

# Assessment of Public Interest in Andrology Between 2006 and 2024: Google Trends Analysis: A Descriptive Study

## 2006-2024 Yılları Arasında Androlojiye Olan Toplumsal İlginin Değerlendirilmesi: Google Trends Analizi: Tanımlayıcı Bir Çalışma

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**ABSTRACT Objective:** We aimed to define public interest about erectile dysfunction (ED) and possible treatment modalities for ED in the last 18 years. **Material and Methods:** Two urologists specialized in andrology defined terms associated with diagnosing and treating ED, reviewing 14 terms such as “erectile dysfunction,” “impotence,” and “Viagra.” These terms were globally searched in all categories, with data from 2006 to 2023 analyzed across three 6-year intervals to compare term popularity. **Results:** The term ED and medications like Tadalafil and Sildenafil saw significant popularity increases over time ( $p=0.001$ ), while shock wave therapies (SWT) popularity surged in the last 6 years. Penile pump and prosthesis interest declined in the final period ( $p=0.001$ ). Terms like impotence, loss of libido, and Cialis also decreased in popularity ( $p=0.001$ ), but Viagra and penile injections remained stable. Overall search data showed a significant increase in the last 6 years ( $p=0.001$ ). Seasonal and geographical trends indicated higher ED term searches in December through February and varying popularity by country, with a notable decline in Japan, Bangladesh, South Korea, and India in recent years. **Conclusion:** This study revealed a significant rise in overall public engagement with ED and its potential treatments over the past six years. Searches for terms such as penile pump and penile prosthesis notably decreased during this period. Moreover, interest in keywords like ED, Tadalafil, Sildenafil, and SWT consistently grew from 2006 to 2024.

**ÖZET Amaç:** Son 18 yıl içinde erektil disfonksiyon (ED) ve ED'nin olası tedavi yöntemleri hakkındaki toplumsal ilgiyi tanımlamayı amaçladık. **Gereç ve Yöntemler:** Androloji alanında uzmanlaşmış iki ürolog, “erektil disfonksiyon,” “iktidarsızlık” ve “Viagra” gibi 14 terimi gözden geçirerek ED'nin tanı ve tedavisiyle ilişkili terimleri belirledi. Bu terimler, 2006'dan 2023'e kadar tüm kategorilerde küresel olarak arandı ve üç adet 6 yıllık dönem halinde analiz edilerek terimlerin popülaritesi karşılaştırıldı. **Bulgular:** ED terimi ve Tadalafil ile Sildenafil gibi ilaçlar zaman içinde önemli bir popülarite artışı gösterirken ( $p=0,001$ ), son 6 yılda şok dalga tedavisinin [shock wave therapies (SWT)] popülaritesi belirgin bir şekilde arttı. Penil pompa ve protezle ilgili ilgi son dönemde azaldı ( $p=0,001$ ). “İktidarsızlık,” “libido kaybı” ve “Cialis” gibi terimlerin popülaritesi de azaldı ( $p=0,001$ ), ancak “Viagra” ve “penil enjeksiyonlar” ile ilgili ilgi stabil kaldı. Genel arama verileri son 6 yılda anlamlı bir artış gösterdi ( $p=0,001$ ). Mevsimsel ve coğrafi eğilimler, ED ile ilgili terimlerin aralık-şubat aylarında daha sık arandığını ve popülaritenin ülkelere göre değiştiğini ortaya koydu. Son yıllarda Japonya, Bangladeş, Güney Kore ve Hindistan'da belirgin bir düşüş gözlemlendi. **Sonuç:** Bu çalışma, son 6 yıl içinde ED ve olası tedavi yöntemleriyle ilgili genel toplumsal ilginin anlamlı bir şekilde arttığını ortaya koymuştur. Penil pompa ve protez gibi terimlere yönelik ilgi bu dönemde belirgin şekilde azalırken, ED, Tadalafil, Sildenafil ve SWT gibi anahtar kelimelere olan ilgi 2006'dan 2024'e kadar istikrarlı bir şekilde artmıştır.

