



# Medical science in peril? analyzing the anti-vaccine rhetoric on Greek Facebook in the COVID-19 era

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## Abstract:

In the post truth era the limits between facts and beliefs, science and pseudo-science seem to be quite blurred. Social media platforms, such as Facebook, provide the ideal vehicle for the widespread sharing of misinformation, by fostering the creation of “filter Bubbles” and “echo chambers”. For the purposes of our study, we analyzed Facebook posts from users’ pages and public groups over a three – month period (from September 2021 to November 2021) with a primary focus on the vaccination against COVID-19. Using thematic content analysis, we attempted to explore the major themes that skeptics of COVID-19 vaccines use to justify their hesitancy. According to research findings, the anti-vaccination discourse on Facebook platform in Greece combines features such as mistrust towards politicians, the medical community, the legacy media, the establishment as a whole, and facts regarding the safety/complications of COVID-19 vaccination itself. If the medical society aspires to combat misinformation regarding health issues, then, deconstructing the anti-vaccination rhetoric will be a pivotal step for the ultimate survival of epistemological truths and scientific discourse in the public sphere.

**Keywords:** COVID-19, anti-vaccine movement, vaccine hesitancy, Facebook, Greece

**Received:** March 31, 2024

**Revised:** May 26, 2024

**Accepted:** May 26, 2024

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## Introduction

The coronavirus disease (COVID-19) emerged as a major global health and social crisis with initially sparse and fragmented data on associated risks. This period of social unrest and uncertainty significantly bolstered social media’s role as a key information source and forum for public discourse, leading to the spread of misinformation and conspiracy theories (Er-okhin et al., 2022). The COVID-19 pandemic highlighted the dual threats of the virus and misinformation, with social media platforms serving as conduits for pandemic-related falsehoods (Bridgman et al., 2020, 2021; Gruzd et al., 2023). As WHO Director-General Tedros Adhanom Ghebreyesus famously tweeted, the challenge is not only “fighting an epidemic” but also “an infodemic”, which fuels movements like anti-vaccination (Germani & Biller-Andorno, 2022).

This paper examines the impact of social media in Greece, where debates over COVID-19 vaccine safety have caused significant polarization. The analysis draws on vaccine hesitancy-related discourse and is based on a sample of Greek Facebook posts disseminated on the popular digital platform either by single pages’ users or by pages’ groups during the period September-November 2021. This topic is worth investigating considering that vaccine-hesitancy attitude is governed by heterogeneity embracing stances that range from partial approval to total disapproval. This multilateralism is dictated by a wide range of social, organisational, and individual factors influencing the public’s beliefs (Huangfu et al., 2022; Al-Jayyousi et

al., 2021).

Past research shows that anti-vaccine arguments proliferate not just in social media posts but also in comments on media organization fan pages and international broadcasters’ accounts, emphasizing the controversy and skepticism surrounding the COVID-19 vaccine and its acceptance (Wawrzuta et al., 2021; Wong et al., 2021).

## Vaccine Hesitancy: An old problem revitalized in the COVID-19 era under the social media dominance

Before the COVID-19 pandemic, there was a noted decline in anti-vaccine discourse on Twitter, with pro- and anti-vaccine communities remaining relatively isolated. However, the pandemic reignited anti-vaccine sentiments, highlighting safety concerns. Although the factors that may lie behind vaccine hesitancy are numerous, a distinctive one is the propensity of social media platforms to misinformation, operating as an aggravating context where citizens’ attitudes are shaped (Lazer et al., 2021; Tustin et al., 2018). Relevant research has indicated that the main channel through which COVID-19 information is obtained could have a significant impact on individuals’ perception of the seriousness of COVID-19 and their willingness to receive a COVID-19 vaccination. Increased dependency on social media for COVID-19 updates is correlated with higher levels of vaccine hesitancy (Park et al., 2022). Additionally, research suggests that seeking COVID-19 information on social media links anti-vaccine views to conspiracy beliefs

(McKinley & Lauby, 2021; Sallam et al., 2021).

COVID-19 has been identified as a controversial topic which enabled the creation of political echo chambers on both sides of the political spectrum, especially within the right-leaning group (Jiang et al., 2021). A study found that Facebook users tend to consume content aligning with their beliefs, limiting exposure to diverse information (Schmidt et al., 2018).

