Twitter analysis of UK populations' views and experiences with dental care during a COVID-19 lockdown

Rationale: Qualitative research on how and why people access emergency dental services suggests that the effects and meanings which people attach to acute dental symptoms are complex (Anderson, 2003, Anderson & Thomas, 2004). Combined with the poor awareness of the existence of emergency dental services, patients' pathways to care are complicated at the best of times (Anderson & Thomas, 2004). The planning of emergency dental services amid an unprecedented crisis may be expected to be even more challenging.

In response to the COVID-19 outbreak, on the 23rd of March 2020 the British Dental Association (BDA) (BDA, 2020) and UK Chief Dental Officers advised dentists that they should cease any routine dental treatment and temporarily close their doors for all but emergency cases. Shortly after, on 30th March, the Scottish Dental Clinical Effectiveness Programme (SDCEP) released a guideline directed at dentists to define dental emergency treatments and care pathways. Prior to this publication the information initially available to patients and the public, however, was minimal and there was no detail on what a dental emergency is or what patients should do if faced with a dental issue. Consulting with the Health Services Research Unit Public Partnership Group confirmed the variation of information available to potential dental patients – and some were unaware of any restrictions. Our public partners had a wide range of views on what would constitute a dental emergency.

It is unknown in what ways the UK population is affected by this change. To ensure that dental emergency services are not overwhelmed by patients' needs, that patients are aware of what steps to take at this time to avoid or minimise long-term health consequences, and in order to plan for service return to normal, understanding patients' experiences is key but also challenging. Analysis of social media communication during the first COVID19 lockdown may help to quickly build that understanding without adding any further burden on the population.

Overarching aims: By providing a rapid timely feedback on care-seeking behaviour of emergency dental patients in the UK in a time of crisis, we hope to immediately inform current efforts to provide practical guidance for patients and practitioners, as well as to consider the implications of 'return to normal' of dental care services. Medium or long-term, generalisable learnings from this work have a potential to also inform other areas of primary care undergoing a similar radical change (such as optometry) and emergency dental service design for future waves of lockdown or pandemics.

Primary aim: To understand the snapshot of issues and perspectives expressed by the UK population on dental care during COVID-19 restrictions by means of a Twitter analysis.

Objectives: Specific objectives include: 1) to explore UK public experiences and views on dental care aspects (e.g., dental hygiene, self-declared need for unscheduled dental care and dental care access/provision) during COVID19 lockdown over time; 2) to explore provision of dental advice to the UK public over time; 3) to map UK public perspectives on the timeline of emergent key dental and socio-political events.

Project team: The project team involves academic and clinical academic staff with expertise in dental care practice, education and research; implementation and improvement research; intervention design; health care service design; qualitative research; systematic reviews. The team includes also HSRU Public Partnership Group, with expertise, insight and experience with providing evidence, testimony and feedback that inform the development of the project design, interpretation and outputs from the public perspective.

METHODS:

Data source: Publicly available messages (tweets) and replies on the Twitter social media platform.

Twitter users include individuals and organisations. As of 2019, Twitter claimed 330 million monthly active users. Of these, more than 40 percent, used the service daily. At that point, approximately 63% of Twitter users worldwide were between 35 and 65 years old. Twitter accounts can be designated as public or private, but unlike platforms such as Facebook, the default setting is public. As a communication platform Twitter is increasingly used to conduct health science research (Cheong et al., 2011; Finfgeld-Connett, 2015; Kim et al, 2013; Nagel et al, 2013; Noll et al., 2017; Sinnenberg et al., 2017; Umihara & Nishikitani, 2013). Unique to Twitter is the ability to publicly send and receive brief messages in real time, making it a way to disseminate information about communicable disease transmission and crises situations. Indeed, there has been a 45% increase in

curated events page usage from 6th March to 16th March 2020 and 30% increase in direct messages (Twitter, 2020). This change has been attributed to people going to Twitter platform for information in relation to COVID19.

