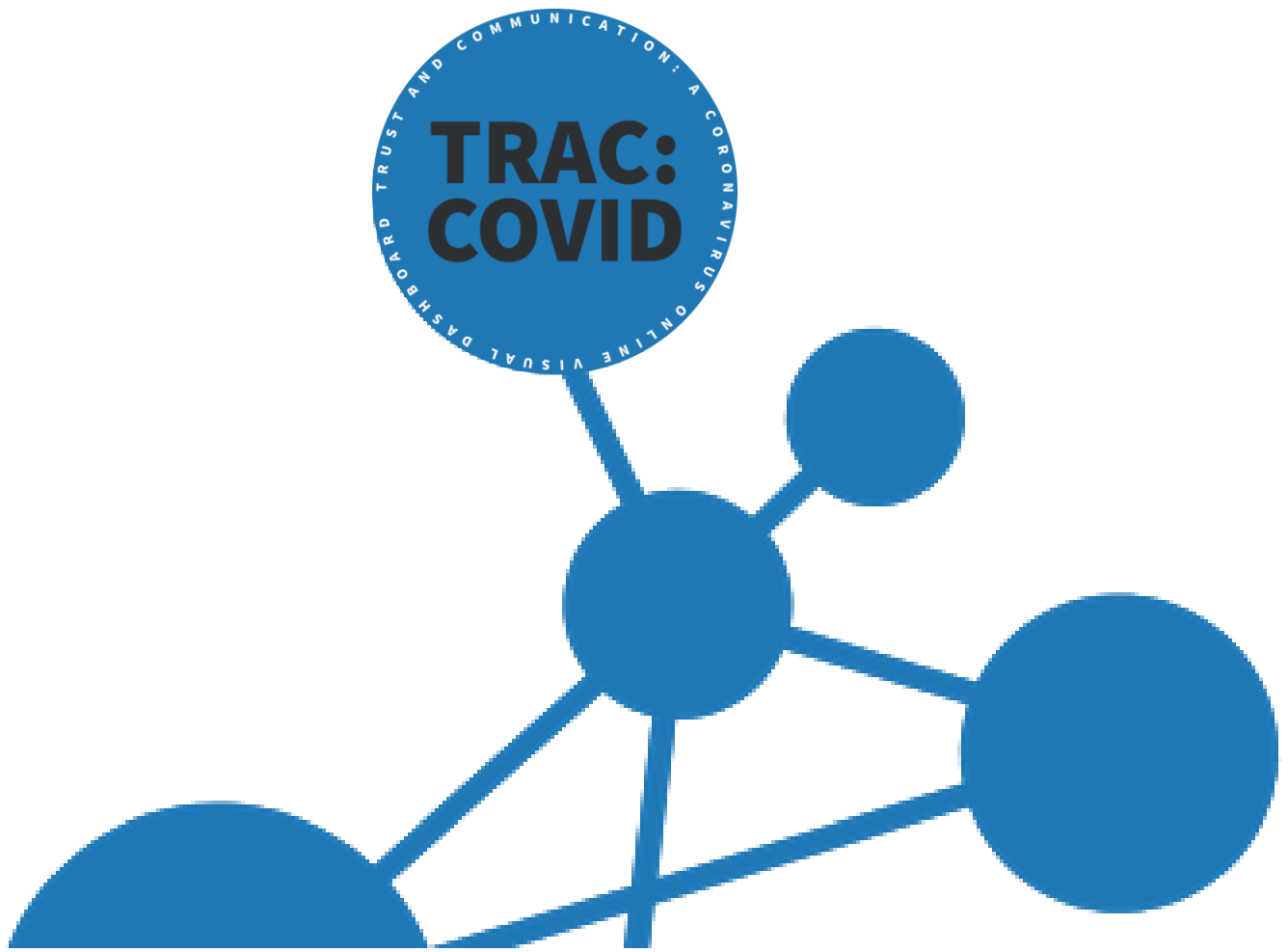# TRAC:COVID

Case study 2: misinformation, authority, and trust

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Executive summary

This case study reports on a study of COVID-19 vaccine misinformation on Twitter and focuses on the scale and variety of iterations of vaccination hesitancy, misinformation and conspiracy theories in ~84 million tweets sampled between 1st January 2020 and 30th April 2021. Findings suggest that COVID-19-specific anti-vaccination (i.e. anti-vax) discourse is underpinned by political (dis)trust, fears of corruption, concerns over safety, and exists within a wider conspiracy theory network.

