Addressing COVID-19 vaccine hesitancy: A content analysis of government social media platforms in England and Italy during 2020–2021

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ARTICLE INFO

Keywords:
COVID-19 Vaccine hesitancy Social media Italy England

ABSTRACT

Objectives: This study investigates how England’s and Italy’s Public Health Governmental Departments addressed COVID-19 vaccine hesitancy (VH) on social media platforms.

Study design: A conventional content analysis of the social media accounts of Public Health England (PHE), currently the UK Health Security Agency, and the Italian Ministry of Health (IMH) were performed during December 1st, 2020–April 30th, 2021.

Methods: A total of 531 and 110 posts were extracted from the accounts of PHE and the IMH respectively. Significant differences in theme distribution were noted. In England, the most common theme around COVID-19 vaccinations was the vaccine rollout (51%), while themes aimed at addressing VH specifically (44.8%) were debunking vaccine myths (10.5%), reaching/addressing minorities (8.5%), institutional encouragement (13.4%), and benefits of vaccines (12.4%). In contrast, Italian government posts majorly discussed COVID-19 vaccine news and updates (27.3%). Posts addressing VH (62.7%) focused on encouraging vaccination (37.3%), describing the benefits of vaccines (17.3%), debunking myths (4.5%), and communication campaigns (3.6%).

Conclusions: Approximately half of British and Italian government social media posts on COVID-19 were related to addressing vaccine hesitancy. Although similar themes were evident, there were also themes unique to each country.

1. Introduction

Vaccination is widely regarded as one of the most successful public health interventions, having saved more lives in the past 50 years than any other public health measure [1,2]. However, scepticism towards vaccinations has been present ever since the first smallpox immunisations in 1798 [1,2]. Vaccine hesitancy (VH) is the refusal or delay in vaccination despite adequate medical services provision [1]. Various concerns have been associated with VH since its infancy, including vaccines being dangerous, ineffective, and utilised to make earnings, as well as beliefs linking vaccines to diseases and vaccine-related harm being hidden by governments [2]. More recently, a shift of societal norms towards experiential knowledge, a deterioration of the support towards governmental organisations and science, and a diffused consumerist vision of healthcare negatively impacted hesitancy and vaccination acceptance rates [2]. Populations require high vaccination coverage rates, as vaccines lead to active immunity against pathogens, consequently protecting individuals and preventing the spread of infectious diseases in the population [1]. VH affects 90% of countries (independently of their income) and concerns all religious, socioeconomic, and ethnic groups [1,2,4]. In Europe, recent outbreaks of life-threatening vaccine-preventable diseases have been recorded [1]. Given these facts, the World Health Organization (WHO) regarded VH as a real threat to global health in 2019 [5].

The COVID-19 pandemic has registered the spread, at an unprecedented speed and pace, of accurate and inaccurate information, hence, being labelled as an infodemic by the WHO director-general Tedros Adhanom Ghebreyesus [6,7]. Platforms such as Twitter, Facebook, Instagram, and YouTube constitute a way to quickly and easily spread rumours, beliefs, and opinions, contributing to the information epidemic...
system and pandemic experiences. Both countries followed a Beveridge

decision was made after taking into account each country’s

findings displayed and discussed against the HBM for the validation

of posts addressing VH during the COVID-19 pandemic.

Therefore, the aim of this study is to analyse the content of govern-

ment social media posts in England and Italy to investigate (1) the

proportion of posts related to addressing vaccine hesitancy, and (2) the

major themes relating to how vaccine hesitancy was addressed. Results

should invite public health professionals to reflect on the COVID-19

response in the social media space, and inform how governmental re-

dponses may be formulated/implemented in the future. The Health

Belief Model (HBM) is paramount in this research, given its connection

to vaccination decisions [14,15].

2. Methods

To investigate the role of social media platforms in addressing

COVID-19 VH the Italian and the English contexts were selected. Such a

decision was made after taking into account each country’s healthcare

system and pandemic experiences. Both countries followed a Beveridge

model of healthcare systems, adopting a National Health Service, being

funded by taxation and free at delivery [16,17]. Additionally, both na-

tions followed a similar pattern in the early stages of the pandemic, with

an initial surge in cases in March, a rapid rate of infection, overburdened

healthcare systems, a concomitant introduction of the vaccination pro-

gram (both in December), and comparable vaccination-related problems

and measures (such as restricting AstraZeneca vaccine usage).