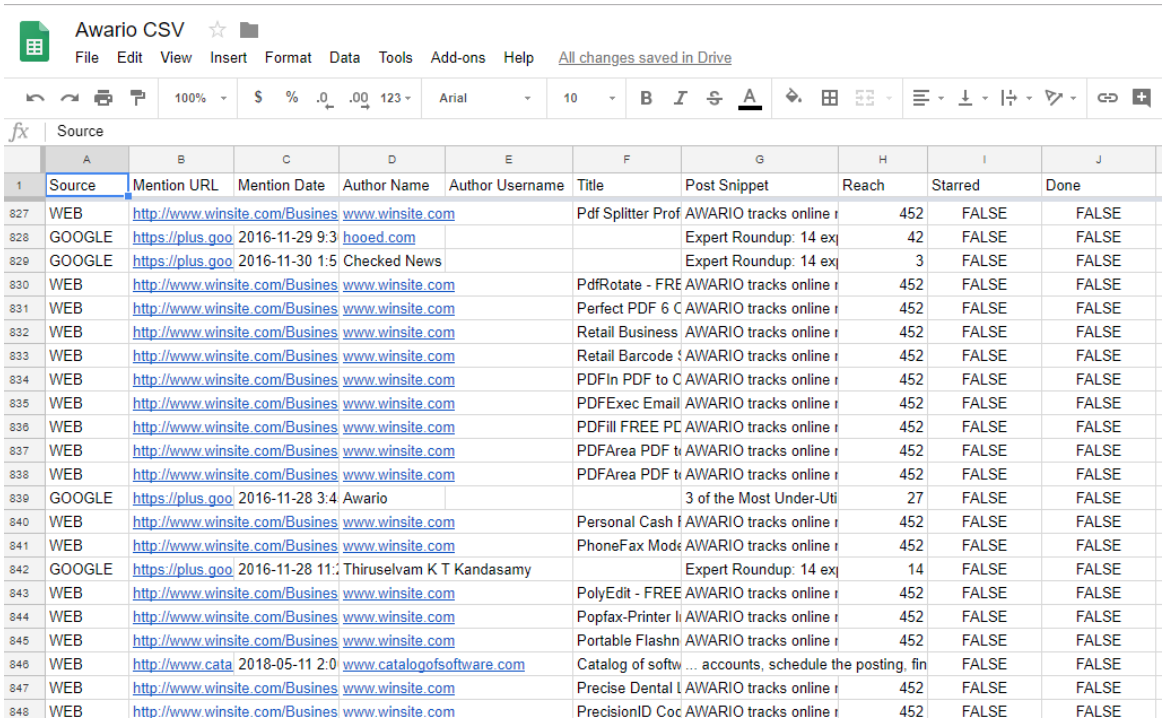
Procedure: Specific methods used in this work will be inspired by good systematic review and qualitative research practice. Steps involved in this process will be steered by the method proposed by UN Women (Lopes et al., 2018):

Step 1: Creating a dataset of relevant tweets in which people mentioned their experiences with handling dental emergency during UK COVID-19 lockdown.

1.1. A social listening tool Awario will be used to collect relevant public tweets (also referred to as 'mentions') from the Twitter platform for a period of 3 months.

1.2. A search strategy will be constructed by the research team of health care service researchers and academic dental care providers and informed by the views and wording recommended by the Public Involvement Partnership at the Health Services Research Unit. A Boolean search will be used, including a combination of keywords and hashtags related to terms 'emergency dental care' and 'COVID-19' (Appendix 1).

1.3. Search results will be exported from Awario in a form of files containing columns with Source, Mention URL, Mention Date, Author Name, Author Username, Title, Post Snippet, Reach, Starred, Done (Image 1).


