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What, Where and When? Using Google Trends and Google to investigate Patient Needs and inform Pharmacy Practice

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Objectives

The aim was to provide a comprehensive overview (using pertinent examples) of the various ways that Google Trends and Google data could inform pharmacy practice. The objectives were to: examine what type of information people search for in relation to a common class of medicines; ascertain where people are directed to (websites) following an initial search for a medicine or medical condition; and establish information about when they search.

Methods

The methodology differed depending on whether Google Trends or Google was being interrogated but the search domain was always limited to the United Kingdom. Google Trends was queried, typically for a five-year time frame, and data downloaded for many search inputs relating to medical conditions (self-treatable and non-self-treatable) and medicines (bought over-the-counter and prescribed). Google was queried and data collected for searches related to “antibiotics”.

Key findings

Google Trends revealed a previously unknown seasonality pattern for irritable bowel syndrome. Related searches for “antibiotics” revealed a high level of interest in the appropriateness of concomitant alcohol consumption and queries about what antibiotics are. Largely, people were being directed to reputable websites following their initial search input about a prescription-only medicine. However, searches for over-the-counter medicines were more likely to lead to commercial domains.

Conclusions

This is one of the first studies to investigate use of Google Trends and Google in a pharmacy-specific context. It is relevant for practice as it could inform marketing strategies, public health policy and help tailor patient advice and counselling.

Keywords

Community Pharmacy, Use of Internet as Information Source, Patient Behaviour, Antibiotics

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Introduction

Internet search data has the potential to provide valuable insights into population behaviour. One tool that allows users to interact with internet search data is Google Trends, a publicly available online resource, provided by Google Inc. For nominated query terms, it provides insights into the timing, frequency and geographic source of matching Google searches.¹

Google Trends has been used for various purposes such as ascertaining trends of substance and illegal drug use and forecasting associated premature deaths,^{2,3} exploring awareness about medical conditions,⁴ and for surveillance and prediction of infectious diseases such as influenza and Dengue Fever.⁵⁻⁸ Additionally, other experts have used Google to examine mental health issues such as suicide likelihood,⁹ assess the quality of patient information and guidance available on the internet,¹⁰ to detect internet search activity for particular conditions¹¹ and the impact of public health campaigns.¹²

The aim of this work was to provide a comprehensive overview (using pertinent examples) of the various ways that Google and Google Trends data can inform pharmacy practice. To the best of our knowledge this is the first such study. The objectives (which can be considered in terms of ‘what’, ‘where’ and ‘when’) were to:

- examine **what** information people search for in relation to medication and medical conditions

Relevance: helps to identify gaps in knowledge and understanding and better inform patient advice and counselling.

- ascertain **where** people are directed to (websites) when they search for particular medicines or conditions

Relevance: once this has been identified, targeted work can be undertaken to ensure the public are getting reliable health information after they perform an initial search.

- investigate **when** people are searching and determine whether seasonality patterns exist

Relevance: this can help with the timing of health promotion campaigns and stock management.

Methods

The methodology and search strategy is outlined under the terms ‘what’, ‘where’ and ‘when’ (aligning with the objectives) using specific examples for each.

What information people search for in relation to particular medication and medical conditions.

Specific example: using Google Trends for antibiotics to glean information about related searches.

Search strategy: on October 8, 2017, Google Trends was queried and data collected for related searches following the search inputs: "antibiotics"; "amoxicillin"; "flucloxacillin"; "trimethoprim"; "doxycycline"; "nitrofurantoin"; "clarithromycin"; "penicillin". The specific antibiotics were those appearing in the ‘Top 100 prescriptions dispensed in the community by community pharmacists, appliance contractors and dispensing doctors in England in 2015’.¹³ The United Kingdom domain was chosen, from January 1, 2012 to December 31, 2016 (data over a five year period), using the “all query categories” (the default setting). For each search input, Google Trends returns the top 25 ‘related queries’. These were recorded and thematic analysis undertaken. Antibiotics were chosen as the example as they are a commonly

prescribed and familiar class of medicines yet have received worldwide media attention in the last few years about the prevalence and consequences of antimicrobial resistance due to inappropriate use.¹⁴

Where people are directed to (websites) when they type particular medicines or medical conditions into the Google search bar.

