Analysis of types and language used in online information available to patients with periodontitis

Abstract

Introduction

This research investigates framing in online patient information for those newly diagnosed with periodontitis.

Methods

This study is a cross-sectional analysis of websites using corpus linguistic techniques. A ‘Google’ search was conducted with the term ‘gum disease.’ 10 pages of search results were reviewed and information available was separated into types of resource: retail, healthcare, and dental practice websites. The dataset was analysed in terms of word frequency, collocation and keyness as compared to the British National Corpus (BNC) Written Sampler. Differences between sources were assessed.

Results

Across combined data sources, there was a tendency for the most advanced symptoms of periodontitis to be given prominence. There was also a negative skew towards avoidance of negative outcomes of treatment rather than achieving positive ones. When comparing types of resource, retail websites tended to be more positive with a focus on improving ‘milder’ stages of disease.

Conclusions

Negative framing could potentially induce engagement with treatment and self-care by the process of ‘fear-appeal,’ however there is a risk that negativity demotivates an already anxious patient. Further research is required to evaluate patient perceptions of the information and to investigate effects this could have on behaviour change.

Periodontal disease (or periodontitis) is the most prevalent inflammatory disease among humans; the most recent representative data available shows that approximately 50% of adults in the UK have some periodontitis, rising to 60% in those over 65 years of age.[1] Often progression goes unnoticed [2] as it can be painless initially. Timely diagnosis and management are highly important;[3] periodontitis can have significant long-term consequences including loose teeth, pain and tooth loss if left untreated, with up to 70% of tooth loss attributed to periodontitis.[4] Multiple studies [5,6,7] have reported the relationship of periodontitis to reduced oral health-related quality of life (QOL) in terms of functional, social and psychological effects. It has been further shown that a greater severity of disease gives a greater impact on QOL and therefore management of the condition should also include awareness of these outcomes.

Framing in healthcare

Successful treatment for periodontitis strongly relies on daily removal of bacterial plaque by the patient and therefore on patient motivation. For this reason, behaviour change is often at the heart of the patient-clinician interactions.[1,8,9] The way in which information is communicated can influence patient perceptions of their condition[10] and patient-physician relationships, both of which have been shown to increase success of behaviour change.[11]

However, the way that information is presented in and of itself has been shown to influence decision making.[12] According to Entman (1993, p.52),[13] framing involves the selection of "*some aspects of a perceived reality*" in order to "*make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation*" (italics in original).

Within oral health research, framing has been assessed in terms of the impact of gain- (for example, highlighting the benefits of a particular behaviour) or loss- (the costs associated with not engaging in a particular behaviour) frames on attitudes, oral health behaviours and plaque levels.[14,15,16,17] However, the findings from these studies are not consistent and reflect complex interactions with variables such as culture[16], motivation[18,19] focus, attitudes,[15] and message credibility.[20] As such, a direct correlation between framing and behaviour change is very complex, difficult to measure and requires further research.[21] However, it is notable that individual perceptions of issues such as susceptibility, ability to implement change, and disease seriousness are key elements in behaviour change theories used in public health, such as the Health Belief Model and the Theory of Planned Behaviour.[22,23]. Research in other areas of healthcare have demonstrated that framing can affect these perceptions; for example, Heideker and Steul-Fischer[24] suggest that negative framing

of specific statistical measures raises health risk perception. Use of medical terminology as opposed to lay terminology in recently medicalised disorders can result in greater perceived seriousness, but lower perceived prevalence.[25] Changing the framing of newspaper articles about cancer risk to emphasise disparities between ethnic groups has been shown to influence perception of risk, and have unintended negative effects on emotional reactions.[26]
As such, it is through this mechanism that we discuss the effect of message framing on perceptions,[13,27] which in turn may play a role in attitude change and health behaviours.

Online health information
Seeking information about healthcare online is common practice. with 45-52% of dental patients reporting the use of online searches in order to seek further information about their dental health,[28,29] and 45% of patients researching healthcare information prior to appointments with their health professional. It is therefore important to consider the quality of the available material.
An existing systematic review shows that the majority of patients were reassured by information that they found online, but in some cases, they found information was anxiety-inducing.[30] However, limited literature is available in terms of the use of written language in dentistry or periodontitis specifically.

