AUTHORS:
Philippa Kerr[1]
Kevin Durrheim[1]
Maria Schuld[1]
Davide Morselli[2]

AFFILIATIONS:
[1]Department of Psychology, University of Johannesburg, Johannesburg, South Africa
[2]Swiss Centre of Expertise in Life Course Research (LIVES), University of Lausanne, Lausanne, Switzerland

CORRESPONDENCE TO:
Kevin Durrheim

EMAIL:
kevind@uj.ac.za

A thematic analysis of South African opinions about COVID-19 vaccination on Twitter

Vaccine hesitancy is a public health concern in South Africa and internationally. Literature on vaccine hesitancy associates this with mistrust of the government. We present a qualitative analysis of opinions about COVID-19 vaccination expressed by South African Twitter (now X) users during the first year of the vaccine rollout in South Africa. We conducted a thematic analysis of 800 randomly selected tweets containing vaccine-related keywords, sampled from four time periods in 2021. We categorised comprehensible South African non-news tweets as pro-vaccination (24.75% of sample), anti-vaccination (20.25%) or ambivalent (4.5%), and then identified themes. Among pro-vaccination tweets, the most common themes were criticism of the government's handling of vaccine procurement and the rollout; concerns that the vaccine was urgently needed and/or not being made available fast enough; and statements that vaccines were safe and/or effective against COVID-19. Among anti-vaccination tweets, the most common themes were claims that the vaccine was harmful or too risky; suspicion of the government's intentions with respect to the vaccine it was offering the public; and opposition to mandatory or 'forced' vaccination. Criticism and mistrust of the government were present among both pro- and anti-vaccination tweets, though for different reasons. We discuss this in light of literature recommending trust-building as a response to vaccine hesitancy.

Significance:

Numerous studies recognise mistrust in the government as a correlate of anti-vaccination opinions, but our findings suggest that holders of both pro- and anti-vaccination opinions in South Africa mistrust the government – albeit for different reasons. Several South African authors propose 'trust-building' as a solution to vaccine hesitancy and refusal, but we suggest that in a context of government corruption, it is not more trust that the South African public needs, but more critical literacy in order to discern when the government is and is not acting in the public (health) interest.

Introduction

Although COVID-19 became an opportunity for a resurgence of the anti-vaccination movement, opposition to vaccinations is not new, and in fact is almost as old as vaccination itself.[1] Several years before the appearance of COVID-19, vaccine hesitancy and refusal had been identified by the World Health Organization (WHO) as a threat to global health[2,3]; these have also been factors limiting the uptake of vaccination for COVID-19[4,5]. A summary of findings from South African surveys conducted in 2020 on willingness to get vaccinated for COVID-19[4] suggests that only between roughly half and 80% of South African adults were willing to get vaccinated if and when a vaccine became available and that vaccine hesitancy actually increased over the course of the pandemic. The latest Africa Center for Disease Control and Prevention statistics suggest that approximately 40% of the South African population has been fully vaccinated for COVID-19.[6]

The WHO identifies five common themes in what it calls 'vaccine denial' beliefs.[2] The first, 'threat of disease', refers to arguments that vaccine-preventable diseases offer no significant threat, either because they no longer exist or because they are not serious. Thus, according to this argument, there is no need for vaccination. The second topic, 'trust', refers to (a lack of) trust in the medical, scientific and government institutions promoting vaccination. To the extent that information coming from these sources is viewed with scepticism, simply offering or repeating factually accurate information about vaccines is unlikely to challenge the misinformation that is circulated by the anti-vaccination movement. The third theme, 'alternatives', refers to alternative remedies that are claimed to be safer and/or more effective than vaccines. The fourth and fifth themes, 'effectiveness' and 'safety', refer to concerns that vaccines are not effective in preventing disease and are in fact unsafe, with harmful side effects, including illness and death.

