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Public interest and awareness regarding general health, sleep quality and mental wellbeing during the early COVID-19 pandemic period: An exploration using Google trends



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ABSTRACT

The internet network continues to be a major source of health-related information. Our research provides insights into the online health-seeking behaviors of the general population, and evaluates the potential relationship between the COVID-19 pandemic and public interest and awareness of general sleep health, mental health and wellbeing.

Google Trends' weekly relative search volumes (RSVs) were examined during 2020 for searches specifically related to COVID-19 symptoms, and for searches related to general health, sleep and wellbeing, in the United Kingdom, the United States of America, France, Italy and Japan. To obtain insight into the association between the initiation of public restrictions and online search trends, we assessed a six-week period; the 'early pandemic period' (EPP) (01 March 2020 – 11 April 2020). To provide a meaningful pre-pandemic comparison, a similar period during 2019 (03 March – 13 April 2019) was compared for RSV and median difference analysis.

The EPP was associated with increased online searches related to COVID-19 symptoms, as compared with those related to more general sleep health, mental health and wellbeing. The latter search terms frequently showed a decrease or minimal change in RSV during the EPP compared with the equivalent period in 2019. This finding illustrates the potential link between the COVID-19 pandemic and online search behavior and corroborates existing findings regarding internet searches during this period.

Proactive communication by healthcare professionals during future pandemics and as an ongoing measure could help prevent public neglect of general health and wellbeing symptoms, and encourage reporting and early intervention.

1. Introduction

As we move past the one-year anniversary of the first national lockdowns across several countries, it is acutely apparent how broad-ranging the effects of the COVID-19 pandemic will be on public mental health. The pandemic has irrevocably changed the way billions of people live; in their home life and work life, people's ability to socialize and interact was dramatically limited via sudden governmental restrictions [1–3].

Many people lost their livelihoods or suffered unemployment and this, alongside school closures and the responsibility of parents to support with home-schooling and social isolation will have heightened mental health issues and disruption to sleep. During such a stressful and anxiety-inducing period, restful and healthy sleep is particularly impor-

tant to public health and mental wellbeing. However, it is of no surprise to learn that survey evidence from healthcare and frontline workers, as well as the general population, shows that insomnia and poor sleep quality during the pandemic were prevalent [4–6].

Sleep problems, even before the pandemic, played a growing part in public health concerns, particularly because of their association with deficiencies in cognitive function, optimal mental health, motivation and emotional resilience [7–10]. Even when sleep disorder symptoms are not considered clinically relevant according to specific diagnosis criteria, there is a well-documented impact on health-related factors such as fatigue, weight management, immune function, cognitive performance, memory and concentration, as well as for diseases such as cancer, cardiovascular disease and diabetes [7–12]. Despite the acknowledged impact of good sleep hygiene, proven approaches such as cognitive behav-

Abbreviations: CBT-I, cognitive behavioral therapy for insomnia; EPP, early pandemic period; RSV, relative search volume.

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ioral therapy for insomnia (CBT-I) are restricted to those patients who seek this treatment from sleep specialists and healthcare professionals. Nonetheless, guidance on sleep hygiene can be provided in print or online formats, which should provide the public with increased access to this education and information [13, 14].

Statistics demonstrate that online searches on health-related topics continue to rise. Indeed, 57% of US consumers would prefer to search online first rather than visit their doctor or healthcare professional (32%) [15]. Examining worldwide search behaviors could be a strong indicator as to which topics are top of mind for the average person looking for health information, and most helpful to address. Furthermore, if the public is dependent on ‘Dr Google’ for sleep and health-related queries, it would be informative to investigate how the pandemic and resulting lockdowns and lifestyle changes correlate with health-related public searches across several regions.

The analysis of online search trends is increasingly being used as a tool to understand general public interest and awareness in different disease areas [16–23]. Google is currently the most commonly used search engine worldwide for general use – accounting for 81.5% of all internet searches [24]. Therefore, analyzing Google searches in five prominent countries is a valuable tool to gain insights into sleep-related challenges. Considering the high prevalence of poor sleep globally [25–30], the analysis of sleep-related searches provides a unique insight into how information about sleep is obtained. These include the frequency of searches, content required, and common terminology used by the general population.

