WhatsApp and audio misinformation during the Covid-19 pandemic

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Abstract

Given user choices and the commercial offerings of internet providers, *WhatsApp* has increasingly become established as a new standard for communication by audio, image, and text. This paper explores the role of misinformation during the Covid-19 pandemic by using content disseminated through *WhatsApp*, thereby making three main contributions: a discussion about the potential shift toward nontextual and nonvisual forms of misinformation; the new social role of audio, namely related to the critique of policies and political actors during the early stage of the Covid-19 pandemic; and the questioning of the First Draft News disinformation conceptual model by proposing a complementary approach that focuses only on factuality. Conclusions were drawn after conducting a content analysis of 988 units of Covid-19-related audio files, images, videos, and texts shared via *WhatsApp* during the early stage of the pandemic. A typology was identified to address distinct claims that focus on five different topics (society, policy and politics, health science, pandemic, and other), as well as audio messaging trending as a novel format for spreading misinformation. The results help us to contextualize and discuss a potential shift toward nontextual and nonvisual forms of misinformation, reflecting the increasing adoption of the audio format among *WhatsApp* users and making *WhatsApp* a fertile environment for the circulation and dissemination of misinformation regarding Covid-19-related themes. In a society characterized by the rapid consumption of information, the idea that content must have a degree of falsehood to mislead is an indicator of the distance between theoretical models and social reality. This indicator is important to identify true content as potential misinformation on the basis of its factuality.

Keywords

Misinformation; Covid-19; Coronavirus; *WhatsApp*; Pandemic; Communication; Health; Society; Audio; *WHO*; *World Health Organization*.

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1. Introduction

On March 11, 2020, a pandemic situation due to Covid-19 was declared by the *World Health Organization* (2020a). Owing to the overabundance of information that accompanied the pandemic, the *World Health Organization* also declared an infodemic (*World Health Organization*, 2020b). The distribution of both information and misinformation related to Covid-19 via social media platforms was identified and generally considered problematic owing to the vulnerability of those who receive such (mis)information. This study explores misinformation concerning the Covid-19 pandemic distributed on *WhatsApp* in Portugal in the early stage of the pandemic. Portugal recorded its first confirmed case of Covid-19 on March 2, 2020. In a 10-day window, *Google* searches for "covid19" experienced a tenfold increase (*Google Trends*, 2020), and the four news outlets in the country's top website rankings all climbed between five and nine places (*Alexa*, 2020), indicating the magnitude of the search for information on how to deal with the pandemic.

At the same time, and despite the international development of Covid-19, the official communication from the Portuguese government did not respond to the needs of the public. Such factors, plus the uncertainty about the new disease, created a high demand for information, and *WhatsApp* rose as a platform (either intentionally or unintentionally) for sharing coronavirus-related misinformation.

To explore the role of misinformation on *WhatsApp* in the context of the Covid-19 pandemic, we made a public appeal to *WhatsApp* users, resulting in the receipt of 988 units of content related to Covid-19. These data were subjected to a debunking process to identify the claims and formats through which misinformation was circulated. The authors adopted a concept of misinformation that differentiated between two levels of factuality: inaccurate or incorrect.

2. Online misinformation: an approach

The body of knowledge regarding misinformation results from multidisciplinary contributions that go back to the first identifications of the phenomenon in the framework of the Cold War, as a mechanism for political manipulation between opposing institutional forces. The events surrounding the 2016 US elections (**Faris** *et al*., 2017), the 2016 Brexit referendum, and the reductive construction of the phenomenon known as "fake news" have consolidated this perspective of misinformation as a less ethical tool of political combat, perpetrated by a motivated agent with an easily identifiable agenda and intention (**Giglietto** *et al*., 2019; **Wardle**, 2018).

The online context of misinformation is marked by the design of platforms that facilitate the scale and speed of its spread, while challenging debunking efforts. Their decentralized nature enables every user to become a possible misinformation agent (**Krafft**; **Donovan**, 2020).

The construction of theoretical models is still largely based on the premise of a hierarchical structure of production agents and diffusers of false content, whose intention is to deliberately deceive the public and, thereby, acquire some type of gain, whether economic or political. The conceptual framework of First Draft News (**Wardle**, 2018; **Wardle**; **Derakhshan**, 2017) is based on this proposition and, under the umbrella concept of "information disorders," establishes the division between misinformation, disinformation, and malinformation by combining factuality and intention.

Misinformation is presented as "false, but not created with the intention of causing harm," in contrast to disinformation, which is "deliberately created to harm," and differentiated from malinformation, which is "based on reality, used to inflict harm" (**Wardle**; **Derakshan**, 2017, p. 20).

Misinformation and malinformation share the inherent idea of a deliberate intent to cause damage, while both misinformation and disinformation require untrue content.

Theoretically, this model is easily understandable and organizes some of the main ideas in the literature, aligning closely with the traditional perspective of misinformation as a tool for political combat (**Fallis**, 2015; **Hernon**, 1995; **Karlova**; **Fisher**, 2013). Through the deconstruction of disinformation and misinformation into seven subcategories:

- satire or parody,
- misleading content,
- false connection,
- false context,
- imposter content,
- manipulated content, and
- fabricated content,

the model identifies some of the main characteristics exhibited by this type of content (**Wardle**, 2018).

