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Online Health Information-Seeking Behaviours (OHISB) for Low Back Pain in the United Kingdom: Analysis of Data From Google Trends and the Global Burden of Disease Study, 2004-2019.
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Online Health Information-Seeking Behaviours (OHISB) for Low Back Pain in the United Kingdom: Analysis of Data From Google Trends and the Global Burden of Disease Study (GBD), between 2004-2019.

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Abstract:

Background:

Low back pain (LBP) is a leading cause of global disability. Timely health-seeking is crucial for early diagnosis and management of pathologies. Despite increases in internet usage, there is sparse literature around online health information-seeking behaviours (OHISB) around LBP, and how they correlate with the LBP disease burden in the UK.

Methods:

To examine OHISB trends, we conducted Prais-Winsten analyses on monthly search volume data from Google Trends in the UK between 01/01/2004 and 12/01/2019. Cross-correlation analyses assessed the relationship between annual LBP search volume and LBP morbidity and mortality data from the Global Burden of Disease study (2004-2019).

Results:

From 2004 to 2019, the trend in LBP search volume was curvilinear ($\beta=1.27$, $t=5.00$, $P<0.001$), with a slope change around the end of 2006. There was a negative linear trend ($\beta=-0.25$, $t_{35}=-1.52$, $P<0.14$) from 2004 to 2006 and a positive linear trend ($\beta=0.67$, $t_{108}=9.17$, $P<0.001$) from 2007 to 2019. Cross-correlations revealed positive associations between search volume and disease burden indicators for LBP such as prevalence and incidence at lags 4 and 5.

Conclusions:

A rising trend in OHISB for LBP is noted between 2004 and 2019. This trend positively correlates with incidence, ~~prevalence~~prevalence, and burden measures. These findings emphasise the importance of high-quality online resources to increase awareness around LBP, facilitating early diagnosis and management.

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Abbreviations:

LBP: Low Back Pain
GBD: The Global Burden of Diseases and Risk Factors Study
YLD: Years Lived with Disability
DALY: Disability Adjusted Life Years
OHISB: Online Health Information-Seeking Behaviours
YLL: Years of Life Lost
RSV: Relative Search Volume

Keywords:

Low back pain; Global Burden of Disease; Google Trends; infodemiology; online health information seeking; disability.

Background:

Low back pain (LBP) is a common and debilitating symptom which can manifest in people of all ages, as a result of various aetiologies (1,2). It is defined as pain in the area between the lower boundary of the twelfth rib and the lower gluteal folds, with possible associated radiation to the lower limbs (3). It is currently the leading cause of disability globally, measured by years lived with disability (YLDs) (3). In most cases, a definite nociceptive

source cannot be identified, and therefore classed as 'non-specific' (4). In the current ageing population, the prevalence of LBP continues to rise rapidly. As of 2020 it was estimated to affect around 619 million people globally and is projected to reach 843 million by 2050, driven by population growth (5). A study on 15,272 adults in the UK found the one-month period prevalence of LBP to be 28.5%, and increasing with age, with the largest prevalence among those aged 41 to 50 years (6). In the UK, LBP is responsible for huge costs, both directly due to medical care required for patients, and indirectly due to lost productivity in the workplace or household. Healthcare costs for patients with LBP are estimated to be around £1.6 billion for the National Health Service (NHS) (7). It is estimated that employees with back pain take an average of 14 to 24 days of sickness per year (8). Work absences due to LBP, termed 'absenteeism', and decreased productivity whilst working with back pain termed 'presenteeism' collectively account for an indirect cost to the UK economy of approximately £5 to £10.7 billion (7). LBPow back pain is an important symptom to resolve quickly due to its link with multiple comorbidities such as poor mental health, including depression, anxiety and insomnia (9). Additionally, severe chronic pain is associated with a significant increase in all-cause mortality, independent of other confounding factors such as socio-economic status (10).