2. Methods

2.1. Google trends tool

Google Trends is a publicly available tool to provide data on the temporal trends of search queries the general population have submitted via the Google search engine, using weekly relative search volume (RSV). Weekly RSV is calculated by Google Trends based on how often search terms were entered in Google relative to the total search volume in a specific country or region. The search volume for a specific search term is normalized to range from 0 to 100, with 100 corresponding to the peak of RSV obtained for the search term during the period of interest (in this case, one year). This can be used as a proxy for changes in public interest across a year.

2.2. Selection of countries and time periods for assessment

We examined Google Trends weekly RSVs over one year (2019 or 2020) for searches specifically related to COVID-19 symptoms, and for searches related to general sleep, health and wellbeing, across five countries – the UK, the USA, France, Italy and Japan. The rationale for selection of these five countries was to gain a global perspective based on high-income countries in which Google is a commonly used search engine. Data were then selected for assessment during the ‘early pandemic period’ (EPP), which was defined as a six-week period (01 March 2020 – 11 April 2020), or an equivalent timeframe to the EPP (based on the weeks shown in the Google Trends output) in 2019 to generate a comparison with online search trends prior to the COVID-19 pandemic. For 2019, median weekly RSVs were calculated for 03 March 2019 – 13 April 2019. Selection of the EPP was based on an assessment of the dates and durations of the initial national public restrictions and lockdown periods due to the COVID-19 pandemic in the countries being assessed, to gain an insight into the association between these public restrictions and online search trends.

2.3. Selection of search terms for assessment

COVID-19 symptom-specific terms were selected based on symptoms described by the WHO [31]. The WHO constitution states that ‘health

is the state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity’ [32]. Whilst overall wellbeing proves challenging to define, frameworks from approaches by WHO and the Medical Outcomes Study point to important health status concepts that influence functioning such as psychological distress, mental health, sleep and pain [33, 34]. General health and wellbeing search terms were selected to give an overview of these prevalent issues concerning sleep health, mental health and quality of life [28–30, 35–39]. The terms are shown in Table 1. Searches were conducted by Sciterion, a medical communications agency, and were based on the main language of the country being investigated, i.e., English for the UK and USA, French for France, Italian for Italy and Japanese for Japan.

Medians of the weekly RSVs were calculated using Microsoft Excel. These were assessed for the EPP in 2020 and compared with the equivalent period in 2019 for all search terms, and the results were summarized for each country. The difference in these median weekly RSVs (during the EPP versus the equivalent 2019 period) were compared, for each term across each country.

3. Results

The differences in median (per week) RSVs between the EPP in 2020 and the equivalent period in 2019 for the five countries are shown in Fig 1 and Supplementary Table S1.

Analysis of median RSVs for COVID-19 symptom-specific searches and general health and wellbeing searches in the USA between the EPP in 2020 and the equivalent period in 2019 are shown in Table 2. Initial lockdowns in the USA occurred between 15 March 2020 and 7 April 2020, depending on the state.

The results as illustrated in Fig 1 and Table 2 demonstrate that the differences in median weekly RSV between the EPP and the equivalent period in 2019 for COVID-19 symptom-specific related search terms were greater than for search terms related to general sleep, health, and wellbeing. This shows that the EPP was associated with increased online searches related to COVID-19 symptoms, as compared with those related to more general sleep health, mental health, and wellbeing. In the USA, searches related to ‘coronavirus disease 2019’ and ‘dry cough’ showed a marked increase during the EPP as assessed by the difference in median RSVs. This is in contrast with general health and wellbeing searches in the USA whereby four out of six search terms showed a decrease during the EPP, with little discrepancy between the EPP median weekly RSV and that of the equivalent period in 2019.

In some cases, for example the terms ‘insomnia’ and ‘depression’ in Italy and ‘difficulty falling asleep’ in France, the EPP of 2020 may have in fact had a negative association with online searches, highlighted by the comparison with search trends during the equivalent period in 2019.

4. Discussion

Internet search data are being increasingly used in healthcare studies to provide insights into population behavior and health-related phenomena [16–23]. The current study aimed to assess whether the EPP of 2020 affected general sleep, health and wellbeing searches, in relation to searches specific to COVID-19 symptoms and to searches conducted prior to the pandemic, in the equivalent period of 2019.

