# Internet Search Patterns and Covid-19: What Are Patients in the United States Asking Online?

Tony S. Shen, Aaron Z Chen, Patawut Bovonratwet, Carol L. Shen, Edwin P. Su

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## Abstract

**Background:** The internet is a well-known source of information that patients use to better inform their opinions and to guide their conversations with physicians in clinic. The novelty of the recent outbreak of the coronavirus disease (Covid-19) has led patients to more frequently turn to the internet to gather more information and to alleviate their concerns about the virus.

**Objective:** The aims of the study were to 1) determine the most commonly searched phrases related to Covid-19 in the United States and 2) identify the sources of information for these web searches.

**Methods:** Activity Modification, and Policy. Additionally, the websites were categorized according to source: World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Non-CDC Government, Academic, News, and Other Media.

**Results:** In total, 200 questions and websites were extracted. The most common question topic was Transmission (31.5%), followed by Clinical Features (27.0%) and Activity Modification (15.5%). Notably, the Clinical Features category captured questions about myths associated with the disease, such as whether consuming alcohol stops the coronavirus. The most common websites provided were maintained by the CDC, the WHO, and academic medical organizations. Collectively, these three sources accounted for 84.0% of the websites in our sample.

**Conclusions:** In the United States, the most commonly searched topics related to Covid-19 were transmission, clinical features, and activity modification. Reassuringly, a sizable majority of internet sources provided were from major health organizations or from academic medical institutions.

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**ABSTRACT:**

*Background:* The internet is a well-known source of information that patients use to better inform their opinions and to guide their conversations with physicians in clinic. The novelty of the recent outbreak of the coronavirus disease (Covid-19) has led patients to more frequently turn to the internet to gather more information and to alleviate their concerns about the virus.

*Objective:* The aims of the study were to 1) determine the most commonly searched phrases related to Covid-19 in the United States and 2) identify the sources of information for these web searches.

*Methods:* Search terms related to Covid-19 were entered into Google. Questions and websites from Google Web Search were extracted to a database using customized software. Each question was categorized into one of six topics: Clinical Signs and Symptoms, Treatment, Transmission, Cleaning Methods, Activity Modification, and Policy. Additionally, the websites were categorized according to source: World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Non-CDC Government, Academic, News, and Other Media.

*Results:* In total, 200 questions and websites were extracted. The most common question topic was Transmission (31.5%), followed by Clinical Signs and Symptoms (27.0%) and Activity Modification (15.5%). Notably, the Clinical Signs and Symptoms category captured questions about myths associated with the disease, such as whether consuming alcohol stops the coronavirus. The most common websites provided were maintained by the CDC, the WHO, and academic medical organizations. Collectively, these three sources accounted for 84.0% of the websites in our sample.

*Conclusions:* In the United States, the most commonly searched topics related to Covid-19 were transmission, clinical signs and symptoms, and activity modification. Reassuringly, a sizable majority of internet sources provided were from major health organizations or from academic medical institutions.

## INTRODUCTION

Since its emergence in late 2019 in Wuhan, China, the disease caused by the novel coronavirus (Covid-19) has drastically impacted daily life around the world [1, 2]. Among the changes to the public sphere include government-imposed lockdowns of businesses, schools, and universities designed to mitigate the spread of the disease and to alleviate the significant strain on health care systems [2]. As many continue to stay at home due to the Covid-19 pandemic, internet use has become an increasingly dominant part of daily life. In a recent poll, a majority of Americans consider the internet "essential" during this time [3]. Nearly all major internet services have seen increased traffic since early March 2020 [4]. Given the unprecedented nature of the pandemic, there is naturally much public uncertainty regarding Covid-19 and thus, many are thus turning to the internet to ask their questions and obtain information about the coronavirus.

Previous studies have shown that patients frequently use the internet to research their conditions and inform their discussions in clinic [5, 6]. As physicians, insight into what topics patients are curious or anxious about may help guide and structure our interactions, leading to improved patient rapport and satisfaction. Additionally, with well-publicized recent examples of misinformation originating from many sources, including places of authority, it is paramount for physicians to collectively take

responsibility to provide reliable and trustworthy information based on the best available evidence [7, 8]. Thus, the aims of the present study were to 1) determine the most commonly searched phrases related to Covid-19 in the United States and 2) identify the sources of information for these web searches. In doing so, we believe that this technology may be understood as distilling the collective curiosity of the internet-using public into useful information for physicians in clinic.