The rhetoric of anti-vaccination discourse

There is a growing body of literature confirming and expanding on this list of themes in anti-vaccination beliefs, including from South Africa since COVID-19.[4,7-13] In this literature, anti-vaccination opinions are almost universally associated with mistrust in the government and other forms of authority.[1,11] Some of this work goes further than listing common beliefs and themes, however, and illustrates the reflexive, socially embedded and rhetorically sophisticated nature of anti-vaccination discourse. Rozbroj et al.[11] surveyed members of the public who self-identified as part of the anti-vax movement in Australia, asking them open-ended questions about what being part of this movement meant to them. Respondents persuasively presented themselves as pro-science, pro-choice, responsible parents, brave, enlightened, critical thinkers, highly informed and highly engaged with the health system. They took issue with the label 'anti-vaccination', seeing it as a derogatory term and as evidence of how they were stigmatised, which strengthened their identity as a movement of courageous people speaking 'inconvenient truths'. The authors argued that the anti-vaccination movement 'is strengthened by hostility towards it, defining itself as bravely fighting for an important cause in the face of undue hardship' (p. 2). Hence, anti-vaccination advocates do not merely provide alternative (mis)information: they show clear awareness of the evidence for the effectiveness of vaccines ('the mainstream'), and their arguments are geared towards rebutting

or undermining this. Hence, anti-vaccination beliefs cannot be attributed simply to a lack of correct information, or solved with the provision of more correct information.[1,11] In contrast to the volume of work on anti-vaccination discourse, there is relatively little work on pro-vaccination opinions (but see Connoway et al.'s analysis of pro- and anti-vaccination South African Facebook pages[7]).

Trust and the politics of vaccination opinions

In South Africa, no major political party took an anti-vaccination position during the COVID-19 pandemic[4], and public opinion about vaccination has not been overtly party-politicised and polarised in the same way as, for example, in the United States of America[14], although Cooper et al. did find that support for the African National Congress (ANC) was associated with greater willingness to vaccinate than support for other parties[4]. Nevertheless, again, one of the most common themes in the South African vaccine hesitancy literature is mistrust of the government, and the 'trust-building measures' that are consequently needed to counter it.[7,8,13] For example, Gittings and colleagues[8] have argued that "mistrust in government and international health systems has emerged as a concerning determinant of vaccine hesitancy and one that is particularly important to tackle" (p. 301). Similarly, Cooper and colleagues[4] argue that building people's confidence in COVID-19 vaccines . . . needs to form part of broader development and trust-building measures that focus on relationships, transparency, participation, and justice. For example, strong leadership and clarity around responses to the COVID-19 pandemic, including . . . vaccines, is important. (p. 930)

Although we also found numerous expressions of mistrust in the government among anti-vax tweets (one of the most frequent anti-vaccination themes we called 'mistrust of the government, therefore mistrust of the vaccine'), these data provide grounds for questioning whether building trust in the government is the straightforward solution to vaccine hesitancy. Firstly, pro-vax tweets were not especially trusting of the government. There were many pro-vax concerns about whether the government could be relied on to deliver vaccines efficiently, timeously and without corruption. Secondly, the call for trust-building introduces a conundrum where the same institutions that people already mistrust must take on the job of convincing people to trust them, thus overlooking the possibility that mistrust about vaccines can take on a life of its own and be unrelated to whether the government is actually acting in the public interest.[1] In the following section, we describe our research questions and methods and then present findings from our thematic analysis of South African tweets related to vaccination for COVID-19.

Research methods

Research questions

Our research questions were: what was the content of vaccination-related opinion on South African Twitter (now X) during the COVID-19 vaccination rollout? Did this vary over the course of 2021? To what extent did these opinions contain similar themes to those already identified in the vaccine hesitancy and refusal literature?

Data collection and sampling

We extracted 574 197 original tweets from the Twitter API, the full sample identified as vaccine-related tweets from South African Twitter users in 2021. Vaccine keywords included: vaccine, vaccination, vax, antivax, anti-vax, anti-vaccine, antivaccine, vaxed, Vaxxed, unvaxed, unvaxxed, vaccinated. The geographic keywords were chosen using a multi-step procedure, in which we geolocated South African Twitter users, extract their followers and extract keywords (words, hashtags, ngrams, mentions) from their vaccination-related tweets that are (a) used frequently and (b) clearly reference a South African context.

On the basis of preliminary content analysis and a prior understanding of the history of the pandemic, we divided the tweets into four phases:

1. 01/02/2021 – 20/02/2021: Announcement of vaccination programme (N = 129 327).

2. 21/02/2021 – 20/06/2021: Low-frequency tweet period, in between waves; front-line health workers and people over 60 are being vaccinated (N = 104 689).

3. 21/06/2021 – 23/11/2021: The mid-year Delta wave; lockdown restrictions return; progressively more age and employment categories are being vaccinated (This is also the first wave after vaccination began, raising doubts over the effectiveness of vaccines.) (N = 219 074).

4. 24/11/2021 – 30/12/2021: The Omicron variant period, discovered on 23 November (N = 121 107).