Regarding the issue of COVID-19 vaccination, pertinent research has indicated a convergence in the rationale behind abstaining from or refusing the vaccine. Specifically, the rapid development of COVID-19 vaccines and the potential risk of serious side effects, doubts regarding vaccine efficacy, conspiracy theories surrounding the motives behind mass vaccination, the mandatory vaccination, and a general lack of trust in established institutions are among the primary focal points of disagreement articulated by individuals in the anti-vaccination faction (Troiano & Nardi, 2021; Eslen-Ziya & Pehlivan, 2022, Küçükali et al., 2022; Wawrzuta et al., 2021).

It is worth mentioning that different arguments have been highlighted by anti-vaxxers on different social media platforms. According to the findings of a relevant study, anti-vaxxers on Facebook and Twitter express their dissent with the governmental handling of the vaccination, by raising issues of vaccination safety and efficacy. On the other hand, users on Tik Tok and Instagram are mainly preoccupied with the impingements on their freedoms, while also criticize people for promoting the vaccination through their social media accounts (Wawrzuta et al., 2022).

Overall, it may be inferred that the anti-vaccination matrix encompasses elements related to the socio-political environment, the levels of trust in the healthcare system and the medical science as a whole, as well as considerations regarding the effectiveness and safety of vaccines/vaccination itself. Under this prism, health institutions should deliver comprehensive information, while also prioritizing transparent communication with the public that takes into consideration citizens' fears and anxieties. Such an approach has the potential to restore public trust in health institutions (Hijazi et al., 2022).

In line with a study conducted in Italy, which affirmed that COVID-19 developments during the pandemic did not effectively diminish the echo-chamber phenomenon around the vaccination issue (Crupi et al., 2022), in the following section we delve into some noteworthy findings regarding the standpoint of the digital users in Greece towards the public management of the pandemic during its initial phase and subsequent lockdowns.

## Literature Review

### The swing in Greeks' public attitude towards the public management of COVID-19 pandemic

In Greece, public trust in health authorities fluctuated dramatically throughout the pandemic, influenced by perceived government transparency and scientific disagreement regarding the effectiveness of policy measures adopted to limit the pandemic and the vaccine efficacy (Papathanasopoulos et al., 2021). The governmental success in addressing the pandemic in its early stages, attributed to the adoption of a transparent *modus operandi* of crisis management which was reinforced by consistent public communication about the prioritization of public health based on recommendations from experts (Ladi et al., 2022, pp. 561-564), was followed by widespread societal disagreement

and doubt concerning the policy measures implemented during the subsequent lockdown.

This swing in public opinion, particularly regarding vaccine hesitancy, underscores the complex interplay between institutional trust and public health policies in Greece. It is not a coincidence that one year after the emergence of the pandemic (March 2021) the Greeks are moving emotionally from optimism to uncertainty (Georgakopoulos, 2021), a development that should be evaluated within the context of a more polarized political field compared to the past and amidst a backdrop of lockdown fatigue (Ladi et al., 2022, p. 571).

The transition of Greek society from the first to the second lockdown was marked by a notable shift in citizens' initial positive perceptions of key institutional actors. During the second lockdown period (November 2020-January 2021), there was an increase in skepticism or outright denial of the credibility of political and health actors, such as representatives from the Ministry of Health, health professionals in the media, and the World Health Organization. This skepticism was particularly prevalent among younger citizens or those with lower educational levels, creating an unfavorable environment in which part of the scientific community was perceived as having been instrumentalized (Papathanasopoulos et al., 2022). This shift in public opinion underscores the volatile nature of public attitudes toward institutional actors, which are contingent upon the perceived effectiveness of policy measures aimed at crisis containment.

This observation inspired the scope of the current study, which focuses on the rhetoric of anti-vaccine argumentation. This issue is particularly critical in Greece, where skepticism towards the scientific community occurs within a context of rapid medical advancements and discord among scientists. Given that managerial trust in relation to the COVID-19 health crisis in Greece has been linked to institutional trust, the trend of vaccine hesitancy warrants a detailed investigation. Such analysis can illuminate specific aspects of Greek public opinion concerning institutional actors, especially those in the health community who are predominantly under governmental oversight.

