

Decreased online hepatitis information seeking during the COVID-19 pandemic: an Infodemiology study

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Keywords

Viral hepatitis • Infodemiology • Google Trends • Health care seeking behavior

Summary

Introduction. *Viral hepatitis remains a public health concern worldwide, mainly in developing countries. The public's awareness and interest in viral hepatitis information are essential in preventing and controlling this disease. Infodemiology has been used as a surrogate to assess the general understanding of disease and measure public awareness of health topics. However, this analysis has not been applied to viral hepatitis. Thus, this study investigated the online global search interest for viral hepatitis in the last decade, focusing on the period before and during the COVID-19 pandemic.*

Methods. *Global online search interest for hepatitis was measured using the Google Trends™ database. Spearman's rank-order correlation correlated country-specific characteristics and prevalence data with search volume index.*

Results. *There was a significant reduction in online search inter-*

est for hepatitis during the COVID-19 pandemic (2020). People searching for hepatitis are also interested in hepatitis vaccination. Search volume index is positively correlated with viral hepatitis and HIV prevalence and negatively correlated with GDP. This correlation mirrors the high burden of viral hepatitis in developing countries and their citizens' desire to be informed about this disease.

Conclusions. *Our study found decreased global online interest in viral hepatitis during the pandemic. Moreover, higher online interest in hepatitis was observed in countries with a lower gross domestic product and high viral hepatitis and HIV prevalence. We demonstrated that global online interest toward viral hepatitis could be assessed through the infodemiologic approach using Google Trends™.*

Introduction

Viral hepatitis continues to be a significant public health problem. Five infectious disease agents cause most of viral hepatitis: hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), hepatitis D virus (HDV), and hepatitis E virus (HEV) [1]. It is estimated that around 2.3 billion people worldwide are infected by at least one of these viruses [2]. Viral hepatitis has caused about 1.34 million deaths annually due to chronic liver disease and primary liver cancer [2-4]. Moreover, while mortality from other infectious diseases such as tuberculosis and HIV decreases, deaths due to viral hepatitis increase over time [4]. Low rates of diagnosis, incomplete vaccination coverage and inaccessible drugs are some of the challenges of the efforts to eliminate viral hepatitis [5].

The COVID-19 pandemic compounded these challenges in eliminating viral hepatitis. COVID-19 has infected around 255 million and has caused around five million deaths [6]. But effects of COVID-19 extend beyond its morbidity and mortality. Management and care of non-COVID disease have significantly been affected [7-9]. Significant reductions in visits to viral hepatitis clinics have been observed in several countries, with some regions recording as much as a 95% decline [10, 11]. Indeed, concerns have been raised regarding the impact of the COVID-19

pandemic in the prevention, control, management, and elimination of viral hepatitis [12].

The internet is an essential source of health information for the public, especially during this COVID-19 pandemic, as evidenced by the increase in online searches for health-related information [13, 14]. The field of infodemiology aims to characterize the distribution and determinants of this digital information [15, 16]. Infodemiology has been utilized to assess the general understanding of disease and measure public awareness and interest in health-related topics [17-20]. Infodemiology has evaluated other infectious diseases such as tuberculosis and influenza [21-23]. However, global infodemiological studies on viral hepatitis are lacking. Thus, this research characterized the online global search interest for viral hepatitis in the last decade, focusing on the period before and during the pandemic. Factors associated with online interest for viral hepatitis were also presented in this study.

Methods

Global online search interest for hepatitis was measured using the Google Trends™ database, which provides reports on search trends in the unit of search volume index (SVI). This number represents the search interest relative to the highest point on the chart for the given region and

Tab. I. Comparison of search volume indices for hepatitis search terms in 2019 (before the pandemic) vs 2020 (during the pandemic).