**METHODS**

Search terms related to Covid-19 were entered into Google Web Search (www.google.com) using a clean-installed Google Chrome browser on May 30 2020 in New York, New York. Google Web Search is by far the most widely used internet search engine in the United States [9]. In 2018, Google introduced a natural language processing algorithm which greatly improved the ability of the search engine to identify clusters of search queries related to any given topic [10]. Due to this new technology, Google redirects all searches related to Covid-19, such as "Covid-19", "coronavirus", "coronavirus disease", etc., to a centralized Covid-19 homepage. This search results page incorporates the location of the user's search and generates a list of questions and websites that are frequently associated with the initial query. On each results page, the 200 most commonly asked questions were generated. The questions were downloaded to a database using a freely available program (Scraper, version 1.7). The specific question and web address were noted on the webpage by their unique XML Path Language (XPath) strings.

The questions were first categorized according Rothwell's classification system by a single trained reviewer [11, 12]. This classification system was expanded into one of the following six topics: Clinical Signs and Symptoms, Treatment, Transmission, Cleaning Methods, Activity Modification, and Policy, which were chosen on based on previously published studies that examined the web and social media concerns of users during the Covid-19 pandemic [13-15] (Table 1).

**Table 1.** Question Classification by Topic and Website Categorization by Source

| Question Classification by Topic | Description |
|---|---|
| Clinical Signs and Symptoms | Properties of the SARS-CoV-2 virus, signs and symptoms of Covid-19, prognosis, risk factors, severity, testing. *Example: Can you have the coronavirus disease without a fever?* |
| Treatment | Treatment strategies for Covid-19, including antiretrovirals and vaccines. Also includes inquiries for unsupported treatments. *Example: Can antibiotics treat the coronavirus disease?* |
| Transmission | Inquiries regarding specific routes of transmission for SARS-CoV-2. *Example: Can coronavirus spread through mosquito bite?* |
| Cleaning Methods | Inquiries regarding specific methods of sanitation to limit spread of Covid-19 *Example: Can ultraviolet light kill the coronavirus disease?* |
| Activity Modification | Questions regarding effectiveness of various activities or lifestyle changes in preventing Covid-19 *Example: Can I walk my dog during quarantine?* |
| Policy | Questions about local or national policy changes enacted in response to Covid-19. Includes questions about economic support. *Example: Does everyone get a stimulus check?* |

| Website Categorization by Source | Description |
|---|---|
| WHO | Website maintained by the World Health Organization (WHO) and hosted on the *who.int* domain *Example: COVID-19 Situation Report (www.who.int)* |
| CDC | Website maintained by the United States Centers for Disease Control and Prevention (CDC) and hosted on the *cdc.gov* domain *Example: Travelers' Health (wwwnc.cdc.gov/travel)* |
| Government | Websites maintained by national, state, or local governmental organizations other than the WHO or CDC *Example: New York State Governor's Office (www.governor.ny.gov)* |
| Academic | Websites maintained by an institution with a clear academic mandate, including universities, academic medical centers, academic societies *Example: ClevelandClinic.org, MayoClinic.org* |
| News | Websites published by local, national, or international news media organization. *Example: USAToday.com* |
| Other Media | Websites maintained by organizations not defined in the categories above. *Example: Wikipedia.org* |

Activity modification consisted of questions regarding the effectiveness of various activities or lifestyle changes in preventing Covid-19. Policy included questions detailing local or national policy changes enacted in response to Covid-19, including questions about economic support. A full listing of the criteria for each topic category is listed in Table 1.

