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The Evaluation of Cardiac Diseases associated Google Search Trends during COVID-19 Pandemic

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ABSTRACT

Introduction: To demonstrate public interest in cardiac diseases during the COVID-19 pandemic by using google trends (GT).

Methods: The authors defined 25 terms related to cardiac diseases including coronary artery disease, hypertension, heart failure, heart attack, acute myocardial infarction, pacemaker, coronary stent, coronary balloon, angioplasty, hyperlipidemia, arrhythmia, ablation, atrial fibrillation, ventricular tachycardia, aortic aneurysm, aortic stenosis, mitral stenosis, mitral valve insufficiency, pulmonary embolism, pulmonary hypertension, endocarditis, heart tumors, pericarditis, myocarditis and pericardial effusion. All keywords were analyzed in GT using the filters 'All categories', 'Web search', and 'Worldwide'. To analyze public attention to cardiac diseases during the COVID-19 pandemic, three 'eight week periods' after the COVID-19 pandemic announcement (March 11th- May 5th, May 6th – June 30th and July 1st - August 25th) were compared with the same durations in the past four years (2016-2019).

Results: Comparison of the March 11th – May 5th 2020 period, and the same periods between 2016 and 2019 demonstrated that total public interest in cardiac diseases was significantly decreased (-7.8%, p=0.001). In the comparison of the second and third eight-week periods, total public attention about cardiac diseases was comparable (p=0.245 and p= 0.365). Terms about coronary artery disease, hypertension and myocarditis were searched significantly more commonly during the COVID-19 era.

Conclusion: The present study found that public interest about cardiac diseases significantly decreased in the first eight weeks at the beginning of the COVID-19 pandemic but public interest reached the same level as previous years after eight weeks. Terms of coronary artery disease, hypertension and myocarditis were searched significantly more commonly during the COVID-19 pandemic.

Keywords: cardiac disease, COVID-19, Google, Google Trends, public interest, pandemic

COVID-19 Pandemisi Sırasında Kardiyak Hastalıklar ile İlgili Google Arama Trendlerinin Değerlendirilmesi

ÖZET

Amaç: Google arama trendlerini kullanarak COVID-19 salgını sırasında kardiyak hastalıklara karşı halkın ilgisini değerlendirmek.

Gereç ve yöntemler: Kardiyak hastalıklar ile ilgili, koroner arter hastalığı, hipertansiyon, kalp yetmezliği, kalp krizi, akut miyokard enfarktüsü, kalp pili, koroner stent, koroner balon, anjiyoplasti, hiperlipidemi, aritmi, ablasyon, atriyal fibrilasyon, ventriküler taşikardi, aort anevrizması, aort darlığı, mitral darlığı, mitral kapak yetmezliği, pulmoner emboli, pulmoner hipertansiyon, endokardit, kalp tümörleri, perikardit, miyokardit ve perikardiyal efüzyon gibi 25 terim belirlendi. Bu terimler Google arama trendlerde "Tüm kategoriler", "Web araması" ve "Dünya Çapında" filtreleri kullanılarak analiz edildi. COVID-19 pandemisi sırasında halkın kalp hastalıklarına olan ilgisini analiz etmek için, COVID-19 pandemisinin başlangıcından sonraki sekiz haftalık üç dönem (11 Mart - 5 Mayıs, 6 Mayıs - 30 Haziran ve 1 Temmuz - 25 Ağustos) son dört yıldaki (2016-2019) aynı sürelerle karşılaştırıldı.

Sonuçlar: 11 Mart – 5 Mayıs 2020 dönemi ile 2016-2019 arasındaki aynı dönemler karşılaştırıldığında, kalp hastalıklarına insanların ilgisinin önemli ölçüde azaldığı görüldü (-7.8%, p=0.001). İkinci ve üçüncü sekiz haftalık dönemlerin karşılaştırılmasında, kalp hastalıklarına yönelik insanların ilgisi benzerdi (p=0,245 ve p=0,365). Koroner arter hastalığı, hipertansiyon ve miyokardit ile ilgili terimler, COVID-19 sırasında istatistiksel olarak daha yaygın olarak arandı.

