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Public awareness for "classic" childhood diseases and inflammatory syndromes in children during the COVID-19 pandemic

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ABSTRACT

Objectives: The objective was to analyze in silico public search interest during the COVID-19 pandemic for some classic infectious childhood diseases, e.g., measles, mumps, chickenpox, scarlet fever, and inflammatory diseases like Kawasaki disease and the pediatric inflammatory multisystem syndrome (PIMS).

Study design: In this study, a comparison of five childhood diseases in public search trends with the pediatric inflammatory multisystem syndrome was performed.

Methods: Google Trends data for the period of five years for six childhood diseases were used. We used topics coverings all languages worldwide and all connected search queries.

Results: Public search interest decreased during the COVID-19 pandemic for some classic infectious childhood diseases. Search interest for the pediatric inflammatory multisystem syndrome, despite strong indication of a connection with COVID-19, remained relatively low compared to Kawasaki disease.

Practice implications: Better understanding of Google Trends can map public awareness of childhood diseases in terms of time course and search intensity.

Conclusions: Public interest during the pandemic was generated for diseases with suspected connection to COVID-19, presumably due to media triggers.

Introduction

Google search engine is a worldwide database of people's search intentions. It shows what is currently searched. For several years data from Google Trends has been used to study, examine and even predict public interest in different diseases. This was named as infoveillance and infodemiology (Eysenbach, 2009). Since Google is known worldwide (with some exceptions, e.g. in China) and used by billions of people, it proves that data presented in Google Trends can be relied on.

Data collected in silico from Google Trends, Google Flu Trends, or Google Cloud Healthcare API have been widely used for a variety of medical indications (Springer, Zieger, & Strzelecki, 2021). Google Trends provides the content searched in Google as normalized data in relative search volumes (Springer, Zieger, & Strzelecki, 2021). Google Trends data were already demonstrated to reveal global childhood disease seasonality, identify outbreaks and forecast their magnitude (Bakker et al., 2016).

Coronaviridae forms a family of enveloped, single-stranded RNA viruses with, so far, seven human pathogenic representatives causing mild respiratory tract infections up to severe pneumonia (Corman et al., 2019). Severe acute respiratory syndrome-related coronaviruses-1, −2 (SARS-CoV-1, −2), and Middle East respiratory syndrome-related coronavirus (MERS-CoV) are responsible for the majority of the severe and most severe disease courses by coronaviruses. These viruses have most likely passed from an animal reservoir to humans in recent years (Corman et al., 2019; Zhou et al., 2020).

There is a widespread belief that COVID-19 is generally asymptomatic or milder in younger age cohorts than in older parts of the population (Hoste et al., 2021; Jones et al., 2020). However, since Jones et al. reported a possible association of COVID-19 with Kawasaki disease, scientific and public awareness aroused for more severe courses of illness in children (Springer et al., 2020b). Severe multisystem inflammatory conditions associated with SARS-CoV-2 in children have been reported in various countries since April 2020 (Hoste et al., 2021). These first descriptions were partly reminiscent of Kawasaki disease or toxic shock syndrome (Hoste et al., 2021). Due to the differences to these known diseases, this novel syndrome was initially defined on the basis of diagnostic criteria and has since been mainly referred to with three similar but slightly different names and abbreviations as a pediatric multisystem inflammatory syndrome (PMIS) (Zou et al., 2021), as pediatric inflammatory multisystem syndrome temporally associated with

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SARS-CoV-2 (PIMS-TS), or as multisystem inflammatory syndrome in children (MIS-C) (Ahmed et al., 2020).

This is a systemic disease that is characterized by persistent fever and, according to the definitions of the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), affects several organ systems, with evidence of increased inflammation markers, and the plausible involvement of SARS-CoV-2 with the exclusion of others causes. Therefore, this study examines the effects of the COVID-19 pandemic on interest in "classic" childhood diseases and diseases in connection with COVID-19.

Methodology

This study used Google Trends (Mavragani & Ochoa, 2019) data to evaluate the public (search) interest in classic childhood diseases. Google Trends offers a comparison between five search terms or topics. Therefore, the four "classic" infectious childhood diseases: measles, mumps, chickenpox, and scarlet fever, were selected as examples and compared with diseases associated with COVID-19.

The methodology is a two-step process. In first step we have collected data with the following settings in Google Trends. The time period was set for the last five years. The region was selected worldwide, covering all countries where Google is available. The category was set as all categories. We did not use a particular search term as a keyword. In this study, we used topics as search inquiries. A topic is a group of terms that share the same concept in any language. For example, it covers all queries related to PIMS / MIS-C disease like *pims, pmis, mis-c, multisystem inflammatory syndrome, pims syndrome, mis-c symptoms, sindrome multisistemico,* etc. We have collected data for six topics provided in the English language: "Paediatric multisystem inflammatory syndrome", "Kawasaki disease", "Mumps", "Chickenpox", "Scarlet fever", and "Measles".