## Research Questions and Methodology

In our study, we have analyzed Facebook posts from users' pages and public groups over a three-month period (from September 2021 to November 2021), primarily focusing on the vaccination against COVID-19. Overall, 407 relevant posts from users' accounts and group pages were coded and analyzed with the aim of providing insightful answers to our research question.

The selection of Facebook as the ideal digital platform for data collection was mainly dictated by two factors. Firstly, in Greece it is the most popular social network for news consumption (Kalogeropoulos, 2023, p. 79), and secondly it is regarded as a platform contributing considerably to the propagation of vaccine-related misinformation on the web (Silverman, 2016; Travers, 2020). For data selection we used keywords like COVID-19 vaccination, vaccine(s) to exclude posts discussing other public health measures related to the pandemic. Subsequently, the dataset was improved by removing posts that exhibited a favorable attitude towards COVID-19 vaccination. Our final sample includes only posts where a critical stance towards the vaccination is conveyed.

Our main research question assesses the aspects of anti-vac-

cine discourse as shared on Facebook with the aim of highlighting the major themes and subthemes related to the argumentation of anti-vaccine advocates. The main question being raised goes as follows (RQ1): What are the dominant themes and subthemes around which the COVID-19 vaccine skeptics organize their argumentation against COVID-19 vaccination?

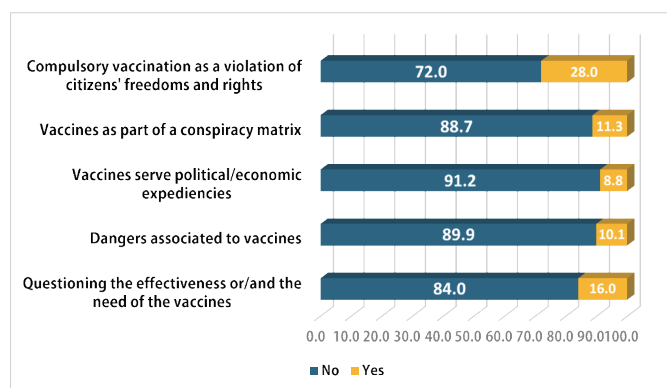
To address our research question, we employed thematic content analysis. The analysis was based on the six-phase guide framework, provided by Braun and Clarke (2006). Given this, we coded each segment of data that was relevant to or has something interesting to say about our research question. We opted for open coding, which means that we did not have pre-set codes. Instead, codes were developed from the data. The next step involved the examination of the codes and an attempt to synthesize those that clearly fitted together under a theme. Subsequently, we reviewed our preliminary themes, tested their consistency across the entire data set, and merged those that seemed to have overlaps under new themes. Distinct subthemes were further generated in cases where needed, in order to better capture the essence of the data.

### Research Findings

Even though vaccine hesitancy is not a new phenomenon in the Greek society, the way that the government chose to cope with the pandemic crisis, sometimes proposing and setting in place contradicting public measures and restrictions in relation to public life, as well as the lack of consensus on the part of the medical community regarding the efficacy of those measures, resulted in the consolidation of the anti-vaccination movement in the Greek public sphere. As presented in Table 1, our analysis revealed five main themes, further divided into relevant sub-themes, which are raised repeatedly within Facebook groups and users' accounts in the sample under investigation. These themes and subthemes are interwoven with each other based on several types of claims highlighting several adverse and negative dimensions of vaccination process (Table 2).

The results of the quantitative analysis indicate that on the Facebook platform, the discourse surrounding COVID-19 anti-vaccination primarily involves frequent discussions on the sensitive issue of citizens' rights and freedoms being infringed by mandatory vaccination policies and the penalties resulting from non-compliance. Other less prevalent themes among digital users who oppose vaccination include skepticism about the efficacy and necessity of vaccines, along with their association with conspiratorial activities. In contrast, the least commonly addressed topic pertains to the perception of vaccines as tools serving political or economic agendas (Figure 1).

