The vaccine in two Brazilian newspapers before and during COVID-19[a]

A vacina em dois jornais brasileiros antes e durante a covid-19

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ABSTRACT

In this article, we analyze 2,120 news stories on vaccine published by the newspapers *O Estado de S. Paulo* and *Folha de S.Paulo* in 2019 and 2020 – before and during the COVID-19 pandemic – in order to understand the changes in the approach to this topic by the press. Using a computer-assisted content analysis methodology, we identified the main elements of the stories in both periods. The results show that the increase in the production of vaccine content was accompanied by the shift from service journalism to a more scientific approach and by the insertion of a diversity of actors, organizations, and countries – revealing characteristics of the political, economic, and ideological aspects that permeate science.

Keywords: Science journalism, vaccine, COVID-19

RESUMO

Neste artigo, analisamos 2.120 matérias sobre vacina publicadas pelos jornais *O Estado de S. Paulo* e *Folha de S.Paulo* em 2019 e 2020 – antes e durante a pandemia da covid-19 – com o objetivo de compreender as mudanças na abordagem desse tema pela imprensa. Com uma metodologia de análise de conteúdo assistida por computador, identificamos os principais elementos das matérias nos dois períodos. Os resultados mostram que o aumento na produção de conteúdo sobre vacina foi acompanhado pela passagem de um jornalismo de serviço para uma abordagem mais científica e pela inserção de uma diversidade de atores, organizações e países – características reveladoras dos aspectos políticos, econômicos e ideológicos que permeiam a ciência.

Palavras-chave: Jornalismo científico, vacina, covid-19

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FOR ALMOST FIVE decades, Brazil has had a successful National Immunization Program (PNI), created in 1973 to coordinate the country's vaccination policy. Since then, the PNI has been responsible for regulating the immunization calendar, introducing new vaccines, standardizing technical procedures, and adopting innovative strategies, such as combining routine vaccination with large campaigns (Silva Jr., 2013). In the wake of the eradication of smallpox in the early 1970s and the creation of the Brazilian Unified Health System (SUS) in the 1988 Constitution, the program has consolidated itself as an important public health policy, responsible for the eradication of diseases such as polio and, for a certain period, the measles.

With the COVID-19 pandemic, declared in March 2020 by the World Health Organization (WHO) – during which Brazil became the second country with the most deaths by the virus –, and the political context of the country, the supply of vaccines against the disease for all Brazilians could not be handled by the country's expertise in this area. The first vaccines were approved at the end of December of that year, but the obstacles created by the Brazilian government delayed the start of the campaign and caused inequalities in the criteria and progress of vaccination among the states. By May 2021, Brazil had vaccinated just over 22 million people with two doses of the COVID-19 vaccine, which represents only 10.5% of the population ("Brasil já…," 2021), in clear contrast to previous experiences of large-scale immunization[1].

Health interventions are complex social processes whose success is due to several factors. When part of the result also depends on an individual decision, as in the case of the vaccine, one of the main factors for its success is communication, both institutional and mediated by the press on the most diverse platforms. Many studies attest that communication and, more specifically, journalism have the potential for social mobilization, risk perception, and the adoption of protective measures (Chen & Stoecker, 2020; Goldstein et al., 2015; Vai et al., 2020). Therefore, media approaches, framing, and editorial decisions can play a key role in public understanding of scientific and health issues and citizens' behavior. The scenario becomes even more complex in a communication environment characterized by *information disorder* (Wardle & Derakhshan, 2017), with the circulation of fake news and conspiracy theories, largely disseminated by denialists or members of the so-called anti-vax movements (Hussain et al., 2018; Johnson et al., 2020).

Due to the centrality of communication, it is necessary to understand how the Brazilian press has approached the theme of vaccines in its coverage. Furthermore, we have the opportunity to investigate communication phenomena and processes in the context of a global public health emergency unprecedented in recent history. Therefore, in this study, we undertook an exploratory,

[1] Annual campaigns against poliomyelitis manage to vaccinate 15 million children in a single day. The first national measles vaccination campaign for the population aged 9 months to 14 years in 1992 vaccinated more than 48 million children in two months. In 2001 and 2002, the vaccination campaign for women of childbearing age distributed the double viral vaccine (rubella and measles) to approximately 29 million women (Ministério da Saúde, 2003).

comparative, and longitudinal analysis of all pieces on the subject of vaccines published by two of the main Brazilian newspapers – *O Estado de S. Paulo* and *Folha de S.Paulo* (herein called *Estadão* and *Folha*) – in 2019 and 2020, that is, before and during the COVID-19 pandemic.

HEALTH CRISES, VACCINES, AND COMMUNICATION

Outbreaks, epidemics, and pandemics do not just motivate research in the medical and biological fields. In the communication and science communication research area, there is a tradition of studies that address the role of the media in these contexts, demonstrating the media's importance as a source of information and its contribution to positioning the subject in the public sphere (Dudo et al., 2007; Ihekweazu, 2016; Medeiros & Massarani, 2010; Tian & Stewart, 2005). Therefore, the interests and editorial choices that guide the coverage of a health emergency can significantly affect the public's understanding of the problem (van den Bulck & Custers, 2009), individual and community attitudes (Rezza et al., 2004), and even broader issues, e.g., the adoption of public policies in response to the problem (Bonneux & van Damme, 2006). Such aspects are especially important in the current crisis as the world has been forced to adopt strict measures of social isolation and individual protection, such as the use of masks, and to promote mass vaccination on a global scale, the most effective way to control the pandemic.