Aims

The aim of this research is to see what messages patients are exposed to when looking for information about periodontitis. While existing tools such as JAMA or DISCERN are available for assessing the quality of evidence[30,31,32,33] these do not consider the language or framing of the material. Knowledge of online information available may assist practitioners in addressing patient concerns and make for a more robust informed consent procedure.

Research question -
The acronym **SPICE**[34] was used to formulate a research question:
The **S**etting was an online search. The **P**erspective being taken is that of the new patient or newly diagnosed periodontal patient, and the Phenomenon of **I**nterest is the type of knowledge that a patient can glean from searching the internet about periodontitis. The **C**omparison was between different types of available resources. The **E**valuation in this study was the framing used in each type of resource. The research question was:

‘What online resources are available to patients when diagnosed with periodontitis and how is that information presented?’

Methodology

A cross-sectional study design was chosen using corpus linguistic methods.

Data Collection (Figure 1)

Google was used to identify relevant websites, as this is the most commonly used in the UK. 'Gum disease' was chosen as the search term which it was considered would likely be used when a patient has been diagnosed with periodontitis.

The search for 'gum disease' was carried out from the 'Google' homepage on 27th August 2020. Measures were taken to reduce the influence of cookies and search history known as the 'bubble effect.'[35]

The first 10 pages of results were screened for inclusion. This decision was made in order that sufficient data could be gathered while still reflecting the potential browsing habits of patients. Sites unrelated to the topic of interest were discarded. Material was not excluded if duplicated across multiple sites as this reflects the repetition and potential reinforcement of the content regardless of validity.[36]

Sampling method

The text from each search result was copied and pasted into a Microsoft Word document. Relevant links within each hit were followed and content from these sites was also copied into the same document. Extra care was taken to consider reflexivity and include all data that could be relevant to a patient regardless of the researcher's opinion on the material.

Hypothesis

Initially we had no specific expectations from the dataset. This pilot-style study was designed to be exploratory and potentially inform future research in which interventions may be tested leading to recommendations for the profession.

Data Analysis

Data were initially coded in terms of the source of the material into the following categories: healthcare, pseudo-healthcare (such as webMD that are not affiliated with a specific healthcare body), retail, and dental practice websites.

WMatrix[37] was chosen to analyse the data. This software allows the researcher to assess patterns of word use. There were two patterns we were interested in. Firstly, we wanted to identify words and meanings that are more common on the websites that would be expected by looking at everyday language use. WMatrix helps us to do this by by labelling each word with its part of speech (for example, noun, adjective,

verb) and potential meaning of the word (e.g. illness or aggression). As an example, the word ‘risk’ may be labelled as a singular common noun and as potentially meaning danger. From this, we can determine which words are more commonly used on the websites than one would expect, and the potential meaning of those words. We compared the text of the websites to the British National Corpus written sampler. Statistically, this was assessed using log likelihood (LL); results were considered statistically significant if the LL score was 6.63 or higher. The effect size was calculated using log ratio.

We were also interested in words that appeared next to each other more commonly that would be expected. For example, if the word ‘tooth’ appeared more frequently with the word ‘loss’ than ‘retention’, this could be an indicator of gain vs loss-framing. We assessed this using a combination of Mutual information (MI) and T-Scores.[38] Statistically significant T-Scores are above 2 and MI scores above 3.

Initially the analysis was carried out for the overall dataset as this was the most relevant and largest sample available. A secondary objective was to compare the information available across different types of resource.

Results

Type of information

The dataset consisted of 104,502 words, comprising 75 different web links.
The types of websites are shown in table 1.
While practice websites represented a large proportion (35% of words and 48% of sources), they tended to appear later in the search results, with only one in the first 20 hits.
Healthcare websites, affiliated with a scientific group, charity or health service comprised 28% of the corpus, while another 20% of the total wordcount was from other sites claiming to be health-related.
Retail websites were a relatively small proportion of the search results (17% of words and 11% of sources). These websites generally appeared early in the search, and, although not part of the dataset, it was noted that these also appeared as advertisements.

