

## GOOGLE TREND AND MASSVIEW ANALYSIS OF INTERNET SEARCH PATTERNS OF COVID-19 SYMPTOMS

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### Dear editor,

The corona-virus (COVID-19) has ravaged the entire world and the mass population is highly susceptible to the ferocious impacts of the mutated version of this pandemic (Nawaz et al. 2021). Over the last couple of weeks, the sharp pangs of this global epidemic have been enormously creeping across the United States, Brazil, India and has been excessively inflicting a state of fear, distress, anxiety, and seclusion among the individuals, employees, and organizations (Gautam & Sharma 2020, Sharma et al. 2020, Hamouche 2021, Ayaz & Dincer 2021). As per the WHO and government advisories, fatigue, nausea, sneezing, loss-of-taste, loss-of-smell, and chest pain are some of the moderate and critical indications of COVID19 (Klopfenstein et al. 2020). In 2020, a significant number of internet searches have been made for a wide range of COVID19 related terms viz. cough, cold, fever, loss of smell, loss-of-taste, mental-health, stress, anxiety, hand-wash, sanitization, coronavirus, mask, pandemic, epidemic etc. The main contribution of this work is to highlight the rate of internet activities (searches) of five major symptoms and other key terms (COVID19 vaccine, pandemic, testing, fever, cold, chloroquine, misinformation regarding COVID19, the impact of COVID19 on education, environment, and tourism) of this pandemic.

The extensive analysis of this study is carried out using Google trend (<https://trends.google.com/trends/>) and mass view analysis (<https://pageviews.toolforge.org/massviews/>) tools. The cumulative, average and standard deviation of the internet activities for different terms (cough, cold, fever, loss of smell and taste) for ten major countries i.e. United States, Brazil, India, Russia, Spain, Mexico, United Kingdom, Canada, Italy and Saudi Arabia have also been computed. Different hypotheses have been designed to understand the relationship in the internet activities related to the cough, cold, fever, loss-of-smell and loss-of-taste of top three COVID-19 infected countries viz. United States, Brazil and India. The hypotheses for the same have been mentioned below:

**Hypothesis 1:** Do the internet activities related to the search of the key term 'Fever' of American and Brazilian users differ during the pandemic period.

**Hypothesis 2:** Do the internet activities related to the search of the key term 'Fever' of American and Indian users differ during the pandemic period.

**Hypothesis 3:** Do the internet activities related to the search of the key term 'Fever' of Brazilian and Indian users differ during the pandemic period.

**Hypothesis 4:** Do the internet activities related to the search of the key term 'Cough' of American and Indian users differ during the pandemic period.

**Hypothesis 5:** Do the internet activities related to the search of the key term 'Cold' of American and Indian users differ during the pandemic period.

**Hypothesis 6:** Do the internet activities related to the search of the key term 'Loss-of-Smell' of American and Indian users differ during the pandemic period.

**Hypothesis 7:** Do the internet activities related to the search of the key term 'Loss-of-Taste' of American and Indian users differ during the pandemic period.

The trend values of Google searches for five major COVID-19 symptoms (cough, cold, fever, loss of smell, loss-of-taste) has been examined. A high rate of search trend has been witnessed for cough, cold and fever as compared to the loss of smell and taste. A peak of searches for the terms viz. cough, cold, fever, loss of smell and loss-of-taste have been observed in March 2020. However, the exception lies with China, where the highest search trend has been found in the month of the end of January 2020. The highest rate of internet activities has been witnessed for the key term 'fever' among different countries viz. United States, Brazil, Russia, Spain, Canada, and Italy. However, for India, Mexico, United Kingdom, Saudi Arabia, and Australia the maximum number of searches have been recorded for 'cough'. After March 2020, a rise in Google search trend has been recorded for loss of smell and taste for India and Saudi Arabia respectively.

Table 1 depicts the cumulative, mean and standard deviation of the internet activity for five distinct COVID19 related key terms i.e. cough, cold, fever, loss-of-smell, and loss-of-taste.

As stated earlier, seven different hypotheses have been designed to determine the correlation between the rate of internet activities (searches) of the top three COVID-19 infected countries (United States, Brazil, and India) for these five major symptoms. These hypotheses have been tested using a T-test. The results (t-stat, the p-value for one and two tail, t critical for one and two tail) of the hypothesis designed in section 2 are presented in Table 2.

As the p-value for all the hypothesis is less than 0.05, therefore, all the hypothesis mentioned in section 3 have been rejected. Concerning the COVID-19 disease, the Wikipedia analysis for the source ([https://en.wikipedia.org/wiki/Coronavirus\\_disease\\_2019](https://en.wikipedia.org/wiki/Coronavirus_disease_2019)) has been carried out to find out the rate of internet activities of COVID-19 related items. A significant number (1736) of different wiki-links have been found. A high rate of page views has been found over seven months (1/1/2020 - 7/31/2020). The page view analysis of different COVID-19 related terms viz. vaccine, pandemic, testing, fever, cold, chloroquine, misinformation, impact on education, environment, and tourism has been accessed. A high rate of page views has been witnessed for the key terms 'pandemic' followed by 'testing' and 'vaccine'. However, the least page views have been explored for the term 'impact of COVID-19 on tourism'.