1. Despite the presence of vaccine misinformation, the majority of tweets about vaccines in relation to COVID-19 either do not contain – or are critical of – vaccine misinformation.
2. COVID-19 vaccine misinformation exists within a wider web of misinformation and conspiracy theories in which attempts are made to undermine confidence and trust in vaccines, health professionals, and policy-makers.
3. Anti-vax tweets often reference multiple anti-vax ideas as well as conspiracy theories not specifically linked to vaccines.
4. Thus, vaccine misinformation can be communicated in numerous ways and alongside other forms of misinformation, making both the identification of an archetypal anti-vax stance and the disaggregation of concerns that inform anti-vax stances difficult, if not impossible.
5. Moreover, given relationships within and between anti-vax ideas and broader conspiracy theories, anti-vax content could be regarded as a vector for the spread of numerous forms of misinformation.
6. These relationships – investigated in this case study through hashtag co-occurrences – provide valuable insights into the 'discursive landscape' of vaccine misinformation and the forms of misinformation and conspiracy theories to which COVID-19 misinformation is related.
7. However, due to the various forms and configurations through which misinformation may be realised and communicated, there is no silver bullet to prevent or detect vaccine misinformation.
8. Some misinformation contains language directly related to known conspiracy theories (e.g. nwo), but other forms are exceptionally novel, subtle, evolving, and, indeed, designed to circumvent automated moderation systems put in place by social media sites.
9. The ongoing role of expert human analysts in interpreting these linguistic behaviours is therefore crucial.
10. More broadly, the outcomes of this case study suggest a need to investigate the social and political conditions that result in social alienation and distrust, which informs anti-vaccination and conspiratorial beliefs. More comprehensive understanding of distrust facilitates understanding of how and why misinformation has been so pervasive and enduring throughout the pandemic.

1   Introduction

Twitter provides a valuable mass public communication service, including for national governments to communicate and respond to issues of (inter)national importance and crises such as global pandemics (see **case study 1**). Yet, social media platforms like Twitter have been acknowledged as posing significant threats due to their use in circulating, amongst other things, misinformation and hate speech. This case study examines some aspects of vaccine misinformation on Twitter in relation to political (dis)trust and vaccine hesitancy in a sample of ~84m Tweets. All tweets presented here have been anonymised in line with our ethics policy.

2 Vaccine misinformation

As noted elsewhere, public distrust in government, pharmaceutical companies, healthcare professions, and medical science and technology has been consistently linked with vaccine rejection and, "since distrust correlates with vaccine refusal, policymakers want to understand it in order to address it."[1]

The World Health Organization's (WHO) *SAGE working group dealing with vaccine hesitancy*[2,3] proposes the following definition of vaccine hesitancy, which includes *confidence* within its 'three Cs' model of vaccine hesitancy:

> Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place and vaccines. It is influenced by factors such as complacency[4], convenience[5] and confidence.

Public trust in relation to vaccines – encompassing "trust in the vaccine (the product), trust in the vaccinator or other health professional (the provider), and trust in those who make the decisions about vaccine provision (the policy-maker)."[6] – underpins vaccine confidence. As such, distrust may emerge if doubt exists about "(i) the effectiveness and safety of vaccines; (ii) the system that delivers them, including the reliability and competence of the health services and health professionals and (iii) the motivations of policy-makers who decide on the needed vaccines."[7] As such, if public trust in vaccines is undermined, it may influence vaccine confidence and result in vaccine hesitancy.

Vaccine hesitancy, therefore, presents a potentially significant threat to the UK government's strategy for tackling COVID-19 and for providing a "route out of lockdown"[8], because of its almost total reliance on vaccine uptake as "the way out of this pandemic and towards a more normal way of life".[9]

Although there has been widespread uptake of COVID-19 vaccinations across the UK adult population, and positive sentiment towards vaccination against COVID-19 has increased across Europe throughout the period of the pandemic[10], there remain some issues concerning vaccine hesitancy as was identified in the Office for National Statistics (ONS) report on *Coronavirus and vaccine hesitancy, Great Britain: 13 January to 7 February 2021*[11]

> we've seen people become increasingly positive about the COVID-19 vaccines, with over nine in ten adults saying they would have it if offered, or having already had it. Of those who are hesitant about receiving the vaccine, it's younger and black adults who are most likely to say this, with concerns around side effects, long term effects and how well the vaccine works being the most common reasons.

> Tim Vizard, Public Policy Analysis, Office for National Statistics

Specifically, the report identifies vaccine hesitancy in:

- around 1 in 6 (17%) **adults aged 16 to 29 years** (the highest of all age groups)
- more than 4 in 10 (44%) **Black or Black British adults** (the highest of all ethnic groups)
- around 1 in 6 (16%) **adults in the most deprived areas of England** (based on Index of Multiple Deprivation) compared with 7% of adults in the least deprived areas of England
- around 1 in 6 (16%) **parents living with a dependent child aged 0 to 4 years** reported vaccine hesitancy, compared with 8% of non-parents or parents not living with a dependent child

2.1   Vaccine hesitancy

Of concern, then, is the danger posed by vaccine misinformation to vaccine hesitant groups that are also most likely to experience the most negative impacts from COVID-19.

