

# INFODEMIC IN THE FIRST AND SECOND WAVE OF THE PANDEMIC: COMPARATIVE MEDIA CONTENT ANALYSIS OF CROATIAN PORTALS

Anita DREMEL – Gordana LESINGER – Juraj JURLINA

## ABSTRACT:

In addition to the COVID-19 pandemic since 2020, there has been a pandemic of information, disinformation and fake news connected with it, referred to by the World Health Organisation as an “infodemic”. Taking into consideration that timely, accurate and transparent provision of information is highly relevant in facing health risks, the media worldwide have invested into professional coverage of the topic. However, numerous online communication platforms soon became flooded by incorrect, fabricated and sensationalist information. The aim of this study is to comparatively analyse the infodemic in the context of Croatian web portals (112 texts from 23 web portals) in the first and second wave of the pandemic. Using the method of quantitative media content analysis, two foci were developed in the instrument: one connected with the discourse of/on scientists (3 codes) and the other with iterative thematic analysis (6 codes were used to uncover topics – the source, danger, vaccine, protective masks, distancing, immunity). A Chi-square test was used to test the statistical significance of the difference between the two waves of the pandemic/infodemic. The results suggest there are four statistically significant differences – one related to the first focus (quoting scientists is more frequent in the second wave) and three to the second (the topic of the source of the virus is less present in the texts appearing during the second wave of the pandemic, while topics of immunity and danger are significantly more represented in the second wave).

## KEY WORDS:

coronavirus, Croatia, infodemic, information, media content analysis, pandemic

## 1 Introduction

As the coronavirus outbreak continues to increase in severity, the volume of information regarding the virus has been growing. COVID-19 presents an unprecedented global health communications challenge.



Dr. Anita Dremel, PhD.  
Faculty of Humanities and Social Sciences  
J. J. Strossmayer University  
L. Jaeger 9  
310 00 Osijek  
Croatia  
adremel@ffos.hr

Anita Dremel earned her Master's degrees in Sociology and English in 2006 at the Faculty of Humanities and Social Sciences in Zagreb. In 2007 she acquired a BA in Japanese studies. In 2014 she defended her doctoral dissertation in Sociology at the same faculty. Employed in higher education since 2007, and since 2017 as an Assistant Professor at the Department of Sociology, the Faculty of Humanities and Social Sciences in Osijek. Her main research interests revolve around gender, culture, violence, modernisation and discourse. She has published scientific papers in English and Croatian and participated in dozens of international conferences.



Dr. Gordana Lesinger, PhD.  
Faculty of Humanities and Social Sciences  
J. J. Strossmayer University  
L. Jaeger 9  
310 00 Osijek  
Croatia  
glesinger@ffos.hr

Gordana Lesinger is an Assistant Professor at the Faculty of Humanities and Social Sciences at the J. J. Strossmayer University in Osijek. She graduated in Journalism at the Faculty of Political Science in Zagreb, and at the Doctoral School ‘Communication Studies’ at the J. J. Strossmayer University in Osijek. Her field of scientific interest includes communication, mass media, Public Relations and professional ethics in journalism. She has continued her education through Public Relations education programmes as the first generation of the School of Public Relations at the Faculty of Political Science (2009), NATO (CICA) Communication School (2004 – 2006), The Netherlands Royal Academy of Government Communication (2004) and the London Public Relations School (2002).



Juraj Jurlina, MA  
Faculty of Humanities and Social Sciences  
J. J. Strossmayer University  
L. Jaeger 9  
310 00 Osijek  
Croatia  
jjurlina@ffos.hr

Juraj Jurlina earned a Master's degree in Sociology in 2016 at the Faculty of Humanities and Social Sciences in Zagreb. In 2018, he enrolled in a doctoral degree programme at the same faculty. Since 2017, he has been employed as a teaching assistant at the Faculty of Humanities and Social Sciences at the J. J. Strossmayer University in Osijek. He conducts seminars and exercises in several theoretical and methodological courses. His research interests include digital media, online social networking sites and the process of individualisation, which is also the topic of his doctoral dissertation. He has published several scientific papers and participated in international conferences.

The infodemic is arguably “propelling the spread of the virus itself”. The avalanche of human response is being facilitated by the flow of information from the broadcast world of traditional media but, in particular, by the networked world of media.<sup>1</sup> This is where the research presented in this study finds its justification and relevance, aiming at comparing the topics appearing in pandemic-related media content on web portals in Croatia during the first two pandemic waves.