While widely cited and referenced, it has nevertheless been used very little as a basis for empirical codification and its applicability remains relatively untested, with some examples of the partial use of its basic concepts in the context of Covid-19 revealing little agreement among researchers (**Brennen** *et al*., 2020; **Salaverría** *et al*., 2020).

The interpretation of disinformation as a political propaganda tool, where opposing sides may deliberately and in a coordinated effort create and spread disinformation, falls short of the complexity of the phenomenon that the Covid-19 infodemic demonstrates. In the context of a public crisis such as a pandemic, the need to obtain information increases

(**Norman**; **Harvey**, 2006), official sources become saturated, and responses cannot keep up in terms of speed or detail, leading to the organic development of a vulnerable environment that is more susceptible to misinformation (**Van-der-Meer**; **Jin**, 2020).

Health misinformation is not new and is particularly common for certain topics, such as vaccines, and especially in populations with a lack of trust in their institutions (**Bode**; **Vraga**, 2018; **Fung** *et al.*, 2016; **Wang** *et al*., 2019). The underlying message is that healthcare agendas are not the result of a thorough scientific process but rather part of a political agenda (**Bessi** *et al*., 2015). False and misleading health-related content can cause immediate harm, and institutions face increasing pressure to act proactively (**Donovan**, 2020).

The speed of dissemination can result in a real impact before debunking is achieved, as exemplified by the cases of Ebola or Zika (**Bode**; **Vraga**, 2018; **Oyeyemi**; **Gabarron**; **Wynn**, 2014), and more recently with the claims regarding drinking methanol as a cure for Covid-19 that led to the death of more than 700 people (**Forrest**, 2020). In this type of scenario, the use of instant messaging applications such as *WhatsApp* contribute to this spread while making it difficult for anyone to access the data, identify, debunk, and assess the impact of the claims, and discover their source, given that it is an encrypted platform without moderation and without direct public access to content.

3. *WhatsApp* as a node for misinformation distribution

WhatsApp has increasingly been adopted as a new norm for networked communication (**Cardoso**, 2008). More than 2 billion people in over 180 countries use the platform, demonstrating that it is a preferred way to communicate in different societies and cultures, as well as being the third most used social media network (**Kemp**, 2020).

Users can use text, image, audio, video, documents, and location, either in one-to-one communication or in groups (with a limit of 256 contacts), to communicate. Although *WhatsApp* presents itself as a service to connect family members or coworkers, its domestication (**Silverstone**, 2006) goes further, highlighting motivations for uses that reflect feelings of belonging and establishing relationships, civic and activist participation, and the need to remain connected and informed in different areas of society within the scope of social, civic, and political actions (**Milan**; **Barbosa**, 2020; **Resende** *et al.*, 2019a; **Treré**, 2020). Users' practices reflect the possibilities conferred by the platform's features, and through them *WhatsApp* connects different generations (**Matassi**; **Boczkowski**; **Mitchelstein**, 2019) and gains new roles as a tailor-made social network.

WhatsApp's ease of use, accessibility, convenience, replicability (by allowing content forwarding), and multiplicity of content formats convey its potential for communication and dissemination. The app also provides a sense of security with end-to-end encryption. As a result, access to content is exclusive to senders and recipients, sharing history and metadata are removed, and efforts at attribution are unfeasible.

The increasing use of audio messages by *WhatsApp* users, accessible directly on the platform, reflects its ease, as users do not have to type anything (**Funke**, 2018). As audio formats rely on voice, users experience a more intimate type of communication and an emotional bond leading to a sense of togetherness (**Rodero**, 2018), something that the use of text makes more challenging. Furthermore, audio simultaneously facilitates the integration of a population with lower levels of literacy (**Conceição**; **Pessôa**, 2018).

The dynamics resulting from the appropriation of online communication platforms is of particular importance when studying the distribution and consumption of misinformation. The imposition of stricter community guidelines by social media platforms, such as *Twitter* and *Facebook*, coupled with the increasing investment in content moderators and the development of artificial intelligence to tackle information disorders, make messaging platforms an attractive alternative (**Rogers**, 2020). Research has revealed an association between *WhatsApp* and the spread of misinformation, rumors, or violence (**Arun**, 2019), and the context of political disinformation has been particularly well studied (**Canavilhas**; **Colussi**; **Moura**, 2019; **Dahir**, 2017; **Garimella**; **Eckles**, 2020; **Resende** *et al*., 2019b; 2019b). Some attention has also been given to everyday life uses, including health-related research (**Al Khaja**; **AlKhaja**; **Sequeira**, 2018), with some studies already focusing on Covid-19 as several countries witness its presence as a channel for transmitting misinformation about the pandemic (**Bastani**; **Bahrami**, 2020; **Cardoso** *et al.,* 2020; **Delcker**; **Wanat**; **Scott**, 2020; **Moreno-Castro** *et al.*, 2021; **Salaverría** *et al*., 2020). As a response, the app implemented limitations on message forwarding as well as shared advice on how users could protect themselves and prevent the spread of misinformation.

However, less research has addressed how specific *WhatsApp* features shape the way in which misinformation is produced, shared, and received by users. **Herrero-Diz** *et al.* (2020) explore how trust between users, who are usually in each other's contact lists, promotes unquestionable sharing, since the information comes from someone with whom the user very often has a personal relationship. These trends and *WhatsApp*'s growth as a prevalent terrain for misinformation sharing, particularly on subjects that other platforms are committed to moderating, make the role of *WhatsApp* in spreading misleading and false content a necessary priority for research.

