



# Global Online Interest in HIV/AIDS care Services in the time of COVID-19: A Google Trends Analysis

Eric David B. Ornos<sup>1</sup> · Ourlad Alzeus G. Tantengco<sup>1</sup> · Cybele Lara R. Abad<sup>2</sup>

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## Abstract

The Covid-19 pandemic has compounded the challenge of HIV/AIDS elimination, creating difficulties in accessing HIV care services such as early testing and treatment. This paper characterized the global online interest in HIV care services-related search terms before and during the pandemic. Global online search interest for HIV was measured using the Google Trends™ database. Spearman's rank-order correlation correlated country-specific characteristics and HIV prevalence data with the search volume index (SVI). We found a significant decrease in the global online search interest for HIV/AIDS care services-related search terms during the Covid-19 pandemic. The top countries with the highest online interest for "HIV/AIDS" search terms were Zambia, Eswatini, Malawi, Lesotho, and Zimbabwe. In addition, search volume indices for HIV correlated positively with HIV prevalence and negatively with GDP, GDP per capita, and the number of physicians. This result highlights that resource-poor countries with a high prevalence of HIV have a high online interest in HIV/AIDS. Therefore, there is a need to improve internet access, the quality of HIV-related health information, and online health literacy to improve health-seeking behavior, especially in areas with a high disease burden. Overall, our study shows that the infodemiologic approach through Google Trends™ can be used to assess the online interest of the public toward HIV infection and related healthcare services.

**Keywords** HIV · Google trend · Infodemiology · Covid-19 · Internet

## Introduction

Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) is a significant public health problem globally, with 36.3 million deaths to date and over 37 million current HIV infections [1–3]. In the post-2015 Sustainable Development Goals, the international community declared its commitment to end the HIV/AIDS

epidemic by 2030 [4, 5]. However, there are several barriers to realizing this goal –first, there are disparities and fragmentation in health systems, leading to inadequate coverage of HIV health care services[6]; 2) there is insufficient access to antiretroviral therapy (ART), a key element in decreasing HIV/AIDS mortality and 3) HIV testing is limited by social factors such as stigma, discrimination, and violence [6, 7].

The Covid-19 pandemic has compounded the challenge of eliminating HIV/AIDS. It has caused almost 400 million infections and 5.75 million deaths worldwide [8]. The emergence of variants of concern (VOC), such as delta and omicron, has caused recurrent Covid-19 surges in several countries [9, 10]. The ongoing pandemic has strained healthcare systems worldwide, causing disruptions in routine health services, including those for HIV [11]. Several countries have recorded a decrease in HIV clinic visits, HIV testing, and ART initiation [12, 13]. Disruptions in these services have raised concerns regarding the possible consequences on HIV incidence and mortality [13].

People living with HIV (PLHIV) use the internet as a source of disease and health services information [14, 15].

✉ Eric David B. Ornos  
ebornos@up.edu.ph

Ourlad Alzeus G. Tantengco  
ogtantengco@up.edu.ph

Cybele Lara R. Abad  
cybelemd@yahoo.com; crabad@up.edu.ph

<sup>1</sup> College of Medicine, University of the Philippines Manila, Manila, Philippines

<sup>2</sup> Section of Infectious Diseases, Department of Medicine, Philippine General Hospital, University of the Philippines, Manila, Philippines

Internet usage was shown to influence the initiation of care and treatment decisions of PLHIV [16]. Moreover, the search for health-related information increased during the pandemic [17, 18]. Google Trends analysis has been utilized to assess public awareness of different diseases and public health interventions and analyze the health-seeking behavior of patients [19–22]. This research characterized the online global search interest for HIV/AIDS care services before and during the pandemic. We hypothesized that the global pandemic would decrease online interest in HIV/AIDS care services. Additionally, we identified the possible factors associated with online interest for HIV/AIDS.

## Methods

We used the Google Trends™ database to measure global online search interest for HIV (<http://trends.google.com>). Google Trends reports search volume index (SVI) unit to measure search trends. This unit represents the search interest relative to the highest point on the chart for the given region and time. For instance, an SVI of 100 correlates with the peak popularity of the search term. A value of 50 signifies that the term is half as popular. A value of zero means that the search term has insufficient data. Previous studies have shown that SVI can give insight into collective health trends and population health-seeking behavior (SVI) [20–23].