More than any other group, **the young adult (18-29) population most use social media**,[12] which is noted as a significant vector in the propagation of medical misinformation and conspiracy theories relating to COVID-19;[13,14] social media has also been recognised as a prominent site for the spread of misinformation during previous outbreaks such as Zika.[15]

Low socioeconomic status – including features such as income and education, which are used to calculate 'deprivation' in the UK[16] – has also been related to negative health outcomes from COVID-19,[17] as was found by the ONS in their study of *Deaths involving COVID-19 by local area and socioeconomic deprivation: deaths occurring between 1 March and 17 April 2020*[18]:

> People living in more deprived areas have experienced COVID-19 mortality rates more than double those living in less deprived areas. General mortality rates are normally higher in more deprived areas, but so far COVID-19 appears to be taking them higher still.
>
> Nick Stripe, Head of Health Analysis, Office for National Statistics

COVID-19 appears to have "uncovered, exacerbated and solidified existing social inequalities."[19] In the UK, social inequities are known to be most severely negative for people from **BAME** or **low socioeconomic** status backgrounds.

Economic inequality "changes the way people interact with other members of their society and engage in society itself" and has been linked to lower rates of social, civil participation, and voter turnout, and a disinclination toward altruism.[20] A strong relationship also exists between economic inequality and low levels of educational attainment and social mobility. For example, although free school meals (FSM) cannot be directly correlated with poverty (the working poor who do not qualify for FSM):

- By eleven, (end of Key Stage 2), less than half (46 per cent) of pupils entitled to free school meals reach the standards expected for reading, writing and mathematics, compared to 68 per cent of all other pupils[21]
- Only 16 per cent of those on free school meals attain at least two A levels compared to 39 per cent of all other pupils.[22]
- Graduates who were on free school meals earn 11.5 per cent less than others five years after graduating.[23]

These negative impacts of poverty may also intersect with other social inequalities and discriminations, for example those based on ethnicity. For example, although "white British students on free school meals (FSM) have poorer attainment at GCSE level than all ethnic minority students analysed"[24] and "students from ethnic minority backgrounds (on average) having higher educational attainment by age 16, and getting into university at higher proportions, this has tended not to translate into higher educational achievement and more equitable job market prospects".[25]

Concerning **BAME (Black, Asian, and minority ethnic) groups**, as well as experiencing the most disproportionately negative health outcomes of any group during the COVID-19 pandemic in the UK, emerging as "more susceptible to higher morbidity and mortality than either UK or USA white groups",[26] Professor Dame Ottoline Leyser, Chief Executive of UK Research and Innovation notes that:

people from BAME backgrounds have experienced the hardest economic shocks. It's crucial that we understand the depth and breadth of the impacts of these factors so that we can take action to alleviate the consequences for these communities.[27]

2.2 Political Distrust

Defining political distrust as "an attitude of an individual who seriously questions or doubts the competence and morality of politicians and political institutions", Schyns & Koop suggest that "political distrust may lead to citizens' resistance to comply with rules, to low efficiency, and to less respect for basic values of the political regime such as tolerance of minorities" and that a greater distrust of politicians and people in government correlates with decreasing trust of other people in general.[28]

People who feel politically powerless – such as those groups that report higher vaccine hesitancy discussed above – are "more likely to accept statements from sources that question the legitimacy of the political system"[29,30] and conspiracy theories may motivate people to take action against (perceived) elites.[31]

For example, research has found that parents who distrust the government and/or their healthcare provider may be sceptical or suspicious of vaccine information endorsed by government and/or their healthcare provider; be more likely to seek and trust vaccine information from unofficial, complementary/alternative medicine (CAM) practitioners; be more likely to have received vaccine information from an anti-vaccine organization; and, "[c]ompared to the trusting parents, the distrustful parents had increased odds of thinking the government and healthcare providers were poor sources of information about immunizations."[32] Some parents believe that CAM, which "can be defined as a group of diverse medical and health care systems, practices and products, which are not considered to be part of "mainstream" or conventional medicine", may suffice in place of vaccines.[33] Others have found that parents who claim nonmedical exemptions from vaccination for their children are "significantly less likely to report confidence in medical, public health, and government sources for vaccine information and were more likely to report confidence in alternative medicine professionals than parents of vaccinated children"[34] and that parental belief in anti-vaccine conspiracy theories is associated with lower intent to vaccinate a child.[35]

2.3 Coronavirus vaccine: conspiracy theories

Vaccine conspiracy theories are not new and may work against vaccine confidence by, for example, questioning the safety of vaccines, the health system that delivers them, or the motives of the organisations that decide which vaccines are necessary.[36] Based on their research on the effects of anti-vaccine conspiracy theories on intentions to vaccinate, Jolley and Douglas argue that "anti-vaccine conspiracy theories may have more than a trivial effect on vaccination intentions" and that:

> anti-vaccine conspiracy theories appear to introduce undue suspicion about vaccine safety, and increase feelings of powerlessness and disillusionment, whilst decreasing trust in authorities, which in turn introduce reluctance to vaccinate.[37]

Kata[38] identifies a range of tropes found in online anti-vaccination (henceforth, anti-vax) arguments, including that vaccines are toxic (containing foreign DNA, aborted fetal tissue, or formaldehyde), thus harmful (citation of previously harmful vaccines/medical treatments such as Thalidomide is common) and linked to autism. Others also link vaccines to genetic modification;[39] population control through sterilisation[40] or even genocide,[41] and DNA alteration.[42] Underpinning these tropes in anti-vax arguments runs a general distrust of science and government but, particularly, pharmaceutical companies which anti-vax advocates suspect to "bribe researchers to fake their data,

cover up evidence of the harmful side effects of vaccines, and inflate statistics on vaccine efficacy" for financial gain or some other sinister motive.[43] In the case of COVID-19, pre-existing anti-vax tropes have been reconfigured to suggest that COVID-19 was, for example, created as a biological weapon in China[44] or that COVID-19 is a false pandemic engineered to administer vaccines containing microchips to track vaccine recipients.[45]

Given the focus of this report and concerns about the potential deleterious social, medical, and political consequences emerging from the novelty, variety, and spread of vaccine misinformation and conspiracy theories in response to COVID-19, it is useful to bear in mind Bergmann, et al.'s (2020) suggestion that:

> Conspiracy theories are inherently social phenomena as their meaning often derives from their specific social context. They are constructed and reconfigured in socio-historical circumstances, by both their creators and consumers. Dissemination of conspiracy theories is enabled and constrained by means of distribution, which in recent years has been facilitated by new power digital technologies.[46]

3   'Vaccine' in COVID-19 tweets

With a frequency of occurrence of ~941,000, **vaccine** emerges as the third most significantly frequent keyword[47] in COVID-19 tweets. Since early November 2020, tweets found to mention **vaccine** became increasingly frequent, coinciding with announcements of the development/effectiveness of several vaccines.
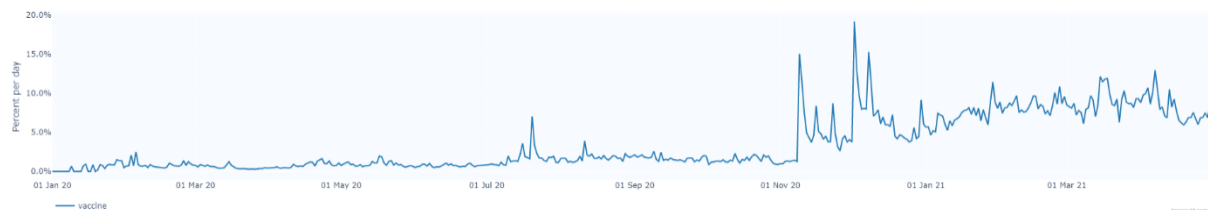
Vaccine, therefore, potentially represents one of the most important public issues discussed throughout the period of the pandemic alongside a range of other (related) issues (**deaths, cases, virus, pandemic**), events (**outbreak**), interventions (**ppe, masks, lockdown, restrictions**), and political figures (**Boris, Cummings**).

Although misinformation also exists in relation to these issues, events, etc. in the suggestion that figures for **deaths** caused by COVID-19 have been overinflated,[48] for example, this case study focuses on **vaccine** misinformation only.

Given the significant frequency of **vaccine**, a further search was conducted for terms related to the base form (*lemma*) VACCINE (e.g. *vaccines, vaccination, vaccinations*) as well as a common orthographic clipping of vaccination – *vax*.

This search returned 4,550,349 individual items, including tweets and retweets. Whereas tweets are (typically) unique instances, through retweeting – one of the core functionalities of Twitter – users are able to repeat and repost the content of a tweet on their own timeline to a wider range of users than the original tweet may have been available to (or intended for). Retweets, therefore, are essentially repeated instances of the same tweet but, through this repetition, can serve important social and ideological functions; retweets recast and repeat "a particular user's linguistic choices (hence, ideological stance)".[49] As such, the analysis of retweets is important as they can be "useful

for interpreting consensus of ideology and opinion",[50] however, the sheer scale of repetition through retweets in the present dataset presents significant practical and methodological challenges for analysis. Large numbers of retweets makes analysis significantly more computationally expensive (making analysis more difficult and time consuming) and text repetition has the potential to fundamentally skew many of the frequency-based methods central to analysis in corpus linguistics.