In the second step, the data from the PubMed database on published papers were collected to confirm scientific interest in the diseases potentially related to COVID-19. PubMed data were collected as indicated with the search terms of interest in the title and abstract (data accessed: 20/09/2021). We have used search queries in the PubMed as follows: *(pediatric multisystem inflammatory syndrome[Title/Abstract]) OR (pediatric inflammatory multisystem syndrome[Title/Abstract]).*

Results

Google Trends data show a significant effect of the COVID-19 pandemic on the public search interest in classic childhood diseases (Fig. 1). In the years before COVID-19, there was a relatively high level of search interest, and some seasonality, e.g., in the case of chickenpox, was evident. At the beginning of 2020, in the wake of the COVID-19 pandemic, relative search interest in these classic diseases declined significantly. High interest peaks for measles are shown (Fig. 1). Interest in Kawasaki disease peaked in April and May 2020, as discussed previously (Springer, Strzelecki, & Zieger, 2021). The search volumes for the PIMS were created starting in 2020 but never reached the popularity documented by the peaks for Kawasaki disease.

As shown in detail in Fig. 2, the first PIMS peak in May 2020 is in the same time window as the peak of Kawasaki disease (Fig. 1) (Springer, Strzelecki, & Zieger, 2021). We suspect that the illustrated PIMS peaks are associated with subsequent reports or publications, as shown below.

First peak

The peak for PIMS in May 2020 started with the issued reports from several countries highlighting that PIMS is increasingly observed. The first scientific publication in The Lancet seems to be work from Riphagen et al. (2020), reporting the situation in the UK. On May 4th, 2020, a New York City Health department statement was issued (Daskalakis, 2020). On May 15th, a risk assessment by European Centre for Disease Prevention and Control was published (European Centre for
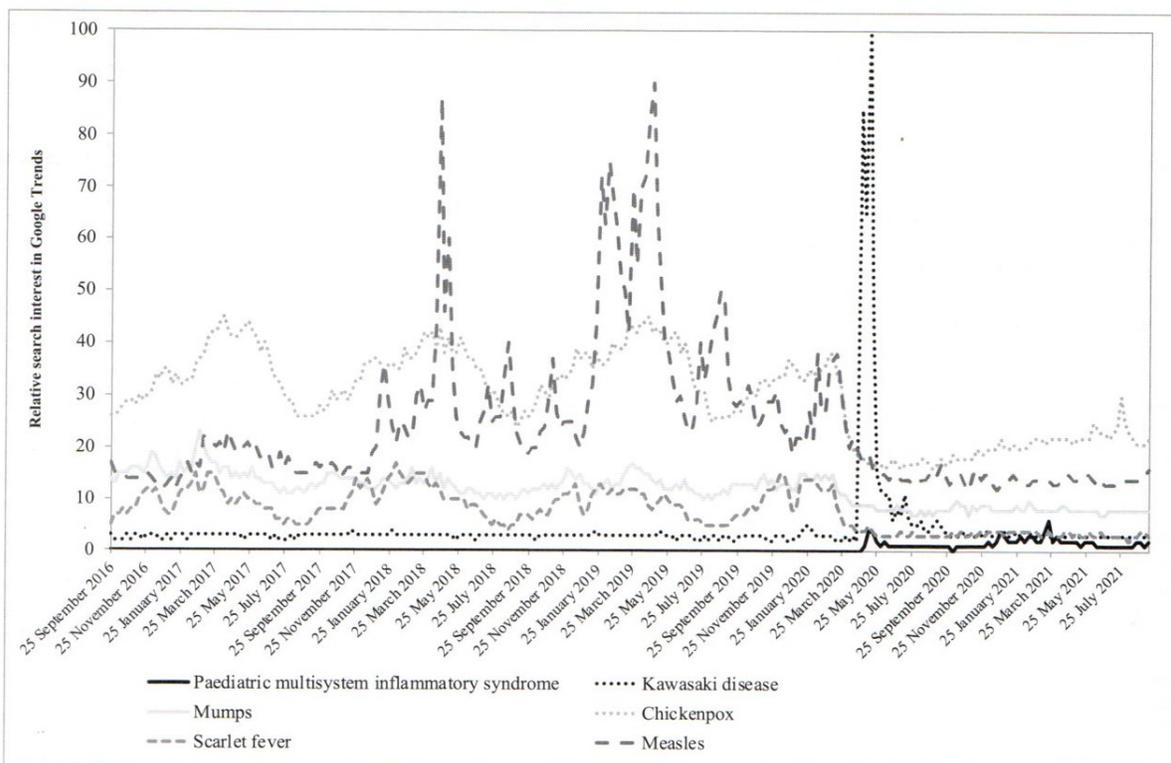

