Published in final edited form as:

Cornea. 2013 July ; 32(7): 1015–1018. doi:10.1097/ICO.0b013e318283c85a.

Gauging Interest of the General Public in Laser Assisted In Situ Keratomileusis (LASIK) Eye Surgery

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Abstract

Purpose—To assess interest among members of the general public in laser-assisted in situ keratomileusis (LASIK) surgery and how levels of interest in this procedure have changed over time in the United States and other countries.

Methods—Using the Google Trends website, we determined the weekly frequency of queries involving the term “LASIK” from January 1, 2007, through January 1, 2011, in the United States, United Kingdom, Canada, and India. We fit separate regression models for each of the countries to assess whether residents of these countries differed in their querying rates on specific dates and over time. Similar analyses were performed to compare four U.S. states. Additional regression models compared general public interest in LASIK surgery before and after the release of a 2008 Food and Drug Administration (FDA) report describing complaints associated with this procedure.

Results—During 2007–2011, the Google query rate for “LASIK” was highest among persons residing in India, followed by the United Kingdom, Canada, and the United States. During this time period, the query rate declined by 40% in the United States, 24% in India, and 22% in the United Kingdom, and it increased by 8% in Canada. In all four of the U.S. states examined, the query rate declined—by 52% in Florida, 56% in New York, 54% in Texas, and 42% in California. Interest in LASIK declined further among U.S. citizens after the FDA report release.

Conclusion—Interest among the general public in LASIK surgery has been waning in recent years.

Introduction

Laser-assisted in situ keratomileusis (LASIK) is an elective intraocular surgical procedure that changes the shape of the cornea to correct refractive error. First approved by the U.S. Food and Drug Administration (FDA) in 1998, this procedure provides an alternative to wearing eyeglasses or contact lenses for persons with various forms of refractive errors, including myopia, hypermetropia, and astigmatism.¹ Persons who consider undergoing LASIK surgery must weigh the potential benefits associated with reducing the need for eyeglasses or contact lenses with the small, albeit real, risk for adverse events, which can result in permanent vision loss, and the out-of-pocket expense associated with the surgery.

Given that 50% of adults in the United States require some form of refractive correction, the potential demand for this surgery is large.² To date, little is known about the interest among

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The authors have no proprietary or commercial interest in any material discussed in this manuscript.

the general public in LASIK surgery and the influence of factors such as the economic recession and news media reports about complications associated with this procedure on the volume of cases performed. Gauging interest among the general public in LASIK eye surgery is challenging because most insurance companies categorize LASIK as an elective procedure. While researchers can query administrative healthcare claims databases to study utilization patterns for many other surgical procedures, LASIK does not have a specific Current Procedural Terminology (CPT) billing code for researchers to use to study trends in this surgery.

In 2009, researchers at Google (Google, Inc., Mountain View, CA) demonstrated that their search engine was capable of determining incidence rates of influenza by studying the frequency that users queried related search terms and that such data correlated strongly with visits to physician offices for influenza, as captured by the Center for Disease Control and Prevention (CDC).³ Since this publication, researchers have taken advantage of this search engine to study other medical conditions including chickenpox and gastrointestinal illnesses.^{4,5} Google Trends has also been used to assess trends in the use of certain pharmaceuticals.⁶ In the field of ophthalmology, researchers have used this tool to assess what types of ocular conditions and procedures are commonly queried by members of the general public and to determine how searches of these conditions can vary with respect to the season of the year.⁷ Considering that more than 184 million U.S. residents are regular internet users, and many seek medical information online, studying trends in search-engine queries may aid researchers in gauging interest among the general public in procedures like LASIK surgery and to help identify factors that may be influencing interest in this procedure.⁸

Materials and Methods

Data Source

Google Trends is a tool designed by Google that captures trends in the frequency that users of their search engine query particular words or phrases. This tool determines the number of searches that have been conducted for a particular word or phrase of interest and compares this with the total number of Google searches performed in a given time period. The data presented on Google Trends is normalized and scaled. Normalization of the data enables researchers to compare frequency of queries performed in different regions, countries, or states accounting for regional differences in population density. Fixed scaling enables researchers to determine changes over time in the frequency of searching for a particular word or phrase, relative to a preset time period, in this case, January 2004. The results of the search engine query are scaled so that 100 represents “peak search volume.” For example, a value of 5 would indicate that the search intensity at that particular time was 5% of the peak intensity of all Google queries.