Figure 1 Major anti-vaccination themes raised on Facebook posts in Greece (September-November 2021, in %)



Source: Authors' own research

Both Facebook pages users and groups users extensively discuss the issue of mandatory vaccination being viewed as a breach of citizens' freedoms and rights, along with concerns about its effectiveness and necessity, highlighting these two particular themes over others. However, there are also notable differences between the two account types. Members of Facebook groups often propagate the belief that vaccines are part of a larger conspiracy matrix, whereas individual users tend to focus on the political or financial benefits that may result from vaccine policies, despite the associated risks to public health. These nuances demonstrate the varying perspectives within the online community regarding vaccination (Figure 2).

In the subsequent section, we will discuss the research findings extensively, leveraging illustrative material (translated from Greek to English) derived from the posts' analysis in order to elucidate the content of each theme more effectively.

#### Questioning the effectiveness and/or the need for the vaccines

The analysis of posts on users' and groups' pages on Facebook that take skeptical views on or reject bluntly the vaccines revealed that one predominant argument against the vaccination is the lack of evidence regarding vaccines' effectiveness. This strain of posts consists of experts quotes that seem to question the effectiveness of the vaccines, information regarding the strategy of other countries to cope with the pandemic (especially cases where the vaccination was not seen as a panacea), as well as hard data that show that even vaccinated people get sick and hospitalized or even die.

#### Vaccines are questioned based on experts' argumentation

In terms of vaccines effectiveness, the disseminated content on the relevant anti-vaccination pages is based on scientific arguments derived from doctors' accounts whose posts are repro-

Table 1

Themes and subthemes of COVID-19 vaccine skeptics on Facebook groups' and users' pages

Themes	Subthemes
1. Questioning the effectiveness and/or the need for the vaccines	1.1 Vaccines are questioned about by experts 1.2 The vaccinated still get sick and die
2. Dangers associated to vaccines	2.1 Vaccines have severe side effects/cause deaths 2.2 Testimonials from "victims"
3. Vaccines serve political/economic expediencies	
4. Vaccines as a part of a wider conspiracy plan	4.1 Attacking the media for propagating the need for the vaccination
5. Compulsory vaccination is a violation of people's rights	5.1 Appeal to judicial sources



**Figure 2**  
Major anti-vaccination themes raised on Facebook posts in Greece per type of account (September-November 2021, in %)



Source: Authors' own research

duced by Facebook users. An indicative case is the re-dissemination of an argument voiced by a doctor within a group called "Focus 8-11, Stefanos Damianidis", referring to the original source which is the doctor's interview on a mainstream radio station. The specific argument highlights the experimental stage that vaccines are going through with the doctor pointing out "I don't want to live as a laboratory animal".

In a user's page, another post questions the effectiveness of vaccines by highlighting the expectations cultivated by the experts that vaccines would signify the end of the pandemic: "Didn't we say last year at this time that next year it will be different, that we will have vaccines so it will end? Why didn't it end?"

### **The vaccinated still get sick and die**

A major argument involved in the discourse of those belonging to anti-vaccine community concerns the mortality rate of the vaccinated people as well as the percentage of vaccinated people admitted to ICUs compared to the unvaccinated ones: "Naive question...! Those of us who have not been vaccinated, have been excluded from all closed venues in the country, because we have a pandemic of unvaccinated people. Then, who transmits the virus and even the fully vaccinated get infected???"

Sometimes, anti-vaxxers chose to be sarcastic about the need of vaccinations, especially when scientists start talking about the need of multiple doses or stressing the need to update COVID-19 vaccines to target new SARS-CoV-2 virus variants:

"So, announcement... I bet 1000 euros, that they will say there is need for a fourth and a fifth dose ...let's see who wants to play with me.???. (...).

### **Dangers associated to vaccines**

#### **Vaccines have severe side effects/cause deaths**

Among the COVID-19-related themes raised repeatedly within Facebook groups' and users' accounts, incorporated in the sample, is a highly controversial one focusing on the adverse side-effects of vaccines and the subsequent increase in deaths' numbers. For example, in users' pages the dissemination of EMA announcements regarding potential adverse reactions linked to Johnson & Johnson and AstraZeneca vaccines is carried out to underscore the risks associated with vaccinations. Such types of posts typically contain hyperlinks directing users to platforms where pertinent notifications can be perused and assessed.