Awario CSV

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

Source

	A	B	C	D	E	F	G	H	I	J
1	Source	Mention URL	Mention Date	Author Name	Author Username	Title	Post Snippet	Reach	Starred	Done
827	WEB	http://www.winsite.com/Busines		www.winsite.com		Pdf Splitter Prof	AWARIO tracks online r	452	FALSE	FALSE
828	GOOGLE	https://plus.goo	2016-11-29 9:3	hooed.com			Expert Roundup: 14 exp	42	FALSE	FALSE
829	GOOGLE	https://plus.goo	2016-11-30 1:5	Checked News			Expert Roundup: 14 exp	3	FALSE	FALSE
830	WEB	http://www.winsite.com/Busines		www.winsite.com		PdfRotate - FRE	AWARIO tracks online r	452	FALSE	FALSE
831	WEB	http://www.winsite.com/Busines		www.winsite.com		Perfect PDF 6 C	AWARIO tracks online r	452	FALSE	FALSE
832	WEB	http://www.winsite.com/Busines		www.winsite.com		Retail Business	AWARIO tracks online r	452	FALSE	FALSE
833	WEB	http://www.winsite.com/Busines		www.winsite.com		Retail Barcode S	AWARIO tracks online r	452	FALSE	FALSE
834	WEB	http://www.winsite.com/Busines		www.winsite.com		PDFIn PDF to C	AWARIO tracks online r	452	FALSE	FALSE
835	WEB	http://www.winsite.com/Busines		www.winsite.com		PDFExec Email	AWARIO tracks online r	452	FALSE	FALSE
836	WEB	http://www.winsite.com/Busines		www.winsite.com		PDFill FREE PD	AWARIO tracks online r	452	FALSE	FALSE
837	WEB	http://www.winsite.com/Busines		www.winsite.com		PDFArea PDF t	AWARIO tracks online r	452	FALSE	FALSE
838	WEB	http://www.winsite.com/Busines		www.winsite.com		PDFArea PDF t	AWARIO tracks online r	452	FALSE	FALSE
839	GOOGLE	https://plus.goo	2016-11-28 3:4	Awario			3 of the Most Under-Uti	27	FALSE	FALSE
840	WEB	http://www.winsite.com/Busines		www.winsite.com		Personal Cash I	AWARIO tracks online r	452	FALSE	FALSE
841	WEB	http://www.winsite.com/Busines		www.winsite.com		PhoneFax Mode	AWARIO tracks online r	452	FALSE	FALSE
842	GOOGLE	https://plus.goo	2016-11-28 11:2	Thiruselvam K T Kandasamy			Expert Roundup: 14 exp	14	FALSE	FALSE
843	WEB	http://www.winsite.com/Busines		www.winsite.com		PolyEdit - FREE	AWARIO tracks online r	452	FALSE	FALSE
844	WEB	http://www.winsite.com/Busines		www.winsite.com		Popfax-Printer I	AWARIO tracks online r	452	FALSE	FALSE
845	WEB	http://www.winsite.com/Busines		www.winsite.com		Portable Flashn	AWARIO tracks online r	452	FALSE	FALSE
846	WEB	http://www.cata	2018-05-11 2:0	www.catalogofsoftware.com		Catalog of softw	... accounts, schedule the posting, fin		FALSE	FALSE
847	WEB	http://www.winsite.com/Busines		www.winsite.com		Precise Dental I	AWARIO tracks online r	452	FALSE	FALSE
848	WEB	http://www.winsite.com/Busines		www.winsite.com		PrecisionID Coc	AWARIO tracks online r	452	FALSE	FALSE

Image 1. The structure of Awario file with exported data.

1.4. Inclusion and exclusion criteria:

Data restriction (automated):

a. Location: the UK (twitter user account defined)

b. Time frame: **from 1st March to at reopening of dental primary care services**

c. Language: only English

Inclusions (manual):

d. Twitter users: any individual or organisation users will be eligible

e. Outcomes: content related to public experiences with dental care and advise of dental care community directed at the UK public

Exclusions (manual):

f. Off-topic tweets

g. Advertisements

h. Communication directed at the dental care community

1.5. Eligibility screening process (also known as 'inclusion screening' and 'evidence selection'): The inclusion process will be performed independently by two researchers. All disagreements will be resolved via discussion to reach a consensus, if this is not possible, by a third researcher.

EXCLUDED: Exclusion of advertisements, obviously off-topic tweets such as the use of dental vocabulary in other context dental care (Image 2), and content obviously directed at the dental

care community, such as dental practitioners sharing their views with colleagues (Image 3) or guidance/educational material aimed at practitioners (Image 4) will be performed.