The official Twitter, Facebook, Instagram and YouTube accounts of

the Italian Ministry of Health (IMH) and Public Health England (PHE)

were monitored from December 1st, 2020 to April 30th, 2021. The ac-

counts were visually inspected to ensure reliability, considering the

verified badge, the account’s description, number of followers, and tags.

Only the posts related to COVID-19 vaccines were considered. Videos

longer than 15 min were excluded due to a reduction in viewership [18].

Data analysis was done using conventional content analysis. This

method of qualitative health research relies on coding categories that

originate from text data [19]. The content discussed in the posts pub-

lished on each social media platform belonging to PHE and IMH was first

inspected as a whole to familiarise with the data, as well as to identify

and quantify the proportion of posts related to COVID-19 vaccines.

Successively, oral and written quotes and content contained in each

COVID-19 vaccine-related post were identified to distinguish the main

themes discussed on the social media profiles of PHE and IMH [20]. The

coding and categorisation processes were performed collectively for all

social media platforms, starting on the 11th of February 2021. Cate-

cgories were described, related frequency and examples identified, and

the findings displayed and discussed against the HBM for the validation

of the results. The model shows a linkage to vaccination decisions and

hesitancy and can be used to comprehend the role of health communi-

cation strategies, including those employing social media platforms, in

predicting immunisation behaviour [14,15]. The components of the

HBM along with their operationalisation are presented in Table 1. The

relevance of the results was discussed in the Italian and English settings,

as well as the European context. No ethical approval was necessary as

Overall, 35.5% of governmental social media posts in England

related to COVID-19 vaccines, while only 14.6% of governmental posts

in Italy related to COVID-19 vaccines (see table 2). Youtube had the

largest proportion of COVID-19 related content in both scenarios, with

85.1% of posts related to COVID-19 in the English setting and 20.8% in

the Italian one (see table 2). A lower proportion was observed on

Facebook in Italy’s case and on Instagram in England’s one. The below

paragraphs illustrate the categories that emerged from the performed

content analysis (Table 3).

3.1. COVID-19 vaccine news and updates

Both PHE and the Italian Ministry of Health regularly provided updates

on the number of doses injected, the approval status of vaccines,

the development of novel vaccines, and novel research regarding the
effectiveness of COVID-19 vaccines. Examples of content falling under

such category include updates on vaccine trials, such as the Novavax

trials, and statements like “suspension of AstraZeneca vaccines on a pre-

cautionary basis.” The proportion of posts originating from all platforms

that fell under this category was higher for the IMH, with 27.3% of posts
discussing COVID-19 vaccine related news, compared to PHE, with just

8.3%.

3.2. COVID-19 vaccine rollout

Both PHE and the IMH shared information on the rollout of the

vaccination campaign, with an emphasis on practical details like where
to get vaccinated, what to do in the event of missed appointments, and

how one will be contacted, as well as information on which groups are

eligible for vaccination and employment calls for medical professionals.

Examples of PHE quotes that fall under this category include “people over
40 can now book their COVID-19 vaccine,” “the NHS will never ask you to
share your bank details or pay for the #COVID-19 vaccination,” “5 million
people in the UK receive a second dose of COVID-19 vaccine,” and a video
showing the process that individuals undergo in getting the COVID-19

vaccine from their arrival at the vaccination centre to their exit. Similar

statements were also posted from the IMH, with a more extensive focus

on recruiting healthcare workers for the rollout of the vaccination

campaign, as shown in the following quote “the portal welcomes appli-
cations for the recruitment of 3000 doctors and 120000 nurses and health

assistants to support the vaccination campaign. Finally, the proportion

of posts falling under such a category was higher for PHE, with 51% of

posts presenting information on the deployment of the vaccine program,

compared to 30% of the posts from the IMH falling under such category.

3.3. Rationale behind COVID-19 vaccine decision-making

About 10% of the content shared by PHE on the selected social media

platforms explained the reasons behind COVID-19 vaccine prioritisation

or vaccination decisions. For instance, PHE justified the reasons behind

age-based prioritisation by mentioning that, according to such an

approach, 99% of people at risk of dying from the disease would be

protected. Similarly, PHE provided reasons behind the decision to utilise

the AstraZeneca vaccine only on individuals under 30 and with no un-
derlying conditions. Accordingly, such an approach weighs up the risks

of being seriously ill or dying from COVID-19 against the extremely small risk

of a serious adverse event. Compared to PHE, the IMH did not provide such

justifications.