According to WHO, the “infodemic” presents a major challenge to the global pandemic response. At the global level, the tech giants that monopolise online platforms are largely unregulated, and information is easily weaponised for political, ideological and economic interests. At the national level, lack of government transparency and accountability, low professional journalism standards, poorly adapted regulation, low digital and media literacy, and existing social divides and inequalities are all drivers that increase the appeal and impact of alternative information sources.<sup>2</sup>

Scientific articles published during the epidemic provided the most intense flow of information to the literature. This process was experienced as being able to complicate the problem rather than resolve it, including the spread of speculative and unverified information, which can be described as a “pandemic infodemic” in a period when it is very easy to deliver instant information to target audiences via social media and Internet journalism.<sup>3</sup> The urgency of the situation, its rapid evolution and the crippling impact on lives and livelihoods have led to an enormous public demand for information. However, this has come at a time when public trust in democratic institutions, including mainstream media, is at a historic low, amplifying the influence of rumours, informal news sources and fringe journalism. Faced with an overwhelming volume of information, the public has the almost impossible task of determining what to believe. The intentional and unintentional dissemination of misleading, inflammatory and false information is heightening fear and confusion, leading to high-risk behaviours, and driving acts of violence and stigmatisation.<sup>4</sup> The COVID-19 infodemic is even more complex, as it goes beyond spreading fake news, rumours and conspiracy theories, and extends to promote fake cures, panic, racism, xenophobia and mistrust in the authorities, among others. This is a complex problem that needs a holistic approach combining the perspectives of journalists, fact-checkers, policymakers, government entities, social media platforms and society.<sup>5</sup> The approach in this study combines sociological and communication-studies perspectives.

It seems we can observe a kind of information ‘pollution’. An enormous amount of unverified information is being disseminated about various aspects of the coronavirus disease, methods of control and prevention of the disease, and its consequences through different media and social networking sites.<sup>6</sup> It can take numerous forms, from misleading headlines to false advertising, rumours, conspiracy theories, memes and sophisticated illicit campaigns to shift public opinion. Furthermore, the causes driving the phenomenon are diverse.<sup>7</sup> Massive waves of information, including extensive amounts of false information have accompanied the coronavirus pandemic. False information is being spread by a number of different actors for various reasons.<sup>8</sup>

Platforms such as *Facebook*, *Instagram*, *Snapchat*, *Twitter*, *WhatsApp* and *YouTube* are great sources of news and information dissemination today, but can sometimes create panic due to the spread of disinformation or false news. Most people who see disinformation about COVID-19 may think that what they are reading is

true and some of it may cause panic. Many social media users are inclined to share disinformation and fuel fear of something that is not necessarily true.<sup>9</sup> A combination of widespread anxiety as well as increased use of social media during lockdowns in many countries have provided fertile ground for ‘organic’ false information and conspiracy theories by individual users who do not intentionally want to deceive anyone, but inadvertently become part of the problem by spreading and/or amplifying misleading messages.<sup>10</sup>

There are subtle differences in definition between fake news, rumours and disinformation, but they have the common features as fabricated content that is different from the facts as a core concept element in theory building.<sup>11</sup> Growing Internet usage, notably by young people during lockdowns, has exposed them to false, sometimes manipulated and manipulative information, including on social media and gaming platforms.<sup>12</sup> *Twitter* conversations can help predict the spread and outbreak of COVID-19 when other reliable leading indicators are not available. Attention to COVID-19 continues to grow on *Twitter*, and likely on other platforms as well.<sup>13</sup> As the consequences of the infodemic continue to unfold, the crisis also presents a significant threat to media freedom, which was already under severe pressure prior to COVID-19. Media freedom watchdogs are voicing concern that governments across the world are using the fight against false information about the coronavirus as a pretext for the implementation of new, draconian restrictions on free expression, as well as to increase press censorship.<sup>14</sup>

To additionally complement this introductory presentation of background, it is useful to discuss various types of false information. Namely, by manipulating public opinion, strategic disinformation related to COVID-19 exploits vulnerabilities in human cognition, allowing for malign state and non-state actors across the world to achieve ideological gains at the expense of democratic discourse. This contributes to further accelerating truth decay; the diminishing role of facts and analysis in public life worldwide. Moreover, the fight against misleading information regarding the coronavirus has been exploited by many governments to further restrict freedoms, including media freedom and freedom of expression.<sup>15</sup> The concept of “fake news” is widely used in the media to describe fabricated news or rumours. Despite its ambiguity and negative connotation, the term was adopted by academia as well to describe the modern form of online disinformation. It was popularised after the 2016 US presidential election, although the phrase itself was known before.<sup>16</sup> The typical definition of disinformation is “the deliberate creation and sharing of false and/or manipulated information that is intended to deceive and mislead audiences, either for the purposes of causing harm or for political, personal or financial gain”.<sup>17</sup> The infodemic has made it even clearer that the global ‘information disorder’ – diagnosed in a 2017 report published by the Council of Europe – entails not only deliberately deceptive disinformation by foreign actors, but also misinformation (without the intent to deceive), as well as various mal-information such as leaks, harassment and hate speech.<sup>18</sup> False information about COVID-19 is

1 SINGH, L. et al.: A First Look at COVID-19 Information and Misinformation Sharing on Twitter. In *ArXiv*, 2020. Preprint. [online]. [2021-04-03]. Available at <<https://arxiv.org/abs/2003.13907>>.

