Online Health Information Seeking Behaviour Due to COVID-19 Pandemic-Induced Health Related Anxiety among the General Population in India

Bright Heber R1*, Chandy Sujith J2, Rajkumar Pradeep1, Dona Maria Philip3

Abstract
Background: Persons with anxiety regarding health may have an increased tendency to seek online health information especially during a pandemic. The primary objective of this study was to determine COVID-19 induced health anxiety among the general population in India using Google Trends data.

Methods: Online health information seeking behaviour with respect to high-risk comorbid conditions for severe COVID-19 disease during the pandemic period was compared to that of the previous year. Correlation between the COVID-19 incidence and online health information seeking behaviour was also computed to explore if the observed health anxiety was due to the pandemic.

Results: Overall, the online health information seeking behaviour was highest for diabetes both during (81.46±8.84) and before the pandemic (64.47±9.48). A significant increase (p<0.001) in the information seeking behaviour during the pandemic was observed with all the four high-risk comorbid conditions including diabetes (+16.99), hypertension (+22.57), lung disease (+21.79), and cardiovascular disease (+14.08). The behaviour with respect to diabetes (r=0.39), hypertension (r=0.48) and lung disease (r=0.69) showed significant positive correlation with the COVID-19 incidence. The observed health anxiety was regardless of prevalence, urbanization and literacy rates of individual states.

Conclusions: The general population in India has increased its online health information seeking behaviour during the pandemic and this may be due to an underlying health anxiety due to COVID-19.

Introduction
Healthcare delivery has been one of the most affected services in India during the COVID-19 pandemic due to heightened restrictions to contain the spread of the SARS-CoV-2 virus.1 Anecdotal evidence suggests that the pandemic together with these restrictions have created apprehensions especially among those with comorbid conditions such as diabetes, hypertension, asthma, COPD, and cardiovascular disease which are known to be risk factors for more severe COVID-19 disease.2 These apprehensions appear genuine due to the elevated mortality rate following COVID-19 infection and the challenge in obtaining routine medical care due to reduced access to healthcare facilities.3,4 Unfortunately, there is no objective evidence yet on health anxiety among the high-risk general population in India.

Having said that, measuring health anxiety among the general population has always been a challenge. This is because anxiety is often a subjective assessment measured using structured, interviewer-administered instruments and self-reports. These tools are labor intensive and are almost always bound to clinical settings with minimal scope for the general population. However, recent evidence suggests that those with health anxiety have increased tendency of online health information seeking behaviour.5,6 This increase can be objectively measured using data obtained from Google Trends, an open online tool, which is being increasingly recognized as an important data source for public health research.

To fill the gap in the evidence, we therefore determined health anxiety among the general population in India, by assessing trends of Google search queries for high risk comorbid conditions, comparing the COVID-19-time period with the corresponding time period of the previous year.

Methods
Study population and design: This was a web based infodemiology study employing digital epidemiological data to study health anxiety due to the COVID-19 pandemic among the general population in India.

Data source: We obtained information seeking behaviour data from Google Trends, a publicly available repository of data on real-time user search patterns. Google Trends data is based on search patterns using the Google search engine that has a market share of over 98% in India.7 We first created a set of search terms (Table 1) that were assumed to be used by the general population for each comorbid condition and then used the “+” sign that allows Google Trends to combine search terms and retrieve the combined data. For each set of search terms, Google Trends provides a Relative Search Volume (RSV) that is represented as a value between 0, indicating the lowest and 100, indicating the highest share of the terms over a specified time period.

In addition to the high-risk...
comorbid conditions including diabetes, hypertension, lung disease, and cardiovascular disease, we also extracted data pertaining to HIV/AIDS and liver disease, the impact of which on COVID-19 is low or uncertain at the time of this study.

We obtained the daily COVID-19 incidence data using the latest available public data from a crowdsourced initiative (covid19india.org) that utilizes data from official sources.

We also computed state-wise online health information seeking behaviour due to the pandemic from Google Trends and evaluated the influence of urban and rural ratio and literacy status. In addition, we calculated state-wise prevalence of COVID-19 per million population using the latest available census data (2011) and assessed its association with online health information seeking behaviour.

**Study period:** RSVs of search terms from April 1 to September 30, 2020 were compared to those corresponding to the same time period of the previous year, 2019.

**Process:** The data extraction took place in early December 2020. We restricted the data category to “health”, geographical region to “India” and customized the time range to correspond with our study period. The RSVs of individual comorbid conditions were compared between both the predetermined time periods. To understand if the change in online health information seeking behaviour is associated with the pandemic, we performed correlation analyses between RSVs of comorbid conditions and daily COVID-19 cases in India. We compared the online health information seeking behaviour between states and applied statistical tests to know if urbanisation, literacy rate or prevalence of the disease had any influence on this.