Despite the huge prevalence and debilitating nature of LBP, there remains a large gap in awareness and understanding amongst the general publicpublic. Barriers in seeking healthcare with lower back pain, LBP such as knowing when to seek help, what red flags are, as well as the physical barriers (e.g., mobility issues) ,preventhinder the prompt and accurate diagnosis of lower back pain (11) and subsequent. This ultimately acts as a barrier to prompt timely access treatment such as physiotherapy or rehabilitationto a range of management options. With the increase in global internet usage in the past two decades, searching for health information online has increased (121,132). In 2021, the internet penetration for the UK was at 96.7%, meaning 96.7% of the population had access, and knew how to use the internet at the time (143). A study has found that out of 155 sampled

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participants, 65.8% had searched for their minor pain symptoms on the internet, with most of these patients sharing their findings with their doctors (154). The internet can provide a huge dataset to monitor health information-seeking behaviours in real time. Individuals with symptoms of LBP may engage in online health information-seeking behaviours (OHISB), via the internet, however it is unclear if these behaviours correlate with diagnoses and management.t as a result of their health information-seeking (i.e., incidence and prevalence).

A popular way of obtaining data on OHISB is through Google searches, as it is the world's most utilised search engine. Google Trends (GT) is a free, publicly accessible tool which provides data on which Google searches are 'trending' at any given time in a particular geographical area. It contains search data from up to 2004 to present, and the data can be a proxy marker for disease awareness, and to an extentpossibly, disease incidence and prevalence i.e., if an individual searches for symptoms of LBP, they are likely to have it. GToogle Trends data has been utilised in the past to understand OHISB and searching patterns for various diseases including COVID-19, Mpox, Chronic Obstructive Pulmonary Disease (COPD), and effectiveness of public health days on increasing awareness about public health topics (165–198).

In this study, we aim to examine data on low back pain gatheredLBP gathered from Google TrendsGT to see trends in OHISB over time, and if they are correlated with data points from the Global Burden of Disease (GBD) study (2019) study such as prevalence, incidence and disability., YLD and DALYs.

Methods:

Search data from Google Trends

Google TrendsGT data is obtained from a sample of all Google searches for a given time period. This data is categorised, linked to specific topics, and anonymized. In order to assess relative popularity accurately, GT Google Trends normalises every data point by dividing it by the total searches within the geographical area at a particular point in time. This normalisation prevents areas with the highest search volume (i.e. highest population) from consistently ranking at the top. The resulting numbers are scaled on a range of 0 to 100 to deem 'popularity' of a topic, taking into account a topic's proportion in relation to all searches across various topics (2019). Only the data point from the initial Google search is included within Google Trends algorithms; any subsequent browsing activity thereafter is not recorded. To increase the reproducibility of the findings, methods are detailed following the recommended reporting guidelines (21).

Global Burden of Disease and Risk Factors Study 2019

The GBD (2019)study examined 369 diseases and injuries in 204 countries between 1990 and 2019 (3). These studies are conducted annually by The Institute for Health Metrics and Evaluation, and they provide large scale free, publicly accessible data for LBP. They cover parameters such as incidence, prevalence, disability-adjusted life years (DALYs), years lived with disability (YLD), and mortality for each disease. Incidence reflects the number of new cases observed for LBP at a particular time. Prevalence, on the other hand, indicates the total proportion of the population experiencing this condition. YLD quantifies the amount of healthy life lost due to poor health; one YLD signifies the loss of one year of healthy life lost. DALYs encompass both YLD and years of life lost (YLL) due to premature mortality. A single DALY represents the equivalent of one year of healthy life lost due to *either* poor health or premature death (220). The GBD 2019 study draws from diverse data sources, including published literature, hospital and clinical data, surveillance and survey data, and medical records from inpatient and outpatient settings (3).

Search Input

Upon searching "low back pain" there are multiple types of search entry types, such as "low back pain" as a 'search term' and as a 'disorder'. For this study, low back pain as a 'search term' was selected, as it encompasses multiple similar search terms with the same meaning, such as "back pain", "pain low back", "back pain low" and it will also include translations of "low back pain" in other languages.

