

# Assessing Signs of Mental Health Issues in Greece during the Pandemic via Google Trends Data Analysis

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**How to cite this paper:** Parpoula, C., Stalikas, A., & Diamanti, F. (2024). Assessing Signs of Mental Health Issues in Greece during the Pandemic via Google Trends Data Analysis. *Psychology*, 15, 1356-1373.  
<https://doi.org/10.4236/psych.2024.158079>

**Received:** June 7, 2024

**Accepted:** August 23, 2024

**Published:** August 26, 2024

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## Abstract

A pandemic is of paramount concern for global health security, and it is imperative to assess the long-term psychosocial impact of the COVID-19 pandemic to gain a comprehensive understanding of its implications. Monitoring the population's mental health status can inform public health decision-makers of potential mental health deterioration on a national level, allowing them to recognize issues of substantive importance and design tailor-made interventions. Toward this end, the goal of this paper is to use Google Trends to track and compare pre-, during, and post-pandemic population-level mental health-related changes in Greece. The findings indicate a significant increase following the pandemic in searches related to "loneliness", "anger", and specific therapy methods and medications typically used for managing and treating anxiety, such as "psychologist", "psychotherapy", "meditation" and "anxiolytics". A near-real-time surveillance tool such as Google Trends has the potential to allow mental health experts to identify emerging mental health needs sooner and develop action plans for mental health promotion and prevention. Since discernible changes in mental health have yet to emerge at a population level, continued surveillance is required; Google Trends may prove to be a powerful data exploration and visualization intelligence tool used as a complementary technique for "storytelling" regarding the "new" mental health pandemic.

## Keywords

Decision-Making, Google Trends, Intelligence, Mental Health, Negative Emotions

## 1. Introduction

Recent technological advancements have changed the methods through which we access extensive volumes of data and vast amounts of information. Mental health information seeking involves actively pursuing such related information through various sources, including the Internet, traditional media, and social networks (Zhao et al., 2022). A prominent example of this is Google Trends, a widely used, freely accessible keyword trend research website, enabling users to explore longitudinal variations in time-location search activity patterns of specific terms/topics of interest at a population level (Hoerger et al., 2020).

Data from Google Trends have proven to be valuable across diverse scientific disciplines, providing insightful “glimpses” into population behavior across various domains (Mavragani, 2020). For instance, it has been extensively utilized in studying health-related phenomena, including infectious disease occurrence and outbreaks (see Eysenbach, 2009; Nuti et al., 2014, and references therein). Moreover, researchers have utilized Google Trends in socioeconomic contexts, exploring areas such as predicting key economic indicators, forecasting national suicide rates, and understanding voter decision-making, among others (see Barros et al., 2019; Marty et al., 2023, and references therein). Recently, the versatility of Google Trends data has made it a valuable resource for psychology researchers seeking to understand and analyze trends in public interest across a wide range of emotional and psychological conditions, as well as various mental health outcomes. Notably, during the COVID-19 crisis, there has been a significant increase in published research papers on topics such as infoveillance, infodemiology, and Google Trends (Springer et al., 2021), with some of this work providing evidence of the pandemic’s impact on the mental health and well-being of people worldwide. For example, Hoerger et al. (2020) examined shifts in mental health-related search behavior in response to the COVID-19 pandemic. Knipe et al. (2020) employed Google Trends analysis to explore community interest in mental health topics during COVID-19. Brodeur et al. (2021) provided insights into how Google search behavior changed due to lockdown measures imposed in US and selected European countries, reflecting shifts in public interest and concerns related to well-being. Sycińska-Dziarnowska et al. (2021) analyzed Google Trends data to evaluate changes in mental health-related queries throughout the pandemic and projected interest in mental health for a brief period following the pandemic.

The extensive use of Google Trends to explore various aspects of mental health has led to the emergence of a new field termed “psychiatric and mental health infodemiology” (Alibudbud, 2023), offering promising insights for mental health services and policies. Infodemiology is defined as “*the science of distribution and determinants of information in an electronic medium, specifically the Internet, or in a population, with the ultimate aim to inform public health and public policy*” (Eysenbach, 2009). By analyzing how people search for and navigate health-related information online, as well as how they communicate and share this information, we can gain valuable insights into the health-related behaviors of

populations. Leveraging Google Trends provides benefits such as real-time data, large sample sizes, and cost-effectiveness compared to traditional data sources. However, its application in mental health research presents methodological challenges and limitations. For a comprehensive discussion on the advantages, applications, challenges, and constraints of using Google Trends in psychiatric and mental health research, readers can refer to [Alibudbud's review \(2023\)](#).

### 1.1. Motivation

The World Health Organization (WHO) declared COVID-19 infectious disease as a pandemic on March 11, 2020. Social distancing policies (such as self-quarantines, lockdowns, etc.) were then implemented nearly worldwide to slow the spread of the disease, threatening several human rights, social and civil liberties. These restriction measures, along with the uncertainty induced by the COVID-19 have contributed to increased mental health issues worldwide, both in the present and the long term, while also raising awareness of mental health as a significant public health concern. However, to date, many questions remain about how to address the effects of the pandemic crisis on mental health. There are limited community-level data globally, and no comprehensive summary of the current data on these impacts has been widely available. Most relevant studies have relied on self-report measures and generally employed cross-sectional designs ([Xiong et al., 2020](#)), concentrating on a short pandemic-related time window. Longitudinal studies have had limited follow-up times, resulting in incomplete follow-up and biased estimates of self-reported mental health and well-being-related changes. Furthermore, some of these studies focused on small and non-representative samples ([Pedersen et al., 2022](#)). Greece has been in the same situation. Thus, current empirical psychiatric and psychological research in Greece still cannot provide full answers to questions posed by the general public concerning the pandemic's long-term psychosocial burden. This will delay a general understanding of pandemic's implications on mental health and well-being status of the general population, and thereby the implementation of effective management strategies.