As such, the approach taken here is to separate tweets and retweets out into individual subcorpora based on whether tweets are classified as tweets or retweets and further in terms of whether these tweets or retweets are classified as either tweets, quote tweets, or retweets. For retweets, instances of the same retweeted content were identified and reduced to a single unique retweet (but retaining a count of how many times this retweet had been retweeted), thus substantially reducing the size of the initial dataset from 4,550,349 to 2,568,495; a reduction of 43.55%. Such as sizeable reduction is a finding in and of itself as it appears that almost half of talk on Twitter in the UK about vaccines in relation to COVID-19 is the product of (re)producing and (re)sharing information about vaccines rather than through the production of original comment. A specific breakdown of the number of tweets per tweet subtype is given in Table 1.

Tweet format	Subtype	Frequency	%	Totals	%
Tweet	Tweets	1,445,191	56.27%	1,675,892	65.25%
	Quote Tweets	230,701	8.98%		
Retweet	Retweets (unique)	892,603	34.75%	892,603	34.75%
	Total	2,568,495	100%	2,568,495	100%

Table 1: corpus size by tweet subtype (unique items)

3.1 Hashtags and misinformation

Shifting focus to the contents of these tweets, hashtags enable users to simultaneously tag tweets with a topic of their choice as well as, using the specific mechanics of twitter, connect a tweet to a wider body of tweets that also contain the same hashtag(s).

The table below contains an overview of the number of hashtags found in each tweet subtype and distinguishes between the total number of hashtags (tokens) and the number of unique hashtags (types). Read together, these two numbers suggest that hashtags are both prolific (hashtag tokens are used at a rate similar to the total number of tweets in the corpus) but also used repetitively; a relatively low number of unique hashtag types contribute to a large hashtag token count.

| Tweet format	Subtype	Hashtag corpus (tokens)	Totals (tokens)	Hashtag corpus (types)	Totals (types)
Tweet	Tweets	1,352,903	1,544,912	190,508	231,140
	Quote Tweets	192,009		40,632	
Retweet	Retweets (unique)	828,284	828,284	95,911	95,911
	Total	2,373,196		327,051	

Table 2: hashtag frequency by tweet subtype

For example, the top 10 most frequent hashtags used in each tweet format have extremely high token counts and, perhaps unsurprisingly for tweets that mention both vaccines and COVID-19, these hashtags relate predominantly to both COVID-19 (e.g. #COVID19, #coronavirus) and vaccines (e.g. #vaccine, #vaccines).

	Tweet		Quote Tweet		Retweet	
	Feature	frequency	feature	frequency	feature	frequency
1	COVID19	169144	COVID19	23041	COVID19	133582
2	vaccine	64293	COVIDvaccine	10803	COVIDvaccine	43817
3	COVIDvaccine	61793	vaccine	9952	vaccine	36848
4	coronavirus	53611	COVID	5393	coronavirus	28859
5	COVID	49633	coronavirus	4284	COVID	28374
6	vaccination	16501	COVIDvaccination	2691	vaccination	10447
7	COVID19vaccine	15937	vaccination	2590	COVID19vaccine	10286
8	vaccines	15900	COVID19vaccine	2426	vaccines	10080
9	COVID19uk	15230	vaccines	2330	COVIDvaccination	8709
10	nhs	14614	COVID19uk	2186	nhs	8136

Table 3: most frequent hashtags in COVID-19 tweets containing reference to vaccines

Although these hashtags are not typically directly related to vaccine misinformation, in some few instances they are used in tweets containing vaccine misinformation and potential anti-vax sentiments (Example 1).
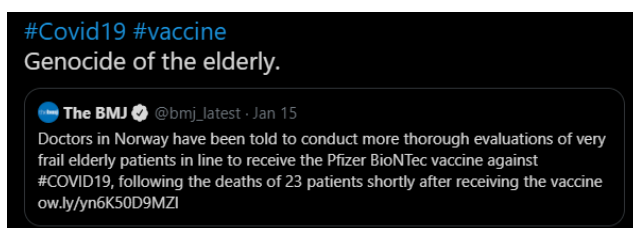
Example 1)

To focus more specifically on misinformation, the top 200 most frequent hashtags for each tweet type (a total of 600 hashtags) were inspected. Again, these most frequent features contain many hashtags not directly related to misinformation, as well as many hashtags associated with positive sentiment towards vaccines (e.g. #vaccineswork, #getvaccinated) and measures taken to supress the spread of COVID-19 (e.g. #wearamask, #maskup). However, also present in these top features are 39 hashtags (Table 4) associated with vaccine hesitancy and/or anti-vaccination, anti-lockdown, and anti-mask sentiments, as well as a number of conspiracy theories (e.g. #billgates, #plandemic). Moreover, many of these hashtags appear alongside each other in individual tweets (e.g. Example 2):

Example 2) Whenever I hear the word coronavirus on TV & Radio, all I hear after is blah blah
blah #vaccine #AntiMask #antivaxx

	hashtag		hashtag
1	5g	21	id2020
2	5gkills	22	kbf
3	5gmindcontrol	23	masksoff
4	agenda2030	24	nomasks
5	agenda21	25	notolockdown
6	ai	26	novaccine
7	antivax	27	novaccineforme
8	antivaxxers	28	novaccinepassport
9	autism	29	novaccinepassports

