

Seasonal trends in hypertension in Poland: evidence from Google search engine query data

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Abstract

Background: Various conditions, including arterial hypertension, exhibit seasonal trends in their occurrence and magnitude. Those trends correspond to an interest exhibited in the number of Internet searches for the specific conditions per month.

Aim: The aim of the study was to show seasonal trends in the hypertension prevalence in Poland relate to the data from the Google Trends tool.

Methods: Internet search engine query data were retrieved from Google Trends from January 2008 to November 2017. Data were calculated as a monthly normalised search volume from the nine-year period. Data was presented for specific geographic regions, including Poland, the United States of America, Australia, and worldwide for the following search terms: “arterial hypertension (pol. nadciśnienie tętnicze)”, “hypertension (pol. nadciśnienie)” and “hypertension medical condition”. Seasonal effects were calculated using regression models and presented graphically.

Results: In Poland the search volume is the highest between November and May, while patients exhibit the least interest in arterial hypertension during summer holidays ($p < 0.05$). Seasonal variations are comparable in the United States of America representing a Northern hemisphere country, while in Australia (Southern hemisphere) they exhibit a contrary trend.

Conclusions: In conclusion, arterial hypertension is more likely to occur during winter months, which correlates with increased interest in the search phrase “hypertension” in Google.

Key words: hypertension, seasonal trends, Google

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INTRODUCTION

Cardiovascular disease (CVD) remains a worldwide problem. A large number of CVD risk factors have been established. Arterial hypertension (HT) is still the most important [1] and carries huge burden for both developed and developing societies [2]. Poland is no different, and the prevalence of HT in this country is high. According to large, epidemiological studies, 32% of adult Poles suffer from HT [3]. It is alarming that only 26% of diagnosed patients are properly treated [3]. Taking into consideration the absence of a new class of anti-hypertensive drugs, adherence to treatment is becoming increasingly important. There are plenty of methods improving adherence, but the effects have not been satisfying so far [4]. Fortunately, the development of new technologies brings

new possibilities. Telemedicine is growing very fast, giving us new tools. One of them is Google Trends, which represents a worldwide repository of search query data starting from 2004. Based on the received information, every day clinical practice could be properly adjusted resulting in improved survival and quality of life.

METHODS

All data were collected between January 2008 and November 2017 using the commercially available Google Trends tool (<https://trends.google.pl/trends/>). Google Trends is a statistical tool that analyses all web searches made via Google search engine for a specific term. As the developer describes, the Google Trends data is an unbiased sample of Google search

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data. The provided non-real time data is a random sample of Google search data that can be pulled from as far back as 2004 and up to 36 h prior to the search made. The users enter any given search term, and Google Trends computes the number of searches done for that term relative to the total number of searches done on Google. The system automatically eliminates biased data, providing reliable information. The user can search for worldwide data or data specified for a geographical area or country of choice.

In order to investigate the seasonality of arterial hypertension, we examined the search terms “hypertension (pol. nadciśnienie)” and “arterial hypertension (pol. nadciśnienie tętnicze)”, and “hypertension medical condition” in Poland, the United States of America, Australia, and worldwide, respectively. Data were presented graphically and are presented as a function derived from a mean number of searches from nine years for all months separately. All searches were performed on the same day. For record-keeping purposes, a screenshot was taken of each of these data points at the time of collection.

Statistical analysis

Statistical analysis was performed using SPSS v 21.0 (SPSS Inc., Chicago, IL, USA). Raw model coefficients were calculated for all models, and the level of significance was set to < 0.05 .

RESULTS

Graphical results of the search queries for HT are shown throughout the series of figures (Figs. 1–4). In all cases the Google Trends search engine does not give numerical data but rather a percentage of a maximal number of query hits. Graphical data demonstrate seasonal variations in the search queries for different geographical regions.

In all cases, Google Trend searches demonstrate a seasonal increase in the search queries in the winter compared to the summer months. In Poland the search volume is the highest between November and May (above 75% of the maximal number of search queries), while patients exhibit the least interest during summer holidays (less than 65% of the maximal search query load; $p < 0.05$). Moreover, a short-lasting decline in the number of search queries is noted during national and religious holidays such as Christmas or All Saint’s day. When we compared the total number of search queries it was shown that people more often look for “hypertension (pol. nadciśnienie)” than “arterial hypertension (pol. nadciśnienie tętnicze)”, but the seasonal variations are less prominent, remaining the same trends in both cases (Fig. 1A, B).

