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A multi-disciplinary exploration of the press review of the Italian National Institute of Health during the COVID-19 pandemic

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ABSTRACT

This study examines how Italian national newspapers portrayed COVID-19 vaccines during 2020–2021. A corpus of 5,621 articles from seven newspapers, collected via the Italian National Institute of Health's daily press review, was analyzed with SketchEngine using corpus-assisted discourse methods. Quantitative analysis showed a rise in vaccine-related coverage at the end of 2020 and throughout 2021. Core terms such as *vaccino* (vaccine) and *vaccinazione* (vaccination) were frequent, while occasional use of synonyms like *serum* and *antidote* risked creating confusion. Qualitative analysis revealed instances of “false balance,” where anti-vaccine views were presented alongside pro-vaccine perspectives as if equally supported by evidence. These findings suggest that even authoritative outlets reproduced reporting practices that may undermine public understanding of vaccines. Greater awareness of such practices, and closer collaboration between health professionals and communication experts, could help improve the quality of health information in the media.

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Introduction

In a widely cited speech at the Munich Security Conference in 2020, the Director General of the World Health Organization (WHO) stated, “We’re not just fighting an epidemic; we’re fighting an infodemic.”¹ The term “infodemic,” which since then has become widely known, refers to the “overabundance of information and the rapid spread of misleading or fabricated news, images, and videos.”² In his speech, the Director General highlighted that “Fake news spreads faster and more easily than this virus, and is just as dangerous,” underlining the need to counter misinformation.

A systematic review analyzing infodemics during disease outbreaks up to 2019 identified social media as the primary channel for spreading misinformation, often using terms like “anecdotal evidence,” “rumours,” and “fake news” interchangeably.³ Another review conducted during the COVID-19 pandemic reached similar conclusions but noted high variability in the proportion of health-related misinformation reported by different studies, with results ranging from 0.2% to 28.8% of social media posts.⁴ According to the authors, this inconsistency largely stemmed from differences in how misinformation was defined and operationalized – a point also highlighted by Gabarron, Oyeyemi, and Wynn⁵. Nonetheless, confusion and inconsistency in the use of the terms “misinformation,” “disinformation,” “infodemic,” and “malinformation” within health research still persists.⁶ This lack of clarity complicates both research and public health responses to infodemics. Unfortunately, research indicates that misleading rather than outright fake content can be more impactful than actual content. Allen et al. found that fake news made up a negligible portion of Americans’ news consumption, while subtler forms of bias, like selective attention and framing, had a broader influence.^{7,8} Their study on Facebook’s impact on COVID-19 vaccination intentions found

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that misleading content from mainstream sources was more influential than outright falsehoods. Factually accurate but misleading headlines received far greater exposure than flagged misinformation. One vaccine-skeptical headline from the *Chicago Tribune*, for example, reached over 50 million users – surpassing the total reach of all flagged false content combined.

This result should be read in light of research showing that traditional media remain a trusted source for health information for most of the public.^{9,10} Despite this, traditional news outlets are not immune to misinformation, often due to inherent biases and framing practices. These outlets may create what is termed a marketplace of rationalizations, selectively presenting information that aligns with preexisting beliefs of both producers and audiences.^{11,12,13}

Good journalistic practice includes unbiased coverage of each side of an issue, and a mission to give voice to each opinion. This, however, may result in so-called “false balance,” or “balance as bias,” which might happen when opposing views concerning scientific topics receive equal media attention despite widespread scientific consensus favoring one view over the other. Nonetheless, this praiseworthy aim might contribute to misinformation, as seen in reporting on climate change and health issues.¹⁴ Studies suggest that such practices risk distorting public understanding of science and medicine,^{15–17} and therefore advocate for preemptive public education and more accurate, evidence-weighted reporting.^{18–21} Similarly, uncertainty in scientific reporting, an inherent aspect of scientific inquiry and academic writing (Hyland^{22,23})^{24–26} can be misrepresented or altered in translation to journalistic formats, leading to unintentional misreporting.²⁷

Therefore, there is a urgent need for public health officers to understand media ecosystems for managing infodemics and integrate media studies with public health strategies to manage information ecosystems more effectively in all seasons, beyond just addressing acute information crises.²⁸

The present study is part of a larger project analyzing the press review of the Italian National Health Institute (*Istituto Superiore di Sanità*, ISS; *Italian National Health Institute*) during the first 2 years of the COVID-19 pandemic. The ISS is one of the main Italian public health institutions and the leading technical-scientific body of the Italian National Health Service. As such, it performs research, trials, control, counseling, documentation, and training for public health, under the supervision of the Italian Ministry of Health. Arguably, during the first 2 years of the COVID-19 pandemic these tasks were particularly important in terms of national public interest, but for that very reason also particularly demanding and burdened by the absolute necessity to provide accurate and timely information to the scientific community, politicians, and the public.

The analysis aimed to explore the following:

- (a) Describe the Italian newspaper coverage of COVID-19 vaccines, by answering two main research questions:
 - Which was the frequency of usage of the different lemmas used to refer to COVID-19 vaccines, and which were their most common collocations?
 - Which was the frequency of usage of the different phrases referring to the anti-vaccine movement, and what were their most common collocations?
- (b) Evaluate the role of misinformation in media coverage, focussing on the nuanced and subtle presence of vaccine misinformation in mainstream Italian press coverage during the pandemic, exploring whether instances of false balance were repurposing and manipulation was present in the coverage of pro- and anti-vaccine perspectives.

Materials and methods

The analysis presented in this paper focuses specifically on the topic of COVID-19 vaccination, as well as on the coverage of opinions for and against COVID-19 vaccines, voiced by experts and laypeople alike. For the purposes of the study, vaccine hesitancy is defined as “a psychological state of indecisiveness that people may experience when making a decision regarding vaccination,”²⁹ whereas anti-vaccination positions are expressed by people opposing COVID-19 vaccines on principle. The study was conducted by a multidisciplinary team of public health officers and linguists, integrating public health knowledge with methodological frameworks from corpus-assisted discourse analysis.

Data collection

A corpus of newspaper articles was compiled containing articles included in the ISS press review and printed from January 1st, 2020 to December 31st, 2021 in a selection of seven main Italian national newspapers, balanced between circulation and publisher, as shown in Table 1. The database Factiva (a research tool owned by Dow Jones & Company providing access to newspaper archives) was used to retrieve the articles included in the ISS press review in .txt format. The data collection phase was 1st September 2022–31st December 2022.