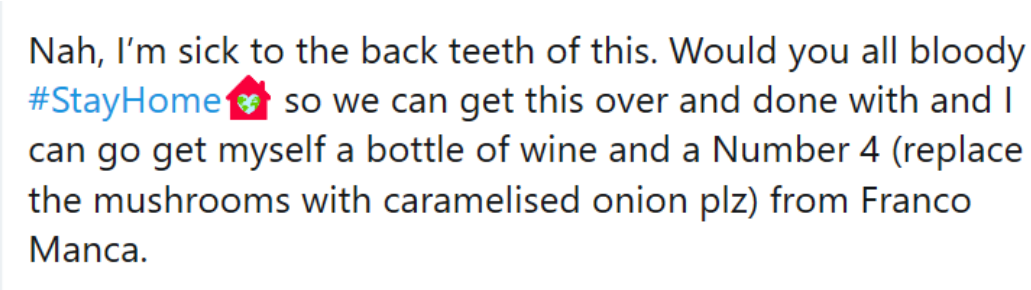


Image 2. Exemplary off-topic tweet (EXCLUDE).

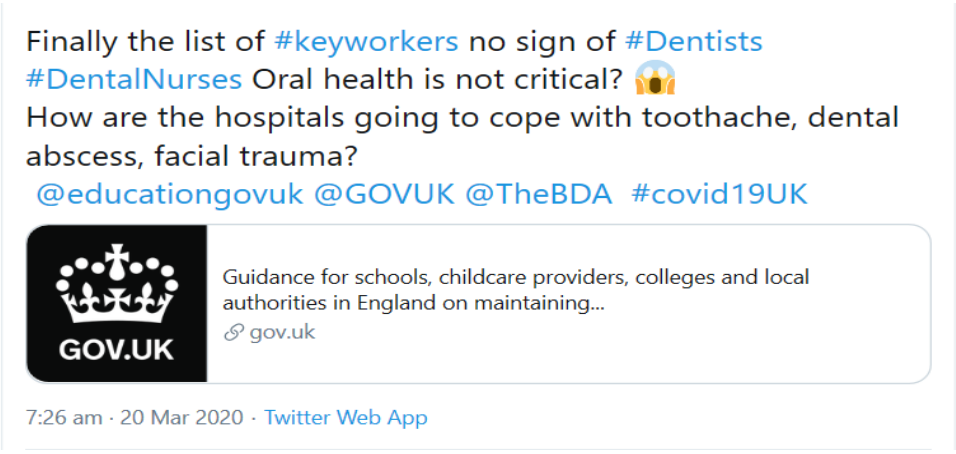


Image 3. Exemplary tweet with content directed at the dental care community, in this case a dental practitioner expressing his views (EXCLUDE).

Image 4. Exemplary tweet with content directed at the dental care community, in this case a local dental committee posting BDA advice (EXCLUDE).

INCLUDED: Included will be tweets concerning any dental care-related topics expressed by the UK public, such as general queries (Image 5), personal and others' experiences with dental care issues and dental care access (Image 6), information sharing directed at the UK public from other member of the public (Image 7) and the dental care community (Image 8).

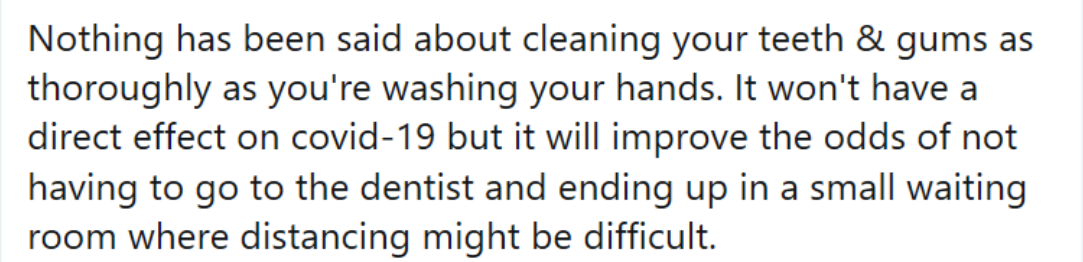


Image 5. Exemplary tweet involving dental hygiene query (INCLUDE).