4. Covid-19 and *WhatsApp*: studying misinformation in Portugal

Our analysis sought to provide answers as to the role played by audio clips on *WhatsApp* as a means for disseminating misinformation regarding Covid-19 in Portugal. The objectives of the research focused on the identification of formats, namely their specificity, and of narrative themes.

A new *WhatsApp* account was created to collect data shared between March 12 and 15, 2020. This allowed participants to forward content received on their *WhatsApp* accounts directly to the account associated with this research (the profile photo chosen was the logo of the research laboratory with the university's acronym. The biography included a brief explanation of the research).

A message to advertise the research was published on the official social media accounts of the university, explaining the research objectives and inviting users to send information about Covid-19 received via *WhatsApp*. This provided the public with a sense of trust in the research. The design also relied on evidence that social media can be a low-budget and rapid way to disseminate studies and collect data (**Kosinski**; **Matz**; **Gosling**, 2015). The research was also advertised in a mainstream national newspaper and on their social media accounts to stress the public interest associated with participation in the research. The use of this technique fits well with the research objective, since its aim was to map the diversity of available content rather than carry out a probabilistic analysis of the research universe.

Both academics and journalists have used *WhatsApp* as a method for collecting data (e.g., **Emery**, 2018; **Moreno-Castro** *et al.*, 2021; *Polígrafo –https://poligrafo.sapo.pt–*) since it allows for participation without temporal or spatial restrictions. In the context of studies on misinformation, it permits direct data collection in the medium itself, which could be more difficult to obtain on other online social networks, particularly owing to the action of content moderators who have the ability to eliminate such material. Since the newly created account was an individual one and not a group, there was a lower probability of users feeling conditioned and of social dynamics impacting the data collection. The method also suffers from some limitations, particularly regarding the heterogeneity of the participants and the information received. It is important to note that the information received may have originated from a set of more proactive individuals and that the same information may be shared countless times. Nevertheless, and taking these aspects into consideration, the method acquired prolific and diverse types of content.

As discussed above, the uncertainty regarding Covid-19, the need for information, and the expectant waiting for Portuguese governmental decisions created an environment in which the dissemination of unofficial information emerged. This crucial period lasted just three days, between March 12 and March 15, 2020, and our analysis focused on messages received during that specific period.

Each message received was manually downloaded and saved in a corresponding folder associated with a specific date. Information sent in text format was copied, pasted, and saved in a text file. Files were renamed for organizational purposes and to avoid possible associations. All the renamed files corresponded to an entry in a global registration and cataloging document. Duplicated files were identified, along with the number of times they were received and the dates of those occurrences. The authors considered content that was exactly the same as that previously identified to be duplicate information, while content showing any kind of change (**Cardoso**, 2008) was considered to be original.

We performed a content analysis (**Krippendorf**, 2004) of the original corpus using a quantitative approach on the basis of a codebook including the following descriptive variables: format, addressee, whether the communication was in the first or third person, and whether the content was misinformation, as well as a typology of claims related to Covid-19. The typology was created on the basis of preliminary studies regarding Covid-19 (**Brennen** *et al*., 2020; **Salaverría** *et al*., 2020) and content data. For coding such variables, the coders selected all the claims present in the content. The whole sample was coded by two coders, and the Cohen's kappa for claim type (0.81) was considered acceptable.

To identify misinformation, we considered the coding challenges presented by the European model (*European Commission*, 2018; **Wardle**; **Derakhshan**, 2017) that did not take into full consideration the empirical limitations in assessing a specific social feature as intent. For this research, the authors adopted the concept of misinformation, differentiating between two levels of factuality: inaccurate or incorrect. In inaccurate content, authors included content misleadingly presented as truthful and content that, at the moment of data collection, to the best of scientific knowledge, was still being questioned (e.g., the use of masks).

The debunking process, through the verification of facts and using official sources, was integrated into the codification process, following the process proposed by **Silverman** (2020) and the code of principles from the *International Fact-Checking Network* (*IFCN*). Depending on the result, a category was assigned to a file according to its meaning: (1) nothing to register, no false claims; (2) misinformation, contains inaccurate claims at the collected date/place; (3) misinformation, contains incorrect claims at the collected date/place.

The method chosen in this analysis brought ethical challenges, and a set of procedures were implemented to overcome these. Although data such as the telephone number or profile photo of the participant became visible upon receipt of the message, these were not collected. All received messages were answered, including thanks for participating in the research, noting that no personal data would be collected, and requesting informed consent via text. The participant

was also given the possibility to drop out of the study at any time. Once the study was completed, all messages received and all data of a private nature associated with them were eliminated. Between March 12 and 15, 2020, 988 files were received. Of those, 232 were original files while 756 were classified as duplicates.

5. Covid-19 topics shared on *WhatsApp*

One of the main findings of this study was the identification of a typology addressing distinct claims and focusing on the following topics: (1) health and science, (2) society, (3) policy and politics, (4) pandemic, and (5) other (see Table 1 for details).

The "health and science" topic (36.3%) refers to claims specific to the coronavirus (18.4%), namely its origins, symptoms, associated diseases, spread, and patient profile. This topic also contains claims on the "prevention, diagnosis, and treatment of Covid-19" (17.9%), including information on how to avoid contagion, diagnose the disease, and treat Covid-19. The "health and science" topic relates to the context of the research and the need felt by the public to obtain answers to address their concerns (**Norman**; **Harvey**, 2006).