Specific examples: these focussed on where people are being directed to in relation to dispensed medicines, over-the-counter brands, self-treatable and non-self-treatable conditions.

Search strategy: a list was compiled from the ‘Top 100 prescriptions dispensed in the community by community pharmacists, appliance contractors and dispensing doctors in England in 2015’.¹³ Each term was entered into a Google search on 23rd September 2017, within the United Kingdom domain. For each set of search results, the first ten unique domain names were extracted and assigned a rank based on their page position, from 1 (first search result, highest rank) to 10 (lowest rank). Searches returning multiple pages from the same domain were treated as a single result. A similar approach was taken to compile a list of over-the-counter products which was derived from the Pharmaceutical Journal’s published list of the top 50 brands.¹⁵ For conditions, this list was developed with reference to the British National Formulary (BNF) chapters¹⁶ and divided into self-treatable conditions (n=74) and non-self-treatable conditions (n=76). Medical terms were converted into plain language as these were considered to be more likely search terms. For example, menorrhagia was replaced by “heavy periods” and dysmenorrhoea was replaced by “period pain”.

Substitutions of terms from the list were justified for two reasons. Firstly, to avoid using medical terms that were likely to be unfamiliar to the lay person. Here Google Trends was used to find more frequently queried related terms. Secondly, to filter terms with ambiguous

meanings (e.g. cold and corn) that would have provided non-medical results. Further details, and the list of conditions are available in the online Supplemental material.

When people are searching

Example: using Google Trends to ascertain whether interest in a particular medical condition (irritable bowel syndrome) and a social/lifestyle factor (smoking cessation) followed a seasonality pattern.

Search strategy: On October 9, 2017, Google Trends was queried and data downloaded for the following search inputs: [“ibs” + “irritable bowel syndrome”; “quitting smoking” + “stopping smoking” + “giving up cigarettes”]. We searched within the United Kingdom domain from 2004-2016 (the largest possible range of full calendar years) using the “all query categories” (the default setting). We selected irritable bowel syndrome as one example of a recurrent self-treatable condition that healthcare professionals may not instantly associate with having a seasonal pattern (i.e. conditions such as the common cold, flu and hay fever were avoided as their seasonality pattern is established and well documented in pharmacy practice textbooks^{17,18}). Smoking cessation was chosen as there is a fixed month each year in the United Kingdom for a public health campaign¹⁹ and therefore one could hypothesize that Google search interest would be greatest around the time of this. Google Trends provide ‘interest over time’ measured on a relative scale from 0-100, with peak popularity coinciding with a value of 100. A value of 50 means it was receiving half the level of peak interest. Monthly observations are returned for search periods spanning greater than 5 years. A seasonal-trend decomposition procedure was applied to extract the trend and monthly seasonality pattern for the last five complete calendar years.²⁰

Ethical approval was not required as this work used freely available, non-identifiable, Google data only and did not involve animals or human volunteers.

Results

What information people search for in relation to particular medicines

From the Google Trends analysis, five main themes were identified. These related to:

- specific infections (i.e. urinary tract infection, chest, skin, throat, chlamydia, malaria, toothache)
- concomitant consumption of alcohol
- side-effects
- administration and dosage
- what is an antibiotic and how does it work

Where people are directed to (websites) when they type particular medicines or medical conditions into the Google search bar.

Table 1 indicates the top ten most commonly returned domains for the top 100 prescribed medicines list¹³ and top 50 OTC product list¹⁵. In each case, the count indicates the number of times the website domain appears near the top of the search results (i.e. within the first ten unique domains). The average rank (i.e. ordinal position) is also listed. A low rank indicates that when the domain appears in the top ten, it is near the top of the search results. The table therefore indicates the pervasiveness and prominence of each site across the searches.

As can be seen Google searches for prescription-only medicines most commonly returned Drugs.com, Wikipedia, electronic Medicines Compendium, WebMD and BNF. However, Google searches for OTC medicines most commonly returned Chemist Direct, Wikipedia, Superdrug, Boots and Amazon.