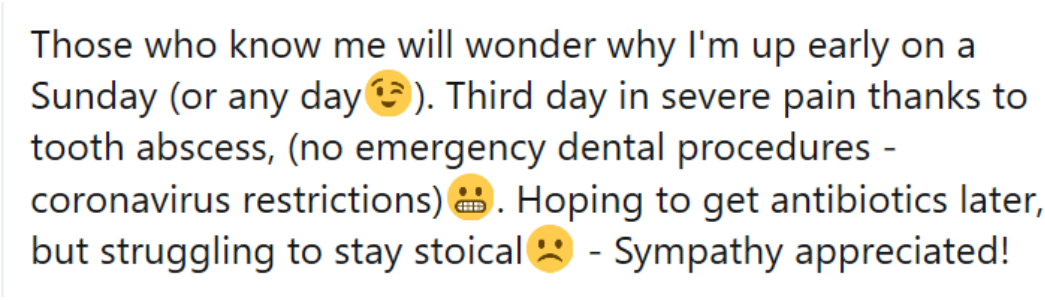


Image 6. Exemplary tweet describing an experience with a self-declared need for unscheduled dental care (INCLUDE).

Image 7. Exemplary tweet containing dental care advice shared by the public (INCLUDE).

Image 8. Exemplary tweets containing dental care advice shared by the dental care community (INCLUDE).

Step 2. Describing the included tweets.

2.1. For included tweets we will calculate frequencies of keywords and hashtags use; provide Awario generated statistics of engagement (numbers of likes, retweets, reach) and describe demographics of users (user type, location).

2.2. Automated sentiment analysis - the process of computationally identifying and categorising text - is an increasingly popular instrument for the analysis of social media discourse. Sentiment scores seemingly represent an objective means of assessing the mood of social media users, and the public at large. Sentiment analysis will be conducted using Awario system that will automatically assign sentiment (positive, negative, or neutral) to collected tweets using natural language processing. Awario team will be contacted to provide details on the method used. A sample of the included tweets will be manually coded in pairs by sentiment and agreement between manual and automated assessment will be assessed. The argument in favour of automated sentiment analysis is that it is faster and more reliable than a human judge, being able to classify many tweets by the same criteria. There are generally still strong reservations against its use, owing to the surrounding uncertainties (Puschmann & Powell, 2018). As such sentiment analysis will simply serve as a tool for the approximation of human behaviour (i.e., mood/emotions), to complement full discourse analysis described in **Step 3**.

2.3. Awario we will also enable us to identify users of influence in Twitter networks, based purely on the size of their audience and numbers of times they tweeted in relation to this study topic (Image 9).