The "society" topic (20.5%) combines content related to "working conditions" (6.7%), which refers to the adaptation and response of work conditions to Covid-19, with content focusing on the "social response" (13.8%), that is, related to behaviors prescribed or proposed by the population at large to address the pandemic's spread.

The "policy and politics" topic (21.8%) combines content focused on the "authorities' response" (10.8%), namely government measures and actions, or lack thereof, to fight the pandemic, together with the "performance of institutions" (11%), namely the availability of human resources and the material capacity of national health systems, as well as guidelines on how to contact or access them. This topic highlights a political dimension of the circulating content through which government decisions are discussed and questioned.

The "pandemic" topic (16.5%) combines two types of claims: first, "data about the pandemic" (11.7%), which characterizes the phenomenon from a micro to macro level, with a special focus on countries, the number of people infected, or deaths; second, the "consequences of the pandemic" (4.8%), with a focus on the pandemic's side effects on the world at large, such as population decrease, economic recession, crisis, etc.

Table 1. Topic, claim, and frequency identified in the analyzed content

Topic	Claim	n *	%
Society	Working conditions	29	6.7
	Social response	60	13.8
Policy and politics	Authorities' response	47	10.8
	Performance of institutions	48	11.0
Health-science	Data about the virus	80	18.4
	Prevention, diagnosis, and treatment	70	17.9
Pandemic	Data about the pandemic	51	11.7
	Consequences of the pandemic	21	4.8
Other	Conspiracy theories	21	4.8
Total		435	100

*The sum is larger than the sample since the analyzed content could contain information regarding more than one claim

Table 2. Frequency of content received according to format (single and combined)

Format	Frequency (single format)	%	Frequency (combined format) *	%
Text	56	42.8	99	49.0
Image	4	3.0	84	41.6
Audio	47	35.9	4	2.0
Video	24	18.3	15	7.4
Total	131	100	202	100

*The total frequency is higher than the total number of the respective files, as they combined more than one format

Finally, the "other" topic focuses mainly on claims of "conspiracy theories" (4.8%) based on the argument that the pandemic was created to serve governments or economic interests.

6. Formats and (mis)information sharing

The shared formats were categorized by considering the multimedia character of the content and following similar approaches applied in related research areas (**Salaverría** *et al*., 2020). Among the content received, 56.5% (n = 131) contained only one type of format while 43.5% (n = 101) combined more than one (Table 2), reflecting the possibilities offered by *WhatsApp*'s features.

Text was identified as the most common format, representing 42.8% as a single format and 49% when combined with others. This feature is reinforced when the image format is analyzed. The relevance of text in these format combinations has the purpose of providing contextualization and meaning to the visually presented content.

Video represents 18.3% of the total single-format content received and 7.4% of the combined-format content. The most common combination is with audio or text, with information being conveyed to explain or contextualize what is seen. Video, being the most complex format to produce and the one that requires most time and attention from the receiver, was the least common.

In previous studies, audio had been found to have a weaker presence when compared with text and image formats (**Canavilhas**; **Colussi**; **Moura**, 2019; **Resende** *et al*., 2019b; **Salaverría** *et al*., 2020), but our study showed it to have a relevant weight, namely representing 35.9% of the total among the single-format content. This finding provides new insights regarding how misinformation might circulate and adapt to new situations and platform features.

7. Characterizing non-misinformation and misinformation on *WhatsApp*

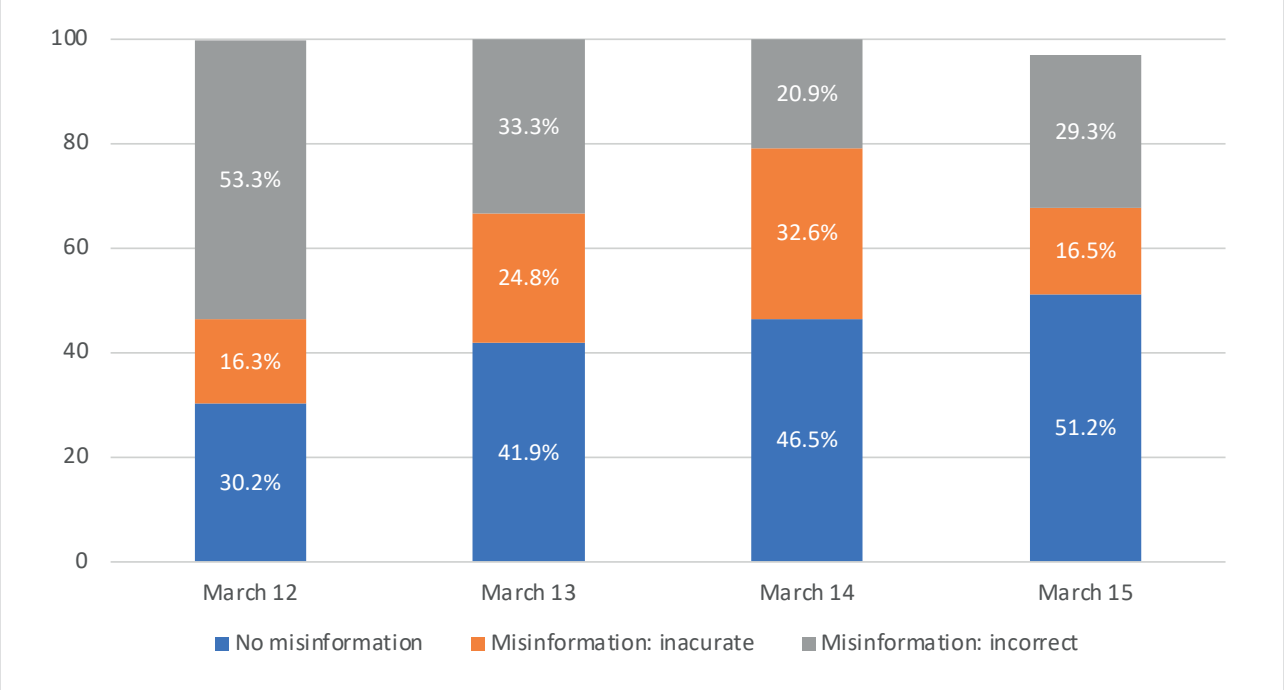
The results of the debunking process (Graph 1) revealed that non-misinformation represented 42.2% (*n* = 98) while misinformation represented 57.8% (*n* = 134) of the overall sample. Owing to the above-mentioned challenges regarding intent, we focused exclusively on factuality, differentiating between incorrect data, and where information was presented in a misleading manner, including false facts from inaccurate data.

