C O R R E S P O N D E N C E

Investigating the impact of search results for fever, headache, cough, diarrhea, and nausea on the incidence of COVID-19 in India using Google Trends

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To the Editor,

We read with great interest the work of Lippi et al. (1) and believe their methodology is of great value in the current pandemic for several developing countries that are struggling to contain the pandemic. India is one such country, and it has recently become the epicenter of the pandemic as it became the first country to ever register more than 400,000 new cases of COVID-19 in a single day (2).

We conducted an electronic search using Google Trends (https://trends.google.com/trends) using the keywords "fever", "cough", "headache", "diarrhea", and "nausea" between January 1st,2021 to April 29th, 2021 for India. The number of new cases of COVID-19 in India during the same time period was obtained from Our World Data website (https://ourworldindata.org/coronavirus/country/india?country=~IND). We converted the data to obtain a weekly average and used Spearman's correlation via Analyse-it (Analyse-it Software Ltd, Leeds, UK) to evaluate the relationship between the keywords and the new cases of COVID-19 in India. We then proceeded to study the differences in r-values and 95% confidence interval (C.I) when the search keywords are projected on the number cases at weeks zero, one, two, and three (1).

The graph showed that the Google trends for fever and cough had a steeper rise than headache and diarrhea (figure 1). The change in the graph for nausea was minimal. A very strong correlation between the average scores for fever and cough was also reported

(r=0.950, 95% C.I: 0.860- 0.983). The correlation for the fever, headache, cough, diarrhea, and nausea for the same week were 0.802 (95% C.I: 0.513- 0.928), 0.845(95% C.I: 0.605-0.945), 0.902 (95% C.I: 0.736-0.965), 0.763 (95% C.I: 0.434-0.913), and 0.413 (95% C.I: -0.100-0.752) each respectively. The correlations for each symptom and the new cases seen in the subsequent first, second, and third weeks are shown in Table 1. The correlations for fever, headache, and diarrhea became stronger from week zero to three as they each tended to approach one. The correlation for cough first rose for week one, but eventually decreased between
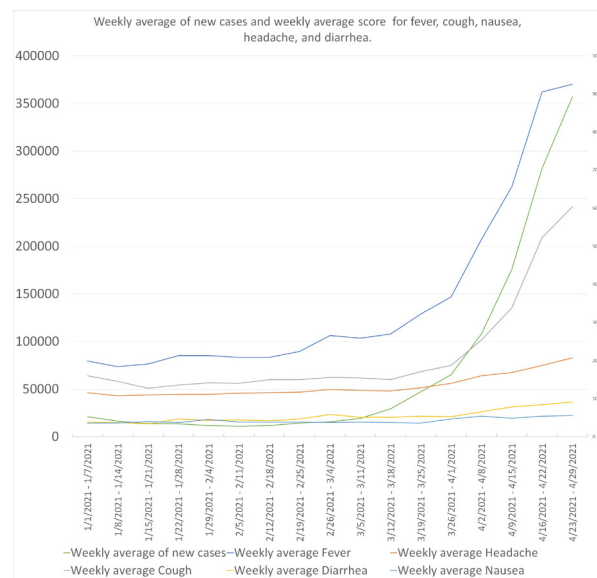

Figure 1.

Table 1. Correlations of symptoms with cases of COVID-19 in India

Stage	Fever (95% CI)	Headache (95% CI)	Cough (95% CI)	Diarrhea (95% CI)	Nausea (95% CI)
Index week	0.802 (0.513-0.928)	0.845 (0.605-0.945)	0.902 (0.736-0.965)	0.763 (0.434-0.913)	0.413 (-0.100-0.752)
One week later	0.848 (0.598-0.948)	0.935 (0.814-0.978)	0.932 (0.806-0.977)	0.816 (0.526-0.936)	0.373 (-0.166-0.740)
Two weeks later	0.882 (0.665-0.962)	0.952 (0.853-0.985)	0.878 (0.656-0.960)	0.844 (0.574-0.949)	0.354 (-0.207-0.741)
Three weeks later	0.938 (0.806-0.981)	0.956 (0.859-0.987)	0.806 (0.467-0.938)	0.883 (0.654-0.964)	0.283 (-0.308-0.716)

weeks two and three. The data for nausea was statistically not significant.

A real time-analysis using the most common symptoms of an infectious disease can be a beneficial tool in preparing a community against a future outbreak. In their analysis for Italy, Lippi et al. found statistically significant correlations within a three-week delay for fever and cough (1). Headache showed the strongest correlation in our study over the different time frames. The changes and the rise in cases can also be closely linked with the level of discomfort and desire for the individuals to seek medical help and be tested. Nausea is usually a short-lasting symptom, and it showed no statistical significance in predicting any changes in new number of cases of COVID-19. Our study also showed that the correlation of cough was strongest after one week, but eventually, decreased. This could also be related to the level of discomfort pushing the individuals to seek medication at home or the hospital.

Several reports have suggested that COVID-19 patients can be stigmatized in some areas in India (3). The authorities are encouraged to readdress these questions at different levels:

• Can patients link their symptoms with a possible COVID-19 diagnosis?

• Are patients hesitant to seek help because of social stigmatization?

• Are patients unwilling to seek help and be tested because of costs?

• Are patients afraid to be diagnosed with COVID-19 because of its mortality rate?

Google Trends for fever, headache, cough, and diarrhea can be a useful tool during a pandemic. Careful monitoring of the changes can help identify potential outbreaks of COVID-19, and identify any issues between appearance and symptoms and being diagnosed.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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