Tartışma: Çalışmamızda COVID-19 pandemisinin başlangıcında ilk sekiz haftada kalp hastalıklarına yönelik insanların ilgisinin önemli ölçüde azaldığını, ancak sekiz hafta sonra ilginin önceki yıllarla aynı seviyeye ulaştığını gördük. Koroner arter hastalığı, hipertansiyon ve miyokardit terimleri COVID-19 pandemisi sırasında istatistiksel olarak daha sık arandı.

Anahtar kelimeler: COVID-19, google, google trendler, kalp hastalığı pandemi

The coronaviruses are enveloped RNA viruses which are associated with the common cold, bronchitis, pneumonia and severe acute respiratory syndrome in mammals. The novel coronavirus infection (COVID-19) first appeared in December 2019 and spread all over the world in a short time (1). According to the latest statistics, 70 million individuals were infected by COVID-19 and 1.6 million deaths were associated with COVID-19 and COVID-19 related complications (2). On March 11th, the World Health Organization (WHO) declared COVID-19 a pandemic and many countries announced preventive rules about social isolation, staying at home, and certain quarantine measures (3). Moreover, many outpatient clinics were closed and elective surgical operations were postponed. Due to inaccessibility of the healthcare system, patients or people with undiagnosed health problems began to use different means to get information about their symptoms and illness, including books, television and the internet.

Previous reports proved that many internet users prefer search engines to find any knowledge on the internet. Although many search engines are available, 90% of internet users prefer Google Search (Google Inc. Mountain View, California, USA) during internet research (4). Google trends (GT) is an application which presents search trend characteristics that determine statistical information for users about how often word or phrase queries are searched for, in which geography and in which languages, in Google searches (5). Teng et al. used GT to analyze public attention to the Zika virus pandemic and the authors predicted the course of the pandemic (6). Similarly, Lampos and colleagues evaluated the social interest in influenza-like illness by using GT (7).

Although, previous studies investigated public attention to different dermatologic, rheumatological and urological diseases during the COVID-19 pandemic by using GT, no study in the literature analyzed the public interest in cardiac diseases during the COVID-19 pandemic. In this study, we aimed to demonstrate public interest in cardiac diseases during the COVID-19 pandemic.

Material and Method

The present study was planned from 1st September to 5th September 2020. The authors defined 25 terms related to cardiac diseases including coronary artery disease, hypertension, heart failure, heart attack, acute myocardial infarction, pacemaker, coronary stent, coronary balloon, angioplasty, hyperlipidemia, arrhythmia, ablation, atrial fibrillation, ventricular tachycardia, aortic aneurysm, aortic stenosis, mitral stenosis, mitral valve insufficiency, pulmonary embolism, pulmonary hypertension, endocarditis, heart tumors, pericarditis, myocarditis and pericardial effusion. All keywords were analyzed in GT using the filters 'All categories', 'Web search', and 'Worldwide'.

Google Trends (GT)

Google Trends is a way to get information about any keyword among similar terms from all searches performed by using Google search in a specified time period. Also, GT can be used to decide which topic will attract the most attention before creating a website. The outcomes of internet exploration can be obtained and recorded from the official website of GT (https:// trends.google.com). The GT score of any term ranges from 0 to 100 (lowest to highest) and a better GT score of searched term is associated with higher relative interest.

To analyze public attention to cardiac diseases during the COVID-19 pandemic, three 'eight week periods' after the COVID-19 pandemic announcement (March 11th- May 5th, May 6th – June 30th and July 1st - August 25th) were compared with the same durations in the past four years (2016-2019). We arranged the starting time of the study as March 11th because WHO declared COVID-19 a pandemic on that date. In the present study, no patient data was used; thus, Institutional Ethics Committee approval was not required.

In the present study, IBM SPSS v.21 was used for statistical analyses. Arithmetic mean ± standard deviations were used to determine continuous variables. The Kolmogorov Smirnov test was applied to check the normality assumption. To show differences between groups, paired samples t test and Wilcoxon test were used. The level of statistical significance was taken as $p < .05$.