We then randomly selected 1000 keyword-containing tweets from each phase. These tweets were recorded in four .txt files, with one tweet per line. In the process, the tweets were removed from their threads, and all tweeters' identities were removed, so the tweets are anonymised, but any other users' handles the tweeter tagged were retained. For anonymity's sake, we have manually removed handles other than those of politicians, political parties and news organisations. Pre-processing also removed all punctuation, special characters such as '&' and '%' (but not #), images and videos from all tweets, and it made capital letters lower case. The absence of punctuation and capital letters sometimes made it difficult to understand the meaning of tweets, especially those with numbers that probably originally contained decimals or percentages. Emojis were retained and are reproduced below.

Qualitative and quantitative analysis of tweets

The analytic process was open-ended and inductive: we had no initial hypotheses about what we would find, and we did the coding before we had read the vaccination opinion literature extensively. This means that these findings can be seen as independent of those from other studies and can be usefully compared with them, an important way of establishing the credibility of these findings. We used a combination of thematic analysis and content analysis, which was appropriate for our aim of capturing the quality and quantity of vaccination opinions over the course of the rollout.[15]

Our analysis proceeded in three steps. We began by reading through the four sets of 1000 tweets, and making notes on the topics and styles in them. We then created a set of coding spreadsheets. The first 200 tweets of each text file were selected for coding: these were pasted into the first columns of four MS Excel spreadsheets respectively. In the next column, each tweet was then assigned a number from 1 to 7, thus: 1 for tweets that we read as being pro-vaccination, 2 for anti-vaccination, 3 for ambivalent about vaccination (expressing both pro- and anti-vaccination views), 4 for tweets that offered no clear opinion about vaccination (for example, asking questions about vaccination but offering no own position), 5 for tweets that appeared to come from outside South Africa (even if they mentioned South Africa), 6 for international and local news tweets and official statements and 7 for tweets that were incomprehensible and/or not about COVID-19 vaccination. This was the first step.

In the second step, tweets coded as pro-vaccination, anti-vaccination or ambivalent (i.e. opinion tweets) were then further assigned as many thematic tags as necessary to capture their contents. In the process of reading the 800 tweets from the four phases, 16 pro-vaccine themes were identified, 2 that were only associated with ambivalent tweets, 3 themes that were not restricted to any particular position and 17 anti-vaccination themes. Later, some themes were merged together, and others were split into more specific themes. We report the results of this qualitative analysis in Supplementary table 1, where we describe and illustrate each of the emergent themes of pro- and anti-vax tweeting. (For brevity's sake, we have omitted ambivalent themes from the table.)

Finally, in the third step, the number of tweets referencing each theme was counted, resulting in the 'frequency' count in Supplementary table 1. Quantifying our themes in this way allowed us to track changes in the expression of different vaccination opinions over time.

Trustworthiness in the analysis

On what basis did we assign tweets to categories? In qualitative analysis, the analyst's job is to read for meaning. We were not working with an already-existing framework that distinguishes pro- from anti-vax opinions; we were creating the framework as we went along, based on an ever-expanding understanding of the parameters of the Twitter vaccination debate. There is an inherent degree of ambiguity in all discourse[16], making a search for total clarity inappropriate; however, in

this data set, some tweets were more ambiguous than others. Consider the following tweet, which contains a clear pro-vaccination stance:

> *the nurse was so quick i didnt even get to take a pic with the needle in my arm* 😩 *im taking* [redacted name] *with next time* 😂 *annyyywayyyy your favourite aunty is halfway there* 💉🤳🙌 *#vaccinerolloutsa #firstdose #35to49gang*

As we came to discover, this tweet, in which the tweeter implies she has had the first of two shots, was part of a genre of pro-vax tweets announcing that the tweeters themselves had been vaccinated. However, it was sometimes less clear whether a tweeter's position was pro- or anti-vax, for example:

> *@news24* [names redacted] *they did actually in countries like france you cant even sit in a restaurant without proof of vaccination hence there were protests but people have accepted they even have qr code scanners so they can check on the spot when were you vaccinated and which vaccine did you take*

This concern with needing to show proof of vaccination to access services was often associated with anti-vax opinion in this data set, but in this case, the tweeter does not ultimately offer their own opinion. Hence, we coded this tweet as '4' – not containing a clear opinion. We recognise that some might disagree, arguing that this is definitely an anti-vax tweet. We spent a long time mulling over ambiguous tweets, and hence, we do not claim that our scheme is the only possible way of representing the range of opinions in this data set. However, we do claim that the analysis was rigorous and comprehensive, that the themes we identified are confirmed by much of the literature, and that the frequencies reported in Supplementary table 1 provide a broadly representative overview of the data.[17] As Silverman argues, using quantification in qualitative research (that is, counting the number of times each theme appeared in our data set) can lend weight to conclusions if used with a clear sense of what is being counted, and why. Counting these frequencies allows us to avoid 'anecdotalism' by showing how prevalent these vaccination-related concerns were over the course of 2021.