Fig. 1. Relative search interest according to Google Trends (data accessed: 20/09/2021).
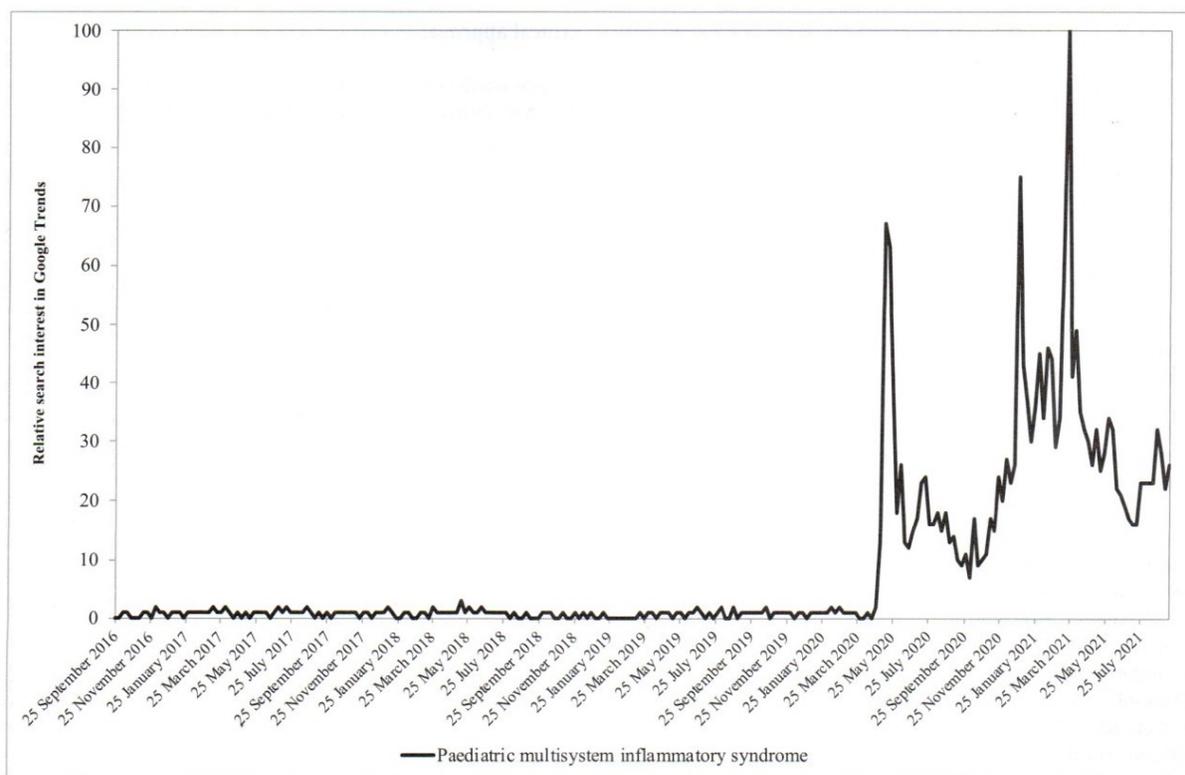
Fig. 2. Relative search interest in PIMS according to Google Trends (data accessed: 20/09/2021).

Disease Prevention and Control, 2020). The risk assessment shows that several countries affected by the COVID-19 pandemic reported cases of children hospitalized in intensive care due to a rare PIMS. This caused a snowball effect for information published by hospitals, news, the internet, social media, and, finally, scientific papers on this topic. For example, one kind of notification was published by the Illinois Department of Children and Family Services, US (Scotellaro, 2020).

Second peak

The peak for PIMS at the end of the 2020 year started corresponding with information published by specialists from the Swiss children's hospitals, led by the Children's Hospital Zurich and the University Hospital Geneva, who have published swiss-national guidelines on the inflammatory syndrome (Kinderspital Zürich, 2020). Following this published information, a series of articles and programs about PIMS and COVID-19 appeared in German-speaking newspapers, online papers, and tv channels, which presumably has caused a peak of interest (as shown in Fig. 2).

Third peak

We assume the third worldwide peak is caused by Spanish-speaking national news outlets and sources, with the main source in Chile, where PIMS developed in children and caused the death of an 11-year-girl and 16-year-boy (BBC News Mundo, 2021). This caused several worldwide publications in the Spanish language about PIMS and growing interest in the period of March 2021 (Andrews, 2021; Quiero, 2021).

Additional searches in the PubMed database revealed a strong increase in published papers about Kawasaki disease from about 400 papers in 2019 to about 700 in 2020. In contrast, there are about 40 published papers in 2020 and also about 40–50 by September 2021 for PIMS. Around 60 papers can be found in PubMed record for 2020

or for January to September 2021 (data accessed: 20/09/2021) if the search also includes publications about *PMIS*.