Search Date

Monthly data for LBP was obtained from ~~Google Trends~~GT for the United Kingdom between January 2004 and December 2019. The rationale for choosing this time period is that the first Google Trends data is available from January 2004, whilst December 2019 is the last data point available for the GBD study. Data was accessed and downloaded on 22/06/23 and all query categories were used. The monthly relative search volume (RSV) data, ranging from 0-100, was converted to an annual average over 12 months (using the mean of the 12 months) and compared with the parameters from the GBD study side by side for each year from 2004-2019.

Data analysis:

The data was analysed using the IBM SPSS 29.0 statistics software. Analysis was firstly conducted on the monthly ~~Google Trends~~GT RSV data to deduce if ~~auto-correlation~~autocorrelation exists within the monthly data. To determine auto-correlation, a Prais-Winsten regression was carried out, and a Dubin-Watson statistic for ~~auto-correlation~~autocorrelation was calculated. Monthly G~~oogle Trends~~T data was converted into a yearly mean for the ~~time~~ period 2004-2019, after which a cross-correlation analysis was done using the incidence, prevalence, YLD and DALY data from the GBD 2019 study for the same ~~time~~ period.

Results:

Trends in Monthly Search Volume for Low Back Pain From January 2004 to December 2019

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The trend in monthly search volume for LBP between January 2004 and December 2019 is shown in Figure 1.

Figure 1 here please

Figure 1
Google Trends relative search volume for low back pain from 2004 to 2019. The apparent slope change in RSV is indicated by the red circle.

An overall positive correlation is seen with RSV over time. The Durbin-Watson statistic (2324) was 1.20. The Prais-Winsten regression of the whole study period, January 2004 to December 2019, resulted in an adjusted R^2 value of 0.23 (SE 13.39) (unadjusted r^2 = 0.24). The autocorrelation coefficient was 0.37 (SE=0.68). Time demonstrated a quadratic effect on search volume (β=1.27, t=5.00, P<0.001), as shown in table 1. A quadratic effect suggests that one slope change occurred over the time period.

Table 1 here please

Table 1
Prais-Winsten regression examining the effect of time on monthly search volume for low back pain (2004-2019).

In figure 1, the slope appears to change around early to mid 2007, circled in red. To examine the trend before and after the apparent slope change, Prais-Winsten regressions were conducted for the 2 periods: 2004 to 2006 (36 months) and 2007 to 2019 (156 months). Lastly, an analysis was carried out for the period 2011 to 2019 due to a change in the Google Trends algorithm for calculating RSV, which took effect from 01/01/2011. These analyses are presented in Table 2.

Table 2
Prais-Winsten regression analyses examining the effect of time on monthly search volume for low back pain between 2004-2006, 2007-2019, and 2011-2019.

Table 2 here please

From 2004 to 2006, the Durbin-Watson statistic was 1.32. The autocorrelation coefficient was 0.30 (SE 0.17). For the overall model, the adjusted R^2 was 0.071 (SE 25.58) (unadjusted R^2 = 0.12). Time demonstrated a negative linear effect on search volume (β=-0.25, t_{35}=-1.52, $P<0.14$), suggesting a reduction in monthly search volume during this period.

From 2007 to 2019, the Durbin-Watson statistic was 1.56. The autocorrelation coefficient was 0.21 (SE 0.08). For the overall model, the adjusted R^2 was 0.61 (SE 7.11) (unadjusted R^2= 0.61). Time demonstrated a positive linear effect on search volume (β=0.78, t_{155}=15.55, $P<0.001$), suggesting that monthly search volume exhibited a positive linear trend from 2007 to 2019.

From 2011 to 2019, the Durbin-Watson statistic was 1.94. The autocorrelation coefficient was 0.20 (SE 0.10). For the overall model, the adjusted R^2 was 0.34 (SE 5.96) (unadjusted R^2 = 0.36). Time demonstrated a positive linear effect on search volume (β=0.67, t_{108}=9.17, $P<0.001$), suggesting a positive linear trend consistent with the trend from 2007 to 2019, despite the improvement changes to GT ~~oogle Trends~~ on 01/01/2011.