Use of language

Symptoms

As may be expected, words relating to symptoms were generally statistically significant (Table 2), for example, ‘Inflammation’ ‘swollen’, ‘bleed’, ‘bleeding’, ‘loose’ (used with regards to mobile teeth), ‘painful’ and ‘discomfort’ were all commonly

present. However, what is striking is that the most severe symptoms are given more prominence in the text, despite periodontitis having few symptoms until the advanced stages (Table 2). Examples are provided in the supplementary material.

Disease process

Semantics of 'Healthy' (which includes words such as well-being and health), appear to be highly statistically significant (Table 2) and are often used in the context of prevention and describing non-diseased tissues rather than related to positive treatment goals or outcomes. However, when describing the disease process, use of 'damage' is used frequently to describe the consequences of periodontitis. Synonyms of this inherently negative word such as 'destroy' and 'harm' also show strong statistical significance. In contrast, the more neutral clinical term 'resorption,' does not appear at all in the dataset (Table 2).

Staging/Diagnosis

In general, frequency and significance of the most negative adjectives (i.e. serious, severe) is higher overall than the more-positive descriptors (mild, early) (Table 2). There appears to be a bias towards negative framing in terms of goals of treatment i.e. avoidance of negative outcomes rather than achieving positive ones. This ties into the suggestion that significant symptoms can be avoided by relatively pain-free treatments. Collocations of treatment come up with 'effective' (MI 4.02, t-score 2.3) and 'success' (MI 6.23, t- score 2.21) however when seen in context, often these are combined with 'not' which suggests consequences if the condition is left untreated.

Prognosis

Words related to 'failure' were statistically significant when describing prognosis and treatment outcomes (Table 5). This included words such as 'loss', 'lost' and 'lose', usually in relation to teeth or periodontal apparatus.
In contrast, words related to 'success' were not significant. Other, more positive words such as 'save,' 'maintain' and 'healing' tended to appear alongside a negative term i.e. 'not maintained' and 'cannot save' and 'delay healing' which contributes to negative framing.

That is not to say all descriptions were negative, the word 'reduce' was found to be statistically significant, and was often used in terms of a reduction in plaque or periodontal pockets, which is a positive outcome (Table 5).

When comparing language used across different categories of website, it was rare that there was a significant or pertinent difference. Therefore, the results presented were from the dataset as a whole.

Discussion

Framing is the selection of "*some aspects of a perceived reality*" in order to "*make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation*" (Entman (1993, p.52; italics in original).[13] This 'framing effect' has been widely researched and, although the relationship with behaviours is complex,[14,15,16,17,18,19,20] research has shown that framing may affect message perception.[27,39] Taken together, the results of this study suggest that while the available articles were informative, there was a tendency to frame periodontal disease negatively, owing to the foregrounding of more severe symptoms, outcomes and prognosis.

Descriptions of symptoms of periodontitis are common within the sample data and very highly frequent as well as statistically significant. Other symptoms which are used often within the corpus such as 'painful' and 'discomfort' are only usually present in the most advanced forms of periodontitis which accounts for only a small proportion (7.4-11.2%) of diagnoses.[40] This may suggest to a reader that the disease is more serious than the majority of patients would experience and may induce fear or increase negative perceptions of periodontitis. Of note is that the more negative words, especially 'aggressive' and 'severe' to describe stages of gum disease are used more commonly in the healthcare websites. This is unexpected and may be, in part, due to the description of the specific diagnosis of 'aggressive periodontitis.' It may also be used to describe that most symptoms tend to occur at these stages. 'Aggressive periodontitis' is no longer part of the recommended system of diagnosis[3] and so may reflect websites not being updated at the time of data collection. However, this terminology is still present on many of the websites when reviewed further in 2022. Updating websites to better reflect the new system of diagnosis and providing descriptions of the earlier stages of periodontitis may be one way in which dental practices and professional bodies may be able help to redress this.