Data analysis

The texts were uploaded to the SketchEngine software,^{31,32} where each article was automatically part-of-speech (POS) tagged, and manually annotated for metadata on year and source, also creating sub-corpora for each newspaper under examination. The corpus was then analyzed quantitatively and qualitatively following a corpus-assisted discourse analysis approach. Corpus-assisted discourse analysis entails the construction of vast collections of texts in a machine-readable format, which can be tagged, annotated, and analyzed quantitatively and qualitatively through dedicated software.³³ This methodology is aimed at exploring the texts' linguistic content and relationship with the wider sociocultural context, examining language in use.^{34,35} Corpus-assisted quantitative and qualitative analyses carried out for this study included analyses of 1) wordlists, 2) keyword lists, 3) concordances, and 4) collocations.

Wordlists compute the terms which appear more frequently in a corpus, either in their lemma form, word form, or in fixed combinations of two or more elements called n-grams. In processing the data, the lemmatization function in SketchEngine was here used, which retrieves occurrences at the level of the lemma rather than the individual word form. This ensures that the reported frequencies for the analyzed items cover all their inflectional variants, including masculine and feminine forms as well as singular and plural. Throughout the article, the provided translations refer to the lemma forms of the analyzed items. Furthermore, wordlists can be compiled based on raw or normalized/relative frequencies calculated on a thousand. A list of exclusion of function words (i.e., words having a grammatical function, including determiners, pronouns, conjunctions, prepositions, and auxiliary verbs) was also uploaded to the corpus so as to exclude them from the final wordlist. The exclusion list can be found in Supplementary Materials.

Keyword lists compute the most frequently used elements in a corpus compared to a reference corpus and help understand which elements are characteristic of the texts and discourses under examination. The keywords for each corpus were here retrieved using the reference corpus ItTenTen20, which includes about 12 billion words from Italian texts from the web and updated to December 2020, and which is available on the SketchEngine. Furthermore, keywords for each sub-corpus in the 2020 and 2021 corpora were retrieved, using the 2020 and the 2021 corpora as reference, respectively. Keyword lists are generated by the software based on a keyness score, calculated through the formula: $(\text{fpm focus} + N)/(\text{fpm ref} + N)$, where fpmw = frequency per million words, or normalized frequency; it was here decided to set $N = 100$, to exclude extremely rare elements.

Concordances show each occurrence of a given element within its immediate linguistic context and can be read and analyzed qualitatively, to explore a word's usage and meaning in context.

Collocations are defined as the words or lemmas which occur more frequently than could be expected by chance alone in a word's immediate surroundings; they help to define a word's semantic preference and semantic prosody, and its positive or negative connotations.³⁶ Lists of

Table 1. Newspapers included in the corpus, circulation, and publisher.

Newspaper	Circulation*	Publisher
<i>Corriere della Sera</i>	ab. 183.000 copies	RCS Mediagroup Spa
<i>La Repubblica</i>	ab. 122.000 copies	GEDI News Network Spa
<i>Avvenire</i>	ab. 96.000 copies	Avvenire Nuova Editoriale Spa
<i>La Stampa</i>	ab. 95.000 copies	GEDI News Network Spa
<i>Il Messaggero</i>	ab. 68.000 copies	Il Messaggero Spa
<i>Il Giornale</i>	ab. 65.000 copies	Soc. Europea di Edizioni Spa
<i>Il Fatto Quotidiano</i>	ab. 56.000 copies	Società Editoriale Il Fatto Spa

*Data updated February 2024 and available from ADS Accertamenti Diffusione Stampa.³⁰

collocations from concordances can be extracted using SketchEngine by selecting the interval and the statistical tests to be used. In the present study, collocations were selected by keeping the default combination of T-score, Mutual Information, and LogDice, as the combination of these tests retrieves meaningful, but not too rare, collocations. The interval was also kept by default, three positions to the left and three positions to the right of the node, in order to obtain collocations at a reasonable distance from the node, also following the mobility of the elements in the Italian sentence. SketchEngine further provides a specific function for extracting collocations and grouping them according to their logical-grammatical function, called WordSketch, which also has a graphic visualization tool; and the WordSketch difference function, which makes it possible to compare the collocations of two given words. Additionally, overlapping meanings between two or more words can also be explored using the Thesaurus function, which automatically generates a list of words belonging to the same semantic category and keeping similar collocations; similarity is calculated through a score based on the percentage of shared collocates (further information on statistics in SketchEngine is retrievable here: <https://www.sketchengine.eu/wp-content/uploads/ske-statistics.pdf>, last accessed 1st August 2024).

Finally, instances of false balance, defined as the journalistic practice of presenting two opposing perspectives as equally valid, even when only one is supported by scientific consensus, are pinpointed through qualitative close reading, following the framework proposed by Boykoff and Boykoff¹⁴ and further applied to medical journalism by Clarke.¹⁵

Results

Corpus composition

The 2020 corpus is made of 2,859 articles and 1,646,927 words; the 2021 corpus is made of 2,762 articles and 1,072,391 words. Table 2 shows the composition of the two corpora based on newspaper and month.

Wordlists and keyword lists

Vaccination

The complete list of the first 200 content words in the 2020 and 2021 corpora as well as the complete list of the first 200 keywords in the 2020 and 2021 corpora can be found in the Supplementary Materials. The most

Table 2. Composition of the 2020 and 2021 corpora.

Corpus 2020		Corpus 2021	
Newspaper	Number of articles (%)	Newspaper	Number of articles (%)
Corriere della Sera	902 (31.5%)	Corriere della Sera	756 (27%)
Il Messaggero	479 (17%)	Il Messaggero	542 (20%)
La Repubblica	439 (15%)	La Repubblica	249 (9%)
Avvenire	363 (13%)	Avvenire	343 (12%)
Il Fatto Quotidiano	263 (9%)	Il Fatto Quotidiano	213 (8%)
Il Giornale	259 (9%)	Il Giornale	359 (13%)
La Stampa	151 (5%)	La Stampa	300 (11%)
Month	Number of articles (%)	Month	Number of articles (%)
January	51 (2%)	January	401 (14.5%)
February	249 (9%)	February	297 (11%)
March	438 (15%)	March	338 (12%)
April	337 (12%)	April	254 (9%)
May	330 (11.5%)	May	179 (6%)
June	247 (9%)	June	192 (7%)
July	274 (9.5%)	July	196 (7%)
August	317 (11%)	August	154 (5.5%)
September	124 (4%)	September	186 (7%)
October	147 (5%)	October	179 (6%)
November	193 (7%)	November	193 (7%)
December	149 (5%)	December	193 (7%)

Table 3. Raw and normalized frequencies of the lemma “vaccination” and its possible synonyms in the 2020 and 2021 corpora.