This interconnection has been identified at other periods in history, as shown by Nascimento (2018) in his study with scientific pieces on poliomyelitis vaccination published by the newspapers *O Globo*, *Estadão*, and *Folha* in the 1970s and 1980s. The researcher notes that the low demand of the population was accompanied by the emergence of new formats of stories that presented vaccines as beneficial instruments for society and immunology as cutting-edge science. Inserted into people's daily lives over the years, journalistic coverage related to vaccines began to assume relevant social functions, such as service provision, science communication, and health promotion. These functions were identified to different degrees in a survey that analyzed 132 articles published by *Folha* from 2018 to 2019 (Massarani, Leal et al., 2021). The study shows that the framing related to public policies was predominant, focusing on public actions for the immunization of the population.

However, even consolidated public policies based on scientific evidence are not without controversy. One of them, concerning the HPV vaccination campaign in 2014, was addressed by Quevedo et al. (2016). As the disease is sexually transmitted, the campaign triggered the moral values of society because it was aimed at teenagers. The researchers note that, while institutional

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communication failed to promote a broad debate on the benefits and risks of
the vaccine, the communication produced by the media addressed procedural
immunization topics and gave voice to audiences critical of vaccination. Still on
moral issues, the research by Sacramento and Paiva (2020) shows that even
among people who decide to vaccinate there is the activation of religious values as
a "security and protection anchor in the face of so many paradigms, information,
truths, and lies in constant profusion" (p. 102).

Statistical projections even suggest a correlation between communication
and vaccination coverage, as in the study by Chen and Stoecker (2020) on US
newspapers. The authors estimated that every 100 pieces on flu published in
October (when the US's "flu season" begins) from 2010 to 2017 were associated
with a 0.3 percentage point increase in the vaccination rate against the disease by
people over 65 years old. The opposite was verified by Wilson and Wiysonge (2020)
in relation to social media. They analyzed 250,000 vaccination-related posts from
2018 to 2019 and, using a five-point disinformation scale, estimated that each
additional point on the scale was associated with a decrease of approximately
two percentage points in average vaccination coverage.

Therefore, it is necessary to pay attention to the articulation of anti-vax groups
on the internet. Almeida (2019) found that 22% of the links shared on the page of
one of these groups on Facebook used a journalistic source. However, the contents
of these sources were appropriated by the participants, who gave them a new
interpretation to reinforce the group's values. With the COVID-19 pandemic,
these groups began to target the new disease. According to a survey by União
Pró-Vacina from the Universidade de São Paulo (USP), 78.4% of the posts made
on these pages disseminated conspiracy theories, used false information or without
evidence, distorted reliable information, and suggested the use or commerciali-
zation of products and treatments not scientifically validated (Rafael Jr., 2020).

In addition to their specific findings, these studies show that the communi-
cation processes related to vaccines reflect the mediatization of science in general,
in which different actors compete not only for the relevance of information
and for the legitimation and commodification of knowledge (Oliveira, 2018)
but also for the very notions of true and false. One of these actors, journalism,
despite having historically built a status of informative authority, has been con-
tinually scrutinized, especially with the severe health crisis that began in 2020.
It is undoubtedly an event that makes any issues related to the communication
of science and health today more sensitive, and we will address this with the
methodological and analytical procedures presented below.

METHODOLOGY

Selection and collection

The objective of this study was to analyze the Brazilian journalistic coverage on vaccines before and during the COVID-19 pandemic. We started the composition of the corpus by selecting the newspapers to be analyzed, prioritizing those of the so-called print media whose content was available on the internet. We chose traditional – or legacy – media (Casero-Ripollés, 2020) given its history of credibility and its predominance as a source of reliable information in critical situations, such as the current pandemic.

Folha de S.Paulo and *O Estado de S. Paulo* can be considered what the literature defines as elite (Carpenter, 2007) or prestigious newspapers (Lacy et al., 1991): commercial publications with wide circulation, national reporting, a tendency toward a more balanced coverage, and agenda-setters of other media outlets (Carpenter, 2007; Lacy et al., 1991). In addition, *Estadão* and *Folha* make all their content available on their websites and provide a search tool with the possibility of looking them up by keyword and date. These particularities were decisive for our selection of the two newspapers since the two criteria previously established were the analysis of the totality of the stories and the temporal division.

On the respective websites, we searched for stories with the keyword "vaccine" (which includes variations with the same stem) from January 1, 2019, to December 31, 2020. We collected the URLs of each publication with Google Chrome's Web Scraper extension, storing them in Excel spreadsheets broken down by year. To extract the content of the URLs, we used NewsPlease, a data scraping module developed for the Python programming language.

From this initial corpus, we excluded the publications whose non-textual information was impossible to extract with the abovementioned technique, such as photo carousels, infographics, videos, and podcasts. To avoid bias in the quantitative analysis, we also removed the content composed of very short notes (such as some columns and comments from readers) to consider only news texts, reports, and articles. A final refinement was made so that only stories with the vaccine as a central theme were included in the corpus. Thus, we kept exclusively the texts in which this word (or its derivations) appeared in the title. The application of this protocol gathered 2,120 stories: 1,352 from *Estadão* (122 in 2019 and 1,230 in 2020) and 768 from *Folha* (79 in 2019 and 689 in 2020).

Processing and analysis

We define this research as quali-quantitative, based on the computer-assisted content analysis of the 2,120 stories that make up the corpus using the WordStat 8 software developed by Provalis Research. This approach is similar to the traditional content analysis, in which a text is systematically classified into categories of interest and inferences are made from the identified characteristics (Bengston & Xu, 1995). With the software, this classification is done by creating a categorization dictionary (Deng et al., 2017, 2018), also called a coding scheme or classification system (Bengston & Xu, 1995). Then, inductively or deductively, the researchers create thematic categories and subcategories in which textual elements are included (words, phrases, and proximity rules) so that the program calculates their frequencies in the corpus.