Results

Here we report an analysis of changing themes over time. Figure 1 describes and counts the different kinds of tweets we found in this Twitter sample across the four time phases, and Figures 2 and 3 summarise the most common themes. Exemplary tweets can be found in Supplementary table 1.

Figure 1 shows that South African vaccination talk on Twitter in 2021 was dominated by opinions and news. There were slightly more tweets expressing pro-vaccination opinions in this sample (198 or 24.75% of the sample) than anti-vaccination opinions (162 or 20.25% of the sample), with the proportion of anti-vaccination tweets growing in phases 3 and 4. Ambivalent tweets (36 or 4.5% of the sample) were relatively infrequent. News-like tweets made up nearly a quarter of the sample, being especially prominent in phases 1 and 2.

Figures 2 and 3 show frequencies of the 10 most common themes across the four time phases. We have grouped these into pro-vaccination (Figure 2) and anti-vaccination (Figure 3) themes.

Discussion

We highlight some findings from these figures. First, many of the anti-vaccination themes in this sample correspond with findings from qualitative analyses of vaccine opinions documented elsewhere: in particular, mistrust of the government's intentions with respect to the vaccine it was administering to the public; claims that vaccines are harmful, deadly, untested, risky, ineffective and/or not what they purport to be; the idea that it is really anti-vaxxers who know the truth and are thinking critically for themselves about vaccination; and opposition to 'forced' vaccination on grounds that it violates individuals' rights and bodily autonomy.[1,2,4,7,8,11]
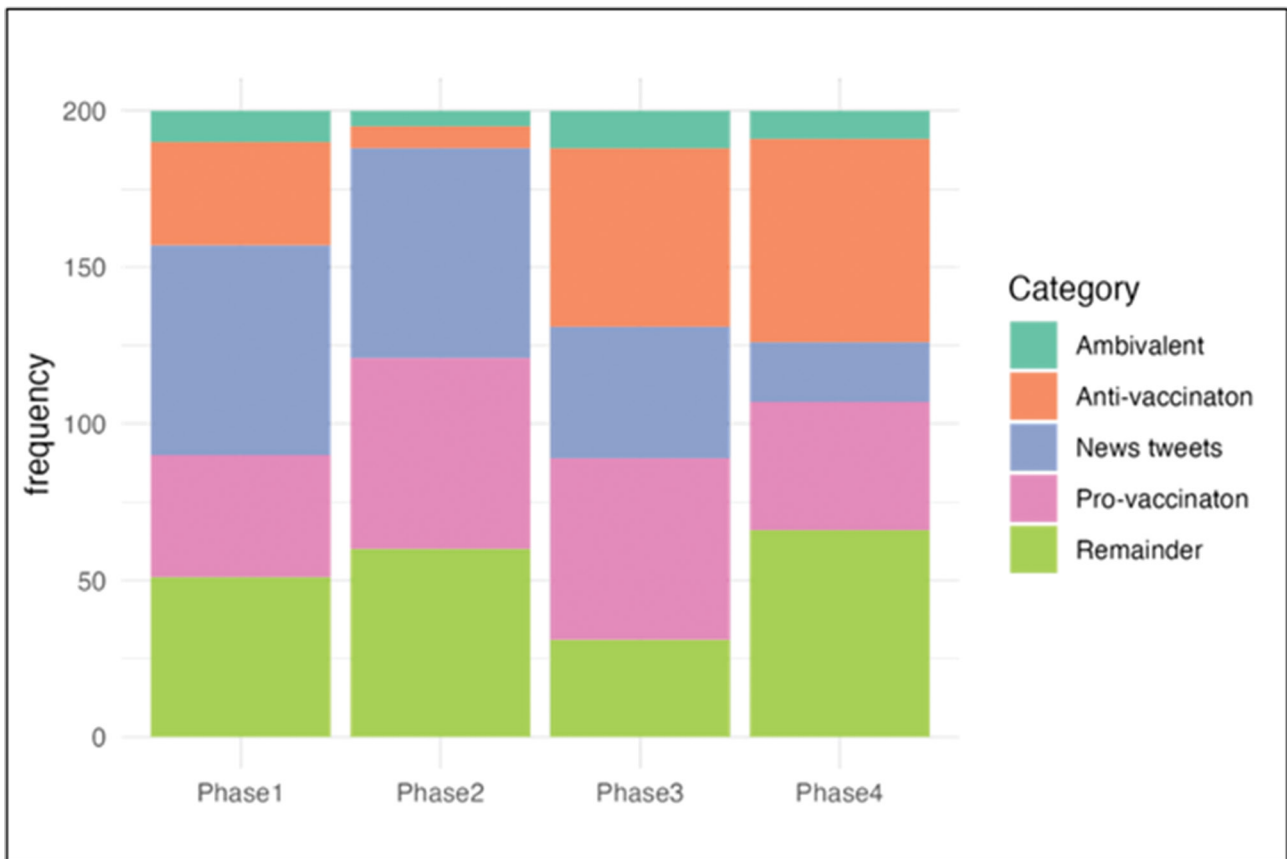