Search Term	Median Annual SVI		p-value
	2019	2020	
Hepatitis	86	65	< 0.0001
Hepatitis A	72	40.5	< 0.0001
Hepatitis B	94.5	71.5	< 0.0001
Hepatitis C	64.5	44.5	< 0.0001
Hepatitis D	71.5	62	0.015
Hepatitis E	68	51	0.0008

Tab. II. Top associated search terms also used by people searching for "Hepatitis" (2011 to 2021).

Search Query	Search Volume Index
Hepatitis vaccine	100
Hepatitis symptoms	95
La hepatitis	90
What is hepatitis	75
Hepatitis B vaccine	62
Hepatitis virus	60
Liver hepatitis	58
Liver	57
Hepatitis treatment	50
Hepatitis test	46
Hepatitis a vaccine	43
Symptoms of hepatitis	40
Hepatitis sintomas	40
Viral hepatitis	37
Hepatitis C symptoms	34
HIV	34

time. An SVI of 100 corresponds to the peak popularity for the search term. A value of 50 means that the term is half as popular. A score of 0 means that there was insufficient data for the search term. SVI has been shown in previous studies to provide insight into population health-seeking behavior and collective health trends.

Google Trends™ was accessed by visiting <http://trends.google.com>. "Hepatitis", "Hepatitis A", "Hepatitis B", "Hepatitis C", "Hepatitis D", and "Hepatitis E". We limited the results to 10 years from the Search Query (October 11, 2011 - November 11, 2021). SVI and related queries were obtained from Google Trends™. The information about GDP allocation (% GDP), HIV prevalence, hepatitis prevalence was obtained from the World Bank [24] and CDA Foundation's Polaris Observatory [25].

Correlation between country-specific characteristics and SVI was determined using Spearman's rank-order correlation. A Spearman's correlation coefficient (ρ) with a p-value of less than 0.05 was considered significant. This statistical analysis was done using GraphPad Prism software version 7 (GraphPad Software, San Diego, CA).

Results

The SVI for hepatitis search terms for 2011-2021 is shown in Figure 1. There has been a gradual increase in

the online interest for hepatitis in the last decade until early 2020 where a global online drop of interest can be appreciated. The declaration of the World Health Organization of COVID-19 as a pandemic coincided with this decline in online interest for hepatitis.

To determine if COVID-19 has affected global online interest in hepatitis, we compared the average SVI between 2019 (pre-pandemic) and 2020 (pandemic season). The SVI for "Hepatitis" ($p < 0.0001$), "Hepatitis A" ($p < 0.0001$), Hepatitis B ($p < 0.0001$), "Hepatitis C" ($p < 0.0001$), "Hepatitis D" ($p = 0.015$), and "Hepatitis E" ($p = 0.0008$) significantly decreased during the pandemic compared to the pre-pandemic season (Tab. I). People searching for hepatitis have also searched for vaccines for hepatitis, for hepatitis B and hepatitis C (Tab. II). People are also interested in knowing symptoms of hepatitis, the definition of viral hepatitis, hepatitis test, and hepatitis treatment. We also noted that "hiv" is related to online interest for hepatitis.

We also identified the countries where hepatitis search terms were most popular for the past ten years. For "Hepatitis", we found that the top countries were Ghana, Nigeria, Uganda, Ethiopia, and Venezuela (Fig. 2A). For the search term "Hepatitis A", the top countries were Venezuela, Guatemala, Peru, Honduras, and Ghana (Fig. 2B). On the other hand, Ghana, Uganda, Nigeria, Ethiopia, and Cameroon have more searches for "Hepatitis B" (Fig. 2C). "Hepatitis C" was most popular in Pakistan, Puerto Rico, the United States, Dominican Republic, and Ghana (Fig. 2D). The search term "Hepatitis D" yielded more results in Nigeria, Nepal, Kyrgyzstan, Pakistan, Bolivia (Fig. 2E). Lastly, "Hepatitis E" was more popular in Nigeria, Nepal, Kyrgyzstan, Pakistan, Bolivia (Fig. 2F).