Similarly, Table 2 indicates the top ten most commonly returned domains for the non-self-treatable and self-treatable conditions list.¹⁶ As can be seen Google searches for non-self-

treatable conditions most commonly returned NHS, Wikipedia, WebMD, Boots and Healthline Media Inc. However, Google searches for self-treatable conditions most commonly returned NHS, Wikipedia, Boots, WebMD, and Healthline Media Inc.

Place holder: Insert Tables 1 and 2 here please.

When

Figure 1 shows the seasonality pattern relating to irritable bowel syndrome and Figure 2 shows the seasonality pattern for smoking cessation. As can be seen, interest in irritable bowel syndrome varies about 20% annually, falling from a high point in August to its lowest level in December. The single largest change occurs between December and January. With regard to smoking cessation, a larger annual variation of about 45% was evident. January shows the largest interest, and December the lowest, (although a second wave of interest from August to October is observed).

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Place holder: Insert Figure 2 around here please.

Discussion

The work has provided useful baseline data about the type of information that can be gleaned from Google Trends and Google, in a pharmacy practice context. For example, a self-treatable condition (irritable bowel syndrome) was found to exhibit annual seasonality. Additionally, queries related to “antibiotics” appeared to suggest a lack of knowledge about this class of medicine and its concomitant use with alcohol. Differences were also apparent between searches for prescription-only and OTC medicines, with OTC searches more commonly linked to commercial domains.

In relation to strengths and weaknesses: to the best of our knowledge, this is the first such study to investigate use of Google Trends and Google from a pharmacy practice standpoint. We consider that this paper provides a useful proof of concept about the type of information that can be derived and utilised in practice. The UK was chosen as the search domain because we reside and work in the UK. Initial consideration was given to using the ‘worldwide search’ function but we quickly realised that unless search terms were included in multiple languages, the results would be biased towards English-speaking countries. We did not have the expertise to do this, particularly regarding the lay terms that patients would use when searching, and some of the material was not relevant in a worldwide context anyway (such as prescription-only deregulations and national health promotion campaigns). Moreover, this should not cause a significant problem in terms of transferability, as other pharmacists can select the country/region applicable to them as part of their search methodology. Additionally, while it is also possible to perform inter-regional comparisons, this was not particularly fruitful in our examples as smaller regions of the UK (such as Northern Ireland) yielded inadequate data for any reports to be generated. Furthermore, it is possible that we had incomplete retrieval of data due to our search strategy (the search terms chosen). Finally, it can be difficult to draw absolute

conclusions from Google Trends data alone and therefore results need to be interpreted with caution.

Regarding ‘what’ (the related searches for the ‘antibiotics’ query), it is noteworthy that searches commonly ask ‘what is/are antibiotics?’ which shows that people may not understand what antibiotics are, or how they work. This is perhaps surprising considering how often they are prescribed (or at least were in the past) and have been the subject of media campaigns. More work is required to ensure this fundamental question is addressed as part of antimicrobial stewardship campaigns and at the point of care. It is encouraging to see that the conditions being searched for are those where antibiotics are typically advocated such as a urinary tract infection and a chest infection rather than viral infections like the common cold. Similarly, other key findings (related searches) were how antibiotics should be taken and whether alcohol was safe to consume alongside antibiotics. It would be helpful for pharmacists to be more proactive about including information about this during antibiotic counselling to ensure they are meeting patient needs and avoiding unnecessary risks. Currently, the focus tends to be about avoidance in the context of antibiotics such as metronidazole, due to the risk of a disulfiram-like reaction.²¹ While advice about interactions is paramount to patient safety, an explicit discussion about the absence of interactions with food, alcohol or other medicines may provide patients with important reassurance and possibly help their understanding and adherence to medicines.

