# NEGATIVE INFORMATION LEADS TO A DECLINE OF TRUST IN SCIENCE: THE CONNECTION BETWEEN TRADITIONAL AND SOCIAL MEDIA USES AND VACCINATION CONSPIRACY BELIEFS

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***Abstract***: *Although vaccine hesitancy is not a new phenomenon, the emergence of social media has led to growing concerns about the media's role in its perpetuation. In this study, hypotheses about the direct and indirect connections between media use and the endorsement of vaccination conspiracy beliefs were tested. The data were collected on an online quota sample of the general population of the Republic of Croatia (N = 1,500) and analyzed using structural equation modeling. The results showed that the total amount of television use, and television as a source of vaccination information were associated with lower vaccination conspiracy beliefs. The connection of social media and vaccination conspiracy beliefs was the opposite, that is, the more frequent use of social media is connected with the increased vaccination conspiracy beliefs. Internet news channels as a source of vaccination information were also associated with a lower level of vaccination conspiracy beliefs. Almost all hypothesized mediation mechanisms were confirmed, given that the use of a certain type of media leads to more (less) positive information about vaccination, which increases (reduces) trust in science credibility, and ultimately reduces (increases) conspiratorial beliefs.*

***Keywords:*** *Keywords: vaccine hesitancy, vaccination conspiracy beliefs, media, social media, science credibility, television, Internet, Covid-19*

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# Introduction

Vaccine hesitancy is not a new phenomenon, but the possibility of spreading unverified information about vaccination through social media and other Internet channels has given new vehicles for promoters of vaccine skepticism (Cascini et al 2022; Garett and Young 2021; Numerato et al 2019; Wilson and Wiysonge 2020), and the Internet is often considered a key space for perpetuating ideas related to anti-vaccination movements (Dubé et al 2021). The emergence of the COVID-19 health crisis has increased concerns about reluctance to get vaccinated and about the influence of the Internet and social media in this respect. The Internet and social media provide additional space for vaccination skeptics to express alternative opinions, especially blaming the mainstream media for being a voice of corrupt elite political and economic interests, as a research study conducted in Croatia reported (Pavić et al 2022). An amount of information available on the Internet and social media that is difficult for an ordinary person to process supported the introduction of the concept of the COVID-19 "infodemic", as the rapid spread of information about the current health pandemic (World Health Organization 2022).

The Internet has been considered a significant source for seeking health-related information over the recent decades (Cotten and Gupta 2004; Jia et al 2021; Obasola and Agunbiade 2016; Percheski and Hargittai 2011; Tan and Goonawardene 2017). The research has highlighted the role of social media in the rapid spread of health information and misinformation to the public and even to healthcare workers (Dyar et al 2014; Smith 2019; Williams et al 2018). A large number of research studies aimed to determine whether the overall amount of use of different types of media and informational reliance on media when seeking health information are connected with vaccine hesitancy. On the whole, recent research studies have indicated somewhat differing impacts of the traditional media (television, print media, radio) in comparison to social media, even though the results are far from conclusive. The measurement of vaccine hesitancy in these studies was very diverse, and its antecedents (such as vaccination conspiracy beliefs) as well as consequences (such as vaccination behaviour) were commonly used. For instance, Allington et al (2021) demonstrated a positive association between the intention to be vaccinated against COVID-19 and the overall amount of broadcast and print media use, but only informational reliance on social media was

negatively connected with the willingness to get vaccinated. Romer and Jamieson (2021) found that the use of mainstream print and broadcast television media was negatively correlated with the vaccination conspiracy beliefs and positively correlated with the intention of getting vaccinated against COVID-19, while the frequency of social media use was positively correlated with vaccination conspiracy beliefs. Al-Uqdah et al (2022) detected that more frequent use of social media for reading news was associated with lower vaccine hesitancy, while the use of social media as a source of vaccine information without any other trusted source was associated with higher vaccine hesitancy. Ijioma and Nze (2022) found that the average use of social media negatively impacted the willingness to get COVID-19 vaccines. Similarly, Piltch-Loeb et al (2021) established that social media were connected with a lower likelihood of vaccine uptake, while the use of traditional media such as television for obtaining health information was positively correlated with the willingness to receive COVID-19 vaccines. Wilson and Wiysonge (2020) found that, on a country level, the use of social media to organize offline action and the prevalence of online foreign misinformation predicted negative attitudes towards vaccines as well as the drop in vaccination rates. Brailovskaia et al (2021), on the online samples from nine countries, found that television reports as a COVID-19 information source positively predicted the willingness to get vaccinated against COVID-19 in six countries, while the use of print media was positively correlated with the willingness only in one country. On the other hand, the use of social media as a COVID-19 information source was a significant negative predictor in three countries and non-significant in others. Some other research studies also brought null or mixed results. For example, Brodziak et al (2021) demonstrated that neither the time spent watching TV and surfing the Internet nor the overall amount of use of social media significantly predicted uncertainty and unwillingness to vaccinate against COVID-19. Alley et al (2021) found that social media use as such was not connected, whereas the frequency of traditional media use was positively connected with the willingness to be vaccinated against COVID-19.

Another group of research studies sought to determine whether the hypothesized media influence depends on the valence (positive or negative) of the information being used. Zhang et al (2021) found that the type of information mattered – exposure to pro-vaccine information on social media – was positively correlated to positive attitudes and behavioral

intentions toward COVID-19 vaccination. Similarly, Xin et al (2023) demonstrated the association between exposure to negative vs. positive information and vaccine hesitancy, while Pierri et al (2022) linked exposure to low-credibility websites with COVID-19 vaccine hesitancy and vaccination refusal. In an experimental study, Betsch et al (2010) determined that accessing vaccine-critical websites increased the perception of vaccination risk and decreased the perception of the risk of omitting vaccinations as well as the intentions to vaccinate.

## Traditional and Social Media and Vaccine Hesitancy

In this study, we aim to situate the possible media effects on vaccine hesitancy into a more general discussion about media effects, and the possible different effects of the traditional and social media. Namely, it is possible to assume that social media do not have the same cultivation influence that existed with the traditional media. Traditional media, such as television, radio, and print media, lead to the mainstreaming effect (Gerbner and Gross 1976), that is, they reinforce the established image of the world based on social institutions, including science. Simply put, the information available on traditional media usually follows the scientific consensus on certain issues. In contrast to them, it can be assumed that the new media pluralism leads to the crumbling of the unified worldviews, that is, to the possibility that different concepts of reality, among them those that carry with them pseudoscientific beliefs and a low level of trust in established science, come to the fore and reach a wider audience. On the other hand, new media environments are very heterogeneous among themselves. Internet news sources are often credible because they represent the online version of established offline media, and online sources of information as such are increasingly taking precedence due to their lower price and the new habits of media consumers. In other words, it cannot be simply assumed that the Internet as a new media platform necessarily offers less credible news, that is, that it cultivates the media audience in a completely different way. In contrast, social media as a source of information probably indeed have completely different effects. They comprise unverified and unreliable sources of information that often marginalize and dismiss mainstream media sources (Phillips and Milner 2017; Rogers 2021). Additionally, social media users with similar attitudes are also more likely to interact with one another, and to share similar

content, thus creating "epistemic echo chambers" and "epistemic bubbles" (Mønsted and Lehmann 2022; Nguyen 2020). For instance, even though the majority of online information is pro-vaccine, vaccine-hesitant online communities are largely disconnected from the pro-vaccine content and sources of information (Getman et al 2017). As Skafle et al (2022) noted, COVID-19 anti-vaccination echo chambers usually contain medical misinformation (side-effects and other harmful effects), conspiracy claims (secret power structures, corrupt elites, etc.) and vaccine development misinformation (faulty procedures, vaccine content, etc.).