Italian lemma (English translation)	2020		2021	
	Raw	Normalized frequency*	Raw	Normalized frequency*
Vaccino (vaccine)	2,034	1.23	4,709	4.39
Vaccinazione (vaccination)	276	0.16	1,985	1.85
Somministrazione (administration)	128	0.07	906	0.84
Iniezione (injection)	40	0.02	303	0.28
Antidoto (antidote)	31	0.02	144	0.13
Siero (serum)	30	0.02	69	0.06
Immunizzazione (immunization)	30	0.02	185	0.17
Inoculazione (inoculation)	5	0.003	54	0.05

*Lemmas are here presented in order of frequency; normalized frequency is calculated using the formula: (total number of occurrences/the total number of words in the corpus)*1,000.

frequent words in the 2020 corpus can be divided into four main groups, based on their semantic content: the words needed to describe the new virus (6% of words, 15.5% of keywords); the progress of contagion (22% of words, 36.5% of keywords); the regulations enforced to reduce contagion (11.5% of words, 13% of keywords); and the people and institutions responsible for such regulations (7% of words, 22.5% of keywords). The lemma “vaccino” (vaccine) also appears among the first 100 most frequent words and is a strong keyword in the 2020 corpus compared to general Italian. The analysis of the most frequent words in the 2021 corpus also shows that these could be divided into four main semantic groups, namely: the progress of contagion (16% of words, 24.5% of keywords); the regulations enforced to reduce contagion (4.5% of words, 9.5% of keywords); the people and institutions responsible for such regulations (7.5% of words, 11.5% of keywords); and vaccination (5.5% of words, 13% of keywords). The most frequently used lemmas belonged to the semantic sphere of vaccination were “vaccinare” (to vaccinate); “vaccino” (vaccine); “dose”; “vaccinazione” (vaccination); “campagna” (campaign); “green pass” (the certificate attesting that the person had received the COVID-19 vaccine, which was required to work and to access some services); and “somministrazione” (administration). The lemmas “vaccinare” (to vaccinate) and “vaccino” (vaccine) are also strong keywords in the 2021 corpus compared to general Italian. Various lemmas which could be used as possible synonyms of the word “vaccino”/vaccine in general language also appear in the two corpora, albeit with different frequencies, as shown in Table 3.

Figure 1(a–d) shows the distribution of lemmas synonymous of vaccino/vaccine in the two corpora and relative sub-corpora.

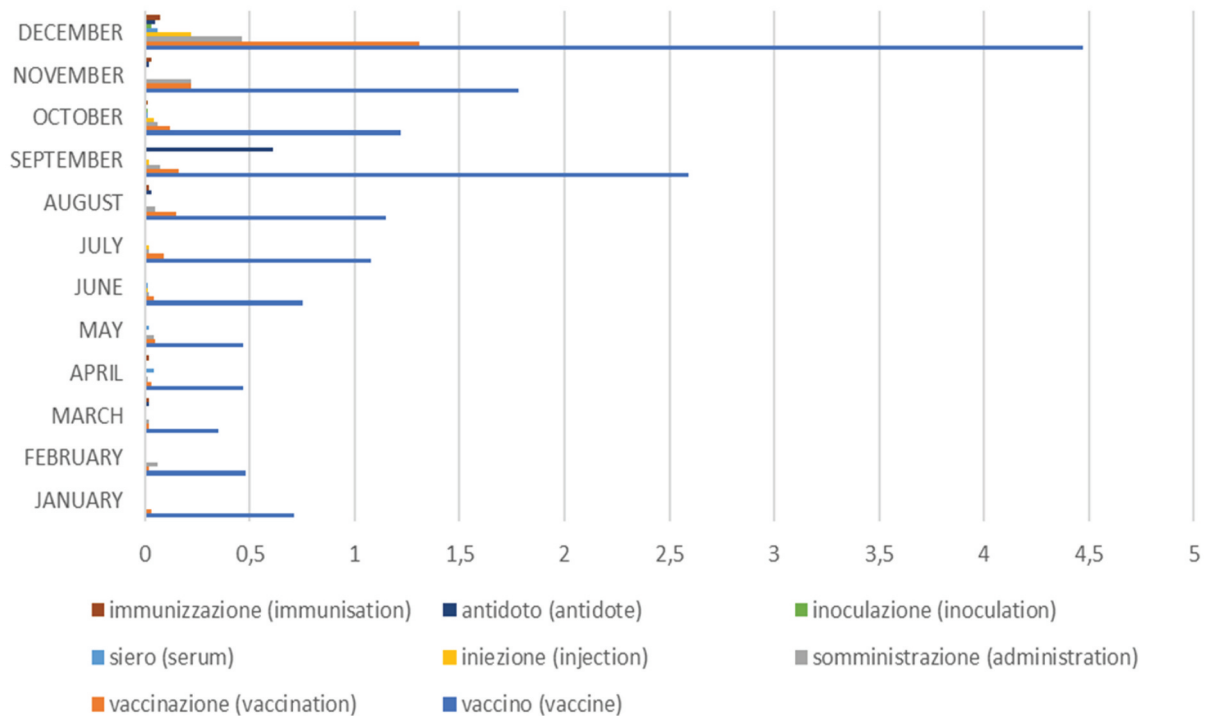
The anti-vaccination movement and community

Lemmas referring to the anti-vaccination movement and community were specifically looked for in the two corpora. The lemma “no vax” (the Italian translation of “anti-vax”) occurred very rarely in the 2020 corpus (raw frequency: 12, normalized frequency: 0.0006), as its hyphenated variant “no-vax” (raw frequency: 5, normalized frequency: 0.0002). Conversely, in the 2021 corpus, the lemma “no vax” was used more frequently, with 268 occurrences (normalized frequency: 0.24), to which 70 occurrences of its hyphenated form “no-vax” should be added (normalized frequency: 0.06); “vax” also appears among the corpus’s keywords compared to general Italian (keyness score: 2.5).

