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Beliefs in misinformation about COVID-19 and the Russian invasion of Ukraine are linked: evidence from a nationally representative survey

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Abstract

Background: Detrimental effects of misinformation were observed during the COVID-19 pandemic. Presently, amid Russia's military aggression in Ukraine, another wave of misinformation is spreading on the internet and impacting our daily lives, with many citizens and politicians embracing Russian propaganda narratives. Despite the lack of an objective connection between these two societal issues, anecdotal observations suggest that supporters of misinformation regarding COVID-19 (BM-C) have also adopted misinformation about the war in Ukraine (BM-U), while sharing similar media use patterns and political attitudes.

Objective: The aim of this study was to determine whether there is a link between respondents' endorsement of the two sets of misinformation narratives, and whether some of the selected factors (media use, political trust, vaccine hesitancy, belief rigidity) are associated with both BM-C and BM-U.

Methods: We conducted a survey on a nationally representative sample of 1,623 individuals in the Czech Republic. Spearman's correlation analysis was performed to identify the relationship between BM-C and BM-U. Additionally, multiple linear regression was used to determine associations between the examined factors and both sets of misinformation.

Results: We discovered that (1) BM-C and BM-U were strongly correlated (rho=0.636) and both were associated with belief rigidity. (2) Increased trust in Russia and decreased trust in the local government, public media, and Western allies of the Czech Republic predicted both BM-C and BM-U. (3) Media use indicating frustration from and avoidance of public/mainstream media, consumption of alternative information sources, as well as participation in online discussions indicative of epistemic bubbles, predicted beliefs in misinformation narratives. (4) COVID-19 vaccine hesitancy predicted only BM-C but not BM-U. However, vaccine refusers were overrepresented in the BM-U supporters and undecided individuals.

Conclusions: Our study provides empirical evidence supporting the hypothesis that the health-related misinformation surrounding COVID-19 pandemic has been politicized and spread via specific media channels. Subsequently, supporters of BM-C were susceptible to political misinformation aligning with Russian propaganda.

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Keywords: misinformation; COVID-19; war in Ukraine; political trust; digital media; belief rigidity; vaccine hesitancy

Introduction

Background

During the COVID-19 pandemic, many countries worldwide have experienced an increase and acceleration in the spread of conspiracies, hoaxes, misinformation, and intentionally disseminated disinformation [1,2]. A large body of scientific research has demonstrated the detrimental effects of the infodemic on vaccine hesitancy worldwide [3,4], hateful and divisive rhetoric [5], politicization of the issue [6], and radicalization [7].

Social epistemic structures known as echo chambers, which primarily emerge in online communities where members reinforce their shared views while actively discrediting other relevant voices [8], have been frequently identified as primary digital channels reinforcing beliefs in misinformation and fueling radicalization [9,10]. Similarly, in the Czech Republic, misinformation narratives have been monitored in online communities [11], as well as in chain e-mails, that have been massively forwarded [12,13]. Apart from the spread of misinformation – false information disseminated without the intent to deceive –, fueled by the uncertainty of pandemic developments and negative emotions on social media [14], it has been suggested that the issue of COVID-19 has also been "hijacked" and used by disinformation campaigns conducted for monetary [15] or political purposes [16]. Previous studies have indicated that worries about harmful effects of vaccination and distrust in Western pharmaceutical companies and politicians have been exploited and reinforced by Russian disinformation campaigns, aiming to undermine public support for state authorities [17]. The Czech Security Information Service reported that activists, promoting anti-vaccination attitudes and pro-Russian narratives used COVID-19 as a useful topic for spreading conspiracies and disinformation [13]. These activists operated largely in symbiosis with the anti-covid movement, particularly on Czech-language fringe news websites [13] labeled "disinformation" or "anti-system" websites by media experts [12].

Another massive wave of infodemic began to spread in Central European countries after the Russian invasion of Ukraine in February 2022 [18]. The war has become a new global threat, dominating media coverage and social media attention. Consequently, the focus on COVID-19 has receded, along with COVID-19 misinformation in the online environment [19]. In the Czech Republic, misinformation, including pro-Russian narratives about the conflict in Ukraine and hostile targeting Ukrainian refugees, has spread on "anti-system" websites [20]. These narratives also proliferated via chain emails, which have steeply increased in number after the invasion [19], in social media communities [21], as well as in online discussions under web news articles, where increased troll and bot activity has been observed [19,20].

Previous research has shown that individuals who believed in COVID-19 conspiracy theories were more prone to believe in other unrelated, broader conspiracies [22,23]. However, since conspiracy theories are only one part of misinformation narratives [22,24], it remains an open question whether those who believe in misinformation about COVID-19 are also more susceptible to believe political misinformation, such as political narratives aligning with Russian propaganda.

Anecdotal observations have suggested that individuals sharing rigid beliefs in misinformation narratives about COVID-19 (BM-C) may have also adopted misinformation about an unrelated societal issue, Russian invasion of Ukraine (BM-U), and that they tend to use specific digital media channels while avoiding public and mainstream media, and share anti-system attitudes and political orientation towards Russia [20]. However, no empirical research has examined this social phenomenon on a population-wide scale. Therefore, to validate or refute these observations, we conducted a nationwide cross-sectional survey representative of the Czech Republic.

Aims and hypotheses

The first aim of this study was to determine whether there is an association between respondents' endorsement of the two sets of misinformation narratives (BM-C and BM-U). *Hypothesis 1:* There is a correlation between BM-C and BM-U.