10	bigpharma	30	novaccinepassportsanywhere
11	billgates	31	nwo
12	chinaliedpeopledied	32	plandemic
13	COVID1984	33	rejectthevaccine
14	COVID19coverup	34	scamdemic
15	COVIDhoax	35	takeoffyourmask
16	endthelockdown	36	thegreatreset
17	fakenews	37	vaccinehesitancy
18	flujabequalsCOVIDjab	38	vaccinemafia
19	greatreset	39	wakeup
20	hydroxychloroquine		

Table 4: most frequent misinformation hashtags

Tweet format	Subtype	Frequency	%	Totals	%
Tweet	Tweets	8,412	49.36%	11,662	68.43%
	Quote Tweets	3,250	19.07%		
Retweet	Retweets (unique)	5,380	31.57%	5,380	31.57%
	Total	17,042	100%	17,042	100%

Table 5: number of tweets containing hashtags in Table 4

To get a better idea of the range of COVID-19 misinformation hashtags, all tweets containing at least one reference to any of those 39 hashtags identified in Table 4 were extracted. This process identified 17,042 individual tweets (Table 5) in which the top 200 hashtags for each tweet subtype (600 total) were again inspected to evaluate possible relations to misinformation. During this process, hashtags were coded into different thematic misinformation **categories**, each containing a variety of **subcategories**. It is possible that hashtags overlap categories, for example, through fusing ideas evident in more prototypical conspiracy theories with COVID-19-specific fears (e.g. *#COVID1984*), which makes placing some hashtags neatly into a single category difficult. However, this initial thematic coding is a first attempt to summarise the potential scale and variety of conspiracy theories (as indexed through the use of hashtags) found in tweets relating to COVID-19 and vaccines and provides a basis for exploring co-occurrences and associations between hashtags that belong to specific types/subtypes. Table 6 quantifies the number of hashtags identified across all tweet **subtypes**, and presents these counts per hashtag **category** and **subcategory**.

Category	Subcategory	Subtotal	Total
Anti	**Anti-vaccine passport** e.g. #novaccinepassports, #novaccinepassportsanywhere	21,972	**35,238**
	Anti-vaccination e.g. #notovaccine, #antivax, #vaccineinjury	6,824	
	Anti-lockdown e.g. #notolockdown, #endthelockdown	4,108	
	Anti-mask e.g. #takeoffyourmask, #nomasks	2,334	
Conspiracy theories	**New World Order** e.g. #agenda21, #nwo, #greatreset	10,343	**26,481**

	General e.g. #chinaliedpeopledied, #torylies, #wakeup	6,669	
	Freedom and censorship e.g. #freedom, #kbf, #standupx	5,043	
	Human rights and crimes against humanity e.g. #crimesagainsthumanity, #genocide	2,808	
	Media #fakenews, #msm	1,387	
	Financial corruption #followthemoney, #kerching	231	
Science and technology	**Technology** e.g. #5g, #5gkills, #5gmindcontrol	8,539	**16,229**
	Microsoft/Bill Gates e.g. #billgatesbioterrorist, #id2020	7,690	
COVID-19	**Fake/planned** e.g. #plandemic, #covid1984	9,024	**10,433**
	Cure e.g. #ivermectin, #hydroxychloroquine	1,409	
Pharmaceuticals	**Vaccine** e.g. #flujabequalscovidjab, #vaccinemafia	3,652	**7,175**
	Corruption e.g. #bigpharma, #corruption	3,523	
Politics	**Protest** e.g. #enoughisenough, #londonprotest	2,839	**3,090**
	#qanon	251	

Table 6: categories of misinformation hashtag in COVID-19 vaccination tweets

Table 6 shows that the most populous **category** of hashtags in COVID-19 vaccination tweets is 'anti', which brings together hashtags that appear to oppose several public health measures, including vaccinations and vaccination tracking apps (vaccine passports), lockdowns, and mask wearing.

As noted in the **introduction**, public trust in vaccines is based on confidence in **product, provider,** and **policy-maker**. Confidence may be undermined through, for example, bringing into question the ingredients of effectiveness of a vaccine (product), manufacturers' agendas (provider), and/or the methods undertaken by national governments to administer vaccines (policy-maker). As can be seen in Table 6, the frequent presence of **anti-vaccination** hashtags *(#antivaccine, #antivax, #antivaxx, #justsayno, #notovaccine, #novaccine, #novaccineforme, #novaccines, #rejectthevaccine, #vaccineinjury, #nocovidvaccine*) might suggest scepticism over vaccine effectiveness or safety. Manufacturer agendas are also critiqued through hashtags relating to **corruption** in the **pharmaceuticals** industry as well as through a large number of **conspiracy** hashtags which suggest that vaccines are a vehicle for tyranny, which relates to a distrust of policy-makers' agendas through, for example, **anti-vaccine passport** and **anti-lockdown** hashtags. Some go so far as to suggest that COVID-19 is a cover for supra-national organisations to pursue ulterior motives of population control and even genocide.