Across the sources, clinical terminology, such as 'resorption' was not used, instead replaced with more loaded lay terminology around destruction and damage. Evidence suggests that, although the use of medical language may not initially be understood by patients, communication can be clearer when the expert introduces medical terminology directly to patients and explains its meaning, rather than using lay language that it is assumed all patients will understand in the same way.[41] For this reason, there may be benefit in using clinical terminology on websites, along with a more neutral lay description, such as 'shrinking' or 'receding'. While the articles did contain positive public health messaging in terms of being informative and focusing on prevention and early detection, this too tended to be negatively framed with a focus on preventing negative outcomes, rather than achieving positive ones. For promotion-focussed individuals in particular, this may be problematic.[19]

The greatest amount of positivity came from the retail websites and could reflect that the 'early' stages of gum problems are when products are most likely to have an effect alongside, or in lieu of, clinical treatment. For example, if a patient starts improving their oral hygiene regime by way of purchasing an electric toothbrush and using it more regularly they may see a change in their symptoms in early stages of the disease such as gingivitis, which is largely reversible.[42]

Dental phobia or anxiety affects approximately one in seven [43] and can lead to poor uptake of, and compliance with, treatment.[44] Therefore, the framing of information in terms of prevention and avoidance of negative health outcomes and use of generally negative wording is potentially problematic. Simply providing risk information is not sufficient for successful, long term behaviour change. [45] Appealing to people's fears of a negative outcome can be successful, but moreso for one-time interventions[46], which is not applicable to periodontal disease, which relies on consistent and prolonged oral health maintenance behaviours from patients. The situation is further muddied when considering individual factors, such as coping efficacy (cf. Health Belief Model and the Theory of Planned Behaviour).[22,23] Dental 'phobia' has been shown to affect not only attendance at the dentist but also ability to manage explanations and treatment.[47] The individual's perception of how simple a behaviour change is may affect how they react to the information.[48] As such, inclusion of information that highlights the relative simplicity of oral health maintenance may be helpful. We cannot, and do not, say that such effects are universal, but instead highlight how the perception of some patients, and success of clinicians' attempts to instil effective behaviour change, may be negatively affected by the wording of online health information about periodontal disease in some people, particularly if fear is invoked. Being aware of these issues has the potential to be helpful for clinicians attempting to engage in behaviour change conversations with patient; by making patents aware of the type of information they might find clinicians may be able to pre-empt some patient concerns and focus discussions on ensuring patents are accurately informed about their condition.

Strengths and limitations

One of the advantages of CL approaches is that it allows the researcher to uncover "*non-obvious meaning"* [49] in this case, identifying persistent patterns of language use that may not have been possible by looking at a single source. However, the flip side of this is that the language is decontenxtalised, so additional framing that may come from formatting or accompanying images or videos has been lost.[50] Future research could involve a content analysis of specific public health messages or images and videos that accompany the text. We also acknowledge that these findings are not experimental; future work could seek to manipulate the language of information about periodontal disease to assess the impact on patient interpretation.

We included 75 websites in order ensure we had sufficient data for the CL approach and for a sufficiently detailed overview of existing online information. However, we acknowledge that this may not reflect average browsing behaviour. It has been suggested that the click rate of the first link on google is 70% and then reduces exponentially with 5% clicking link 10. This is known as click bias.[51] This would mean from the data in this research that patients would be exposed to is mostly retail and healthcare websites with an omission of almost all practice websites. This may mean that patients are exposed to fewer messages around treatment (which seems to be a focus of practice websites), and more to information about prevention which seems to emerge more in the retail sites. However, it also needs to be considered that individuals will have different perceptions of what information is relevant to them and from a reputable source. The findings may also be more applicable to females, as women are more likely to carry out information seeking behaviour associated with healthcare, particularly online.[52,53]

As a clinician, the primary researcher may attribute significance to some words above others. Having said this, reflexivity was considered throughout the research process. Every statistically significant finding was investigated regardless of their clinical interest and care was taken to try and assess lay terms and explanations as opposed to clinical jargon in order to try to maintain a patient perspective throughout.

Conclusion

This research has demonstrated that patients using the internet to search for information about gum disease may be exposed to information which focusses to a greater extent on the more severe symptoms of the condition, and lay terms which reflects more aggressive terminology than more neutral clinical terminology. This has the potential to raise anxiety or fear in some patients, which may in turn lead to demotivation. Practitioners should be aware of this and ensure that patients are aware of what they may find online and how this reflects the reality of their individual situation.

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