Given the characteristics described above, the new media environment represents a fertile ground for vaccination conspiracy theories. Conspiracy theories can be understood as alternative explanations to the officially announced version of an event, and such alternative versions usually assume the existence of secret societies and conscious manipulation by invisible powerful individuals who attempt to change or conceal the truth of an event (Brotherton et al 2013). Although belief in conspiracy theories has remained widespread for many years, it is observed that they, as a rule, become more prominent during times of social turmoil since they provide alternative explanations for events when there is a lack of authoritative expert explanations (Prooijen and Douglas 2017). Among others, the dangers arising from the endorsement of conspiracy theories stem from the possibility that, based on such beliefs, some members of society will make potentially harmful health decisions (Prooijen and Douglas 2018). Using an experimental approach, Warner and Shepard (2014) found that media echo chambers increase belief in conspiracy theories, regardless of participants' prior beliefs. A study on the impact of using YouTube and belief in vaccine conspiracy theories emphasizes that echo chambers and filter bubbles occur when a YouTube user develops a watch history, meaning that the subsequent YouTube content will be like the previous one (Hussein 2020). Different types of media platforms differ in the proliferation of belief in conspiracy theories in terms of the amount, dynamics, and strength of such content (Stempel et al 2017; Theocharis et al 2021). For example, Walter and Dronchon (2022) detected a positive link between non-mainstream media and social media use and conspiratorial predispositions, while there was a negative link between newspaper use and conspiratorial predispositions, and no link with television and radio. Hollander (2018) found that general media use was

not, but the use of specific media outlets was related to the endorsement of conspiracy theories.

## Research Goals and Hypotheses

In this study, we aimed to test the model of serial mediation to discover whether the overall amount and the types of use of various media sources will be connected with the endorsement of vaccination conspiracy beliefs, as one of the causes of vaccine hesitancy. In other words, the serial mediation tested in the current study assumes that the frequency of media uses and the type of media employed for vaccine information (credible vs. non-credible) significantly influence the content of vaccine-related information consumed (positive/negative), which can determine varying levels of trust in scientific credibility, subsequently impacting beliefs in vaccine conspiracy theories. Therefore, this study aims to address the research question regarding the association between different types of media used to monitor vaccine-related topics and vaccine conspiracy theories while exploring the extent to which this association is mediated by trust in scientific credibility and the valence of the content followed by the respondents.

This study contributes to the field in four ways. First, the hypotheses outlined in the paper stem from the need to test connections that have been inconclusive in previous research and from the premise that social media play a negative role when it comes to increasing vaccine hesitancy. Second, it is necessary to differentiate between social media and credible Internet news sources, such as online newspapers, which in recent years have become somewhat as credible as offline sources since the role of gatekeeping is not significantly different from the "traditional" media. Third, based on previous research, the total media use amount needs to be distinguished from the specific media use amount related to vaccination information. And fourth, the valence of vaccination information and science credibility as a possible mediation link needs to be accounted for in order to provide a more complex explanation of the effects.

Therefore, the general and specific hypotheses were as follows:

H1. The amount of television use and Internet use will be negatively correlated, while the amount of social media use will be positively correlated with vaccination conspiracy beliefs.

H2. The reliance on television and the Internet as a source of vaccination information will be negatively correlated, while the reliance on social media will be positively correlated with vaccination conspiracy beliefs.

H3. The type of consumed media content (positive/negative) and trust in scientific credibility will be serial mediators of the relationship between media usage frequency and belief in vaccination conspiracy theories.

H4. The type of consumed media content (positive/negative) and trust in scientific credibility will be serial mediators of the relationship between reliance on media as a source of vaccination information and belief in vaccination conspiracy theories.

## Sample and measures

A survey was conducted in July 2022 using an online questionnaire on an opt-in panel quota sample of the Croatian general population (N = 1,500), while the data were collected by a public opinion polling company. Quotas were determined based on gender, age, and region within Croatia. The sample consisted of 50.33% women, 61.33% of the sample members lived in urban areas, and 29.93% completed higher education. The average age was 42.61 years, with a standard deviation of 13.10.

The predictor variables in the study included the frequency of the average daily overall use of a) television, b) Internet, and c) social media. All three variables were measured on a scale ranging from 0 – not at all to 13 – more than 10 hours. The frequency of consuming information related to vaccination on the aforementioned media (television, credible Internet sources such as online newspapers, and social media) was measured on a scale ranging from 1 – never to 10 – very often. Age (in years), gender (1 – male; 2 – female), and level of scientific literacy were included as control variables. As a measure of scientific literacy, the Oxford scale (Miller 1998) was used. The scale contains 13 items that assess textbook knowledge, derived from statements about scientific facts that an average citizen

should have encountered during primary education (Stocklmayer & Bryant 2012). The scale has been frequently used in Eurobarometer surveys and other vaccine hesitancy studies (Motoki et al 2021; Stocklmayer and Bryant 2012).

Mediator variables included the measures of the valence of information related to vaccination and the science credibility scale. The valence was measured by asking whether the respondent on average follows the media sources which are predominantly critical or predominantly affirmative toward vaccination. To measure the level of trust in scientific credibility, we utilized the Credibility of Science Scale (CoSS) (Hartman 2017), which comprises six items rated on a five-point Likert scale. This scale aims to evaluate the degree to which individuals have a default inclination to trust in the scientific method and the research findings, as well as their overall positive perception of scientists. It is worth noting that the authors emphasized the CoSS scale's validity in relation to different topic-specific beliefs about science (Hartman 2017), and that the scale has been subsequently validated (Tavani et al 2021) and used in other studies (Dieckman and Hartman 2022; Johnson and Dieckmann 2020; Lobato et al 2020).

As for the outcome variable, a seven-item scale was used to assess the extent to which individuals believe in vaccine conspiracy beliefs (Shapiro et al 2016). Respondents were asked to rate their level of agreement with each statement on a five-point Likert scale. A higher score on the scale indicated a higher belief in vaccine conspiracy theories. The Croatian and Serbian versions of the scale have been validated and used in several studies to investigate the relationship between vaccine conspiracy beliefs and their association with vaccination behavior (Jovanović et al 2023; Milošević Đorđević et al 2021; Pavić and Šuljok 2022).