To build the categorization dictionary of this study, we used the Semi-automatic Dictionary Building Process (S-DBP) developed by Deng et al. (2018), divided in six steps: definition of the objective; creation of the corpus; pre-processing; identification and categorization of elements; extension and simplification; validation. One of the advantages of using this method is that these authors used precisely the same software to test the proposed protocol.

Concerning our study, we have already presented the first two stages of the categorization process. The third step includes refining and cleaning the data and choosing a cut-off criterion. For this, we applied the WordStat feature to remove stop words, such as prepositions and conjunctions, and standardized inconsistent spellings (e.g., Butantan instead of Butantã). The chosen cut-off criterion was the TF-IDF (Term Frequency-Inverse Document Frequency), a statistical formula that measures the "importance" of a word in the corpus.

After calculating the TF-IDF for each subset of stories (divided by newspaper and by year, that is, four subsets), we proceeded to identify and categorize the words and phrases with the highest TF-IDF into categories created *a priori* or from the results themselves. This was done with the 100 words and the 100 most heavily weighted phrases in each subset, totaling 800 categorizations. In the theoretical framework, we noticed that the definition of the number of words and phrases to be categorized is random (Lo et al., 2019; Wallace, 2018) and that the larger the number, the more comprehensive and accurate the dictionary will be.

Categorization is an immersive, iterative, and thoughtful process. Although some words are obvious ("Bolsonaro" necessarily refers to the president of Brazil, Jair Bolsonaro), others need to be differentiated by a longer phrase or by context ("Ministry" should be classified according to its denomination, such as

Ministry of Health, Ministry of Economy, etc.). With this technique, categories are made and unmade throughout the process. For example, phrases such as "Anvisa approval," "vaccine approval," and "authorization for emergency use," among others, were classified in the subcategory "Approval and Registration," which in turn makes up the subcategory "Technical and Scientific Aspects," which is included in the larger category "Approaches". By applying the categorization dictionary to the corpus, the program used can calculate in how many stories and in which period each topic was present. At the end of this process, we obtained a dictionary with three broad categories: diseases and vaccines; approaches; and organizations, actors, and countries. Each of them is composed of several subcategories, presented in Table 1.

Table 1

Categorization dictionary

DISEASES AND VACCINES	APROACHES	ORGANIZATIONS[2], ACTORS, AND COUNTRIES
COVID-19	**Service provision**	**Organizations**
Diphtheria	Vaccination campaigns	Government entities and bodies
Yellow fever	Target audience	Anvisa
Typhoid fever	Locations and times	CDC
Flu	Dosage	EMA
Hepatitis	Symptoms of diseases	FDA
HPV	**Technical and scientific aspects**	Judiciary
Meningitis	Approval and registration	Legislative
Pentavalent	Research and development	Ministry of Economy
Polio	Action mechanisms	Ministry of Health
Rabies	Tests	Public Ministry
Rhinitis	Phases	Health departments
Measles	Efficacy and safety	Research institutions[3]
Tetanus		Butantan Institute
Triple viral (MMR)	**Production and commercialization**	Fiocruz
Tuberculosis		Gamaleya Institute
	Disinformation and denialism	Oxford
	Obligatoriness	Universities (in general)
	Fake news	Pharmaceutical companies and laboratories
	Anvi-vax movement	Astrazeneca
	Vacine and autism	Bharat Biotech
		Biontech
		Cansino
		Inovio
		Janssen

[2] We used the broad concept of organization of Maximiano (2000) – "a combination of resources which deliberately seeks to fulfill some kind of objective" (p. 91) – to refer to the several bodies, entities, instituions, companies, and structures identified in the corpus.

[3] Although these institutions are also linked to the government, we classified them separately as they are directly involved in research related to the COVID-19 vaccine.

Continue...

DISEASES AND VACCINES	APROACHES	ORGANIZATIONS², ACTORS, AND COUNTRIES
		Jhonson&Jhonson
		Moderna
		Novavax
		Pfizer
		Serum
		Sinopharm
		Sinovac
		Vaxart
		International organizations/ initiatives
		Covax
		OMS
		OPAS
		Medical/scienti5c societies
		SBI (Imunologia)
		SBI (Infectologia)
		SBIm
		SBP
		Sociedades (geral)
		Actors
		Antonio Barra Torres
		Joe Biden
		Jair Bolsonaro
		Boris Jhonson
		Bruno Covas
		João Doria
		Paulo Guedes
		Rodrigo Maia
		Nelson Mandetta
		Eduardo Pazuello
		Vladimir Putin
		Donald Trump
		Countries
		Germany
		Brazil
		China
		United States
		Israel
		Italy
		United Kingdom

Note. Elaborated by the authors.

We consider that the last step of the process proposed by Deng et al. (2018) – validation – was carried out in this study by applying the dictionary in the corpus. The results chosen for analysis were the relative frequencies (percentages) of the presence of categories and subcategories in the stories (as there was a substantial increase in stories from 2019 to 2020, it would not be representative to make comparisons with absolute numbers). In this way, it was possible to identify the topics that received more or less coverage by each newspaper and the changes in the approach to these topics before and during the COVID-19 pandemic.

RESULTS

Coverage intensity

The COVID-19 pandemic intensified journalistic coverage related to vaccines in the two analyzed newspapers. In 2019, the monthly average of publications was 17 stories (10 in *Estadão* and 7 in *Folha*). This number was almost 10 times higher in 2020, when, on average, 160 news, reports, and articles were published on the subject per month. The difference between the two newspapers also increased significantly. In 2020, *Estadão* produced an average of 103 stories on vaccines whereas *Folha* produced 57, which represents almost double (1.8 times) their production in 2019.