The second aim was to examine associations between beliefs in the two sets of misinformation (BM-C and BM-U) and factors anecdotally observed or suggested in both contexts. Media monitoring and official reports have indicated that both sets of misinformation have been spreading through specific digital media channels, some with political leanings towards Russia [13,20]. However, it remains unknown whether users of these channels are significantly more likely to believe the misinformation and to trust specific geopolitical powers on nationwide scale. Therefore, we investigated the relationships between BM-C/ BM-U and 2a) political trust, and 2b) media use factors. *Hypothesis 2a:* Distrust in the Czech government's decisions and public media, trust in Russia, and distrust in Russia's geopolitical opponents and Western allies of the Czech Republic (U.S., EU, NATO) are shared factors that explain both BM-C and BM-U. *Hypothesis 2b:* Some of the media channels previously linked to the dissemination of misinformation — social media, particularly online communities creating an echo chamber effect, discussions under web news articles, "anti-system" websites, obtaining news information from emails (possibly indicating political chain emails), as well as frustration from public media, avoidance of public and mainstream media, avoidance of news coverage of the examined societal issues (COVID-19, war in Ukraine), and sharing news — explain BM-C and BM-U.

The third aim of this study was to examine whether BM-C and BM-U are connected to COVID-19 vaccine hesitancy. Determining that this factor explains not only BM-C but also BM-U would indicate that this specific health-related behavior significantly reflects the politicization of the COVID-19 issue to such an extent that it increased susceptibility to political misinformation. *Hypothesis 3:* COVID-19 vaccine hesitancy explains both BM-C and BM-U.

Additionally, we aimed to test whether beliefs in the two categories of misinformation are associated with belief rigidity. The underlying assumption is that individuals who endorse misinformation place greater emphasis on the importance of these beliefs, as they often provide complex collective narratives and transcend mere opinions on specific health, societal, or political issues. Rather, they may become a belief system infused with moral convictions, which tends to be fixed and rigid [25,26]. Belief rigidity has been connected to echo chambers [8,27], conspiracy thinking [28], and polarization [25,29,30]. *Hypothesis 4:* Belief rigidity explains both BM-C and BM-U.

Methods

Procedure

The data were collected from 25th April to 5th May 2022, at the time when COVID-19 had subsided and two months after the start of the Russian invasion of Ukraine. The cross-sectional survey was completed by members of the Czech National Panel [31] as a part of a longitudinal study [32], using the standardized Computer Assisted Web Interviewing (CAWI) method. Participation was voluntary, with financial compensation. The mean completion time of the survey was approximately 11 minutes. The survey included sociodemographic data (gender, age, level of education, region of residence, and household income), as well as questions about beliefs in misinformation regarding COVID-19 and the Russian invasion of Ukraine, media use, political trust, belief rigidity, and

whether and how many times they have been vaccinated against COVID-19. Only self-reported measures were used.

Participants

Participants of the longitudinal study [32] were invited to participate in the current study. We received responses from 1,623 respondents (return rate: 55%; 51.7% women) aged between 20 and 91 years (M = 55.04, SD = 15.55). The proportions of participants' attained educational levels were as follows: 4.6% elementary school education, 29.1% certificate of apprenticeship, 36.2% high school education, and 30.2% university degree. The sample was constructed to be quota-representative of the adult population of the Czech Republic. To ensure repeated participation of various socio-demographic groups, it was necessary to adjust the current sample through post-stratification weighting. This adjustment was based on current population distributions (using data from the Czech Statistical Office) for the following characteristics: gender, age, education, size of place of residence, region, cross-cutting of age and education, cross-cutting of age and gender, and employment status. The inclusion criteria were knowledge of the Czech language and age over 18. The procedure performed in this study was in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. The study was approved by the ethics committee of National Institute of Mental Health (CZ) (no. 181/21). All participants provided informed consent.

Measures

Beliefs in misinformation narratives. To measure BM-C and BM-U, we developed two questionnaires. The questionnaires were constructed based on the main misinformation related to COVID-19 published by the Center against Hybrid Threats within the Ministry of the Interior of the Czech Republic [33]. The Ministry reported that such narratives had been spread in an attempt to exploit the societal issues in accordance with the interests of foreign powers. We reduced the number of items from the original fifteen to six based on results from our pilot study (N = 423), excluding items according to item analysis, exploratory factor analysis and the results of Cronbach alpha coefficient. BM-C consisted of these items: 1. "Western pharmacological vaccine companies are untrustworthy", 2. "Vaccines are dangerous for the vaccinated", 3. "The discrimination against Russian and Chinese vaccines is largely driven by political reasons", 4. "The coronavirus was developed artificially, probably as a biological weapon", 5. "The epidemic is fake, the situation has never been so serious", 6. "Epidemic measures was ineffective and were counterproductive". Similarly, the BM-U questionnaire was constructed, using the prevalent misinformation narratives related to the Russian invasion in Ukraine at the time of the study [34]. We selected four items from the original eight based on pilot data according to the same procedure as in BM-C. BM-U consisted of these items: 1. "The demilitarisation and de-Nazification of Ukraine is a legitimate objective for the Russian military operation in Ukraine", 2. "The civilian casualties on the Ukrainian side are deliberately exaggerated by the European media", 3. "Ukraine is developing banned biological weapons on its territory", 4. "NATO and Western countries are exploiting Ukraine to serve their own interests". Both questionnaires showed good internal consistency in both the pilot study (BM-C: Crohnbach α = 0.953; BM-U: Crohnbach α = 0.932) and in the current study (BM-C: Crohnbach α = 0.846; BM-U: Crohnbach α = 0.891). Participants rated the items on a 5-point scale (1: "I do not agree at all" – 5: "I completely agree").

COVID-19 vaccination. Participants were asked whether and how many times they had been vaccinated against COVID-19 (0, 1, 2 or 3 times). It should be noted that at the time of the survey, the Ministry of Health of the Czech Republic recommended three doses of the vaccine.