Similar analysis was performed for the United States of America, a country located in the Northern hemisphere, generating the largest number of Internet search queries and having similar seasons as Poland. Also, in this case it was shown that a significantly higher number of searches is made during the winter season compared to the summer months ($p < 0.05$). Similar results were seen when the search query

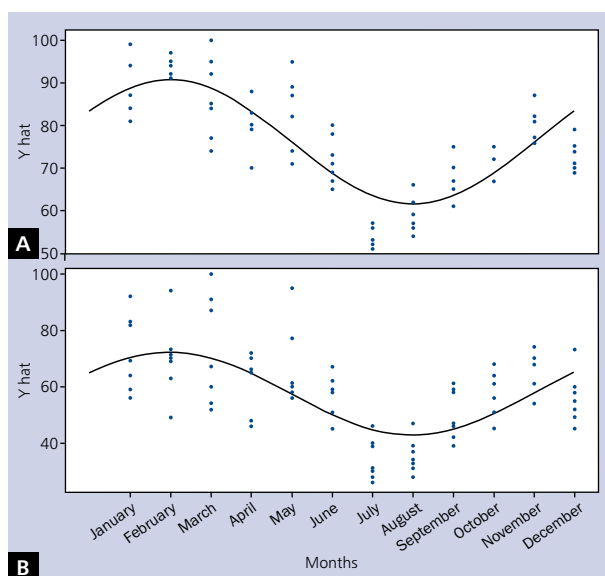


Figure 1. Example of seasonal trends in search for “hypertension (pol. nadciśnienie)” (A) and “arterial hypertension (pol. nadciśnienie tętnicze)” (B) in Poland

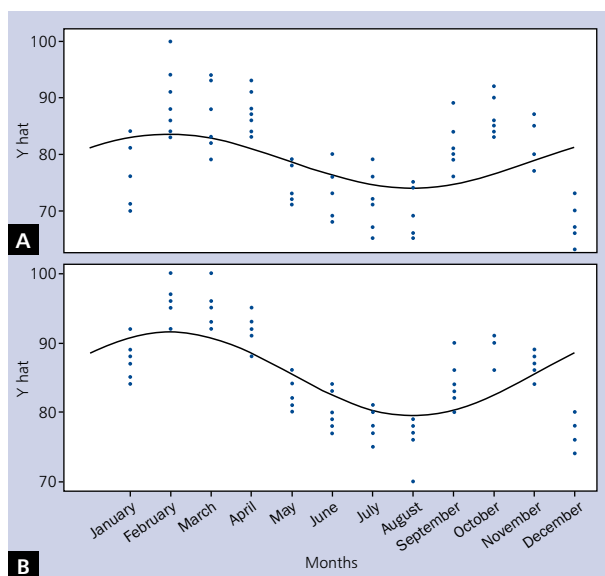


Figure 2. Example of seasonal trends in search for “hypertension” (A) and “hypertension medical condition” (B) in the United States of America

“hypertension” and “hypertension medical condition” was analysed (Fig. 2A, B).

In the case of Australia, an English-speaking country located in the Southern hemisphere, with four seasons, but with an opposite temperature distribution to Poland, also some seasonal patterns were seen. In Australia the coldest months occur during June to August and the warmest during November to March, and the number of hours with the highest sun exposition is opposite to that observed in Poland. Therefore,

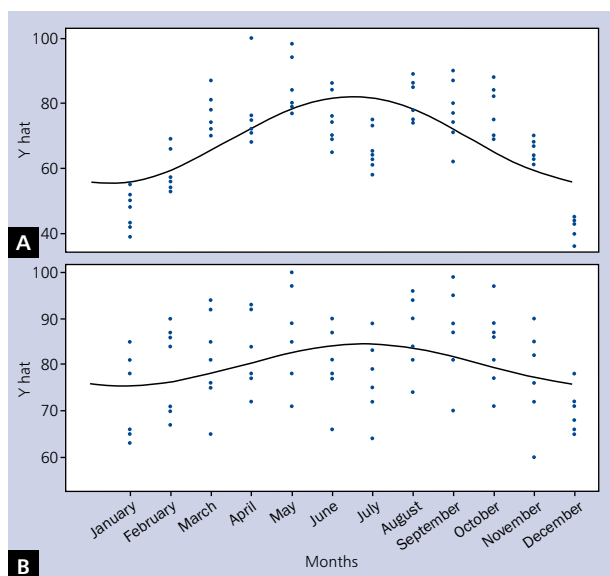


Figure 3. Example of seasonal trends in search for “hypertension” (A) and “hypertension medical condition” (B) in Australia

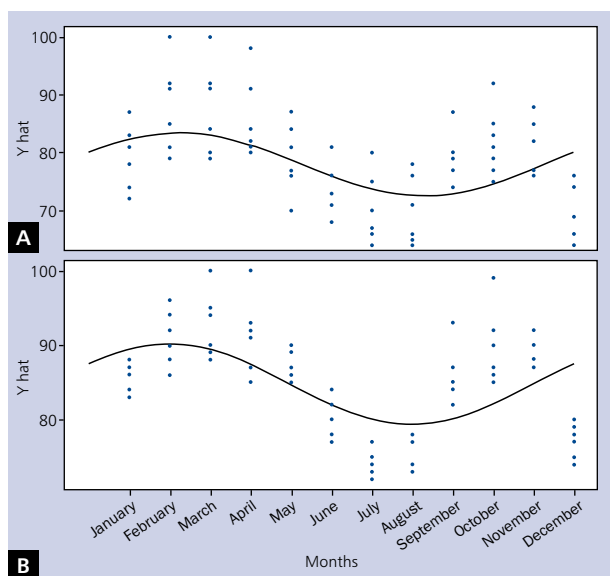


Figure 4. Example of seasonal trends in search for “hypertension” (A) and “hypertension medical condition” (B) worldwide

in Australia the highest number of search queries is seen from May to August and the lowest during November to March. The same pattern is observed for the “hypertension” and “hypertension medical condition” query ($p < 0.05$) (Fig. 3A, B).