For 2019, it is hard to outline a coverage trend in quantitative terms since the numbers fluctuate each month. *Estadão* registered the highest number of stories on vaccines in July (19 stories), while in *Folha* the peak occurred in March (11 stories). When analyzing the publications in these months, it appears that, in the first newspaper, the increase in content was due to the extension of the measles vaccination campaign in the state of São Paulo because the cases of the disease were rising. In the second newspaper, no specific subject dominated the coverage that month.

For 2020, it is possible to trace an ascending trend line over the months, especially from the year's second half. In both newspapers, the sharpest jump occurred in December, with 429 stories in *Estadão* and 256 in *Folha*. The topics covered in that month included: approval for emergency use of the first COVID-19 vaccines; start of vaccination in European countries, the United States, and Israel; judgment by the Federal Supreme Court (STF) on mandatory vaccination; forecasts for the acquisition of immunization and the beginning of the COVID-19 vaccination campaign in Brazil.

The vacine in two Brazilian newspapers before and
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Diseases and vaccines

In 2019, the two newspapers' coverage on diseases and vaccines mainly addressed measles (Figure 1). Mentions of measles or its vaccine were present in more than half of the stories on the subject in *Estadão* (57.4%) and almost half of the stories in *Folha* (49.4%). The MMR triple viral vaccine came in second place, present in 28.7% of the publications in the first newspaper and 24.1% in the second. Less than 20% of stories mentioned flu (including diseases caused by influenza virus subtypes), yellow fever, and polio. Other diseases and vaccines were mentioned in less than 10% of the coverage, including meningitis, pentavalent vaccine, tuberculosis, hepatitis, diphtheria, tetanus, rabies, HPV, rhinitis, and typhoid fever.

Figure 1

Number of stories per newspaper with mentions of diseases and vaccines (2019)
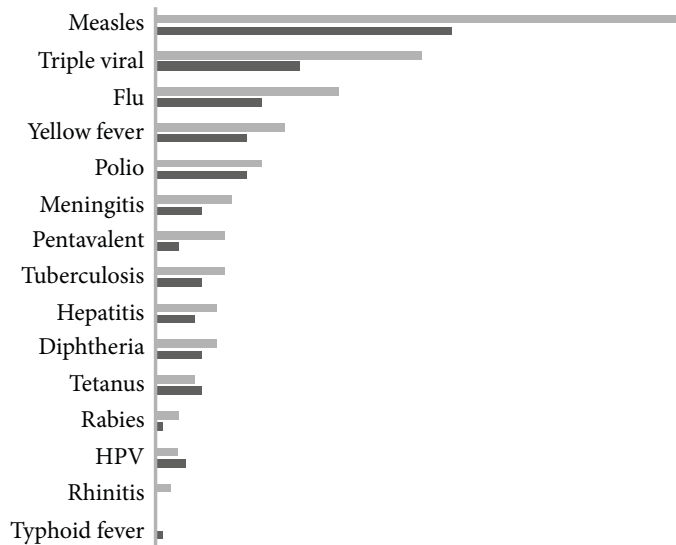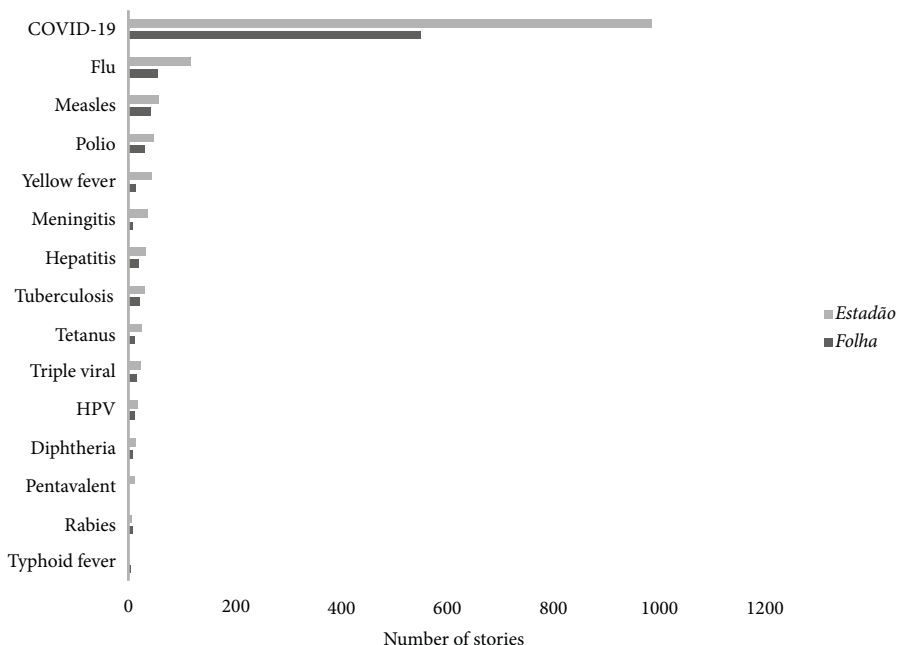

Note. Elaborated by the authors.

The following year, vaccine-related coverage was dominated by COVID-19 (Figure 2). About eight out of ten stories in the two newspapers mentioned the new disease. All other diseases and vaccines appeared in less than 10% of the publications. However, it should be noted that, in absolute numbers, there was a general increase in the approach to these other diseases from 2019 to 2020. In *Estadão*, for example, the number of stories mentioning the flu jumped from 24 to 117. There was also an increase in mentions of yellow fever (from 17 to 42) and poliomyelitis (from 14 to 47), among others. In *Folha*, the increase in absolute terms was mainly related to influenza (from 14 to 55), polio (from 12 to 31), and tuberculosis (from 6 to 20). This growth was also

recorded in relation to meningitis, hepatitis, tetanus, HPV, diphtheria, rabies, and the pentavalent vaccine. Measles, widely discussed in 2019, had a lower presence in *Estadão* in 2020 (from 70 to 56 stories) and a slightly higher one in *Folha* (from 39 to 41). The decrease could also be seen in the mentions of the MMR vaccine, although to a lesser extent.