The largest amount of content classified as misinformation was received on March 12 and 13, 2020. A steady decrease followed, not only in the total content received, but also that of a misinformative nature. The fact that Portugal, together with Finland, ranks first in terms of news confidence and low media polarization (**Cardoso**; **Paisana**; **Pinto-Martinho**, 2020) may explain this rapid decrease of misinformation dissemination. We hypothesize that this decrease is owing to the efforts made by Portuguese legacy media outlets that were alerted specifically to messages containing misinformation related to Covid-19 circulating through *WhatsApp*. The publication of news articles regarding audio misinformation on *WhatsApp* was also combined with the work of two Portuguese fact-checking platforms accredited by the *International Fact-Checking Network* (*IFCN*). *Polígrafo* and *Observador*
https://observador.pt/seccao/observador/fact-check

focused, during the same period, on the verification of content related to Covid-19, with an emphasis on content circulating on *WhatsApp*.

The results of this verification were shared by the media affiliated with these fact-checking platforms; in the case of the *Polígrafo*, this was the Portuguese TV channel *SIC*, the market share leader and trusted by 79.7% of the Portuguese population (**Cardoso**; **Paisana**; **Pinto-Martinho**, 2020).

Content related to Covid-19 and identified as non-misinformation was characterized by relying mainly on the use of the "image with text" format (41.8%) and aimed at improving knowledge related to the pandemic. Such knowledge included generic recommendations on proper behavior to protect oneself and others and to avoid exposure to the virus, for example, washing one's hands frequently or respiratory etiquette. Non-misinformation had its main origin in identifiable civil society initiatives. These origins also initiated nationwide societal calls to publicly thank health professionals for their work, which were conveyed mostly through text format.



Graph 1. Frequency of content received, per day, according to the result of the debunking process

Our research highlighted another dimension of non-misinformation sharing, namely the use of memes. Memes are understood herein to represent a digital information culture that shares common attributes and is distributed online through imitation or transformation (**Shifman**, 2014). In the context of Covid-19 in Portugal, memes were used to respond to and exacerbate societal behaviors, reflecting offline behaviors; For example, they highlighted the "toilet paper run" or keeping a "safe" social distance. The memes found in our sample were not of a misinformative nature, nor did they convey racist or hateful messages or rely on political narratives (**Saint Laurent**; **Glaveanu**; **Literar**, 2021); instead they focused on humorous narratives, distancing themselves from falsehoods.

Regarding the misinformative dimension, the analysis revealed that misinformation is mainly spread through the "text," "image with text," and "audio" formats. "Audio" formats are less well documented in misinformation research and thus represent one of the novelties of this analysis.

Misinformation in the "text" and "image with text" formats was found more commonly in the "health science" topic. During a health crisis, most of the content classified as misinformation tends to be linked to uncertainty about the new disease, coupled with the need to obtain information on the risk of contagion, symptoms, and treatments (**Bode**; **Vraga**, 2018; **Gesser-Edelsburg** *et al*., 2018). Content related to the Covid-19 pandemic was no exception in our sample: we identified misinformation regarding recommendations about strengthening one's immune system, the practice of alternative medicine, or tips on how to eliminate the virus. The most commonly recorded content was advice on drugs that could supposedly help fight the virus, or data about the availability and efficacy of potential vaccines. At the time of sharing, such content did not have sufficient scientific backing to confer any real legitimacy to such claims.

One of the more traditional formats of misinformation, i.e., the image, relied on charts or diagrams through which procedures or benefits associated with a certain "treatment" were explained. Nonetheless, the images lacked identifiable, proper sources or clear scientific proof; For example, images were used to compare Covid-19 symptoms and those of the flu or the common cold. Although the image content might not have contained incorrect claims about the flu or common cold, the message omitted any need for a proper diagnosis to be performed by a specialist who could confirm Covid-19, contributing to further misinterpretations. This provides a good example of how true content can be communicated in an inaccurate manner, and how this remains distinct from incorrect content.