Media use. We utilized an adapted version of the media use questionnaire [35]. We omitted some

items and included additional ones, while also rewording some items to better suit the research objectives of measuring media behavior and media effects that may be indicative of or contribute to the spread of misinformation. To compare responses to the two societal issues, we utilized identical wording for questions related to the COVID-19 pandemic (C), and the Russian invasion of Ukraine (U), with only a difference in the topic and time frame being questioned (e.g. "How often did you search for news regarding COVID-19 at the height of the pandemic?"/ "How often did you search for news on the Russian invasion of Ukraine last month?"). The mirrored items were placed in different locations within the questionnaire and never in sequence. The newly developed measures were tested in a pilot survey conducted via Facebook in April 2022 (N = 423, response rate: 51.8%). Respondents were asked about their frequency of use of various media channels that have been previously connected to spreading misinformation: *emails* as a source of information (possibly indicating political chain emails), *Youtube*, *"anti-system websites"* that have been identified as such by various media experts [12,36]. However, at the time of our survey, in reaction to the Russian invasion of Ukraine and the uncertain development of the situation, most of the "anti-system websites" were evaluated as a threat to national security and were officially banned in the Czech Republic due to their open promotion of Russian disinformation narratives. Therefore, only one functioning, moderate news website remained in our survey. As control media channels, we asked respondents how often they used media outlets categorized as *public media* and *mainstream news websites* [36]. Participants indicated frequency of their use for each media category (1: "never" – 5: "several times a day – more than two times"). Additionally, respondents estimated the amount of time they spent on social media per day in hours and minutes (*Exposure to social media)*. Participants also evaluated how often they use social media as a means of obtaining news information (*Social media – information source*) (1: "never" – 5: "very often"). Participants were further asked to rate how often they read online *Discussions under web news articles* (1: "never" – 5: "very often"). Next, respondents indicated whether they engaged in *Discussions on social media* about COVID-19 (C) and Russian invasion of Ukraine (U) ("yes"/ "no"). If they indicated "yes", the next question aimed to assess the participants'participation in *online bubbles* on the issues of covid-19/ war in Ukraine (C/U), namely how often they spent time in online environments with people who strongly agreed with them on the two issues (1: "never" – 7: "more than 10 times a day"). Participants also rated how often they searched for news (*Search for news*) on these two societal issues (C/U) (1: "never" – 7: "more than 10 times a day"), how often they shared news (C/U) (*Sharing news*) (1: "never" – 7: "more than 10 times a day"), and how much interested they were on these topics (C/U) (*Interest in* news) (1: "I was not interested at all" – 5: "I was very interested"). In addition, participants rated how much public and mainstream media frustrates or upsets them (*Frustration from media*) (1: "strongly disagree" – 6: "I strongly agree").

Political trust. Perceptions of *Trust in the Czech government and public media* were assessed in relation to (1) the COVID-19 pandemic and (2) the Russian invasion of Ukraine. Respondents were asked to rate their level of trust in the following areas: (1a) the official statements of the Ministry of Health regarding vaccination; (1b) trust in Czech public media reports regarding COVID-19; (2a) trust in the Czech government in its decisions regarding the conflict in Ukraine, and (2b) trust in Czech public media reports regarding the conflict in Ukraine. Due to the high correlation of 1a and 1b ($r = 0.783$, $n = 1623$, $p < 0.001$), as well as 2a and 2b ($r = 0.849$, $n = 1623$, $p < 0.001$), we summed the items in one score for each topic: trust in the Czech government and public media regarding COVID-19 – *Trust in CZ-C*; trust in the government and public media regarding Russian invasion of Ukraine – *Trust in CZ-U*. Participants rated their responses on a 5-point scale (1: "absolutely not" – 5: "absolutely yes"). *Distrust in foreign geopolitical actors*. Respondents indicated how much they believed various states and international organizations (Russia, United States, China, EU, NATO) intentionally disseminate misleading information through social media (1: "never" – 5: "very often").

Belief rigidity was assessed by asking participants how much they believe in the correctness of their

own opinions regarding societal problems, such as politics, war, pandemics, etc., so that it cannot be influenced or changed by any other information (1: “never” – 5: “very often”).

Statistical Analysis

All data were analyzed using R software [37]. The significance level was set at $p \leq .05$. Post-stratification weighting was applied using a quadratic programming algorithm based on current population distributions of the following characteristics: gender, age, education, region, residence size, job status, interaction between age and education, and interaction between age and gender. Descriptive statistics were used for demographic description. Shapiro-Wilk test did not confirm normal distribution of BM-C and BM-U. As the data were non-parametric, we used Spearman’s correlation to determine the relationship between BM-C and BM-U (Hypothesis 1). Multiple linear regression models were used to reveal the relationships between the examined factors according to Hypothesis 2–4 (political trust, media use, COVID-19 vaccine hesitancy, belief rigidity) and BM-C and BM-U. For the multiple linear regression models, we used normalization of non-parametric right skewed data by square root. Two distinct models were constructed, one for BM-C and one for BM-U (dependent variables), with political trust, media use, COVID-19 vaccine hesitancy, and belief rigidity as independent variables. We also controlled for demographic characteristics (age, gender, education, income). In order to compare the predictive power of the independent variables, we utilized a feature scaling approach. Specifically, we employed normalization to standardize all continuous input variables to a uniform range of 1 to 5. This step guarantees comparability and stability in the regression analysis, establishing a standardized input space for the model and enabling the evaluation of the effect of each variable. However, categorical variables were maintained in their original scale to preserve their interpretability and intrinsic categorical distinctions.