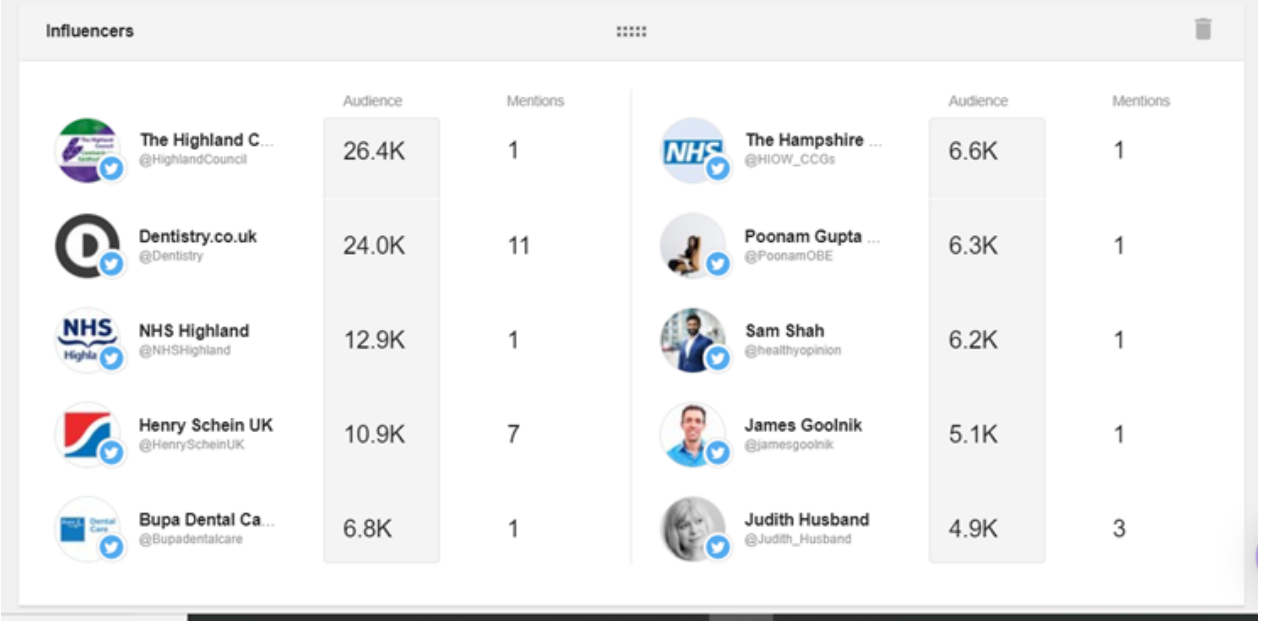


Image 9. An exemplary list of Tweeter network influencers on emergency dental care during COVID-19.

Step 3. Thematic analysis of original posts, threads and replies.

3.1. An initial scoping of relevant tweets suggest they will contain information such as: COVID19-related queries about dental hygiene; a description of a specific dental emergency; associated feelings, deployed coping strategies; original posts and replies with advice on how and where to access dental care (e.g., type of dental care available and when to seek emergency dental care) and treatment delay methods (e.g., official guidance and homegrown methods).

3.2. Original posts, threads and replies (discourse analysis) will be coded and analysed using a data-driven thematic approach (Braun & Clarke, 2006), which allows categories to emerge from the data and acknowledged the significance of the context in which the analysed information was generated. It focusses on extracting categories from the data and is a flexible technique that can be used using combined inductive and deductive approaches. The core analytic work will involve the following phases: 1) familiarisation (researchers will read through allocated 100 tweets several times and create a preliminary list of prior categories, categories will be both grounded in text and when relevant inspired with literature (e.g., the SDCEP flow diagram that classes emergencies into definite, possible, routine, unclear); 2) initial coding of a subset of data (another subset of 100 tweets, including text and images, will be coded independently by two researchers according to these categories, when relevant information could not be coded

into an existing category, a new category will be created); 3) categories will be reviewed to create sub-categories or merge categories into candidate themes that addressed similar issues and a coding book will be developed (including a code label (a short descriptive mnemonic (4-14 characters) that helps the coder quickly distinguish coded form each other); description of the content to which it applies and an example). All dataset will be coded independently by two researchers using the coding book; 4) one researcher will develop rich analysis of the data presented by the finalised themes. The results derived from this process will be discussed with the wider group in order to refine theme names, improve the interpretation of the information and the credibility of the results.

3.3. We will then attempt to apply to the identified data a theory/model explaining delay in seeking treatment, such as Andersen et al (1995) model of patient delay, Zola (1973) triggers to consultation or a candidacy framework (Evans et al., 2007; Kirkpatrick et al., 2018). The choice of the model will be data-driven and agreed through discussion.

Step 4. Between UK nations (England, Scotland, Wales and Northern Ireland) group and over-time comparisons

4.1. We will search for co-occurrence between demographic of users and frequency of keywords or hashtags and sentiments.

4.2. We will attempt to compare levels of engagement, sentiments and types of issues and advices shared across England, Scotland, Wales and Northern Ireland (specific location will be identified from users' profile or from mention of country in the tweet).