Cross-Correlation Between Annual Search Volume and Disease Burden Indicators for LBP (2004-2019)

A mean was taken of the monthly RSV data from GT~~oogle Trends~~ to give an annual average for RSV, allowing a comparison with the annual data from the ~~Global Burden of Diseases~~GBD study. Table 3 presents cross-correlations between annual RSV and disease burden indicators at lags -1, 0, 1, 2, 3, 4 and 5.

Table 2 here please

* = exceeds 95% confidence interval

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Cross-correlation analysis reveals that there is a negative correlation between relative search volume and incidence, ~~prevalence~~prevalence, and YLD/DALY data at lag 0. There is a positive correlation between RSV and incidence at lag 4, suggesting a ~~four year~~four-year delay between online searching and a diagnosis of back pain. A positive correlation between RSV and prevalence, and RSV and YLD/DALYs becomes apparent at lag 5, suggesting a ~~five year~~five-year delay.

Discussion~~:~~

This study ~~aimed to tackle two key objectives: 1). e~~Examined ~~the~~ trends in ~~online health information-seeking behaviours~~ OHISB for LBP ~~low back pain~~ in the UK between 2004 and 2019 ~~using search volume data from Google Trends~~, and ~~2).~~ explored the relationship between~~Compare~~ those trends~~it~~ and several~~against the~~ ~~Global Burden of Disease indicators~~GBD indicators, including incidence, prevalence, YLD and DALYs~~, for the same period~~.

Principal findings

~~In relation to the first objective, the F~~findings ~~of this study~~ show that the ~~relative search volume~~OHISB for LBP has increased over time between January 2004 and December 2019. From a search of news and events from 2004 to 2019, there were no significant events such as low back pain awareness campaigns which explain this positive trend. The trend in RSV for ~~low back pain~~ LBP was curvilinear, with a slope change at the end of 2006. Further analyses revealed a downward trend in RSV between 2004 to 2006, and an upward trend from 2007 to 2019. The downward trend from 2004 to 2006 was not ~~expected, and~~expected

and could have been due to a multitude of factors. One factor that explains thispossible explanation is 'noise' in thesy' data caused by the Google Trends algorithm still being in its infancy at the time, given the fact that Google Trends only began as a project in 2004. Their data collection and analysis methods were improved upon in later updates, in January 2011 and January 2016, which could explain the more consistent'tidy' trend from 2007 onwards (242). Another potential explanation is that between 2004 and 2006, limited usage of personal computers and the internet may have resulted in infrequent searches for LBP, possibly contributing to fluctuating trend results at both extremes. Access to the internet was significantly better from 2007 onwards (253), likely due to the increase in use of computers and 'smartphones', revolutionised by the Apple iPhone introduced in the same year (264).

In relation to the second objective, resultsResults revealed a positive correlation between search volume and GBD indicators, such as incidence and prevalence. This was evident on the 4th and 5th lag, suggesting there is a 4 to 5 year4-to-5-year delay between searching of LBP online, and the diagnosis made by a healthcare professional. One potential explanation for this delay could be that patients could have initially searched for symptoms online, andonline and were able to manage their back pain using over-the-counter analgesics. However, when symptoms becoame more severe, or becoame more intrusive to their activities of daily living, patients would seek professional advice and receive a to seek a diagnosis. This could particularly be the case for younger individuals who may put off seeing their doctor due to work or other commitments, explained further in the limitations. Another potential reason for this delay is the long waiting times to be seen by specialists, and patients often requiring multiple visits to the doctor before a definitive diagnosis is reached (27). Indicators like YLD and DALYs showed a 5 year5-year delay from symptom searching, implying that it took five years after the initial OHISB for years of life to start being lost due to disability. This delay can also be explained by the worsening of symptoms and impact on activities of daily living on patients over time.

