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SHORT REPORT

Can Google Help Your Nearsightedness? A Google Trend Analysis of Public Interest in Myopic Progression

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Purpose: To explore public interest in myopia progression and management and to correlate these trends to available treatments.

Methods: Keywords were chosen for interest in myopia overall and those signifying interest in myopia treatments. Treatment options were separated into four main categories: atropine, glasses, contact lenses, and orthokeratology. Search terms were queried across ten years of Google Trends data and the relative search volume was analyzed to quantify the change in search volume over time.

Results: A positive linear trend over time was present for all myopia interest keywords except "nearsighted" ($p = 0.074$) and "near work myopia" ($p = 0.086$). Interest in the four myopia treatment categories included in this study also displayed a significant positive trend over time. There is also a statistically significant positive correlation between all four treatment options and four of the seven categories of population interest, "myopia control", "myopia", "myopia progression", and "screen time myopia".

Conclusion: This study demonstrates the utility of GT to correlate public interest in myopia treatments over time. All treatment terms had statistically significant linear search volume growth over a ten-year period. The positive correlation between interest in myopia as a health problem and available treatments supports existing evidence that GT can track rising public health concerns and corresponding treatment-seeking behaviors.

Keywords: myopia, Google Trends, nearsighted, orthokeratology, atropine

Introduction

Myopia is one of the leading causes of visual impairment worldwide, affecting an estimated 30% of the population.[1,2] Rates of myopia are rising, with a predicted 2.6-fold increase between 2010 and 2050, impacting nearly half of the world's population.[3,4] While refractive errors can be addressed with optical correction, this does not prevent the consequences of axial elongation such as irreversible changes to the retina, choroid, and sclera.[5] The downstream effects of myopia also create a large socioeconomic burden of global interest.[3,5]

In addition to the increasing prevalence, myopia is affecting younger age groups and progressing more severely than before.[6] Factors contributing to the myopia epidemic include genetic predispositions and changes in global evolutionary behaviors such as increased near work and decreased time spent outdoors.[7] Among a generation of children affected by COVID-19, during which virtual learning skyrocketed, myopic progression was statistically higher than pre-pandemic levels.[8,9] Given the increasing prevalence of myopia, recent surveys show that ophthalmologists use a variety of methods to decrease myopic progression including pharmacologic treatment such as low-dose atropine drops, optical correction, and behavioral recommendations, with pharmacologic treatments being the most popular.[3] Other studies evaluated the attitudes of parents and caregivers on myopia and showed that about half considered myopia a health concern, and the majority understood the significant role technology plays in enhancing that risk.[9,10] Together, these studies provide an important context to understanding the role of treatment, as any treatment requires both parental understanding of the condition and acceptance of the proposed intervention.

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Although important, these surveys provide a snapshot of attitudes at a given time. They are subject to geographic and demographic biases and are limited to the responses received. Alternative resources to assess public interest in clinical conditions on a dynamic basis provide clearer insight into trends over time. Google is an important resource for parents and caregivers, as it provides easy access to clinical information. Google Trends (GT) is a free, open-source tool that allows analysis of search traffic data of keywords and search terms starting from January 2004 up to the current minute.[11,12] This tool provides a dynamic approach to evaluate what users are searching over time. The results from GT are reported using relative search volumes (RSV), where a percentage of interest in a keyword is determined at a specific time relative to the maximum search traffic for that keyword over the designated time period. RSV are displayed on a scale of 0 to 100, where value of 100 reflects the highest volume of search traffic, and RSV values of 0 reflect the lowest search traffic or insufficient data for the term. This controls for population size, multiple search terms by the same individual, and regional differences in utilization.[13]

The purpose of this study is to explore public interest in myopia and management of its progression as well as correlate these trends to available treatments. With this additional tool to elucidate patient interests, ophthalmologists can use this information to formally educate on topics patients are turning to the internet to learn more about.