In line with previous studies, the websites were categorized according to source: World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Non-CDC Government, Academic, News, and Other Media [16, 17] (Table 1). Specifically, Non-CDC government websites consisted of webpages directly maintained by a national governmental entity such as the National Institutes of Health (United States) or the National Health Service (United Kingdom). Academic websites were defined as an organization with a clear academic mission statement. Other media consisted of websites not described by one of the previous categories, including CNET, WebMD, and Wikipedia. A full listing of the criteria for each web source category is listed in Table 1.

**RESULTS**

In total, 200 questions and their corresponding source of information were extracted. The most common question topic was Transmission (31.5%), followed by Clinical Signs and Symptoms (27.0%) and Activity Modification (15.5%) (Table 2a-b).

**Table 2a.** Top 25 questions associated with Covid-19

| | |
|---|---|
| Can antibiotics treat the coronavirus disease? | Can you have the coronavirus disease without a fever? |
| Is headache a symptom of the coronavirus disease? | Does drinking alcohol kill the coronavirus? |
| Is there a vaccine for coronavirus? | How long does the coronavirus stay on clothing? |
| Are masks effective against the coronavirus disease? | Is bleach an effective cleaning agent for the coronavirus disease? |
| Can children pass on the coronavirus disease? | Is the coronavirus disease more severe than the flu? |
| Can coronavirus spread through mosquito bite? | Should I accept packages from China? |
| Can I stay at home if I have the coronavirus disease? | Should I cancel my trip due to coronavirus? |
| Can the coronavirus disease spread faster in an air-conditioned house? | Should I wear a face mask out in public? |
| Can the coronavirus disease spread through delivered packages? | What antiviral drugs are available to treat the coronavirus disease? |
| Can the coronavirus disease spread through feces? | What is a pandemic? |
| Can the coronavirus disease spread through food? | What is the recovery time for the coronavirus disease? |
| Can you get coronavirus from talking to someone from a distance? | Who gets a stimulus check? |
| | Are rashes a symptom of the coronavirus disease? |
| | Can hand sanitizer explode in a hot car? |

**Table 2b.** Distribution of questions by topic

| Topic | Number | Percent |
|---|---|---|
| Total | 200 | 100% |
| Transmission | 63 | 31.5% |
| Clinical Signs and Symptoms | 54 | 27.0% |

**Table 2c.** Distribution of websites by source

| Source | Number | Percent |
|---|---|---|
| Total | 200 | 100% |
| CDC | 73 | 36.5% |
| Academic | 48 | 24.0% |

| Activity Modification | 31 | 15.5% | WHO | 47 | 23.5% |
|---|---|---|---|---|---|
| Policy | 22 | 11.0% | News | 13 | 6.5% |
| Treatment | 18 | 9.0% | Government | 10 | 5.0% |
| Cleaning Methods | 12 | 6.0% | Other Media | 9 | 4.5% |

Most questions regarding the transmissibility of the coronavirus asked about specific modes of transmission such as spread through food, feces, air conditioning units, delivery packages, and mosquitoes. Interestingly, the Clinical Signs and Symptoms category captured questions about myths associated with the disease, such as whether consuming alcohol stops the coronavirus. In the Activity Modifications category, there were many questions about staying at home, wearing masks, and managing preexisting travel plans. The most commonly asked question, "Can antibiotics treat the coronavirus disease?", was classified as Treatment, which in total, compromised 9% of the searched questions.

With respect to sources of information, the most common websites provided were maintained by the CDC (36.5%), academic medical organizations (24.0%), and the WHO (23.5%) (Table 2c).With an additional 5% of web information provided by a government source, an overwhelming majority of information (89%) came from highly trustworthy web sources. However, the remaining 11% of information came from either news or other media. In particular, 4.5% of information came from web sources classified as other media, which included potentially erroneous sources of information such as Wikipedia.

**DISCUSSION**

In the midst of a highly unprecedented pandemic with significant economic and public health implications, the internet is a crucial source of information for the general public in order to guide their everyday life. As information is changing rapidly and is compounded by fallacies originating from places of authority, we believe that the pandemic highlights the role of physicians in providing

patients the most reliable information based on the highest quality of evidence. Thus, the present study effectively characterized the intellectual curiosity of millions of Americans into six easily categorizable groups and demonstrated the origin of the general public's sources of information.