3.4. Debunking COVID-19 vaccine myths

Both PHE and the IMH addressed misleading claims concerning
COVID-19 vaccines. Specifically, COVID-19 vaccination rumours were addressed in 10.5% and 4.5%, respectively, of the content posted by PHE and the IMH. In doing so, Italy’s strategy focused on the false myths surrounding dangerous batches of AstraZeneca vaccines; whereas, England’s one covered issues such as the adequacy of COVID-19 vaccines for faith communities, vaccines and fertility issues, and DNA modification. Moreover, checklists or validated pages were made available by PHE and the IMH to verify the veracity of COVID-19-related material. Employing reputable experts to address contentious queries like “do the vaccines contain any pork products” was a notable strategy used by PHE to address vaccine-related concerns. Such a strategy was absent from the Italian environment, being exclusive to the English one.

### 3.5. Reaching and addressing minorities

The results of the investigation showed that 8.5% of the content shared by PHE aimed at reaching minorities. Particularly, PHE provided multilingual content, for instance, via infographics in different languages, and addressed multicultural concerns such as the suitability of COVID-19 vaccinations for various religions. For instance, the following quote was posted on various social media platforms if you are observing Ramadan, getting the #COVID19 #vaccine will not break your fast. The inclusion of credible public health specialists in videos was crucial to addressing the issues faced by minorities and delivering trustworthy material. In contrast, Italy’s strategy lacked such considerations on minorities.

### 3.6. Mechanism of action of COVID-19 vaccines

Both governmental agencies provided details on the immune mechanisms resulting from COVID-19 immunisation. This was mainly performed using infographics or videos to demonstrate how the various COVID-19 vaccinations induce antibody production. PHE paid particular attention to the severity and likelihood of adverse effects posting quotes as most side effects of the #COVIDVaccine are mild and only last for a short time. Comparable percentages of posts in both the Italian and English settings discussed the COVID-19 vaccines’ methods of action.

### 3.7. COVID-19 vaccine development - safety checkpoints

Both governmental agencies provided details on the procedures involved in developing COVID-19 vaccines, focusing in particular on how safety and efficacy are assured before releasing the product into the market. As an illustration, PHE emphasised in a video that all vaccinations were rigorously evaluated before being introduced with a procedure analogous to that applied to any other vaccine but in a condensed time period. Furthermore, it emphasised that the vaccine is constantly monitored, even after it has been approved, to ensure that there are no unexpected events. Similarly, the IMH shared a video showing the main steps involved in COVID-19 vaccine development, providing a short explanation of each.

### 3.8. Industrial and ministerial encouragement to vaccine against COVID-19

Both public health governmental departments posted videos and posts showing celebrities, citizens, health professionals, and institutional figures encouraging individuals to vaccinate or showing personal experiences with the COVID-19 vaccine. For instance, PHE posted a video of Michael Caine and Elton John advertising the COVID-19 vaccine. Michael Caine is seen getting vaccinated in the video and claiming “if you are observing La Stanza degli Abbracci...”. The proportion of posts addressing such content was included in 14.5% of PHE’s posts. Contrastingly, the IMH did not provide such information.

### 3.9. Following COVID-19 measures and guidance after vaccination

PHE highlighted on the various platforms the need to follow COVID-19 measures such as hand washing, social distancing, and mask-wearing after vaccination. Such content was included in 14.5% of PHE’s posts. Comparably, the IMH did not provide such information.

### 3.10. Benefits of COVID-19 vaccines

Both PHE and the IMH emphasised the advantages of getting vaccinated against COVID-19 by citing research showing, for example, a decrease in hospitalization rates, household infections, transmission, and COVID-19 mortality as a result of immunisation. When compared to PHE, which covered such content in 12.4% of its postings, the IMH covered it in 17.3% of its posts.

### 3.11. COVID-19 VH

The IMH focused explicitly on COVID-19 VH in the health communication campaign entitled La Stanza degli Abbracci. Throughout the video, the concepts of a return to normality, doubts, lack of severe side-effects, and ability to recover from vaccination were presented. This video was shared across all selected social media platforms, making up approximately 4% of the COVID-19 material shared by the IMH.