We accessed Google Trends™ by visiting <http://trends.google.com>. We chose search terms related to the disease, diagnosis, prevention, and treatment of HIV as reported in the literature [24–26]. The authors also added terms as deemed appropriate in this study. The search terms included, “HIV”, “AIDS”, “HIV/AIDS”; HIV prevention and diagnosis terms such as “HIV clinic”, “HIV doctor”, “HIV test” “HIV PrEP”, “HIV PEP”, “HIV ART”, “HIV prevention”, “condom”; and common medications for HIV such as “trimeq”, “tivicay”, “atrima”, “complan”, “genova”, “stribild”, “isentress”, “norvir”, “prezista”, “viread”. We limited the results to 4 years from the Search Query (January 1, 2018 - December 31, 2021). We obtained SVI and related queries from Google Trends™.

We investigated the difference in the HIV-related search terms between the pre-pandemic and pandemic period. December 31, 2019, was chosen as a delineation between two time periods since WHO was first alerted of the case on this date. We used the Mann-Whitney U test ( $p$ -value < 0.05 considered significant) to compare SVIs before and after the time point. We also determined the correlation of HIV-related search term SVIs with COVID-19 disease SVIs throughout the specified period using Spearman’s correlation ( $p$  < 0.05 considered significant).

We also determined country-specific variables that may correlate with SVIs. These variables include HIV prevalence and socio-economic factors shown in multiple studies to be correlated with HIV risks ([27–30]). The data on HIV prevalence, GDP, GDP per capita, Physician per 1000 population, and poverty indices were taken from World Bank (The World Bank, 2021). The correlation between country-specific characteristics and SVI was determined using Spearman’s rank-order correlation. A Spearman’s correlation coefficient ( $\rho$ ) with a  $p$ -value of less than 0.05 was considered significant. This statistical analysis was done using GraphPad Prism version 7 (GraphPad Software, San Diego, CA).

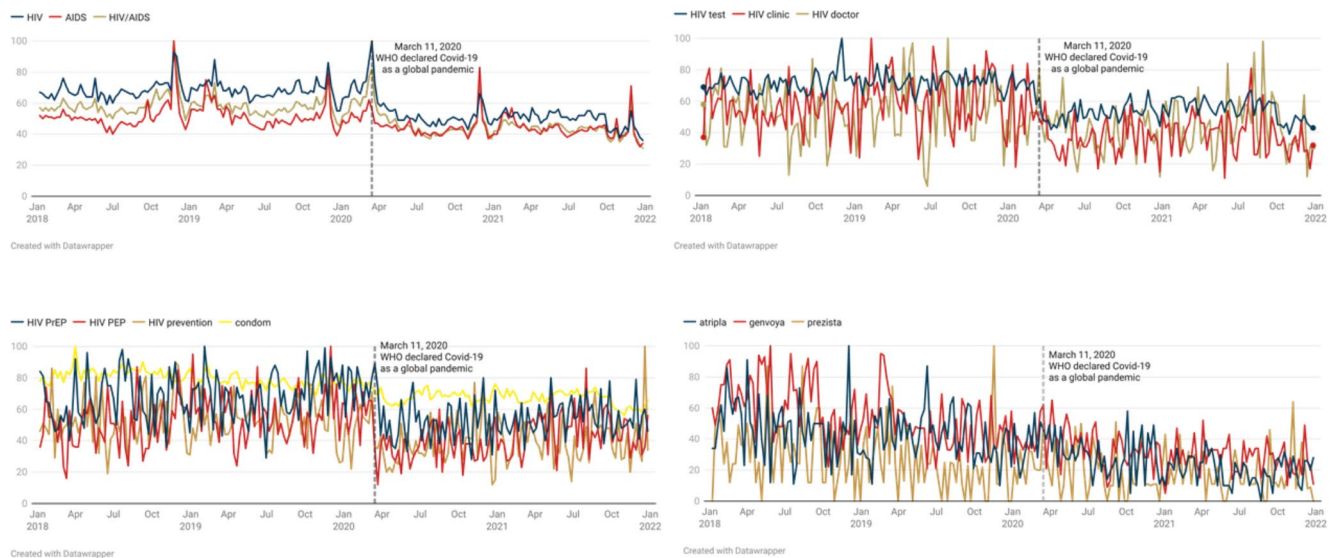
## Results

Search volume indices on HIV search terms for 2018–2021 are shown in Fig. 1. A global online interest drop for HIV search terms was observable in early 2020. The nadir in the global online interest for HIV search terms coincided with the World Health Organization (WHO) declaration of Covid-19 as a pandemic.