**Keywords:** Andrology; search engine

**Anahtar Kelimeler:** Androloji; arama motoru

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Erectile dysfunction (ED) is characterized by deficiency in obtaining and maintaining sufficient penile erection for sexual intercourse. ED can occur due to serious diseases including cardiovascular diseases, diabetes mellitus, stroke, hypertension etc.<sup>1</sup> Beyond the difficulty of the situation, ED can result in deterioration of partner relationships, social isolation, depression, higher hospital admission, and increases in health costs. Ayta et al. created a model showing the prevalence of ED by years, and the authors emphasized that almost 350 million men will suffer with ED in 2025, demonstrating an increase of 111% in comparison to 1995.<sup>2</sup> In addition, ED is a sensitive issue, and data collection especially face-to-face conversations can involve bias. Many patients do not want to apply to health institutions, and used internet-based sources to understand their symptoms, disease process and treatment options about ED.

A search engine is simply defined as a software system that finds internet sources with web search. Numerous search engines were developed for the market in the last four decades, but internet statistics reveal that Google Search (Google Inc. Mountain View, California, USA) is the most frequently preferred search engine by internet users.<sup>3</sup> Recently, more than 90% of population use Google Search engine while exploring information on the internet. Google trends (GT) was developed to analyze data about how often a word or phrase is searched about, in which language, and in which location. Ergul et al. analyzed public attention about genital esthetic procedures among women from 2004 to 2022, and the authors found that vaginal tightening, vaginal laser and labiaplasty were increasingly searched from 2004 to 2022.<sup>4</sup> In another study, Teng et al. determined that GT provided important information about the epidemic during the Zika virus epidemic.<sup>5</sup>

Although public interest in diverse health conditions has been evaluated in numerous studies, to our knowledge, there is no study which evaluates public attention to ED and possible treatment modalities. In this study, we aimed to define public interest about ED and possible treatment modalities for ED in the last 18 years.

## MATERIAL AND METHODS

This study was performed between January 1, 2024 and January 10, 2024. Terms related to the diagnosis and treatment of ED were defined by 2 urologists experienced in andrology. In total, 14 terms including “erectile dysfunction”, “impotence”, “sexual dysfunction”, “loss of libido”, “Tadalafil”, “Sildenafil”, “Viagra (Pfizer Inc., ABD)”, “Cialis (Eli Lilly and Company, ABD)”, “natural Viagra”, “Trimix”, “shock wave therapy (SWT)”, “penis pump”, “penile injections”, and “penile prosthesis” were reviewed. Terms were searched worldwide and across all categories. Data that did not yield sufficient results in the GT database [penile Doppler ultrasonography, phosphodiesterase type 5 (PDE-5) inhibitors, penile platelet rich plasma, vacuum erection devices, nocturnal penile tumescence] were excluded from the study.

The data for 14 Google search terms related to ED were evaluated between 1.1.2006-31.12.2023. This 18-year period was divided into 3 time intervals of 6 years each (01.01.2006-31.12.2011, 01.01.2012-31.12.2017, and 01.01.2018-31.12.2023). The popularity of the terms was compared between these three periods. The popularity of the term “ED” by month between 01.01.2006-31.12.2023 was evaluated. In addition, a graph showing the popularity of this term by country according to time intervals was created. Ethics committee approval was not required because patient data were not used in this study.

### GT

GT is a tool provided by Google that shows the popularity of certain keywords, topics, or queries over time. Users can see the popularity of search terms across different time periods, geographic regions, and categories. This popularity is scored on a scale from 0 to 100. A score of “100” for a term indicates the highest popularity of that term at that time. This is a relative value, not an absolute number. GT is a useful tool for market research, content creation, understanding public interests, and a variety of other purposes.