### 3.12. Unrelated content

Despite referencing COVID-19 vaccinations in the post, 2.7% of the content published by the IMH covered medical topics unrelated to them. Posts about blood donation and how it is still feasible after having a vaccine are an example of the type of content that falls under this category.

### 4. Discussion

The content analysis revealed that the number of posts published on different social media platforms varied between the two health communication strategies, with the PHE presenting an overall higher number of posts addressing the topic of COVID-19 vaccines. Both PHE and IMH displayed a higher proportion of posts on YouTube, while a lower proportion was observed on Facebook for IMH and on Instagram for PHE. The codes and categories identified in the government social media posts from both countries exhibited a strong consistency. Nevertheless, significant differences in theme distribution were noted. Specifically PHE presented a high proportion of posts falling under the COVID-19 vaccine rollout category and a low under the COVID-19 vaccine development - safety checkpoints one. In contrast, the posts of the IMH majorly centred around the category of COVID-19 vaccines' news/updates.

Not all the content shared by PHE and the IMH addressed VH. From the conducted analysis it is clear that the categories which address VH common to both government strategies were emphasising the benefits of vaccination, debunking COVID-19 vaccine myths, and institutional encouragement. Apart from such common themes, the countries differed in some respects with only PHE recognizing the importance of providing multilingual and multicultural content to address the concerns of minorities, ultimately affecting their health behaviours [21]. Italy’s strategy lacked such considerations. Nevertheless, Italy’s approach focused directly on COVID-19 VH in the previously described communication campaign La Stanza degli Abbracci. The proportion of posts addressing VH was higher for the IMH compared to PHE, with 62.7% of posts addressing vaccine hesitancy compared to 44.8%. It is important to note that even though posts addressing the COVID-19 vaccines’ mechanism of action, development, assurances of their safety and efficacy, and
Moreover, networks have improved search results and made it harder for users to interact and view false content, striking users, and encouraging claims that targeted the dimension cues to action directly impacts one’s health communication strategies for addressing VH, complementing such interventions. A recent study [27] found that the results obtained adequately described the data, the retrieved proportions may reflect the points in the vaccination programme that the two countries had reached: PHE giving strong background on technical implementation to reinforce public expectations and demand for the vaccination programme which was happening; the Italian messaging addressing previous high levels of vaccine hesitancy and providing reassurance to the public about the safety of the vaccine. In both cases there was a sense of preparing the public with the promise of freedom through vaccination.

Despite such differences, both health communication approaches are in line with the HBM, conceivably affecting one’s hesitancy levels and ultimately immunisation behaviour [1, 15, 21]. The identified categories increase one’s perceived severity and susceptibility of COVID-19 infection, having implications for the perceived threat of infection [15, 21]. Individuals are more prone to take preventive action, in this case, getting immunised against COVID-19, when the perceived threat of infection of COVID-19 is high and when individuals believe they are susceptible to the risk of infection [22]. Moreover, the COVID-19 vaccine-related content posted by PHE and IMH increases one’s self-efficacy and perceived benefits of immunisation and decreases the perceived barriers. The previously mentioned actions conceivably positively affect one’s vaccination decisions and hesitancy levels [15]. In this regard, individuals are more likely to engage in preventive action when the benefits are higher than the costs [22]. Additionally, the extensive presence of encouraging claims that targeted the dimension cues to action directly impacts one’s immunisation behaviour and potentially diminishes VH [15, 21]. Both health communication strategies can be judged effective in increasing one’s vaccine acceptance and decreasing VH levels, as both plans addressed individual beliefs regarding the benefits, susceptibility, self-efficacy, and barriers related to COVID-19 vaccines and COVID-19 [22]. England’s health communication approach influenced more extensively individual beliefs regarding COVID-19 vaccinations by focusing on the concerns of minorities.

4.1. Contextualisation

The researched social media platforms used methods to minimise the spread of false information during the COVID-19 pandemic. These included fact-checking, taking down misleading content, restricting users from interacting and viewing false content, striking users, and providing links to reliable and official COVID-19 content [23–26]. Moreover, networks have improved search results and made it harder for users to find accounts that discourage vaccination against COVID-19 [24–26]. The findings of this study propose the use of social media platforms as tools in health communication strategies for addressing VH, complementing such interventions. A recent study [27] found that during the first phases of the COVID-19 pandemic, countries have regularly employed Twitter, Facebook, Instagram, and Youtube in health communication strategies, reflecting England’s and Italy’s activity.