Results

Comparison of the March 11th – May 5th 2020 period, and the same periods between 2016 and 2019 demonstrated that total public interest in cardiac diseases was significantly decreased (-7.8%, p=0.001). Searches for 14 terms including heart failure, heart attack, pacemaker, coronary stent, angioplasty, ablation, atrial fibrillation, ventricular tachycardia, aortic aneurysm, aortic stenosis, mitral stenosis, pulmonary hypertension, endocarditis, and pericardial effusion were significantly decreased at the beginning of the COVID-19 pandemic. However, inquiries about

coronary artery disease, hypertension, hyperlipidemia, pericarditis and myocarditis were significantly increased.

In the comparison of the second eight-week period (May 6th – June 30th 2020 vs May 6th – June 30th 2016-2019), total public attention about cardiac diseases was comparable (p=0.245). In total, eight terms (coronary artery disease, hypertension, hearth failure, arrythmia, pulmonary embolism, endocarditis, myocarditis, pericarditis) had significantly higher search frequency in comparison with the prior 4 year period. In contrast, public interest was significantly decreased for seven terms including heart attack, coronary stent, angioplasty, ablation, aortic aneurysm, aortic stenosis and mitral stenosis.

The comparison of the third eight-week period (July 1st – August 25th 2020 vs July 1st – August 25th 2016-2019) stated that total social attention about cardiac diseases was similar (p=0.365) and only searches for the angioplasty term were significantly decreased (p=0.001). Furthermore, seven keywords including coronary artery disease, hypertension, heart failure, hyperlipidemia, arrhythmia, pulmonary embolism and pericarditis had significantly higher relative interest during the COVID-19 pandemic era when compared to the prior four year period. Lastly, inquiries about seventeen terms (heart attack, acute myocardial infarction, pacemaker, coronary stent, coronary balloon, ablation, atrial fibrillation, ventricular tachycardia, aortic aneurysm, aortic stenosis, mitral stenosis, mitral valve insufficiency, pulmonary hypertension, endocarditis, heart tumors, pericarditis and pericardial effusion) were similar.

Discussion

Google sources demonstrated that half of world's population use Google as a search engine and almost a quarter of these people use Google in English (8). In today's world, many patients or patient relatives obtain first information about diseases including symptoms, methods of diagnosis and alternative treatment modalities from the internet instead of attending the professional health system. During the COVID-19 pandemic, reduced public transport facilities, quarantine practices, and postponed outpatient clinic admissions resulted in reductions in access to the health system. Thus, we had the possibility to analyze public attention about cardiac diseases by using GT. The present study showed a significant reduction of public interest about cardiac diseases in first eight weeks at the beginning of the COVID-19 pandemic. However, after the first eight weeks, social interest in cardiac diseases reached the levels of previous years.

Previous studies evaluated the public interest in different medical fields between pre-COVID-19 period and COVID-19 era. Guzman et al. investigated the public interest about cosmetic practices, general dermatological diseases and malignancies and they found a significant public interest reduction for all three terms in the first 15 days of the COVID-19 pandemic. Also, Guzman et al. demonstrated that inquiries about general dermatological conditions increased similar to the pre-COVID-19 period, one month after the beginning of the COVID-19 pandemic (9). In another study, Kardes and colleagues showed significant public attention decline in rheumatological diseases by using GT, by comparing the first 12 weeks of the COVID-19 pandemic and in same period of the previous four years (10). In parallel with these studies, we determined a significant reduction in GT search volume about cardiac diseases in the first eight weeks of the COVID-19 pandemic. We believed that intense interest of news agencies and individuals on COVID-19 in the beginning of pandemic, have a role on these results.

Each keyword has a different search volume according to google search. We determined significantly higher search volumes for two terms (coronary artery disease and hypertension) during the COVID-19 pandemic. We explain in this situation by the very common occurrence of these diseases. It is well known that coronary heart disease and related complications are now the leading cause of mortality all around the world. Almost 7.2 million people die each year from coronary artery disease. However, 1.13 billion individuals suffer from hypertension according to WHO. Additionally, coronary artery disease and hypertension terms are more likely to be known by the public than other specific cardiology terms like ablation, atrial fibrillation, etc.