The Y-axis scale in both figures represents relative search interest for the selected region and time relative to the highest point on the graph. A value of 100 is the highest popularity of the word. A value of 50 means the word is only half as popular. A score of 0 indicates insufficient data for that term. In Fig. 1, results for PIMS are displayed in relation to the highest peak for "Kawasaki disease". In Fig. 2, only one topic is presented, "PIMS", which is why the chart has the highest peak at 100. However, the shape and peaks on both figures are the same for PIMS.

Discussion

The current pandemic is a demanding and challenging time for the public health sector. The high level of interest in COVID-19 described above may have contributed to a shift in the focus of search interests (Springer et al., 2020a). Social distancing and all measures to control COVID-19, which also have an impact on the spread of other infectious diseases, have certainly played a role. Strategies for this have largely been implemented around the world (Nicolay et al., 2020). This may explain the significant effect of the pandemic, which generated a decline in the population's search interest for classic childhood diseases.

Originally, the prevailing opinion was that children infected with SARS-CoV-2 show asymptomatic or mild courses. Nevertheless, in the course of the COVID-19 pandemic, in addition to the discussion about potential collateral damage to the psyche of children through various lockdown measures and social distancing (Bichard & Herring, 2020; Crawley et al., 2020; Patra et al., 2020; Saito, 2021), increasingly serious or fatal courses of illness in connection with COVID-19 were reported (Hoste et al., 2021).

In addition to the academic interest - proven by publication activity based on PubMed data - the interest of (social) media was aroused for these serious courses. In terms of search interest, Kawasaki disease

stands out from classic diseases. An unusually high level of publicity for Kawasaki disease was most likely generated through (social) media (Springer, Strzelecki, & Zieger, 2021). A search interest has been shown for PIMS, but despite the severity of the disease, it could not reach the level of Kawasaki disease or other childhood diseases studied. We believe that the peaks in relative search interest were caused or triggered by reports from the scientific community and the media.

Practice implications

These differences in public perception must be taken into account in order to draw public attention to rare but serious diseases. This is necessary to focus on identifying serious medical complications and the research work and addressing research funding on such topics as well. In a one-health approach, in addition to interest in the disease and its therapy, nursing, interest in its origin, possible reservoirs, and accompanying environmental conditions should also play a more prominent role (Springer et al., 2020b; Springer, Zieger, & Strzelecki, 2021).

Misinformation, but also deliberately misleading disinformation, can influence decisions and actions. The increasing importance of social media as a communication platform contributes to the availability and spread of correct information, but also of misinformation (Di Domenico et al., 2021; Gabarron et al., 2021). Especially during the COVID-19 pandemic, the mass dissemination of information via social media, commonly referred to as infodemic, became very important (Gabarron et al., 2021). In an information society, this has many implications, including for the medical and nursing fields (e.g. Aral, 2020).

The results of this study form a further basis for complementary studies and provide a better understanding of how Google Trends can map public awareness of childhood diseases in terms of time course and search intensity. This study also contributes to the foundation for future research on epidemic data and information in search engines.

Limitations

This study has some limitations. The popularity of Google as a search engine varies worldwide and is therefore not representative of all parts of the world. Furthermore, Google Trends cannot clearly reflect the search motivation behind search queries.

Conclusions

To conclude, the belief in constant medical progress must not hide the fact that infectious diseases, whether viral, bacterial, or fungal, are one of the greatest challenges of this century. This fact is well understood within the scientific community and has once again become known to the general public (Heddini et al., 2009; Rappuoli, 2004; Reperant & Osterhaus, 2017). In addition, COVID-19 pandemic has shown how vulnerable today's well-connected, globalized world is. In the future, the evaluation of search engine data sources for research in silico, as has already been shown, may also help in the early detection of novel diseases to initiate the necessary measures. The results of this study also contribute to a better understanding of the media's influence on the public's attention. In addition, in the case of new or rare disease patterns, a targeted sensitisation of the population may be necessary or desirable in order to be able to initiate medical and nursing measures at an early stage. Data on the attention situation in the population could possibly contribute to a more targeted use of information and information offers in the future.

In particular, in our information society, where social media play a major role in informing the public alongside internet search engines, the challenge to the scientific community will be to provide and communicate verified scientific information appropriately in order to inform the public correctly and adequately.

Ethical approval

We used publicly available anonymized data about a quantified number of searches. There is no need for ethical approval.

CRediT authorship contribution statement

Michael Zieger: Conceptualization, Validation, Investigation, Writing – original draft, Writing – review & editing, Visualization. **Artur Strzelecki:** Validation, Formal analysis, Investigation, Writing – review & editing, Visualization, Supervision. **Steffen Springer:** Conceptualization, Methodology, Validation, Investigation, Writing – original draft, Visualization.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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