This study demonstrates that an increasing number of patients seek information about their LBP symptoms online. The positive correlation of search volume with GBD indicators implies that increases in incidence and prevalence of LBP is reflected in ~~online health information-seeking behaviours~~OHISB. Patients with LBP, or their carers may be searching online for the cause of their pain, or to find treatments to help manage the pain. Additionally, health information-seeking behaviours could be a key strategy for patients to cope with their back pain (2~~5~~8). Though most people rely on their doctors as the primary source of health information, sometimes they are unsatisfied with the lack of medical explanations and lack of adequate solutions for their pain, and resort to seeking information online (29~~6~~). Some patients also opt for alternative medicine such as acupuncture, massage, and spinal manipulation (30~~27~~). Another important factor to consider is timeliness; patients may seek information from online sources as it is quicker. This is particularly important in light of the current crisis where NHS waiting times are at an all-time high for A&E and outpatient appointments e.g., orthopaedics and rheumatology (31~~28~~). There are also several patient-related barriers to a timely diagnosis when presenting with low back pain. For instance, patients may ~~not have enough~~have insufficient knowledge about back pain to know when to seek help. They may be unaware of the red-flag signs associated with ~~back pain~~LBP, such as weight loss and incontinence, which could lead to missed diagnoses of serious lower back pathologies. Another barrier is that individuals do not prioritise seeking advice from a healthcare professional about their LBP, whether it be due to work commitments, personal beliefs, or that symptoms are not yet severe enough to warrant seeking help. This can make it difficult for an early diagnosis to be reached, which can impede early treatment, such as physiotherapy. A randomised clinical trial has demonstrated that early physiotherapy provides a significant improvement in disability in individuals diagnosed with low back pain compared to usual care alone (32).~~(29).~~

Recommendations~~:~~

Based on the findings of this study, emphasis should be placed on increasing awareness around low back painLBP using internet-based resources, so that patients can get an early diagnosis and early treatment, before symptoms become severe or hinder their activities of daily living. One way this could be done is through online health campaigns around low back pain awareness which could aim to explain the causes of LBP back pain, red flag symptoms to be aware of, and when to seek advice from a healthcare professional. This could be in the form of a website or app, however it is crucial to ensure that it is a user-friendly interface as patients report that as a key barrier to accessing health information online (30).

Strengths and limitations

A key strength to this study is that it is one of the first studies examining OHISB for LBP through Google TrendGT data in the United Kingdom. Furthermore, this study compares the correlation between GT oogle Trends data to GBD indicators to understand if OHISB can predict incidence and prevalence of LBP, which has not been done until nowpreviously. The results of this study are supported by another study other evidence from researchwhich examiningined OHISB forin COPD using GTeogle Trends data (165), suggesting a general increase in OHISB for various medical conditions over time as internet usage increases.

A few limitations of this study should be considered. Firstly, the exact data collection and analysis methods for Google Trends data are unknown. Secondly, as Google Trends data is reliant on the internet, it is difficult to understand health information-seeking behavioursOHISB about certain groups of people who do not or cannot access the internet, such as the elderly (31). One study has found that younger patients, and females were more likely to use the internet to search for health information (324). Younger patients, who often have work commitments, may be more likely to tolerate back pain symptoms for longer, and may try other remedies such as over-the-counter analgesics initially, resulting in a delayed consultation with their doctor. This could explain why a large lag exists between symptom

searching and case incidence and prevalence. Another limitation is that Google Trends has made several improvements to its data collection and analysis over the years which makes it difficult to understand RSV over different time periods (e.g., before and after an improvement). However, our analysis of the data in different sections, 2004-2006 and 2007-2019, has helped mitigate any differences caused by this. Finally, it is important to note that OHISB occurs through various other platforms apart from Google searches, such as through other search engines, and social media. This is an area which requires further research as the prospect of delivering health information through social media is an area of large interest currently.

