

Article 2: Information-Seeking Behaviors for Information on Covid-19 Vaccinations

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1 Abstract

Previous research has greatly failed to distinguish between the activation of information seeking behaviors online and offline. Using theories of social support and uses and gratifications theory I investigate the factors associated with each vehicle type when on information seeking vehicle: personal connection, doctor, social networking site, online forum, and online search engine. Using novel survey data of 948 Americans and their experience seeking out information about the Covid-19 vaccines, I find little evidence that online search is more utilized than seeking social support from personal network connections or health professionals. I find evidence that the vehicles queried in this survey are conceptually different and that the utilization of different vehicles varies by demography and information sources. Finally, I find that different fountains of information and information search vehicles hold real world consequences through their associations with Covid-19 vaccination rates and intentions, as information from a doctor increased the Covid-19 vaccination uptake while receiving information from a Social Networking Site like Facebook or Twitter was associated with lower odds of vaccination.

Keywords: Information-Seeking Behavior, Covid-19, Vaccine Hesitancy, Social Networks, Social Support, Information & Communication Technologies

2 Intro

Information is all around us and permeates every facet of human society, from the hordes of data gathered during the internet age or passing gossip between friends. Human communication and human society are based on the circulation of information and knowledge. Information can be shared by others through information campaigns and consumed by an individual, called information push, or intentionally sought out by individuals, called information pull (Cybenko and Brewington 1999).

Information is especially important given the prominent trends of misinformation, disinformation, and mistrust in traditional institutions (Kata 2010; Starbird 2019). While no belief in false information can be thought of as harmless (Douglas 2021) some discredited theories such as ‘vaccines cause autism’ have major ramifications for both the individual and the social world that surrounds them. For example, a newfound public resistance to vaccination against Measles by so-called ‘anti-vaxxers’ caused a 17% increase in rates worldwide in 2019. This increase killed 142,000 people, most of whom were children under the age of five (Givetash 2019). However, even in the ever-evolving research agenda of misinformation and infodemiology (Eysenbach 2002), much of the research focuses on the ‘push’ or ‘supply’ side of information, like spaces where individuals first encounter with conspiracy theories or other information (Broniatowski et al. 2020;

Johnson et al. 2020).

The lack of research in which vehicles are likely to be chosen when an individual faces a need for information makes it difficult for policy makers to propose effective information campaigns that promote the health and wellbeing of individuals in our society. Even outside of the misinformation literature, much of the research conducted in social networks and communication focus on senders, influencers, and persuasion strategies (Katz and Lazarsfeld 1955; Lazarsfeld, Berelson, and Gaudet 1944 ; Merton 1968), rather than on “the receiver as an active information seeker and processor.” (Johnson and Meischke 1993; though there are always exceptions Eysenbach 2009).

I use the case of information around Covid-19 vaccinations to explore the variation of usage of information search vehicles. In doing so, I seek to answer how computer-mediated or interpersonal information-seeking strategies vary across populations in their search for information about Covid-19 vaccinations and investigate how these strategies affect vaccination uptake.

Before addressing my central research questions, I offer an overview of the current state of social science literature in regards to information-seeking strategies before providing a description of the research methodology and analytic sample. I discuss the implications of these findings for the sociological understanding of information search and vaccination uptake.

2.1 Information Search

Active, directed searching by individuals to obtain information is sparsely discussed in the sociological literature. Pejtersen (1984), a scholar of library and information science, theorized that there are 5 strategies for searching for information. The most common strategy is browsing, where people follow leads based on associations without premeditation. Another strategy is analytical, which includes an explicit consideration of all facets of the question to guide a search. The empirical method guides the search based on tactics that were successful in past research. The known site strategy is to go to the direct source of the information if known. And finally, the similarity method is to find information based on another similar question that already has an answer. These 5 strategies vary in their demands for prior knowledge, cognitive processing, memory, and time spent. While this theory is aimed at finding information in a library setting, scholars have extended the theory to other fields and validated the framework (Fidel 2012); the frame is a useful beginning point for my theories of information search through network activation or through computer-mediated communication.

Some communication theorists ask why an answer to a question is sought in the first place. The Theory of Uncertainty Management (Brashers 2001) professes that people search for information when their uncer-

tainty around the subject leads to anxiety or other cognitive harms. The Theory of Motivated Information Management (Afifi and Weiner 2004, 2006) extends the prior by adding that uncertainty itself is not the catalyst for information-search; rather, it is driven by a discrepancy between the current level of uncertainty on a subject and desired level of uncertainty. In other words, individuals only perform information search when they are distressed by their lack of knowledge or understanding on a subject.

One way to find information is to activate network ties to find out information through a form of social support. Social support, while previously used interchangeably with the term social networks and social integration (House, Umberson, and Landis 1988), are the emotional, informational, and instrumental assistance functions performed between social ties and have strong and measurable association with health outcomes (House and Kahn 1985; Thoits 2011). Informational support is the process of seeking “help in defining, understanding, and coping with problematic events and include education, advice, or referral to another source of support” (Winemiller et al. 1993:640). Brashers, a health communications researcher, defines informational support slightly differently, focusing on the exchange of information that “facilitates coping with life stresses... that may be exchanged among members of a support network” (2002:260). These definitions help to differentiate between seeking information through social ties or through something anonymous like online search; a need for coping or deeper understanding of important matters is thought to sway that decision.

Social support has long been theorized to stem from core discussion networks and much of the historical social support surveys only looked at these core networks. The underlying assumption is that individuals reach out to a handful of strong ties when in need of support, which could be elicited in surveys using name generators (Marsden 1987). This approach has yielded important insights, but largely overlooks crucial processes of resource activation (Hurlbert, Haines, and Beggs 2000; Perry and Pescosolido 2015; Smith 2005). For instance, Small (2017) shows that the core discussion network does not capture how people activate social support in practice and indicates that people draw on much broader social connections for support, reminiscent of the weak ties research by Granovetter (1973). There is ongoing research investigating how weak-tie support holds for different support types based on the architecture put forward by House, Umberson, and Landis (1988) of instrumental, emotional, and informational support.