Myocarditis and pericarditis are rare cardiac diseases and the prevalence of myocarditis and pericarditis were about 27 and 20 cases per 100,000 individuals annually, respectively (11). On the other hand, impact of COVID-19 on cardiac system is still under investigation. Halushka et al. evaluated 277 COVID-19 patients in terms of myocarditis and authors faced with myocarditis in 20 patients (7.2%) (12). In another study, Kumar and colleagues found pericarditis as primary presentation of COVID-19 (13). Also, social media and new agencies announced myocarditis and pericarditis as possible consequences of COVID-19. Thus, myocarditis and pericarditis attracted attention of the people during this period. In parallel, we faced with higher public interest on myocarditis and pericarditis (only in first two 'eight week' period) after the beginning of COVID-19 pandemic.

Table 1: Google trends statistics of terms and comparison of results by years

	March 11- May 5				May 6 – June 30				July 1 – August 25			
	2020	2016-2019	% change	*P* value	2020	2016-2019	% change	*P* value	2020	2016-2019	% change	*P* value
Coronary Artery Disease	52.3±23.6	29.2±8.0	79.8	**0.001**	52.3±11.1	48.5±14.2	7.8	**0.039**	62.0±12.8	56.8±12.6	9.1	**0.031**
Hypertension	65.7±7.2	58.5±9.4	12.3	**0.001**	75.0±8.1	65.9±11.4	13.8	**0.001**	84.7±10.7	74.3±12.2	14.0	**0.001**
Heart Failure	60.1±6.8	66.5±9.7	-9.6	**0.001**	74.5±8.1	68.1±10.5	9.4	**0.001**	70.0±7.2	64.8±10.1	8.0	**0.001**
Heart Attack	62.1±5.1	68.7±5.6	-9.6	**0.001**	50.2±3.9	52.1±4.7	-3.6	**0.010**	35.0±2.3	35.8±6.8	-2.2	0.438
Acute Myocardial Infarction	27.5±8.9	29.7±10.1	-7.4	0.141	37.4±13.1	38.3±12.8	-2.3	0.673	41.8±14.1	42.3±17.2	-1.2	0.844
Pacemaker	56.2±7.2	70.1±12.1	-19.8	**0.001**	61.0±8.9	62.4±8.9	-2.2	0.363	74.8±9.1	72.7±12.8	2.9	0.264
Coronary Stent	22.6±8.6	28.3±11.2	-20.1	**0.001**	30.1±11.3	36.8±17.6	-18.2	**0.001**	37.1±14.3	40.6±17.1	-8.6	0.150
Coronary Balloon	24.2±11.2	22.9±9.9	5.7	0.700	20.2±8.5	17.8±11.4	13.5	0.437	18.8±10.5	20.9±13.5	-10.0	0.531
Angioplasty	46.3±11.1	63.1±13.4	-26.6	**0.001**	55.9±11.5	63.8±14.6	-12.4	**0.001**	52.6±10.8	59.9±13.8	-12.2	**0.001**
Hyperlipidemia	67.4±14.9	54.4±13.3	23.9	**0.001**	62.6±9.8	57.2±10.6	9.4	0.081	51.8±15.1	44.9±16.8	15.4	**0.005**
Arrhythmia	15.3±2.5	15.5±5.1	-1.3	0.875	69.3±9.2	57.4±13.4	20.7	**0.001**	75.8±9.8	60.7±12.6	24.9	**0.001**
Ablation	41.9±10.6	68.8±14.3	-39.1	**0.001**	57.2±9.8	63.6±13.8	-10.0	**0.001**	63.1±11.5	63.4±13.7	-0.5	0.907
Atrial Fibrillation	54.0±9.4	65.6±13.1	-17.7	**0.001**	68.3±12.6	70.8±13.4	-3.5	0.215	68.4±12.2	66.4±13.1	3.0	0.292
Ventricular Tachycardia	41.5±11.1	50.7±14.3	-18.1	**0.001**	53.3±13.6	54.4±15.5	-2.0	0.601	56.8±13.7	55.5±15.5	2.3	0.555
Aortic Aneurysm	41.4±9.1	59.3±13.4	-30.2	**0.001**	51.5±8.3	57.6±13.7	-10.6	**0.002**	58.2±13.2	60.7±15.6	-4.1	0.281
Aortic Stenosis	41.4±10.8	58.5±16.1	-29.2	**0.001**	48.8±11.9	54.6±16.1	-10.6	**0.012**	61.0±17.6	59.7±17.2	2.2	0.627
Mitral Stenosis	41.1±13.9	52.2±16.9	-21.2	**0.001**	48.3±15.4	53.6±16.6	-9.9	**0.031**	51.6±14.7	52.7±17.4	-2.1	0.671
Mitral Valve Insufficiency	22.9±13.2	29.3±18.4	-21.8	0.116	20.5±11.1	19.5±13.9	5.1	0.751	21.7±15.1	21.4±15.1	1.4	0.927
Pulmonary Embolism	11.1±2.1	10.9±6.4	1.8	0.853	59.3±7.8	53.8±10.0	10.2	**0.001**	61.8±11.3	51.6±10.6	19.8	**0.001**
Pulmonary Hypertension	48.8±9.4	60.1±13.7	-18.8	**0.001**	62.4±12.3	65.5±14.5	-4.7	0.140	60.5±14.3	62.9±13.9	-3.8	0.239
Endocarditis	48.4±8.4	58.9±11.9	-17.8	**0.001**	56.1±13.6	52.2±12.2	7.5	**0.040**	59.4±11.1	57.7±13.2	2.9	0.363
Heart Tumors	17.7±9.2	21.7±12.6	-18.4	0.150	20.2±9.9	23.7±11.2	-14.8	0.250	23.7±10.2	25.6±12.6	-7.4	0.345
Pericarditis	75.1±12.1	59.9±12.5	25.4	**0.001**	79.2±10.4	56.6±12.7	39.9	**0.001**	61.6±13.8	56.7±9.8	8.6	0.287
Myocarditis	26.1±7.1	17.6±7.2	48.3	**0.001**	28.1±6.5	23.7±9.4	18.6	**0.001**	30.2±8.3	24.5±9.8	23.3	**0.001**
Pericardial Effusion	46.2±15.2	52.2±17.2	-11.5	**0.019**	49.9±15.8	49.2±15.2	1.4	0.767	55.4±15.5	51.1±18.3	8.4	0.097
Total	44.4±20.5	50.1±22.5	-7.8	**0.001**	51.5±22.3	48.8±20.3	5.5	0.245	52.8±21.9	50.5±18.9	4.5	0.365