Source identification is essential to assess the credibility of content (**Nyhan**; **Reifler**, 2012), and misinformation producers seem to have taken this into account. It was possible to identify in our dataset, in either text or visual format, examples of misinformation build-up generated by false perceptions concerning information (**Wardle**, 2018) through unsupported references to international institutions such as *Unicef*, the *World Health Organization*, or the *Portuguese National Health Service*.

Another misinformative strategy identified was misappropriation. For example, the misappropriation of a suggestion made in one article published by *The Lancet*,
https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30116-8/fulltext
concerning the possible negative effects of ibuprofen, which led to incorrect claims of a direct correlation between the use of ibuprofen and higher death rates. Thus, misinformation shared regarding the Covid-19 pandemic through *WhatsApp* using the "text" and "image with text" formats was present mostly as false references to a third party (71.4%), not following a specialist approach to the subject but relying on everyday language, sourced from a supposed third-party organization with social credibility. Such content was mainly directed toward the general population (63.6%) rather than specific individuals. Misinformation made abundant use of claims without providing any scientific data that would confer legitimacy to its effectiveness or highlight potential solutions whose efficacy was not scientifically proven, and also lacked clarity, thus inducing different degrees of uncertainty within the general population. To improve the acceptance of misinformation as potentially true, names and images associated with renowned institutions or medical professionals were appropriated and combined with both common and generic information to give context or personalize a given prescription of attitudes and behaviors.

Studies have shown the importance and growth of audio formats, namely on messaging platforms. **Maros** *et al.* (2020) indicated an increase in the importance attributed to audio messages on *WhatsApp* as a means of communication. Having family, friends, and colleagues as part of one's *WhatsApp* contact list implies credibility, since the message is shared by a known source. This causes the shared content to seem more credible, even if it is considered misinformation. In *WhatsApp* groups, when compared with individual contacts, the situation gains greater dimension. Research has shown that, in groups, audio represents a third of the misinformation, reaching more people because it was shared by more users, revealing how viral this format can become (**Cardoso** *et al.,* 2020; **Maros** *et al*., 2020).

Fact checkers have also increased the alert level regarding misinformation in audio format on *WhatsApp* (**Delcker**; **Wanat**; **Scott**, 2020; **Funke**, 2018; *Polígrafo*, 2020). This is the result of the adoption by users of a format that is understood to facilitate communication. As pointed out by **Rodero** (2018), voice (when compared with text) is a simple, fast, and easy way to communicate, particularly in a society where time seems to be of the essence. To send an audio on *WhatsApp* requires no typing; the user only has to press a button to record the message. The use of voice also allows the message to be less prone to misinterpretation, when compared with text, as discussed by **Funke** (2018).

This perceived ease is coupled with the fact that using voice adds emotional features to the message, which is an important and distinctive variable according to Wardle (**Delcker**; **Wanat**; **Scott**, 2020). On the other hand, while other, more regulated platforms such as *Facebook* are proactively fighting disinformation, less regulated platforms such as *WhatsApp* offer a space for less scrutinized content to be disseminated (**Delcker**; **Wanat**; **Scott**, 2020).

Our analysis confirms and sustains some of the previously described trends. In our sample, the audio format is the second most used format to convey misinformation about Covid-19 on *WhatsApp*. Of the total audio files analyzed, 87.2% were classified as misinformation.

Audio misinformative strategy had similarities to that of text and image usage, but also exhibited some differences. In certain audio clips, supposed medical doctors, or someone close to a health professional, described chaotic situations and environments experienced in hospitals. The burden of the claim was placed on the unavailability of medical supplies, namely personal protective equipment such as masks or gowns. As a consequence, health professionals worked unprotected, conveying the idea of governments' disrespect for a profession essential to protecting the population. Other messages portrayed an image of incapability, either of the infrastructure or human resources, on the part of health services to respond owing to the number of infected individuals, the delay in their response, or poor working conditions. These messages suggested that the national health system was on the brink of collapse. Nonetheless, at that moment, Portugal had only about 100 infected people. Our analysis reinforces others, such as that by **Maros** *et al*. (2020), highlighting that audio messages with a more mournful approach or related to family or work tend to have a higher rate of sharing. The misinformative audio messages were also characterized by being anchored to specific events, located in time or space, while at the same time trying to establish an emotional connection with the listener. The identified audio misinformation used emotional tones of voice associated with storytelling strategy techniques (**Lamb**, 2008).

Who are the targets of audio misinformation? In audio misinformation, the "authorities' response" was always unequivocally questioned. Namely, the Portuguese government's supposed delay in the imposition of social isolation or other protective or restrictive measures was used to question the country's preparedness to fight a pandemic. Another strategy identified in misinformation-containing audio messages was speakers claiming to have access to privileged knowledge regarding governmental decisions, stating that their aim was to provide information to help citizens. They presented themselves as close to decision-makers, saying that a total lockdown would soon follow and that people should be prepared for it over the next day or within hours. They mentioned known names, e.g., people in political positions, or gave specific details about where meetings occurred to bolster the supposed accuracy of their message, to hide its misinformative nature and convey the idea that the authorities were hiding something.

Another finding was that different topics assumed different narratives. For example, the topic "data about the pandemic" questioned the experience being conveyed by the media and political actors. The level of preparedness of medical services, the fake number of infections or deaths, and incorrect measures that may be taken by governments are common arguments used in audio regarding Covid-19, not exclusively related to a specific country, and identified by fact checkers as misinformation (**Delcker**; **Wanat**; **Scott**, 2020). Audio message content claimed that the number of infected was far worse than what was made publicly available, and that several deaths had already occurred, with accusations of a governmental and media cover-up; meanwhile, news media and the government had no deaths yet accounted for.