### 1.2. Scope

In light of this, the goal of this paper is to utilize Google Trends data analysis as a means of assessing signs of mental health issues and psychological well-being concerns resulting from the pandemic in Greece. Mental health issues encompass a wide range of conditions that affect a person's thinking, feeling, mood, and behavior. These issues can impact daily functioning and include conditions characterized by excessive fear, worry, or nervousness, such as generalized anxiety disorder or panic disorder, disorders primarily affecting a person's emotional state, such as depression, sleeping disorders, and/or other mental states associated with significant distress, impaired functioning, or risk of self-harm ([WHO, 2022a](#)). Furthermore, a person's overall life satisfaction, pleasant feelings, and low levels of negative emotions are all included in the broad and multidimensional concept of psychological well-being ([Diener et al., 1999](#)).

In this paper, Google search data from pre-, during and post-pandemic periods were analyzed to examine specific topics/terms whose search frequency increased and/or decreased significantly, aligned with a timeline of key pandemic-related events/dates in Greece. In our study, the search terms of interest spanned three main themes: *Healthcare Needs and Coping Strategies*, *Negative Emotions*, and *Depressive and Anxiety Symptoms*. More details are given below. To the best of our knowledge, this study represents the first national investigation aiming to track and identify significant changes in mental health status and psychological well-being among Greeks related to the pandemic, employing an infoveillance tool such as Google Trends.

## 2. Material and Methods

In this study, we retrieved Google Trends data for a set of mental health-related search queries for Greece before, during and after the pandemic.

### 2.1. Data Source

Google Trends tool provides access to search requests made to Google for a particular term (i.e., an exact keyword or a combination of keywords in a search query) or topic (i.e., terms that share the same concept are grouped together and aggregated by Google) of interest. This allows users to receive search volumes reflecting the interest in a particular term/topic from around the globe or in a specific place (e.g., Greece) for a selected time period (e.g., last 12 months). The Google Trends tool offers its users several search options such as searching all categories for a specific keyword, limiting their search by choosing a query category and/or subcategory (e.g., health as a category, mental health as a subcategory), and specifying the search type (e.g., web, news etc.). Instead of returning the absolute number of search volumes, Google Trends provides a normalized value (each data point is divided by the total volume of searches for the selected location and time period during data retrieval) indicating the search activity for a requested search term/topic within the user-specified time window and location, that is relative search volumes (RSVs). The estimated search rate ranges between 0, representing the minimum search interest for the term/topic in the pre-specified location during the selected time period, to 100, indicating the highest point in relative popularity. Google Trends adopts a sampling method to return a dataset representative of all Google searches made each time data are retrieved.

### 2.2. Search Strategy

In our study, we sought to explore the effects the pandemic had on Greek people in terms of their psychological health and well-being. For this purpose, we attempted to track, detect, and analyze population-level mental health-related changes based on Google Trends search volumes for Greece. We explored key themes related to the mental health and distress of the population. We investigated search terms related either to immediate psychological reactions just after the pandemic declaration or to short- and long-term changes in psychological

health status expected to occur later. These themes were selected as a proxy measurement of individual psychological reactions to a period of significant life disruption and a public health crisis that had also triggered a socioeconomic crisis, combined with healthcare needs and coping strategies to deal with associated negative emotions and mental health symptoms.

The key topics included in our study were selected based on pandemic-related suggestions and concerns outlined by the WHO (2022b), as well as findings from research studies investigating the burden on mental health posed by the pandemic. We also utilized Google Trends' suggestions for related search queries to complement the topics already selected, thereby gathering additional search terms relevant to our study and characteristic of the Greek population. However, based on our study design and scope, we did not examine potential signs of positive affect, optimism, or positive public sentiment (such as hope, kindness, solidarity, sense of community, social responsibility, etc.). Furthermore, we excluded terms with very low search volume or those displaying relatively stable trend behavior over time to reduce sampling noise (Eichenauer et al., 2022).

### 2.3. Methodological Considerations

The minimum methodological documentation, consisting of a six-point checklist, is detailed below to facilitate the reproducibility of our results for future related studies. Specifically, we adhered to the recommended checklist for the preparation, documentation, and development of a Google Trends data analysis, as outlined by Alibudbud (2023).

**Keyword selection:** The search terms of interest (presented in detail below) spanned three main themes associated with *Healthcare Needs and Coping Strategies*, *Negative Emotions*, and *Depressive and Anxiety Symptoms*. For the first topic, search terms such as “escape”, “psychotherapy”, “meditation”, and “psychologist” were used. The second topic included terms such as “loneliness”, “melancholy”, “anxiety”, “anger”, “nervousness”, and “insecurity”. For the last one, search terms such as “heart palpitations”, “insomnia”, “sleepiness”, “excessive worry”, “migraine”, “psychosomatic symptoms”, “depression”, “panic attack”, and “suicide”, were evaluated. Additionally, for the latter theme, Google searches regarding a sub-theme involving selected *Anxiolytics and Antidepressants* medications were examined. Note that the query language used was Greek, and not Greeklish (Tzekou et al., 2007).