The “word” boxes

The closer lexical analysis of the two corpora further showed that some newspapers created glossaries at the end of news articles in the form of small boxes, graphically separated from the body of the text with the aim to define or explain terms (single words or phrases) likely perceived as important in the discourse and/or possibly difficult for the reader to understand. A total of 206 entries were found in the 2020 corpus, encoding 96 individual words (as some headwords were defined several times by different newspapers or by the same newspaper in different articles) which were distributed as follows: *Corriere della Sera*: 131 entries, 80 headwords; *Avvenire*: 62 entries, 20 headwords; *Fatto Quotidiano*: 11 entries, 11 headwords; *Repubblica*: two entries, two headwords. Also, in the 2021 corpus, 103 headwords were coded for a total of 161 entries. However, the practice was only upheld by *Corriere della Sera*, which encoded 87 headwords for a total of 134 entries, the last of which on 31st December 2021; and partially by *Avvenire*, which encoded 19 headwords

(a) Distribution of lemmas referring to vaccination in the 2020 corpus (months)



(b) Distribution of lemmas referring to vaccination in the 2020 corpus (newspapers)

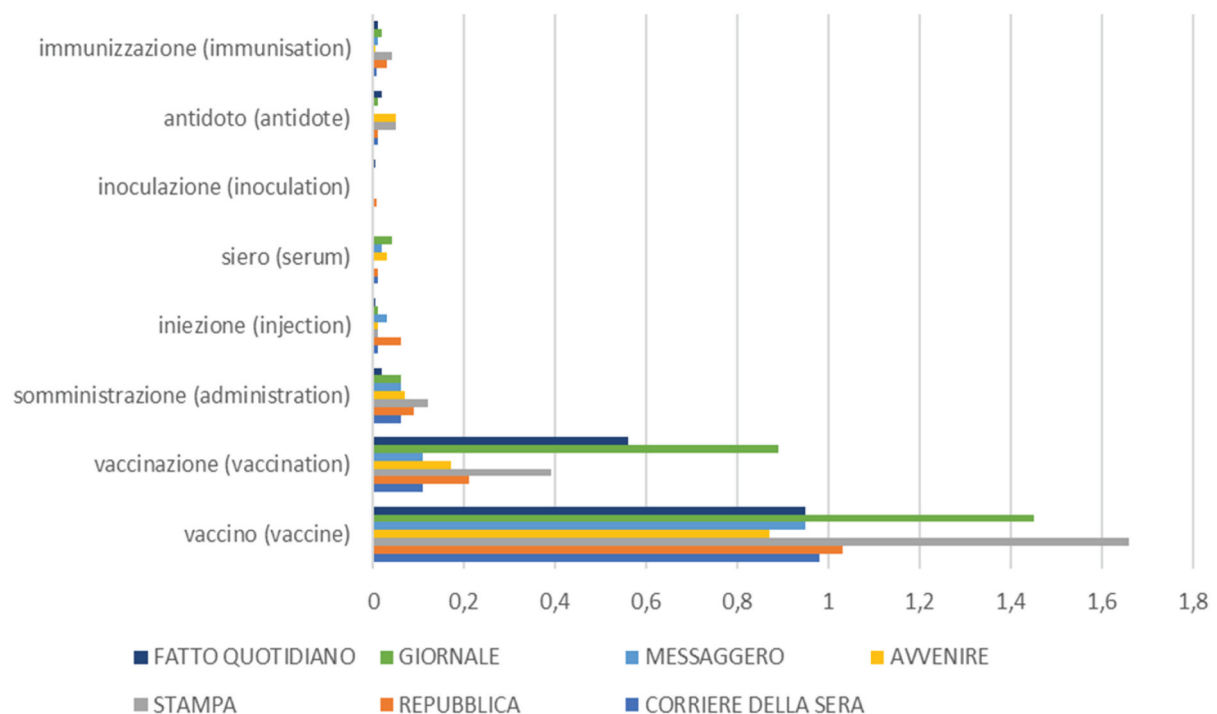
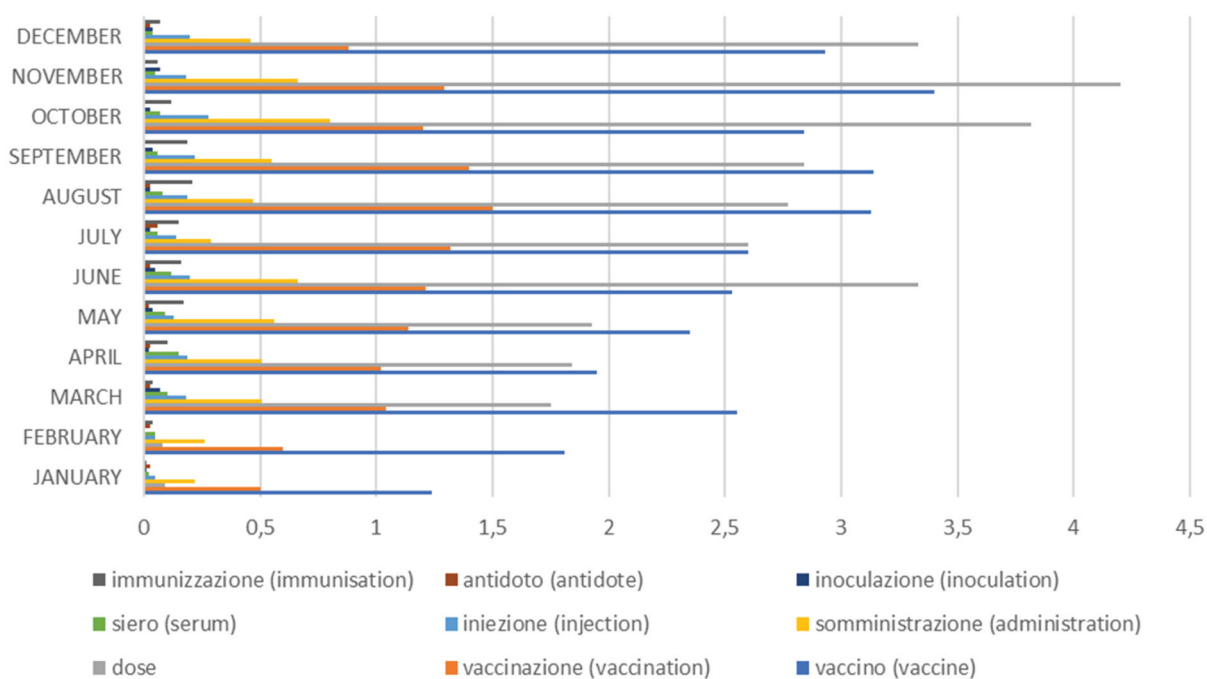


Figure 1. Distribution of lemmas referring to vaccination in the corpora and sub-corpora. *The x-axis shows the normalized frequency of each word (it is useful to remind here that normalized frequencies are calculated by dividing the number of occurrences of an element within the corpus by the total number of words in the corpus and then multiplying the result by a common factor, here one thousand). The x-axis shows the relative frequency of the lemmas in the corpora.