The most severe complication after vaccination is death, an issue highly emphasized among the anti-vaccine community:

*Is this new sudden death pandemic being observed by any scientist? What exactly has happened? And all deaths from a heart attack. Has the Ministry of Health dealt with this? Mrs. Pagoni and Mr. Vasilakopoulos, in addition to being TV stars, do they remember that they are also doctors? (...)Let's also look at the new sudden death pandemic...*

### **Testimonials from "victims"**

Another strain of posts regarding the adverse side-effects of vaccination instead of using "hard data" as in the former case, make an appeal to the emotional state of the users' by bringing into the public light testimonies of ordinary people on how the vaccines have affected their lives. Typical of such a framing is the narrative of a mother, whose daughter was adversely affected by the vaccines, who talks about the "huge mental cost" as well as the "financial burden" provoked during the post-vaccination period.

### **Vaccines serve political/economic expediencies**

The measures that Europe is "requesting", such as the 3rd dose obligation, the vaccination certificate for those who wish to travel in the EU, the statement of an EU official that the EU has ordered vaccines until 2023, are all instances that interpreted as political expediency with the aim of profit, collusion with Big Pharma, etc., by the opponents of the vaccines. Often, accompanied by a valence framing and negative wording such as "criminals", "gang", this kind of posts shares the belief that the vaccination plan serves all kind of interests but the safety of the people. In a user's post for instance, it is argued: "The blunt admission on the part of the European official that essentially the E.U. does not buy approved drug treatments, so as not to 'sacrifice' pre-purchased vaccines from Pfizer and Moderna".

Furthermore, the policy measures aimed at combating the spread of the coronavirus such as performing rapid test is assessed as a trick through which the diagnostic laboratories gain financial benefits.

### **Vaccines as a part of a wider conspiracy plan**

Facebook groups and users' accounts have operated as the ideal place for conspiracy theory arguments to flourish. In some cases, this type of discourse is all-inclusive, incorporating commentaries and criticism on various aspects of the pandemic (e.g. contradictions as to the transmissibility of the virus, under-representation of scientists who express non-mainstream views on media, spreading of vaccine scare-mongering through "deliberate" hospital deaths).

<sup>1</sup>The criterion mean refers to the average value of a particular criterion or measure within a dataset, in this case the average value is 2.50

**Table 2**

Types of claims of the COVID-19 skeptical camp on Facebook groups' and users' pages

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1. Vaccines are unnecessary and/ or ineffective
  2. Vaccines are potential harmful/have severe side effects
  3. Vaccines cause death
  4. Vaccines' efficacy as a means to handle the pandemic is questioned by the "experts" who honor their medical oath
  5. Vaccines are part of a wider conspiracy plan
  6. Compulsory vaccination is a violation of people's freedom and rights
  7. Vaccines serve political/ economic expediencies
  8. Media are part of the conspiracy plan, they propagate along with other institutional actors the need for vaccination
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In the relevant posts policymakers are accused of "being attracted by illiberal regimes and perverse biopolitical experiments on millions [of citizens]". In the context of conspiracy theories articulated about vaccines can also be incorporated arguments describing Greece as a field of experimentation, a feature also attributed to Israel.

According to research findings, the interconnectedness between conspiracy theories and pandemic vaccination is a schema of argumentation found both on Facebook pages owned by simple citizens and by Facebook pages owned by journalists. The latter is exemplified by sfak.news Facebook page: "Wake up, it's all a well-crafted plan under the pretext of the pandemic / They are all using us for their dirty work. Be united because they want you with the exact opposite [stance] / Wake up".

#### **Attacking the media for propagating the need for the vaccination**

Last, but not least, the media is described as falling into the fallacy of venality/kickback resembling those institutional actors that violate the Constitution with their decision concerning the handling of COVID-19 pandemic.

According to sfak.news Facebook page the governmental policy of compulsory vaccination is an undercover plan fueled by the gradual government propaganda implemented through the mainstream media. A characteristic incident concerns the continuation of vaccination's necessity through the administration of a third forthcoming dose, even for the health-professionals despite the initial assurances to the contrary, a fact that prompts the administrator of the particular page to talk about an imminent propaganda, in the next period of time, aimed at "publications [presenting] that young children and even babies are entering the ICU" as a pressure lever for mandatory vaccinations.