**Time period selection:** Weekly time points beginning April 21, 2019 to May 1, 2022. This long time period was divided in four phases:

- 1) **Pre-pandemic:** 4/21/19 to 3/08/20;
- 2) **Immediately after pandemic declaration:** 3/15/20 to 04/19/20;
- 3) **During pandemic:** 3/15/20 to 1/03/22;
- 4) **Post-pandemic:** 3/15/20 to 5/01/22.

The former four time windows are crucial for tracking and highlighting differences in the psychological health status of the general population in Greece from phase to phase. These phases coincide with the implementation of various health,

social distancing, and financial support measures by the Greek government at different points during the pandemic. Therefore, it is important to provide here a brief description of the key events that have taken place in Greece during the three phases following the pandemic declaration. This timeline tracks the development of the pandemic in Greece in relation to restriction measures, school closures, remote work, travel, tourism flows, etc.

The pre-to-immediately after pandemic yearly period (corresponding to search data for 53 weeks, i.e., 4/21/19 to 4/19/20) depicts significant pandemic-associated spikes or drops for mental health-related search terms/topics immediately after the pandemic declaration by WHO on 3/11/20. The first Greek confirmed COVID-19 case was recorded on February 26, 2020. From the very next day, restriction measures (such as cancelation of cultural events and selective schools' closure) were imposed by the Greek government in the most affected areas of Greece. In a very short time, the COVID-19 cases had started to increase rapidly leading the Greek government to immediately escalate restriction measures at a national level, declaring closure of all educational institutions and workplace suspensions on March 10, 2020. The first reported Greek death due to COVID-19 was on March 12, 2020. Following that, Greece adopted a national lockdown beginning on March 23 until May 4, 2020 (Parlapani et al., 2020).

This first lockdown expectedly caused the closure of entertainment places, tourist resorts, beauty salons, and closure of all stores (except from supermarkets and pharmacies). During this lockdown, self-quarantine measures were also imposed (lasting for two weeks in case of potential exposure) and controls of the incoming and outgoing traffic in airports, railway stations, etc. were made. As it can be seen, it is remarkable that the Greek government imposed several strict social distancing measures and a national lockdown in less than a month after the first COVID-19 case was diagnosed in Greece. Therefore, by including this specific time frame in our study, i.e., the first 40 days following the pandemic declaration, we sought to explore immediate psychological responses in Greece.

The short- and long-term changes on psychological health status, expected to occur later, were then explored by comparing the pre-pandemic, during pandemic and post-pandemic periods under study. Note that the pandemic period considered here extends approximately one week after Greece's first vaccinations against the coronavirus, which were administered on December 27, 2020. Additionally, the post-pandemic period ends on May 1, 2022, a significant date, characterized as "going back to normal", by which the Committee of Experts of the Greek Ministry of Health recommended lifting the last COVID-19 measures and adopted re-opening policies.

**Region selection:** Greece.

**Query category:** All Google query categories were selected.

**Type of search:** The default option "Web Search" was selected.

**Date of data retrieval:** July 27th, 2022.

## 2.4. Statistical Analysis

Before analyzing the Google Trends data, we assessed the homogeneity of variance

and normality assumptions. In all cases, both Levene's test for homoscedasticity and the Kolmogorov-Smirnov test for normality were statistically significant (alpha level set at 0.05). Consequently, non-parametric tests were employed for analysis purposes. Specifically, we conducted two-sided Mann-Whitney  $U$  tests to compare the weekly search term frequency data of the pre-pandemic period with each subsequent period under study (following Hoerger et al., 2020). This allowed us to assess whether the two independent sub-samples under consideration were likely to originate from the same population each time. Omnibus distributional equality could be implied here. However, based on our study design and scope, separate consideration of distinct null hypotheses was considered more appropriate than requiring an omnibus null. Therefore, we adopted a more lenient approach in which each test is conducted independently and yields its own inference. No correction for multiple testing is then needed due to the lack of an omnibus proposition about which all of the tests collectively speak (García-Pérez, 2023). It is also important to note here that Google Trends data are adjusted based on the total number of searches within a specified time frame. This implies that within each chosen time window, the data are obtained from a random sub-sample drawn by Google, reflecting searches by different individuals. Furthermore, Google Trends eliminates repeated searches from the same person over a short period of time. Here, data and parameter estimates are presented as mean rank values along with Mann-Whitney  $U$  test statistics and their associated asymptotic  $p$ -values (adjusted for ties). All analyses were performed using the Statistical Package for Social Sciences (SPSS) version 28. Statistically significant changes, indicating increases or decreases in related Google searches, are those reported in Tables 1-3. Non-significant findings are briefly discussed in the text.

**Table 1.** Statistical comparisons of population-level mental health-related searches for *Healthcare Needs and Coping Strategies*.