To determine if Covid-19 affected global online interest in HIV, we compared the median SVI between 2018 and 2019 (pre-pandemic) and 2020–2021 (pandemic period). The SVIs for all HIV-related search terms significantly decreased during the pandemic compared to the pre-pandemic season (Table 1). In addition, we observe the highest drop in online search interest for search terms Atripla (43.18% drop, Mann-Whitney  $U = 2066$ ,  $p < 0.0001$ ) and Stirbild (42.50% drop, Mann-Whitney  $U = 2884$ ,  $p < 0.0001$ ), which are common HIV medications. The biggest drop was shown in medications, which might indicate a decrease in online interest in HIV treatment. Moreover, we found that SVIs for several HIV and care search terms are correlated negatively with COVID-19 SVI. This negative correlation indicates high COVID-19 online interest amidst low online interest in HIV (Supplementary Table I; Supp. Figure 1).

We also determined the Youtube SVI for search terms “HIV”, “AIDS” and “HIV/AIDS” (Supp. Figure 2). We observed a drop in global online search interest for HIV-related terms. Furthermore, Youtube SVIS for these HIV-related search terms significantly decreased during the pandemic compared to the pre-pandemic period (Supplementary Table III).

We also identified the countries where HIV search terms were most popular for 2018–2021. The countries with the highest online search interest for “HIV” search terms were Malawi, Lesotho, Zambia, Eswatini, and Zimbabwe. The top countries that used the “AIDS” search term were Eritrea, Zimbabwe, Malawi, Liberia, and Papua New Guinea. Lastly,



**Fig. 1** Search volume indices for HIV related terms for the year 2018–2021. SVIs were calculated separately for each search term such that SVIs are normalized within each term

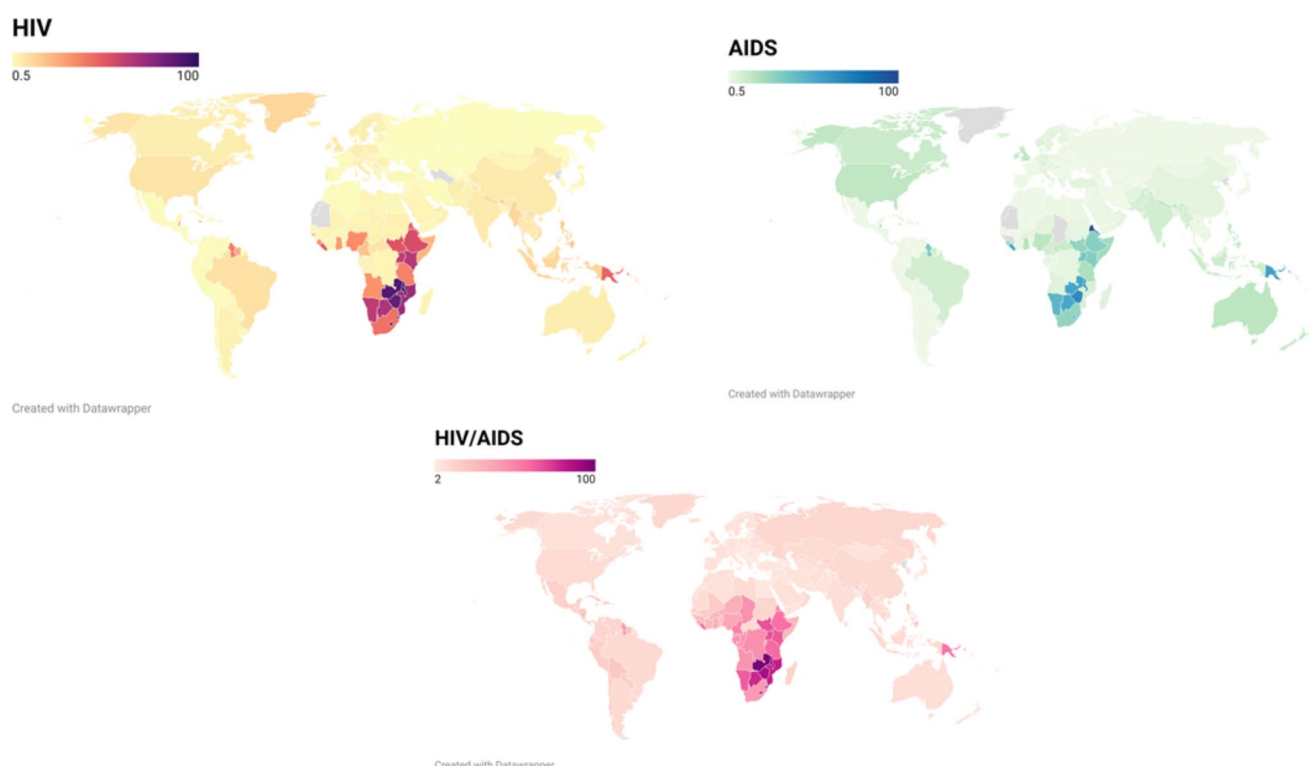
**Table 1** Comparison of search volume indices for HIV search terms in 2018–2019 (before the pandemic) vs. 2020–2021 (during the pandemic). (Mann Whitney U test)