4.2. Policy implications

Examining the role of social media platforms on VH in the context of the COVID-19 pandemic seems vital given the global penetrance of social media platforms and the necessity of securing adequate levels of public confidence in public health interventions such as immunisation campaigns [23]. The results of this study are relevant to PHE and IMH to evaluate their activity during the first months of the vaccination rollout. The comparative nature of this study and the analysis made by utilising the HBM could help PHE and IMH design even more effective strategies for current and future health emergencies, with Italy focusing more extensively on addressing the concerns of minorities and providing multilingual content. Moreover, the English and Italian approaches can serve as examples for enacting similar strategies in the European setting.

To ensure coherent public health action and build public trust, our findings recognise the need for consistent messages concerning COVID-19 vaccines between European Public Health Governmental Departments and different communication channels [27, 28]. This study calls upon national and international collaboration, transparency, comprehensibility, inclusivity, consistency, and evidence-based approaches when designing and enacting health communication strategies [27]. Our findings also suggest that governments and public health organisations shall consider the impact and maximise the positive use of social media platforms in all public health interventions and health emergencies, not only to those related COVID-19 immunisation. Social media platforms represent a low-cost means for improving population and individual health [22, 29]. They can serve for information dissemination, healthy lifestyles’ promotion, policies’ support, and citizen encouragement, demonstrating their relevance in the public health arena [29, 30].

4.3. Limitations

The exclusive utilisation of the HBM as a comparison tool may have unidentified elements in posts that affect VH, such as cognitive biases/heuristics, or the mental shortcuts people use to rapidly and effectively solve problems [31]. Moreover, this study solely investigated the role of social media platforms and health communication strategies on VH, neglecting the impact of the broad range of determinants influencing VH [1]. Additionally, one’s demand for vaccination goes beyond hesitancy [32].

Notwithstanding the above limitations, the findings presented might be a good indicator of the role of social media platforms in propagating and as tools in addressing COVID-19 VH. When considering the employment of social media platforms by Public Health Governmental Departments, no preferential treatment was given. Moreover, to ensure that the results obtained adequately described the data, the retrieved posts were observed persistently during the selected period. The employment of the HBM was based on previous works on vaccine uptake, revealing its adequacy.

5. Conclusions

It is crucial to monitor and use social media platforms adequately during health emergencies and intensify the training of public health professionals in health communication and social media use. Monitoring the comments arising from posts by the Italian Ministry of Health and Public Health England could help predict the public’s willingness to get immunised against COVID-19 as well as reactions to such health messages. Psychological models can further support the understanding of the impact of health communication strategies on COVID-19 VH behaviour. Research investigating the usage of social media networks by different age groups could act as guidance when planning vaccination rollout.

Ethical statement

The authors declare not to have any competing interests. The authors declare not to have received any kind of funding. The authors declare that no ethical approval was required for this study as it refers exclusively on data available to the public.

Declaration of competing interest

All the authors declare NOT to have any conflict of interest.
Appendix 1

Table 1
HBM - Operationalisation. Adapted from: Why do some Korean parents hesitate to vaccinate their children?, by Chang & Young Lee, 2019, Published Online: Epidemiology and Health Journal. Copyright 2019 by Korean Society of Epidemiology.

| Operationalisation | Description |
|--------------------|-------------|
| Perceived Susceptibility | Belief of contracting COVID-19 when unvaccinated |
| Perceived Severity | Belief regarding the seriousness of COVID-19 and consequences if one is not vaccinated |
| Perceived Threat | Threat of COVID-19 infection |
| Perceived Benefits | Benefits related to being immunised against COVID-19 |
| Perceived Barriers | Adverse reactions from COVID-19 immunisation; Accessibility to providers; Lack of information regarding the COVID-19 vaccine |
| Cues to Action | Experience with vaccinations; Recommendations delivered from professionals and institutions |
| Self-efficacy | Actual or self-perceived ability of oneself to take steps to get immunised against COVID-19; Ability to recover from side-effects |
| Individual Behaviour | Decision related to COVID-19 vaccination (vaccinated/unvaccinated) and hesitancy levels |