In terms of ‘where’, with the current drive for greater self-care²² and increased prevalence of internet use²³, it is crucial that people are routinely directed towards reliable online information. It is encouraging to see that some of the websites that people are being directed to, after typing a particular medical condition into the Google search bar, are reputable, authoritative sources of information, frequently with government backing [for example, the British National Health

Service (NHS)]. It is noted that several of the resources are US-based which has implications for UK residents, for example, product availability, doses, directions and licensed indications may differ. Wikipedia represents a potential exception²⁴. There was little difference between the self-treatable and non-self-treatable condition websites. Perhaps it was more interesting to note the variation in websites for prescription-only versus OTC medicines. When people searched for prescription-only medicines using Google, they tended to be directed to several trustworthy domains such as electronic Medicines Compendium, WebMD, BNF, Patient and NHS (see Table 1). However, when people searched for OTC medicines using Google, the websites tended to be commercial (Chemist Direct, Superdrug and Boots) with some having no healthcare or pharmacy expertise (Amazon and Morrisons). It would be useful if authoritative resources that provide information on prescription-only medicines included guidance on OTC products too.

Ascertaining ‘when’ people were searching over a particular timeframe was insightful; the examples we selected both revealed seasonality patterns. Irritable bowel syndrome exhibited a modest swing in interest of around 20% over the year, peaking in August, and falling steadily to its lowest level in December. The single largest change occurs between December and January. In comparison, smoking cessation exhibited a large swing of around 45%. Interest peaked in January and dipped in December (however there was a second wave of interest from August to October). It is unsurprising that the peak time is at the start of a new year when resolutions are being set however, it is somewhat curious that the second peak in interest did not correlate with the UK National No Smoking Day (March).¹⁹ As previously mentioned, it is important to have an awareness of online searching patterns so that launches of marketing strategies, public health policies and health promotion campaigns can be informed by these. It would be useful to ascertain whether this peak level of interest mirrors OTC medicine sales

and prescribing trends. Google Trends should also be used to assess the impact of campaigns and the level of interest in deregulated prescription-only products from the time of their launch onto the OTC market.

Conclusion

Google Trends and Google enable free, easily accessible, insights into human behaviour which can consequently inform practice alongside other data. To the best of our knowledge this is first such study to comprehensively investigate the use of Google Trends and Google from a pharmacy practice standpoint. The examples outlined in this paper should provide some helpful baseline findings and provoke thought as to the type of information that can be derived and utilised.

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Conflicts of Interest

The authors declare that they have no conflicts of interest to disclose.

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Table 1 Where people are directed to (top 10 websites) when they type particular medicines into Google search bar

| Prescribed Medicine List | | | OTC Medicine List | | |
|---|-------|--------------|--------------------------------------|-------|--------------|
| Website domain | Count | Average Rank | Website domain | Count | Average Rank |
| Drugs.com (US) | 86 | 2.70 | Chemist Direct (UK) | 29 | 5.52 |
| www.drugs.com | | | www.chemistdirect.co.uk | | |
| Wikipedia | 84 | 4.20 | Wikipedia | 28 | 4.21 |
| en.wikipedia.org | | | en.wikipedia.org | | |
| Electronic Medicines Compendium (UK) | 82 | 4.07 | Superdrug (UK) | 28 | 5.64 |
| www.medicines.org.uk | | | www.superdrug.com | | |
| WebMD (US) | 67 | 4.41 | Boots (UK) | 25 | 3.28 |
| www.webmd.com | | | www.boots.com | | |
| British National Formulary, accessed via National Institute for Health and Care Excellence (UK) | 49 | 6.02 | Amazon (UK) | 23 | 4.83 |
| bnf.nice.org.uk | | | www.amazon.co.uk | | |
| Healthline Media Inc. (US) | 40 | 4.50 | Electronic Medicines Compendium (UK) | 22 | 6.41 |
| www.healthline.com | | | www.medicines.org.uk | | |
| NetDoctor (UK) | 40 | 5.98 | NetDoctor (UK) | 17 | 5.47 |
| www.netdoctor.co.uk | | | www.netdoctor.co.uk | | |
| Patient (UK) | 39 | 5.95 | Tesco (UK) | 15 | 6.27 |
| patient.info | | | www.tesco.com | | |
| National Health Service (UK) | 36 | 2.69 | Morrisons (UK) | 12 | 6.92 |
| www.nhs.uk | | | groceries.morrisons.com | | |
| RxList (US) | 29 | 5.52 | Sainsburys (UK) | 12 | 8.17 |
| www.rxlist.com | | | www.sainsburys.co.uk | | |

The left hand side shows the top ten most commonly returned domains for the top 100 prescribed medicines list; the right hand side relates to the top 50 OTC medicines list. Count indicates the number of times the website domain appears near the top of the search results (i.e. within the first ten unique domains). The average rank (i.e. ordinal position) is also listed. A low rank indicates that when the domain appears in the top ten, it is near the top of the search results.