General Search Term Classification	Search Terms	Median SVI		Percent Change in SVI	p-value	
		Pre-pandemic (2018–2019)	Pandemic (2020–2021)		Mann-Whitney U	
General HIV/AIDS terms	HIV	67	51	-23.88%	871	<0.0001
	AIDS	50	43.5	-13.00%	1965	<0.0001
	HIV/AIDS	57	44	-22.81%	1111	<0.0001
HIV prevention and diagnosis	HIV clinic	57.5	38.5	-33.04%	1958	<0.0001
	HIV doctor	54	43	-20.37%	3493	<0.0001
	HIV test	72	54	-25.00%	618.5	<0.0001
	HIV PrEP	70	54	-22.86%	2983	<0.0001
	HIV PEP	54	41	-24.07%	3492	<0.0001
	HIV ART	49	43.5	-11.22%	4632	0.0737
	HIV prevention	52.5	39	-25.71%	2992	<0.0001
	condom	80	68	-15.00%	342	<0.0001
	trumeq	26	17	-34.62%	2778	<0.0001
HIV/AIDS treatment	tivicay	46	35	-23.91%	3491	<0.0001
	Atripla	44	25	-43.18%	2066	<0.0001
	Complera	41	31.5	-23.17%	4048	0.0017
	Genvoya	54.5	31.5	-42.20%	1447	<0.0001
	Stribild	40	23	-42.50%	2884	<0.0001
	Isentress	28.5	21	-26.32%	3867	0.0004
	Norvir	29	24.5	-15.52%	3717	<0.0001
	Prezista	24	15.5	-35.42%	3647	<0.0001
	viread	39	26	-33.33%	1904	<0.0001

the top countries with the highest online interest for the “HIV/AIDS” search topic were Zambia, Eswatini, Malawi, Lesotho, and Zimbabwe. The Philippines ranked 45th for “HIV” search term, 43rd in “AIDS”, and 66th “HIV/AIDS”.

We determined country-specific factors that may correlate with online interest in HIV. Our correlation analysis showed that GDP correlated negatively with search terms “HIV”

( $r=-0.394$ ,  $p<0.0001$ ), “AIDS” ( $r=-0.396$ ,  $p<0.0001$ ), and “HIV/AIDS” ( $r=-0.403$ ,  $p<0.0001$ ). Similarly, GDP per capita also showed a negative correlation with search terms “HIV” ( $r=-0.14$ ,  $p=0.04$ ), “AIDS” ( $r=-0.07$ ,  $p=0.28$ ), and “HIV/AIDS” ( $r=-0.522$ ,  $p<0.0001$ ). The number of physicians in the country is also negatively correlated with “HIV” ( $r=-0.399$ ,  $p<0.0001$ ), “AIDS” ( $r=-0.392$ ,  $p<0.0001$ ), and