Periods	Search Items			
	Escape	Psychotherapy	Meditation	Psychologist
Pre-pandemic vs. Immediately after pandemic declaration				
	<b>Mean Ranks</b>			
Pre-pandemic	27.16	28.19	25.01	29.41
Immediately after pandemic declaration	25.75	17.67	42.58	8.08
Mann-Whitney $U$ test statistic	133.50	106.00	234.50	27.50
$p$ -value	0.830	0.115	<b>0.008</b>	<b>0.001</b>
Pre-pandemic vs. During pandemic				
	<b>Mean Ranks</b>			
Pre-pandemic	46.40	40.16	38.77	45.33
During pandemic	44.51	51.34	52.86	45.69
Mann-Whitney $U$ test statistic	968.00	1261.50	1327.00	1018.50
$p$ -value	0.728	<b>0.042</b>	<b>0.010</b>	0.948
Pre-pandemic vs. Post-pandemic				
	<b>Mean Ranks</b>			
Pre-pandemic	65.82	68.70	67.00	66.55
Post-pandemic	85.95	84.74	85.46	85.64
Mann-Whitney $U$ test statistic	3298.50	3163.00	3243.00	3264.00
$p$ -value	<b>0.011</b>	<b>0.045</b>	<b>0.021</b>	<b>0.017</b>

**Table 2.** Statistical comparisons of population-level mental health-related searches for *Negative Emotions*.

Periods	Search Items	
	Loneliness	Anger
Pre-pandemic vs. Immediately after pandemic declaration		
	<b>Mean Ranks</b>	
Pre-pandemic	24.87	25.91
Immediately after pandemic declaration	43.67	35.50
Mann-Whitney <i>U</i> test statistic	241.00	192.00
<i>p</i> -value	<b>0.005</b>	0.147
Pre-pandemic vs. During pandemic		
	<b>Mean Ranks</b>	
Pre-pandemic	39.13	42.66
During pandemic	52.47	48.60
Mann-Whitney <i>U</i> test statistic	1310.00	1144.00
<i>p</i> -value	<b>0.016</b>	0.274
Pre-pandemic vs. Post-pandemic		
	<b>Mean Ranks</b>	
Pre-pandemic	69.32	67.03
Post-pandemic	84.48	85.44
Mann-Whitney <i>U</i> test statistic	3134.00	3241.50
<i>p</i> -value	0.058	<b>0.020</b>

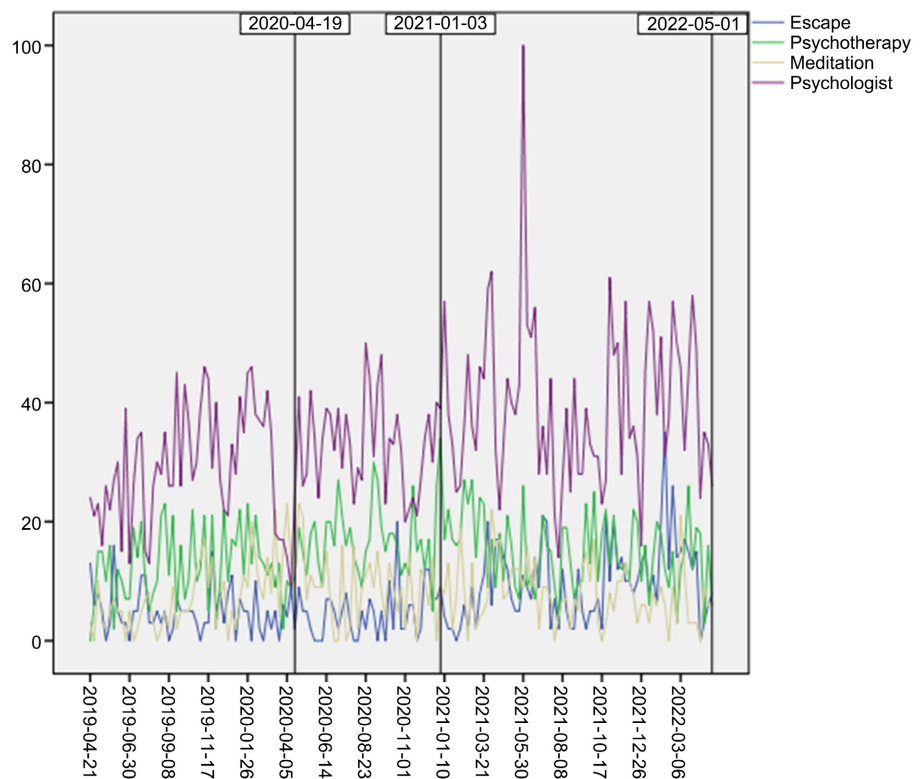
**Table 3.** Statistical comparisons of population-level mental health-related searches for *Depressive and Anxiety Symptoms*.