4.1. Potential ‘masking relationship’ related to the EPP

Whilst it is unsurprising that searches related specifically to COVID-19 symptoms increased in March and April 2020 (the EPP) due to the increased media attention surrounding the pandemic globally [40, 41], it is notable that some searches regarding sleep, health and wellbeing did not increase and in some cases even decreased relative to the equivalent period in 2019. From these findings, it could be conceived that a potential ‘masking relationship’ exists during such health crises as the

Table 1
List of search terms selected for assessment on Google Trends.

English	French	Italian	Japanese
COVID symptom-specific search terms			
Coronavirus disease 2019	Maladie du coronavirus	Malattia di coronavirus	新型コロナウイルス感染症 Shingata korona uirusu kamsenshō
Fever	Fievre	Febbre	発熱 Hatsu netsu
Anosmia	Anosmie	Anosmia	嗅覚障害 Kyūkaku shōgai
Sore throat	Mal de gorge	Gola infiammata	喉の痛みNodonoitami
Dry cough	Toux seche	Tosse secca	乾いた咳 Kawaita seki
Dysgeusia	Dysgueusie	Disgeusia	味覚障害 Mikaku shōgai
Fatigue	Fatigue	Fatica	倦怠感 Kentaikan
General health and wellbeing search terms			
Insomnia	Insomnie	Insomnia	不眠症 Fuminshō
Difficulty falling asleep	Troubles du sommeil	Difficoltà a dormire	入眠障害 Nyūmin shōgai
Depression	Dépression	Depressione	うつ病 Utsubyō
Psychological stress	Stress psychologique	Stress psicologico	心理的ストレス Shinri-teki sutoresu
Anxiety	Anxiété	Ansia	不安 Fuan
Pain	La douleur	Dolore	痛み Itami

*Data shown are normalized to range from 0 to 100, with 100 corresponding to the peak search volume obtained for the search term throughout the Year 2020 (EPP) or the Year 2019 (equivalent period). EPP, early pandemic period.

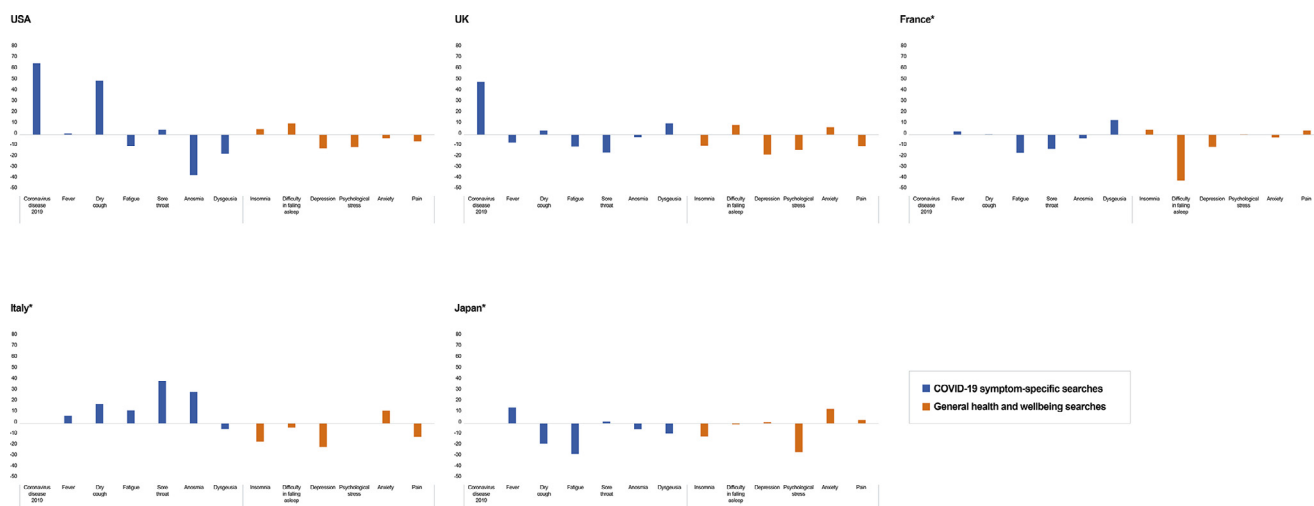


Fig 1. Differences in median relative search volumes between the early pandemic period in 2020 and the equivalent period in 2019. *The search term ‘coronavirus disease’ did not produce any results in 2019 for France, Italy or Japan, or in 2020 for Japan.

pandemic (and more noticeably during the EPP), which is linked with shifts in the general public’s online health searches.