#### **Compulsory vaccination is a violation of people's rights**

According to research findings, a much-debated aspect of the vaccine-related theme proves to be the compulsory character of the vaccination process imposed by the government. These posts are usually accompanied by designations such as «junta», «dictatorship», «fascism» and are all indicative of the climate of attack to human freedoms, that the ruling class has established, and which is denounced by the anti-vaxxers. For example, in a post made by the sfak.news account, there is the implicit correlation of pandemic handling by the Greek government with fascism:

*What is fascism? Fascism is a political ideology that imposes strict social and economic measures to strengthen the government and deprive citizens of their rights. A fascist system is usually run by a dictator who imposes things on citizens against their will and, through acts of violence and strict legis-*

*lation, suppresses any dissent.*

#### **Appeal to judicial sources**

To highlight the violation of human rights, anti-vaxxers often make use of judicial sources. This is exemplified by the reproduction of the statements made by the President of the Union of Prosecutors and deputy prosecutor of the Supreme Court, who maintains that:

*No person can be subjected to a physical operation, even if he/she is a health-officer, and, in fact, to the extent that this can influence his/her body", underlying the absolutism feature that lie behind the compulsion to risk one's life.*

#### **Concluding remarks**

Our analysis of 407 posts from anti-vaccine Facebook groups and user pages revealed that the anti-vaccine stance primarily focuses on the perceived dangers and safety of COVID-19 vaccinations, while also questioning their necessity as a preventative measure during the pandemic. During the winter of 2021, the Greek government's endorsement of the third vaccine dose led to a notable transition in public sentiment, from a state of optimism to significant uncertainty and mistrust towards health and political institutions. The discourse on social media in Greece, reflective of broader vaccine hesitancy, featured diverse arguments about the increasing reports of deaths, adverse side effects among vaccine advocates, and the ineffectiveness of vaccines. This multidimensionality confirms the viewpoint of Gruzdt et al. (2023) that vaccine hesitancy represents a spectrum of beliefs fueled by skepticism towards vaccines.

Similarly, in the USA, online discussions have shown a shift from positive to negative sentiments towards vaccines, primarily due to safety concerns and insufficient scientific explanations regarding side effects (Chen & Crooks, 2022). In neighboring Turkey, mistrust is directed towards the rapid scientific process, vaccine manufacturers, and health authorities, often intertwined with suspicions of autonomy violations and severe side effects (Küçükali et al., 2022). By contrast, in Turkey as exactly in Greece, the social media public discourse has little recourse to religious views, a trend attributable in the case of Turkey to the favourable stance of Islam religion towards COVID-19 vaccines (Küçükali et al., 2022, p.13).

In Poland, social media platforms like Facebook and Twitter echo these themes, with frequent discussions on the dangers of vaccines to human health, their ineffectiveness, and pervasive government mistrust, alongside global conspiracy theories, such as microchips in vaccines (Wawrzuta et al., 2022).

Kata (2010) suggests that anti-vaccination discourses may reflect varying health perceptions or distrust towards once-legitimate authorities, highlighting the complex nature of an-

ti-vaccinationism. Our study elucidates the primary arguments within the anti-vaccine camp, aiding the medical community in developing strategic communication plans to restore trust and combat vaccine hesitancy.

To achieve such goals, policymaking should be informed by the validated assumption that public attitudes towards vaccination are neither stable nor consistent during a health crisis, due to various factors that affect public sentiments, concerns, and perceptions of the crisis's severity. Therefore, in each health crisis, it is crucial that policymakers gain a timely understanding of public conceptions and awareness of the problem, in order to develop customized communication plans that address the audience's concerns. Given that previous research has indicated vaccine hesitancy as a significant obstacle in strengthening vaccination campaigns (Chen & Crooks, 2022, p. 11), policymakers in Greece need to find effective methods to evaluate vaccine hesitancy in real time to enhance vaccine adoption during severe health crises.

The current study reveals a notably dynamic presence of COVID-19 vaccine hesitancy on the Facebook platform in Greece, a finding consistent with past research that either analyzed vaccine-related social media opinions in other countries (e.g., the UK, Knight et al., 2022) or explored the various phases of vaccine hesitancy (Kumar et al., 2022). These research findings partially reflect the complexities of societal viewpoints related to vaccine hesitancy, which enable policy institutions—after further in-depth research on societal reactions to vaccinations—to formulate campaigns with effective communication strategies aimed at influencing different behavioral patterns of vaccine hesitancy. To combat anti-vaccine arguments or sentiments among citizens, health policy institutions should invest in research programs that systematically monitor vaccine hesitancy during different phases of a health crisis, noting that the COVID-19 pandemic has demonstrated how anti-vaccine stances on social media platforms evolve over time (Huangfu et al., 2022; Wawrzuta et al., 2021).

