants who were not vaccinated had a variety of reasons. One had an adverse reaction towards the flu vaccine and has seen the news that the Johnson & Johnson vaccine can cause heart disease. The other one believes that the vaccines have not been thoroughly researched and examined, in addition, this participant is a cancer survivor, and they have concerns about whether the vaccine will allow the return of their cancer. Both of these participants have expressed that if there were more research done and it does not seem to have adverse outcomes, they will consider getting the vaccine.

"And there hasn't been any research that I see regarding breast cancer and getting the COVID-19 vaccine. So I'm really terrified that if I do that, the cancer may come back. And this is a question that I brought forward to the doctor that was talking at the health fair at work. And he didn't know how to answer that." (PLWD 410, 297-300).

Follow-up

Since the baseline interviews, about half of the participants obtained boosters. One participant stated that they will be open to obtaining yearly boosters as prevention. Those who were vaccinated and boosted still believe that it is still a protective measure and was grateful for the vaccines, especially those who were infected with COVID-19 after vaccination. All participants who were infected with COVID-19 believe the vaccine helped with reducing the severity of the infection, one mentioned that they are no longer afraid of dying from COVID-19 infections.

For those who had doubts about the vaccine in the initial baseline interview, one interview did not discuss vaccines at all, another one was still not vaccinated, and the participant who was hesitant about boosters actually did obtain a booster in addition to their vaccines. The participant who was still not vaccinated did express concerns about the newly emerging variants and believe that they may be open to getting the vaccine eventually. The participant who was hesitant about boosters still questions the efficacy of vaccines, but in the follow-up interview, they also brought up the concern of people around them being diagnosed with issues that they never had before after vaccination:

"So these are people that I know: family members, friends of family, just different people in my network, in my community, I guess, are just becoming ill. You know, I've even seen a lot of people that have a lot of joint issue now; a lot of severe rheumatoid arthritis or just pain in the muscles and the joints and stuff that have had the Covid vaccines." (PLWD 415, 201 – 204)

Discussion

The overall goal of this study used a mixed-method approach to identify the information sources that potentially impact people's behavior in addition to further exploring reasons behind such behaviors of COVID-19 testing and attitudes. This analysis shows that people with diabetes trust the CDC, the US government, certain news sources (specifically local news), healthcare professionals, and people with scientific backgrounds as sources for information on COVID-19. In general, trust in information sources does not directly lead to testing and other preventative behaviors. However, along with other factors that were evaluated, certain facilitators and barriers were identified and explored. Overall, people's perceived risk of COVID-19 and diabetes were heightened and exposures and symptoms were a facilitator along with the perceived risk to get tested. Social opportunities and the people that participants surround themselves with were also a facilitator of testing. Social media, although not a trusted source of information, was a facilitator for participants to obtain home tests.

The logistic regression modeling results were congruent with the interview data that participants trusted health professionals, family and close friends, news, and the US government, but not so much with social media. One theme that emerged through the interviews when discussing news sources, several participants brought up that they pay more attention to local news, which demonstrated that information that are of more local relevance to individuals may be perceived with additional attention and trustworthiness. The result of the level of trust in these sources was also demonstrated in a cross-sectional nationwide survey study where researchers found that of the COVID-19 information sources the participants trust the government websites the most, and among other sources, news and media was the largest source of information (Ali et al., 2020). However, in our study, trust in these information sources does not necessarily directly

influence testing behavior without other factors to be considered. The high percentage of trust in health professionals, family and close friends, news and the US government did not lead to a high level of testing outcome (all ORs less than 1).