Figure 1: Proportions of tweet types by phase. 'News tweets' include international and local news as well as other news-like reports and official statements of fact. 'Remainder' includes incomprehensible tweets, tweets not about COVID-19 vaccination and tweets probably not from South Africa.
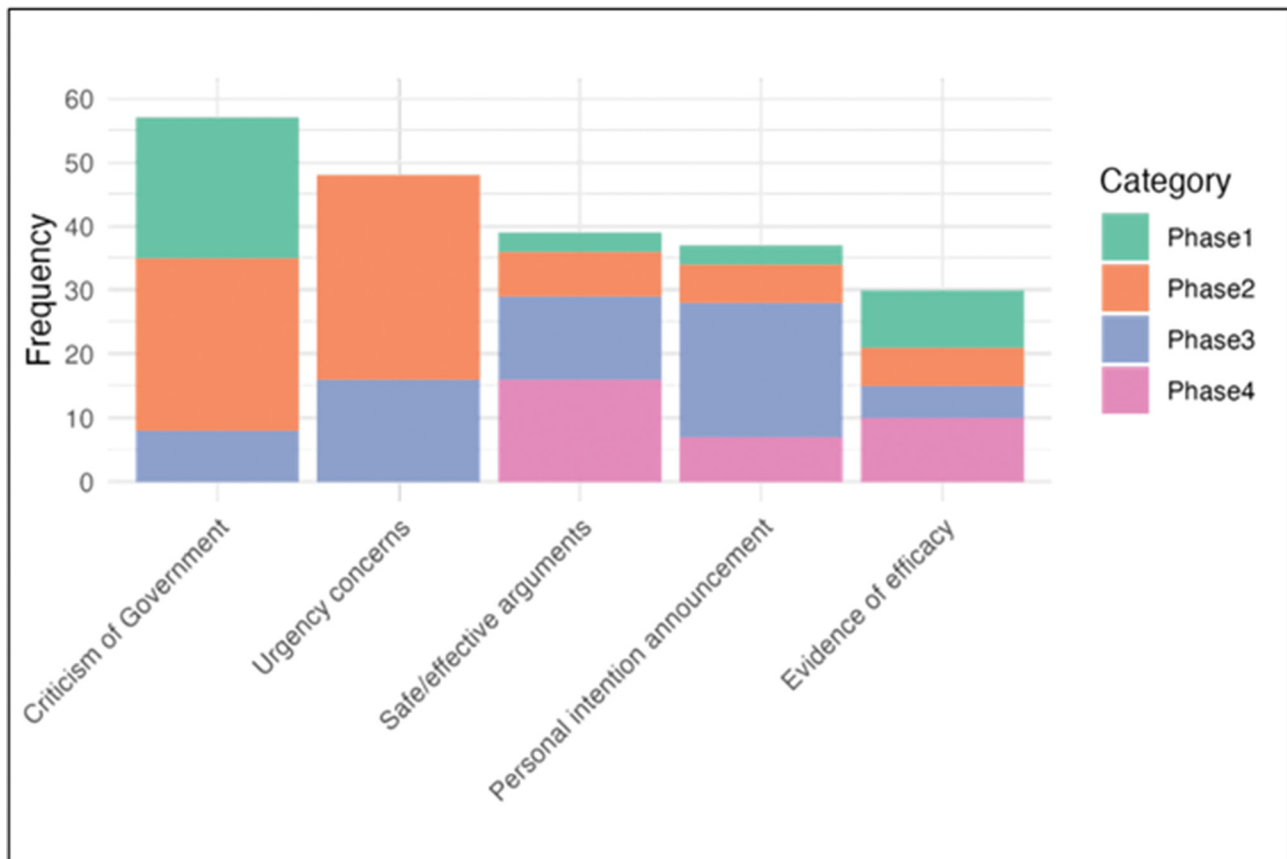
Figure 2: Frequency of top five pro-vaccination themes by phase. Theme 1 – Criticism of government's handling of vaccine procurement and rollout. Theme 2 – Concerns and complaints that vaccination is urgent but not going fast enough. Theme 3 – Statements that vaccines are safe and/or effective against COVID-19. Theme 4 – Announcements of personal intention to get vaccinated, or of having been vaccinated. Theme 5 – Discussions of emerging evidence on vaccine efficacy.