Results

Correlation between BM-C and BM-U and descriptive statistics for BM-C and BM-U

A strong correlation was found between BM-C and BM-U (Spearman's rho = 0.636, $p < 0.001$). For a more straightforward description of BM-C and BM-U, we considered 4 points (“I rather agree”) and 5 points (“I completely agree”) as an indication of belief in misinformation (*supporters*). Those who rated 3 points (“I neither agree nor disagree”) were considered undecided whether they believe in misinformation or not (*undecided*). Those who rated 1 (“I completely disagree”) or 2 (“I rather disagree”) were considered *opponents* who do not endorse misinformation narratives. According to this grouping based on cumulative scores, the prevalence of BM-C supporters was 8.7%, and the prevalence of BM-U supporters was 9.9%. The number of undecided respondents were 33% for BM-C and 31.1% for BM-U. The demographic description showed that supporters in BM-C were most represented in apprenticeship education degree (44.7%), followed by high school degree (32.6%), university education level (17.7%) with lowest numbers in elementary education level (5%). BM-C opponents were most prevalent in university education level (37.4%). Supporters of BM-U were most prevalent in apprenticeship education level (37.3%), followed by high school degree (33.5%) and university degree (24.2%). Opponents in BM-U had mostly high school (37.3%) and university education (35.7%), followed by apprenticeship education (23.3%). Overall, supporters and undecided (both for BM-C and BM-C) were less prevalent in the university education level and more in apprenticeship education level compared to non- supporters. Regarding household income, supporters and undecided (both for BM-C and BM-C) were represented less in the high-income

group and more in the below poverty line income group compared to opponents. In terms of gender, noticeable differences were found in the undecided groups, particularly in BM-U, with female participants representing a higher proportion (60.2%). Conversely, male participants were more prevalent among BM-U supporters (mean 60.9%). Differences in age compared to average of the whole sample (M=55.04) were observed only in BM-U supporters, who were older (60.9 years), and BM-U opponents, who were younger (49.3 years). Vaccine refusers were minimally represented in BM-C opponents (7.2%), more in BM-C undecided (28.2%), and most in BM-C supporters (72.3%). 27.7% of BM-C supporters were vaccinated despite their beliefs. Regarding BM-U, vaccine refusers were most represented in BM-U supporters (39.8%), followed by BM-U undecided (25.3%), with lowest numbers in BM-U opponents (13.5%) (Figure 1). All descriptive statistics for BM-C and BM-U are provided in Table 1.

Figure 1.

Table 1. Sociodemographic description of BM-C and BM-U.

Sociodemographic variables	Opponents BM-C (%)	Undecided BM-C (%)	Supporters BM-C (%)	Opponents BM-U (%)	Undecided BM-U (%)	Supporters BM-U (%)
Male + female	946 (58.3)	536(33)	141 (8.7)	957 (59)	505 (31.1)	161 (9.9)
Female	469 (49.6)	303 (56.5)	67 (47.5)	472 (49.3)	304 (60.2)	63 (39.1)
Male	477 (50.4)	233 (43.5)	74 (52.5)	485 (50.7)	201 (39.8)	98 (60.9)
Age (mean)	55.02	54.79	56.07	53.25	56.58	60.80
Education 1	26 (2.7)	41 (7.6)	7 (5)	35 (3.7)	31 (6.1)	8 (5)
Education 2	216 (22.8)	193 (36.0)	63 (44.7)	223 (23.3)	189 (37.4)	60 (37.3)
Education 3	350 (37.0)	191 (35.6)	46 (32.6)	357 (37.3)	176 (34.9)	54 (33.5)
Education 4	354 (37.4)	111 (20.7)	25 (17.7)	342 (35.7)	109 (21.6)	39 (24.2)
Income 1	51 (5.4)	48 (9)	16 (11.3)	55 (5.7)	41 (8.1)	19 (11.8)
Income 2	269 (28.4)	197 (36.8)	47 (33.3)	289 (30.2)	175 (34.7)	49 (30.4)
Income 3	378 (40)	206 (38.4)	60 (42.6)	369 (38.6)	211 (41.8)	64 (39.8)
Income 4	248 (26.2)	85 (15.9)	18 (12.8)	244 (25.5)	78 (15.4)	29 (18)
Vaccinated	878 (92.8)	385 (71.8)	39 (27.7)	828 (86.5)	377 (74.7)	97 (60.2)
Unvaccinated	68 (72)	151 (28.2)	102 (72.3)	129 (13.5)	128 (25.3)	64 (39.8)

Table 2. Description of variables used in linear regression models for BM-C and BM-U. For composite variables, individual items are listed in italics.

Variable	SD	SE	Min	Max	M	Md
Age	15.56	0.39	20	91	55.04	57
Education	1.24	0.31	1	4	2.71	3
Income	1.15	0.03	1	4	2.89	3
Gender	0.50	0.01	1	2	1.52	2
BM-C	5.41	0.13	6	30	16.04	16
1. *Western pharmacological vaccine companies...*[a]	1.15	0.03	1	5	2.60	3
2. Vaccines are dangerous for the vaccinated.	1.16	0.03	1	5	2.41	2
3. Russian and Chinese vaccines....	1.24	0.03	1	5	2.74	3
4. The coronavirus as a biological weapon...	1.26	0.03	1	5	3.12	3
5. The epidemic is fake...	1.23	0.03	1	5	2.33	2
6. Epidemic measures was ineffective...	1.17	0.03	1	5	2.85	3
BM-U	4.26	0.11	4	20	9.89	10
1. De-Nazification of Ukraine is a legitimate...	1.21	0.03	1	5	2.11	2
2. The civilian casualties on the Ukrainian side...	1.23	0.03	1	5	2.45	3
3. Ukraine is developing biological weapons...	1.14	0.03	1	5	2.41	3