However, informational support can also be sought outside of the social network context, namely via computer-mediated information search tools such as the process of “Googling.” As the online environment began penetrating all facets of modern human life, it makes sense that performing online search has become one of the most convenient vehicles for information search. While Small (2017) focuses on how support can depend on a network tie simply “happened to be there,” online search is theoretically the most frictionless and costless mode of support. No social capital or relationship is necessary when choosing to utilize a search

engine.

There are three computer-mediated vehicles I consider for this analysis: online search engines like Google or Bing, posting questions on online forums like subreddits or Facebook groups, and posting a status update online via Facebook or Twitter. While the first two are largely anonymous and don't require a personal network, the third is a unique hybrid between personal network connections and online search.

There are important factors that can influence information-seeking strategies besides the strength of social capital or ease of search. For instance, we can borrow uses and gratifications theory (UGT) from studies of mass communication (Blumler and Katz 1974; Tan 1985). UGT posits that users are not passive consumers of media and that people have an active role in choosing different sources of media based on their satisfaction of specific needs on an individual basis. UGT is based on Maslow's (1943) hierarchy of needs and is compatible with Lazarsfeld and Katz's theory of two-step flow (1955) because people can choose their media and the opinion leaders they follow. Modern-day theorists have extended UGT theory and classified the uses and gratifications of the internet and of social media. Stafford, Stafford, and Schkade (2004) theorize that the internet provides gratification through useful content that meets expectations, gratification from purposeful navigating or random browsing as a process, and social gratification from forming and deepening social ties. Leung (2013) theorizes that social media is gratifying for users because it allows for venting of negative feelings, provides recognition, provides entertainment, promotes social affection, and fulfills cognitive needs.

Adapting these facets of UGT and social support to my own case, I theorize that online search allows for increased anonymity, a lowered social cost, and the potential avoidance of embarrassment and other negative social interactions, especially in the case on search engines. Stephen Rains (2018) finds that patients tend to search for technical information about an illness online but they then turn to their social network for experiential information from others facing similar circumstances in the case of cancer. The type of information sought is therefore important. If specific expertise on a specific topic is desired by a searcher, they may reach out to personal connections that they see as expert such as a doctor, or if an individual distrusts the medical establishment, they may be more likely to activate informational support among their social network or turn to online groups that validate their worldview (Bogers and Wernersen 2014). Finally, UGT and Brasher's definition of social support (2002) help us to theorize that the psychosocial needs like identity management or relational maintenance (Brashers et al. 2002) of an individual may influence their chosen information search vehicle: when the informational need is related to forming and deepening social ties search is likely to be done from network ties.

3 Research Methodology

The data used for this research project are based on original survey data sampled between December 03, 2021 through December 12, 2021. This survey was hosted on Qualtrics and participants were paid and recruited using Amazon Turk (MTurk). The total valid survey responses ($n = 948$) were selected from a total of 1,066 respondents; some responses were disqualified due to a few factors such as detected usage of a VPN, random answer clicking (determined by illogical responses), poor quality typed responses (e.g., social network alters consistently named random nouns), or taking the survey more than once. The sample is slightly gender unbalanced, slightly skewing towards a male sample. For the respondents who provided their zip code ($p = 0.98$), the sample is quite balanced with a slight skew towards MTurkers in the South ($p = 0.41$). The survey took an average of 24.48 minutes with a standard deviation of 13.23 minutes. The shortest valid survey took 3.75 minutes and the longest took 111.08 minutes. Participants were paid \$6.00 for their time after Amazon administrative fees, funded by a Grant awarded to Kelsey E. Gonzalez and Nicolas Legewie by the Summer Institute in Computational Social Science and the Russell Sage Foundation. The main portion of this survey replicates the book, *Someone to Talk To* (Small 2017) by expanding on Small’s finding that people draw on much broader sources than “important people” for support by segregating weak-tie social support into instrumental, emotional, and informational support (see House et al. 1988). The latter part of the survey focuses on resource activation for the specific case-study of information during the Covid-19 pandemic analyzed in this paper.

3.1 Measures

3.1.1 Sought Information

There are multiple dependent variables of interest for this paper. The first variable is a dichotomous indicator of whether someone intentionally sought out information about Covid-19 vaccinations. The survey asked, “And how about you yourself intentionally looking for information about a Covid-19 vaccine? Such information can include things such as advice, clarification, facts, and experiences.” About 78% (\hat{p}) of respondents had intentionally sought out information about Covid-19 vaccinations (95% Confidence Interval = {76%, 81%}).

Further dependent variables segment the above question into multiple options; “How did you look for information about the Covid-19 vaccine?” Respondents were posed with 5 responses and ‘other,’ of which they could select multiple. The largest proportion, 44%, asked their ‘doctor or another health professional’ (95% Confidence Interval = {41%, 47%}). About 42% said they asked, ‘a person like friend, neighbor, or family member that [they] know’ (95% Confidence Interval = {39%, 45%}). An additional 41% searched

Table 1: Descriptive Statistics for Dichotomous and Numeric Variables

	Mean	SD
Received info	0.66	0.47
Received info, Doctor	0.47	0.50
Received info, Person	0.67	0.47
Received info, News	0.65	0.48
Received info, Social Networking Site	0.40	0.49
Received info, Online Forum	0.35	0.48
Sought Info	0.78	0.41
Sought Info, Doctor	0.44	0.50
Sought Info, Person	0.42	0.49
Sought Info, Social Networking Site	0.18	0.39
Sought Info, Online Forum	0.27	0.44
Sought Info, Online Search	0.41	0.49
Vaccination Status	0.84	0.36
Vaccination Outlook	0.87	0.34
Age	37.76	10.75
Hispanic or Latino/x	0.15	0.36
Race, White	0.88	0.33
Race, Black	0.08	0.27
Race, Native American	0.03	0.16
Race, Asian or Pacific Islander	0.04	0.20
Associate’s Deg or above	0.74	0.44

Notes: 948 Surveyed, Conducted December 03 through December 12, 2021.