As Connoway and colleagues[7] note, however, "some themes [in anti-vaccination discourse] endure, [while] others are more specific to time and place" (p. 4). Likewise, the WHO acknowledges that although there are some recognisable common themes in vaccine-denialist beliefs, there are also a multitude of different reasons why people hesitate about or refuse vaccination in different parts of the world.[2,3] Supplementary table 1 contains a comprehensive overview of every theme we found in this data set, with an example tweet for each one. A productive direction for future analysis would be to study these in more detail and to ask questions about which aspects of vaccine hesitancy and refusal on South African Twitter are consequences of the international anti-vax movement's influence, and which are more local in origin.

Second, we note that the emergence and disappearance of several pro-vaccination themes seems to correspond clearly to the progress of the rollout in South Africa. Criticism of the government's handling of the process was a relatively common theme in the first half of the year but then declined, presumably as the rollout got underway and the whole adult population became eligible for vaccination. Expressions of urgency that the vaccination rollout was not going fast enough did not appear at the very beginning of the process, but appeared in phase 2 (late February to June), and then also petered out in later phases. Relatedly, personal announcements of having been or intending to get vaccinated peaked in phase 3, starting in July, when eligibility for vaccination dropped from over 60s to include younger age groups (who are also presumably more active on Twitter). Also, approximately a quarter of all tweets were news-like tweets (in the register of a headline) and/or official statements, but these declined proportionately in the last two phases, presumably as news interest in the pandemic tailed off towards the end of the year.

By contrast, anti-vax opinions were relatively uncommon in the first two phases, and in fact almost disappeared in phase 2, but then increased in phases 3 and 4. Concerns with mandatory vaccination, claims about vaccine inefficacy, and claims that COVID-19 was not real or not serious, hardly featured in the first two phases, but then increased significantly in phases 3 and 4. We have no hypothesis to offer explaining the decrease in the proportion of anti-vax tweets in phase 2, but the increase in the last two phases resonates with South African survey findings that vaccine hesitancy actually *increased* as the pandemic and rollout progressed[4], and this seems to have occurred at the same time as news interest was declining.

Third, we note that although much of the literature associates anti-vax opinions with mistrust of the government[4,8,11-13], criticism and mistrust of the government was a strong theme among both pro- and anti-vaccination tweets in this sample. Even though the South African government took a firmly pro-vaccination official stance, pro-vax tweeters were still quick to criticise the government's handling of vaccine procurement and the rollout, latching onto blunders, raising concerns about corruption, and initially complaining that the rollout was going too slowly. And when the rollout eventually got underway, almost no pro-vax tweeters gave credit to government for this. We found only one tweet out of 800 that did so (see Supplementary table 1), compared to 57 tweets that criticised the government's efforts, 37 that announced the tweeter personally had been or would be getting vaccinated and 23 discussing (in a neutral or positive way) logistics and milestones in the vaccination rollout. Otherwise, the complaints dried up towards the end of the year (see Figure 1).