Appendix 2

Table 2
Total number of posts, number of collected posts, and number and percentage of posts on COVID-19 vaccines originating from the social media platforms of PHE and the IMH.

| Platform (December 1st, 2020- April 30th, 2021) | Total Number of Posts | Number of Collected Posts (excluding content with a duration longer than 15 min) | Number of Posts on COVID-19 vaccines (%) |
|------------------------------------------------|-----------------------|----------------------------------------------------------------------------------|-----------------------------------------|
| PHE IMH                                        | 1503 864              | 1496 753                                                                          | 124 (84.3) 73 (49.5)                    |
| Twitter                                       | 1197 400              | 1191 365                                                                          | 408 (34.3) 55 (15.1)                    |
| Facebook                                      | 229 343               | 229 309                                                                           | 64 (27.9) 39 (12.6)                     |
| Instagram                                     | 9 31                  | 9 31                                                                              | 2 (22.2) 6 (19.4)                       |
| YouTube                                       | 68 90                 | 67 48                                                                             | 57 (85.1) 10 (20.8)                     |
| Total                                         | 1503 864              | 1496 753                                                                          | 124 (84.3) 73 (49.5)                    |

Table 3
Examples of quotes/content originating from the social media posts of PHE and the IMH, the emerging codes and categories, the definitions of categories, and the number and percentage of posts belonging to each category.

| Example quotes/content | Codes | Categories | Definitions | Number of posts posted by PHE (%) | Number of posts posted by the IMH (%) |
|------------------------|-------|------------|-------------|------------------------------------|--------------------------------------|
| Oxford/AstraZeneca COVID-19 Vaccine Authorised Novavax vaccine trials | Approval/ Suspension Status New research/Blogs | COVID-19 vaccine news/ updates | Post entails information on the approval status and suspension of COVID-19 vaccines, or novel research, blogs, or reports regarding COVID-19 vaccines | 44 (8.3) 30 (27.3) |
| 5 million people in the UK receive second dose of COVID-19 vaccine The NHS will never ask you to share your bank details or pay for the #COVID-19 vaccination | Doses Injected Fraud | COVID-19 vaccine rollout | Post includes information on the rollout of the vaccination campaign, focusing on the number of doses available and injected, citizens, health professionals, and vaccination hubs. Topics include vaccination hubs, the process of getting immunised (personal experiences, consent form, etc.), individuals’ eligibility, vaccines and age groups, contacting individuals (fraud prevention), missed appointments, or hiring of health personnel. | 271 (51.0) 29 (26.4) |
| Graphs depicting vaccination uptake by age-groups. The NHS is opening its newest front in the fight against COVID-19 with the activation of the first seven NHS Vaccination centres Information on bookings in case of missed appointments. People aged 40 or over can now book their COVID-19 vaccine Video showing the process that individuals undergo in getting the COVID-19 vaccine from their arrival to the vaccination centre to the exit. Based on the available data and evidence, JCVI has advised that it is preferable for adults aged under 30 with no underlying conditions to be offered an alternative to the AstraZeneca vaccine where available. This weights up the risks of being seriously ill or dying from COVID-19 against the Benefits v. Risks | Missed Appointments Eligibility Priority groups Vaccination procedures/ experience | Rationale behind COVID-19 vaccine decision making | Post contains reasons behind COVID-19 vaccine prioritisation or vaccination decisions (such as why is the AstraZeneca vaccine not adequate for individuals below 30 years old). | 44 (8.3) / |

(continued on next page)
Our research shows that one dose of the COVID-19 vaccines have already saved thousands of lives and the benefit for the majority of the population is clear. Our research shows that one dose of #COVID19 vaccine can cut household transmission by up to half. 