4. NATO and Western countries are exploiting...	1.33	0.03	1	5	2.91	3
C-19 vaccination	1.17	0.03	0	3	2.18	3
Chain emails	1.36	0.03	1	6	2.21	2
Youtube	1.50	0.04	1	6	2.43	2
Anti-system websites	1.18	0.03	1	6	1.71	1
Public media	1.62	0.04	1	6	3.51	4
Mainstream news websites	1.66	0.04	1	6	3.48	4
Exposure to social media	107.30	2.66	0	1440	101.82	80
Social media info. source	1.24	0.03	1	5	2.90	3
Discussions under news	1.07	0.03	1	5	2.78	3
Discussions social media (C)	0.37	0.01	1	2	1.16	1
Discussions social media (U)	0.28	0.07	1	2	1.09	1
Online bubbles (C)	1.22	0.03	0	7	0.48	0
Online bubbles (U)	0.10	0.02	0	7	0.27	0
Search for news (C)	1.32	0.03	1	7	3.03	3
Search for news (U)	1.45	0.04	1	7	2.99	3
Sharing news (C)	1.10	0.03	1	7	1.64	1
Sharing news (U)	1.02	0.03	1	7	1.52	1
Interest in news (C)	0.89	0.02	1	4	2.31	2
Interest in news (U)	0.92	0.02	1	4	2.90	3
Frustration from media	1.26	0.03	1	6	3.96	4
Trust in CZ (C)	2.12	0.05	2	10	5.60	6
1. *...Ministry of Health - vaccination*[a]	1.10	0.03	1	5	2.90	3
2. *...public media - covid-19*	1.14	0.03	1	5	2.70	3
Trust in CZ (U)	2.46	0.06	2	10	5.38	6
1. *...government - conflict in Ukraine*	1.31	0.03	1	5	2.68	3
2. *...public media - conflict in Ukraine*	1.25	0.03	1	5	2.69	3
Distrust in Russia	1.16	0.03	1	5	3.98	4
Distrust in U.S.	1.10	0.03	1	5	3.30	3
Distrust in EU	1.15	0.03	1	5	3.11	3
Distrust in China	1.16	0.03	1	5	3.68	4
Distrust in NATO	1.18	0.03	1	5	3.02	3
Rigid beliefs	1.05	0.03	1	5	2.94	3

[a] Exact wording of the items is provided in the Methods section.

Factors explaining BM-C

The multiple linear regression model explained 48.24% of the individual differences in BM-C ($F = 51.38$; adjusted $R^2 = 0.48$; $p < .001$). Description of variables used in the BM-C model is provided in Table 2. The results showed significant relationships between thirteen examined factors as the independent variables and BM-C total score as the dependent variable (Table 3). Trust in Czech government and public media, vaccination against COVID-19, distrust in Russia, searching for news on COVID-19, consumption of public media and mainstream news websites, and participation in online discussions predicted lower levels of BM-C. Distrust in the U.S., distrust in the EU, frustration from public and mainstream news, rigid beliefs, use of emails as source of information, sharing COVID-19 news, and engagement in online bubbles predicted higher levels of BM-C. Regarding demographic factors, upper income (compared to high income), as well as elementary, apprenticeship and high school education level (compared to university education level) were associated with increased BM-C. Below poverty line income group (compared to high income) predicted lower levels of BM-C.

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Factors explaining BM-U

The multiple regression model explained 62.21 % of the variance in BM-U ($F = 90.01$; adjusted $R^2 = 0.62$; $p < .001$). Description of variables used in the BM-U model is provided in Table 2. We found significant relationships between twelve examined factors as independent variables and BM-U total score as the dependent variable (Table 3). Trust in Czech government and public media, distrust in Russia, consumption of mainstream news websites, and searching for news about the war in Ukraine predicted lower levels of BM-U. Conversely, distrust in the U.S., distrust in the EU, frustration from public and mainstream news, consumption of "anti-system websites", use of emails as source of information, use of social media as information source, reading discussions under web news articles, and belief rigidity predicted higher levels of BM-U. Regarding demographic factors, below poverty line income (compared to high income), elementary education level (compared to university education level), as well as older age were associated with higher levels of BM-U.

Table 3. The results of multiple linear regression models for BM-C and BM-U.

Explaining variable	Coefficient (SE) BM-C	*t* value BM-C	*P* value BM-C	Coefficient (SE) BM-U	*t* value BM-U	*P* value BM-U
Intercept	2.09 (0.23)	9.00	<.001***	2.30 (0.28)	8.24	<.001***
C-19 vaccination	-0.15 (0.01)	-12.04	<.001***	-0.02 (0.01)	-1.55	.122
Information from emails	0.05 (0.02)	2.52	.012*	0.04 (0.02)	2.13	.034*
Youtube	-0.03 (0.02)	-1.85	.065	-0.02 (0.02)	-1.26	.209
Anti-system websites	-0.01 (0.02)	-0.51	.613	0.06 (0.02)	2.92	.004**
Public media	-0.05 (0.01)	-3.21	.001**	-0.02 (0.01)	-1.37	.172
Mainstream news websites	-0.01 (0.02)	-0.94	.347	-0.04 (0.02)	-2.52	.012*
Exposure to social media	-0.03 (0.05)	-0.62	.535	-0.07 (0.05)	-1.42	.155
Social media info. source	-0.001 (0.02)	-0.05	.962	0.03 (0.02)	2.01	.045*
Discussions under news	0.02 (0.02)	0.96	.337	0.05 (0.02)	2.68	.007**
Discussions social media (C/U)	-0.26 (0.09)	-2.78	.005**	-0.02 (0.15)	-0.12	.901
Online bubbles (C/U)	0.14 (0.05)	2.71	.007**	0.03 (0.07)	0.42	.678
Search for news (C/U)	-0.08 (0.02)	-3.48	.005***	-0.06 (0.02)	-2.30	.021*
Sharing news (C/U)	0.06 (0.03)	2.30	.021*	0.01 (0.03)	0.48	.629
Interest in news (C/U)	0.01 (0.02)	0.71	.477	-0.03 (0.02)	-1.59	.112
Frustration from media	0.13 (0.02)	7.10	<.001***	0.10 (0.02)	5.42	<.001***
Trust in CZ C/U	-0.19 (0.02)	-9.53	<.001***	-0.23 (0.02)	-11.81	<.001***
Distrust in Russia	-0.10 (0.02)	-4.20	<.001***	-0.24 (0.02)	-10.26	<.001***
Distrust in U.S.	0.12 (0.03)	3.79	<.001***	0.20 (0.03)	6.63	<.001***
Distrust in EU	0.08 (0.04)	2.12	.034*	0.10 (0.04)	2.65	.008**
Distrust in China	0.01 (0.02)	0.35	.725	-0.05 (0.02)	-0.22	.824
Distrust in NATO	-0.01 (0.04)	-0.31	.759	0.07 (0.04)	1.81	.071
Rigid beliefs	0.09 (0.02)	5.55	<.001***	0.08 (0.02)	4.99	<.001***