Periods	Search Items		
	Sleepiness	Depression	Suicide
Pre-pandemic vs. Immediately after pandemic declaration			
	<b>Mean Ranks</b>		
Pre-pandemic	28.87	29.21	28.35
Immediately after pandemic declaration	12.33	9.67	16.42
Mann-Whitney <i>U</i> test statistic	53.00	37.00	77.50
<i>p</i> -value	<b>0.013</b>	<b>0.003</b>	0.074
Pre-pandemic vs. During pandemic			
	<b>Mean Ranks</b>		
Pre-pandemic	56.02	55.11	50.84
During pandemic	34.00	35.00	39.66
Mann-Whitney <i>U</i> test statistic	516.00	559.00	759.50
<i>p</i> -value	<b>0.001</b>	<b>0.001</b>	<b>0.042</b>
Pre-pandemic vs. Post-pandemic			
	<b>Mean Ranks</b>		
Pre-pandemic	103.19	114.88	98.21
Post-pandemic	70.27	65.36	72.36
Mann-Whitney <i>U</i> test statistic	1542.00	992.50	1776.00
<i>p</i> -value	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>

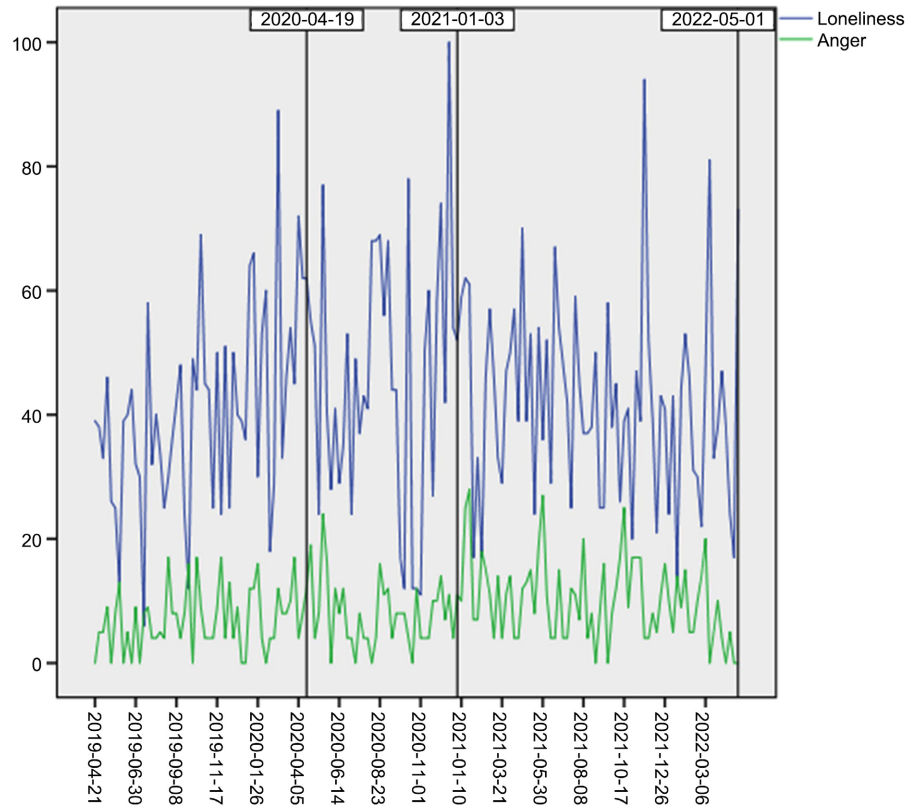
### 3. Results

In relation to the topic *Healthcare Needs and Coping Strategies* (refer to **Table 1** and **Figure 1(a)**), Google searches for “escape” rose significantly only for the post-pandemic phase. Regarding therapeutic techniques, individuals searched significantly more for “psychotherapy” during the pandemic and near its end. Searches for “meditation” significantly increased across all examined periods compared to the pre-pandemic period. In the case of “psychologist”, related searches significantly decreased immediately after the pandemic declaration, increased temporarily during the pandemic, and showed a steep significant increase in the post-pandemic period.

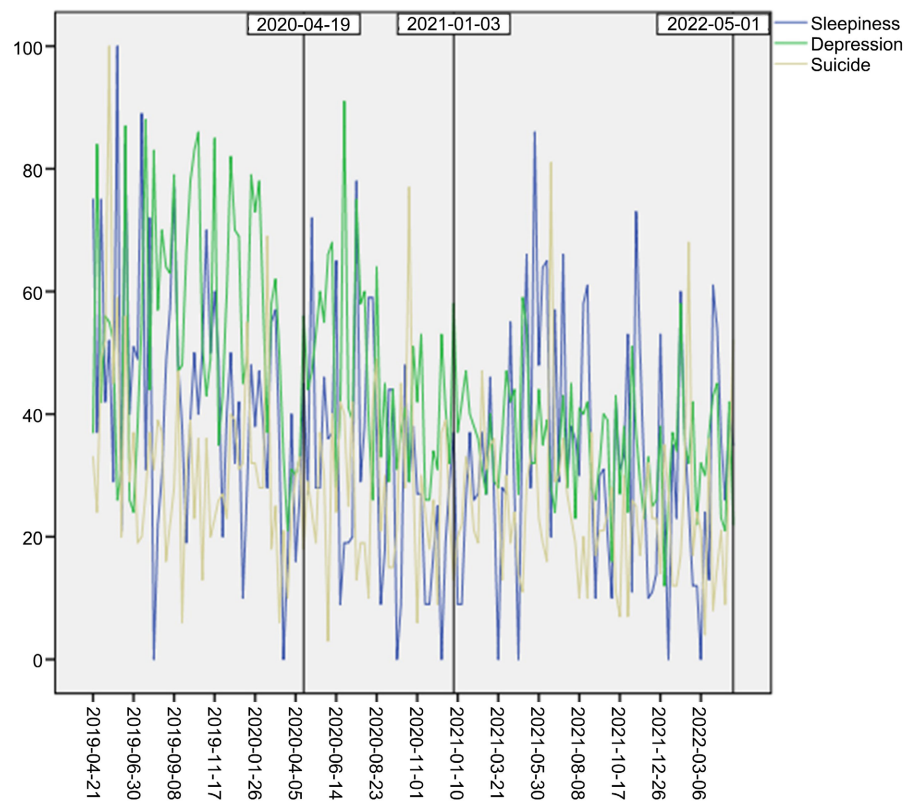
In the category of *Negative Emotions* (refer to **Table 2** and **Figure 1(b)**), statistically significant increases were observed in Google searches for “loneliness” immediately after the pandemic declaration and during the pandemic, with marginally significant increases noted in the post-pandemic phase. Searches for “anger” showed a gradual increase, with a statistically significant rise observed only for the post-pandemic period. Additionally, people searched more frequently for terms such as “anxiety” and “nervousness”; however, no statistically significant changes were observed. Furthermore, it is noteworthy that searches related to “insecurity” and “melancholy” did not exhibit significant changes. In fact, such searches were found to have slightly decreased across all examined periods, with values almost similar to those in the pre-pandemic phase.