‘for [their] question using an online search engine such as Google or Bing’ (95% Confidence Interval = {38%, 45%}). About a quarter of the sample, 27%, ‘posted queries in an online discussion group, listserve, or other online forum like a Facebook Group or Subreddit’ (95% Confidence Interval = {24%, 30%}). And finally, 18% of the sample ‘posted queries on a social networking site such as Facebook timeline, Twitter status update, or LinkedIn’ (95% Confidence Interval = {16%, 21%}). Much of the question wording and the specific categories of search were inspired by ICPSR project 37220 (Scanlon 2019).

3.1.2 Vaccination Outlook

Another Dependent variable for this analysis is a dichotomous variable indicating whether the respondent has received or plans to receive a vaccination against Covid-19. For this survey, the number of doses or timeline of receipt were less relevant to the research question. This variable instead focuses on intent or opinion about the vaccine. About 87% have a positive view about the vaccine. This construct is made through the combination of two survey items. The first item is actual vaccination status, obtained through the question ‘Did you receive a Covid-19 vaccine?’ 84% of the sample said that they had indeed received a vaccination (95% Confidence Interval = {82%, 87%}). As the national vaccination rate is closer to 75% (CDC 2020), this indicates some bias in our sample that must be acknowledged: either MTurkers are more likely to be

Table 2: Descriptive Statistics for Categorical Variables

		N	Percent
Gender	Female	418	44.09
	Male	524	55.27
	Other	6	0.63
Highest Education Level	Graduate or professional degree	145	15.30
	Bachelor's degree	560	59.07
	Associate's or Technical degree	72	7.59
	Some college	100	10.55
	High school graduate	68	7.17
	Less than high school	3	0.32
Plan to be Vaccinated if not	Probably not	38	4.01
	Definitely yes	13	1.37
	Definitely not	61	6.43
	Might or might not	22	2.32
	Probably yes	13	1.37
Found Info Sought Useful	Very useful	345	36.39
	Moderately useful	112	11.81
	Extremely useful	264	27.85
	Slightly useful	18	1.90
	Not at all useful	2	0.21
Census Region	Midwest	171	18.04
	Northeast	170	17.93
	South	365	38.50
	West	223	23.52

Notes: 948 Surveyed, Conducted December 03 through December 12, 2021.

vaccinated that the normal population (sampling bias) or there is some conformity bias in the responses causing survey takers to provide false answers. The second survey item that contributes to 'Vaccination Outlook' was only given to those who had not responded 'yes' to the to their vaccination status. These respondents were asked 'Do you plan to receive a vaccine for the prevention of the Covid-19 virus?' Of those who were asked this question ($n = 147$), 9% said they were 'definitely yes' getting the vaccine; 9% said they were 'probably yes' going to receive vaccine. The rest of the sample was more unsure: 15% said they 'Might or might not,' 26% said 'Probably not,' and finally 41% said they would 'definitely not' receive the vaccine. The variable 'Vaccination Outlook' indicates that either the respondent received a Covid-19 vaccine or either probably or definitely will in the future.

3.1.3 Independent Variables

The first independent variables used in this analysis are based on the question, 'In the past 12 months, without searching for it, did you receive information about the Covid-19 vaccine from ... (check all sources you received information from).' This differs from the 'How did you look for information' question above because this is based on passive reception of information. The largest proportion of respondents had received

information from a person like friend, neighbor, or family member that [they] know ($\hat{p} = 67\%$). Respondents also commonly received information from a television news channel or a newspaper, about 65% of the sample. 47% of the sample had received information from their doctor or other health professional while 40% received information from a social networking site such as Facebook timeline, Twitter status update, or LinkedIn. Finally, the lowest proportion of the sample had received information from an online discussion group, listserve, or other online forum like a Facebook group or subreddit ($\hat{p} = 35\%$).

We also asked various demographic questions to understand our sample. The average age of our sample was 37.76. Our sample was 44% female, and 55% male. The sample is diverse racially though some ethnic groups are underrepresented compared to national averages. Race was evaluated using the question, ‘What is your race? If you are “mixed race,” select all that apply.’ Because of the multi-selection question, each variable is dichotomous and proportions are shown. 88% of the sample claimed they were ‘White,’ 8% claimed to be ‘Black or African American,’ 3% chose ‘American Indian or Alaskan Native,’ 4% selected ‘Asian,’ and finally when asked, ‘Are you Hispanic, Latino/a/x, or Latin American Origin?’ 15% selected ‘Yes.’ Respondents were also asked to select the highest level of education that you have completed. Based on the breakdown between ‘Less than high school,’ ‘High school graduate,’ ‘Some college,’ ‘Associate’s or Technical degree,’ ‘Bachelor’s degree,’ and ‘Graduate or professional degree,’ 74% of the sample were classified to have a college-level education (Associate’s degree or above).