Analyses

We performed a query using Google Trends for the terms “LASIK,” “LASEK,” and “Laser assisted in situ keratomileusis” to determine the frequency of searches for these terms performed from January 1, 2004, through January 1, 2011. Of these three terms, only the term “LASIK” was queried frequently enough to study trends in the interest in this procedure over time. We obtained weekly estimates of searches about this procedure over this 7-year time period.

To identify regional differences in the frequency of searches conducted using the term “LASIK,” we repeated the query for each of the four countries: United States, Canada, United Kingdom, and India to obtain weekly estimates of searches of this procedure from

January 1, 2007, through January 1, 2011. We chose 2007 as the starting date for this analysis since data were limited for two of these four countries prior to 2007. A similar analysis was performed comparing queries for “LASIK” in four selected U.S. states: New York, Florida, Texas, and California. Our analyses were restricted to these particular countries and states because we found that Google Trends did not adequately capture usage patterns for other countries or states prior to 2008 to enable assessment of longitudinal changes in the volume of queries performed.

To investigate differences in “LASIK” queries among the four selected countries, we fit four separate regression models (one for each country). In each regression, the “LASIK” query rate was the dependent variable and time (in weeks, from 2007 to 2011) was the independent variable. The regression models allowed us to determine 1) whether countries had different querying rates at specific dates, and 2) if the rate of change in querying rate over time varied by country. Similarly, we fit four separate regression models for the four selected U.S. states.

Google Trends also has a “News reference volume” feature that records the timing of articles pertaining to the word or phrase of interest that appears on the Google News website. When exploring this feature, we noticed one spike in publicity pertaining to LASIK surgery during the week of April 25, 2008. This spike in publicity about LASIK surgery was attributable to a statement released by the FDA on LASIK-related complaints.¹ To determine whether the release of this statement had an impact on public interest in this procedure, we assessed trends in “LASIK” queries across the United States and Canada in the two years prior to this press release (January 1, 2006, through April 17, 2008) as compared with two years after this press release (April 25, 2008 through January 1, 2011). There were inadequate data prior to April 2008 to run this analysis on query rates in England and India. A comparison of pre- and post- press release data was performed by using two separate regression models, one for before and one for after the release of the FDA report. Similar comparisons were made to determine the impact of the FDA report on “LASIK” queries in each of the four US states.

Since the data used in this analysis are publicly available on the Google Trends website and are completely de-identified, institutional review board approval was not obtained to conduct this analysis.

Results

Among the four nations studied, the volume of queries for “LASIK” was highest in India, followed by England, Canada, and the United States. In the first week of January 2007, the volume of “LASIK” queries in the US, Canada, and England were 0.91, 1.00, and 2.52 (India lacked adequate data prior to 2008). By comparison, for the first week of January 2011, the volume of “LASIK” queries in the US, Canada, England, and India were 0.52, 1.23, 1.52, and 1.94, respectively. Relative to trends observed in rates of queries of this term performed in the US (−0.11/yr.) from 2007–2011, there was a steeper decline in the volume of “LASIK” queries in India (−0.35/yr.) and England (−0.19/yr.). In contrast, the rate of change in volume of “LASIK” queries in Canada increased (+0.18/yr.) during the same time period. Overall change in queries in the time period evaluated was a 40%, 24% and 22% decline in the United States, India and England, respectively. The increase in queries in Canada was 8% over the same time period. Table 1 presents the average query rate for each year from 2007–2010 for the four countries.

Among the four states, between 2007 and April 2008, the state with the highest absolute volume of “LASIK” queries was Florida followed by New York, California, and Texas.