**Statistical analysis:** We compared the means of RSVs of the pandemic period with that of the previous year for each comorbid condition using independent T test. We also calculated correlation coefficients (Spearman’s ρ) for each of the comorbid conditions. We used STATA 16.0 and SPSS 21.0 to analyze the data. Alpha < 0.05 was considered statistically significant.

**Institutional review board approval** was obtained for these analyses.

**Results**

Overall, the online health information seeking behaviour before the pandemic was highest for diabetes (64.47±9.48) followed by lung disease, hypertension, HIV-AIDS, hepatitis and cardiovascular disease. During the pandemic, the pattern remained the same except for cardiovascular disease which surpassed that of hepatitis (Table 2). The COVID-19 daily incidence steadily increased from 423 on 1st April, 2020 to 86,748 on 30th September, 2020.

**Change in online health information seeking behaviour during the pandemic**

Information seeking behaviour in relation to all high-risk comorbid conditions such as diabetes (p<0.001), hypertension (p<0.001), lung disease (p<0.001), and cardiovascular disease (p<0.001) significantly increased during
the pandemic period as compared to the period before the pandemic. Overall, information seeking increased the highest for hypertension (+22.57). The change in information seeking behaviour of high-risk conditions are shown in Table 2. The behaviour with respect to high-risk conditions was found to have an increasing trend during the pandemic that continued to remain higher than the baseline until September 30, 2020. However, the behaviour remained constant before the pandemic. Conversely, the behaviour with respect to conditions such as HIV-AIDS (p<0.001) and hepatitis (p=0.005) significantly reduced during the pandemic. Trend of information seeking behaviour of all comorbid conditions are shown in Figure 1. COVID-19 related information seeking behaviour also spiked in relation to the announcement of the first lock-down in the country on 22nd March 2020 (Figure 2).

### Interstate variation in online health information seeking behaviour

The per million period prevalence of COVID-19 till September 2020 was found higher in Goa, Puducherry, New Delhi, Andhra Pradesh and Maharashtra. Conversely, the least prevalent states were Bihar, Madhya Pradesh, Mizoram, Meghalaya and Rajasthan. However, the prevalence of the disease in individual states did not correlate with corresponding online health information seeking behaviour (p = 0.245). In the most urbanized areas including New Delhi, Chandigarh, Puducherry, Goa and Mizoram, the online health information seeking behaviour was no different from Bihar, Assam, Odisha, Meghalaya, and Uttar Pradesh which are least urbanized (p = 0.399). Similarly, in Kerala, Mizoram, Goa, Tripura and Andaman where the literacy rates are high, the online health information seeking behaviour did not differ significantly from Bihar, Rajasthan and Jharkhand where the literacy rates are relatively low (p = 0.521). The correlation coefficients of prevalence, urbanization and literacy rate are shown in Table 3.

### Table 3: Correlation between online health information seeking behaviour and other potential factors

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>Correlation coefficient</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence</td>
<td>0.21</td>
<td>0.245</td>
</tr>
<tr>
<td>Urbanization</td>
<td>0.15</td>
<td>0.399</td>
</tr>
<tr>
<td>Literacy rate</td>
<td>0.11</td>
<td>0.521</td>
</tr>
</tbody>
</table>

### Table 4: Correlation between information seeking behaviour and COVID-19 incidence

<table>
<thead>
<tr>
<th>Comorbidity conditions</th>
<th>Correlation coefficient (mean)</th>
<th>Incidence rate ratio (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>+0.39</td>
<td>1.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>+0.48</td>
<td>1.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>-0.01</td>
<td>0.99</td>
<td>0.89</td>
</tr>
<tr>
<td>Lung disease</td>
<td>+0.69</td>
<td>1.06</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HIV-AIDS</td>
<td>-0.30</td>
<td>0.95</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>+0.20</td>
<td>1.02</td>
<td>0.005</td>
</tr>
</tbody>
</table>

### Discussion

This study found a significant increase in online health information seeking behaviour concerning diabetes, hypertension, lung disease and cardiac disease. This may be attributed to considerable health anxiety due to COVID-19 among the general population. The rise in health information seeking had significant positive correlation with COVID-19 daily incidence. The behaviour remained elevated throughout the study period indicating that the general population has not recovered from the health anxiety until September 30, 2020. The behaviour with respect to conditions such as HIV-AIDS and hepatitis, however, significantly reduced concurrently. This may be because, despite being immunosuppressive, HIV-AIDS and hepatitis were not reported to be risk factors for severe COVID-19 during the study period. Though HIV-AIDS has been associated with severe COVID-19 much later, a majority of patients included in these studies had comorbidities including diabetes, hypertension, cardiovascular disease and lung disease. Further, earlier studies even showed that outcomes in patients with HIV-AIDS was similar to that of general population. A recent meta-analysis also found no increased COVID-19 related mortality among those with liver disease, but found significant increase among those with high-risk comorbidities included in our study. Media coverage that often preceded peer-reviewed scientific reports may have also influenced the general population, who may have then shifted their online health information seeking behaviour towards high-risk conditions.