In Table 1, descriptive statistics of the measures are shown. We can note that the overall amount of Internet use is higher than television use and that the Internet was also the most used source of vaccination information. In terms of science literacy, given that the maximum attainable score was 13, the mean score (M=9.2, SD=2.73) indicated a relatively high level of scientific literacy among the participants. Given that higher levels of science credibility typically imply skepticism, the results of this study suggest that, on average, participants have trust in science (M=27.4, SD=7.69). Regarding vaccine conspiracy beliefs, participants, on

average, hold a relatively low belief in vaccine conspiracy theories (M=26.86, SD=12.03). As for media consumption, participants' average use of television (M=3.44, SD=2.33), Internet news sources (M=3.65, SD=2.35), and social media (M=3.26, SD=2.34) for vaccine-related information were relatively similar. The proportion of participants who more often visit vaccine-affirmative information sources is higher than those who visit critical information sources (56.67% and 43.33%, respectively).

**Table 1. Measurements – descriptive statistics**

| Measure | Min. | Max. | Mean | Std. Dev. |
|---|---|---|---|---|
| TV - total use | 1 | 13 | 4.29 | 1.80 |
| Internet - total use | 1 | 13 | 5.85 | 2.28 |
| Social media - total use | 1 | 13 | 3.60 | 1.87 |
| TV - vaccination info use | 1 | 10 | 3.44 | 2.33 |
| Internet - vaccination info use | 1 | 10 | 3.65 | 2.35 |
| Social media - vaccination info use | 1 | 10 | 3.26 | 2.34 |
| Negative valence | 1 | 2 | 1.43 | .496 |
| Science literacy | 0.00 | 13.00 | 9.20 | 2.74 |
| Science credibility | 6.00 | 42.00 | 27.38 | 7.69 |
| Vaccination conspiracy beliefs | 7.00 | 49.00 | 26.83 | 12.03 |

## Analytical approach

Structural equation modeling (SEM) was used for data analysis, as a method that combines factor analysis and regression analysis. It is considered an appropriate analytical tool for testing theoretical models and hypotheses, as its advantage lies in an ability to account for measurement error of multiple dependent and independent variables that are simultaneously analyzed in the overall model (Blunch 2008; Hair et al 2021, Tarka 2018).

As noted in the hypotheses outline, the tested models incorporated theoretical assumptions and empirical findings based on the literature review. Five manifest variables (TV total use, Internet total use, social media total use, gender, and age) and one latent variable (scientific literacy)

served as predictors of the latent outcome variable (conspiracy beliefs) in the first structural model. The variables of valence and trust in science credibility served as serial mediators between the predictor variables and the dependent variable (vaccination conspiracy beliefs). The second model included the same structural specification and the same outcome variable as the first model but the predictors included the amount of use of TV, Internet news sources, and social media for obtaining vaccination information.

## Results

Both models exhibited acceptable index values for the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), exceeding 0.95, which is considered a well-fitting model (Hu and Bentler, 1999). Additionally, the Root Mean Square Error of Approximation (RMSEA) values up to 0.05 are considered acceptable for a good model fit. The AIC and BCC values of the first model are 1958.487 for the AIC and 1963.934 for BCC. The second model values of AIC and BCC are 1941.410 and 1946.858. Overall, considering the satisfactory values of CFI, TLI, and RMSEA, and a relatively low Standardized Root Mean Square Residual (SRMR), the fit indices indicated a good model fit.

### Table 2. Model fits

|         | $x^2$    | df  | p    | CFI  | TLI  | RMSEA | 90% CI lower | 90% CI upper | SRMR  |
|---------|----------|-----|------|------|------|-------|--------------|--------------|-------|
| Model 1 | 1716.487 | 439 | .000 | .938 | .930 | .044  | .042         | .046         | .0824 |
| Model 2 | 1699.410 | 439 | .000 | .945 | .938 | .044  | .042         | .046         | .0800 |

Model 1 results (Figure 1 and Table 3) indicate that the total amount of television use was significantly associated with vaccination conspiracy beliefs, i.e. that total, direct, and indirect effects of television use were significant and negative in sign. In other words, television use consistently lowered the endorsement of vaccination conspiracy beliefs, both directly, and indirectly through the serial mediation of negative valence and science credibility. Therefore, the overall amount of television use was related to the lower vaccination conspiracy beliefs both directly and through the lower amount of negative information about vaccination, which then in

turn led to higher trust in science credibility, thus ultimately lowering the endorsement of vaccination conspiracy beliefs.

*Figure 1. Model 1 (standardized coefficients)*
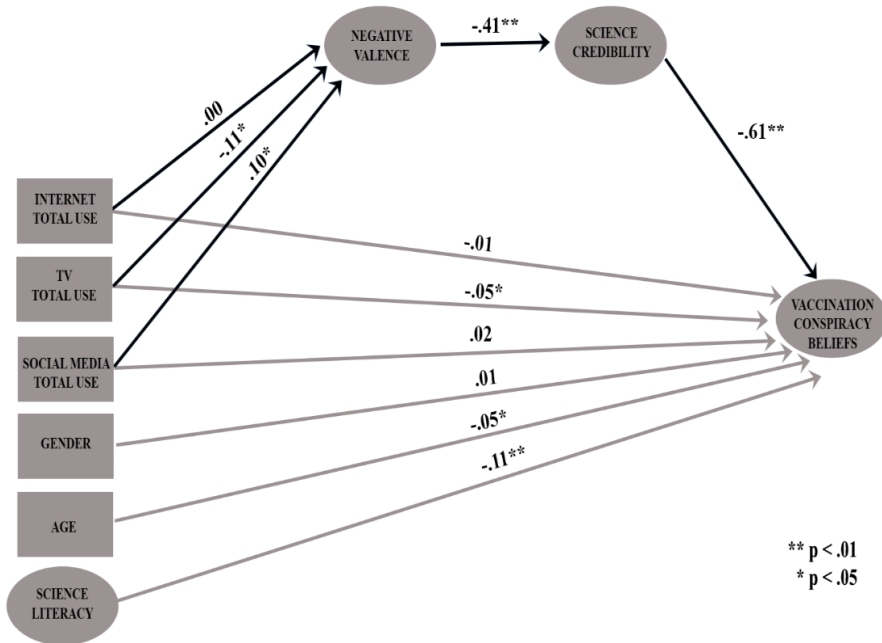


As for the overall amount of Internet use, no total, direct, or indirect effects were detected. In other words, overall Internet use was not connected with the endorsement of vaccination conspiracy beliefs.

Regarding social media use, the indirect effect was significant, while direct and total effects were not significant. Therefore, while the total effect could not be confirmed, the overall social media use was connected with consuming more negative information about vaccination and ultimately with higher vaccination conspiracy beliefs. This seemingly inconsistent result is not uncommon when structural equation modeling is used and arises from the fact that the test of the indirect effect is more statistically powerful than the test of the total effect (Kenny and Judd 2014; O'Rourke and MacKinnon 2015). Therefore, since there was an a priori

hypothesized indirect effect, we can confirm its existence even in the case of the insignificant total effect (Agler and De Boeck 2017).

As for control variables, scientific literacy is significantly negatively correlated with beliefs in conspiracy theories, indicating that individuals with higher literacy levels had lower levels of vaccination conspiracy beliefs. The results showed that gender had an insignificant relationship with vaccination conspiracy beliefs, while age was significantly negatively correlated, meaning that younger respondents on average had higher levels of vaccination conspiracy beliefs.