**Fig. 2** Search frequencies for HIV related terms by country from 2018–2021. The color intensity represents the percentage of searches for the leading search term in a particular region. Search term popular-

ity is relative to the total number of Google searches performed at a specific time, in a specific location

“HIV/AIDS” ( $r=-0.68$ ,  $p<0.0001$ ). On the other hand, the poverty headcount ratio showed a positive correlation with “HIV” ( $r=0.187$ ,  $p=0.030$ ), “AIDS” ( $r=0.147$ ,  $p=0.088$ ), and HIV/AIDS ( $r=0.401$ ,  $p<0.0001$ ). Furthermore, HIV prevalence is correlated positively with the search terms “HIV” ( $r=0.427$ ,  $p<0.0001$ ), “AIDS” ( $r=0.356$ ,  $p<0.0001$ ), and “HIV/AIDS” ( $r=0.601$ ,  $p<0.0001$ ).

## Discussion

This study showed a significant decrease in the global online interest in HIV/AIDS-related healthcare services during the Covid-19 pandemic. This reduction was mirrored in Youtube, another popular platform. This drop in online search interest might be due to shifting concerns from HIV to Covid-19 during the pandemic. This reduction parallels the decrease in online interest in other non-covid chronic diseases such as obesity, cancer, and rheumatic and ophthalmologic diseases [31–35]. Cancer screening online searches have significantly reduced during the pandemic [32]. Online interest in invasive surgery has also decreased [22].

The decrease in online interest is paralleled by an evident reduction in physical visits to HIV clinics during the Covid-19 pandemic. Several countries have shown reductions in

HIV testing/screening performed, leading to decreased HIV diagnoses and timely initiation of treatment [11, 12]. The decline in testing has been attributed to nationwide lockdown, transportation difficulty, travel requirements, and patients’ fear of contracting covid-19 in HIV clinics [36, 37]. For example, in the Philippines, monthly numbers from the Department of Health HIV and AIDS Registry showed a decline from a median of 1092 reported cases/month in 2019 to 620 cases/month in 2020 (Supplementary Table VI) [38–40]. A decrease in HIV diagnosis might be due to an actual reduction in incidence because of a decline in risky behaviors. Risky sexual behaviors, including multiple sexual partners and condomless sex, decreased during the period with heightened pandemic restrictions [41, 42]. However, there is concern that many HIV diagnoses are missed or delayed because of Covid-19 associated lockdowns [43]. In addition, there is evidence of reduced access to and utilization of STD and HIV services despite continued risky sexual behavior [44]. Moreover, a Japanese survey showed that HIV cases with AIDS diagnosis increased during the pandemic when seasonality effects were removed [45].

Our results also showed decreased online search interest for commonly used HIV medications. Internet health information-seeking behavior was previously shown to be associated with adherence to ART [46]. Thus, the observed

**Table 2** Correlations between country-specific socioeconomic indicators and search volume indices for HIV search terms. (Spearman's correlation)

Country specific characteristics	Search Terms	Spearman r	p-value
HIV prevalence	"HIV"	0.4273251	< <b>0.0001</b>
	"AIDS"	0.355592746	< <b>0.0001</b>
	"HIV/AIDS"	0.600515185	< <b>0.0001</b>
GDP	"HIV"	-0.393784924	< <b>0.0001</b>
	"AIDS"	-0.395379888	< <b>0.0001</b>
	"HIV/AIDS"	-0.403432255	< <b>0.0001</b>
GDP per capita	"HIV"	-0.147535477	<b>0.041</b>
	"AIDS"	-0.078655427	0.279
	"HIV/AIDS"	-0.522355369	< <b>0.0001</b>
Physicians per 1000 population	"HIV"	-0.398875982	< <b>0.0001</b>
	"AIDS"	-0.392127563	< <b>0.0001</b>
	"HIV/AIDS"	-0.681560063	< <b>0.0001</b>
Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of the population)	"HIV"	0.186838184	<b>0.030</b>
	"AIDS"	0.147188438	0.088
	"HIV/AIDS"	0.400725982	< <b>0.0001</b>
Multidimensional poverty headcount ratio (% of the total population)	"HIV"	-0.045179434	0.734
	"AIDS"	-0.063932815	0.637
	"HIV/AIDS"	0.255086366	0.051
Unemployment, total (% of the total labor force) (modeled ILO estimate)	"HIV"	0.016358631	0.833
	"AIDS"	0.013221514	0.865
	"HIV/AIDS"	-0.004636209	0.951