We found that online interest in hepatitis was positively correlated with the prevalence of hepatitis B ($p = 0.86$), hepatitis D ($p = 0.36$), and hepatitis E ($p = 0.80$) (Tab. III). Furthermore, there was also a positive correlation between hepatitis B prevalence and SVI for "hepatitis B" ($p = 0.23$), the prevalence of hepatitis C with SVI for "hepatitis C" ($p = 0.55$), and prevalence of hepatitis E with SVI for "hepatitis E" ($p = 0.08$). We also found that GDP had a negative correlation with the search terms "hepatitis" ($p < 0.0001$), hepatitis A (0.0005), hepatitis B (< 0.0001), hepatitis C (0.02), hepatitis D (0.009), and hepatitis E ($p = 0.008$).

Due to the propensity of hepatitis to have coinfection with HIV, we also checked the correlation of HIV prevalence with online interest in hepatitis. HIV

Fig. 1. Search volume indices for the terms “Hepatitis”, “Hepatitis A”, “Hepatitis B”, “Hepatitis C”, “Hepatitis D”, and “Hepatitis E” in the year 2011 to 2021. SVIs were calculated separately for each search term such that SVIs are normalized within each term.

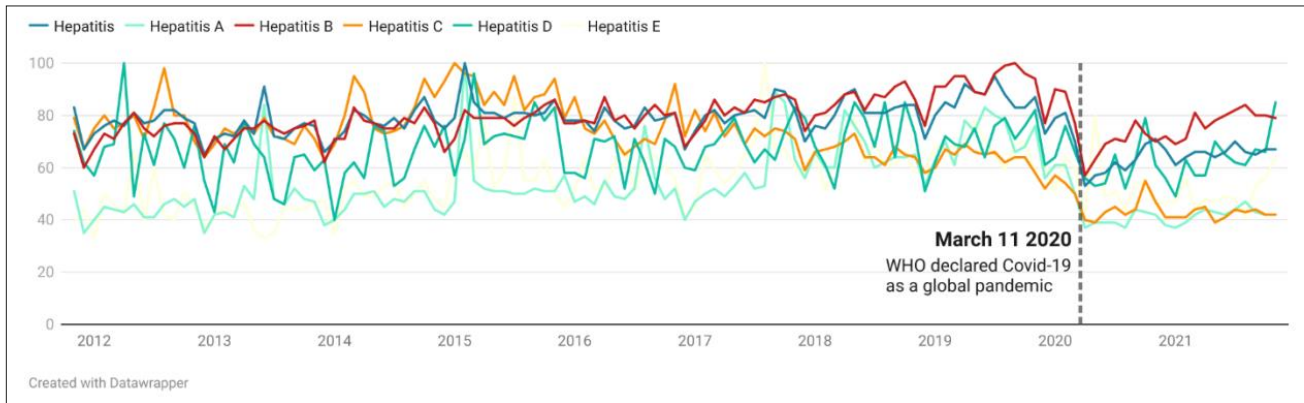
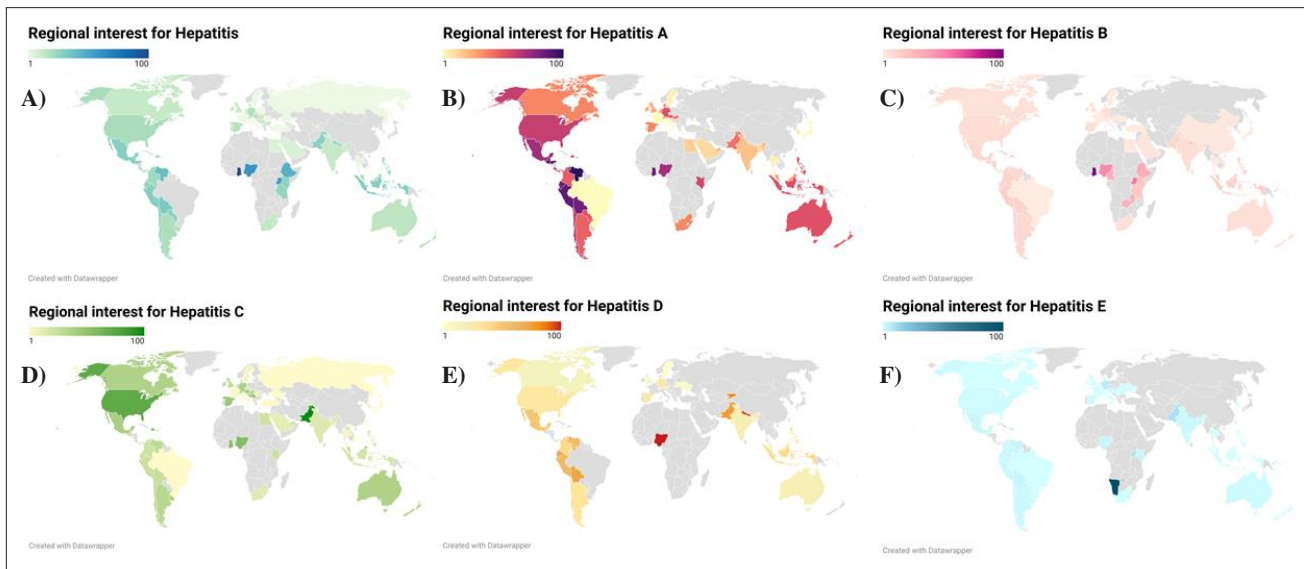