2 UNDP: *Responding to COVID-19 – Information Pollution*. Released on 2<sup>nd</sup> June 2020. [online]. [2020-09-20]. Available at: <<https://www.undp.org/publications/responding-covid-19-information-pollution#modal-publication-download>>.

3 SAHINER, F. et al.: Analysis of a News Article in the SARS-CoV-2 Pandemic and Infodemic with Current Scientific Literature. In *Journal of Molecular Virology and Immunology*, 2020, Vol. 1, No. 2, p. 54-67.

4 SAHINER, F. et al.: Analysis of a News Article in the SARS-CoV-2 Pandemic and Infodemic with Current Scientific Literature. In *Journal of Molecular Virology and Immunology*, 2020, Vol. 1, No. 2, p. 54-67.

5 ALAM, F. et al.: Fighting the COVID-19 Infodemic in Social Media: A Holistic Perspective and a Call to Arms. In *Proceedings of the International AAAI Conference on Web and Social Media*, 2021, Vol. 15, No. 1, p. 913-922.

6 CIFUENTES-FAURA, J.: COVID-19 and Infodemics: How to Solve This Problem. In *International Journal of Media and Information Literacy*, 2020, Vol. 5, No. 2, p. 145-152.

7 UNDP: *Responding to COVID-19 – Information Pollution*. Released on 2<sup>nd</sup> June 2020. [online]. [2020-09-20]. Available at: <<https://www.undp.org/publications/responding-covid-19-information-pollution#modal-publication-download>>.

8 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus ‘Infodemic’: How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.

9 UNDP: *Responding to COVID-19 – Information Pollution*. Released on 2<sup>nd</sup> June 2020. [online]. [2020-09-20]. Available at: <<https://www.undp.org/publications/responding-covid-19-information-pollution#modal-publication-download>>.

10 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus ‘Infodemic’: How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.

11 KIM, S., KIM, S.: The Crisis of Public Health and Infodemic: Analyzing Belief Structure of Fake News about COVID-19 Pandemic. In *Sustainability*, 2020, Vol. 12, No. 23, p. 4.

12 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus ‘Infodemic’: How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.

13 SINGH, L. et al.: A First Look at COVID-19 Information and Misinformation Sharing on Twitter. In *ArXiv*, 2020. Preprint. [online]. [2021-04-03]. Available at <<https://arxiv.org/abs/2003.13907>>.

14 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus ‘Infodemic’: How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.

15 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus ‘Infodemic’: How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.

16 VZIATYSHEVA, V.: How Fake News Spreads Online? In *International Journal of Media and Information Literacy*, 2020, Vol. 5, No. 2, p. 217-226.

17 KIM, S., KIM, S.: The Crisis of Public Health and Infodemic: Analyzing Belief Structure of Fake News about COVID-19 Pandemic. In *Sustainability*, 2020, Vol. 12, No. 23, p. 10.

18 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus ‘Infodemic’: How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.

being produced and disseminated on a large scale, impeding efforts to rapidly impose quarantines. Thus, in addition to the COVID-19 pandemic itself, an infodemic related with it is leading to social crises.<sup>19</sup> The WHO maintains a list of themes of disinformation regarding the pandemic, including claims that drinking bleach or pure alcohol can cure or prevent infections; that 5G mobile networks spread the virus; that cold weather and snow can kill COVID-19; and that mosquitos can spread the virus. In the physical realm, there is concern that anti-lockdown protests are working as superspreading events not only for the virus itself, but also for radical ideologies and anti-elite/anti-vaccination conspiracy theories.<sup>20</sup>

Leaning against the background of the literature presenting the possibly escalating effects and severe social consequences of spreading the infodemic, the aim of this study is to analyse the situation in the Croatian context and to compare the publications on Croatian portals during two respective pandemic waves, with the initial thesis that there will be significant differences in presented topics. The content of media publications appearing on the most frequented Croatian portals were analysed using quantitative content analysis.

## 2 Method

The selected research method is media content analysis, which is found adequate due to its ability to make huge advances to our understanding of a wide range of topics in the current age of big data.<sup>21</sup> The method is flexible and in combination with the fact that state-of-the-art technology enables massive generation of data, more studies that rely on content analysis can be expected. According to, for instance, Berelson,<sup>22</sup> Krippendorff<sup>23</sup> and Weber,<sup>24</sup> content analysis can be defined as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding, or as Holstiput it, as a technique for making inferences based on systematic identification of certain characteristics of messages.<sup>25</sup>

The objective of this research is to analyse the phenomenon of “infodemic” based on the descriptive media analysis and quantitative content analysis of texts appearing on several most popular web portals in Croatia during the first and second wave of the pandemic and to compare the two waves. The first wave refers to the period from March to June 2020, while the second wave encompasses the period from October to December 2020. The portals included in the sample are the following: *bug.hr*, *vecernji.hr*, *juarnji.hr*, *telegram.hr*, *novilist.hr*, *net.hr*, *poslovnih.hr*, *faktograf.hr*, *t-portal*, *dv.com*, *glasistre.hr*, *slobodnadalmacija.hr*, *hrt.hr*, *rtl.hr*, *24sata.hr*, *sib.hr*, *ika.hr*, *dnevnik.hr*, *soundguardian.com*, *indeks.hr*, *hr.ninfo.com*, *belupo.hr*, *zadarski.slobodnadalmacija.hr*.