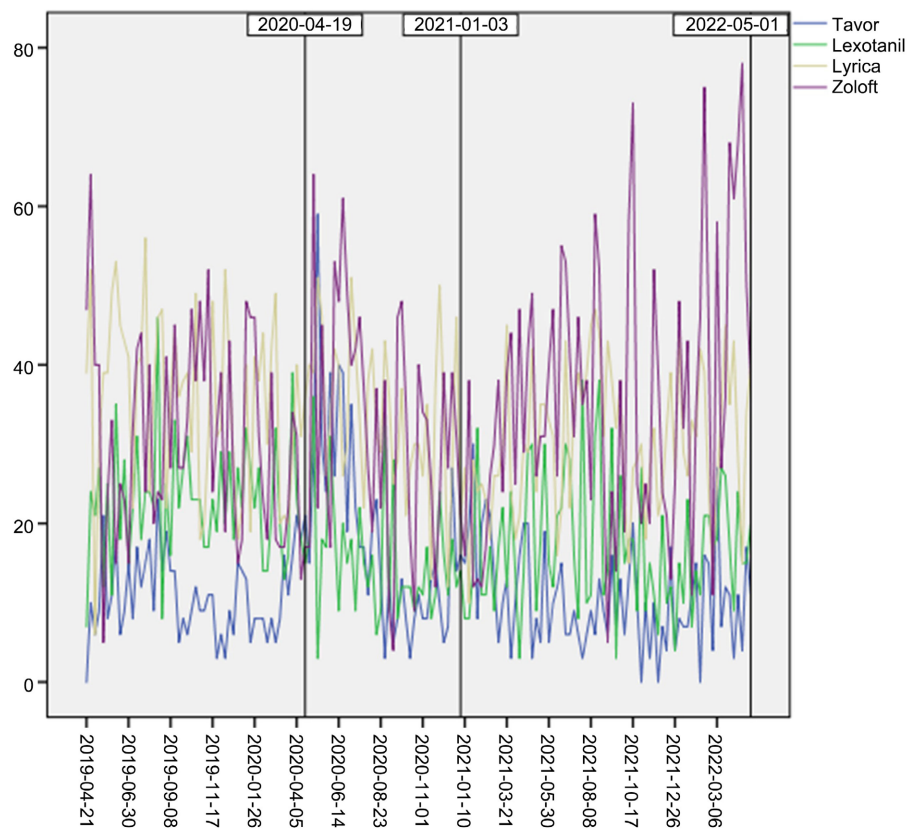
(a) Health Care Needs and Coping Strategies



(b) Negative Emotions



(c) Depressive and Anxiety Symptoms



(d) Anxiolytics and Antidepressants

**Figure 1.** Google Trends analysis of search themes under consideration.

For the topic *Depressive and Anxiety Symptoms* (refer to **Table 3** and **Figure 1(c)**), statistically significant decreases were observed in Google searches for “sleepiness” across all examined periods, while increases were noted for “insomnia” immediately after the pandemic declaration and during the pandemic; however, these changes were not statistically significant. There were no statistically significant changes in searches related to “heart palpitations”, “excessive worry”, “migraine”, and “psychosomatic symptoms”. In fact, searches for these terms slightly decreased across all periods, with values almost similar to those in the pre-pandemic phase in some cases. Regarding “panic attack”, Google searches remained stable immediately after the pandemic declaration, but increased somewhat during and after the pandemic phase. Additionally, statistically significant decreases were recorded for “depression” and “suicide” across all examined periods compared to the pre-pandemic phase, except for suicide immediately after the pandemic declaration.

Additionally, we examined the behavior of Google searches related to *Anxiolytics and Antidepressants* (refer to **Figure 1(d)**), medications commonly used to treat depression and anxiety. We analyzed Google searches for the most frequently prescribed anxiolytics (“Atarax”, “Tavor”, “Lexotanil”, “Xanax”, and “Lyrica”) and antidepressants (“Cymbalta”, “Zoloft”, “Ladose”, and “Seroxat”). For anxiolytics,

we observed an increasing trend in searches for all drugs immediately after the pandemic declaration and during the pandemic, followed by a decline during the post-pandemic phase. Statistically significant changes were recorded only for “Tavor”, “Lexotanil”, and “Lyrica” across the three periods following the COVID-19 outbreak. Regarding antidepressants, we observed non-significant decreasing trends in searches for all drugs immediately after the pandemic declaration (except for “Zoloft” which exhibited a significant increasing trend). Additionally, searches increased during the pandemic and near its end, but these changes were also not statistically significant.