Fig. 2. Search frequencies for “Hepatitis” (A), “Hepatitis A” (B), “Hepatitis B” (C), “Hepatitis C” (D), “Hepatitis D” (E), and “Hepatitis E” (F) by country in the year 2011 to 2021. The color intensity represents the percentage of searches for the leading search term in a particular region. Search term popularity is relative to the total number of Google searches performed at a specific time, in a specific location.



prevalence was positively correlated with the SVI for “hepatitis” ($p = 0.007$), hepatitis A ($p = 0.0305$), and hepatitis B (0.007).

Discussion

This study showed that the online interest in hepatitis has gradually increased in the last decade. However, we observed a significant decrease in the global online interest for hepatitis during the COVID-19 pandemic. The worldwide reduction of online interest in hepatitis parallels the decline of public interest in non-COVID diseases, including cancer, obesity, rheumatic, and ophthalmologic diseases during the pandemic [26–30]. Management of non-COVID diseases has been affected by COVID-19. Emergency department visits and hospital admissions of non-COVID illnesses have decreased during the early months of the pandemic. A decrease in

the public interest for viral hepatitis is evident in online search behavior and decline in physical visits in the viral hepatitis clinics during the pandemic [10, 11]. This decrease in online interest might hinder efforts to curb the threat of viral hepatitis.

We noted that those searching for hepatitis also searched for hepatitis vaccines. This is good because the public is also aware of the availability of vaccines to prevent hepatitis. Vaccination is part of WHO’s core interventions to eliminate hepatitis in 2030 [4]. Global coverage of the hepatitis B vaccine has steadily increased since the 1990s and has reached 85% coverage in 2019. A slight dip was noted in 2020, with 83% coverage for the Hep B vaccine [31]. Overall global basic vaccination coverage significantly dropped in 2020 [31, 32]. Reduced vaccination has been affected by vaccine supply, vaccine hesitancy, and change in health-seeking behavior [32, 33]. Our results showing decreased online interest in hepatitis is consistent with decreased health-

Tab. III. Correlations between SVIs for hepatitis search terms and country specific characteristics.