Figure 2

Number of stories per newspaper with mentions of diseases and vaccines (2020)

Note. Elaborated by the authors.

APPROACHES

The vaccine coverage approaches also followed a similar pattern in the two newspapers before and during the COVID-19 pandemic. The trend for coverage focused on service provision decreased whereas content related to technical and scientific aspects and the production and commercialization of immunizations increased (Figure 3). It is observed that the approach focused on the topic of service provision was predominant in the stories of 2019 (82.8% in *Estadão* and 79.8% in *Folha*), occupying only half of the vaccine-related publications of the following year. The topics scientific issues and commercial aspects, which before the pandemic corresponded to less than 40% of publications, exceeded 70% and 50% of stories in 2020,
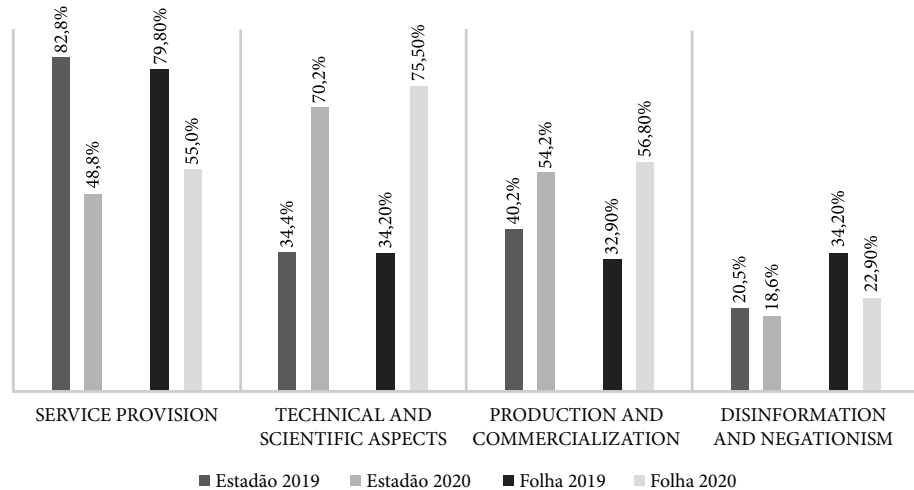
respectively. There was a slight variation in the proportion of stories with
elements of disinformation and denialism, with a slight downward trend
in both newspapers.

Figure 3

Relative frequency of approaches identified in vaccine coverage, by newspaper and by year

■ Estadão 2019   ■ Estadão 2020   ■ Folha 2019   ■ Folha 2020

Note. Elaborated by the authors.

It is also possible to verify, within each of these dimensions, which aspects
were more or less addressed by the newspapers. In 2019, service journalism
focused mainly on information about public vaccination campaigns and their
target audience. Campaigns continued to be the most addressed service topic
in 2020, although in a much smaller proportion than in the previous year.
They were addressed mainly in December, when the media began to reflect the
expectation of the COVID-19 vaccination campaign. Still from this perspec-
tive, information on the application of different doses of the vaccine (dosage),
symptoms of diseases, and places and times of vaccination, which were present
in more than a quarter of the service provision stories in 2019, represented only
a tiny proportion of the publications in 2020.

This trend is inverse when observing the technical and scientific issues
presented by newspapers before and during the pandemic. *Estadão* and
Folha addressed aspects related to vaccine research and development in
about 34% of their stories in 2019. A year later, this proportion jumped to
66.7% in the first newspaper and 71.8% in the second, with an emphasis
on COVID-19 vaccine trials carried out by pharmaceutical companies and

research institutions around the world. In this specific perspective, the newspapers more frequently reported the phases of pre-clinical (animal) and clinical (human) tests to which a potential immunizer is submitted for an evaluation of its efficacy and safety.

Still concerning technical and scientific content, coverage included information on regulatory health entities' approval and registration of vaccines. There were no mentions of this subject in any story in 2019. The topic appeared in the news only in May 2020, at the time still tangentially, reaching sustained coverage in the second half of that year. In 2020, information on vaccine approval and registration was mentioned in 18.6% of the publications in *Estadão* and 21.5% in *Folha*.

Regarding the portion of coverage that deals with disinformation and denialism, although there were no significant variations from one year to the next, it is possible to observe a change in focus. In 2019, fake news, the anti-vax movement and, more specifically, the false claim that the MMR vaccine could cause autism were among the main topics of this category, with a little more prominence in *Folha's* coverage. In 2020, discussions about mandatory vaccination came to the fore. This topic, practically not addressed in the previous year, emerged from the controversies raised by President Jair Bolsonaro himself. He publicly defended the non-compulsory immunization, especially when questioning the CoronaVac vaccine, at the time still under development by the Chinese company Sinovac. The drugmaker had signed an agreement with the Butantan Institute, in São Paulo, on the initiative of Governor João Doria, the president's political antagonist.
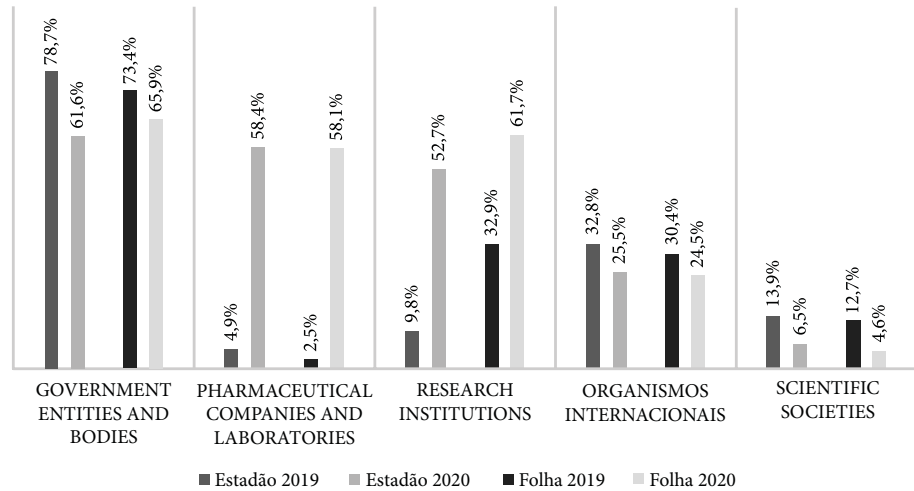
ORGANIZATIONS, COUNTRIES, AND ACTORS

