Exploring the impact of public health campaigns for glaucoma and macular degeneration utilising Google Trends data in a New Zealand setting

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ABSTRACT

AIM: To evaluate the impact of public health campaigns for glaucoma and age-related macular degeneration compared to breast cancer and prostate cancer using Google Trends data.

METHODS: Relative search volumes for the terms ‘glaucoma’, ‘macular degeneration’, ‘breast cancer’ and ‘prostate cancer’ for New Zealand from October 2008–September 2018 were obtained via Google Trends. Intervention time-series analyses were used to compare observations before and after each awareness campaign.

RESULTS: Of the campaigns occurring in the 10-year study period, statistically significant increases in search behaviour were observed for breast cancer (45%, p<0.01), prostate cancer (32%, p<0.01) and glaucoma (16%, p<0.01). Macular degeneration search behaviour increased on average 14% but this was not statistically significant (p>0.1), although increased activity (294%) was observed in December 2016, corresponding with the release of a report, public meeting and media release on the socioeconomic impact of macular degeneration.

CONCLUSIONS: Glaucoma and macular degeneration search behaviour in New Zealand has a low impact following health awareness campaigns in comparison to breast and prostate cancer. This implies there is scope for improvement with these campaigns and a large increase in macular degeneration activity following a public meeting, and report release suggests that increased funding may increase impact. This study also highlights the utility of internet data for cost-effective monitoring of public interest in health issues.
Internet search engines and social media generate massive amounts of data. Google Trends is a freely available web tool which analyses a proportion of the billions of daily Google search engine queries to provide user-specified data on relative search volumes. Google Trends data has been utilised in previous studies to estimate disease incidence (such as seasonal allergic conjunctivitis, cancers), to identify and predict epidemic influenza outbreaks, and gauge public interest in a health-related condition or procedures such as laser refractive surgery. Thus, internet search behaviour may be a useful proxy to approximate a population’s health-seeking behaviour.

With the rising ageing population and forecasted increase in healthcare costs and burden, Internet data could complement traditional epidemiological research tools to optimise service delivery planning and public health initiatives.

**Aim**

We aim to evaluate the impact of public health campaigns for macular degeneration and glaucoma public awareness campaigns in New Zealand compared to breast and prostate cancer using Google Trends data.

**Methods**

Search volumes for the terms ‘glaucoma’, ‘macular degeneration’, ‘breast cancer’ and ‘prostate cancer’ for New Zealand from October 2008–September 2018 were obtained via Google Trends on 28 September 2018 (Figure 1). These terms also included commonly related search words identified by Google Trends, in order to capture a representative sample of possible search terms.

The values yielded are not absolute figures, but relative numbers: 0–100. The value 100 is assigned to the highest volume (or most popular term) during the specified period of time, and all other volumes are assigned a value relative to this. Therefore, a value of 0 does not mean that a term has never been searched, but that it was too small to be included in the output data, to avoid compromising anonymity of user data. The RSV were analysed for monthly and yearly temporal patterns in relation to their respective disease awareness campaigns.

**Statistical analysis**

Statistical analysis was conducted in SPSS statistical software version 25 (IBM, Chicago, IL). Intervention time-series analyses were used to compare observations before and after the awareness campaign. A time domain Box-Jenkins auto-regressive integrated moving average (ARIMA) model analysis was used for each medical condition. A 60-month intervention series was used to identify an ARIMA (0,1,1) (0,1,1) model with differencing to achieve stationarity. To ensure the robustness and applicability of the ARIMA analysis, the data was evaluated for normality of sampling distribution, homogeneity of variance, independence of residuals and outliers. A p value of ≤0.05 was considered significant.

**Results**

Mean relative search volume per month is illustrated in Figure 1. Breast cancer had the highest search volumes, followed by prostate cancer, glaucoma and AMD.

![Figure 1: Mean relative search volume per month.](https://www.google.com/trends)
For breast cancer, there was a peak in search activity corresponding to the awareness campaign in October (p<0.01). The breast cancer campaign with the highest Google Trends impact resulted in a 68% rise in search activity under that term. Of the campaigns that have occurred over the past 10 years, breast cancer search behaviour increased on average 45% under that term. The impact of the campaign is moderate to strong, with the peak of activity occurring within the first two weeks of the awareness month. Data showed post-campaign search activity dropping back to baseline levels (pre-campaign) within 6–8 weeks. In-between the yearly campaigns, there are some spikes in activity, which cannot be accounted for against any intervention activity. Search activity remains at baseline (pre-intervention) levels until the launch of the following year's campaign.