The sample includes 112 texts, 60 published during the first wave and 52 published during the second wave of the pandemic, selected based on the keywords related to the coronavirus pandemic. The aim was to analyse how pandemic and infodemic were presented on frequented media portals. This is why the sample includes the text discussing an aspect of the coronavirus pandemic measures or disease or reporting the statements of medical doctors and scientists relating to the COVID disease, the pandemic or infodemic. Various statements by scientists were often in collision or contradictory, which contributed to the appearance of fake news and left room for disinformation in these chaotic circumstances.

There are two parts of the media content analysis of selected texts. The first part focuses on the treatment of statements by scientists and their authority on the portals and is operationalised via three codes: quotations of scientists, suspicion about what scientists claim and whether the text was written by an MD or a scientist,

comparatively during two respective waves of the virus outbreak. The second part focuses on specific topics based on iterative thematic analysis. The coded topics that thereby emerged include six topics: the source, danger, vaccine, protective masks, distancing and immunity. Table 1 shows the topics that emerged based on media content analysis. Posterior to coding the entire collected media content (112 articles) as presented, a Chi-square test was administered to show whether the differences between two samples (media content from the first and second wave, respectively) are statistically significant.

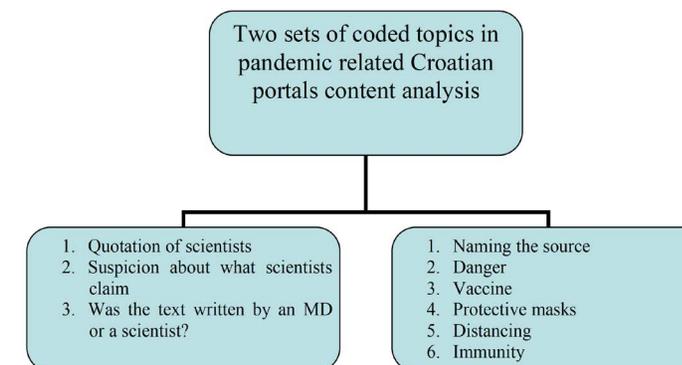


Figure 1: Topics coded in media content of Croatian portals

Source: Own processing

## 3 Results and Discussion

The comparison of obtained data sets from the two waves of the pandemic based on two corpora of distinctive codes (9 in total) has revealed four statistically significant differences between the two waves and five statistically insignificant differences. The first corpus contains three codes and refers to the position of scientists in the texts – whether they are quoted, whether there is any suspicion expressed regarding what scientists say and whether the text was written by a scientist. Table 1 shows that in both pandemic waves, scientists were quoted in the majority of texts and particularly so, with a statistically significant increase – scientists were more frequently quoted during the second wave of the pandemic.

Table 1: Quoting scientists

|                 |             | Quoting Scientists |            |           |
|-----------------|-------------|--------------------|------------|-----------|
|                 |             | NO                 | YES        | TOTAL     |
| Researched Wave | First Wave  | 43.3% (26)         | 57.7% (34) | 100% (60) |
|                 | Second Wave | 25% (13)           | 75% (39)   | 100% (52) |

Chi-square= 4.125

p = 0.042

Source: Own processing

Table 2 shows that out of 60 texts published during the first wave only 3 expressed some kind of suspicion about the scientists, and there was only one such text out of 52 during the second wave of the pandemic. The Chi-square value of 3.781 (p=0.151) indicates that in addition to the small number of such texts, the difference between information spread and type during two pandemic waves is not statistically significant regarding this matter.

19 KIM, S., KIM, S.: The Crisis of Public Health and Infodemic: Analyzing Belief Structure of Fake News about COVID-19 Pandemic. In *Sustainability*, 2020, Vol. 12, No. 23, p. 9.

20 BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus 'Infodemic': How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020, p. 1. [online]. [2021-09-03]. Available at: <https://www.europarl.europa.eu/thinktank/en/document/EPRS\_BRI(2020)652083>.

21 STEMLER, S.: An Overview of Content Analysis. In *Practical Assessment, Research, and Evaluation*, 2000, Vol. 7, No. 17, p. 6.