We also observed changes in the organizations mentioned in the vaccine-related stories published by *Estadão* and *Folha* during the two years. Figure 4 shows that the role of government entities, mainly the Ministry of Health and the State and Municipal Health Departments, began to be disputed by laboratories, pharmaceutical companies, and research institutions from Brazil and around the world, whose mentions increased significantly in 2020. It can be said that the presence of government entities remained high in coverage after the COVID-19 pandemic (above 60% in both newspapers), but it was surpassed by public and private institutions involved in research for developing a vaccine against the disease. The proportion of mentions of international organizations and scientific societies decreased over the years.

Figure 4

*Relative frequency of organizations mentioned in vaccine coverage, by newspaper and
by year*

GOVERNMENT ENTITIES AND BODIES — PHARMACEUTICAL COMPANIES AND LABORATORIES — RESEARCH INSTITUTIONS — ORGANISMOS INTERNACIONAIS — SCIENTIFIC SOCIETIES

■ Estadão 2019   ■ Estadão 2020   ■ Folha 2019   ■ Folha 2020

Note. Elaborated by the authors.

There were also changes in the frequency with which organizations were mentioned in the news coverage. In 2020, the National Health Surveillance Agency (Anvisa), responsible for evaluating and authorizing (or not) medicines and vaccines in Brazil, emerged as the most cited government entity, surpassing the Ministry of Health in *Estadão* coverage. It is also noteworthy that, after these two organizations, the most frequent entities and bodies referred to were those of the Legislative and Judiciary Branches (National Congress, Chamber of Deputies, Senate, Federal Supreme Court, and Courts of Justice). These organizations had minimal expression in 2019 – below 7% for the Legislative and 2% for the Judiciary.

As for laboratories, pharmaceutical companies, and research institutions, the pandemic was responsible for inserting a wide variety of infrequent names in the news. While in 2019 stories the few mentions of these organizations referred to universities and, in an even smaller number, to the Oswaldo Cruz Foundation (Fiocruz) and the Butantan Institute, in 2020 there were much more frequent references to them and other international institutions, such as the University of Oxford in the United Kingdom and the Gamaleya Institute in Russia (which developed the Sputnik V vaccine). In addition, pharmaceutical companies such as Astrazeneca, Sinovac, Pfizer, BioNTech, and Moderna were present in more than 15% of the stories. It is important to remember that the University of Oxford and Astrazeneca jointly

developed a COVID-19 vaccine – Covishield – and made a technology transfer agreement with Fiocruz to manufacture the immunizer in Brazil. Another agreement was signed between China's Sinovac and the Butantan Institute for producing the CoronaVac vaccine.

Likewise, countries rarely or never mentioned in the vaccine coverage throughout 2019 gained expression or appeared in the following year's stories. The United States went from less than 20% to almost 40% of the 2020 stories on vaccines. China and the United Kingdom, practically absent in the 2019 coverage, were present in more than 20% of the publications the next year. Russia, which was not mentioned once in the pre-pandemic news, appeared in 11.5% of the stories in *Estadão* in 2020 and in 11.3% of the stories in *Folha* that same year.

Finally, the analysis of the actors mentioned in the stories shows that the vaccine-related coverage before the COVID-19 pandemic made little reference to specific names. The most frequent references were to Jair Bolsonaro and the then Minister of Health Luiz Henrique Mandetta, but they were still very low – 13.9% and 9.8% in the stories of *Estadão* and 8.9% and 5.1% in *Folha*, respectively. In 2020, the name of the Brazilian president was much more frequently mentioned, appearing in 36.3% of the publications of *Estadão* and 49.1% of *Folha*. They were followed by the names of João Doria and Eduardo Pazuello, the latter being the third to assume the post of Minister of Health since the beginning of the pandemic in Brazil. Other actors appear in the survey, but with reduced proportional expression.

DISCUSSION

International media attention to COVID-19 grew in proportion to the disease's severity. Our study portrays this fact by comparing vaccine coverage in two leading Brazilian newspapers before and during the pandemic. Although vaccines are routinely present in the news, they became the focus of special attention as they are one of the main ways to control the health crisis, reflecting all the anxiety and expectation of the moment. Such drastic changes have inevitable implications for the media production process, which, according to the newsmaking theory (Wolf, 2008), involves selecting the facts that will become journalistic news, the approaches, and the angle of the stories. In the case of the COVID-19 vaccine, we consider one more aspect: the feedback that newspapers had to give to public demand for reliable information. In this sense, the increase in vaccine-related coverage we identified may be, in part, an effect of the trend observed in different reception surveys (Casero-Ripollés, 2020; Vai et al., 2020),

which show the public's trust in media outlets as sources of credibility, especially in a context of social isolation.