3.2 Antivax hashtags

A specific focus on **anti-vaccination** hashtags finds that some of the most frequent hashtags appearing to be semantically associated with negative sentiment towards vaccines (e.g. #antivaxx), are, perhaps counterintuitively, most commonly used to deride anti-vaccination stances and to

articulate fears of the potential harms that could result from contact with – and adherence to – anti-vaccination beliefs rather than as a resource for articulating anti-vaccination stances.

Although some **anti-vaccination** hashtags – especially those prototypically prefixed by anti- (e.g. #antivax) – are commonly used in the contestation of anti-vaccination misinformation, they can found in tweets that articulate some vaccine hesitant opinions, which might range from apathy (Example 2) to concerns over safety (Example 3).

> Example 3) You dont have to be " #antivaxx " to not want to take a rushed out #vaccine thats skipping the procedure that every other vaccine follows.
> Its just being pro saftey, especially where a virus with a 99.9% survival rate is concerned.
> SAFE vacciens take years to develop
> #COVID19

Unlike hashtags prefixed by anti-, those prefixed with no (e.g. #novaccine, #novaccines) appear to be more directly associated with vaccine hesitancy and misinformation, again including suggestions that vaccines are dangerous – poisonous, even (Example 4) – but also that, if COVID-19 is acknowledged as being curable (thus, existent), vaccines are unnecessary (Example 5), ineffective (Example 6) and/or unsafe (Example 7) interventions due to the availability of other therapies. Indeed, some users suggest that COVID-19 itself may be less harmful than a vaccine (Example 7) and that some have died as a result of having the vaccine (Example 8).

> Example 4) I don't want it and I will never be ready to get this vaccine ✖ poison! **#NoVaccine** #CovidVaccine #Covid19UK
> Example 5) Real doctors! They are all treating COVID-19 with hydrocloxychlorine successfully! **#novaccine** needed
> Example 6) **#novaccines**
>
>   use #ivermectin or #HydroxyChloroquine instead. Both proven, cheap, safe, and effective. The latter has a safety record better than paracetamol and can even be given to pregnant and breastfeeding mums - UNLIKE the "vaccine"
> Example 7) **#NoVaccineForMe** I think it would be safer to catch #COVID19
> Example 8) 55 Americans and 29 Norwegians have died following their #CovidVaccine #NoVaccineForMe #COVID19

Further examples show that fears about lack of safety can be premised on suggestions that any COVID-19 vaccination is a mass experiment being conducted on the general human population with unknown consequences (Example 9) and of unknown design (Example 10). An apparent discourse of 'vaccines as experiments' begins to become more explicitly articulated in Examples 11 and 12 wherein humans are metaphorically referred to as guinea pigs and lab rats, which are used widely in the pharmaceutical industry to test new treatments.

> Example 9) Nobody knows what else it could trigger in years to come , it really is one hell of an experiment **#NoVaccineForMe**
> Example 10)   #Ivermectin effectively treats #COVID19 **#NoVaccine** necessary (or, rather, experimental biological agent)
> Example 11)   Make no mistake , this has been planned...YOU are the Guinea pig! #IDoNotConsent **#NoVaccines**
> Example 12)   These lunatics need to be stopped. Using the general public as lab rats. #NewWorldOrder #fuckbillgates #NoVaccine #lies #COVID19

Not only are vaccines suggested as being experiments, they are also framed as being dirty (Example 13, 14), and as a means for infection (the vaccine being the virus; Example 15), depopulation/genocide (Example 15, 16), and tyrannical population control (Example 17, 18).

Example 13)　　I would rather clean a whole Central line tube carriage with my tongue than take a Covid vaccine #NoVaccine

Example 14)　　The Covid vaccine news and covid news is propagana the vaccine is the virus #NoVaccineforMe more fool anyone who gets it! #nanobots as boris says, #dirtyVaccines

Example 15)　　no to changes to human medical regulations 😡 😡 😡 #novaccine #vaccinesaregenocide #coronavirusvaccine

Example 16)　　Step this way for your Covid-19 vaccination... #thefinalsolution #novaccine

Example 17)　　#TYRANNY #EndRestrictionsNOW **#NoVaccine** #WeDoNotConsent Wake up People and #FightForFreedom

Example 18)　　Thank you to all protesters fighting for our freedom from Covid-19 tyranny. #NoVaccine #London #Protest

As such, the proposition that a COVID-19 vaccine is unsafe by design provides a basis onto which a wide range of archetypal conspiracy theories can be grafted. Including the idea that vaccines are being mandated by, and pave the way for, a **New World Order**. Indeed, **anti-vaccination** hashtag use may interact with conspiracy theories existent prior to COVID-19 (e.g. the introduction and use of 5G as a means for mass population control; Example 19).