Anti-vax tweets were also critical of the government, but for opposite reasons: a number complained that the government was forcing them to take a harmful vaccine against their will, and/or expressed mistrust of the government's intentions with respect to the vaccine it promoted to the public. Some tweeters explicitly said they had 'trust issues' with the government and needed more reassurance that what they would be getting was a real vaccine. Hence, the difference between pro- and anti-vax tweeters was not that the former trusted and the latter mistrusted
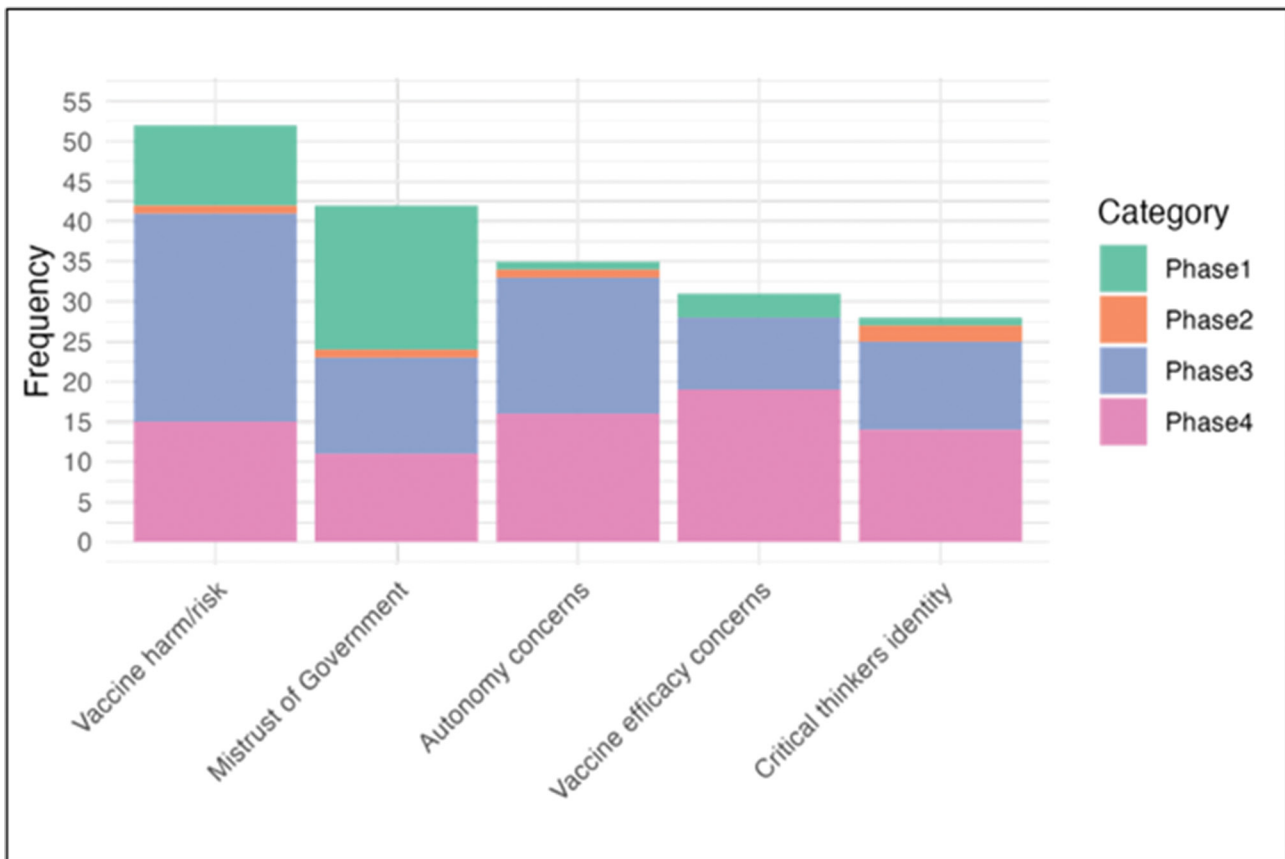
Figure 3: Frequency of top five anti-vaccination themes by phase. Theme 1 – Vaccine is harmful, too risky or insufficiently tested. Theme 2 – Mistrust of the government's intentions w.r.t. the vaccine. Theme 3 – Vaccine mandates violate individual autonomy and rights. Theme 4 – Doubts about vaccine efficacy; claims it doesn't work. Theme 5 – Anti-vaxxers are critical thinkers who can see through the lie.

the government; rather, the difference was in the substance of their mistrust. Pro-vax critics of the government were making an assumption that the (untrustworthy) South African government and the (trustworthy) international vaccine development enterprise were independent of each other, so the government could be held to account for how it handled these vaccines, whereas anti-vaxxers' suspicions tended to assume there was some shady, unclear connection between the government and the origins of the vaccine it purported to be administering, and hence, since the South African government was generally corrupt and not to be trusted, neither was the vaccine.