This ‘masking relationship’ may be supported by a similar study, which used Google Trends data to evaluate the impact of lockdown in Europe and the USA. This recent study identified increases in search intensity for certain wellbeing terms due to lockdown, but significant decreases in searches for suicide, stress and divorce. A drop in searches for sleep was also associated with lockdown in Europe [42]. In other fields such as oncology, decreased pursuit of cancer-related information was seen during the COVID-19 pandemic in the USA [43]. Unfortunately, the larger ripple effect of such online health searches is perhaps indicative of a public tendency towards neglect of non-COVID symptoms and

consequential lack of reporting, referrals to secondary care and impact on health outcomes, which are already being reported in many regions [44–46].

Whether such a ‘masking relationship’ in online search tendencies could be attributed to observations by other researchers on excessive internet use, is yet to be defined. However, it is interesting to note that a link may exist between such a ‘masking relationship’ and online behavioral trends including cyberchondria (defined as obsessive online searching for health-related information, particularly about specific symptoms) [40]. Furthermore, certain research has recognized a condition where individuals are overwhelmed and cannot process all communication and information available, resulting in what has been termed

Table 2
Differences in median relative search volumes between the EPP and the equivalent period in 2019 in the United States of America.

Search terms	Median for the 2019 EPP equivalent* (03 March 2019 – 13 April 2019)	Median for EPP* (01 March 2020 – 11 April 2020)	Difference in medians
General health and wellbeing terms			
Insomnia	73.5	78.5	5
Difficulty falling asleep	47	57	10
Depression	93.5	80.5	-13
Psychological stress	96	84	-12
Anxiety	93.5	90	-3.5
Pain	95	88.5	-6.5
COVID-19 symptom-specific terms			
Coronavirus disease 2019	19	83.5	64.5
Fever	68.5	69.5	1
Dry cough	27.5	76	48.5
Fatigue	93	82	-11
Sore throat	66.5	71	4.5
Anosmia	62	23.5	-38.5
Dysgeusia	56.5	38.5	-18

* Data shown are normalized to range from 0 to 100, with 100 corresponding to the peak search volume obtained for the search term throughout the Year 2020 (EPP) or the Year 2019 (equivalent period). EPP, early pandemic period.

‘information overload’ [47]. Both behaviors, cyberchondria and information overload, have been identified as impairing cognitive reasoning in humans [40, 47-49].

Within the non-COVID-19-related sleep, health and wellbeing search terms, the median weekly RSVs in the USA showed little difference between the EPP and the equivalent period in 2019. In certain instances in France and Italy, the comparison of 2019 and 2020 search trends suggests that the EPP of 2020 may have reduced the volume of online searches (for example ‘difficulty falling asleep’ in France or ‘insomnia’ and ‘depression’ in Italy). Therefore, could it be that this ‘masking relationship’ was hiding the underlying sleep, health and wellbeing disorders that the general population, faced with the concerns induced by an emerging pandemic, were enduring?

4.2. Between-country differences

Some differences in results were observed between the countries selected for analysis. The most notable divergences in search trends based on the EPP could be seen in the USA and Italy. This may be due to factors such as the high number of Google users in the USA (over 267 million in 2020), or the fact that public restrictions began slightly earlier in Italy (21 February 2020 for ten municipalities). [50, 51] The EPP did not correlate with much change in search trends in Japan for general sleep, health and wellbeing terms as compared with COVID-19 symptom-specific terms. Reasons for this are unknown but may be partly due to the mild and non-coercive lockdown of Japan during the EPP, which relied on voluntary public co-operation [52], or due to differences in terminology used by native Japanese speakers when searching online.

It is of note that the term ‘coronavirus disease 2019’ did not produce any search results in the 2019 EPP equivalent period in France, Italy or Japan, but did generate results in the UK and the USA. The small number of searches for this term in the UK and USA prior to the COVID-19 pandemic may have been related to coronavirus variants other than SARS-CoV-2, for example SARS-CoV or MERS-CoV [53]. The reason as to why this term produced no search results in Japan in the EPP of 2020 remains unclear but may be due to differences in terminology used when searching in the Japanese language that were not detected by the Google Trends algorithm.