Example 19)　　Coronavirus isn't what you should be concerned about...do your research #stop5g #agenda21 #novaccine

Exploration of a hashtag network (Figure 1) mapping co-occurrence between hashtags in tweets that contain **anti-vaccination** hashtags shows frequent networked relationships with signifiers of widely shared general **conspiracy theories** (e.g. *#nwo, #nonewnormal*), including those that suggest COVID-19 was **fake/planned** (e.g. *#plandemic, #scamdemic*), as well as with wider **anti-mask** (e.g. *#nomask*)**,** **anti-lockdown** (e.g. *#nolockdown*), and anti-government (e.g. *#distrustthegovernment*) sentiments.
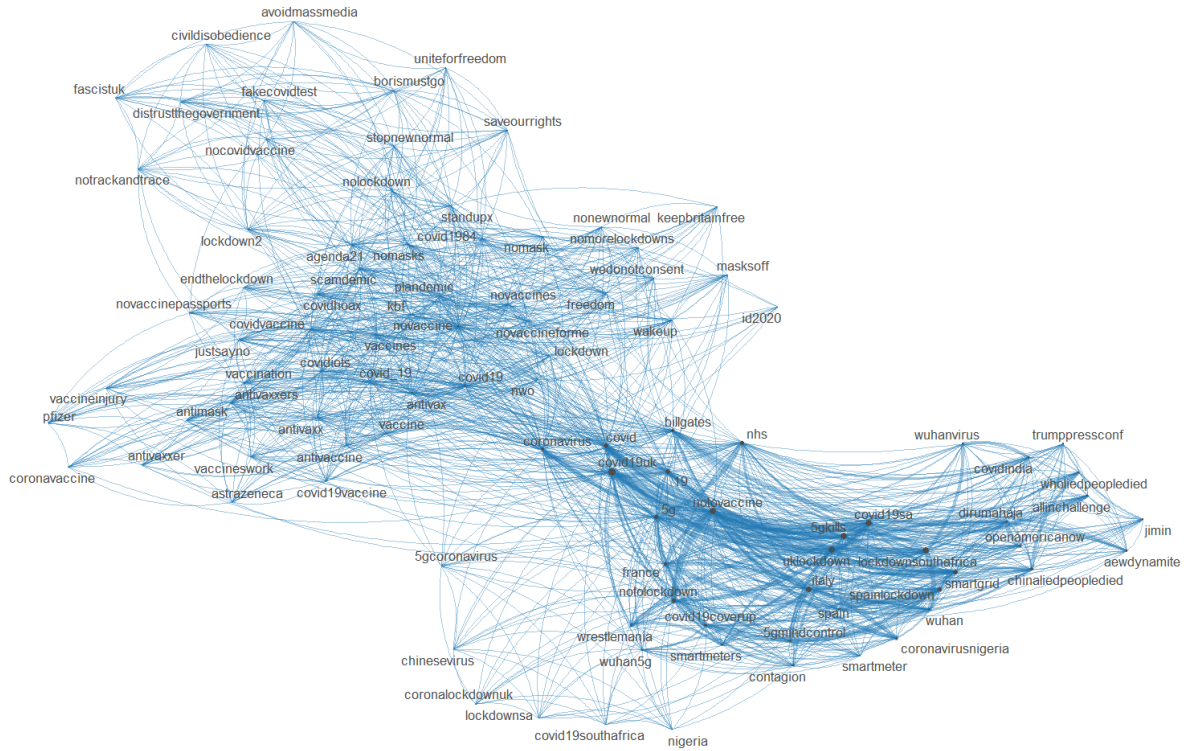
Figure 1: hashtag co-occurrence network for tweets containing anti-vaccination hashtags (e.g. #novaccine)

Conclusions

- This brief case study outlines some of the broad issues involved in the study of COVID-19-related misinformation.
- Although this specific case study represents analysis of a small fraction of the ~84m tweet TRAC:COVID dataset, the outcomes of that analysis finds that Twitter is being used by some to emphasise distrust of vaccines, providers of vaccines, and policy-makers making decisions about vaccines.
- Study of the contents of tweets containing COVID-19 misinformation-related hashtags suggests interrelationships between various forms of misinformation in COVID-19 tweets and appears to suggest that anti-vaccination views exist within a broader network of conspiracy theories
- Therefore, the increasing prominence of anti-vax beliefs during the pandemic, which have been enabled at least in part by the functionalities of social media platforms like Twitter, may serve to catalyse – or even reveal the existence of – a broader public engagement with previously fringe conspiracy theories
- Work presented in this case study is to be further developed through the use of www.traccovid.com, where you can keep up with the latest project updates and outcomes as well as carry out your own studies of COVID-19 misinformation.

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