**Table 3. Mediation analysis (Model 1)**

| Total effect | | | | | |
|---|---|---|---|---|---|
| | **Coefficient** | **p** | **SE** | **LL** | **UL** |
| TV – total use | -.072 | .003 | .023 | -.117 | -.027 |
| Internet – total use | .010 | .679 | .022 | -.035 | .053 |
| Social media – total use | .044 | .113 | .027 | -.019 | .098 |
| **Direct effect** | | | | | |
| TV – total use | -.046 | .027 | .020 | -.086 | -.005 |
| Internet – total use | .009 | .675 | .020 | -.030 | .047 |
| Social media – total use | .021 | .419 | .025 | -.028 | .069 |
| **Indirect effect** | | | | | |
| TV – total use | -.026 | .000 | .006 | -.039 | -.015 |
| Internet – total use | .001 | .937 | .005 | -.010 | .011 |
| Social media – total use | .023 | .001 | .007 | .010 | .037 |

The results of the second model (Figure 2 and Table 4) revealed that all three total effects were significant, i.e. the reliance on television and Internet news sources as the sources of vaccination information lowered vaccination conspiracy beliefs, while the reliance on social media for

obtaining vaccination information was connected with higher conspiracy beliefs.

## Figure 2. Model 2 (standardized regression coefficients)
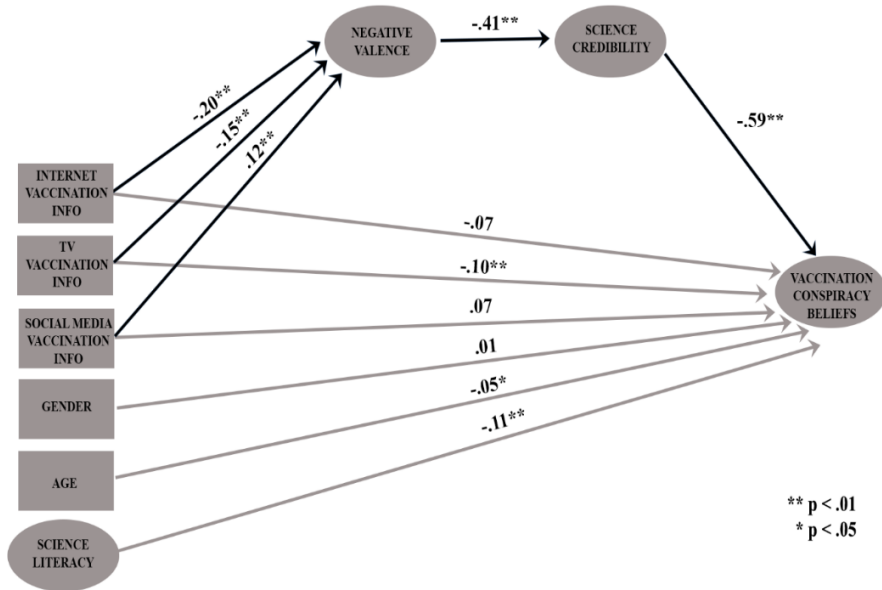


As visible in Table 4, the direct and indirect effects of television were significant, thus indicating a partial mediation. The direct effects of the Internet and social media were not significant, thus indicating full mediation. In other words, the reliance on Internet news sources and television for vaccination information led to receiving less negative information, higher trust in science credibility, and lower vaccination conspiracy beliefs. On the other hand, obtaining vaccination information through social media led to more negative information, lower trust in science credibility, and higher vaccination conspiracy beliefs. Aside from the mediation path, only the direct effect of television was detected, while the remaining two were non-significant.

## Table 4. Mediation analysis (Model 2)

| Total effect | | | | | |
|---|---|---|---|---|---|
| | **Coefficient** | **p** | **SE** | **LL** | **UL** |
| TV — vaccination info | -.097 | .004 | .033 | -.159 | -.031 |
| Internet — vaccination info | -.086 | .021 | .038 | -.162 | -.013 |
| Social media – vaccination info | .071 | .015 | .029 | .014 | .127 |
| Direct effect | | | | | |
| TV — vaccination info | -.072 | .015 | .028 | -.126 | -.013 |
| Internet — vaccination info | -.052 | .106 | .033 | -.117 | .011 |
| Social media – vaccination info | .050 | .052 | .026 | .000 | .099 |
| Indirect effect | | | | | |
| TV — vaccination info | -.025 | .001 | .008 | -.041 | -.010 |
| Internet — vaccination info | -.034 | .000 | .009 | -.053 | -.017 |
| Social media – vaccination info | .023 | .004 | .007 | .008 | .036 |

In Table 5, we summarized the implication of the results on the hypotheses that were put forward in this study. We can note that H1 and H3 were partially confirmed, while H2 and H4 were fully confirmed. In other words, the effect of the overall amount of media use was confirmed only in the case of television, while the indirect effects of overall use were confirmed only in cases of television and social media. The reliance on television, the Internet, and social media for obtaining vaccination information was connected with vaccination conspiracy beliefs, and the same goes for the hypothesized mediation paths/indirect effects.

## Table 5. Summary of the hypotheses testing

| Hypothesis | Conclusion |
|---|---|
| H1. The amount of television use and Internet use will be negatively correlated, while the amount of social media use will be positively correlated with vaccination conspiracy beliefs. | This hypothesis is partially confirmed since only the total amount of television use is negatively correlated with vaccination conspiracy beliefs, while the total effect was not confirmed with regard to the Internet and social media. |
| H2. The reliance on television and the Internet as a source of vaccination information will be negatively correlated, while the reliance on social media will be positively correlated with vaccination conspiracy beliefs. | This hypothesis is fully confirmed since the total effect of all three predictors was significant. The reliance on television and the Internet was negatively correlated with vaccination conspiracy beliefs, while the connection of social media reliance was positive. |
| H3. The type of consumed media content (positive/negative) and trust in scientific credibility will be serial mediators of the relationship between media usage frequency and belief in vaccination conspiracy theories. | This hypothesis is partially confirmed since the indirect effects of television and social media were significant, while the indirect effect of the Internet was non-significant. The mediation direction was in accordance with the hypothesis. |
| H4. The type of consumed media content (positive/negative) and trust in scientific credibility will be serial mediators of the relationship between reliance on media as a source of vaccination information and belief in vaccination conspiracy theories. | The hypothesis is fully confirmed since all three indirect effects were significant and the mediation direction was in accordance with the hypothesis. |

## Discussion

The main objective of this study was to examine the extent to which the content consumed on different media platforms is connected with the acceptance of vaccination conspiracy beliefs. To investigate these relationships, we employed the model of serial mediation using SEM analysis. Such a model assumed a significant correlation between the frequency of media use or reliance on the media for vaccination information, the type of media relied upon for vaccine information (credible vs. non-credible), the content of vaccine-related information consumed (positive/negative) on these media platforms, and the varying levels of trust in scientific credibility and endorsement of conspiracy

theories. Our findings confirmed a significant difference in explaining vaccination conspiracy endorsement between credible and non-credible media sources.