22 See: BERELSON, B.: *Content Analysis in Communication Research*. New York : Free Press, 1952.

23 See also: KRIPPENDORFF, K.: *Content Analysis: An Introduction to Its Methodology*. Newbury Park : Sage, 1980.

24 Compare to: WEBER, R. P.: *Basic Content Analysis*. Newbury Park : Sage, 1990.

25 See: HOLSTI, O. R.: *Content Analysis for the Social Sciences and Humanities*. Reading : Addison-Wesley, 1969.

Table 2: Suspicion about scientists

|                 |             | Suspicion about Scientists |          |               |           |
|-----------------|-------------|----------------------------|----------|---------------|-----------|
|                 |             | NO                         | YES      | GENERALLY, NO | TOTAL     |
| Researched Wave | First Wave  | 95% (57)                   | 0% (0)   | 5% (3)        | 100% (60) |
|                 | Second Wave | 98.1% (51)                 | 1.9% (1) | 0% (0)        | 100% (52) |

Chi-square= 3.781

p=0.151

Source: Own processing

The third code in the first corpus referred to whether a scientist or a medical doctor authored the text in question. The results show that seven out of 60 texts were authored by a scientist or MD during the first wave, while there was only one such text out of 52 during the second wave, but without statistical significance after conducting Fisher's test (see Table 3). The results can be compared to similar studies, which show that although the scientific community generally still enjoys relatively high levels of public trust, there are individuals expressing scepticism about scientists.<sup>26</sup> These realities make it a priority for medicine to identify and mitigate health disinformation.

Table 3: Scientists or MDs as authors of texts

|                 |             | Written by Scientist/MD |           |           |
|-----------------|-------------|-------------------------|-----------|-----------|
|                 |             | NO                      | YES       | TOTAL     |
| Researched Wave | First Wave  | 88.3% (53)              | 11.7% (7) | 100% (60) |
|                 | Second Wave | 98.1% (51)              | 1.9% (1)  | 100% (52) |

Chi-square= 3.987

p=0.046

Fisher's test; p=0.066

Source: Own processing

The next corpus of six codes referred to the topics appearing in the texts. The six codes were developed based on available literature and quick word frequency counts. The first topic refers to the source of the virus and includes possibilities like zoonosis (implying a non-human source) or man-made origin (created accidentally in the lab or spread on purpose). The results show that the majority of analysed texts suggest that the source of the virus is natural, with a small number claiming man-made origins. There is extensive variability in writing about this topic. There were in our sample 14 analysed texts during the first wave and 2 texts from the second wave of the pandemic discussing the topic of where the virus came from, which was proven to be statistically significantly different – there were significantly fewer texts discussing this topic during the second wave.

26 FUNK, C.: Mixed Messages about Public Trust in Science. In *Issues in Science and Technology*, 2017, Vol. 34, No. 1, p. N/A. [online]. [2015-04-17]. Available at: <https://issues.org/real-numbers-mixed-messages-about-public-trust-in-science/>.

Table 4: The source of the virus

|                 |             | Topic - Source |            |           |
|-----------------|-------------|----------------|------------|-----------|
|                 |             | NO             | YES        | TOTAL     |
| Researched Wave | First Wave  | 76.7% (46)     | 23.3% (14) | 100% (60) |
|                 | Second Wave | 96.2% (50)     | 3.8% (2)   | 100% (52) |

Chi-square=8.639

p=0.003

Source: Own processing

The second of the six analysed topics was the danger of COVID-19 – a very frequent topic in both the first (40 out of 60 texts) and second wave (48 out of 52 texts). Based on the Chi-square test the difference was statistically significant, namely the topic was relevantly more represented in the second wave (see Table 5).

Table 5: Danger of COVID-19

|                 |             | Topic - Vaccines |            |           |
|-----------------|-------------|------------------|------------|-----------|
|                 |             | NO               | YES        | TOTAL     |
| Researched Wave | First Wave  | 32.2% (19)       | 67.8% (40) | 100% (59) |
|                 | Second Wave | 7.7% (4)         | 92.3% (48) | 100% (52) |

Chi-square=10.109

p=0.001

Source: Own processing

The majority of texts express the view that the virus presents medium, large or very large danger. Great variability of writing about this topic can also be noticed in this case. When it comes to the topic of vaccines, over half of the texts in both waves discuss this topic, without statistically significant difference between the two waves, indicating that vaccines are a steadily represented topic on Croatian portals. Table 6 shows the obtained results regarding this topic.

Table 6: The topic of vaccines

|                 |             | Topic - Vaccines |            |           |
|-----------------|-------------|------------------|------------|-----------|
|                 |             | NO               | YES        | TOTAL     |
| Researched Wave | First Wave  | 36.7% (22)       | 63.3% (38) | 100% (60) |
|                 | Second Wave | 42.3% (22)       | 57.7% (30) | 100% (52) |

Chi-square =0.372

p=0.542

Source: Own processing

Maybe somewhat unexpectedly, the topic of wearing masks, primarily revolving around their protectiveness and meaningfulness of wearing them, appears in 16 out of 60 or 26.7% of analysed texts from the first wave and 23 out of 52 or 44.2% of texts from the second wave of the pandemic. Chi-square test (3.786, p=0.052) has shown that the difference between the two waves regarding the frequency of the appearance of the topic of masks on Croatian portals is on the edge of statistical significance (see Table 7).