4 Analysis

My analytic strategy proceeds in four steps. In Tables 1 & 2, I present descriptive statistics for all study variables, including variable ranges, means, and standard deviations. For this paper, I rely heavily on logistic regression, modeled in `r`; specifically, I fit a series of Binomial Generalized Linear Models (Venables and Ripley 2002). In Table 3¹, I fit a logistic regression model predicting whether someone sought information about Covid-19 using their sources of information (‘Received info’) as well as various demographic variables such as age, education level and race. Figure 1 then illustrates the relationship between the coefficients and information seeking.² In Table 4 I disaggregate information seeking behaviors by investigating the difference in proportions of each of the 5 different avenues of seeking information about Covid-19: from another person, from a doctor, on an online forum, on a social networking site, or using an online search tool. I investigate these differences through a phi coefficient (Warrens 2008), otherwise known as a mean square contingency coefficient which is used to investigate the degree of association between two binary variables.³ I then

¹All tables in this paper were created with the `modelsummary` package in `r` (Arel-Bundock 2022)

²Figures in this paper were all created using the `r` packages `jtools` (Long 2020) and `ggplot2` (Wickham 2011; Wickham, Chang, and Henry n.d.)

³To calculate the Phi Coefficient, I utilize the `Psych` `r` package (Revelle 2015)

investigate the associations between my predictors and the 5 information search vehicles by modelling a series of logistic regressions in Table 5. Finally, in Table 6, I investigate whether there is a relationship between information receiving and information seeking behaviors and the choice to get vaccinated against Covid-19 through a logistic regression model predicting Vaccination Outlook. Figure 2 then illustrates the relationship between the coefficients and vaccination outlook.

5 Results

5.1 Information Seeking

Table 3: What predicts someone intentionally searched for information

	Model 1
Received Info, Doctor	1.037*** (0.181)
Received Info, Person	0.624*** (0.171)
Received Info, News	0.316+ (0.175)
Received Info, Social Networking Site	0.320+ (0.187)
Received Info, Online Forum	0.873*** (0.203)
Age	0.025** (0.009)
Associate’s Deg or above	0.456* (0.192)
White	0.857 (0.575)
Black	1.274* (0.625)
Native American	0.405 (0.710)
Asian	0.105 (0.588)
Hispanic or Latino/x	0.425 (0.271)
Num.Obs.	948
$R^2_{McFadden}$	0.110
BIC	988.1
Log.Lik.	−442.618
F	6.183

Raw, Unexponentiated Coefficients

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed test).

Table 3 provides the results of my logistic regression analysis predicting whether someone sought information about Covid-19. These initial results suggest similar results for each vehicle of information delivery: each mode of receiving information whether from a doctor, a person, the news, a social networking site, or an online forum, all increase the odds of seeking out information. For example, respondents who had received information from a doctor or other medical professional were 2.82 (relative odds ratio = $\exp(\beta k)$, $p < 0.001$) times more likely to seek out information over someone who hadn’t. Similarly, respondents who had received information from ‘a person like friend, neighbor, or family member that [they] know’ were 1.87 ($p < 0.001$) times more likely to seek out information over someone who hadn’t received information from a person like

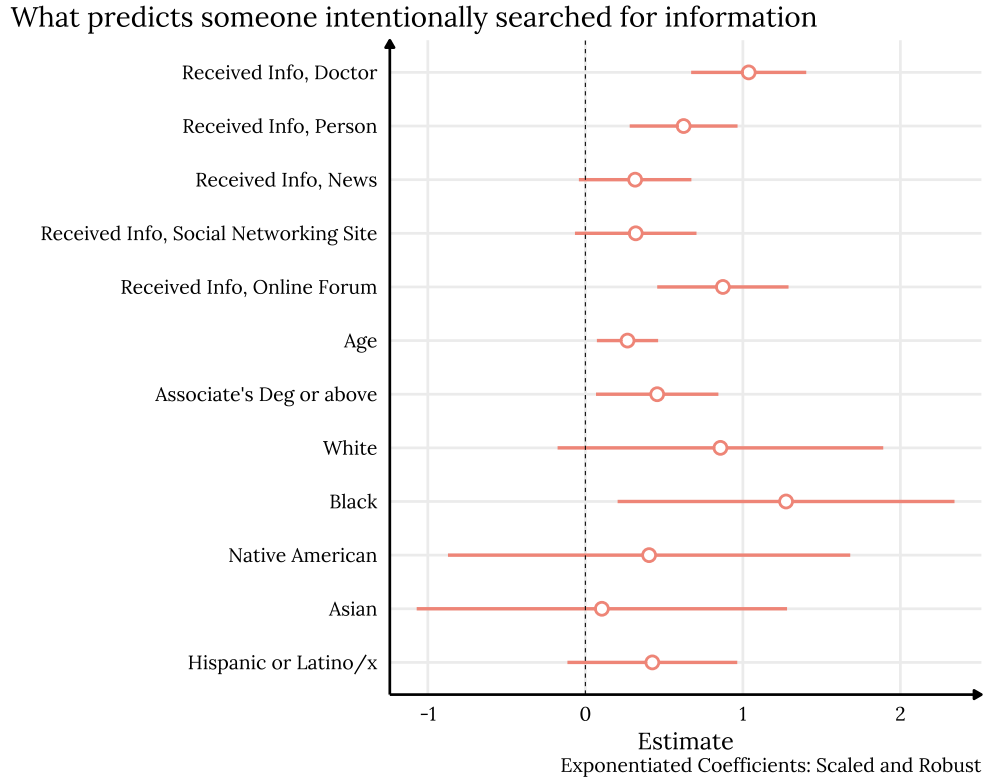


Figure 1: Plot of Coefficients, Model 1

that. Interesting, those who had received information from an online discussion group, listserve, or other online forum including a Facebook group or subreddit were 2.39 ($p < 0.001$) times more likely to search out more information than someone who hadn't. While most demographic variables don't seem to have a strong effect on whether someone sought out information about the Covid-19 vaccine, a few key variables had strong associations. Age, for instance, is associated with seeking information; every additional year of age a person holds they are 3% more likely to search for information, possibly indicating a generational effect of information seeking patterns ($p < 0.01$). Additionally, those who were more educated, that is those with an associate's degree or higher, were 1.58 more likely to seek additional information than those without the degree ($p < 0.05$). And finally, there is evidence to suggest that the Black or African American sample was more likely to seek out information, specifically: Blacks were 3.58 times more likely to seek out information over non-Blacks ($p < 0.05$). Figure 1 illustrates the relationship between the coefficients and information seeking.