(c) Distribution of lemmas referring to vaccination in the 2021 corpus (months)



(d) Distribution of lemmas referring to vaccination in the 2021 corpus (newspapers)

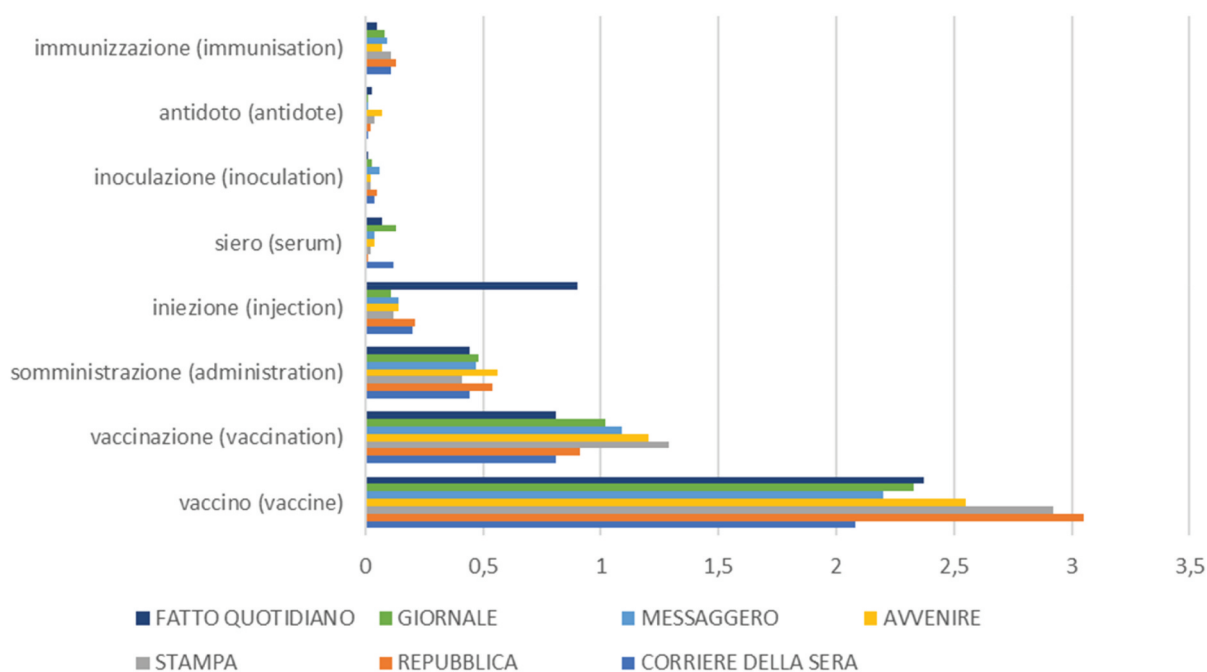


Figure 1. (Continued).

for a total of 27 entries, the last of which on 23rd June 2021. The headwords defined in the 2020 corpus can be traced back to five main semantic spheres, which largely overlap with those identified by the analysis of the most frequent words and keywords, namely: words needed to describe the new virus; referring to the progress of contagion; referring to the measures taken to prevent contagion; referring to people and institutions responsible for the enforcement of such measures; and specialized medico-scientific lexicon. Conversely, 80% of the headwords defined in the 2021 corpus belonged to specialized medico-scientific lexicon. The headwords defined in the 2020 corpus did not explicitly refer to the topic of vaccination (except for one single entry explaining the meaning of “adenovaccino” (adenovirus-based vaccine)), but some of them explored the concepts of immunity: “immunità” (immunity, two entries), “immunità di gregge” (herd immunity, three entries), and “IgM/IgG” (three entries). Conversely, 25% of the headwords defined in the 2021 corpus referred to vaccination. Some of these entries referred to “immunità di gregge” (herd immunity) and “immunità naturale” (natural immunity); others delved into the technology of “vaccini a mRNA” (mRNA vaccines); some clarified the meaning of words which can be used in general language but with a different sense, such as “efficacia” (efficacy/effectiveness) and “booster” (booster shot); and finally, others defined and explained measures for (compulsory) vaccination such as the abovementioned “green pass.” Although most entries took the form of definitions or descriptions, other lexicographic strategies such as translation, exemplification, paraphrase, and etymology were also employed. A close reading of the entries revealed that a number of definitions, especially those concerning “immunità naturale” (natural immunity), “efficacia” (efficacy), and “booster,” included elements of vagueness, hedging, or factual inaccuracies.

Concordances and collocations

Vaccination

The complete list of shared collocates (i.e., words that co-occur with more than one of the listed lemmas) is given in the Supplementary Materials (except for the nouns “siero” and “inoculazione,” whose synonyms could not be retrieved by SketchEngine due to the small number of occurrences). [Figure 2](#) shows the visualization of the shared collocates of the lemmas “vaccino” (vaccine) and “vaccinazione” (vaccination) in both corpora. The lemmas appearing in [Figure 2](#) are translated in [Table 4](#).