Conclusion

Analysis of Google search data revealed an increasing trend in OHISB around LBP in the UK between 2004 and 2019 which positively correlates with GBD incidence and prevalence indicators over the same period. These findings suggest an increasing number of patients, relatives and carers are accessing health information around LBP online, and that internet searching patterns may be linked with a diagnosis by a healthcare professional. This emphasises the need for accurate and high-quality informational material around LBP to be available on the internet in a user-friendly manner for people of all ages. This can contribute towards early diagnosis, and prompt patient-centred treatment in order to achieve better health outcomes for patients with low back pain.

Authors' contributions

HP and TS designed the aims, concept, and methodology of the study. HP led the statistical

analysis and initial development of the manuscript. TS approved the manuscript prior to

submission and had overall oversight of the project.

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Competing interests

None to declare.

Ethical approval

Not required.

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Revision Notes

We would like to thank the reviewer and editor for their comments. They have been incredibly helpful in strengthening this manuscript. In the table below we have directly copied each point and detailed how each point has been addressed in the corresponding box in the column on the right. We have also been through the manuscript to improving the writing throughout.

Reviewer Comment	Author Response
>Clear research question which accurately reflects the contents of the study. The authors could consider rephrasing it to "Online Health Information-Seeking for Low Back Pain in the United Kingdom: Analysis of Data from Google Trends and the Global Burden of Disease Study between 2004-2019". >Appropriate data analysis techniques that are consistent with previous literature examining similar long-term patterns in Google Trends. >Good interpretation of the trend in increasing searches for low back pain over time and and potential reasons for a lag in diagnoses after OHIS.	The author team thank the reviewer for their overwhelmingly positive review of out paper and think that in addressing the comments that have been provided, we have significantly strengthened our paper.
>Ensure consistency throughout text when using "online health information seeking behaviour" or "OHISB". There are some occasions where the full expression could be replaced with the abbreviation.	This has been revised throughout (page 8 and 9).
>Ensure citations are all present for broad statements.	This has been fixed throughout the manuscript at several points
>Introduction: Good exploration of the existing evidence, including a discussion of those affected, economic and social costs. It sets up the motivation and background leading to the study well.	Thank you for this positive feedback
-The following quote may need a citation, "Barriers in seeking healthcare with lower back pain, such as knowing when to seek help, what red flags are, as well as the physical barriers e.g., mobility issues, hinder the prompt and accurate diagnosis of lower back pain".	A new reference (11) has been added to support this statement: Kikuchi S. The Recent Trend in Diagnosis and Treatment of Chronic Low Back Pain. Spine Surg Relat Res. 2017 Dec 20;1(1):1-6. doi: 10.22603/ssrr.1.2016-0022. PMID: 31440605; PMCID: PMC6698534. (Page 3 final paragraph).

-It would be interesting to know the age structure of the 96.7% of internet users given the segment of the population most affected by back pain.	The world bank data is not broken down by age unfortunately so this cannot be detailed in this manuscript.
-More specificity is needed here, "A study has found that out of 155 sampled participants, 65.8% had searched for their symptoms on the internet, with most of these patients sharing their findings with their doctors (14)." Is this in reference to low back pain or other health issues?	These are minor pain symptoms. This now reads "A study has found that out of 155 sampled participants, 65.8% had searched for their minor pain symptoms on the internet, with most of these patients sharing their findings with their doctors" (Page 4 paragraph 1)
-It may be good to introduce the Global Burden of Disease Study and its findings in relation to low back pain in a sentence or two. I do see however that this has been done in the methods section.	This is an interesting point. This information has been included in the Method section. (Page 4 final paragraph)
-I would recommend following the reporting guidelines for Google Trends searches in the following paper: Nuti SV, Wayda B, Ranasinghe I, Wang S, Dreyer RP, Chen SI, et al. (2014) The Use of Google Trends in Health Care Research: A Systematic Review. PLoS ONE 9(10): e109583. https://doi.org/10.1371/journal.pone.0109583. For example, the date of access and query category (e.g. all cetegories) and Google data source (e.g. web search) are not specified.	Firstly the following line has been added "To increase the reproducibility of the findings, methods are detailed following the recommended reporting guidelines (21)." (page 4 paragraph 4) and the noted details have been added. Date of access has been added (page 5 paragraph 3) Query data (page 5 paragraph 3). Google data source is included in the same section.
-I believe that inputting "low back pain" as a topic rather than a search term would include results in other languages.	This is noted in the manuscript (page 5 paragraph 2).
-Motivation for examining separate trends (2004-2007, 2007-2019 and 2011-2019) needs to be specified within the methods.	This is provided in the Results section paragraph 2. The justification is that clear alternating trend direction in these time cut-offs. This is also discussed in the Discussion (Page 7, paragraph 4).
-Figures and tables are all relevant, legible and presented well.	Thank you we appreciate this positive comment
-P-values for the lags for the cross-correlation analysis might be advisable if they can be retrieved from Stata.	P-Values are not included as a test of inference perspective here to avoid a significant risk of