Table 4: Phi Coefficient (ϕ) of binary association between each Information Search Vehicle

	Person	Dr	Online Forum	Social Networking Site	Online Search
Person	NA	0.28	0.172	0.275	0.216
Dr	NA	NA	0.192	0.152	0.098
Online Forum	NA	NA	NA	0.371	-0.073
Social Networking Site	NA	NA	NA	NA	0.057
Online Search	NA	NA	NA	NA	NA

5.2 Information Search Vehicles

To further investigate how people search for information, I asked those who had sought information out intentionally, “How did you look for information about the Covid-19 vaccine?” Because respondents could select as many responses as applicable, each response is recorded as a dichotomous variable. Table 1 reveals differences in the prevalence of usage of the various information seeking vehicles: Around 40% of the sample has inquired for information from a doctor, a person, or using online search tool (44%, 42%, 41%) while my respondents used vehicles like online forums (27%) and social networking sites (18%) to seek out information at significantly lower rates. To investigate how each Information Search Vehicle are related to each other using the Phi Coefficient (

phi) of binary association between each Information Search Vehicle pair. The Phi coefficient can be interpreted like a correlation coefficient, with numbers closer to -1 or positive one indicating a very strong relationship (Warrens 2008). Table 4 shows the results of these coefficients. Out of the five information search vehicles investigated, there is evidence that the vehicles are distinctly different concepts because most coefficients fall under 0.3, the general rule of thumb for correlation coefficients to indicate a relationship. There does seem to be a relationship between Online Forums and Social Networking Sites, possibly due to an individual’s propensity to use online networks over in-person networks. These coefficients indicate a weak relationship between any two vehicles of information search and that respondents in my sample utilize each of these a little bit differently.

Results of each logistic regression are displayed in Table 5. Modeling each response as a separate formula is useful for interpretation, but there are important caveats: because each logistic regression is on a different scale, one must not compare the magnitude of coefficients between models. We can, however, use the direction and significance of the coefficients to draw conclusions about these different forms of information search vehicles.

The first model in Table 5 predicts whether a respondent sought information intentionally about Covid-19 vaccinations by asking their doctor or another health professional. First and foremost, I find that those who received information about Covid-19 vaccinations were 6.97 times more likely to seek out more information

Table 5: What predicts someone intentionally searched for information, by vehicle of information search

	Dependent Variable				
	Doctor	Person	Online Forum	Social Networking Site	Online Search
Received Info, Doctor	1.942***	1.124***	0.181	0.540**	0.430**
Received Info, Person	0.800***	1.199***	0.728***	0.281	0.365*
Received Info, News	0.437**	0.100	0.359*	0.514*	1.091***
Received Info, Social Networking Site	-0.130	0.437**	-0.603**	0.731***	1.272***
Received Info, Online Forum	0.412*	0.263+	1.266***	0.974***	0.695***
Age	0.002	0.001	-0.007	-0.003	0.029***
Associate's Deg or above	0.542**	0.154	1.086***	1.344***	-0.952***
White	0.631	0.245	0.009	0.559	0.012
Black	0.366	0.208	0.608	0.646	0.357
Native American	0.309	-0.696	0.209	0.762	-0.831
Asian	-0.294	-0.566	-2.496**	-0.568	0.634
Hispanic or Latino/x	0.324	0.116	0.529*	0.632**	-0.585*
Num.Obs.	948	948	948	948	948
$R^2_{McFadden}$	0.193	0.121	0.145	0.154	0.221
BIC	1152.2	1237.6	1048.0	864.8	1104.6
Log.Lik.	-524.709	-567.376	-472.576	-380.971	-500.907
F	13.742	9.194	8.497	7.879	14.319

Raw, Unexponentiated Coefficients

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed test).

from their doctor than those who had not ($p < 0.001$). However, receiving information from other vehicles also increased the odds of seeking out information from medical professions. Those who received information from a person like a friend or a relative were 2.23 times more likely to ask their doctor ($p < 0.001$), while those who received information from the news or television were 1.55 times more likely ($p < 0.01$). I also find that those who received information from an online forum like a subreddit were 51% more likely to ask their doctors than those who hadn't ($p < 0.05$). Finally, respondents with an associate's degree or higher were 72% more likely to ask their doctor for information on the Covid-19 vaccinations than those who held less education ($p < 0.01$).

The second model predicts whether a respondent sought information about Covid-19 vaccinations by asking a person like friend, neighbor, or family member that they know. Only three coefficients in this model were significant and help us draw any conclusions on who is most likely to activate their personal social network for informational support. In this study, I find that receiving information about the vaccine from a doctor, their personal network, or a social networking site is associated with seeking out more information. Those who received information from a doctor or other medical professional were 3.08 times more likely to seek information from a person like a friend ($p < 0.001$). Moreover, it seems that receiving information from your personal social network, like a friend or relative, is associated with seeking information from those same people; in fact, I find that those who did are 3.32 more likely to do so ($p < 0.001$). Finally, the respondents who received information about the vaccine on a social networking site were 55% more likely

to seek information from their personal network than those who hadn't ($p < 0.01$). The unexpected result of this model is that very few factors predict personal social network activation, and this model has the lowest McFadden's R^2 , indicating possible omitted variables.