Both “vaccino” and “vaccinazione” appear as synonyms; “antidoto” (antidote), “farmaco” (drug), and “profilassi” (prophylaxis) are also included as synonyms for “vaccinazione.” Furthermore, both lemmas are linked to terms referring to other preventive measures such as “mascherina” (mask), “coprifuoco” (curfew) and “lockdown,” to screening (“test,” “screening”) and swab tests (“tampone”), to scientific research (“studio,” study; “ricerca,” research), to vaccine safety and effectiveness (“anticorpo,” antibody; “risposta,” response), and to vaccination enforcement (“piano,” plan; “operazione,” operation; “campagna,” campaign). Words belonging to the semantic sphere of war also stand out as having similar patterns of usage: the Figure shows the noun “guerra” (war), and the Tables in the SM also list “battaglia” (battle), “lotta” (fight), “arma” (weapon), and “scudo” (shield). The concordances show that they were consistently used to refer to the metaphor of war against the virus, where vaccination is considered a possible powerful ally. The lemmas “allarme” (alarm, warning) and “allerta” (alert) are also included in the lists in the Tables; however, the analysis of their concordances shows that the alarm was raised by pandemic trends, and not by vaccination itself, which was rather framed as a possible way to manage contagion. The other terms analyzed show partially overlapping shared collocates, and some specificities: for instance, the lemma “somministrazione” was frequently used in conjunction with words pointing to the process of development, production, and distribution of vaccine vials.

The 30 occurrences of the lemma “siero” in the 2020 corpus and the 144 occurrences in the 2021 corpus were explored in more detail: the first aim was to assess whether the noun was used with the same denotative meaning of “vaccine,” and the second aim was to understand whether it had a different connotative meaning (i.e., if it evoked different cultural or emotional associations). To this end, concordances were read and divided into sentences where the noun was used with a different meaning, sentences with a pro-vaccination stance, sentences with an anti-vaccination stance, and sentences with a neutral stance.

The screening of the 2020 corpus revealed that in 14 sentences the noun “siero” was used to refer to serological tests, and in 16 sentences it was used as synonym for “vaccine.” In nine out of these 16 occurrences, the lemma was used neutrally, sometimes to avoid repetition (our emphases):

Table 4. Lemmas included in Figure 2, in alphabetical order, and their English translations.

Lemma	English translation	Lemma	English translation
allerta	alert	numero	number
anno	year	operazione	operation
anticorpo	antibody	parte	part
antidoto	antidote	persona	person
campagna	campaign	piano	plan
caso	case	prenotazione	reservation
ciclo	cycle	produzione	production
contagio	contagion	profilassi	prophylaxis
copertura	coverage	protezione	protection
coprifuoco	curfew	regione/regioni	region/regions
dato	datum	restrizione	restriction
decesso	death	ricerca	research
discesa	descent	richiamo	booster shot
esposto	exposed	ricovero	hospitalization
farmaco	drug	risposta	response
focolaio	hotspot	scuola	school
giorno	day	segnalazione	warning
governo	government	settimana	week
guerra	war	sistema	system
immunizzazione	immunization	situazione	situation
indagine	survey	somministrazione	administration
iniezione	injection	sperimentazione	trial
Italia	Italy	studio	study
lezione	lesson	tampone	swab test
mascherina	mask	vaccinazione	vaccination
mese	month	vaccino	vaccine
misura	measure	variante	variant
mossa	move	verifica	test
morte	death	vittima	victim
notifica	notification		

- “At an advanced stage is the vaccine developed by a collaboration between Oxford University and the Italian company Advent-Irbm of Pomezia, which has started human trials, administering its serum to over 510 healthy people.”

Six sentences overtly expressed a favorable attitude to the vaccine:

- “We could have the two serums as a Christmas present.”
- “The great race for the serum which should defeat the virus.”

In one case the noun was used to report vaccine hesitancy:

- “Healthcare professionals, among the first to receive the serum, do not all seem willing to adhere to the vaccination campaign.”

In 2021, the lemma was mostly used as a synonym for “vaccine”; it referred to serological tests in three occurrences, and it was used metaphorically in one occurrence in the phrase “serum of truth.” In ten occurrences, “serum” was used in sentences discussing the vaccine’s alleged side effects, while in other ten sentences it was used to report vaccine-skeptical positions. In one case, the noun was used by one vaccine-skeptical interviewee and juxtaposed to the term “vaccine”:

- “My choice was to stall and wait for more serums, because the current products baffle me. I would not call them vaccines, but molecular biology complexes. Pfizer and Moderna risk changing genetic codes, the other two use products that touch the conscience from an ethical point of view, namely cell lines from aborted fetuses.”

However, it appears the two terms have been used interchangeably, as in (our emphases):

of these, 14 sentences displayed a neutral stance, two expressed an overtly positive stance, and four expressed negative attitude. The following example is an instance of positive attitude:

- “Receiving the first dose of the antidote is an act of love and duty.”

While the ensuing example is an instance of negative attitude:

- “The antidote was allegedly tested on a small number of people and for little time.”

Notably, the idea of ongoing research and experimentation on the antidote was present in 50% of these sentences, as in:

- “The high rate of contagion and the wide spread of the virus make the continent an ideal ecosystem for testing different antidotes.”

In the 2021 corpus, the word was used metaphorically in four occurrences, and was otherwise used as a neutral synonym for vaccine, as in the following:

- “It is enough to delve into the data of the latest report on the pandemic, published by ISS, to record that the vast majority of cases of SARS-CoV-2 reported in Italy in the last 14 days concern people who have not been vaccinated, or who have been vaccinated with the first dose, or even with the single-dose antidote but before the end of the two weeks necessary to develop a complete immune response.”

The anti-vaccination movement and community

The closer reading of the 17 occurrences of “no vax” (the Italian equivalent of “anti-vax”) in the 2020 corpus revealed that in 8 cases the word was used within direct quotations from interviewees, experts in the medico-scientific fields who were commenting on the anti-vaccination community, as in the following excerpt:

- “Do you think it is useful to vaccinate Italians against influenza?” “I feel sorry for the anti vax people – in fact, I don’t feel sorry at all, if anything I feel sorry that they are being listened to so much – but mass vaccination would make it easier for healthcare to discern COVID-19 cases from others.”

In other cases, anti-vax theories are ambiguously mentioned alongside possible side-effects of the COVID-19 vaccine, as in the following extract (our emphases):

- News and doubts are chasing each other, anti-vax and deniers have spread numerous hoaxes and in the confusion many are afraid of the contraindications, so much so that the ISS has launched an information campaign on the vaccine days ago, from December 24, with a section dedicated to FAQs to refute and disprove the most widespread hoaxes both online and off the web. And with one fundamental recommendation: [...] the rules remain: even after undergoing vaccination, one must continue to observe protective measures toward others, such as wearing a mask, keeping social distance and washing one’s hands thoroughly. This will be necessary until immunization data prove with certainty that, in addition to protecting oneself, the vaccine also prevents transmission of the virus to others.