Data comparing the number of search queries for the whole world are similar to those for the Northern hemisphere and are a result of the higher total number of Internet searches generated by the population of the Northern hemisphere (Fig. 4A, B).

DISCUSSION

Arterial hypertension is highly prevalent nowadays. It is estimated that the number of people suffering from HT will grow up to 1.56 billion by 2025 [5]. This results in huge costs. Back in 2001 suboptimal blood pressure (BP) control cost 370 billion US dollars, being approximately 10% of the world’s overall healthcare expenditure [6]. Also, looking from the other side, HT is a chronic disease bringing very dangerous and disturbing effects. HT affects multiple systems in the human body, leading to organ damage. This can in turn lead to coronary heart disease, ventricular hypertrophy, atrial fibrillation, stroke, and chronic kidney disease, to name just a few [7]. Every mentioned illness worsens the patient’s prognosis and quality of life and increases costs associated with healthcare. The best possible, documented way to prevent organ damage is to lower BP below the targets recommended by international guidelines. It reduces mortality of patients with HT due to CVD [7, 8]. Even though it seems easy to achieve, BP control is unsatisfactory. Less than 50% of patients worldwide with HT reach the BP values suggested by guidelines [9]. In Poland only one in eight hypertensive patients reach the mentioned target [3]. HT-induced complications are likely to occur in the population with poor BP control [3, 9]. There has not been a new drug class developed in the last 20 years, which makes us look for different ways of improving anti-hypertensive therapy. Adherence seems to be an area where lots can be achieved [4]. It is a big issue not only in treating HT, but also in lipid lowering therapy and aspirin in both primary and secondary prevention [10]. The problem often begins right after leaving the doctor’s office. According to the available studies, 24% of patients refuse to begin treatment, no matter the underlying disease [11]. We suggest that in HT, which is painless, even more patients refuse to start taking medications and follow doctor’s recommendations regarding lifestyle. Another issue is non-persistence. Available data show that half of patients stop anti-hypertensive treatment at one year [12]. Also, pharmacological companies are trying to improve adherence by simplifying therapy. Multiple single-pill fixed-dose combinations are becoming more and more popular. It has been proven that good adherence improves cardiovascular risk [13]. Detecting non-adherence is still big challenge for practicing clinicians. Doubts about whether a patient is non-adherent, mistreated, or under-diagnosed are present in everyday practice. On the other hand, patients are often curious about their health condition and are willing to look for more information than received during the visit at the doctor’s office. Over two thirds of Internet searches are done through Google [14]. We used the Google Trends tool to look at seasonal changes in interest in HT across Poland. A similar search was done regarding obstructive sleep disorder breathing, showing large differences depending on the time of the year [15]. It is worth mentioning that comorbidities accompanying HT tend to exacerbate in the winter months

[16–18]. HT is no different, and BP values in this period are higher [19]. That correlates with increased frequency of phrase “hypertension” searches in Google. The cause of higher BP during colder months is multifactorial [20]. Both systolic and diastolic BP rise when the temperature drops [21, 22]. During winter, limited sunlight exposure results in lower vitamin D synthesis. The association between vitamin D level and HT has been tested in many clinical trials [23, 24]. A change in hormone levels has also been suggested as a factor in higher BP values in this period. Aldosterone and catecholamines seem to be crucial in this area [25]. What is more, cholesterol levels rise during winter [26], resulting in arterial stiffening, which promotes HT development. Additionally, decreased physical activity during the colder season [27] plays a role in more HT diagnoses at this time. Last but not least, air pollution seems to significantly impact BP values [28]. Pollution levels depend on the season, with the greatest variation observed during winter [29]. Additionally, air pollution in Poland is extremely high [30]. During colder months air pollution is very rarely within the limits of norm, especially in larger cities.

The question remains: do people tend to look for “hypertension” more often in winter because more people are diagnosed with HT in this period, or is it due to a lack of different activities such as summer trips? In our analysis we showed a decrease in interest during Christmas. It implies that when people are busy, they are less likely to care about their health, and possibly their adherence could fall. At this point, it is essential to emphasise the role of a doctor in mobilising and supporting patients to improve adherence in those periods. However, the fact that BP values are higher in winter is proven and should not be forgotten.

CONCLUSIONS

In conclusion, hypertension remains a big socioeconomic problem and is more likely to occur during winter months, which correlates with increased interest in searches for the phrase “hypertension” in Google. New technologies are bringing new possibilities, and they can help in everyday practice. This knowledge hopefully will result in improving patient’s adherence, as it seems to be the biggest area to work with in hypertensive patients.

Conflict of interest: none declared

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