I also wanted to see what was associated with posting in an online discussion group, listserve, or other online forum like a Facebook Group or Subreddit about Covid-19 vaccinations. This is conceptually different than posting a query on a social networking site like Facebook or twitter where identities are involved, but is theoretically more [costly?][friction?] than searching on an internet search engine. I found that having received information about the vaccine from your personal social network (like a friend or relative), the news, or an online forum was associated with higher odds of querying an online forum. Specifically, receiving information from your personal network is associated with 2.07 higher odds ($p < 0.001$), from news or television media with 1.43 higher odds ($p < 0.05$), and receiving information on an online forum associated with 3.55 higher odds ($p < 0.001$). Moreover, I found that those with an associate's degree or above were 2.96 times more likely to search for information on an online forum ($p < 0.001$). Finally, I found a racial-ethnic with Hispanic-Latinos; I found that they were about 70% more likely to query an online forum than non-Hispanics ($p < 0.05$). However, there were also a few variables that lowered the odds of posting in an online discussion group. First, those who had received information from a social networking site were 45% less likely to query a forum than those who hadn't (relative odds ratio = $1 - \exp(\beta k)$, $p < 0.01$). Moreover, I find more ethnoracial effects: Respondents who claimed Asian ancestry were 92% less likely to query online forum ($p < 0.01$).

The fourth model predicts whether an individual sought information about Covid-19 vaccinations through posted queries on a social networking site such as Facebook timeline, Twitter status update, or LinkedIn. Receiving information about Covid-19 seems to be quite related to posting on social media. Those who received information from their doctor's had 1.72 higher odds of posting on a social networking site ($p < 0.01$), while those who received their information from tv/news had 1.67 higher odds ($p < 0.05$). Furthermore, those who received information on social networking sites were more likely to post queries on social networking sites ($\beta = 2.08$, $p < 0.001$). The respondents in our sample who received information on online forums had 2.65 higher odds of posting queries on their social networking platforms ($p < 0.001$). I found a relationship between education and posting on social networking sites as well; specifically, those with an Associate's degree or above were 3.83 times more likely to post vaccination queries on social networking sites than those with lower education ($p < 0.001$). Finally, I find that Hispanic-Latinos were 88% more likely to ask their connections on a social networking site about the Covid-19 vaccinations than non-Hispanics ($p < 0.01$).

Searching for information using an online search engine such as Google or Bing is theoretically the search

vehicle with the least amount of social or cognitive friction. Our descriptive statistics showed that not everyone used this vehicle, with only 41% of our sample (See Table 1) having sought information about the Covid-19 vaccines using online search engines. My model reveals interesting patterns to help explain the variation. As with previous models, receiving information of any kind increase the odds of online search, though to varying magnitudes (Doctor: 1.54 odds; Person: 1.44 odds; News or Television: 2.98 odds; Social Networking Site: 3.57 odds; Online Forum: 2 odds). I also find that older respondents were more likely to search online, with each addition year aged to yield 3% higher odds of searching online ($p < 0.001$). The most interesting variations come from what decreases the odds of online search. First, those with an Associate's degree or higher were 61% less likely to search online for questions about Covid-19 than those with less educational attainment ($p < 0.001$). In addition, I find that Hispanic-Latinos had 44% lower odds of searching online than non-Hispanics ($p < 0.05$).

5.3 Vaccination Views

Table 6: Does receiving or searching for information predict vaccination status?

	Model 1
Received Info, Doctor	1.049*** (0.301)
Received Info, Person	-0.206 (0.242)
Received Info, News	0.108 (0.247)
Received Info, Social Networking Site	-0.794*** (0.240)
Received Info, Online Forum	-0.321 (0.248)
Sought Info, Doctor	1.386*** (0.341)
Sought Info, Person	0.570* (0.285)
Sought Info, Social Networking Site	0.710 (0.466)
Sought Info, Online Forum	0.354 (0.342)
Sought Info, Online Search	0.085 (0.260)
Age	-0.018+ (0.011)
Associate's Deg or above	1.281*** (0.234)
White	1.122 (0.767)
Black	0.808 (0.799)
Native American	0.126 (0.829)
Asian	1.555+ (0.918)
Hispanic or Latino/x	1.039* (0.505)
Num.Obs.	936
$R^2_{McFadden}$	0.261
BIC	669.2
Log.Lik.	-266.187
F	6.348

Raw, Unexponentiated Coefficients

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed test).

Finally, in Table 6, I investigate whether there is a relationship between information receiving and

information seeking behaviors and the choice to get vaccinated against Covid-19 through a logistic regression model predicting Vaccination Outlook. I find that receiving information from a doctor or other medical profession is associated with 2.85 odds of receiving a Covid-19 vaccinated ($p < 0.001$) and that seeking information from a doctor also increases the odds of vaccination by 4 ($p < 0.001$). I find that my respondents who received information on a social networking site like Facebook or Twitter about the vaccines were 55% **less likely** to get vaccinated than those who received no information through that vehicle ($p < 0.001$). However, I did find that those who reached out to family or friends with their concerns were 77% more likely to become vaccinated ($p < 0.05$). Furthermore, my respondents who held an Associate's degree or above had 3.6 higher odds of becoming immunized ($p < 0.001$). And finally, I found further ethnoracial differences in my sample. I found that Hispanic-Latinos had 2.83 higher odds of vaccination than non-Hispanics ($p < 0.05$) and that my Asian sample had 4.73 higher odds as well over non-Asians ($p = 0.09$). See Figure 2 for a visual representation of how these different coefficients are related to vaccination outlook.

Does receiving or searching for information predict vaccination sentiment?