In both examples, anti-vax theories are mentioned intertextually and polyphonically, that is, the authors of the texts acknowledge the existence of anti-vax theories and positions which are spread through other media, and report their views without adopting them. Notably, however, the second example places much emphasis on the need to “prove with certainty” that the vaccine could help to “prevent transmission” in addition to vaguely “protecting” the patient.

The semantic prosody of the 338 occurrences of the phrase “no(-)vax” in the 2021 corpus is captured by its most frequent collocates, shown in [Table 5](#).

These collocates appear connected to two main topics: the collective dimension of the anti-vaccination movement (“piazza”/”square,” “movimento”/”movement,” “gruppo”/”group,” “milione”/”million”) and their main ideas (“teoria”/”theory,” “argomento”/”topic,” “divieto”/”ban,” “lockdown,” “Green Pass”). Of note here

Table 5. First 30 collocates of the lemma “no vax” in the 2021 corpus, together with the score obtained by the statistical tests used.

Lemma (English translation)	T-score MI LogDice	Lemma English translation	T-score MI LogDice
teoria (theory)	2.45 9.75 9.27	divieto (ban)	1.71 6.22 7.46
convincere (to convince)	3.15 7.83 9.13	gruppo (group)	1.71 6.11 7.40
piazza (square)	2.64 8.05 8.97	green	1.96 5.74 7.35
movimento (movement)	1.99 8.58 8.58	contro (against)	2.76 5.37 7.30
ascoltare (to listen)	1.99 8.20 8.48	mondo (world)	1.70 5.60 7.11
irriducibile (irreducible)	1.73 10.31 8.43	lockdown	1.69 5.43 7.00
non (not)	3.13 6.64 8.38	finire (to end)	1.68 5.12 6.79
news	1.73 9.40 8.36	pass	1.66 4.55 6.37
fake	1.73 9.31 8.35	scendere (to go down)	1.66 4.53 6.36
indeciso (uncertain)	1.73 8.97 8.30	sanitario (sanitary)	2.12 4.33 6.32
scettico (sceptical)	1.73 8.84 8.29	medico (MD)	1.89 4.23 6.19
argomento (argument)	1.73 8.33 8.20	mentre (while)	1.88 4.10 6.07
minaccia (threat)	1.73 8.02 8.13	milione (million)	1.86 3.87 5.87
occhio (eye)	1.72 7.71 8.05	sempre (always)	1.61 3.77 5.73
duro (hard)	1.72 6.79 7.73	dire (to say)	2.06 3.64 5.70

T-score, MI, and LogDice are statistical measures that assess whether two words occur together more often than chance would predict. The T-score highlights frequent, stable combinations by weighing observed co-occurrence against the expected frequency, thus favoring common patterns. Mutual information (MI) instead measures the relative strength of association between words, often bringing out rarer but tightly bound pairs, though it can overvalue infrequent combinations. LogDice provides a compromise by balancing frequency and association strength on a fixed scale, which makes results more comparable and less sensitive to extreme word counts.

is the presence of two adjectives, namely “indeciso” (undecided) and “scettico” (skeptical), which hint at a vaccine hesitant position, rather than at an outright opposition to vaccination; these adjectives however coexist with other qualifying attributes which negatively describe anti-vaccinationists as “irriducibili”/“irreducible,” as a “minaccia”/“threat,” and which connect their beliefs to “fake news.” The latter are expressed in the following excerpt from an interview to a member of the Institute:

- “How much weight will be given to the fake news spread by the Anti Vax? A lot of nonsense is being said, unfounded and absurd news. Even the tones used by those who are against vaccines have become aggressive, excited, alarmist. There has even been talk of a reduction in fertility in younger people: but which diabolical conspiracy could aim at this?”

See also the following text, taken from an article about the restrictions in place during the Christmas holidays:

- “The axe of no-vax fake news also falls on Christmas tables, increasing the risk of contagion during family festivities.”

Qualitative close reading and false balance

The qualitative close reading of the concordances and the texts included in the corpus reveals examples of journalistic practices which are difficult to notice at the lexical or even at the sentence and text level, but which may become apparent when considering the newspaper as a whole linguistic and cultural product which can be variably consumed by readers, often in conjunction with other media. One such journalistic practice is the commendable search for balanced reporting, which, however, risks resulting in false balance when covering health and science topics.

One example of false balance when covering the topic of COVID vaccinations can be found within the 2021 corpus, in two articles published in two consecutive days by the same newspaper. One text is an interview with a well-known specialist in infectious diseases, in which the expert was commenting on various aspects of the management of the pandemic, including vaccination. This theme was given particular prominence in the headline, through a direct quotation from the interview: “I can’t understand people who are against protecting themselves; [I say] no to the general obligation, but yes for health workers and school staff.” However, on the following day, another interview with a medical doctor, who was not a specialist in infectious diseases or other discipline related to the management of the COVID pandemic, was published in the same newspaper. As stated in the by-line, “[T]he ASL [*Azienda Sanitaria Locale*, Local Health Authority] suspended him because he did not vaccinate. So many years in a white coat, yet his words

exude mistrust in science: now he risks dismissal.” The headline of the article also contains a direct quotation from the interview: “I’m not an anti-vax, I just don’t trust these serums.” Of note here is the interviewee’s statement, who purports not to hold anti-vaccination, but merely vaccine-skeptical views.

Another example of false balance in vaccination coverage could be found in another broadsheet, where two articles with contrasting headlines were published 3 days apart. The first (written by a renowned Italian immunologist as a guest writer) was entitled “Covid, too many hospitalizations: yes to the vaccine for children,” whereas the second was entitled “Covid vaccine, all the doubts for the children.” While the first article provided ample space to the unequivocally positive opinion of the immunologist, the second reported extensively on the doubts expressed by various interviewees, both from the medical and the political fields. In the text, misgivings and uncertainties acquired a great pragmatic and textual prominence both because they were mentioned in the headline and because the information within the text was organized in such a way that a positive evaluation of the vaccine was provided at the beginning of the article (i.e., it was presented as the known information), while the doubts were described in the body and ending of the text (i.e., in the rhematic position, being the focus, the new information, more easily remembered by the reader because it is given in the closing). Additionally, this artificial juxtaposition of several different points of view can be said to give rise to a staged debate among scientists and politicians, further suggesting – and to some extent fabricating – controversy and uncertainty.