Table 2 Where people are directed to (top 10 websites) when they type particular medical conditions into Google search bar

| Non-self-treatable conditions | | | Self-treatable conditions | | |
|---|-------|--------------|---|-------|--------------|
| Website domain and name of organisation | Count | Average Rank | Website domain and name of organisation | Count | Average Rank |
| National Health Service (UK) | | | National Health Service (UK) | | |
| www.nhs.uk | 71 | 2.27 | www.nhs.uk | 72 | 1.83 |
| Wikipedia | | | Wikipedia | | |
| en.wikipedia.org | 63 | 4.56 | en.wikipedia.org | 47 | 4.06 |
| WebMD (US) | | | Boots (UK) in partnership with WebMD | | |
| www.webmd.com | 36 | 5.67 | www.webmd.boots.com | 45 | 4.20 |
| Boots (UK) | | | WebMD (US) | | |
| www.webmd.boots.com | 31 | 5.90 | www.webmd.com | 36 | 4.94 |
| Healthline Media Inc. (US) | | | Healthline Media Inc. (US) | | |
| www.healthline.com | 21 | 5.00 | www.healthline.com | 29 | 4.00 |
| MedicineNet (US) | | | MedicineNet (US) | | |
| www.medicinenet.com | 19 | 5.95 | www.medicinenet.com | 27 | 5.22 |
| Bupa (UK) | | | NetDoctor (UK) | | |
| www.bupa.co.uk | 17 | 6.29 | www.netdoctor.co.uk | 24 | 6.71 |
| Daily Express (UK) | | | Mayo Clinic (US) | | |
| www.express.co.uk | 16 | 6.44 | www.mayoclinic.org | 22 | 5.54 |
| NetDoctor (UK) | | | Medical News Today (UK) | | |
| www.netdoctor.co.uk | 16 | 7.56 | www.medicalnewstoday.co | | |
| MedlinePlus (US) | | | m | 13 | 6.23 |
| medlineplus.gov | 14 | 4.79 | Bupa (UK) | | |
| | | | www.bupa.co.uk | 11 | 6.00 |

The left hand side shows the top ten most commonly returned domains for the non-self-treatable conditions (n=76); the right hand side relates to self-treatable conditions (n=74). Count indicates the number of times the website domain appears near the top of the search results (i.e. within the first ten unique domains). The average rank (i.e. ordinal position) is also listed. A low rank indicates that when the domain appears in the top ten, it is near the top of the search results.