**Table 1.** Cumulative analysis of internet activity of COVID19 related key terms

Country	Metric	Cough	Cold	Fever	Loss of Smell	Loss of Taste
United States	Cumulative Sum	8080.00	7260	8252.00	269.00	270.00
	Mean	38.29	34.40	39.11	1.27	1.28
	Standard Dev	18.26	16.83	16.52	0.76	0.62
Brazil	CumulativeSum	5798.00	2028	8678.00	10.00	9.00
	Mean	27.48	9.611	41.13	0.05	0.04
	Standard Dev	13.20	4.553	12.55	0.21	0.20
India	CumulativeSum	9204.00	7426	9160.00	230.00	196.00
	Mean	43.62	35.2	43.41	1.09	0.93
	Standard Dev	14.66	7.99	10.20	0.93	0.61
Russia	CumulativeSum	9156.00	2046	11265.00	9.00	0.00
	Mean	43.39	9.697	53.39	0.04	0.00
	Standard Dev	20.94	4.163	12.86	0.20	0.00
Spain	CumulativeSum	3031.00	1460	4562.00	21.00	18.00
	Mean	14.36	6.919	21.62	0.10	0.09
	Standard Dev	10.48	5.307	15.70	0.30	0.28
Mexico	CumulativeSum	11142.00	2019	8151.00	16.00	12.00
	Mean	52.81	9.5687	38.63	0.08	0.06
	Standard Dev	16.88	3.2274	6.42	0.26	0.23
United Kingdom	CumulativeSum	4621.00	3651	2453.00	261.00	257.00
	Mean	21.90	17.30	11.63	1.24	1.22
	Standard Dev	17.29	9.36	10.09	1.22	1.12
Canada	CumulativeSum	5566.00	6257	6305.00	141.00	150.00
	Mean	26.38	29.65	29.88	0.67	0.71
	Standard Dev	14.20	17.042	16.86	0.55	0.51
Saudi Arabia	CumulativeSum	9949.00	5176	4719.00	219.00	153.00
	Mean	47.15	24.53	22.36	1.04	0.73
	Standard Dev	17.22	9.63	6.88	1.65	1.42
Italy	CumulativeSum	3992.00	1924	6906.00	14.00	8.00
	Mean	18.92	9.12	32.73	0.07	0.04
	Standard Dev	13.16	6.35	16.48	0.25	0.19

**Table 2.** Analysis of t-test of COVID-19 related internet activities

	Country	t Stat	P(T<=t) one-tail	t Critical one-tail	P(T<=t) two-tail	t Critical two-tail
Cough	United State and Brazil	6.96E+00	6.71E-12	1.65E+00	1.34E-11	1.97E+00
	United States and India	-3.30E+00	5.31E-04	1.65E+00	1.06E-03	1.97E+00
	Brazil and India	-1.19E+01	1.82E-28	1.65E+00	3.64E-28	1.97E+00
Cold	United State and Brazil	2.06E+01	5.17E-66	1.65E+00	1.03E-65	1.97E+00
	United States and India	-6.12E-01	2.70E-01	1.65E+00	5.41E-01	1.97E+00
	Brazil and India	-4.03E+01	8.20E-147	1.65E+00	1.64E-146	1.97E+00
Fever	United State and Brazil	-1.41E+00	7.97E-02	1.65E+00	1.59E-01	1.97E+00
	United States and India	-3.21E+00	7.11E-04	1.65E+00	1.42E-03	1.97E+00
	Brazil and India	-2.05E+00	2.07E-02	1.65E+00	4.13E-02	1.97E+00
Loss of smell	United State and Brazil	2.25E+01	1.50E-74	1.65E+00	3.01E-74	1.97E+00
	United States and India	2.23E+00	1.33E-02	1.65E+00	2.65E-02	1.97E+00
	Brazil and India	-1.58E+01	8.54E-45	1.65E+00	1.71E-44	1.97E+00
Loss of Taste	United State and Brazil	2.76E+01	1.29E-96	1.65E+00	2.59E-96	1.97E+00
	United States and India	5.87E+00	4.55E-09	1.65E+00	9.10E-09	1.97E+00
	Brazil and India	-2.01E+01	1.55E-63	1.65E+00	3.09E-63	1.97E+00

To summarize, a massive volume of internet activities related to COVID-19 has been globally seen over this period. A high prevalence of search practices has been reported for cough, cold and fever as compared to the loss of smell and taste. The high peaks have been observed during March 2020. The highest rate of internet activities has been endured for 'fever' among different countries viz. United States, Brazil,

Russia, Spain, Canada, and Italy. However, the largest number of searches for 'cough' has been registered for India, Mexico, UK, Saudi Arabia and Australia. All the hypotheses related to the internet activities of the United State, Brazil and India have been rejected as the p-value is less than 0.05. This rejection disapproves the fact that the search trend for fever of United State, Brazil and India user differs during this

pandemic period. Likewise, no significant variation in search trend of cough, cold, loss of taste and smell is recorded for the United States and Indian users. Besides, a significant page view rate has been witnessed for the key terms 'pandemic' followed by 'testing' and 'vaccine'. However, the least page views have been explored for the term 'impact of COVID-19 on tourism'. Additionally, the range of page views obtained using mass view analysis for the twelve different COVID-19 related key terms lies between 7.76E+04 to 1.12E+07.

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