	type 1 error. Instead, significance is determined by 95% confidence intervals.
-Good examinations of the reasons for a potential increase in searches for low back pain over time as well as the idea that the prevalence of searches for lower back pain mirrors the increase illustrated by the GBD study. It could be suggested that increasing awareness about low back pain via OHIS could be contributing to increased presentation for diagnoses further down the line?	This is very true and is now described in the Discussion section (page 8 paragraph 2).
-Perhaps use a more formal register when using the terms "noisy" and "tidy" data.	Tidy has been changed for "more consistent" (page 7 paragraph 4) Noisy has been revised to "noise in the data" (page 7, paragraph 4).
-Although there is a mention of current waiting times, the following sentence needs to be evidenced with studies examining the period between 2004 and 2019: "the long waiting times to be seen by specialists, and patients often requiring multiple visits to the doctor before a definitive diagnosis is reached.	A reference (27) has been added to support this statement. Quon JA, Sobolev BG, Levy AR, Fisher CG, Bishop PB, Kopec JA, Dvorak MF, Schechter MT. The effect of waiting time on pain intensity after elective surgical lumbar discectomy. Spine J. 2013 Dec;13(12):1736-48. doi: 10.1016/j.spinee.2013.05.038. Epub 2013 Jul 11. PMID: 23850131.
-There is mention of younger individuals contributing more significantly to DALYs and YLD, but this needs to be placed in the context of the statistic about the age group with the higher low back pain prevalence.	This is a really important point and is explained in the Discussion section (Page 9, paragraph 4)
-Exploration for the reasons for 4-5 year lags has been done well and includes a multitude of explanations and relevant literature.	Thank you for this positive comment.
-The validity and utility of online public health campaigns is certainly supported by the findings of this study, but given the demographics of those most affected, these should be extended to other avenues of dissemination that do not rely on high levels of digitalisation. Following on from this, although we tend to know that certain groups are not as proficient with the internet, this phrase "certain groups of people who	A reference (31) has been added to support this statement. Chang J, McAllister C, McCaslin R. Correlates of, and barriers to, Internet use among older adults. J Gerontol Soc Work.

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do not or cannot access the internet, such as the elderly" is a sweeping statement and should be cited. The whole sentence however, related to the lack of knowledge of those who may not use the internet is nonetheless very relevant.	2015;58(1):66-85. doi: 10.1080/01634372.2014.913754. Epub 2014 Dec 1. PMID: 24941050.
-Potentially explore some of the limitations of the GBD study and how this may impact the interpretation of your findings.	
-A good conclusion that correctly appraises the findings of the study.	Thank you for this comment
-The study findings might suggest avenues for future research including investigation into the reasons for the apparent 4-5 year lag in diagnoses.	This has now been added to the main Discussion section.