4.3. Existing evidence of associations between the COVID-19 pandemic, mental health, and sleep health

Recent literature concerning the COVID-19 pandemic and general and mental health disorders [2] have noted the impact of media and

local infection rates. Fiorenzato et al. [2] showed that both frequent consumers of COVID-19 mass media and those residing in highly infected areas or communities reported greater symptoms of depression and anxiety, with hypochondria being particularly prevalent in the latter group.

The relationship between stress, anxiety and difficulty sleeping is well established and research has shown that genetics, those of the female gender and a family history of insomnia, alongside environmental stress (such as a pandemic situation) all influence how an individual’s sleep system responds to stress [54]. Of interest is the recent OASIS study, a large randomized controlled trial of a psychological intervention for a mental health problem (conducted in a student population) [55]. This study provided compelling evidence of insomnia being a causal factor in mental health problems including psychotic episodes, and urges healthcare systems to consider that the control of sleep and the treatment of disrupted sleep could be placed at a higher priority in mental health services and provisions [55].

4.4. Study limitations

Our study includes several limitations regarding the Google Trends tool and selection criteria. Google Trends analyzes online searches at a general population level, and does not account for age, gender, underlying health conditions, or ongoing mental health or sleep-related issues. We are also unable to make complete interpretations as some internet users may use alternative search engines to Google. However, Google is a dominant internet search provider and accounts for 91% of desktop search traffic in Italy, 86% in the UK, 84% in France, 83% in the USA and 76% in Japan [56]. Google Trends calculates its data via a proprietary algorithm, which may call into question its accuracy and reproducibility as a resource for scientific research, but is nonetheless a useful tool [20].

The countries selected in this study are high-income countries. Comparison with low- or middle-income countries would be a valuable avenue for future research. The general health and wellbeing search terms in this study focused on certain sleep disturbances and mental health conditions. Future avenues of research could include additional search terms to give a broader understanding of online searches related to sleep disturbances, sleep disorders and mental health, for example terms around sleep quality, sleep apnea, parasomnias, excessive daytime sleepiness, and restless leg syndrome.

4.5. Wider implications for healthcare services

The COVID-19 pandemic is known to have markedly impacted sleep quality and mental health of the general population [4-6, 57-60]. Stud-

ies have highlighted the hidden burden of the pandemic on other aspects of healthcare and health services, and social-distancing rules implemented in 2020 resulted in a reduction in health-seeking and primary care consultations [44–46, 61, 62]. As we enter a time when the lockdown periods of the pandemic are (in the majority) coming to an end, researchers, healthcare professionals and economists are becoming increasingly aware of the long-term consequences of public restrictions and social-distancing laws on both health outcomes and healthcare resourcing requirements [63–66].

5. Conclusion

The findings of this study highlight the importance of increased vigilance from healthcare professionals and proactive communication with the general population during times of public health crisis such as the EPP. Such approaches will help generate solutions to support general mental health, sleep hygiene, sleep quality and wellbeing during such an occurrence, where media and public communication becomes largely focused on a specific topic such as COVID-19. As the pandemic has raised awareness of the importance of public health communication via media and online outlets, to population sectors with lower health literacy and with varying health-seeking behaviors [67–69], this is a time to look to the future and consider how we can apply our learnings to improve the general sleep health, mental health and overall wellbeing of the general population, both during future pandemic situations and as ongoing public health interventions.

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Declaration of Competing Interest

Professor Lemoine has received consulting and research grants from Sanofi Consumer Healthcare, unrelated to this publication.

Professor Koga declares no competing interests or financial disclosures.

Dr Bertin is a current employee of Sanofi Consumer Healthcare.

Dr Ebert has served as a consultant to/on the scientific advisory boards of Sanofi, Novartis, Minddistrict, Lantern, Schön Kliniken, Ideamed and German health insurance companies (BARMER, Techniker Krankenkasse) and a number of federal chambers for psychotherapy. He is a shareholder of the GET.ON Institute (HelloBetter).

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Supplementary materials

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