Considering the variation in vaccine sentiments across different social media platforms (Wawrzuta et al., 2022), future research should emphasize these differences and, where feasible, include cross-platform comparative analyses with datasets concerning digital users from various countries. Regarding Greece, future research should focus on exploring the social reactions that lead to various phases of vaccine hesitancy, as understanding these can play a pivotal role in identifying the multiple factors influencing vaccine hesitancy. Furthermore, future studies, as suggested by previous research (Wawrzuta et al., 2022), could provide deeper insights into the phenomenon of vaccine hesitancy—either in Greece or elsewhere—by carefully considering the sociodemographic features and varying susceptibilities to specific anti-vaccine viewpoints among different social networking sites' users.

Identifying an effective method to monitor the dynamics of vaccine opinion distribution across digital platforms, through methodologies like the one proposed in the research by Chen and Crooks (2022) which incorporates a metric based on the ratio of anti-vaccine to pro-vaccine sentiments, could provide policymakers in Greece with useful insights into vaccine hesitancy levels and vaccination rates during health crises in general.

### Limitations

The study presented in this paper reflects only the preliminary results of a research project inspired by the clear shift

in public attitudes in Greece regarding scientific community during the COVID-19 pandemic. It certainly has limitations; nevertheless it has great potential to expand in terms of the research results' scope. We aim on a next stage to expand the analysis in terms of themes and sub-themes touching on anti-vaccination public arguments on social media platforms. As to the limitations, first we solely tested the methodology of thematic content analysis on Facebook database, while other social media platforms content can be receptive to it. Second, the social media dataset is characterized by weaknesses – such as lack of demographic representativeness in terms of digital users – which dictate the necessity to generalize the sorts of data under investigation and expand the parameters based on which the investigation of vaccine hesitancy is implemented.

### Data Availability Statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Funding Information

This work was supported by the European Union's Horizon 2020 research and innovation programme under Grant 101004488. The information and views in this paper are those of the authors and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

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## Appendix A

**Main themes of the COVID-19 vaccine skeptics' camp on Facebook groups' and users' pages with posts as examples**

Theme	Quote
<b>1. Dangers associated to vaccines</b>	Finally the health workers open their mouths: "We are constantly receiving patients with complications of vaccination, but they are declared as something else and not as complications of vaccination" .
<b>2. Questioning the effectiveness and/or the need for the vaccines</b>	(...)I am quoting death charts in vaccinated countries like Israel, USA and Greece in order to compare with India. As it can be seen, the high vaccination rates do not prevent the dramatic increase in deaths that also concern the vaccinated. India shows us that the way out of the pandemic lies in natural immunity. The medical community should focus on effective treatments and not think unilaterally about vaccines that are ineffective and have an expiration date!
<b>3. Vaccines serve political/economic expediencies</b>	Common law criminals those who suggest the 3rd "booster" dose of mRNA vaccines. Their recommendations do not stem from any kind of "science", but from political mandates and expediencies. That's what the two experts at the U.S. Food and Drug Administration (FDA) revealed, saying earlier this month that they are going to resign from their position expressing their dissent with White House's order to proceed with the green light for the "3rd dose."
<b>4. Vaccines as a part of a wider conspiracy plan</b>	I have the feeling that it was agreed that Greece would become a field of experimentation and that is why she does not want us to wait for America and Europe. Israel serves as animal testing openly, transparently. <<Let America and Europe not overtake us, let us be ahead for the third vaccination dose>> Pagoni
<b>5. Compulsory vaccination is a violation of people's rights</b>	We can clearly distinguish that the suspension of the Constitution (liberties, equality, rights) with the mandatory vaccination and with the other provisions concerning various measures of citizens life, was not ultimately an imposed solution for the protection of public health that he (note: the prime minister) was unfortunately forced to take, but a decision that he particularly enjoys and "evolves" sadistically(...).