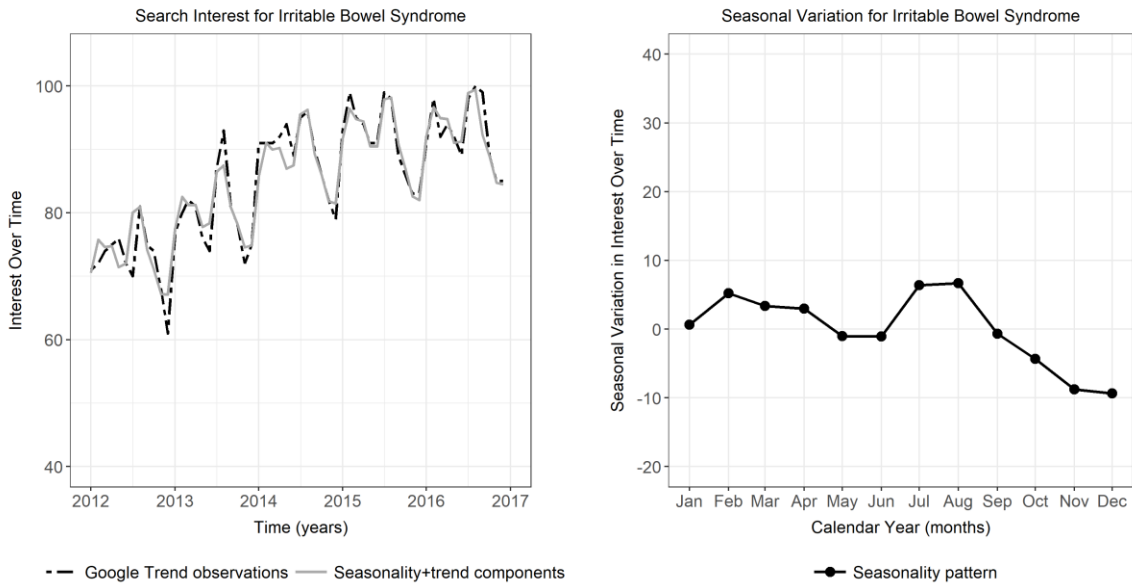


Figure 1 - Search interest and fitted seasonality pattern for Irritable Bowel Syndrome. Search interest obtained from Google Trends has been linearly decomposed into seasonality, trend and irregular components using the standard technique ‘Seasonal Decomposition of Time Series by Loess (STL)’.²¹ The left hand side depicts the observed search interest for five complete calendar years (dotted line), and the combined seasonality and trend components (solid line). The right hand side depicts the recurring seasonality pattern plotted over a single twelve month period.

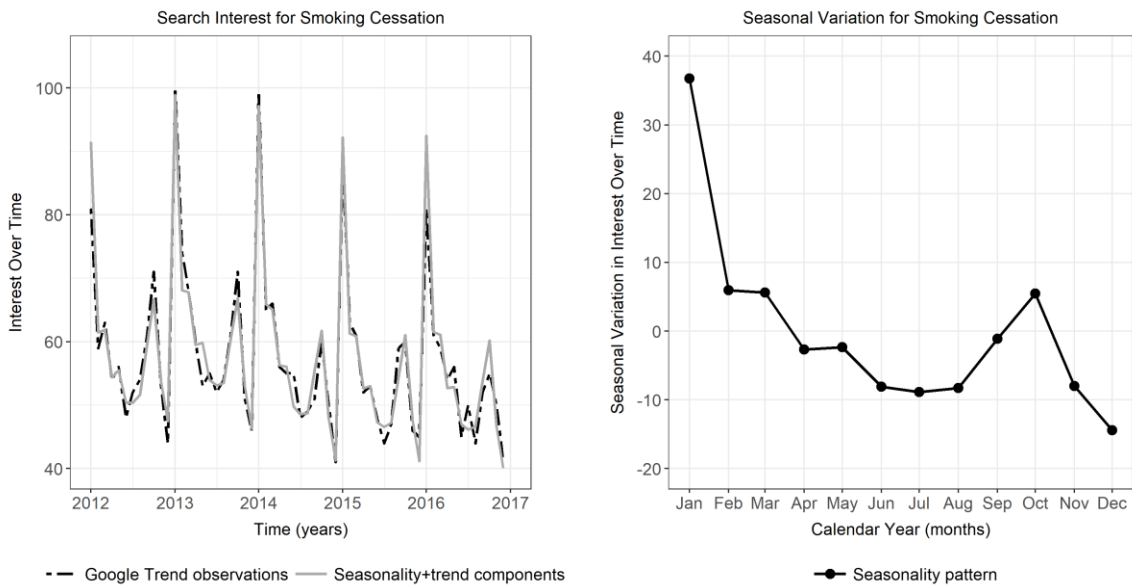


Figure 2 - Search interest and fitted seasonality pattern for Smoking Cessation. The decomposition approach is the same as described in Figure 1. The left hand side depicts the observed search interest for five complete calendar years (dotted line), and the combined seasonality and trend components (solid line). The right hand side depicts the recurring seasonality pattern plotted over a single twelve month period.