With the higher testing behavior with diabetes and age that is shown in Model 2, the interviews confirmed that older people and people living with diabetes do believe that increase in age and having diabetes poses a greater risk of hospitalization and severe illnesses with COVID-19, respectively. The result of age was similar to another study that investigated primary sources of COVID-19 information and its association of perceived risk of Medicare beneficiaries where the researchers found the perception of risk increased with increased age (Park et al., 2021). However, among people with diabetes in the same study, there was no significance for the perception of increased risk for COVID-19 by diabetes status (Park et al., 2021). In our study, although the knowledge and evaluation of increased risk among people with diabetes do not relate to testing in general, when adding in the factor of exposure to COVID-19 and possible symptoms, participants all state that they went to get tested, or were willing to be tested, which could explain the higher testing behavior in Model 2 and that factors impacting testing behavior is multi-faceted.

Although there was less trust in social media, Model 1 and 2 both predicted a higher testing behavior. Through the interviews, the participants explained that they distrust social media because they believe social media is a platform for opinions and not facts but there are instances where they trust social media information if it is from the accounts of organizations and/or people that they trust, therefore, suggesting that there is a gradient for what social media information participants choose to trust. This result is in congruence with the results from one of the studies mentioned previously by Ali and colleagues where they found that less than 5% of the

participants trust social media information sources on COVID-19 (Ali et al., 2020). However, the results from our qualitative portion of the study suggests that information dissemination can still be effective on social media as long as the information is streamlined through accounts and organizations that people trust. It is still worth noting that the method that information is presented and the context of the information are relevant to how participants may process information and result in actions. For example, when one participant mentioned their distrust in the US government, it was because of the way that they presented vaccination information and the strong persuasive language that is associated with vaccination discouraged them to be vaccinated in addition to the lack of research information on how the vaccine can impact cancer survivors. Therefore, health information messaging should be meticulous with the language and tone that is presented to the public.

Although there was no significant association with family and friends in Models 3 and 4 and less testing behavior were observed in Models 1 and 2, the interviews suggested a different perspective on participants' social context and its potential influence on testing behavior. Although from the baseline interview, some stated that their family and friends have been tested and are in support of testing, they did not necessarily state that they are encouraged to test because of it. One participant even stated that their close family and friends do not impact their testing behavior. However, the interview data show that some have obtained home tests from family members, and another participant had helped a neighbor to perform a home test; this all shows that social context and family and friends can be significant facilitators to further testing for some individuals. It is also worth noting that most of these influences are due to obtaining and performing home tests, and not testing at a clinic, pharmacy, or testing center. In Park and colleague's study, although there was no investigation between trusted sources and testing

behavior, their results showed that trust in family and friends as an information source had one of the top three percentages of likelihood to obtain a COVID-19 vaccine when it is available (Park et al., 2020). Our qualitative result showed a similar impact with testing among the participants influenced by family and friends.

Home tests were further explored and while participants do not always use the home tests, they generally still think that having the home tests are valuable. While home tests provide a convenient method for testing the population, one must consider that they may not be the best surveillance tool since people do not have to report their test results to any agency. However, for those who believe in following quarantine guidelines, home testing could be beneficial to control the further spread of disease. Some researchers recommend for a self-reporting system to collect all testing results, which includes home test results to ensure accurate real-time data on the population (Michaels et al., 2022). However, there are many limitations that comes with such system that must be addressed, such as accessibility and technological issues.

With vaccinations, participants stated that it is a protective measure that they took to prevent COVID-19 infections. This could explain the observation in the logistic regression model that being vaccinated leads to less testing due to the belief that it is protecting them from infection. A participant explained that being vaccinated brings them a false sense of security that they may not contract the virus which was later proven wrong but still brought them some comfort that the vaccines did lessen the impact of the infection. This might explain the small odds ratio of vaccination and testing in the sample. In interviews, participants state that they plan to follow instructions for future guidance on prevention strategies from their trusted information sources, which may include staying up to date with boosters according to guidelines.