Income 1 (below poverty line) [a]	-0.20 (0.07)	-2.73	.006**	0.14 (0.07)	2.00	.046*
Income 2 (low income) [a]	0.10 (0.05)	1.95	.051	0.07 (0.05)	1.42	.156
Income 3 (upper income) [a]	0.12 (0.05)	2.48	.013*	0.07 (0.05)	1.48	.140
Education 1 (elementary) [b]	0.31 (0.07)	4.59	<.001***	0.20 (0.07)	3.00	.003**
Education 2 (apprenticeship) [b]	0.21 (0.05)	4.10	<.001***	0.06 (0.05)	1.14	.254
Education 3 (high school) [b]	0.16 (0.05)	3.43	<.001***	0.02 (0.05)	0.32	.750
Gender (female)[c]	-0.06 (0.04)	-1.55	.121	-0.03 (0.04)	-0.81	.420
Age	0.001 (0.001)	1.35	.178	0.07 (0.02)	3.23	.001**

[a] contrasted to high-income group

[b] contrasted to university degree

[c] contrasted to male

Discussion

Correlation between BM-C and BM-U

A strong correlation discovered between BM-C and BM-U supports our hypothesis, indicating that a significant number of individuals believing in COVID-19 misinformation have also adopted political misinformation regarding the Russian invasion of Ukraine. This extents previous findings that beliefs in COVID-19 conspiracies correlate with beliefs in other, broader and unrelated conspiracies [22,23] to the politicized side of COVID-19 misinformation, which increased susceptibility to political misinformation aligning with Russian propaganda. To address possible common factors underlying both sets of beliefs, we examined the role of various factors in BM-C and BM-U discussed below.

Associations of political trust and beliefs in misinformation

Our finding that lowered trust in the governmental decisions and public media was associated with both increased BM-C and BM-U supported our hypothesis. Moreover, it was the strongest predictor explaining both BM-C and BM-U. It is in line with previous research linking distrust in the public institutions to COVID-19 misinformation beliefs [38–41]. While most previous findings on associations between beliefs in COVID-19 misinformation and political attitudes report that conservatism is associated with increased susceptibility to misinformation [42–44], we did not inquire about partisanship but rather about trust in geopolitical powers. Our results showing increased trust in Russia in higher levels of both BM-C and BM-U indicates a leaning towards this geopolitical power in supporters of both sets of misinformation. Additionally, we further observed increased distrust in the Czech Republic's geopolitical allies and Russia's main opponents – the U.S. and the EU – in higher levels of both BM-C and BM-U. While this political inclination is not surprising regarding BM-U, which openly promotes Russian propaganda, it is not as readily apparent in the case of BM-C. However, our result aligns with previous research that has suggested the role of Russian disinformation campaigns in supporting anti-vaccination movement [17,45,46].

Our findings can thus be contextualized in light of goals of Russia's hybrid war strategy, which aims to continually undermine the trustworthiness and legitimacy of the foreign governments in the eyes of the target population by warping their beliefs, thoughts, decisions, and behavior over the long term [47]. The goal of this tactics is to gradually reconstruct the target population's prior beliefs in favor of Russia [48,49]. However, our study cannot establish a causal relationship in terms of direct influence of Russia's disinformation campaigns. The inclination towards Russia may also have deep historical roots, as the Czech Republic – former Czechoslovakia – was part of the Eastern

Bloc under direct influence of the Soviet Union for four decades. Increased trust in Russia may also represent an alternative to the current Western orientation of the Czech Republic as a member of EU and NATO, reflecting a broader, socially driven epistemic mistrust that manifests in the rejection of authoritative information, as suggested by the socio-epistemic model of belief in conspiracy theories [50].

Associations of media use and beliefs in misinformation narratives

All of the identified media use factors linked to either BM-C or BM-U provided support for our hypothesis regarding media use, formulated based on previous observations and theoretical or empirical associations with the dissemination of misinformation. However, it is noteworthy that not all of the examined factors demonstrated significant relationships with both BM-C and BM-U. The strongest media factor associated with higher levels of both beliefs was identified as frustration from public and mainstream media. While previous research has established this factor as a predictor of higher anxiety and depression levels during COVID-19 pandemic [35], our study extends its relevance to the context of misinformation susceptibility. This observation is complemented by another finding, which links less frequent consumption of public media and less frequent searches for COVID-19 news with higher BM-C levels, and less frequent consumption of mainstream media and searches for the news about the war in Ukraine with BM-U. These findings align with previous research [1,51,52] and suggest that supporters of misinformation narratives engage in avoidance behavior, possibly due to their mistrust in information they perceive as misrepresented in public and mainstream media.