Previous studies have examined search and Twitter trends related to the Covid-19 pandemic from regions around the world, including the United States, China, Italy, and Spain [13-15, 18-20]. In April, Husnayain et al. examined Google search trends in Taiwan, effectively noting that searches for handwashing drastically increased after a perceived face mask shortage in the country [14]. More recently, Rovetta et al. examined the Google search trends in Italy, and characterized the most common search terms in the country, including "face mask," "disinfectant," "symptoms of the coronavirus," "health bulletin," and "vaccines" [19]. In the United States, Chen et al. examined over 100 million tweets to track social media conversations about the Covid-19 pandemic [18]. However, to our knowledge, no study has examined internet search patterns related to Covid-19 in the United States. This question is of utmost importance for several reasons. First, the United States represents not only the highest Covid-19 burden in the world, but also a country where well-publicized recent examples of misinformation originate from the head of state [8]. Second, while Twitter effectively captures a significant source of information, it is by no means comprehensive, and the platform appeals to a select audience [21].

Thus, the present study revealed that the most commonly searched criteria about Covid-19 included information about transmission, clinical signs and symptoms, and activity modification. Understanding what matters to our patients should compel us to be well-informed on these topics. We believe that as physicians, we should collectively take responsibility to provide reliable information based on the best available evidence [22]. Even if we do not regularly manage patients with Covid-19, at the very least we should be prepared to answer to the most common clinical

questions asked online such as modes of transmission or the status of a vaccine. Although many answers may be obvious to us, there remain many questions that are active areas of study for which we must remain up to date. Regardless of the specific details of our individual practice, we should always have the willingness to learn and the preparation to answer these commonly asked questions.

Further, the present study revealed that the sizable majority of internet sources provided were from major health organizations or from academic medical institutions. While we find this to be encouraging, we must remember that our patients also consume information from multiple other sources. The social media "echo chamber" phenomenon is an active area of study for sociologists and computer scientists and has been shown to rapidly propagate rumors or misinformation on a mass scale [23-25]. Again, we believe that physicians should take responsibility for providing the best quality information in the domains in which we hold influence. On a larger scale, perhaps there is a role for physicians learn and adapt techniques employed by marketers and politicians to better communicate medical information with the public. However, for most of us, we believe that our role is simply to understand the concerns of our patients regarding COVID-19, to remain informed ourselves, and to be ready to answer their questions.

There are several limitations to the present study. First, the Covid-19 pandemic is rapidly changing, and the results of the present study captured web searches as of May 2020. Due to the changes in pandemic characteristics, such as the emergence of new hotspots, it is entirely plausible that the focus of web searches has changed as well. In addition, the present study only captures the web searches of users in New York during May 2020, as the Google Covid-19 database generates search results based on the date of search and user location. Thus, we are unable to analyze trends in either. However, other published studies have examined Google searches in other regions of the world, including China, Taiwan, and Italy [13-15, 19]. Thus, the results of the present study should be used

in conjunction with those around the world to provide a more comprehensive view of the search patterns of citizens across the world. In addition, the present study makes use of Google's coronavirus homepage, which generates the most commonly asked questions based on the specific user's location and date of search. Due to the limitations of this feature, we are unable to compare trends in location and trends in time, which should be a direction for future studies. Lastly, Google Web Search was the only search database examined, and the present study fails to capture information from alternative search engines. However, as previously noted, Google Web Search is by far the most highly utilized search engine in the United States [9].

## CONCLUSION

People use Google Web Search to identify sources of information about the novel coronavirus (Covid-19). In the United States, the most commonly searched topics related to Covid-19 were transmission, clinical signs and symptoms, and activity modification. Reassuringly, the majority of information in the present study came from highly reputable sources, including the CDC, academic websites, and the WHO.

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## CONFLICT OF INTEREST:

Dr. Edwin P. Su reports potential financial bias outside this submitted work. This includes the following: Kyocera: IP royalties; Orthalign, Inc: IP royalties; Stock or stock Options; Smith & Nephew: Paid consultant; United Orthopedics, Inc: Paid consultant. The other authors declare no conflicts of interests.

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# Supplementary Files