reduction in online search interest for HIV medications may reflect the decrease in adherence to ART in different countries. This was observed in several countries, which showed declines in ART initiation during the pandemic [11]. In addition, a decrease in adherence to ART in patients living with HIV has also been noted [47]. Early initiation of and adherence to ART is known to decrease HIV mortality; thus, decreases in ART treatment are alarming because this jeopardizes the health status of patients living with HIV [6].

There is an over-representation of low to middle-income (LMIC) nations in the top countries for HIV/AIDS-related search terms. Furthermore, HIV SVIs correlate positively with HIV prevalence. SVIs and HIV prevalence correlate negatively with GDP, GDP per capita, and the number of physicians per country (Table 2; Supplementary Table IV). This negative correlation was also reflected in the geographical distribution of online interest in HIV search terms. These terms were most popular among LMIC countries. These results can be explained by the relatively high burden of HIV in these countries [2, 3]. The correlation with physicians per country also highlights people's desire for HIV information in countries with limited resources, especially regarding health care services.

Government leaders can utilize the findings of our study in framing policies amidst global pandemics. Drops in

online interest in HIV care search terms during the COVID-19 pandemic, paralleled with a reduction in HIV clinic visits, testing, and ART initiation signifies that healthcare personnel should be proactive in engaging PLHIV in their healthcare. In addition, systems should be in place to provide necessary services such as diagnostics, medications, and treatment in the face of pandemic restrictions.

This study has several limitations. Although the most popular search tool, Google is not the sole web search engine. This online search engine is also not available in all countries. Countries without Google trends data were not included in the analysis. The data generated from Google Trends is subject to the inherent nonrepresentative sampling bias in Google search trends. This study only included data collected from people with internet access and may have inadvertently excluded lower-income groups with limited access or areas with issues with freedom of speech. Despite these limitations, we have successfully shown a decline in global online interest in HIV-related care services during the Covid-19 pandemic, which is concerning.

## Conclusion

This Google Trends analysis demonstrated a significant drop in online interest in HIV care and services during the Covid-19 pandemic. This decrease in online interest mirrored the observed reduction in HIV clinic visits, testing, and ART initiation. Thus, healthcare personnel should be proactive in engaging PLHIV in their healthcare. Systems should be in place to provide necessary services such as medications and treatment in the face of pandemic restrictions. In addition, we showed that SVI for HIV-related search terms was positively correlated with HIV prevalence and negatively correlated with GDP, GDP per capita, and physicians per 1000 population. These findings highlight the high burden of disease of HIV in LMIC and the desire for HIV-related information among their citizens. Therefore, there is a need to improve access to the internet and the quality of HIV-related health information online due to its importance in HIV patient care. Furthermore, online health literacy and health-seeking behavior, especially in areas with a high disease burden, are needed to realize the goal of HIV/AIDS elimination. Overall, we showed the utility of Google Trends analysis in assessing the dynamics of online interest in HIV care services before and during the Covid-19 pandemic.

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**Author Contributions** EDBO and OAGT contributed to conception and design. Data collection and analysis were performed by EDBO and OAGT. First draft of the manuscript was written by EDBO and all



authors commented on previous version of the manuscript. All authors read and approved the final manuscript.

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**Data Availability** The authors confirm that the data supporting the findings of this study are available within the article and its supplementary material.

**Code Availability** Not Applicable.

## Declarations

**Competing Interests** The research was conducted in the absence of any commercial or financial relationships that could be construed as a potential competing interest.

**Ethics Approval** No Ethics Approval are required since all data are publicly available.

**Consent to Participate** Not Applicable.

**Consent for publication** Not Applicable.

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