On the other hand, supporters of BM-C and BM-U showed higher engagement with other media channels. Specifically, there was an association between obtaining news information from emails (possibly indicating chain emails) and both BM-C and BM-U. Additionally, reading discussions under web news articles was associated with BM-U, as was consuming information from “anti-system website”. These findings corroborate observations regarding the role of such media channels in disseminating misinformation content and the susceptibility of their consumers to misinformation [13,19].

Next, the positive relationship between obtaining information from social media and increased BM-U, as well as association between engagement in online bubbles and increased BM-C, indicates that social media environment contributed to the spread of misinformation and their users’ endorsement, as suggested by previous research [1,41,53–56]. While we acknowledge the limitations of the online survey method in assessing the phenomenon of online (epistemic) bubbles or echo chambers, it is plausible to assume that this phenomenon may have indeed been reflected in our results, as it aligns with prior findings [8–10,54].

Conversely, the negative relationship of engagement in discussions on social media and BM-C, as well as the lack of discernable associations between cumulative exposure to social media and BM-C/BM-U underscores the reductive conclusions of associating social media platforms solely with the spread of misinformation. Indeed, social media offer users engagement in socializing and discussing a diverse array of content, as well as a broad spectrum of viewpoints on socio-political issues. Notably, in the context of non-democratic regimes, digital media often serves as a primary source of obtaining reliable information. Research in non-democratic regimes indicates that the use of digital media correlates with diminished adherence to misinformation, contrasting with users reliant solely on official information channels [57].

Our next finding of positive association between sharing news and heightened levels of BM-C indicates that BM-C supporters demonstrated a propensity for active engagement with digital media. Speculatively, this could be due to heightened arousal triggered by specific content, frustration, or a sense of moral obligation to disseminate the alternative information on social media, perceived as accurate, compared to information reported by public and mainstream media, perceived

as misleading or incomplete [58]. This inference is drawn from previous research indicating that the perceived accuracy of content significantly influences the likelihood of its sharing by users [59]. While our study did not directly explore the specific content shared by respondents, it is pertinent to note that previous studies have demonstrated that misinformation tends to be inherently more frequently shared than other types of news [59].

Covid-19 vaccine hesitancy

Our finding that vaccine hesitancy was the second strongest factor associated with BM-C supports our hypothesis and aligns with extensive prior research linking exposure to COVID-19 misinformation to COVID-19 vaccine hesitancy [39,52,60–63]. Our finding provides further evidence that COVID-19 vaccine refusal is a behavioral indicator of diverse attitudes that transcend medical concerns. Specifically, as evidenced by responses to the BM-C questionnaire, these attitudes encompass a pronounced distrust towards Western vaccine companies and Western consensus about severity and origin of the virus, and increased trust towards the Russian and Chinese vaccines. However, it is important to note that 27.7% of BM-C supporters reported being vaccinated, indicating a divergence from their beliefs. They may ultimately yield to social pressure and decided to get vaccinated, considering practical difficulties posed by remaining unvaccinated in their daily lives during the pandemic.

Contrary to our hypothesis, COVID-19 vaccine hesitancy was not associated with BM-U, suggesting that this health-related behavior is a broader phenomenon that includes vaccine hesitancy due to health reasons, medical concerns, simple reluctance, and other factors. We conclude that vaccine hesitancy should not lead to the reductionist conclusion that COVID-19 vaccination was entirely politicized. However, we observed higher prevalence of vaccine refusers in BM-U supporters (39.8%), followed by BM-U undecided (25.3%), with lowest numbers in BM-U opponents (13.5%). Special attention should be given to the BM-U undecided group, requiring longitudinal monitoring to assess whether they might become new adherents of BM-U.

Belief rigidity

Our additional finding of a positive association between rigidity of one’s beliefs regarding socio-political issues with both BM-C and BM-U indicates that those who adhere to the alternative interpretations of both socio-political issues tends to harbor more fixed and rigid opinions than those who does not support such interpretations. Our finding is consistent with previous studies connecting belief rigidity to conspiratorial thinking [28] and beliefs in misinformation propagated through social media [64]. Rigid beliefs have been found to facilitate group cohesion, partisanship, polarization and extremism [25,29,65]. It is thus plausible that beliefs such as BM-C/ BM-U may serve as a group-shared alternative “truth” while being shared through the digital media environment as identified in our analysis. Furthermore, it is in line with our other finding (discussed above) indicating avoidance of public and mainstream information sources. This pattern is consistent with previous research suggesting that belief rigidity is strengthened when individuals isolate themselves from contradictory information, thus reinforcing their confirmation bias [10].

Limitations

The primary shortcoming of this study was the constraint imposed by the short survey format. Due to time limitations, it was not feasible to use longer standardized questionnaires such as the Belief Rigidity Scale. Instead, we opted for a single statement specifically related to societal issues, such as politics, war, and pandemics, and we considered this finding as supplementary. On the other hand,

we chose to investigate media use in more detail with practical implications in mind, aiming to identify specific media channels where misinformation is prevalent for targeted recommendations. However, some aspects of the media environment, such as online communities with an echo chamber effect and chain emails, were challenging to assess via survey. Consequently, our findings regarding these information sources should be interpreted with caution. Additionally, while we acknowledge the availability of standardized COVID-19 conspiracy/misinformation scales, our objective was to study COVID-19 misinformation prevalent in the local context of the Czech Republic as identified by previous analytical sources.