Table 7: The topic of masks

|                 |             | Topic - Masks |               |              |
|-----------------|-------------|---------------|---------------|--------------|
|                 |             | NO            | YES           | TOTAL        |
| Researched Wave | First Wave  | 73.3%<br>(44) | 26.7%<br>(16) | 100%<br>(60) |
|                 | Second Wave | 55.8%<br>(29) | 44.2%<br>(23) | 100%<br>(52) |

Chi-square=3.786

p=0.052

Source: Own processing

The topic of social distancing (see Table 8) was discussed with a relatively high variability of arguments for or against this measure. 25% of analysed texts from the first wave and 40.4% of analysed texts from the second wave thematised social distance and its effectiveness. The difference was proven to be statistically insignificant based on the Chi-square test (30.23, p=0.082).

Table 8: The topic of social distancing

|                 |             | Topic - Social Distance |               |              |
|-----------------|-------------|-------------------------|---------------|--------------|
|                 |             | NO                      | YES           | TOTAL        |
| Researched Wave | First Wave  | 75%<br>(45)             | 25%<br>(15)   | 100%<br>(60) |
|                 | Second Wave | 59.6%<br>(31)           | 40.4%<br>(21) | 100%<br>(52) |

Chi-square=30.23

p=0.082

Source: Own processing

The last of the analysed topics refers to immunity. The results show that 36.7% of the analysed texts published on Croatian portals during the first wave and 63.3% of texts from the second wave discussed the topic of immunity in some way. Chi-square (8.003) proved this difference to be statistically significant, namely the topic was far more widely and frequently present during the second wave of the pandemic (see Table 9).

Table 9: The topic of immunity

|                 |             | Topic - Immunity |               |              |
|-----------------|-------------|------------------|---------------|--------------|
|                 |             | NO               | YES           | TOTAL        |
| Researched Wave | First Wave  | 63.3%<br>(38)    | 36.7%<br>(22) | 100%<br>(60) |
|                 | Second Wave | 36.5%<br>(19)    | 63.5%<br>(33) | 100%<br>(52) |

Chi-square=8.003

p=0.005

Source: Own processing

The results suggest there are four statistically significant differences – one related to the first focus and three to the second. Quoting scientists is more frequent in the second wave, while the topic of referring to sources is less present in the texts appearing during the second wave of the pandemic. Finally, topics of immunity and danger are also significantly more represented in the second wave of the pandemic. All other codes indicated no significant difference in media content presentation during the two waves. These results make sense in terms of trends and context. The first wave of the pandemic was characterised by more topics devoted to the source of the virus, whereas issues of measures and vaccination start to take over in later phases.

This can be compared to literature claiming that already existing repositories of news and information become relevant in influencing further developments.<sup>27</sup>

In addition to this, the texts analysed in this study are available on the Internet (web portals) and it is thus useful to examine how the topics presented there influence perceptions of risks and necessary protection, which is comparable to similar research.<sup>28</sup> One of the greatest challenges when it comes to health-related information online is that it is extremely hard to evaluate valid and reliable facts and sources<sup>29</sup> and this also particularly goes for Internet sources.

The comparative analysis of pandemic-related content on Croatian web portals during the first two pandemic waves enabled some insights into trends of media coverage of infodemic. Even though scientists are quoted, not many articles are written by scientists or MDs and scientific positions are often questioned, even though there is great variability in how topics are represented. This situation can be compared to other research contributions, for example, on leveraging media and health communication strategies in overcoming the infodemic,<sup>30</sup> that accentuate the confusion brought about by conflicting positions of scientists and MDs or various interpretations of topics. The overflow of information can unfortunately harm the implementation of activities for controlling the spread of the virus, but the Internet as the place of diffusing information can also help public health policies in realisation of desired outcomes. The results can also be compared to research that shows both that the rapid spread of the virus contributed to online discourse on it and how themes in online texts changed with the adoption of social distancing measures and non-pharmaceutical interventions.<sup>31</sup>

## 4 Conclusion

*Fama volat*, an old Latin saying – or the famous quote by Mark Twain that a lie can travel halfway around the world while the truth is putting on its shoes – popularly testify to not only the speed but also the potential danger of travelling disinformation. Regarding the diffusion of information, mounting evidence suggests that falsehoods spread more easily than truths online.<sup>32</sup> The global condition of information communication technology and the features of the Internet make this ancient truth even more radically echo today. Online media, web portals in case of this study, are a critical factor of influence in many areas of late modern society. It is therefore crucial to use them adequately and to understand some regularities and mechanisms of online communication, particularly so when it comes to public health,<sup>33</sup> because medicine is in a similar position as policy makers and the online media industry when it comes to curbing fake news and disinformation.<sup>34</sup>

27 CLARK, P. A. et al.: Vaccinations and the Influence of Social Media in the United States. In *Journal of Neonatology & Clinical Pediatrics*, 2020, Vol. 7, No. 42, p. 5.