Methods

Google Trends Analysis

Google Trends was utilized to extract data on keyword search terms from March 1, 2013 to March 1, 2023. The search terms were divided into two comparison categories: search terms marking interest in myopia overall and myopia treatment options (Tables 1 and 2). Terms to measure general interest in myopia were determined by using the "related queries" function on GT that highlights similar terms of interest to "myopia". The myopia treatment search terms were chosen broadly based on a recent review of current treatments on myopia, which highlighted four main categories: orthokeratology, atropine, contact lenses, and glasses.[14] Terms were then narrowed to those seen in Tables 1 and 2 based on the availability of sufficient data on GT for the term

Table 1 Myopia Interest Search Terms Used in Analysis. (Data Source: Google Trends [www.google.com/Trends])

	Generated Search Terms		
Myopia Interest	Myopia Control	Myopia	Childhood myopia
	Myopia Progression	Nearsighted	Screen Time Myopia
	Near Work Myopia		

Table 2 Myopia Treatment Search Terms Used in Analysis. (Data Source: Google Trends [www.google.com/Trends])

	Generated Search Terms
Orthokeratology	Ortho-K Orthokeratology Abiliti
Atropine	Atropine drops Atropine eye drops Atropine eye
Contact lenses	Misight Biofinity NaturalVue
Glasses	Stellest MiyoSmart

and researcher consensus that the term captures the general population and minimizes bias. The aim was to choose phrases that cover treatment concepts, branded names, and colloquial terms to adequately capture popular variations users might search. With these parameters, GT generated data based on RSV of each selected term.

Statistical Analysis

The significance of monotonic trends over time was determined using the Mann-Kendall equation. Univariate linear regression was used to evaluate the correlation between GT search volume for terms representing public interest in myopia and corresponding terms for interest in treatment options. P value <0.05 was applied to define statistical significance. All statistical and trend analyses were performed with Microsoft Excel version 15.21.1.

Results

General Trends in Myopia and Myopia Treatments

Changes over time in myopia interest and treatments revealed a positive linear trend for keywords "childhood myopia" ($p < 0.001$), "myopia progression" ($p < 0.001$), "screen time myopia" ($p < 0.001$), "myopia control ($p < 0.001$), and "myopia" ($p < 0.001$). No significant trend was noted for keywords "nearsighted" ($p = 0.074$) or "near work myopia" ($p = 0.086$). The myopia interest keywords with significant positive linear trends are demonstrated in Figure 1. Interest in the four myopia treatment categories included in this study also displayed a significant positive trend over time:

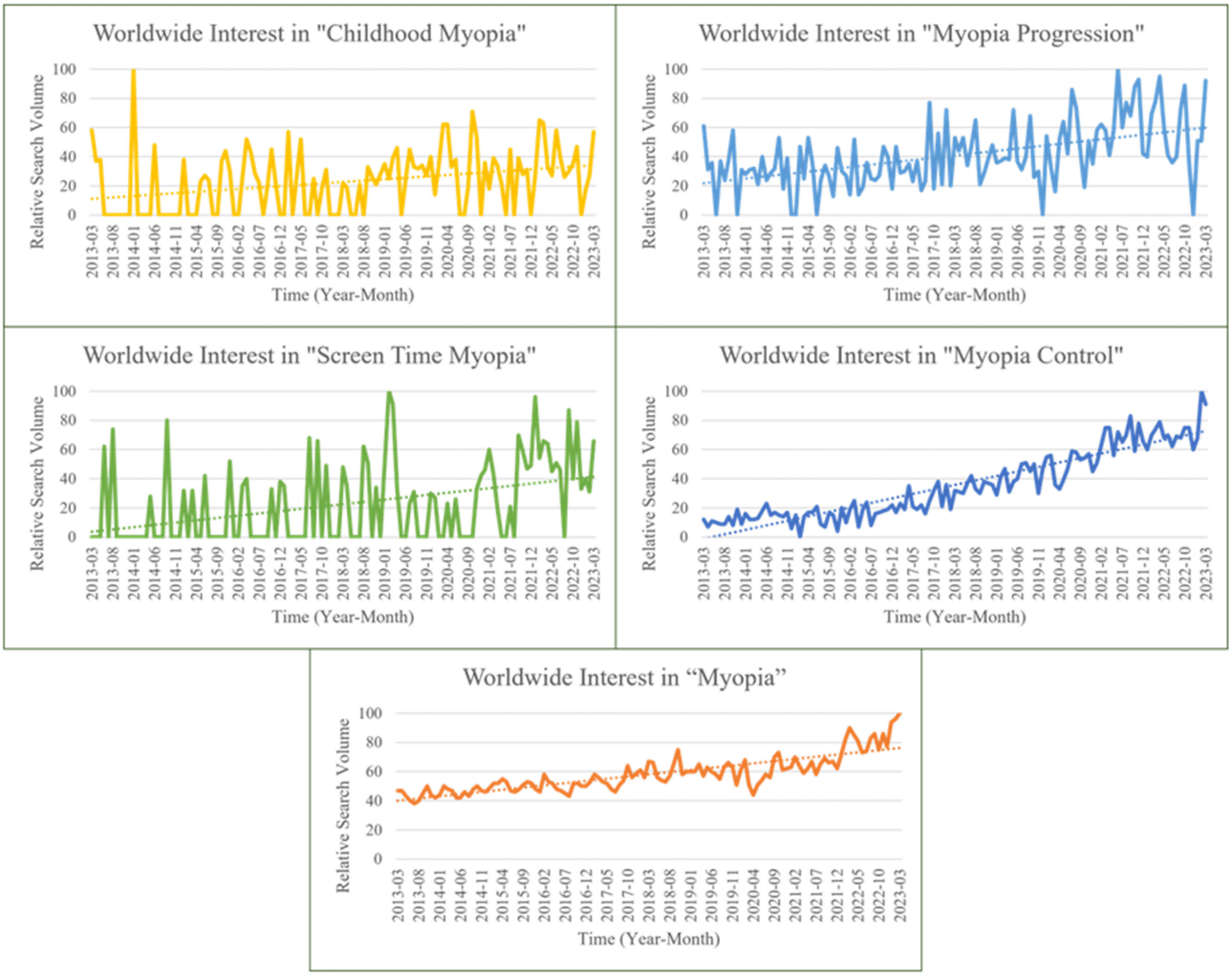

Figure 1 Worldwide Google Trends search traffic for myopia interest keywords with statistically significant positive trends.

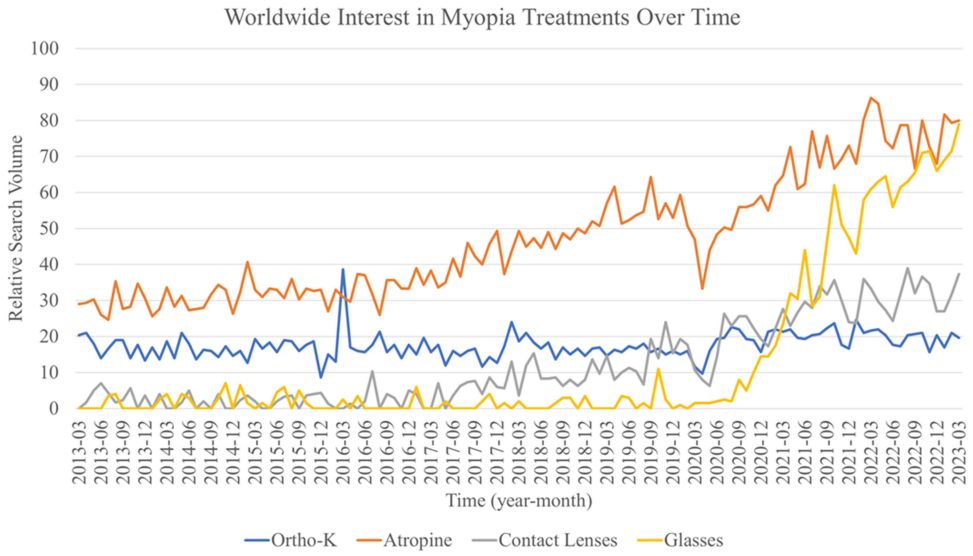

Figure 2 Worldwide Google Trends search traffic for four myopia treatment categories.

orthokeratology ($p < 0.001$), atropine ($p < 0.001$), contact lenses ($p < 0.001$) and glasses ($p < 0.001$). Trends for average interest for all keywords for the four treatment categories is displayed in Figure 2. Both Figures 1 and 2 emphasize an upward trajectory for myopia-related search volumes over 10 years.