#### 4. Discussion

The present study explored pre-, during, and post-pandemic population-level changes in Google Trends’ relative search frequency for key topics related to mental health and distress in Greece. Google Trends data provided valuable insights into shifts in mental health-related queries, offering a window into emerging trends in community interest regarding mental health symptoms and service needs. By analyzing these trends, we gauged the evolving landscape of public concerns about mental health issues. The terms selected for investigation encompassed a significant portion of the language that one would expect the general public to use when searching for healthcare solutions and coping strategies for managing negative emotions and mental health symptoms. This analysis illuminated broader patterns in how individuals seek support and information related to mental health during a public health crisis.

Google Trends data analysis suggested that Greeks may have experienced increased anxiety symptoms and sought common anxiety treatment-delivery techniques, searching increasingly for “psychologist”, “psychotherapy” and “meditation” during the pandemic and near its end. Additionally, a meaningful increasing trend was also recorded for anxiolytics, such as “Tavor”, “Lexotanil” and “Lyrica” drugs, immediately after the pandemic declaration and during the pandemic. This aligns with the results of [Parlapani et al. \(2020\)](#), who observed that 77.4% of the respondents reported moderate to severe anxiety symptoms in Greece due to the pandemic. Furthermore, searches for “escape” showed a decreasing trend immediately after the pandemic declaration and during the pandemic, and significantly increased only for the post-pandemic phase. This finding is in line with the results of [Tsouros et al. \(2021\)](#), who observed a steep decline in daily excursions and travel time during the lockdown period in Greece. Moreover, [Vatavali et al. \(2020\)](#) investigated how individuals spend their time before and during the lockdown in Greece, and also recorded that a significant proportion of participants had decreased willingness for action and activity or felt less active and more tired (31.8% and 37.8%, respectively).

Statistically significant increases were also observed for Google searches regarding “loneliness” and “anger”. This aligns with several findings, indicating that social isolation associated with quarantine measures had negative psychological

effects in adults, including anger, confusion, and post-traumatic distress. Moreover, early evidence showed that a significant proportion of children and adolescents reported high levels of loneliness in China, Canada, Turkey, United States, India, and Europe. Specifically, in Italy and Spain, the two European countries most affected during the first wave of the pandemic, experiencing very high numbers of COVID-19 cases and deaths, loneliness and irritability in youth significantly increased during the spring lockdown (Magklara et al., 2023). Our findings also echo those of Kalaitzaki et al. (2022), who reported increased levels of loneliness, perceived stress, and PTSD symptoms in the general population between the two COVID-19 lockdowns in Greece. Additionally, Vatavali et al. (2020) found that 34.5% of Greek respondents felt lonelier during the lockdown.

Furthermore, Greeks searched more frequently for terms such as “anxiety” and “nervousness”. However, there was no evidence of statistical significance of this increasing trend in any time period under consideration compared to the pre-pandemic one. It thus remains unclear if these symptoms are actually escalating or search behavior has merely experienced a temporary stable growth in volume over the selected time periods. Our findings are in line with some of the results discussed in the work of Vatavali et al. (2020), who found that 39.3% of the respondents stated they were more nervous after the pandemic, while 46% declared no change. Moreover, 53.9% and 35.7% of the participants felt more stressed and anxious than before the lockdown in Greece, with 30.9% and 48.6% respectively, declaring no change. Additionally, there were non-substantial decreases in searches related to “insecurity” and “melancholy”. It may be that a significant increase in these searches will occur later, indicating the need for ongoing surveillance on Google Trends. This is particularly crucial given the anticipated cumulative burden on the mental health status and psychological well-being of Greeks due to the decade-long financial crisis, the global pandemic, and the ongoing war in Europe.

Finally, several depressive and anxiety symptoms were examined through Google Trends data analysis. A statistically significant decreasing trend was recorded for searches related to “sleepiness” across all examined periods. Conversely, increasing searches (though not statistically significant) were observed for “insomnia” immediately after the pandemic declaration and during the pandemic. These findings are consistent with those of Voitsidis et al. (2020), who reported that 37.6% of the respondents experienced sleep problems. Additionally, Gkintoni et al. (2021) noted that students with mental health issues exhibited higher rates of sleep difficulties and depression, along with reduced levels of life satisfaction and vitality during the pandemic and lockdown period in Greece.