Contrary to the upward curve of publications in 2020, the lack of a trend line in the previous year shows that, in non-pandemic times, vaccine coverage obeys, first of all, journalistic factualism. By analyzing the number of publications and the most mentioned diseases, we can see how the increase in measles cases and the actions taken to contain the outbreaks were strongly present in the 2019 publications, such as the stories "Measles Cases Skyrocket to 384 in SP and Vaccination is Extended" (Carvalho, 2019) and "Measles Sounds the Alarm for Low Vaccination Coverage in the Country" (Pasquini, 2019). These examples draw attention to the tone of concern framed by the two newspapers, which certainly reflects the resurgence of the disease in national territory and remembers the measles outbreak that had already been recorded in 2018, mainly in the country's Northern region.

The other diseases and vaccines have much lighter appearance frequencies in line with the seasonality with which they are addressed, especially due to annual vaccination campaigns, such as for the MMR, influenza, yellow fever, and poliomyelitis. Thus, we essentially characterize vaccine coverage in 2019 as service journalism (Eide & Knight, 1999) since it indicated to readers the period of immunization and the public for which it was intended. At this point, our study corroborates the results of Massarani, Leal et al. (2021) in analyzing stories on vaccines published by *Folha* from 2018 to 2019.

> It is observed that the insertion of vaccines as everyday issues is predominant, demonstrating that vaccination is understood as a resource incorporated into people's lives, highlighting the role of the newspaper in providing service about government campaigns and actions. (Massarani, Leal et al., 2021)

We have advanced in this aspect by doing a comparative analysis with the pandemic year, from which perhaps the significant change in journalistic terms arises: the shift from the perspective of service journalism to that of scientific journalism in a stricter way. As a dominant theme on the media's public agenda, details about the development of a new immunizer come into play, such as its testing phases, the vaccine's efficacy and safety and mechanisms of action, and its approval and registration processes. There is also an increase in the economic approach, which involves production capacity, costs, and agreements to acquire doses. In stories such as "Understand Anvisa's Rules for the Emergency Use of Covid-19 Vaccines" (Machado, 2020) and "How CoronaVac, the Chinese Vaccine Against the Virus, is Being Developed"

(Santos, 2020), the newspapers aim to explain technical and scientific details related to vaccination.

From the examples above, it can be noted that even in December, *Estadão* referred to the vaccine developed by the company Sinovac as the "Chinese vaccine," in a lexical choice incorporated in the discussions on origin and safety and on the obligation to take the vaccine – the latter included more frequently in coverage related to disinformation and denialism in 2020. These are issues that go back to the very history of immunization in Brazil, marked by the Vaccine Revolt, a protest against the mandatory smallpox vaccination in 1904 which established a public debate in the then national capital Rio de Janeiro on the population's fear of scientific novelty (Benchimol, 2003; Chalhoub, 1996). When analyzing the coverage of the newspapers *Correio da Manhã* and *Gazeta de Notícias* in the months before the 1904 uprising, Salgado (2018) concludes that the emphasis given to science was achieved by the intense public debate about the smallpox vaccine and the bill that instituted its mandatory application.

Despite advances over more than a century, the controversies on vaccination are still not completely pacified, as our results show. In 2019, *Estadão* and *Folha* published an extensive and conclusive study that found that there is no relationship between the MMR vaccine (against measles, mumps, and rubella) and autism in children, putting an end to false information that had already been denied on other occasions (Hviid et al., 2019). In 2020, questions about the safety of the COVID-19 vaccine and the obligation to take it were made by President Jair Bolsonaro, whose management of the pandemic in Brazil was marked by denialism of scientific evidence ("COVID-19 in…," 2020).

These questions are also the most frequent topics in anti-vax groups on Facebook, as verified by Almeida (2019). Her research shows that, in the discussions of these groups, there is distrust about vaccines and who is to blame for their effects – precisely the question raised by Bolsonaro at the end of 2020 when explaining why he had refused a contract to purchase the vaccine from Pfizer/BioNTech: "There in the Pfizer contract it is very clear: 'we [the company] are not responsible for any side effects.' If you turn into an alligator, it's your problem" (Valadares, 2020). It so happens that, at the time, the last stage of testing for this vaccine, conducted even in Brazil, had already been completed, and the vaccine had already been approved for emergency use in countries such as the United States, United Kingdom, and Mexico.

From the results presented above, the diversity of organizations, countries, and actors in the coverage of the two newspapers from one year to another stands out. Vaccines now have a name and nationality, but this attribution

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varies according to editorial choices, as shown by the previous example of the
"Chinese vaccine" and the following headlines: "SP Government Celebrates
the Success of *Pfizer Vaccine* [emphasis added], but Says *CoronaVac* [emphasis
added] is 'Further Ahead'" (Resk, 2020); "*Russian Vaccine* [emphasis added]
Produces Immunity Against Novel Coronavirus, First Published Data Show"
(Batista, 2020). In this scenario, the interests of authorities, major world
powers, and pharmaceutical industry giants are in dispute in the "vaccine
race" – a metaphor for the speed and competition of vaccine production
identified in our previous research with newspapers from Brazil, the United
States, and the United Kingdom (Massarani & Neves, 2021).

Therefore, the vaccine, as a product that follows the rules of market eco-
nomy, characterized by the worldwide demand for a scarce item, leaves the
local context for a context of international interest within the scope of a glo-
balized system of production of scientific knowledge, as the following stories
show: "Russian Rush for Vaccine Exposes Geopolitical Dispute Capable of
Delaying Cure of Covid-19" (Turrer, 2020); "China and Russia Are Ahead in the
Dispute for the Covid Vaccine, Fleeing From Already Established Rules" (Dou &
Khurshudyan, 2020); "Russia Says Sputnik V Is Safe and Opens Up Vaccine
Geopolitics" (Gielow, 2020); "China Is About to Beat the US with a Vaccine in
Its Backyard, Says the US Military" (Sá, 2020). This is a sensitive point, as the
possible correlation between communication and the adoption of individual
health protection measures has already been found in other studies (Chen &
Stoecker, 2020; Wilson & Wiysonge, 2020). Although we need more research to
estimate this relationship in the case of the COVID-19 vaccine, surveys carried
out in Brazil and the United States showed a decrease in people's willingness to
be vaccinated when the vaccine was associated with China or Russia ("Brasileiros
resistem…," 2020; Kreps et al., 2020).