### STATISTICAL ANALYSIS

Statistical analyses were performed with SPSS version 27 (IBM Corp., Armonk, NY). Relative search

**TABLE 1:** Comparison of terms related to erectile dysfunction with Google Trend data by years.

|                      | 01.01.2006-31.12.2011         | 01.01.2012-31.12.2017         | 01.01.2018-31.12.2023          | p value      |
|----------------------|-------------------------------|-------------------------------|--------------------------------|--------------|
| Erectile dysfunction | 47.0 (38.0-52.0) <sup>a</sup> | 61.0 (57.0-67.5) <sup>b</sup> | 75.0 (71.0-77.8) <sup>c</sup>  | <b>0.001</b> |
| Impotence            | 51.0 (48.0-58.0) <sup>a</sup> | 42.0 (39.0-45.0) <sup>b</sup> | 29.0 (26.0-33.0) <sup>c</sup>  | <b>0.001</b> |
| Sexual dysfunction   | 58.5 (48.0-71.3) <sup>a</sup> | 36.0 (33.0-38.0) <sup>b</sup> | 34.5 (33.0-37.0) <sup>b</sup>  | <b>0.001</b> |
| Loss of libido       | 51.0 (43.4-56.0) <sup>a</sup> | 46.0 (43.0-51.0) <sup>b</sup> | 35.0 (33.0-38.0) <sup>c</sup>  | <b>0.001</b> |
| Tadalafil            | 14.0 (13.0-15.0) <sup>a</sup> | 17.0 (16.0-20.0) <sup>b</sup> | 55.0 (42.0-65.5) <sup>c</sup>  | <b>0.001</b> |
| Sildenafil           | 21.0 (20.0-23.0) <sup>a</sup> | 39.0 (31.3-43.0) <sup>b</sup> | 73.5 (65.0-85.8) <sup>c</sup>  | <b>0.001</b> |
| Viagra               | 68.0 (64.0-72.0)              | 66.0 (63.0-70.0)              | 70.0 (64.0-75.0)               | 0.108        |
| Cialis               | 57.0 (54.0-66.8) <sup>a</sup> | 51.0 (47.0-54.0) <sup>b</sup> | 38.5 (35.0-43.0) <sup>c</sup>  | <b>0.001</b> |
| Natural Viagra       | 47.5 (38.3-58.5) <sup>a</sup> | 74.5 (62.5-82.8) <sup>b</sup> | 59.0 (52.3- 68.8) <sup>c</sup> | <b>0.001</b> |
| Trimix               | 56.0 (51.3-60.0) <sup>a</sup> | 49.0 (46.0-52.0) <sup>b</sup> | 59.5 (53.5-64.0) <sup>c</sup>  | <b>0.001</b> |
| ESWT                 | 35.5 (31.5-41.3) <sup>a</sup> | 37.0 (34.3-39.0) <sup>a</sup> | 57.0 (52.3-61.8) <sup>b</sup>  | <b>0.001</b> |
| Penis pump           | 47.0 (43.3-51.8) <sup>a</sup> | 49.0 (44.0-53.0) <sup>a</sup> | 39.0 (35.0-41.0) <sup>b</sup>  | <b>0.001</b> |
| Penile injections    | 25.0 (16.0-34.0)              | 26.0 (23.0-30.8)              | 26.5 (21.3-31.0)               | 0.436        |
| Penile prosthesis    | 37.0 (32.0-45.8) <sup>a</sup> | 35.0 (32.0-36.8) <sup>a</sup> | 29.0 (27.0-32.0) <sup>b</sup>  | <b>0.001</b> |
| Total                | 43.9 (37.2-49.2) <sup>a</sup> | 44.9 (40.0-48.5) <sup>a</sup> | 49.6 (45.3-54.0) <sup>b</sup>  | <b>0.001</b> |

In pairwise group comparisons, statistically similar results are indicated by the same letters (such as a-a); ESWT: Extracorporeal shock wave therapy.