During the first week of 2007, the volume of “LASIK” queries in Florida, New York, California, and Texas was 2.36, 1.11, 1.06, and 0.99, respectively. From April 2008 through January 2011, Florida continued to have the highest volume of “LASIK” queries, followed by New York, Texas and California. The volume of “LASIK” queries declined to 1.14, 0.78, 0.49, and 0.57 in the four states, respectively, by the first week of January 2011. Over all, there was a 52%, 56%, 54%, and 42% decline in “LASIK” queries in Florida, New York, Texas, and California, respectively. Table 2 presents the average query rate each year from 2007–2010 for the four states.

We assessed the potential impact of the FDA report on complaints associated with LASIK surgery (released in April 2008) on rates of “LASIK” queries in the different countries (Figure 1). The report’s possible impact was estimated to be the structural break in the 2 regression lines on April 25, 2008. To interpret these findings, if the 95% confidence interval (CI) limits cross through zero, this indicates that there is no statistically significant difference between the two time periods and if the upper and lower limits are both above or below zero, this indicates statistically significant differences between the time periods. The difference in the structural break point was 0.15 query units, 95% CI (0.12–0.18) in the United States, indicating a statistically significant negative impact on “LASIK” queries. By comparison, no significant difference was observed in the structural break point in Canada (0.01 query units, 95% CI [−0.05–0.07]) (Figure 2). Next, we assessed the impact of the FDA report on the four states (Figure 3). The difference in the structural break point was greatest in the state of Florida (0.34 query units, 95% CI [0.25–0.43]). The difference in the structural break point was similar in New York (0.15 query units, 95% CI [0.09–0.20]) and California (0.15 query units, 95% CI [0.11–0.19]). The state with the smallest difference in the structural break point was Texas (0.06 query units, 95% CI [0.02–0.10]). Comparing the confidence intervals of these estimates, the FDA report findings affected “LASIK” query rates among Floridians more than it did individuals residing in the other three states.

Discussion

Interest among the general public in LASIK eye surgery, as captured by trends in Google queries, has been declining in the United States over the past several years. Interest in the procedure is slightly higher in Canada, and much higher in the United Kingdom and India, than in the United States. In addition, interest among the U.S. general public seems to have been adversely affected by an FDA-issued press release on LASIK-related adverse events.

A likely reason for the decreased interest in LASIK eye surgery in the United States in recent years has been the downturn in the economy that began in late 2008. LASIK is considered a cosmetic procedure and is not typically reimbursed by health insurance plans; the estimated out-of-pocket expense of LASIK surgery in the United States is \$4300 for both eyes.⁹ Interest in other cosmetic surgeries, including eyelid surgery, breast augmentation, and liposuction, also waned between 2007 and 2010, by 13%, 15%, and 33%, respectively.¹⁰

While the economic downturn has contributed substantially to the decreased interest in LASIK surgery, negative publicity from news stories, such as an FDA press release, can also affect potential patient interest. Among the four U.S. states examined, the decrease in query volume following the FDA report was most pronounced in Florida (which simultaneously experienced the greatest increase in unemployment¹¹). The report seems to have had little effect, however, on Canadians’ pursuit of information on LASIK. Interest in LASIK in Canada may be more stable due to earlier availability of advanced technology in laser vision, partly due to lack of restrictions imposed by the FDA in the United States, and lower costs, due to lack of royalty fees and perhaps more cost-effective delivery of care. In

addition, Canadians may place lower value on information gained from a U.S. regulatory organization, compared with Americans. Furthermore, the economic recession in Canada was less severe relative to the United States.

Capturing levels of interest among the general public in LASIK eye surgery can be challenging for several reasons. Because LASIK surgery is a nonreimbursable procedure, we cannot use administrative databases to determine the number of LASIK surgeries performed. Second, methods that have previously been used to quantify interest in cosmetic procedures among the general population—for example, surveys of board-certified surgeons or subspecialty society members, and health care industry data management and technology development companies—would capture only the sentiments of those persons who visit eye-care providers. Yet most patients who are eligible for and considering LASIK eye surgery typically have no ocular comorbidities; thus, the frequency of routine eye examinations generally among such patients would be low, precluding their widespread participation in the more traditional survey methods. Third, we believe that most individuals who considered LASIK eye surgery in recent years, given their average age-range and financial means, would be proficient internet users. For these reasons, analyzing the volume of queries from a widely used search engine like Google offers a unique opportunity to gauge interest in this procedure. Google Trends has been used previously to study influenza outbreaks and statin use for dyslipidemia.^{3–6}