Specifically, we found a negative correlation between the overall amount of television use and reliance on television as a source of vaccination information and the beliefs in vaccination conspiracy theories, while in both cases this relationship was partially mediated through the valence of information (less negative information received) and the trust in science credibility (higher trust) as serial mediators. On the other hand, we detected a positive indirect effect between the overall amount of social media use and vaccination conspiracy beliefs, as well as positive total and indirect effects of the reliance on social media for vaccination information, and the belief in vaccination conspiracy theories. Therefore, social media use for obtaining vaccination information leads to higher conspiracy beliefs, mainly through consuming more negative information, which leads to a decline in trust in science credibility. When it comes to Internet use, there was no connection between the overall amount of Internet use and vaccination conspiracy beliefs, but the reliance on the Internet for obtaining vaccination information was negatively connected in total and indirectly with vaccination conspiracy beliefs. Overall, the impact of the Internet as an information source was partially confirmed.

These findings should be interpreted considering the distinctions between credible and non-credible media sources. It is noteworthy that the reliance on both the Internet and television is negatively connected with the endorsement of vaccination conspiracy theories. In this regard, the results support the argument made by Dutta-Bergman (2004) that traditional and credible online media are complementary when the same content is consumed across them. Even though there has been some tension between traditional media journalism and online journalism, mostly related to professional interests and the question of who is entitled to qualify as a "journalist" (Cassidy 2007; Poler Kovačić et al 2010), online news media sources are increasingly seen as equal and credible sources of information. During the COVID-19 pandemic in Croatia, online news sources provided similar information as offline ones. A media framing analysis of Croatian print media during the first phase of the COVID-19 pandemic (Holy 2021) revealed overwhelmingly positive reporting with scientists and politicians involved in fighting the pandemic framed within the hero

archetype. Similarly, a study conducted by Pavić et al (2022) using human-coding content analysis determined that online news sites in Croatia provided mostly affirmative information about vaccination during the COVID-19 pandemic. Beliga et al (2021) using natural language processing showed that online news media in Croatia concentrated mostly on the statements of people from the state administration and those scientists who were members of the state bodies dedicated to fighting the pandemics. On a more general note, the overwhelming majority of online news consumption is still related to mainstream news outlets (Flaxman et al 2016). The absence of a connection between the total amount of Internet use and conspiratorial beliefs indicates the vagueness of the Internet as a global information and communication network, that is, the variety of influences that can result from its use. It can be said that the Internet as such is a neutral tool that can be used to distribute information whose impact on trust in the scientific mainstream is unclear. In the context of the COVID-19 health crisis, however, online sources mostly provided information that supported the scientific mainstream. Therefore, overall, media sources with a high level of credibility, regardless of whether they are offline or online, as a rule, conveyed the official picture of reality, i.e. they supported the official narrative about the COVID-19 pandemic and the ways to fight it.

On the other hand, social media provide the opportunity to present information that is not in accordance with the accepted epistemic mainstream, so it is understandable that people who seek vaccination information on social media are more often exposed to negative information. This mechanism is recursive, considering that already accepted beliefs influence the adoption of new ones. Traditional and social media operate using different logic, since traditional media rest upon the gatekeeping role of professional journalists, while social media content is produced by a diverse group of creators, it is more personalized and subjective (Van den Heijkant et al 2023), whereas its selection and consumption are heavily influenced by social contacts and opinion leaders (Bergström and Jervelycke Belfrage 2018). Notwithstanding the fact that social media users are somewhat exposed to passive and incidental learning, social media still represent a high-choice media environment (Bode 2016; Dutton 2009) in which lower trusting individuals more often consume non-mainstream news sources (Fletcher and Park 2017). Nguyen (2020) points out the existence of epistemic bubbles and echo chambers

that differ in their mechanisms of action and ways of battling them but lead to similar outcomes. Epistemic bubbles, mainly operating through content search algorithms, act in such a way as to unintentionally exclude alternative sources of information, that is, by multiplying the same sources of information, creating the illusion of epistemic authority. However, it is debatable whether the bubble is created by the algorithms or the users themselves through intentional selective exposure. On the other hand, echo chambers work in such a way that alternative voices are systematically discredited, which makes it impossible to build a system of trust in credible sources of information based on accepted scientific results. These conclusions are supported by the results of research studies that showed that people expressed less trust in news that was distributed through social media channels in comparison to the one that is retrieved from an original news website (Karlsen and Aalberg 2023), rate lower credibility of news articles when they were shared by their own Facebook friends in comparison to those shared by a news organization (Tandoc 2018), and trust social media significantly less in comparison to traditional news media (Lu et al 2022; Salaudeen and Onyechi 2020). In other words, people trying to find objective and credible information generally will not look for it on social media, at least when the source of information is not a credible organization, assuming that unverified and biased choices are behind them. Therefore, the findings of this study strongly suggest that social media can act as catalysts in facilitating the widespread dissemination and acceptance of narratives that often contradict scientifically confirmed facts. Such narratives can be particularly harmful as they may influence individuals to make detrimental health decisions based on their belief in conspiracy theories (Prooijen and Douglas 2018), while simultaneously fostering extreme distrust in the scientific process and the beneficial effects of scientific advancements.

## Conclusion

This study aimed to expand upon the assumption of a connection between media use and vaccine hesitancy by placing more emphasis on the distinction between credible and non-credible media, instead focusing on the distinction between "old" and "new" media. Additionally, in the study, mediation mechanisms that translate the characteristics of the particular

media type were examined. It was determined that the use of credible media leads to more positive information about vaccination, thus increasing trust in the science's credibility and decreasing vaccination conspiracy beliefs, while the effect of social media proved to be the opposite. By considering these aspects, a more comprehensive understanding of the media's role when explaining vaccine hesitancy can be attained, which can guide effective strategies to reduce belief in vaccine conspiracy theories.

As for the study limitations, given that our research design is cross-sectional, it was not possible to unequivocally confirm the direction of causal relationships. Namely, people with initial high trust in science as an institution may choose those sources that offer precisely such information (television and credible online Internet news), as opposed to those with lower levels of trust who look for information on social media. Future studies should differentiate even more precisely between certain types of online information sources (online sources with and without counterparts in traditional media), as well as distinguish between certain types of social media because, given the differences in style, formality, and content, they may not have the same effect on the spread of misinformation and increasing vaccine hesitancy.

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## Declaration of conflicting interests

The authors declare no conflicting interests.

Ethics Committee of the Faculty of Humanities and Social Sciences Josip Juraj Strossmayer University of Osijek approved the study (Ethical approval code: 2158-83-02-19-2).