In the national context, despite a reasonable reduction in mentions of gover-
nment entities and bodies as a whole, the much more expressive presence of
the Legislative and, especially, the Judiciary branches reveals how the pandemic
in Brazil involved the different spheres of public power. In 2019, mentions of
Judiciary entities did not reach 2% of the vaccine stories, but surpassed 10%
in the following year. It is important to note that, right at the beginning of the
health crisis, in April 2020, the Federal Supreme Court (STF) decided that state
and municipal governments had the autonomy to determine social isolation,
contradicting a provisional measure that put this determination up to the federal
government. The narrative that the Court took away from the Executive branch
the power to fight against the pandemic was appropriated by President Jair
Bolsonaro as a justification for not adopting more effective prevention measures.

Another legal issue had as one of its primary motivators, once again, the discussion about mandatory vaccination, which also had to be pacified by the STF in December 2020. These and other related matters were also processed by the Legislative sphere, such as the approval of emergency aid for workers affected by the pandemic and pressures to hold the president accountable for mishandling the crisis. It is worth noting that the Legislative branch would assume an even more significant role in the following months, as early as the beginning of 2021, with the investiture, by the Senate, of a Parliamentary Commission of Inquiry (CPI) to investigate the elements that led to the large number of deaths by COVID-19.

The actors that gain prominence are also evidence of a more personalized and politicized coverage, characterized by the presence of authorities from the political world (Chinn et al., 2020). Before the pandemic, the vaccine news in *Estadão* and *Folha* made little mention of specific names, which changed with the public and declared antagonism between Bolsonaro and Doria the following year. The newspapers even classified the internal dispute as a military clash: "'Vaccine War' Can Help to Unite Forces of the Democratic Center Against Bolsonaro" (Frazão, 2020); "Amid the 'Vaccine War', Doria Says that Bolsonaro Government Insists on Denialism" (Amâncio, 2020). Currently, it is known that this political and ideological clash had direct consequences on the progress of COVID-19 vaccination in Brazil, such as the delay in starting the campaign, the shortage of doses, and the lack of pandemic control, which would reach a new contamination and mortality peak in early 2021.

FINAL CONSIDERATIONS

Vaccines are responsible for controlling or eradicating diseases and reducing health care costs and inequalities among countries (Andre et al., 2008). With the COVID-19 pandemic, these factors became even more evident, which motivated us to conduct this comparative study on the coverage of vaccines by two of the most important Brazilian newspapers, having as an inflection point a severe global public health emergency. In order to carry out a comprehensive study that could consider all publications, we used a computer-assisted content analysis methodology, which allows exploring large textual datasets and associating quantitative results with qualitative inferences. For this, we created a categorization dictionary to identify the main elements of 2,120 stories on vaccine published by *Estadão* and *Folha* in 2019 and 2020.

Our results show how the pandemic has caused a significant increase in content production by newspapers, representing an additional challenge and responsibility. This scenario leads us to question whether the media and communication professionals were prepared for such an impact, both in terms of qualifications to deal with complex scientific issues and in working relationships in adverse conditions. A survey of Brazilian communication workers reveals that the pandemic has aggravated a sector already in crisis, marked by layoffs, precarious contracts, lower wages, work densification, stress, and uncertainties about the future (Figaro, 2020).

On the other hand, regarding content, it is important to emphasize the expansion of the scientific approach related to the vaccine, in addition to the essential service provided by newspapers in the pre-COVID coverage. Although this change presupposes an extremely painful event for society, we reflect on whether replacing an episodic approach with a more in-depth one can contribute to overcoming a science journalism based exclusively on sensationalism (Teixeira, 2002) or, in the words of Adeodato (2002), which "reinforces the futuristic fantasies of fantastic discoveries" (p. 223). It is worth mentioning, for example, that although COVID-19 dominated the newspapers' coverage in 2020, the absolute frequency of mentions of other diseases and vaccines also increased compared to 2019, representing a significant advance for science journalism.

The insertion of other dimensions and actors in the news also made the vaccine no longer be seen as a finished product readily available in health units but as a scientific technology in constant development which mobilizes efforts of researchers from all over the world and goes through a long process that involves political, economic, and ideological aspects until its availability to society. In this sense, full-time coverage and the need to refute and clarify false or distorted information made room for other voices in science coverage (Massarani, Brotas et al., 2021). On the other hand, we express the same concern as Bolsen et al. (2014) regarding the risk that what has been called the politicization of the pandemic negatively interferes with the adoption of measures based on scientific evidence, even more so when this politicization is captured in the public debate promoted by the media, as some of our results reveal. The characteristics of this politicization have been investigated in different contexts (Hart et al., 2020; Ward et al., 2020), but the fact that in Brazil it was characterized by the media as a war between two of the most important adversaries of the political scene helps to explain the course of the crisis in the country.

Such reflections can be extended to science in general, which must be considered not only for its results but also, above all, for its processes, which contribute to the perception that, as a human activity, it is not isolated from the rest of society or exercised only within the confines of laboratories. In addition, all these aspects become the information framework available to society and, when, associated with other sources and social relationships, are appropriated to different degrees and with different interpretations. Though it is still too early to talk about a paradigm shift in science journalism and the public understanding of science, the impacts of the current COVID-19 pandemic in communication studies represent a fertile field of investigation, including the application of the categorization dictionary constructed here in other outlets and time periods. ◼

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