Although we know of no previous study substantiating the findings of this analysis, our findings are consistent with those of market research, and membership surveys of the American Society of Cataract and Refractive Surgery and International Society of Refractive Surgeons. These surveys indicate a 31% decline in LASIK surgery and 28% decline in overall laser vision-correction surgeries between 2007 and 2009.¹² Although the volume of cases increased in 2010, the relative volume of LASIK has decreased by 18% since 2007 and by 28% since 2005, at the peak of the U.S. LASIK market. These trends not only follow the overall economy but also changing trends in laser vision correction. Volume of surface laser vision correction (i.e., photorefractive keratectomy and laser subepithelial keratomileusis) has increased by 30% since 2007 and by 120% since 2005. An ever-growing number of alternative surgical options are available to patients and surgeons, including phakic intraocular lenses, refractive lens exchange, and corneal inlays.¹²

Our study has several limitations. First, the analysis captures only users of the Google search engine. Although Google is the most widely used search engine, many other Internet search engines exist. We have no reason to believe that users of Google behave differently than users of other Internet search engines, however. Moreover, our analysis does not capture interest in this procedure among persons without Internet access, a subpopulation that is disproportionately higher in India than in the other countries examined. Second, while the FDA report about LASIK complications was a major news event that could affect interest among the general public, there are many other national, regional, and local news stories that convey positive and negative feedback to members of the general public about this procedure that were not considered. Third, our analysis did not consider other factors that may differ among countries or among U.S. states, such as the price of surgery, ease of access to LASIK surgeons, and differences in the mean age of Google users. While industry analysts have reported a stabilization of LASIK prices in the United States during 2006–2010, we know of no reports comparing prices among different communities.

In conclusion, interest in LASIK surgery among members of the general public, as captured by analyzing query rates of the popular Google search engine, has steadily declined. The extent of this decline in interest varies by country and U.S. state. Factors contributing to the

decreased interest in the procedure may include the sluggish economy, negative LASIK-related publicity, and alternative options for correcting refractive error.

Acknowledgments

Grant support: National Eye Institute K23 Mentored Clinician Scientist Award (1K23EY019511-01); American Glaucoma Society Clinician Scientist Grant, Blue Cross Blue Shield of Michigan Foundation, and an unrestricted grant from Research to Prevent Blindness

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Figure 1. Average “LASIK” Query Rate Each Week from 2007–2011 Among the Four Countries
 Black line reflects the release of the FDA report on LASIK complaints the week of April 28, 2008
 LASIK = Laser assisted in situ keratomileusis

Figure 2. Average “LASIK” Query Rate Each Week from 2004–2011 Among Persons Residing in the United States and Canada

Black line reflects the release of the FDA report on LASIK complaints the week of April 28, 2008

LASIK = Laser assisted in situ keratomileusis

Figure 3. Average “LASIK” Query Rate Each Week from 2004–2011 Among the Four States
 Black line reflects the release of the FDA report on LASIK complaints the week of April 28, 2008

NY = New York, Cal = California; LASIK = Laser assisted in situ keratomileusis

Table 1

Google Trends Average Query Rate for “LASIK” for the Four Countries, 2007–2010

	United States	Canada	United Kingdom	India
2007	0.78	0.99	2.12	*
2008	0.62	0.98	2.03	2.78
2009	0.51	1.01	1.73	2.40
2010	0.47	1.07	1.66	2.12

* Inadequate data in 2007

LASIK = Laser assisted in situ keratomileusis

Table 2

Google Trends Average Query Rate for “LASIK” in Different US States, 2007–2010

	California	Florida	Texas	New York
2007	0.89	1.70	0.81	1.00
2008	0.68	1.31	0.66	0.82
2009	0.50	1.10	0.55	0.74
2010	0.44	1.04	0.48	0.72

LASIK = Laser assisted in situ keratomileusis