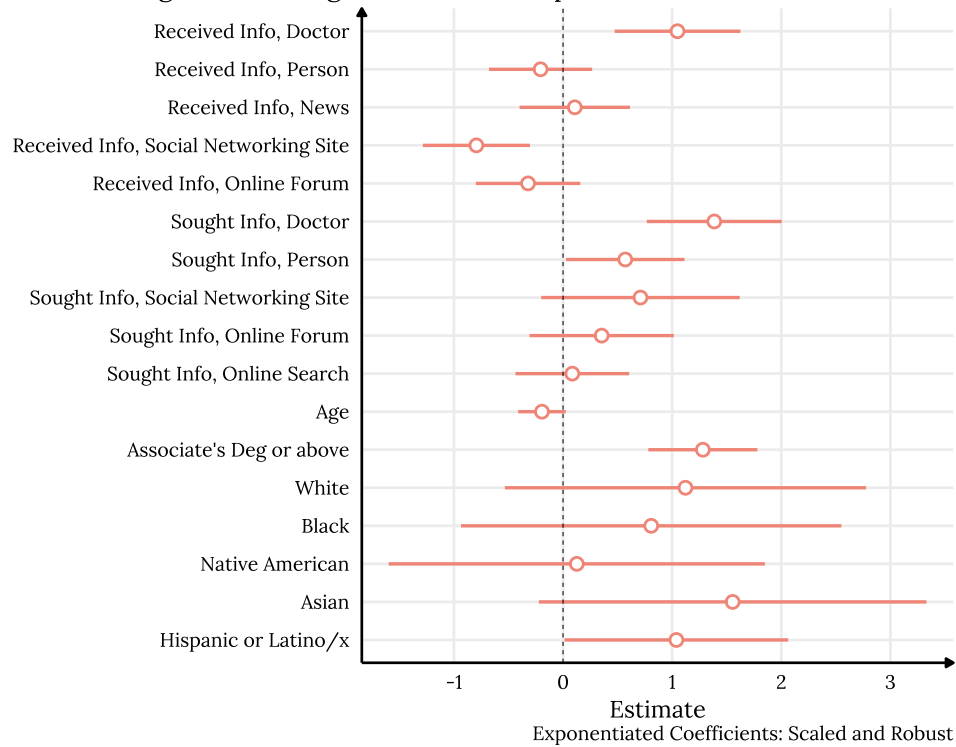


Figure 2: Plot of Coefficients, Model 3

6 Discussion

Previous research in Sociology and Infodemiology has greatly failed to distinguish between the activation of information seeking behaviors online and offline. In this paper, I aim to uncover just how different various methods of information search are and begin a line of research inquiry that investigates the factors associated with each different vehicle. Finally, I also aimed to uncover how the different fountains of information and information search vehicles hold real world consequences through their associations with Covid-19 vaccination rates and intentions.

I first find that receiving information about Covid-19 vaccinations from any outlined source increases the likelihood of searching out more information. I also find important demographic differences in the overall propensity to seek out information. First, I find that the older a respondent is, the more likely they are to seek out information about Covid-19 vaccinations, possibly indicating a larger information need by elderly populations overall, or a more pressing need to search for information about the Covid-19 vaccinations because of the higher risk of hospitalizations that older populations face (Turner et al. 2018). Furthermore, I find that those who are college educated were more likely to seek out information; for the most part this trend can be observed in Table 5 as well. Human Capital Theory (Mirowsky and Ross 1998) may help to explain this finding; this theory claims that higher education can provides the skills to gain health-related knowledge and use this knowledge to be proactive in their own lives. Finally, I find that my respondents who identified as Black were more likely to seek out further information; this may be explained by the maltreatment that African Americans have endured in the US healthcare system (Bailey et al. 2017) which has led to major distrust of the medical establishment among the population (Bronson and Nuriddin 2014; Center 2019; Murray 2015).

Table 5 further demonstrated important takeaways about how individuals seek information. First, I find that the different information seeking vehicles queried in this survey are conceptually different and that the utilization of different varies by demographic and supply (information fountain? ~ source of having receiving information). Overall, receiving information about Covid-19 vaccination generally is associated with information seeking behaviors, though there are key variations. First, if you received information from a doctor, you were likely to search from information from a doctor; this may indicate an already existing trusting relationship between patient and healthcare provider but it may also indicate the healthcare provider taking initiaive and emphasizing the importance of the vaccine or the survey respondent seeking out information from an expert. Another important finding is that if you received information from a Social Networking Site like Facebook or Twitter, you were less likely to query Online Forums like Reddit or Facebook Groups; this may be an example of Uses and Gratification Theory (Blumler and Katz 1974), where

the two online platforms may act as substitute sources of information and those who were satisfied with the information they received on a Social Networking Site didn't have the need to seek out more information. Finally, the ethnoracial variations exhibited in Table 5 likely demonstrate how cultural attitudes around the trustworthiness of different sources of information affect the utilization of different methods; for example, Asians seem are less likely to use online forums than non-Asians while Hispanics are more likely to use them than non-Hispanics. The internal variations between the different information search vehicles hint at different user profiles and may have major repercussions on the quality of information they find and who is exposed to poor quality information.

Given the rampant misinformation around Covid-19, her related vaccinations (Motta, Stecula, and Farhart 2020; Pathak, Agarawalla, and Gupta 2020; Shahsavari et al. 2020) and the slowed rate of vaccinations in the United States, it is important to uncover what relationship the different fountains of information and information search vehicles for Covid-19 vaccinations are associated with compliance with public health recommendations. Table 6 demonstrated just how these different fountains of information and information search vehicles are associated with real world consequences through Covid-19 vaccination rates and intentions. The first takeaway is that receiving or seeking information from a doctor or other medical profession leads to higher likelihood of completed or planned vaccinations. While blanket advice like "Healthcare Providers should recommend the vaccine to their patients" would be ineffective because of the declining number of Americans with a primary care doctor (Levine, Linder, and Landon 2020), increasing trust in the institution of medicine seems to remain a strong predictor of vaccinations. A second major takeaway is that receiving information from a Social Networking Site like Facebook timeline or Twitter status update was significantly associated with lower vaccination rates. While we don't know what exact information was absorbed on these platforms, the lower odds of vaccination indicate that it was not positive. Much has been attempted between 2020 and 2022 to curb vaccine misinformation on these social networking platforms (see Bowman 2020 for an early example); however, I find evidence that these social networking platforms nevertheless have a measurable negative impact. Finally, this study also contributes to the conversation on ethnoracial and educational differences in vaccine hesitancy. I find in my sample that Hispanic-Latinos and Asians were more likely than non-Hispanics and non-Asians to receive or plan to receive a vaccination against Covid-19 (Table 6). Research in this area has mixed results, with some studies showcasing consistent findings to these (Bagasra, Doan, and Allen 2021; King et al. 2021), while others show that Whites have the lowest levels of vaccine hesitancy and many minorities are much more hesitant (Foxworth 2021; Momplaisir et al. 2021). My finding that college-educated respondents were more likely seek vaccination is largely consistent with the broader literature (Khairat, Zou, and Adler-Milstein 2022), though again there are many variations depending on the vaccine in question and study context (Siddiqui, Salmon, and Omer 2013).