# References

Agler, Robert and Paul de Boeck. (2017). ″On the Interpretation and Use of Mediation: Multiple Perspectives on Mediation Analysis.″ Frontiers in Psychology, 8. https://doi.org/10.3389/fpsyg.2017.01984

Alley, Stephanie, Robert Stanton, Matthew Browne, Quyen G. To, Saman Khalesi, Susan Williams, Tanya Thwaite, Andrew Fenning and Cornel Vandelanotte. (2021). ″As the Pandemic Progresses, How Does Willingness to Vaccinate against COVID-19 Evolve?″ International Journal of Environmental Research and Public Health, 18(2), 797. https://doi.org/10.3390/ijerph18020797

Allington, Daniel, Siobhan McAndrew, Vivienne Moxham-Hall and Bobby Duffy. (2021). ″Media usage predicts intention to be vaccinated against SARS-CoV-2 in the US and the UK.″ Vaccine, 39(18), 2595–2603. https://doi.org/10.1016/j.vaccine.2021.02.054

Al-Uqdah, Lola, Abron Franklin, F. A., Chu-Chuan Chiu and Brianna Boyd. (2022). ″Associations Between Social Media Engagement and Vaccine Hesitancy.″ Journal of Community Health, 47(4), 577–587. https://doi.org/10.1007/s10900-022-01081-9

Beliga, Slobodan, Sanda Martinčić-Ipšić, Mihaela Matešić, Irena Petrijevčanin Vuksanović and Ana Meštrović. (2021). ″Infoveillance of the Croatian Online Media During the COVID-19 Pandemic: One-Year Longitudinal Study Using Natural Language Processing.″ JMIR Public Health and Surveillance, 7(12), e31540. https://doi.org/10.2196/31540

Bergström, Annika and Maria Jervelycke Belfrage. (2018). ″News in Social Media.″ Digital Journalism, 6(5), 583–598. https://doi.org/10.1080/21670811.2018.1423625

Betsch, Cornelia, Frank Renkewitz, Tilman Betsch and Corina Ulshöfer. (2010). ″The Influence of Vaccine-critical Websites on Perceiving Vaccination Risks.″ Journal of Health Psychology, 15(3), 446–455. https://doi.org/10.1177/1359105309353647

Blunch, Neill. (2008). Introduction to Structural Equation Modelling Using SPSS and AMOS. London: SAGE Publications, Ltd. https://doi.org/10.4135/9781446249345

Bode, Leticia. (2016). ″Political News in the News Feed: Learning Politics from SocialMedia.″ Mass Communication and Society, 19(1), 24–48. https://doi.org/10.1080/15205436.2015.1045149

Brailovskaia, Julia, Silvia Schneider and Jürgen Margraf. (2021). ″To vaccinate or not to vaccinate!?″ Predictors of willingness to receive Covid-19 vaccination in Europe, the U.S., and China. PLOS ONE, 16(12), e0260230. https://doi.org/10.1371/journal.pone.0260230

Brodziak, Anna, Dawid Sigorski, Malgorzata Osmola, Michal Wilk, Angelika Gawlik-Urban, Joanna Kiszka, Katarzyna Machulska-Ciuraj and Pawel Sobczuk. (2021). ″Attitudes of Patients with Cancer towards Vaccinations-Results of Online Survey with Special Focus on the Vaccination against COVID-19.″ Vaccines, 9(5), 411. https://doi.org/10.3390/vaccines9050411

Brotherton, Robert, Christopher French and Alan Pickering. (2013). ″Measuring Belief in Conspiracy Theories: The Generic Conspiracist Beliefs Scale.″ Frontiers in Psychology, 4. https://doi.org/10.3389/fpsyg.2013.00279

Cascini, Fidelia, Ana Pantovic, A. Yazan Al-Ajlouni, Giovanna Failla, Valeria Puleo, Andriy Melnyk, Alberto Lontano and Walter Ricciardi. (2022). ″Social media and attitudes towards a COVID-19 vaccination: A systematic review of the literature.″ EClinicalMedicine, 48, 101454. https://doi.org/10.1016/j.eclinm.2022.101454

Cassidy, William P. (2007). ″Online News Credibility: An Examination of the Perceptions of Newspaper Journalists.″ Journal of Computer-Mediated Communication, 12(2), 478–498. https://doi.org/10.1111/j.1083-6101.2007.00334.x

Cotten, Shelia R. and Sipi S. Gupta. (2004). ″Characteristics of online and offline health information seekers and factors that discriminate between them.″ Social Science & Medicine, 59(9), 1795–1806. https://doi.org/10.1016/j.socscimed.2004.02.020

Dieckmann, Nathan F. and Robert O. Hartman. (2022). ″Conspiracist and paranormal beliefs: A typology of non-reductive ideation.″ International Journal of Personality Psychology, 8, 47–57. https://doi.org/10.21827/ijpp.8.38006

Dubé, Ève, Jeremy K. Ward, Pierre Verger and Noni E. MacDonald. (2021). ″Vaccine Hesitancy, Acceptance, and Anti-Vaccination: Trends and Future Prospects for Public Health.″ Annual Review of Public Health, 42(1), 175–191. https://doi.org/10.1146/annurev-publhealth-090419-102240

Dutta-Bergman, Mohan Jyoti. (2004). ″Complementarity in Consumption of News Types Across Traditional and New Media.″ Journal of Broadcasting & Electronic Media, 48(1), 41–60. https://doi.org/10.1207/s15506878jobem4801_3

Dutton, William H. (2009). ″The Fifth Estate Emerging through the Network of Networks.″ Prometheus, 27(1), 1–15. https://doi.org/10.1080/08109020802657453

Dyar, Oliver J, Enrique Castro-Sanchez and Allison H Holmes. (2014). ″What makes people talk about antibiotics on social media? A retrospective analysis of Twitter use.″ Journal of Antimicrobial Chemotherapy, 69(9), 2568–2572. https://doi.org/10.1093/jac/dku165

Flaxman, Seth, Shared Goel and Justin M. Rao. (2016). ″Filter Bubbles, Echo Chambers, and Online News Consumption.″ Public Opinion Quarterly, 80(S1), 298–320. https://doi.org/10.1093/poq/nfw006

Fletcher, Richard and Sora Park. (2017). ″The Impact of Trust in the News Media on Online News Consumption and Participation.″ Digital Journalism, 5(10), 1281–1299. https://doi.org/10.1080/21670811.2017.1279979

Garett, Renee and Sean D. Young. (2021). ″Online misinformation and vaccine hesitancy.″ Translational Behavioral Medicine, 11(12), 2194–2199. https://doi.org/10.1093/tbm/ibab128

Gerbner, George and Larry Gross. (1976). ″Living with Television: The Violence Profile.″ Journal of Communication, 26(2), 172–199. https://doi.org/10.1111/j.1460-2466.1976.tb01397.x

Getman, Rebekah, Mohammad Helmi, Hal Roberts, Alfa Yansane, David Cutler and Brittany Seymour. (2018). ″Vaccine Hesitancy and Online Information: The Influence of Digital Networks.″ Health Education & Behavior, 45(4), 599–606. https://doi.org/10.1177/1090198117739673

Hair, Joseph F., Tomas M. Hult, Christian M. Ringle, Marko Sarstedt, Nicholas P. Danks and Soumya Ray. (2021). An Introduction to Structural Equation Modeling. https://doi.org/10.1007/978-3-030-80519-7_1