28 CAROLYN, A. L., CAROLYN, L.: Effects of News Media and Interpersonal Interactions on H1N1 Risk Perception and Vaccination Intent. In *Communication Research Reports*, 2013, Vol. 30, No. 2, p. 134.

29 DA SILVA, E., TOLEDO, M. M.: Internet and COVID-19: Information and Misinformation. In *Inter-American Journal of Medicine and Health*, 2020, Vol. 3, p. 1.

30 MHEIDL, N., FARES, J.: Leveraging Media and Health Communication Strategies to Overcome the COVID-19 Infodemic. In *Journal of Public Health Policy*, 2020, Vol. 41, No. 4, p. 410-420.

31 MASSARO, M. et al.: Non-Pharmaceutical Interventions and the Infodemic on Twitter: Lessons Learned from Italy during the Covid-19 Pandemic. In *Journal of Medical Systems*, 2021, Vol. 45, No. 4, p. 1-12.

32 VOSOUCI, S. et al.: The Spread of True and False News Online. In *Science*, 2018, Vol. 359, No. 6380, p. 1146-1151.

33 See: GRANT, L. et al.: Vaccination Persuasion Online: A Qualitative Study of Two Pro-vaccine and Two Vaccine-Sceptical Websites. In *JMIR Journal of Medical Internet Research*, 2015, Vol. 17, No. 5, p. 1; MELOVIC, B. et al.: The Impact of Online Media on Parents' Attitudes toward Vaccination of Children – Social Marketing and Public Health. In *International Journal of Environmental Research and Public Health*, 2020, Vol. 17, No. 16, p. 1.

34 SOUTHWELL, B. G. et al.: The Persistence and Peril of Misinformation. In *American Scientist*, 2017, Vol. 105, No. 6, p. 372-375.

The Internet itself can either hinder or facilitate organised action in some fields.<sup>35</sup> Even though the infodemic situation on the Internet is a broad issue that at times seems to have little hope of general resolution,<sup>36</sup> there is room for action and therefore a clear need for constant future research on aspects of the infodemic as relevant factors in fighting public health risks.<sup>37</sup> It is thereby crucial to understand the context and dynamic of disinformation exchange to help determine the extent of the problem and suggest possible solutions.<sup>38</sup>

*Acknowledgement: The study is part of the project 'The Impact of the Internet and Internet Social Networking Sites on the Attitudes and Decisions about Vaccination' led by Professor Željko Pavić, PhD., and funded by the Croatian Science Foundation (Grant number: HRZZ IP-2019-04-7902).*

## BIBLIOGRAPHY:

- ALAM, F. et al.: Fighting the COVID-19 Infodemic in Social Media: A Holistic Perspective and a Call to Arms. In *Proceedings of the International AAAI Conference on Web and Social Media*, 2021, Vol. 15, No. 1, p. 913-922. ISSN 2334-0770.
- BENTZEN, N., SMITH, T.: *The Evolving Consequences of the Coronavirus 'Infodemic': How Viral False Coronavirus-Related Information Affects People and Societies across the World*. Brussels : European Parliamentary Research Service, 2020. [online]. [2021-09-3]. Available at: <[https://www.europarl.europa.eu/thinktank/en/document/EPRS\\_BRI\(2020\)652083](https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2020)652083)>.
- BERELSON, B.: *Content Analysis in Communication Research*. New York : Free Press, 1952.
- BRONIATKOWSKI, D. A. et al.: Weaponized Health Communication: Twitter Bots and Russian Trolls Amplify the Vaccine Debate. In *American Journal of Public Health*, 2018, Vol. 108, No. 10, p. 1378-1384. ISSN 1541-0048.
- CAROLYN, A. L., CAROLYN, L.: Effects of News Media and Interpersonal Interactions on H1N1 Risk Perception and Vaccination Intent. In *Communication Research Reports*, 2013, Vol. 30, No. 2, p. 127-136. ISSN 8824-096.
- CIFUENTES-FAURA, J.: COVID-19 and Infodemics: How to Solve this Problem. In *International Journal of Media and Information Literacy*, 2020, Vol. 5, No. 2, p. 145-152. ISSN 2500-106X.
- CLARK, P. A. et al.: Vaccinations and the Influence of Social Media in the United States. In *Journal of Neonatology & Clinical Pediatrics*, 2020, Vol. 7, No. 42, p. 1-23. ISSN 2378-878X.
- DA SILVA, E., TOLEDO, M. M.: Internet and COVID-19: Information and Misinformation. In *InterAmerican Journal of Medicine and Health*, 2020, Vol. 3, p. 1-3. ISSN 2595-6647.
- FUNK, C.: Mixed Messages about Public Trust in Science. In *Issues in Science and Technology*, 2017, Vol. 34, No. 1, N/A. ISSN 0748-5492. [online]. [2015-04-17]. Available at: <<https://issues.org/real-numbers-mixed-messages-about-public-trust-in-science/>>.
- GRANT, L. et al.: Vaccination Persuasion Online: A Qualitative Study of Two Provacine and Two Vaccine-Sceptical Websites. In *JMIR Journal of Medical Internet Research*, 2015, Vol. 17, No. 5, p. 1-20. ISSN 1438-8871.
- HOLSTI, O. R.: *Content Analysis for the Social Sciences and Humanities*. Reading : Addison-Wesley, 1969.
- KIM, S., KIM, S.: The Crisis of Public Health and Infodemic: Analyzing Belief Structure of Fake News about COVID-19 Pandemic. In *Sustainability*, 2020, Vol. 12, No. 23, p. 1-23. ISSN 2071-1050.
- KRIPPENDORFF, K.: *Content Analysis: An Introduction to Its Methodology*. Newbury Park : Sage, 1980.
- MASSARO, M. et al.: Non-Pharmaceutical Interventions and the Infodemic on Twitter: Lessons Learned from Italy during the Covid-19 Pandemic. In *Journal of Medical Systems*, 2021, Vol. 45, No. 4, p. 1-12. ISSN 1573689X.
- MELOVIC, B. et al.: The Impact of Online Media on Parents' Attitudes toward Vaccination of Children – Social Marketing and Public Health. In *International Journal of Environmental Research and Public Health*, 2020, Vol. 17, No. 16, p. 1-28. ISSN 1660-4601.