For prostate cancer, there was a peak in search activity corresponding to the awareness campaign in September (p<0.01). The campaign with the highest Google Trends impact resulted in a 51% rise in search activity under that term. Of the campaigns that have occurred over the past 10 years, prostate cancer search behaviour increased on average 32% under that term. The impact of the campaign is moderate to strong, with the peak of activity occurring at the first two weeks of the awareness month. Data showed post-campaign search activity dropping back to baseline levels (pre-campaign) within four weeks. There are a few small spikes in activity, not accounted by any intervention, and otherwise search activity remains at baseline (pre-intervention) levels until the launch of the following campaign. One larger spike in activity (294%) was observed in December 2016 for macular degeneration. This did not correspond to any awareness week, but did coincide with the release of a report on the socioeconomic cost of AMD the prior month,12 a large public meeting and media release.

For glaucoma, there was a small peak in search activity corresponding to the awareness campaign in July (p<0.01). The glaucoma campaign with the highest Google Trends impact resulted in a 28% rise in search activity under that term. Of the campaigns that have occurred over the past 10 years, glaucoma search behaviour increased on average 16% under that term. The impact of the campaign is short with the peak of activity occurring at the first week of the awareness month. Data showed post-campaign search activity dropping back to baseline levels (pre-campaign) within 4–6 weeks. With the exception of some spikes in activity, which cannot be accounted for by any intervention activity, search activity does not increase until the launch of the following year's campaign.

For macular degeneration, there was a small increase in search activity corresponding to the awareness campaign in May, but this did not reach statistical significance (p>0.1). The macular degeneration campaign with the highest Google Trends impact resulted in an 18% rise in search activity under that term. Of the campaigns that have occurred over the past 10 years, macular degeneration search behaviour increased on average 14% under that term. The impact of the campaign is weak, with the peak of activity occurring during the awareness week. Data showed post-campaign search activity dropping back to baseline levels (pre-campaign) within four weeks. There are a few small spikes in activity, not accounted by any intervention, and otherwise search activity remains at baseline (pre-intervention) levels until the launch of the following campaign. One larger spike in activity (294%) was observed in December 2016 for macular degeneration. This did not correspond to any awareness week, but did coincide with the release of a report on the socioeconomic cost of AMD the prior month,12 a large public meeting and media release.

Discussion

This data demonstrates a correlation between increased internet search activity and national public health campaigns, suggesting that there is a positive effect on public awareness due to the campaigns. Over the past decade, glaucoma campaigns generated an average 16% increase in search activity, which is weak in comparison to breast cancer (45% increase) and prostate cancer (32% increase). AMD campaigns failed to generate a statistically significant increase in search activity, but a strong increase (294%) was observed following the release of the Deloitte report, media release and public meeting on the socioeconomic impacts of AMD.12

The higher results for breast and prostate cancer in comparison to macular degeneration and glaucoma during their respective awareness campaigns may be explained by a number of factors, such as the nature and resourcing of the campaigns. It could also be explained by higher relative prevalence.
and mortality rates for cancer, in addition to greater funding for awareness campaigns. Breast cancer is estimated to affect one out of nine New Zealand women in their lifetime, and kills over 600 people each year. Prostate cancer is the most common cancer in males, with an estimated 3,000 new diagnoses and 600 deaths annually in New Zealand. Australia and New Zealand have the highest incidence rates in the world at 104.2 per 100,000. Macular degeneration is thought to affect 1.1% of all New Zealanders aged 45 years old and above, increasing to 7.6% of those aged 80 years and above. Glaucoma prevalence is approximately 2% in New Zealanders aged 45 and above, increasing to 10% in those aged 80 and above. Morbidity and mortality due to visual impairment are less readily quantifiable, and a less visible public health issue.