Furthermore, our investigation revealed pandemic-associated spikes in searches related to “panic attack” during and after the pandemic phase. Regarding antidepressants, a decreasing trend was observed immediately after the pandemic declaration, while searches for such drugs increased (though not statistically significantly) during the pandemic and near its end. In contrast to the relatively stable and slightly decreased rates of searches related to “heart palpitations”, “excessive

worry”, “migraine”, and “psychosomatic” symptoms, terms associated with “depression” and “suicide” demonstrated a sustained decrease across all examined periods (except for “suicide” immediately after the pandemic declaration). It remains uncertain whether the onset of such changes in Google search behavior will occur later, and whether these symptoms are becoming less intense or if search behavior is merely exhausting. These latter results indicate a direction opposite to the findings of several self-report surveys in the Greek population, which revealed significant increases in a multitude of depressive and anxiety symptoms. [Parlapani et al. \(2020\)](#) recorded a significant proportion of participants reporting moderate to severe depressive and anxiety symptoms (22.8% and 77.4%, respectively) in Greece. [Patsali et al. \(2020\)](#) confirmed that Greek students are at high risk of depression and suicide due to the pandemic outbreak. [Louvardi et al. \(2020\)](#) reported significantly higher distress and somatization levels among chronic disease patients, with no statistically significant differences found for anxiety and depression. [Karaivazoglou et al. \(2021\)](#) provided evidence for an increased prevalence of anxiety, depressive and PTSD symptoms. [Fountoulakis et al. \(2021\)](#) reported that 9.31% of the Greek study sample suffered from clinical depression, with an additional 8.5% experiencing severe distress. Additionally, almost 40% of the respondents reported elevated anxiety levels and increased depressive feelings. Suicidal thoughts decreased in 4.42%, and increased in 10.40% of the stratified sample. [Stylianou and Ntelas \(2023\)](#) found that a high proportion (approximately 80%) of the sampled population in Greece felt their mental health deteriorating due to the pandemic. However, it is worth noting, in line with our findings, that [Brodeur et al. \(2021\)](#) also reported a significant decrease in searches for suicide, while for depression and suicidal ideation, no such meaningful changes were discerned in a related study by [Hoerger et al. \(2020\)](#) immediately after the pandemic declaration.

#### 4.1. Limitations and Strengths

The present study based on Google Trends data analysis, as well as all other studies of this type, has several limitations. First, Google Trends data is limited to searches of online users in areas with free access to information and Internet access. Second, Internet access and usage vary significantly across different age groups, socioeconomic statuses, and geographic locations. This alone raises concerns about the potential biases in the data, as it may not adequately capture the mental health experiences of individuals who are less likely to use the Internet or search for health-related information online. Consequently, the study’s findings may not be fully representative of the broader population. Third, Google Trends is anonymized, thus allows no conclusions regarding individual search behavior. Fourth, there can be various reasons associated with changes in search behaviors, as each search request could be related to increased media coverage, news reporting stimulating curiosity about specific topics, and individual curiosity, among others. For example, “googling” the term “suicide” is not necessarily evidence that someone

has suicidal thoughts and feelings, as search queries are not exclusively submitted by Google engine users who are experiencing related symptoms. Moreover, the relationship between Google Trends data and surveillance data for mental disorders is not yet well-established (Knipe et al., 2021). Therefore, we need to refrain from utilizing the data as a direct metric for mental disorders, as Google Trends only reflect the approximate volume of online information utilization regarding specific mental health-related topics. This perspective is important for interpreting the findings accurately, ensuring a precise portrayal of the study's implications.

From another perspective, Google search data may be considered advantageous for several reasons. First, the data is updated in almost real-time. Second, Google Trends data represent aggregate measures of search activity, thereby being less vulnerable to small-sample bias. Third, search results are normalized to the time and location of a query, allowing easier comparisons between terms of interest. Fourth, people's searches in the Google engine reflect their uncensored desires and needs for information, thus lacking many of the biases of traditional self-report surveys (Baker & Fradkin, 2017; Hoerger et al., 2020). The interested reader may refer to Rovetta (2021), who discussed in detail both the limits and potential of web infoveillance not only during the COVID-19 pandemic but also for future research.

#### **4.2. Recommendations for Future Research**

As aforementioned, most surveys examining the pandemic's implications on population mental health adopted a cross-sectional study design, resulting in significant loss to follow-up and/or biased estimates of self-reported mental health and well-being measures. A unified approach, combining the use of both Google Trends analysis and self-report surveys, could help the public mental health community and practitioners to continuously monitor the population's psychological health status, better understand the short- and long-term psychosocial burden of COVID-19, recognize issues of substantive importance, identify possible mechanisms of change, design tailor-made interventions, and intervene sooner. One of our future goals is to gather data via web mediums (such as multi-modal social media data and/or Google Trends RSVs) for mental health-related topics, and then utilize graphical, time-series, and multiple change-point analysis approaches to compare trends for these topics against population measures of these outcomes recorded using validated self-report scales.

### **5. Conclusion**

The initially stated overarching aim of this research was to monitor the psychological health status in Greece through Google Trends analysis, thereby informing public health decision-makers of any potential deterioration on a national level due to COVID-19. The pandemic's effects were found to reflect in mental health information-seeking behavior. Utilizing the Google Trends infoveillance tool

enabled us to track and detect emerging significant changes in online information-seeking behavior related to mental health symptoms and treatment needs. These findings contribute to informing policy and the implementation of public mental health interventions, empowering stakeholders to prevent the onset of mental disorders and mitigate their associated impacts, thereby promoting the psychological well-being and resilience of the general population.

### Data Availability Statement

Source data. All data are freely available directly from Google Trends (<https://trends.google.com/trends/>). Underlying data. Open Science Framework: Assessing signs of mental health issues in Greece during the pandemic via Google Trends data analysis [https://osf.io/spht6/?view\\_only=e756121afb4c4acfa3ee7e8b6bf5ea96](https://osf.io/spht6/?view_only=e756121afb4c4acfa3ee7e8b6bf5ea96).

### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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