Conclusions

Our study provides evidence from a survey on a nationally representative sample indicating a strong correlation between beliefs in misinformation about COVID-19 (BM-C) and Russian invasion of Ukraine (BM-U), while both sets of beliefs were found to be associated with belief rigidity. Notably, political trust, including increased trust in Russia, and decreased trust in the local government and public media, as well as Western allies of the Czech Republic (U.S., EU), were revealed as shared strong predictors explaining both BM-C and BM-U. Next, we identified several media use factors, previously suggested in the dissemination of misinformation, that explained either BM-C or BM-U (consumption of “anti-system” news websites with pro-Russian leanings, reading discussions under web news articles, participation in discussions on social media indicating epistemic bubbles, avoidance of public and mainstream media, obtaining information from social media, sharing news). Both sets of beliefs were predicted by frustration from public and mainstream media, obtaining information from emails (indicating chain emails), and avoidance of news about COVID-19/war in Ukraine. Although COVID-19 vaccine hesitancy predicted only BM-C and not BM-U, it is noteworthy that vaccine refusers were overrepresented in the BM-U supporters and BM-U undecided groups, compared to BM-U opponents. In summary, our findings support the hypothesis that the initial health misinformation surrounding COVID-19 pandemic, spread via specific media channels, has become politicized, and supporters of COVID-19 misinformation were susceptible to the subsequent, political misinformation aligning with Russian propaganda. To achieve a deeper understanding of the phenomena under investigation, longitudinal monitoring is imperative. By tracking the development of the BM-C, BM-U, and the examined factors over time, causal relationships can be elucidated.

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Declaration of interest statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Abbreviations

BM-C: Belief in misinformation about COVID-19
BM-U: Belief in misinformation about the Russian invasion of Ukraine

Data availability

The dataset generated during the current study is available in open data repository: https://osf.io/rkhg5/?view_only=b270efc8db9c469483bcbbd9719c2ccb

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Supplementary Files

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Figures

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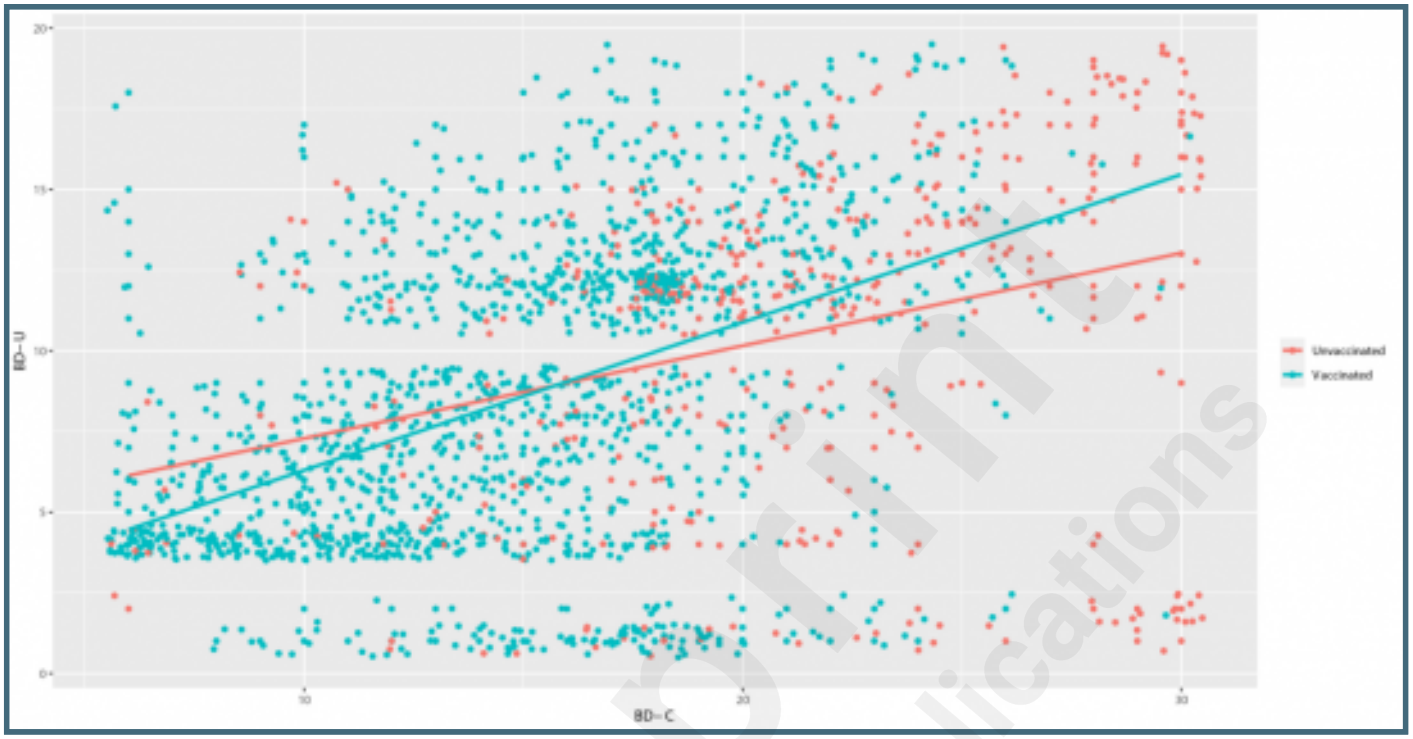
Distribution of unvaccinated (shown in red) and vaccinated (shown in cyan) against COVID-19 in relation to beliefs in misinformation about COVID-19 (BM-C) and beliefs in misinformation about the war in Ukraine (BM-U). The x-axis represents BM-C total score, the y-axis represents BM-U total score.



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