7 Conclusion

Previous research has greatly failed to distinguish between the activation of information seeking behaviors online and offline and largely focuses on the information that is sent to consumers [push], seeing people as passive receivers of information. In this paper, I instead focus on individuals as active agents in their search for information to begin a line of research inquiry that investigates the factors associated with the various methods of information search.

Given the large swaths of both misinformation and disinformation regarding Covid-19 (Motta et al. 2020; Pathak et al. 2020; Shahsavari et al. 2020) and the measurable impacts this misinformation has had on pandemic-related health behaviors (Loomba et al. 2021), Covid-19 provides an ideal study to investigate how we choose to search for information that affects both our own lives and the lives of others.

This paper has provided several key findings that can be used to motivate policy interventions for the Covid-19 vaccination campaigns and in the future for other information campaigns. However, these findings are not to be taken out of the context of their limitations. This paper is built off a small survey sample (`r_nrow(rain)`) that was hosted online and anonymously through MTurk, a service that provides people with micro-jobs. Because of how the website is set up, respondents are incentivized to fill out surveys as quick as possible and there were many responses that were poor quality and removed from the sample before analysis. Moreover, there is no incentive for respondents to be honest in these surveys. However, each of these limitations are often pointed to as limitations of survey research as a whole.

Overall, this research project is important because the vehicles used in information search impacts the information and quality of information found. By looking at how individuals search, I aim to identify pain points and focus areas for future interventions in the misinformation process.

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8 Appendix 1: Survey Questions

Q181: Now, we're going to transition a bit to ask you about the information you received during the Covid-19 pandemic.

Q170: In the past 12 months, without searching for it, did you receive information about the Covid-19 vaccine from ... (check all sources you received information from)

- your doctor or other health professional? (1)
 - a person like friend, neighbor, or family member that you know ? (9)
 - From television news channel or the newspaper? (10)
 - From an online discussion group, listserve, or other online forum including a Facebook group or subreddit? (11)
 - From a social networking site such as Facebook timeline, Twitter status update, or LinkedIn? (12)
 - Other (13) _____
-

Q171: And how about you yourself intentionally looking for information about a Covid-19 vaccine? Such information can include things such as advice, clarification, facts, and experiences.

- Yes (4)
 - No (5)
-

Q172: How did you look for information about the Covid-19 vaccine?

- Asking a person like friend, neighbor, or family member that I know (1)
- Asking my doctor or another health professional (4)
- Posted queries in an online discussion group, listserve, or other online forum like a Facebook Group or Subreddit (5)
- Posted queries on a social networking site such as Facebook timeline, Twitter status update, or LinkedIn (6)
- Searched for my question using an online search engine such as Google or Bing (7)

- Other (8) _____

Q173: What sort of information did you search for? Separate different topics with a comma or semi-colon.

Q174: How useful was the information you found?

- Extremely useful (22)
- Very useful (23)
- Moderately useful (24)
- Slightly useful (25)
- Not at all useful (26)

Q175: Did the information you learned affect your decision to get vaccinated against Covid-19?

- Yes (39)
- No (40)

Q179: Did you receive a Covid-19 vaccine?

- Yes (9)
- No (10)
- I'm unsure or would not like to respond (11)

Q180: Do you plan to receive a vaccine for the prevention of the Covid-19 virus?

- Definitely not (9)
- Probably not (10)
- Might or might not (11)
- Probably yes (12)
- Definitely yes (13)

- I would not like to respond (14)
-

gender: What is your gender?

- Male (1)
 - Female (2)
 - Other (3) _____
 - Prefer not to say (4)
-

hispanic: Are you Hispanic, Latino/a/x, or Latin American Origin?

- Yes (1)
 - No (2)
-

race: What is your race? If you are “mixed race,” select all that apply.

- White (1)
 - Black or African American (2)
 - American Indian or Alaskan Native (3)
 - Asian (please specify): (4) _____
 - Other (please specify): (5) _____
 - Prefer not to say (6)
-

educ: What is the highest level of education that you have completed?

- Less than high school (1)
- High school graduate (2)
- Some college (3)
- Associate’s or Technical degree (4)
- Bachelor’s degree (5)
- Graduate or professional degree (6)

income: We would be interested to know roughly what your total household income before taxes is. We mean income from all sources, including welfare, stock dividends, other household members' income, etc. In 2020, in which bracket did your total family income fall?

- Under \$1,000 (1)
- \$1,000 to \$9,999 (2)
- \$10,000 to \$19,999 (3)
- \$20,000 to \$29,999 (4)
- \$30,000 to \$39,999 (5)
- \$40,000 to \$49,999 (6)
- \$50,000 to \$59,999 (7)
- \$60,000 to \$74,999 (8)
- \$75,000 to \$89,999 (9)
- \$90,000 to \$109,999 (10)
- \$110,000 to \$129,999 (11)
- \$130,000 to \$149,999 (12)
- \$150,000 or over (13)
- Don't know (14)

age: What is your age? (in years)