## Updates concerning the development of COVID-19 vaccines, specifically focusing on Italian studies.

- **IMH**
  - Novel research/reports

### Table 3 (continued)

| Example quotes/content | Codes                  | Categories                  | Definitions                                                                                       | Number of posts posted by PHE (%) | Number of posts posted by the IMH (%) |
|------------------------|------------------------|-----------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------------|
| Videos showing a man who experienced damage after he refused the polio vaccination. | Personal stories       | Institutional and ministerial encouragement to vaccinate against COVID-19 | Post shows celebrities, experts, or ministers inviting individuals to immunise against COVID-19 or presents a comparison with previous disease outbreaks, the immunisation of institutional figures (such as prime ministers), highlighting the cruciality of vaccines via personal stories, or conceptualises vaccinations to weapons and COVID-19 to war. | 71 (13.4)                         | 41 (37.3)                             |
| Vaccines are vital in helping us return to a normal way of life and I encourage anyone who is offered a vaccine to take it as soon as possible (Mary Ramsay: Head of Immunisation at PHE). | Experts                | Multicultural Concerns        | Post presents multilingual content or multicultural concerns by addressing the worries of minorities (such as the adequacy of COVID-19 vaccines for different religions). | 45 (8.5)                          | /                                      |
| Video showing Elton John and Michael Caine promoting COVID-19 vaccination. The video also shows Michael Caine getting vaccinated and stating that it is harmless. | Celebrities            | Reaching/addressing minorities | Post presents multilingual content or multicultural concerns by addressing the worries of minorities (such as the adequacy of COVID-19 vaccines for different religions). | 45 (8.5)                          | /                                      |
| We don’t know if the COVID-19 vaccine prevents transmission. This means you could potentially still carry and transmit the virus to other vulnerable people, even if you are protected. If you have received a COVID-19 vaccine, please continue to follow the lockdown rules. | Lacking evidence       | Following COVID-19 measures/guidance after vaccination | Post claims the need of following COVID-19 measures such as hand washing, social distancing, and mask wearing after vaccination, given the lack of robust evidence of COVID-19 vaccines on transmission | 77 (14.5)                         | /                                      |
| The COVID-19 vaccines have already saved thousands of lives and the benefit for the majority of the population is clear. Our research shows that one dose of #COVID19 vaccine can cut household transmission by up to half. | Following COVID-19 measures/guidance after vaccination | Benefits of COVID-19 vaccines | Post claims the advantageous effects of COVID-19 vaccinations on the individual or societal level (i.e., reduced hospitalisations, infection rates, deaths, etc.). | 66 (12.4)                         | 19 (17.3)                             |
| We don’t know if the COVID-19 vaccine prevents transmission. This means you could potentially still carry and transmit the virus to other vulnerable people, even if you are protected. If you have received a COVID-19 vaccine, please continue to follow the lockdown rules. | Following COVID-19 measures/guidance after vaccination | Benefits of COVID-19 vaccines | Post claims the advantageous effects of COVID-19 vaccinations on the individual or societal level (i.e., reduced hospitalisations, infection rates, deaths, etc.). | 66 (12.4)                         | 19 (17.3)                             |
| The COVID-19 vaccines have already saved thousands of lives and the benefit for the majority of the population is clear. Our research shows that one dose of #COVID19 vaccine can cut household transmission by up to half. | Following COVID-19 measures/guidance after vaccination | Benefits of COVID-19 vaccines | Post claims the advantageous effects of COVID-19 vaccinations on the individual or societal level (i.e., reduced hospitalisations, infection rates, deaths, etc.). | 66 (12.4)                         | 19 (17.3)                             |

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Table 3 (continued)