4.3. Changes over time (from 1st March to reopening of dental primary care services) in the content of identified tweets will be described; and engagement and sentiments mapped onto a timeline of lockdown, to analyse impact of released official guidelines for dental practice. For this, in addition to guidance referred to in tweets, we will monitor releases of any new relevant UK guidance affecting dental care practice (e.g., Scottish Dental Clinical Effectiveness Programme) and relevant news stories released during this time period and available in widely accessible outlets, like the BBC website.

REFERENCES:

Andersen, B.L., Cacioppo, J.T. and Roberts, D.C. (1995), Delay in seeking a cancer diagnosis: Delay stages and psychophysiological comparison processes. British Journal of Social Psychology, 34: 33-52. doi:10.1111/j.2044-8309.1995.tb01047.

Anderson, R. (2004) Patient expectations of emergency dental services: a qualitative interview study. Br Dent J. 2004 Sep 25;197(6):331-4; discussion 323.

Anderson, R., Thomas, D.W. (2003). 'Toothache stories': a qualitative investigation of why and how people seek emergency dental care. Community Dent Health.; 20(2):106-11.

BDA (2020). Live updates: Coronavirus and dentistry. Available at: https://bda.org/advice/Coronavirus/Pages/latest-updates.aspx

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. Qualitative Research in Psychology, 3 (2). pp. 77-101.

Cheong, France and Cheong, Christopher, "Social Media Data Mining: A Social Network Analysis Of Tweets During The 2010-2011 Australian Floods" (2011). PACIS 2011 Proceedings. 46. http://aisel.aisnet.org/pacis2011/46.

Evans, J., Ziebland, S., McPherson, A. (2007) Minimizing delays in ovarian cancer diagnosis: an expansion of Andersen's model of 'total patient delay', Family Practice, Volume 24, Issue 1, February 2007, Pages 48–55, https://doi.org/10.1093/fampra/cml063.

Finfgeld-Connett, D. (2015). Twitter and health science research. *Western journal of nursing research*, *37*(10), 1269-1283.

Kim, E.-K., Seok, J. H., Oh, J. S., Lee, H. W., Kim, K. H. (2013). Use of Hangeul Twitter to track and predict human influenza infection. PLOS ONE, 8, e69305. doi:10.1371/journal.pone.0069305.

Lopes, A.C., Bailur, S., Barton-Owen, G. (2018) Can big data be used for evaluation? A UN Women feasibility study. NY: Un Women.

Nagel, A., Tsou, M., Spitzberg, B., An, L., Gawron, J., Gupta, D., Sawyer, M. (2013). The complex relationship of realspace events and messages in cyberspace: Case study of influenza and pertussis using tweets. Journal of Medical Internet Research, 15, e237. doi:10.2196/jmir.2705.

Noll, D., Mahon, B., Shroff, B., Carrico, C. and Lindauer, S.J (2017) Twitter analysis of the orthodontic patient experience with braces vs Invisalign. The Angle Orthodontist: May 2017, Vol. 87, No. 3, pp. 377-383.

Puschmann, C., Powell, A. (2018). Turning Words Into Consumer Preferences: How Sentiment Analysis Is Framed in Research and the News Media. Social Media + Society. https://doi.org/10.1177/2056305118797724

Sinnenberg, L., Buttenheim, A. M., Padrez, K., Mancheno, C., Ungar, L., & Merchant, R. M. (2017). Twitter as a Tool for Health Research: A Systematic Review. *American journal of public health*, *107*(1), e1–e8. https://doi.org/10.2105/AJPH.2016.303512.

Twitter (2020). An update on our continuity strategy during COVID-19. Available at https://blog.twitter.com/en_us/topics/company/2020/An-update-on-our-continuity-strategy-during-COVID-19.html.

Umihara, J., Nishikitani, M. (2013). Emergent use of Twitter in the 2011 Tohoku earthquake. Prehospital and Disaster Medicine, 28, 434-440. doi:10.1017/S1049023X13008704.

Zola, I. K. (1973). Pathways to the doctor: From person to patient. Social Science & Medicine, 7(9), 677–689. https://doi.org/10.1016/0037-7856(73)90002-4.