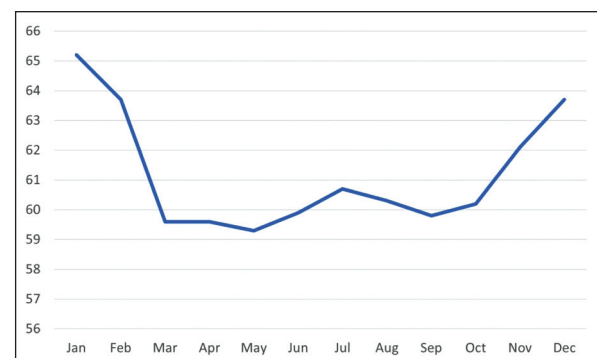
volume (RSV) data from 01.01.2006 to 31.12.2011, 01.01.2012 to 31.12.2017, 01.01.2018 to 31.12.2023 were separated, and the RSV means were calculated. The normality of the distribution of data was evaluated with the Kolmogorov-Smirnov test. Comparison of RSV means between periods was performed using the Kruskal-Wallis test. The Games-Howell test was used for post hoc analysis between groups. The data were analyzed at 95% confidence level, and a p-value of less than 0.05 was accepted as statistically significant.

## RESULTS

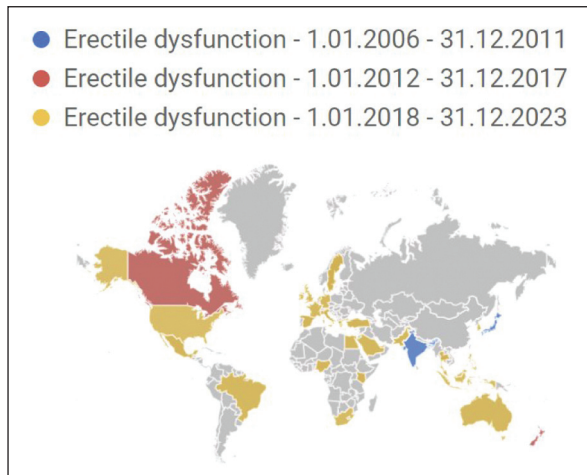
The popularity of the term ED tended to increase significantly across the time periods ( $p=0.001$ ). The terms Tadalafil and Sildenafil similarly showed a statistically significant increase at each time point ( $p=0.001$ , and  $p=0.001$ ; respectively). The term SWT was similar in the first two time periods but showed a statistically significant increase in the last 6-year period ( $p=0.001$ ). The popularity of terms penile pump and penile prosthesis were similar in the first two time periods but showed a statistically significant decrease in the last 6-year period ( $p=0.001$ , and  $p=0.001$ , respectively). The terms impotence, loss of libido, and Cialis showed a statistically sig-

nificant decrease in popularity over time ( $p=0.001$ ,  $p=0.001$ , and  $p=0.001$ ; respectively). The popularity of the terms Viagra and penile injections did not change over time ( $p=0.108$ , and  $p=0.436$ ; respectively). The mean for all search data was 43.9 between 2006 and 2011, 44.9 between 2012 and 2017, and 49.6 between 2018 and 2023. A statistically significant increase was observed in the last 6-year period compared to other time periods ( $p=0.001$ ) (Table 1).

The graph of the distribution of the term ED by months is shown in Figure 1. An increase was ob-



**FIGURE 1:** Evaluation of the term "erectile dysfunction" by months in Google Trends data (01.01.2006-31.12.2023).



**FIGURE 2:** Ranges of years in which the term “erectile dysfunction” was most popular by country.

The popularity of the term “erectile dysfunction” peaked in most countries in the last 6 years (yellow areas). However, its popularity decreased over time in some countries (blue areas) (Japan, Bangladesh, South Korea, and India).

served in December, January, and February compared to other months. The distribution of the term ED according to countries and comparison according to time periods is shown in Figure 2. Search data increased in many countries over the last 6 years. In Japan, Bangladesh, South Korea, and India, the highest popularity was between 2006 and 2011, with a decline in recent years.