Figure 1
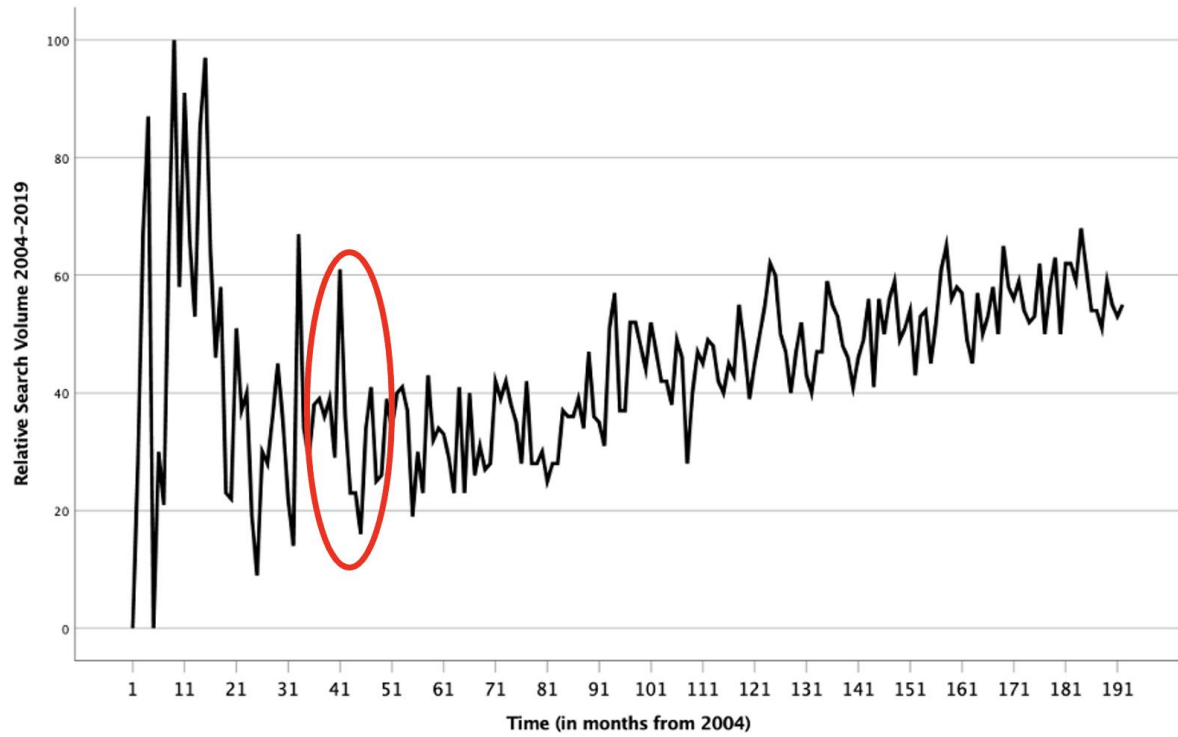
Figure 1
Google Trends relative search volume for low back pain from 2004 to 2019. The apparent slope change in RSV is indicated by the red circle.

Table 1

Predictors	Beta (standardised coefficients)	t (df=191)	P value
time	-0.86	-3.38	<0.01
time^2	1.27	5.00	<0.001

Table 1
Prais-Winsten regression examining the effect of time on monthly search volume for low back pain (2004-2019).

Table 2

Predictor: time	Beta (standardised coefficients)	t	P value
2004-2006	-0.25	-1.52 (df=35)	<0.14
2007-2019	0.78	15.55 (df=155)	<0.001
2011-2019	0.67	9.17 (df=107)	<0.001

Table 2
Prais-Winsten regression analyses examining the effect of time on monthly search volume for low back pain between 2004-2006, 2007-2019, and 2011-2019.

Table 3

Predictor	Lag -1	Lag 0	Lag 1	Lag 2	Lag 3	Lag 4	Lag 5
Incidence	0.001	-0.176	-0.356	-0.341	-0.217	0.018	0.380
Prevalence	-0.127	-0.363	-0.565*	-0.589*	-0.454	-0.186	0.141
Years Lived with Disability (YLD)	-0.133	-0.367	-0.567*	-0.589*	-0.451	-0.185	0.141
Disability Adjusted Life Years (DALYs)	-0.133	-0.367	-0.567*	-0.589*	-0.451	-0.185	0.141

* = exceeds 95% confidence interval

Table 3
Cross-correlation analysis of annual LBP search volume and LBP disease burden indicators (2004-2019).