Correlation of Myopia Interest Keywords to Treatment Keywords

Univariate linear regression analysis demonstrated a statistically significant positive correlation between all four treatment options and four of the seven categories of population interest, "myopia control", "myopia", "myopia progression", and "screen time myopia". "Childhood myopia" had a significant positive correlation with all treatment options studied other than orthokeratology. GT interest in "nearsighted" and "near work myopia" did not correlate with RSVs of any of the analyzed treatments (Table 3).

Table 3 Relationship of Trends in Myopia Interest GT Terms to Interest in Four Treatment Types for Myopia Control. (Data Source: Google Trends [www.google.com/Trends])

Myopia Interest GT Terms		Treatment GT Categories			
		Orthokeratology	Atropine	Contact Lenses	Glasses
Myopia Control	R^2 Coefficient (95% CI) P value	0.132 0.055 (0.030–0.081)++ 4.27E-5*	0.856 0.667 (0.616–0.715)# 6.98E-52*	0.829 0.453 (0.415–0.489)+ 2.02E-47*	0.621 0.764 (0.656–0.873)# 8.00E-27*
Myopia	R^2 Coefficient (95% CI) P value	0.090 0.084 (0.035–0.132)++ 0.001*	0.753 1.147 (1.023–1.266)# 6.09E-38*	0.657 0.739 (0.642–0.836)# 1.87E-29*	0.649 1.435 (1.244–1.627)# 8.35E-29*
Childhood Myopia	R^2 Coefficient (95% CI) P value	0.011 0.018 (−0.012–0.048) 0.248	0.093 0.241 (0.104–0.377)+ 0.001*	0.072 0.146 (0.050–0.241)+ 0.003*	0.053 0.245 (0.057–0.433)+ 0.011*
Myopic Progression	R^2 Coefficient (95% CI) P value	0.119 0.056 (0.028–0.083)++ 1.04E-4*	0.280 0.402 (0.28–0.519)+ 4.52E-10*	0.318 0.296 (0.217–0.374)+ 1.60E-11*	0.216 0.476 (0.311–0.640)+ 7.99E-08*

(*Continued*)

Table 3 (Continued).

Myopia Interest GT Terms		Treatment GT Categories			
		Orthokeratology	**Atropine**	**Contact Lenses**	**Glasses**
Nearsighted	R^2 Coefficient (95% CI) P value	0.00 0.026 (−0.051–0.103) 0.504	0.001 −0.046 (−0.410–0.318) 0.802	0.016 −0.174 (−0.423–0.076) 0.170	0.002 0.129 (−0.361–0.619) 0.603
Screen Time Myopia	R^2 Coefficient (95% CI) P value	0.035 0.024 (0.001–0.047)++ 0.041*	0.205 0.274 (0.176–0.372)+ 1.81E-07*	0.151 0.162 (0.092–0.232)+ 1.09E-05*	0.202 0.367 (0.235–0.500)+ 2.24E-07*
Near Work Myopia	R^2 Coefficient (95% CI) P value	0.019 0.017 (−0.005–0.039) 0.135	9.86E-05 −0.006 (−0.112–0.101) 0.914	0.001 −0.010 (−0.083–0.064) 0.799	1.55E-06 0.129 (−0.142–0.144) 0.989

Notes: Significant correlations (P < 0.05) marked with *. Strong correlations marked with # (coefficient > 0.500), moderate correlations marked with +(coefficient 0.100–0.500), and weak correlations marked with ++(coefficient < 0.100).

Discussion

This study demonstrates the utility of GT to correlate public interest in myopia treatments over time. All treatment terms had statistically significant linear search volume growth over a ten-year period. GT myopia interest terms with significant positive trends in search volumes over the ten-year period include "myopia control", "myopia", "childhood myopia", "myopic progression", and "screen time myopia". Serving as a conjugate for public interest in myopia, either from increased attention to a growing public health concern in conjunction with a rise in patients affected by myopia, these terms all had statistically significant correlations with the rise in interest of the four myopia treatment categories. The positive correlation between interest in myopia as a health problem and available treatments supports existing evidence that GT can track rising public health concerns and corresponding treatment-seeking behaviors. Other studies have shown a correlation between GT search volume and future medical billing for those treatments, which is a promising future direction for GT use in the field of ophthalmology.[13,15]