Conclusions

In thinking about responses to vaccine hesitancy and COVID-19 denialism, it is important to learn lessons from previous studies of the international anti-vaccination movement. Dubé and colleagues note how the anti-vaccination movement works by constantly shifting the goalposts, making the mere provision of accurate information from scientific discoveries an ineffective way of challenging it:

> *It is thus unlikely that accumulation of scientific evidences disproving the causal association between vaccination and different diseases or conditions (e.g., sudden infant death syndrome, autism, diabetes, etc.) will ever stop the anti-vaccination movements. This is well illustrated by the shifting hypothesis linking the measles component of the MMR to autism: once disproved by science, a new hypothesis was generated that focused on additives in vaccines, and then after that, on 'too many, too soon'…Evidence alone does not help reshape these anti-vaccine beliefs.*[1(p.107)]

Moreover, criticising the anti-vaccination movement can have the consequence of strengthening the group's sense of being a persecuted minority bravely speaking the truth.[11] These insights mean that sensitivity and caution are needed in thinking about future strategies to encourage vaccination. Hoare et al. distinguish between hardline anti-vaxxers, who are impervious to persuasion, and those who are initially unsure about vaccination but are open to being persuaded if they find health professionals who will answer their questions carefully and explain the benefits.[18]

We would also be cautious to recommend that the public become 'more trusting' of government, even though we agree that mistrust in the government was a common theme among anti-vax tweets. A degree of mistrust in the government is probably healthy and appropriate, given the South African government's endemic corruption, general indifference to the well-being of its people and past history of AIDS denialism. We should hold our government to account – as many of the pro-vax tweeters in this sample were doing – not mindlessly trust it. The trust-building recommendation also introduces a conundrum where the onus for convincing people to be more trusting is put onto the same entities that people already mistrust. Trying to get around this by saying that information needs to come from sources people do trust[8,12] then potentially creates an endlessly moving target for intervention, and begs the question of why people do not trust in the first place, even when the government *is* acting in the public interest. Here we come back to the crucial insight that the anti-vaccination movement manufactures controversy and mistrust where none previously existed.[1] Anti-vaccination movements exist even in countries with traditionally very high levels of public trust in government, e.g. Norway and Australia. As Cooper and colleagues note, the COVID-19 vaccine rollout in South Africa was *already* a high point of public service delivery[4], yet much of the public rejected it.

Hence, it seems to us that what is needed is greater critical literacy on the part of the public, enabling us to exercise discernment about when the government is acting in the public interest and when it isn't. The 'mainstream media' have already played a crucial role in this regard, as journalists provided the public not only with information about COVID-19 and about vaccination but also about government corruption involving funds set aside for the vaccination programme. Yet the tragedy of vaccine refusal during COVID-19, at least as reflected in this Twitter commentary, was that a large proportion of the public was apparently unable to tell the difference: many tweeters were unable to separate their knowledge of government corruption and service delivery failures from evidence that in this particular case, the government was actually succeeding at doing something in the public interest, for example, the following tweet from our sample:

> to those who cant wait to take the vaccine if you think the government will ever do anything for your benefit think again #familymeeting #alcoholban

Hence, we recognise that addressing vaccine hesitancy may imply focus in a different direction from 'more trust': towards public education, critical literacy and patient-led advocacy that holds the government to account and enables people to make their own informed, self-interested health decisions. However, we recognise that if the vaccine-refusing public believes they are already making their own self-interested health decisions and mistrusts the 'mainstream media' as well as the government, then this provides an enormous challenge about how to encourage vaccination uptake in the absence of a societal consensus about what is in fact in the public's best health interests. Although Twitter users are not representative of the whole South African public, social media platforms are becoming increasingly important in spreading opinions and misinformation[19], and their role in promoting the public good requires more research.

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Data availability

The data supporting the results of this study are available upon request to the corresponding author.

Declarations

We have no competing interests to declare. We have no AI or LLM use to declare. The research proposal was reviewed and granted exemption by the University of Johannesburg Humanities Research Ethics Committee (REC-186-2022).

Authors' contributions

P.K.: Data analysis; writing – initial draft. K.D.: Writing – revisions, funding acquisition, project leadership. M.S.: Data curation; data analysis. D.M.: Data collection, sample analysis. All authors read and approved the final manuscript.

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