Discussion

The corpus-assisted discourse analysis of the Italian National Institute of Health press review for 2020–2021 presented in this article showed that mentions of “vaccino” (vaccine) and related terms increased notably in late 2020, aligning with EMA authorizations and the rollout of mass vaccination campaigns.³⁶ Media coverage emphasized safety and effectiveness, while lexical choices such as “siero” (serum) and “antidoto” (antidote) revealed nuanced connotations, including subtle expressions of mistrust.^{37–41}

To our knowledge, this study is the first to combine corpus-based linguistic analysis with public health objectives in examining COVID-19 vaccination discourse. These findings complement survey- and narrative-based studies which have recently been conducted in Italy. Fattorini and Loner⁴² analyzed media narratives from 2016 to 2023 from the perspective of sociology of health and noted persistent framing of vaccines around risk and hesitancy, and Fattorini⁴³ showed that parents’ interpretation of scientific expertise can reinforce skepticism. Similarly, Barbieri’s et al.⁴⁴ survey-based approach highlighted the influence of inconsistent messaging on public mistrust, while Del Ponte et al.⁴⁵ explored “open-day” initiatives to overcome COVID-19 vaccine hesitancy in Italy and found that effective institutional messaging can boost vaccination coverage. Unlike these studies, our corpus-based approach captures lexical and discursive patterns in mainstream newspapers, thus providing complementary evidence of the linguistic environment influencing public perception.

Quantitative analysis did not reveal extensive negative coverage; vaccines were largely presented as effective, although terms associated with the anti-vaccination community sometimes conflated outright refusal with indecisiveness.²⁹ This aligns with Del Ponte et al.⁴⁵ and Barbieri et al.⁴⁴, who distinguish between vaccine hesitancy and firm refusal, highlighting the need for targeted communication strategies differentiating between the two groups. Qualitative analysis also identified instances of false balance, again echoing Fattorini et al. (2025) and other previous studies^{6,46} showing that misleading news may affect public perceptions of vaccination. Arguably, such editorial practices can unintentionally reinforce hesitant narratives, even in mainstream outlets,^{7,20} suggesting the importance of critical examination of journalistic mechanisms.

The present study has several limitations. Although the corpus is of a good size and was constructed from the press review of the ISS, and therefore represents a reasoned selection of widely circulated and editorially heterogeneous newspapers, it does not include all the articles published by Italian newspapers during the pandemic; consequently, the results cannot be generalized. Furthermore, some of the results of the quantitative analysis could vary slightly by modifying the parameters chosen: in particular, different collocations could be obtained by selecting a different range of positions to the right and/or left of the node or by modifying the statistical tests used, although we minimized the risk of obtaining biased results by adopting standard tests and intervals. Finally, the social media pages and webpages of the newspapers were not included in the analysis; however, there are no substantial differences between the online and offline versions of the newspapers included in the corpus, as their social media pages mainly function as

noticeboards that link to the content of the website, which is covered by a paywall and largely reproduces the content of the printed edition.

Despite these limitations, the analysis has provided a comprehensive view of the ways in which the lemmas “vaccine,” “vaccination,” and their synonyms were used by a representative selection of mainstream Italian national newspapers during the first 2 years of the COVID-19 pandemic, unveiling the mechanisms which underlie the drafting of newspaper articles dealing with public health topics. Public health authorities could benefit from a preemptive inoculation about such mechanisms,^{7,20} which could help them better foresee their possible positive and negative outcomes when interacting with the press, acting as a kind of social vaccine.^{47,48}

Beyond the specific findings, our results point to the importance of targeted professional training. In line with WHO’s essential public health functions, training programs for health professionals should include modules on media communication, risk appraisal, and the management of information ecosystems. Developing these skills would not only improve the clarity and reliability of public messages but also strengthen the capacity of public health institutions to anticipate and respond to infodemics. Brief, practice-oriented training interventions, designed jointly with communication experts, may thus represent a cost-effective strategy to enhance both institutional preparedness and public trust.

Conclusions

This study set out to describe Italian newspaper coverage of COVID-19 vaccination during 2020–2021 by addressing three main research questions. With respect to the use of vaccine-related terminology (RQ a), newspapers relied consistently on lemmas such as *vaccino* (vaccine) and *vaccinazione* (vaccination), while synonyms like *siero* (serum) and *antidoto* (antidote) appeared less frequently. Collocational patterns linked vaccination to concepts of protection, campaigns, and administration, underscoring both the scientific and organizational dimensions of the immunization effort; conversely, synonyms like serum and antidote carried connotations that sometimes reflected mistrust. In relation to the representation of the anti-vaccine movement (RQ b), references to “no vax” were rare in 2020 but increased sharply in 2021, often associated with collective mobilization and negatively evaluated through collocates such as *minaccia* (threat) and *fake news*. Finally, in examining the role of misinformation (RQ c), the analysis found no systematic support for anti-vaccine positions but did reveal cases of false balance, where pro- and anti-vaccine perspectives were juxtaposed as if equally supported by evidence. These journalistic practices, though well intentioned, may inadvertently foster misleading interpretations and undermine public trust. Taken together, these results highlight the central yet complex role of the press in mediating medico-scientific information. They point to the need for precise terminology, critical reflection on journalistic conventions, and closer collaboration between journalists and public health professionals to ensure that transparent, evidence-based communication reaches communities not only during emergencies but also in ordinary times. The key take-home messages are summarized in [Figure 3](#).



Figure 3. Key take-home messages.

Author contributions

CRedit: **Carlotta Fiammenghi**: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft; **Elisabetta Ceretti**: Conceptualization, Project administration, Supervision, Writing – review & editing; **Loredana Covolo**: Project administration, Supervision, Writing – review & editing; **Nicola Pelizzari**: Methodology, Validation, Writing – review & editing; **Mirella Anna Taranto**: Conceptualization, Project administration, Resources, Supervision, Writing – review & editing; **Luana Penna**: Conceptualization, Project administration, Resources, Supervision, Writing – review & editing; **Laura Brunelli**: Supervision, Writing – review & editing; **Silvio Brusaferrò**: Resources, Supervision, Writing – review & editing; **Umberto Gelatti**: Conceptualization, Project administration, Supervision, Writing – review & editing.

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