## DISCUSSION

ED is one of the most common medical conditions in men with increasing prevalence.<sup>6</sup> Due to economic factors, social pressure, and shame related to the disease, numerous patients with ED use web sources to obtain knowledge about ED and possible treatment alternatives for ED. We believe that revealing the most commonly searched words on the internet regarding ED is important when preparing resources for patient information. Thus, this study was conducted to define public interest about ED and possible ED treatments from 2006 to 2024 using 14 selected terms. Public interest in the terms ED, Tadalafil, Sildenafil, and SWT continuously increased from 2006 to 2024, and public attention to penis pump and penile prosthesis terms significantly decreased in the last six years. Finally, total search rates for 12 selected terms significantly in-

creased in the last 6 years compared to the previous 12 years.

A disease or symptom can be described with different words in the medical literature or among the public.<sup>7</sup> Also, while expressing ED status, words such as impotence, ED, lack of erection or slang words can be used. Sevgili and Baytaroglu analyzed public interest about cardiologic diseases using GT, and concluded that the frequency of Google searches for words that are more popular and used among the public has increased in recent years.<sup>8</sup> In the present study, unlike the words “impotence”, “sexual dysfunction”, and “loss of libido”, the keyword “ED” consistently increased significantly throughout the study period. Due to our results, we recommend that healthcare professionals who want to reach patients with ED create texts that include the word “ED” more.

PDE-5 inhibitors are the most common medication chosen for ED, and work by increasing cyclic guanosine monophosphate levels and blood flow in the penis.<sup>9</sup> In their study investigating the frequency of use of PDE-5 inhibitors, Corona et al. emphasized that Sildenafil and Tadalafil were most frequently used PDE-5 inhibitors.<sup>10</sup> Viagra and Cialis were made available to patients as the first commercial products containing Sildenafil and Tadalafil raw materials. Our study showed that people started to search for PDE-5s on the internet not with market names, but rather with ingredient names.

Minimally invasive treatments or non-invasive treatments are preferred more in recent years because they are cheaper, do not require hospitalization, and are more painless compared to surgical procedures.<sup>11</sup> SWT is a relatively new treatment option providing regenerative effects to the penile vascular system, and increasing angiogenic factor release.<sup>12</sup> Vardi et al. investigated the role of SWT in the management of ED, and the authors concluded that SWT treatment resulted in better erection status one month after treatment.<sup>13</sup> In the present study, public attention about SWT continuously increased in the last 18 years. However, public interest in more invasive treatment modalities like penile injections and penile prosthesis remained the same or decreased.

Although this is the first study to define public interest in ED and possible ED treatments by using GT, the present study involves some limitations. Firstly, we analyzed only Google searches in the present study; however, Google is not the only search engine, and some search engines may be preferred more frequently in some geographical regions and in some languages. Despite this, Google is most commonly used search engine at rates of more than 90%. In addition, only terms in the English language, which is most common language on the web, were searched. The evaluation of more than one language would be confusing and difficult to analyze. Public attention to ED and possible ED treatments in rarer languages could be analyzed in further research. Lastly, 12 frequently used words related to ED and ED treatments were chosen; however, patients can search with rarer but unique words about this subject.

## CONCLUSION

In conclusion, the present study showed that total public interest about ED and possible ED treatments significantly increased in the last six years. In contrast, the terms penile pump and penile prosthesis were searched significantly less in the last six years. In addition, public interest for the keywords ED, Tadalafil, Sildenafil, and SWT continuously in-

creased from 2006 to 2024. Organizations and individuals providing professional healthcare services will be able to create content using words with high search frequency, allowing them to reach patients more easily and effectively.

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*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

### **Conflict of Interest**

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### **Authorship Contributions**

*Idea/Concept: Hakan Çakır; Design: Hakan Çakır; Control/Supervision: Hakan Çakır, Faruk Özgör; Data Collection and/or Processing: Hakan Çakır, Faruk Özgör; Analysis and/or Interpretation: Faruk Özgör; Literature Review: Faruk Özgör; Writing the Article: Hakan Çakır; Critical Review: Faruk Özgör; References and Fundings: Hakan Çakır; Materials: Hakan Çakır, Faruk Özgör.*

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