Breast and prostate cancer both tend to affect relatively young people (with incidence increasing from age 50 years onwards) in comparison to macular degeneration and glaucoma. Older people are less likely to use the internet as their main source of information; of those aged 75 years and over, only 52% had home internet access, and 32% had used the internet in the past year. Therefore, breast and prostate cancer may have higher RSV because they tend to affect younger age groups who are more likely to use the internet. Also, data on new patient presentations to Optometry or Ophthalmology clinics, and phone enquiries to Macular Degeneration New Zealand and Glaucoma New Zealand were not available for this study; it may be that the interest generated by these campaigns are manifested more in these avenues, rather than through internet search data.

The positive correlation between public health campaigns and increased internet search activity is in keeping with previous research demonstrating an increase in search activity after WHO campaigns and Breast Cancer Awareness Month. Sharat-pehani et al analysed Google Trends data using a system dynamics model to demonstrate that WHO disease awareness programmes (for tuberculosis, AIDS, breast and autism) increased population awareness. Their modelling also simulated the effect of word-of-mouth, as knowledge gleaned by the internet users would be propagated exponentially to others. The power of social media further amplifies this. Noar et al analysed the traffic generated by a viral Facebook skin cancer selfie by a young woman, and demonstrated an exponential increase in skin-cancer related queries and internet activity as a result. Social media is a cheap, cost-effective form of health promotion; organisers should consider utilising these platforms in addition to traditional mass media campaigns.

Previous similar studies suggest patients are increasingly seeking internet-derived information on ophthalmic conditions. Nicholson et al assessed 41 websites on ophthalmic-related conditions (cataract, glaucoma, retinal detachment) and found the overall quality to be poor. There was a dearth of patient-friendly information available. Only five were authored or reviewed by ophthalmologists, three by general practitioners and two by optometrists. As the internet becomes a more popular medium for the public, health providers need to adapt and use these channels more.

Strengths to this study include the use of a large dataset in a developed country with high rates of internet access, over a long time period of 10 years. This increases the likelihood that the data is representative of the modern New Zealand population. The use of breast and prostate cancer as comparisons provided useful benchmarks for what could potentially be achieved with effective campaigns. Also, the data is freely and easily accessible. This provides a novel way to assess the effectiveness of health campaigns, even in real time. This feedback can help guide organisations’ health promotion strategies to help them maximise their reach and efficacy.

There are limitations to this study. Firstly, this data was only obtained from one popular search engine. Secondly, only a proportion of the total search volumes are analysed. This is randomly generated and assumed to be representative of the sample population. Therefore the search volumes are not absolute; they are given as a ratio, relative to the most popular search term in that user-specified query. A decrease in relative volume does not directly translate to a decrease in total volumes, but a decrease relative to the most popular term.
Furthermore, the intent and identity of the users Googling a specific term cannot be determined. For example, we cannot know if a user searching ‘glaucoma’ because they are seeking information as a patient, healthcare professional or other. We do not know if this increased search activity translates to increased numbers attending for assessment, or if this leads to improved outcomes. Future studies could utilise Google Trends data to complement real-world data on new presentations, referrals for assessment or compliance with treatment and other outcome-related measures.

Educating public health organisations in the use of Google Trends to monitor the effectiveness of their initiatives could help optimise their services. The data is free and readily accessible, but analysis and interpretation can be complex. Nuti et al conducted a systematic review of studies utilising Google Trends data in healthcare, and found that a large proportion failed to adequately document search strategies, and only 10% were reproducible.21 Google collaboration with health researchers to develop effective search methodology could lead to more robust research. Access to real numbers would also increase accuracy and reliability, though may be more cumbersome to handle.

Conclusions

Glaucoma and AMD health promotion efforts during Glaucoma Awareness Month and Macular Degeneration Awareness Week respectively generated a weak increase in public interest via internet search activity in comparison to breast and prostate cancer campaigns. A large increase in Google traffic for AMD following the Deloitte report release,12 media attention and public meeting suggests that increased funding and media presence may generate increased awareness.

Furthermore, this study highlights the use of internet search traffic as a useful proxy for population health-seeking behaviour. It also demonstrates the power of internet and social media in the dissemination of information, especially among younger adults. Health campaigns should utilise these platforms to reach a wider audience.

Competing interests:
Nil.

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