Not all GT terms chosen displayed statistically significant trends, emphasizing the need for careful selection of keywords to effectively draw conclusions. Myopia interest terms "nearsighted" and "near work myopia" did not have a significant change in search volume over a ten-year period. This could possibly be due to altered GT accuracy with certain keywords, such as capturing wider discrepancies in search volume data with non-technical terms.[15] "Childhood myopia" was the only public interest term that did not correlate with one of the treatment terms, "orthokeratology". However, given the correlation between "orthokeratology" and other myopia interest terms chosen in this study, researchers should exercise caution when using limited GT data to extrapolate information about public interest. Broader analyses with multiple search terms should be used to provide a more holistic view of public interest and prevent misleading conclusions.

As GT is a dynamic tool, it allows for analysis on how search terms change over time. These general trends can be cross-referenced with events like FDA approvals and advertisement campaigns to see how the public responds to these influences via search volumes. When looking at glasses for myopic progression, Essilor's Stellest spectacle lenses first became available in China, Singapore, and Russia in 2020, and proceeded to become FDA approved in May 2021.[16] When looking at the worldwide trends in search traffic (Figure 2), the search volume for myopia glasses starts to increase at the beginning of 2020 and continues to trend steeply upward through today. A similar trend is seen with contact lenses. The MiSight, made by Cooper Vision, was approved by the FDA in late 2019, and the GT shows a small increase in searches in 2020.[17] These both directly correlate with the Introduction and availability of these products to the market.

Orthokeratology lenses were first available for daily use in the US in the early 1990s and for overnight use in the early 2000s, both of which are prior to the start of available GT data.[18] The Abiliti Orthokeratology lens by Johnson & Johnson was first available in the US in May 2021 with expanded access in September 2022.[19] When looking at the trends in search traffic (Figure 2), there is no associated spike or general increase in search volume associated with this product

launch and subsequent marketing. Unlike glasses, orthokeratology search volumes have remained relatively consistent since 2013, which is consistent with these lenses being available to patients across the world for decades.

Atropine differs from the other treatments included in this study as it is a generic pharmaceutical without specific product launches or marketing. It has been used to prevent myopic progression prior to the start of available GT data, but there is a general increase in search volumes starting in 2016, correlating with the publication of landmark five-year clinical trial on atropine for the treatment of myopia.[20] More than just a reflection of large marketing campaigns, the GT data shows an increased public interest in atropine, which may be attributed to both patients and providers seeking more information about advances in treatment.

Although GT data does provide a dynamic method for gauging public interest in various topics, it has limitations. Although the most popular, Google is not the only search engine available and is not available in every country, so this study inevitably excludes searches done through other platforms or in languages other than English.[21] Additionally, the GT data does not provide information about the person performing the search, including identity of the searcher, either patient or provider, nor does it tell us the intention of the search, such as general interest or intention to seek treatment. This results in an aggregate data set of the general population, not specifically prospective patients. In addition, there is a natural variation in the search words used, especially with non-technical terms. Although it is impossible to capture all variations, this is why search terms were evaluated to ensure enough search volume to make meaningful comparisons.

Conclusion

This study contributes to the growing body of literature underscoring GT's ability to model public interest in medicine successfully. As GT continues to improve its algorithm's accuracy and patients increasingly turn to the internet for healthcare information, it has the potential to become a valuable instrument for physicians to keep a pulse on public interest. As a free, open-source resource, GT holds enormous potential for medical marketing and industry expansion based on real-time public interest. Moreover, existing research has demonstrated GT's correlation with use of treatments and procedural volumes, highlighting the important link between medical media consumption and healthcare expenditures.[15]

Our study demonstrates that search volumes for public interest in myopia have rapidly increased over the last ten years, correlating with interest in treatments targeted at slowing its progression. Given the elective nature of myopia treatments that may be advertised to patients, GT can track the ensuing consumption of online information as people seek to better understand these treatments. Unlike product or market surveys that capture a single moment in time and are limited by participation, ophthalmologists can use GT to capture interest from large populations, and tracking changes over ten years indicates how population awareness of myopia has changed tremendously.

Disclosure

The authors report no conflicts of interest in this work.

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