Hartman, Robert O., Nathan F. Dieckmann, Amber M. Sprenger, A. M., Bradley J. Stastny and Kenneth DeMarree. (2017). ″Modeling Attitudes Toward Science: Development and Validation of the Credibility of Science Scale.″ Basic and Applied Social Psychology, 39(6), 358–371. https://doi.org/10.1080/01973533.2017.1372284

Heijkant, Linda van den, Martine van Selm, Lina Hellsten and Rens Vliegenthart. (2023). ″Framing pension reform in the news: Traditional versus social media.″ Communications, 48(2), 249–272. https://doi.org/10.1515/commun-2021-0058

Hollander, Barry A. (2018). "Partisanship, Individual Differences, and News Media Exposure as Predictors of Conspiracy Beliefs." Journalism & Mass Communication Quarterly, 95(3), 691–713. https://doi.org/10.1177/1077699017728919

Holy, Mirela. (2021). "Media Framing of the Coronavirus in Croatia." In Medias Res, 10(18), 2813–2828.
https://doi.org/10.46640/imr.10.18.3

Hu, Li-tze and Peter M. Bentler. (1999). "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives." Structural Equation Modeling: A Multidisciplinary Journal, 6(1), pp. 1–55. https://doi.org/10.1080/10705519909540118

Hussein Eslam, Prerna Juneja and Tanushreeitra Mitra. (2020). "Measuring Misinformation in Video Search Platforms: An Audit Study on YouTube." Proceedings of the ACM on Human-Computer Interaction, 4(48), 1–27. https://doi.org/10.1145/3392854

Ijioma, Nnaemeka E., Chinwe Nze. (2022). "Evaluating the Influence of Social Media Use in COVID-19 Vaccine Hesitancy of Residents of Owerri Metropolis." Advances in Journalism and Communication, 10(01), 10–24. https://doi.org/10.4236/ajc.2022.101002

Jia, Xiaoyun, Yan Pang and Linagni Sally Liu. (2021). "Online Health Information Seeking Behavior: A Systematic Review." Healthcare, 9(12), 1740. https://doi.org/10.3390/healthcare9121740

Johnson, Brandwin B. and Nathan F. Dieckmann. (2020). "Americans' views of scientists' motivations for scientific work." Public Understanding of Science, 29(1), 2–20.
https://doi.org/10.1177/0963662519880319

Jovanović, Veljko, Milica Lazić, Vesna Gavrilov-Jerković, Marija Zotović-Kostić and Vojana Obradović. (2023). "Vaccine Conspiracy Beliefs Scale: Validation and Measurement Invariance in a Youth Sample." Evaluation & the Health Professions, 016327872311702.
https://doi.org/10.1177/01632787231170237

Karlsen, Rune and Toril Aalberg. (2023). "Social Media and Trust in News: An Experimental Study of the Effect of Facebook on News Story Credibility." Digital Journalism, 11(1), 144–160. https://doi.org/10.1080/21670811.2021.1945938

Kenny, David A. and Charles M. Judd. (2014). "Power Anomalies in Testing Mediation." Psychological Science, 25(2), 334–339.
https://doi.org/10.1177/0956797613502676

Lobato, Emilio J.C., Maia Powell, Leace M.K. and Colin Holbrook. (2020). ″Factors Predicting Willingness to Share COVID-19 Misinformation.″ Frontiers in Psychology, 11. https://doi.org/10.3389/fpsyg.2020.566108

Lu, Linqi, Jiawei Liu, Connie Yuan, Kelli S. Burns, Enze Lu and Dongxiao Li. (2021). ″Source Trust and COVID-19 Information Sharing: The Mediating Roles of Emotions and Beliefs About Sharing.″ Health Education & Behavior, 48(2), 132–139. https://doi.org/10.1177/1090198120984760

Milošević Đorđević, Jasna, Silvia Mari, Milica Vdović and Ana Milošević. (2021). ″Links between conspiracy beliefs, vaccine knowledge, and trust: Anti-vaccine behavior of Serbian adults.″ Social Science & Medicine, 277, 113930. https://doi.org/10.1016/j.socscimed.2021.113930

Miller, Jon D. (1998). ″The measurement of civic scientific literacy.″ Public Understanding of Science, 7(3), 203–223. https://doi.org/10.1088/0963-6625/7/3/001

Motoki, Kosuke, Toshiki Saito and Yuji Takano. (2021). ″Scientific Literacy Linked to Attitudes Toward COVID-19 Vaccinations: A Pre-Registered Study.″ Frontiers in Communication, 6. https://doi.org/10.3389/fcomm.2021.707391

Mønsted, Bjarke and Sune Lehmann. (2022). ″Characterizing polarization in online vaccine discourse—A large-scale study.″ PLOS ONE, 17(2), e0263746. https://doi.org/10.1371/journal.pone.0263746

Nguyen, C Thi. (2020). ″Echo chambers and epistemic bubbles.″ Episteme, 17(2), 141-161. https://doi.or/10.1017/epi.2018.32.

Numerato, Dino, Lenka Vochocová, Vaclav Štětka and Alena Macková. (2019). ″The vaccination debate in the "post-truth" era: social media as sites of multi-layered reflexivity.″ Sociology of Health & Illness, 41(S1), 82–97. https://doi.org/10.1111/1467-9566.12873

Obasola, Oluwaseun and Ojo Melvin Agunbiade. (2016). ″Online Health Information Seeking Pattern Among Undergraduates in a Nigerian University.″ SAGE Open, 6(1), 215824401663525. https://doi.org/10.1177/2158244016635255

O'Rourke, Holly P and David P MacKinnon. (2015). ″When the test of mediation is more powerful than the test of the total effect.″ Behavior Research Methods, 47(2), 424–442. https://doi.org/10.3758/s13428-014-0481-z

Pavić, Željko, Adrijana Šuljok and Juraj Jurlina. (2022). ″Balanced Reporting and Boomerang Effect: An Analysis of Croatian Online News Sites Vaccination

Coverage and User Comments during the COVID-19 Pandemic." Vaccines, 10(12), 2085. https://doi.org/10.3390/vaccines10122085

Pavić, Željko and Adrijana Šuljok. (2022). "Vaccination conspiracy beliefs among social science & humanities and STEM educated people—An analysis of the mediation paths." PLoS ONE, 17(3): e0264722. https://doi.org/10.1371/journal.pone.0264722

Percheski, Christine and Eszter Hargittai. (2011). "Health Information-Seeking in the Digital Age." Journal of American College Health, 59(5), 379–386. https://doi.org/10.1080/07448481.2010.513406

Phillips, Whitney and Ryan M. Milner. (2017). The Ambivalent Internet: Mischief, Oddity, and Antagonism Online. Cambridge: Polity Press.