What do misinformative audios have in common? Personification is the most common characteristic of the different misinformation narratives and is a determinant for the shift toward shared content where emotion is conveyed (**Delcker**; **Wanat**; **Scott**, 2020). In fact, the audio messages were constructed on the basis of first-person narratives to a specific individual, a friend, a relative, or the entire family. The introduction of names and places sustained the existence of a relationship between the original sender and the original receiver of the file. To capture the listener's attention, the audio is presented as a private communication between individuals rather than for public consumption.

An emotive tone (e.g., alarmed, scared, overwhelmed, or preoccupied) gave context and meaning to the audio and created a similarity with features of fictional storytelling while relying on the power of intimacy created by voice.

Recourse to the feature of "privileged access to information" was the second most relevant characteristic standing out in the audio content in our sample. By claiming to have access to undisclosed information from the "front line," the misinformation design sought to achieve wider acceptance. Most of the audio messages embodied features of rumor with a "hearsay" emotional warning, justified with an alarming story. The privileged access portrayed was associated with either a fictional friendship, a common professional career, or one's own expertise in understanding and interpreting scientific data.

Another finding of this study was the confirmation of the impossibility of accessing the original creators of the audio content, of knowing whether it was produced for private use with the aim of alarming only one loved one or the wider population, and of understanding whether there was a deliberate lie or just the reproduction of more "hearsay" that someone considered to be true. This finding mirrors the empirical difficulty of coding according to intent. However, the claims conveyed could, and have been, classified as misinformation with inaccurate or incorrect data on the basis of checking the facts the affirmations made.

8. Conclusion

Can we argue that there is a potential shift toward nontextual and nonvisual forms of misinformation? Audio is a popular tool through which individuals can communicate up to 24 different emotions (**Cowen** *et al*., 2019), conferring a personal and intimate mark upon audio by imprinting tone, emotion, or purpose –factors that are more challenging to achieve when using text and/or image formats. Additionally, the production and sending of an audio message on *WhatsApp* consists of a simple process, allowing the user to record and send it directly from the application, highlighting one of the platform's features (**Funke**, 2018) and making it an easy and simple way to create and disseminate misinformation.

Despite improvements in literacy rates, a considerable portion of the world population still has difficulty expressing ideas correctly through text (*Unesco*, 2019). Therefore, audio represents a leveraging tool for communication, allowing a message to be produced and distributed, and to reach a wide potential audience, without the need for the producer and consumer of the message to share reading and writing skills. Nonetheless, the anonymized nature and lack of checkable details, such as visual or textual clues, location, author, or date and time stamps, associated with this format make it harder to verify.

A more detailed data analysis concluded that audio was the most common among the content received and identified as duplicated, representing 85.6% (n = 694) of the total of the duplicate files received. These data provide clues regarding the importance given to audio on *WhatsApp* and its virality regarding Covid-19, standing out as a potential preference to disseminate content. The audio message functionality was introduced into *WhatsApp* in 2013, and over the last few years it has experienced an increase in usage at the expense of text, becoming a popular feature (**Fernando**, 2018). We argue herein that this change, provided by the platform's features, reflects an ongoing transformation in the process of domestication of the platform's functionalities (**Matassi**; **Bockowski**; **Mitchelstein**, 2019). When compared with text, audio information is easier to transmit and access, thus proving to be the fastest and simplest way to communicate in a digital society (**Rodero**, 2018).

Was there a new social role for audio misinformation content in building narratives focused on the critique of policies and political actors during the early stage of Covid-19 dissemination? The predominance of the "policy and politics" topic offers a perspective on how clearly government institutions communicate and, consequently, how their messages are understood by the population. The analysis of official and specific communication regarding Covid-19 in the Portuguese context indicates that the main messages can be classified as dubious or confusing (*CovidCheck*, 2020).

Regardless of the different claims presented in each audio message, there were certain repeated characteristics: an emotional connection with the listener and a questioning of trust in governmental institutions. The government was a common target, and through various suggestions, statements, and accusations, the audio messages heightened uncertainty and caused social alarm.

The accusations focused on the government having more information than they communicated, and fostered the impetus for the diffusion of two main ideas:

1) that decisions were being made but only shared within the center of power, giving them time to prepare and adapt, instead of communicating with the population, causing distance and imbalance between citizens and government structures; and

2) that the capacity of the government, namely the response of institutions and the reality of the situation, must be questioned.

The popularity of audio brings out other characteristics that impact on how misinformation circulates on *WhatsApp* and should be considered by researchers. At this point, given that there are no metrics associated with measuring the virality of content, this aspect can only be estimated. Such data could help to contextualize and claim a potential shift toward nontextual and nonvisual forms of misinformation, reflecting an increasing adoption of the audio format among *WhatsApp* users. The credibility of the content shared, since it is from a known source, poses a difficulty to listeners to classify it as misinformation. Nonetheless, research shows (**Maros** *et al*., 2020) that *WhatsApp* is a fertile environment for misinformation circulation and dissemination.

The trending misinformation format mirrors the format of preference among users (**Funke**, 2018), that is, audio messages, at a time when most efforts made by platforms to develop AI misinformation identification systems still focus on visual and textual clues.