35 WARD, J. K., PERETTI-WATEL, P., VERGER, P.: Vaccine Criticism on the Internet: Propositions for Future Research. In *Human Vaccines & Immunotherapeutics*, 2016, Vol. 12, No. 7, p. 1924-1929.

36 WILSON, S. L., WIYSONGE, C.: Social Media and Vaccine Hesitancy. In *BMJ Global Health*, 2020, Vol. 5, No. 10, p. 6.

37 WARD, J. K., PERETTI-WATEL, P., VERGER, P.: Vaccine Criticism on the Internet: Propositions for Future Research. In *Human Vaccines & Immunotherapeutics*, 2016, Vol. 12, No. 7, p. 1924-1929.

38 BRONIATKOWSKI, D. A. et al.: Weaponized Health Communication: Twitter Bots and Russian Trolls Amplify the Vaccine Debate. In *American Journal of Public Health*, 2018, Vol. 108, No. 10, p. 1378-1384.

MHEIDLY, N., FARES, J.: Leveraging Media and Health Communication Strategies to Overcome the COVID-19 Infodemic. In *Journal of Public Health Policy*, 2020, Vol. 41, No. 4, p. 410-420. ISSN 1745-655X.

SAHINER, F. et al.: Analysis of a News Article in the SARS-CoV-2 Pandemic and Infodemic with Current Scientific Literature. In *Journal of Molecular Virology and Immunology*, 2020, Vol. 1, No. 2, p. 54-67. ISSN 2717-7874.

SINGH, L. et al.: A First Look at COVID-19 Information and Misinformation Sharing on Twitter. In *ArXiv*, 2020. Preprint. [online]. [2021-04-03]. Available at <<https://arxiv.org/abs/2003.13907>>.

SOUTHWELL, B. G. et al.: The Persistence and Peril of Misinformation. In *American Scientist*, 2017, Vol. 105, No. 6, p. 372-375. ISSN 0003-0996.

STEMLER, S.: An Overview of Content Analysis. In *Practical Assessment, Research, and Evaluation*, 2000, Vol. 7, No. 17, p. 1-7. ISSN 1531-7714.

UNDP: *Responding to COVID-19 – Information Pollution*. Released on 2<sup>nd</sup> June 2020. [online]. [2020-09-20]. Available at: <<https://www.undp.org/publications/responding-covid-19-information-pollution#modal-publication-download>>.

VOSOUGHI, S. et al.: The Spread of True and False News Online. In *Science*, 2018, Vol. 359, No. 6380, p. 1146-1151. ISSN 1095-9203.

VZIATYSHEVA, V.: How Fake News Spreads Online? In *International Journal of Media and Information Literacy*, 2020, Vol. 5, No. 2, p. 217-226. ISSN 2500-106X.

WARD, J. K., PERETTI-WATEL, P., VERGER, P.: Vaccine Criticism on the Internet: Propositions for Future Research. In *Human Vaccines & Immunotherapeutics*, 2016, Vol. 12, No. 7, p. 1924-1929. ISSN 2164-554X.

WEBER, R. P.: *Basic Content Analysis*. Newbury Park : Sage, 1990.

WILSON, S. L., WIYSONGE, C.: Social Media and Vaccine Hesitancy. In *BMJ Global Health*, 2020, Vol. 5, No. 10, p. 1-8. ISSN 2059-7908.