Previous studies have reported COVID-19 induced generalised anxiety among healthcare workers, those who were quarantined and the general public. However, the findings from these studies were all based on subjective measures obtained using structured questionnaires. Recently, fear of the pandemic, manifested as excess online search volume, was reported in a retrospective study that used objective data from Google Trends. The study, however, aimed to predict the influence of pandemic-induced fear on stock markets. Nevertheless, health anxiety among the general population has not been measured yet using objective data due to methodological limits. We adopted this relatively novel method of measuring health anxiety by taking advantage of the recent evidence indicating increased online health information seeking behaviour due to health anxiety. Health anxiety or fear of illness is known to prompt individuals to search for health information online and once the fear subsides, the behaviour decreases or disappears. Direct comparison of the present study, therefore, is limited by differences in study design. Nevertheless, the same outcomes have been studied previously in selected groups and our findings are consistent with those.

A recent Google Trends study reported a significant increase in online health information seeking behaviour among the global population regarding lung disease, however, no change was observed with respect to diabetes or hypertension in contrast to our findings. A possible explanation for this difference in the behaviour is that the global study was conducted early during the course of the pandemic when lung disorders...
were more associated with a worse prognosis of COVID-19. Diabetes, hypertension, and cardiovascular disease were reported to be risk-factors only later in relation to lung disorders. A relatively large disease burden of diabetes, hypertension and cardiovascular disease in India may also partly explain the increase in the behaviour in our study.

A significant increase in the online information seeking behaviour among the general population in the US has been recently reported. The increase in the behaviour significantly correlated with the increase in COVID-19 incidence when the data from the US as a whole was considered. However, the study found no such correlation when the incidence and corresponding information seeking behaviour of individual states were compared.20 We too observed a similar pattern in India with regards to anxiety where individual state-wise COVID-19 incidence did not correlate with respective information seeking behaviour, however, a strong correlation was observed when India as a whole was considered. This could be because proactive measures and public health policies pertaining to the pandemic are first implemented at the national level. The general population is more likely to be impacted by the measures taken at the national level irrespective of the disease burden at respective states.

There is inconclusive evidence on factors associated with online health information seeking behaviour. Previous studies have found education, health literacy, female gender and young people to have positive association.22,23 Due to methodological limits we were unable to compute the effect of population demographics. However, we analyzed and found both urbanization and literacy rates of states to have no influence on the online information seeking behaviour. The reason could be that internet penetration in India has been increasing exponentially as compared to urbanization and literacy rates. Recent statistics suggest that at least 50% of India’s population has internet access.24 In addition, evidence suggest that having a diploma or not is not associated with online information seeking among adults, rather internet experience is associated.25

Limitations of this study are inherent to the study type. Firstly, infodemiology studies are more likely to be representative of populations using the internet and not the entire population. Another limitation is the lack of detailed information on the study population such as the demographics that impedes further characterization and subgroup analysis. Furthermore, Google Trends only permits the use of a limited number of search terms per query and hence we could not use a comprehensive list of terms that the general population may have used. However, this factor is less likely to affect the data obtained since we used all relevant popular terms that form at least part of the excluded terms.

In conclusion, this study suggests that the general population in India exhibits significant increase in online health information seeking behaviour due to COVID-19 and this may be attributed to health anxiety. We demonstrated that Google Trends analysis is able to uncover health anxiety among the general population indirectly by measuring relevant Google RSVs as they appear in real time. This helps to identify vulnerable groups and thus may be effective during other major global or national events in future. It is hoped that the findings of this study will help policy makers and healthcare professionals recognize the prevailing issue of health anxiety during this pandemic period. This can then lead to interventional strategies to mitigate the risks associated with health anxiety in the population.

**Funding**: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Key Messages**

Regardless of COVID-19 prevalence in individual states, the general population in India exhibits significant health anxiety regarding high-risk comorbid conditions for severe COVID-19 disease such as diabetes, hypertension, lung disease and cardiovascular disease as evidenced by increased online health information seeking behaviour.

**References**