Diagnosis and/or treatment delays for cardiac diseases due to reasons associated with COVID-19 could increase health expenses, treatment process, morbidity and mortality. Waldstein et al. found a significant relationship between hypertension and poor cognitive function in older adults and the authors emphasized the negative impact of delayed hypertension diagnosis on brain functions (14). In another study, McKinley and colleagues showed that hospital admission delays for people with coronary artery disease prevented maximum treatment benefit (15). In a more recent study, Jella et al. tried to analyze the possible impact of COVID-19 pandemic on hip and knee surgeries and they stated that delays in treatment of hip and knee diseases will result in higher patient numbers and financial cost after pandemic (16). No study in the literature have investigated the effect of the COVID-19

pandemic on the diagnosis and treatment of cardiac diseases, which may be a subject for another study.

Although this research is the first to analyze public attention about cardiac diseases by using GT, the present study has some limitations. First of all, Google is not the only search engine. However, Google search engine is the most used search engine with 90% usage rate. In addition, we only investigated terms in the English language. We believe that using all languages would be technically difficult and confusing for the reader. Furthermore, English is the most commonly used language in Google search and we analyzed the same population who searched with English in Google. Also, the present study only focused on the name and treatment modalities for cardiac diseases, not symptoms related with cardiac diseases which could be a topic for another research. Finally, this study focused on the period at the beginning of the COVID-19 pandemic and we believe that long-term public interest outcomes can be evaluated in further studies.

In conclusion, the present study found that public interest about cardiac diseases significantly decreased in the first eight weeks at the beginning of the COVID-19 pandemic in the comparison to the same time period in the prior four years. Additionally, public interest about cardiac diseases reached the same level as previous years, eight weeks after the COVID-19 pandemic announcement. Also, terms about coronary artery disease, hypertension and myocarditis were searched significantly more common during the COVID-19 pandemic.

Abbreviation

COVID-19: Coronavirus infection

WHO: World Health Organization

GT: Google trends

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