| Example quotes/content                                                                 | Codes                  | Categories          | Definitions                                                                 |
|---------------------------------------------------------------------------------------|------------------------|---------------------|-----------------------------------------------------------------------------|
| Suspension of AstraZeneca vaccinations on a precautionary basis                       | Approval suspension status | Recruiting health professionals | COVID-19 vaccine rollout Post includes information on the rollout of the vaccination campaign, focusing on the number of doses available and injected, citizens, health professionals, and vaccination hubs. Topics include vaccination hubs, the process of getting immunised (personal experiences, consent form, etc.), individuals’ eligibility, vaccines and age groups, contacting individuals (fraud prevention), missed appointments, or hiring of health personnel. Same as above Same as above |
| The portal welcomes applications for the recruitment of 3000 doctors and 120000 nurses and health assistants to support the vaccination campaign | Priority groups | Vaccination hubs | Doses injected Doses available | Vaccination allowed in pharmacies 10 million doses injected | Same as above Same as above |
| Infographic showing the first categories who will receive the vaccine.                | Unknown efficiency | Debunking COVID-19 vaccine myths | Post presents and addresses misleading claims regarding COVID19 vaccines. Misleading claims include scientifically unproven content related to COVID-19 vaccines (i.e., DNA alteration, infertility, etc.) (Khatri et al., 2020). Moreover, it provides checklists or verified pages to check the accuracy of COVID-19 related information or targets the importance of sharing accurate information and ways to do so. Same as above Same as above |
| Post mentioning that the phrase I do not vaccinate against #COVID-19 because the safety monitoring of the #vaccine will arrive after the vaccination campaign is over is false. | Immune responses | Mechanism of action of COVID-19 vaccines | Post discusses the mechanism of action of COVID-19 vaccines, focusing on immune responses (including the severity and likelihood of adverse effects), or different typologies of vaccines. Same as above Same as above |
| AIFA, unjustified alarm regarding the safety of the AstraZeneca vaccine. The post also provides a URL link to reliable information sources. | Techniques for vaccine development | COVID-19 Vaccines Development – safety checkpoints | Post discusses the steps involved in COVID-19 vaccines’ development, drawing on concepts of safety and efficacy, clinical trials, or application of previous knowledge. Same as above Same as above |
| We are pleased to continue our collaboration with Twitter to help citizens in Italy find accurate and timely information #COVID-19 and #vaccines. When you search for terms related to these topics, the new prompt appears which directs you to our dedicated pages | Doubt about the need to vaccinate | COVID-19 VII | Post targets the several doubts of individuals regarding COVID-19 vaccines, such as those regarding their effectiveness or adverse effects. / 4 (3.6) |
| Video showing the main steps involved in COVID-19 vaccine development, namely, identification and isolation of the COVID-19 pathogen, techniques employed for vaccine development, clinical trials, and safety and efficacy checkpoints with brief explanations for each. The video also describes immune responses. The information is presented by the General Direction of Prevention at the Ministry of Health. | Self-love | Benefits of COVID-19 Vaccines | Post claims the advantageous effects of COVID-19 vaccinations on the individual or societal level (i.e., reduced hospitalisations, infection rates, deaths, etc.). Same as above Same as above |
| Video entitled La Stanza degli Abbracci | Return to normality/Personal stories/experiences | Epidemiological studies (efficacy) | Unknown efficiency | Debunking COVID-19 vaccine myths | Post presents and addresses misleading claims regarding COVID19 vaccines. Misleading claims include scientifically unproven content related to COVID-19 vaccines (i.e., DNA alteration, infertility, etc.) (Khatri et al., 2020). Moreover, it provides checklists or verified pages to check the accuracy of COVID-19 related information or targets the importance of sharing accurate information and ways to do so. Same as above Same as above |
| URL links to scientific papers and videos demonstrating reduced hospitalization and infection rates thanks to vaccination. | Immunisation of Ministers Encouraging posts | Institutional and ministerial encouragement to vaccinate against COVID-19 | Post shows celebrities, experts, or ministers inviting individuals to immunise against COVID-19 or presents a comparison with previous disease outbreaks, the immunisation of institutional figures (such as prime ministers), highlighting the cruciality of vaccines via personal stories, or conceptualises vaccinations to weapons and COVID-19 to war. Same as above Same as above |
| Videos showing the immunisation of Mario Draghi and Sergio Mattarella. | Immunisation of health professionals | Unrelated content | Video explaining that you can donate blood after receiving the COVID-19 vaccine. | Post contains information primarily on medical themes unrelated to COVID-19 vaccines despite mentioning the latter. / 3 (2.7) |
| We have an additional weapon to fight against the virus. We have in our hands an instrument that can allow us to win this challenge and similar quotes. | Blood donation | Biography of the vaccine | Video explaining that you can donate blood after receiving the COVID-19 vaccine. | If you are vaccinated against #COVID-19 and find out that you are pregnant after the second dose of the #vaccine, there is no reason to stop the #pregnancy. | Same as above Same as above |
| Videos showing the immunisation of health professionals. | Video explaining that you can donate blood after receiving the COVID-19 vaccine. | Video explaining that you can donate blood after receiving the COVID-19 vaccine. | Video explaining that you can donate blood after receiving the COVID-19 vaccine. | Video explaining that you can donate blood after receiving the COVID-19 vaccine. | Same as above Same as above |

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