Should we adopt a new approach to disinformation with a clearer move toward factuality? The characteristics of misinformation in health, and Covid-19 in particular, as well as the characteristics of the platform studied, accentuate some conceptual limitations of the First Draft News model (**Wardle**, 2018). This paper does not intend to propose an alternative model, but instead aims to argue for the need to discuss its applicability for the categorization and conceptualization of "information disorders" in light of empirical data gathered from different platforms, languages, and contexts.

In the research carried out regarding *WhatsApp* content, some of the challenges identified were overcome by dividing the content into different categories, taking into account only the contextual factuality and not the intent to mislead, se-

parating "incorrect content" containing false claims from "inaccurate content" containing potentially misleading claims, and labeling the remainder as "nothing to register." These methodological choices led to the categorization of true (but contextually misleading) claims as imprecise content, and the fact checking was done taking into account the positioning of the scientific community at the time the content was shared (in the Portuguese context). No attempt was made to assess intent, given the impossibility of contacting the users who were the original sharers or creators. We can also argue that, even if these data were accessible, sustaining claims of intent to mislead on a platform such as *WhatsApp* would imply a high degree of potential doubt as to how to ensure the validity of such an assessment. Therefore, all inaccurate or incorrect content available in the sample was considered to be misinformation. The methodological discussion and construction of the codebook, which anticipated the analytical dimensions of this research, brought to light the fragility of the practical applicability of the First Draft News disinformation conceptual model (**Wardle**, 2018), questioning its limitations on three different axes: the degree of practicality regarding the verification of intention to mislead, the limitation on the noninclusion of truthful content, and the nonconsideration of the space–time vector of the publication. These limitations became even more evident given the nonpolitical but politicized nature of the object of study: misinformation about a new disease circulating on an encrypted messaging platform.

The question of intent cuts across much of the literature on disinformation and is the main criterion used by **Wardle** (2018) to distinguish disinformation from misinformation. The idea that there is a deliberate will to mislead by producing or sharing this kind of content is contradicted by user inquiries (**Herrero-Diz**; **Conde-Jiménez**; **Reyes-de-Cózar**, 2020), by individuals' conception of what disinformation is (**Nielsen**; **Graves**, 2017), and by research done on digital literacy (**Jones-Jang**; **Mortensen**; **Liu**, 2019), which shows that the sharing and production of misinformation arises spontaneously, often allied with a strong emotional charge, where the user is not aware of the incorrect or inaccurate content. Although there is always intent in the production and sharing of any message, the nature of such intent, that is, whether it is done to mislead, to express a true belief, or for any other purpose such as parody or satire, is extremely difficult to assess without a thorough understanding of the production process and the context that led to the original production and sharing of a message, something that the receiver of a given message usually has no access to, in terms of resources such as the availability of time and fact-checking literacy (**Nascimento**, 2021).

At the same time, the model fits into the perspective of disinformation as a tool for competing sectors, in which there is an organized, mechanical, and sometimes professional structure producing and sharing content. Although at certain times and at certain stages of the dissemination process this type of structure may be present, research has found several examples where the production and dissemination of incorrect or inaccurate content is organic and spontaneous, and the few identified structures result from the combined efforts of digital communities with common ideals, such as responses to social tensions, moral panic, or other types of community anxiety (**Bode**; **Vraga**, 2018; **Nielsen**; **Graves**, 2017; **Resende** *et al.*, 2019b).

In addition to the existing doubts regarding the identification of intention, there is the impracticability of its assessment. For a phenomenon that subsists almost exclusively in the digital space, and in a context of academic research based on the basic principles of ethics and respect for the privacy of the study's subjects, it is practically impossible to assess the intent of an agent who discloses content or identify its producer. Added to this challenge is the fact that many misinformation researchers work with content collected by third parties, namely fact-checking platforms or, as in our case, forwarded by other users on a platform that removes or encrypts users' identifying data.

The concept of misinformation based on the factuality of its content is transversal in literature (**Giglietto** *et al*., 2019) and was also partially applied in this study. In a society of rapid information consumption, in which often only the headlines are read or where videos, images, and text can be edited and their context changed, the idea that content needs to have a degree of falsehood to mislead is an indicator of the distance between theoretical models and social reality. It is also important to identify true content as potential misinformation when not properly contextualized and likely to cause misinterpretation (**Fallis**, 2015).

If the introduction of the space–time vector is already relevant in the framework of misinformation in its most traditional forms, the analysis of this phenomenon in the context of a pandemic with the emergence of a new disease, and wherein scientific time does not correspond to the social demand for information, makes this need even more evident. The idea of factuality as an immutable concept, in time and space, has been little discussed in the literature on misinformation, and our research around Covid-19 reveals the need to introduce this variable. During a pandemic associated with a new disease, the scientific certainties of today become the doubts of tomorrow, because incorrect facts of yesterday turn out to be true a few weeks later, for example, the issue of wearing face masks, with differences in recommendations for their use in time (March versus May) and space (Europe versus China) (**Cheung**, 2020). The analysis of misinformation should always be done taking into account the moment and location in which the content is shared. The need for researchers to have access to the variables of time and place of sharing is thus highlighted, and should not depend on collection by third parties.

These three considerations, that is, the impracticality of verifying intention, the noninclusion of truthful content, and the absence of the publication's space-time vector, result from the methodological discussion carried out among the researchers during the analysis, wherein it became evident, from the first moments of contact with empirical examples, that the current theoretical model presented significant shortfalls.

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