There were some differences in testing means by race and ethnicity groups that were significant and need to be further investigated. In the baseline data, the Hispanic population showed a higher testing mean than non-Hispanic groups. In the follow-up data, the Black population had a significant lower testing mean compared to Whites and Asians. This shows that the Hispanic population's testing behavior is higher than non-Hispanics, and Black population's testing behavior is lower than the White and Asian groups. With these results, there may be potential barriers to testing for the Black population. This observation was different from another study that looked at individuals receiving care in the US Department of Veterans Affairs where most of the COVID-19 testing recipients were Black when compared to Whites and Hispanics, but Hispanics had a higher testing rate than Whites (Rentsch et al., 2020). It is also worth noting that the other race group (including mixed race populations) has the lowest mean in all of the racial groups (mean=0.8919); however, the difference between the other group and the rest of the groups was not significant. While this does not indicate significance, there may still be underlying reasons and barriers to why their testing mean is lower than others.

Strengths and Limitations

There are several strengths and limitations in this study. Some of the strengths in this study are the large sample size in survey data, the extensiveness with evaluations of information source variables, and the mixed method employed to understand other factors that impacts COVID-19 testing and attitudes. The large sample size in the baseline study allows for generalization of the data to a wider population, to the residents in Georgia and those impacted by diabetes. The information source variables were separated into many categories which allowed detailed investigations to the variations in trust in different types of sources. Mix method

study protocols allowed for additional exploration to survey question topics and to gain a deeper understanding to other factors that impacted behavior. The qualitative data collection and analysis was guided by a proven behavioral theory – COM-B, allowing exploration of key factors influencing COVID-19 prevention behaviors - social opportunities, psychological capabilities, and reflective motivation.

The limitations that are in the study include the way that quantitative variables were categorized and analyzed and the small number of completed follow-up surveys. Data were collected through two different versions of the survey with mostly the same questions, but the news information variable was condensed from separate variables of news in the newspaper, news on the radio, news on TV, and news online into one single variable in version two due to NIH requirements. We believed that there may be variations within how trustworthy news may be perceived depending on the platform that it is on and this can be an area of interest in future research. Completed follow-up surveys were only about 20% of the completed baseline surveys which is a significant decrease in the sample size in the follow-up survey that could explain the non-significance of the resulting follow-up models.

For the qualitative portion of the study, the lack of sampling in different race and ethnicity groups in the interview, there was no comparison between race and ethnicity groups. There were also no Hispanic participants within the qualitative data to allow us to investigate any potential differences in testing and prevention behavior within the Hispanic group. In addition, although all participants were interviewed with a baseline interview, and then followed up with an interview at least three months after the initial baseline interview, not all interviews were conducted at the same time. Due to the fast-changing nature of the pandemic, people's attitudes

and testing guidelines may have changed during different time frames. There were no clear cut-offs to the time frames during the pandemic to analyze the data.

Implications for Public Health Practice

The results of this study can be used to improve health care and prevention in many ways. As our participants stated their high level of trust in healthcare professionals, their method of explaining and disseminating health information can be crucial to the population's health behaviors. This study can contribute to future messaging in disease prevention to the public and to work with healthcare professionals to allow for effective information distribution and uptake. In addition, social media platforms can be an effective platform to distribute information to a wider audience. Although information on social media may not be the most trustworthy to the population, but people still consume information on these platform nonetheless, creating an opportunity for public health officials to spread their messages widely.

Conclusion

Our data show that while trust in different information sources can impact participants' testing behavior but many factors play into whether or not participants decide to get tested. While social media is not a trustworthy information source, individuals still consume COVID-19 information on social media platforms which may still influence their behavior toward testing and prevention strategies. The numerous factors that were cited that impacted their behaviors were exposure to and symptoms of COVID-19, social influence from family and friends, trusted resources guidance, and information to test and take precautions.

For future research, we encourage additional purposive sampling for qualitative in-depth interviews to further investigate the possibility and reasons for differences between different race and ethnicity groups. In addition, investigating additional factors associated with social media and online resources would be helpful to further understand the reason for trusting or not trusting information that participants come across that they do not see on their trusted accounts, and how this information may appeal to the public. With this information, public health officials can better craft health information messages for effective dissemination and acceptance.

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