Pierri, Francesco, Brea L. Perry, Matthew R. DeVerna, Kai-Cheng Yang, Alessandro Flammini, Filippo Menczer and John Bryden. (2022). "Online misinformation is linked to early COVID-19 vaccination hesitancy and refusal." Scientific Reports, 12(1), 5966. https://doi.org/10.1038/s41598-022-10070-w

Piltch-Loeb, Rachael, Elena Savoia, Beth Goldberg, Brian Hughes, Tanner Verhey, Juliette Kayyem, Cynthia Miller-Idriss and Marcia Testa. (2021). "Examining the effect of information channel on COVID-19 vaccine acceptance." PLOS ONE, 16(5), e0251095. https://doi.org/10.1371/journal.pone.0251095

Poler Kovačič, Melita, Karmen Erjavec, and Katarina Štular. (2010). "Credibility of Traditional vs. Online News Media: A Historical Change in Journalists' Perceptions?" Medijska istraživanja, 16 (1), 113-130.

Rogers, Richard. (2021). "Marginalizing the Mainstream: How Social Media Privilege Political Information." Frontiers in Big Data, 4. https://doi.org/10.3389/fdata.2021.689036

Romer, Daniel and Kathleen Hall Jamieson. (2021). "Patterns of Media Use, Strength of Belief in COVID-19 Conspiracy Theories, and the Prevention of COVID-19 From March to July 2020 in the United States: Survey Study." Journal of Medical Internet Research, 23(4), e25215. https://doi.org/10.2196/25215

Salaudeen, Mistura and Ngozi Joy Onyechi. (2020). "Digital media vs mainstream media: Exploring the influences of media exposure and information preference as correlates of media credibility." Cogent Arts & Humanities, 7(1), 1837461. https://doi.org/10.1080/23311983.2020.1837461

Shapiro, Gilla K., Anne Holding, Samara Perez, Rhonda Amsel and Zeev Rosberger. (2016). "Validation of the vaccine conspiracy beliefs scale." Papillomavirus Research, 2, 167–172. https://doi.org/10.1016/j.pvr.2016.09.001

Skafle, Ingjerd, Anders Nordahl-Hansen, Daniel S. Quintana, Rolf Wynn and Elia Gabarron. (2022). ″Misinformation About COVID-19 Vaccines on Social Media: Rapid Review.″ Journal of Medical Internet Research, 24(8), e37367. https://doi.org/10.2196/37367

Smith, Naomi and Timothy Graham. (2019). ″Mapping the anti-vaccination movement on Facebook.″ Information, Communication & Society, 22(9), 1310–1327. https://doi.org/10.1080/1369118X.2017.1418406

Stempel, Carl, Thomas Hargrove and Guido Stempel. (2007). ″Media use, social structure and belief in 9/11 conspiracy theories.″ Journalism & Mass Communication Quarterly, 84(2), 353-372. https://doir.org/10.1177/107769900708400210

Stocklmayer, Susan M. and Chris Bryant. (2012). ″Science and the Public—What should people know?″ International Journal of Science Education, Part B, 2(1), 81–101. https://doi.org/10.1080/09500693.2010.543186

Strömbäck, Jesper, Elena Broda, Salma Bouchafra, Sofia Johansson, Gregor Rettenegger and Elina Lindgren. (2023). ″Conspiracy thinking and the role of media use: Exploring the antecedents of conspiratorial predispositions.″ European Journal of Communication, 38(3), 255–271 https://doi.org/10.1177/02673231221122951

Tan, Sharon Sween-Lin and Nadee Goonawardene. (2017). ″Internet Health Information Seeking and the Patient-Physician Relationship: A Systematic Review.″ Journal of Medical Internet Research, 19(1), e9. https://doi.org/10.2196/jmir.5729

Tandoc, Edson C. (2019). ″Tell Me Who Your Sources Are.″ Journalism Practice, 13(2), 178–190. https://doi.org/10.1080/17512786.2017.1423237

Tarka, Piotr. (2018). ″An overview of structural equation modeling: its beginnings, historical development, usefulness and controversies in the social sciences.″ Quality & Quantity, 52 (1), 313-354.

Tavani, Jean Louis, Anthony Piermattéo, Gregory lo Monaco and Sylvain Delouvée. (2021). ″Skepticism and defiance: Assessing credibility and representations of science.″ PLOS ONE, 16(9), e0250823. https://doi.org/10.1371/journal.pone.0250823

Theocharis, Yannis, Ana Cardenal, Soyeon Jin, Toril Aalberg, David Nicholas Hopmann, Jesper Strömbäck, J., Laia Castro, Frank Esser, Peter van Aelst, Claes de Vreese, Nicoleta Corbu, Karolina Koc-Michalska, Joerg Matthes, Christian Schemer, Tamir Sheafer, Sergio Splendore, James Stanyer, Agnieszka Stępińska and Vaclav Štětka. (2021). ″Does the platform matter? Social media and COVID-19 conspiracy theory beliefs in 17 countries.″ New Media & Society. https://doi.org/10.1177/14614448211045666

Van Prooijen, Jan-Willem and Karen M. Douglas. (2017). ″Conspiracy theories as part of history: The role of societal crisis situations.″ Memory Studies, 10(3), 323–333. https://doi.org/10.1177/1750698017701615

Van Prooijen, Jan-Willem. and Karen M. Douglas. (2018). ″Belief in conspiracy theories: Basic principles of an emerging research domain.″ European Journal of Social Psychology, 48(7), 897–908. https://doi.org/10.1002/ejsp.2530

Walter, Annemarie and Walter H. Drochon. (2022). ″Conspiracy Thinking in Europe and America: A Comparative Study.″ Political Studies, 70(2), 483-501. https://doi.org/10.1177/0032321720972616

Warner, Benjamin R. and Ryan Neville-Shepard. (2014). ″Echoes of a Conspiracy: Birthers, Truthers, and the Cultivation of Extremism.″ Communication Quarterly, 62(1), 1–17. https://doi.org/10.1080/01463373.2013.822407

Wilson, Steven Lloyd and Charles Wiysonge. (2020). ″Social media and vaccine hesitancy.″ BMJ Global Health, 5(10), e004206. https://doi.org/10.1136/bmjgh-2020-004206

Williams Abimbola, Jennifer Warren, Lauren Kurlander and Mafudia Suaray. (2018). ″Critical Communications: A Retrospective Look at the Use of Social Media among American Sierra Leoneans during the Ebola Outbreak.″ The Journal of Social Media in Society, 7(1), 366-380.

World Health Organization. (2022). Official infodemic definition, accessed at 17th may 2023. https://www.who.int/health-topics/infodemic

Xin, Meiqi, Sitong Luo, Suhua Wang, Junfeng Zhao, Gouhua Zhang, Lijuan Li, Liping Li, and Joseph Lau. (2023). ″The Roles of Information Valence, Media Literacy and Perceived Information Quality on the Association Between Frequent Social Media Exposure and COVID-19 Vaccination Intention.″ American Journal of Health Promotion, 37(2), 189–199. https://doi.org/10.1177/08901171221121292

Zhang, Ke Chun, Yian Fang, He Cao, Hongbiao Chen, Tian Hu, Yaqi Chen Xiaofeng Zhou and Zixin Wang. (2021). ″Behavioral Intention to Receive a COVID-19 Vaccination Among Chinese Factory Workers: Cross-sectional Online Survey.″ Journal of Medical Internet Research, 23(3). e24673. https://doi.org/10.2196/24673