Appendix 1 Indicative search terms

Search term group	Hashtags	Key words
Dental emergency	#toothache #toothswelling #pulltooth #abscess #teeth #dentalemergency #dentalpain #emergencydentaltreatment #dentalcare #dentist #dentistry #tooth #mydentist @mydentist_uk #dental	abscess bleeding gum bleeding tooth broken tooth bruxism chipped tooth crown broken crown dislodged crown out dental dental bridge out dental cap dental care dental emergency dental hygiene dental nerve pain dental pain dental plate dentist dentistry denture broken emergency dental treatment extract teeth extract tooth extraction filling broken filling dropped out filling loose filling needed grind teeth gum boil gum inflammation gum ulcer jaw clenching loose teeth loose tooth mouth ulcer pull tooth root canal root treatment sore gum teeth teeth grinding tongue ulcer tooth tooth ache tooth infection

		tooth nerve pain tooth out tooth repair tooth sensitivity tooth stain tooth swelling toothache veneer broken
COVID19 lockdown	#covid19 #COVID_19 #COVID-19 #coronavirus #coronavirusuk #covid19uk #UKlockdown #stayhome #CoronavirusLockdownUK	UK lockdown lockdown UK stay home COVID19 COVID_19 COVID-19 coronavirus corona virus COVID

Boolean search:

(
#toothache
OR
#toothswelling
OR
#pulltooth
OR
#abscess
OR
#teeth
OR
#dentalemergency
OR
#dentalpain
OR
#emergencydentaltreatment
OR
#dentalcare
OR
#dentist
OR
#dentistry
OR
#tooth
OR
#mydentist
OR
@mydentist_uk
OR
#dental
OR
dental

OR
near/3:tooth,ache
OR
toothache
OR
near/3:tooth,swelling
OR
near/3:pull,tooth
OR
abscess
OR
tooth
OR
near/3:dental,emergency
OR
near/3:dental,pain
OR
teeth
OR
near/6:emergency,dental,treatment
OR
near/3:dental,care
OR
near/3:root,canal
OR
near/3:root,treatment
OR
near/3:gum,boil
OR
extraction
OR
near/3:extract,tooth
OR
near/3:extract,teeth
OR
near/6:dental,nerve,pain
OR
near/6:tooth,nerve,pain
OR
near/3:tooth,out
OR
near/3:chipped,tooth
OR
near/3:crown,out
OR
near/3:crown,dislodged
OR
near/3:crown,broken
OR
near/3:dental,cap
OR
near/3:dental,hygiene
OR

near/3:veneer,broken
OR
near/3:mouth,ulcer
OR
near/3:tongue,ulcer
OR
near/3:broken,tooth
OR
near/3:bleeding,gum
OR
near/3:bleeding,tooth
OR
near/6:dental,bridge,out
OR
near/3:dental,plate
OR
near/3:denture,broken
OR
near/3:filling,needed
OR
near/3:filling,loose
OR
near/6:filling,dropped,out
OR
near/3:filling,broken
OR
near/3:gum,inflammation
OR
near/3:gum,ulcer
OR
near/3:loose,tooth
OR
near/3:loose,teeth
OR
near/3:sore,gum
OR
near/3:tooth,infection
OR
near/3:tooth,repair
OR
near/3:tooth,sensitivity
OR
near/3:tooth,stain
OR
near/3:teeth,grinding
OR
near/3:grind,teeth
OR
near/3:jaw,clenching
OR
bruxism
)
AND

```
(
#covid19
OR
#COVID_19
OR
#COVID-19
OR
#coronavirus
OR
#coronavirusuk
OR
#covid19uk
OR
#UKlockdown
OR
#stayhome
OR
#CoronavirusLockdownUK
OR
near/3:UK,lockdown
OR
near/3:lockdown,UK
OR
near/3:stay,home
OR
COVID19
OR
COVID_19
OR
COVID-19
OR
coronavirus
OR
near/3:corona,virus
OR
COVID
)
AND
lang:en
AND
country:GB
FROM twitter
```