Country-specific characteristics	Search Terms	r	P-value
Hepatitis B prevalence	"Hepatitis"	0.023	0.859
	"Hepatitis B"	0.149	0.235
Hepatitis C prevalence	"Hepatitis"	-0.116	0.393
	"Hepatitis C"	0.088	0.548
Hepatitis D prevalence	"Hepatitis"	0.250	0.364
	"Hepatitis D"	-0.100	0.950
Hepatitis E prevalence	"Hepatitis"	0.040	0.800
	"Hepatitis E"	0.320	0.085
GDP (current US\$)	"Hepatitis"	-0.525	< 0.0001
	"Hepatitis A"	-0.459	< 0.001
	"Hepatitis B"	-0.540	< 0.0001
	"Hepatitis C"	-0.302	0.021
	"Hepatitis D"	-0.482	0.009
	"Hepatitis E"	-0.370	0.008
Prevalence HIV	"Hepatitis"	0.383	0.007
	"Hepatitis A"	0.343	0.031
	"Hepatitis B"	0.460	< 0.001
	"Hepatitis C"	0.035	0.829
	"Hepatitis D"	0.084	0.709
	"Hepatitis E"	0.250	0.130

seeking behavior for hepatitis. Reduced vaccination coverage might increase the global burden of chronic hepatitis and hinder the progress towards hepatitis elimination [32].

Several developing countries are represented in the top countries searching for hepatitis online. Furthermore, our results showed that GDP is negatively correlated with the online search interest for hepatitis. The high online interest for hepatitis among developing countries might be due to the high prevalence of hepatitis in these countries [2, 4]. This was confirmed in our correlation analysis, which showed that online interest in global hepatitis was positively correlated with the prevalence of viral hepatitis. This is consistent with the positive relationship between online search interest via Google Trends and the prevalence of infectious diseases [34]. Moreover, in developing countries with high hepatitis prevalence, numerous public health programs, and health education campaigns are conducted by several NGOs [35]. These campaigns might have increased the public's awareness of the disease and might have affected their online health-seeking behavior.

Our results also showed that people searching for viral hepatitis are also interested in HIV. We also found that HIV prevalence is positively correlated with online interest for hepatitis search terms. This reflects the close relationship between hepatitis and HIV infection. Hepatitis B and hepatitis C share similar modes of transmission with HIV [36]. Furthermore, viral hepatitis and HIV have a propensity for coinfection, which results in significant morbidity and mortality [36, 37].

This study has several limitations. Although the most popular search tool, Google is not the sole web search engine available, and its penetration to different countries may vary. Also, the data is subjected to the inherent

nonrepresentative sampling bias in Google search trends. The data used in this study was collected from people with internet access. This might have excluded lower-income groups and areas with issues on freedom of speech. We have limited our search to the English language. Moreover, this might have omitted searches using other languages used in other parts of the world. Despite these limitations, this study still analyzed the pattern and geographical distribution of global online interest in viral hepatitis.

Conclusion

Our study, which utilized Google Trend analysis, showed a significant drop in the online interest for hepatitis during the COVID-19 pandemic. The decrease in online interest is consistent with the decreased health-seeking behavior for hepatitis disease during the pandemic. We noted that people searching for hepatitis are also interested in the hepatitis vaccine, a cornerstone for hepatitis control, prevention, and elimination. However, vaccination efforts have been hampered during the COVID-19 pandemic. Decreased health-seeking behavior for hepatitis might be one of the factors for reduced vaccination. Search volume index is positively correlated with viral hepatitis and HIV prevalence and is negatively correlated with GDP. This mirrors the high burden of viral hepatitis and HIV disease in developing countries and the desire of their citizens to know more about these diseases. Overall, our study has shown that infodemiologic approach through Google Trends™ can be used as a tool to assess the online interest of people toward viral hepatitis.

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Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author's contribution

Conceptualization: EDBO, OAGT. Data Processing: EDBO. Data Analysis: EDBO, OAGT. Writing original draft: EDBO. Writing-review and editing: OAGT.

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