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How Media Reports on COVID-19 Conspiracy Theories Impact Consensus Beliefs and Protective Action: A Randomized Controlled Online Trial

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Abstract

This study examines the influence of news coverage on coronavirus disease (COVID)-related conspiracy theories on consensus perceptions regarding the seriousness of COVID-19 and its impact on attitudes and behaviors. In an online experiment, 395 participants either watched a report containing conspiracy theories, scientific facts, or information about a political summit, and they subsequently completed a questionnaire. Viewing reports on conspiracy theories lead to higher assessments of consensus compared with other reports. Perceived consensus correlated positively with attitudes toward COVID, which further correlated positively with behavior. The study shows that news reports can bias assessments of consensus, which has implications for public communication.

Keywords

consensus, gateway belief model, COVID-19, conspiracy theory, news

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Coronavirus disease 2019 (COVID-19) has brought a global pandemic to the 21st century. Mankind, however, was not only confronted with a new type of virus, but also with various conspiracy theories about its origin. Douglas et al. (2019) define conspiracy theories as "attempts to explain the ultimate causes of significant social and political events and circumstances with claims of secret plots by two or more powerful actors" (p. 4). While conspiracy theories are not exclusive to scientific contexts, they have tremendous impact on trust in scientific research, which is particularly relevant in crises, like the COVID-19 pandemic: Research has shown that especially during societal crises, people tend to believe in conspiracies (van Prooijen & Douglas, 2017), because they can provide a compass for attitudes and behaviors. Conspiracy theories usually offer causal explanations that can reduce perceived uncertainty (e.g., Douglas et al., 2017). In a pandemic, the belief in conspiracy theories can lead individuals to disregard containment measures (Allington et al., 2021). Therefore, it is important to find out how conspiracy theories spread and how they can be contained.

In this context, the media plays an important role. The term *infodemic* describes the concurrent spread of misinformation, and conspiracy theories together with the virus (Chowdhury et al., 2021). While much research has focused on the impact of social media in times of COVID-19 (Tsao et al., 2021), we think that it is also important to look at traditional media coverage (e.g., TV) as first studies indicate its relevance (Romer & Jamieson, 2021), and analyze its impact on conspiracy beliefs, and protective behaviors. Hence, our study builds on public opinion research, and adapts the gateway belief model (GBM) (e.g., van der Linden et al., 2019) to the context of COVID-19.

The Gateway Belief Model

With the GBM, van der Linden et al. (2015) demonstrated that the appraisal of risk depends on the perception of what others believe. In the context of climate change, the model shows that the perceived scientific consensus on whether climate change is human-caused determines the belief in climate change, the worry about it, the belief in human causation and thus, the support for public action (Goldberg et al., 2020; van der Linden et al., 2019). Scientific consensus means that the majority of scientists are in agreement, for example, on the causes of climate change. According to the GBM, misperceptions of perceived consensus are a "gateway" cognition influencing individual beliefs and actions (van der Linden et al., 2019). For instance, if people mistakenly assume that the majority of scientists do not believe in human-caused climate change, then they are likely to not believe in it either, and they are much less likely to perceive climate change as a serious risk or support policies to reduce it.

The model assumes that consensus can serve as a decision heuristic by implying that the majority is correct in its assessments (Chaiken, 2014; Maibach & van der Linden, 2016). When people are asked to assess the consensus among scientists on issues, such as climate change, the estimated consensus often diverges from the actual scientific consensus, which is known as the consensus gap (Cook, 2016). The impact of consensus estimates could also be found in the social environment of individuals. Goldberg et al. (2020) were able to show that the consensus on whether climate change is human-caused within our circle of friends and family strongly influences our attitudes regarding climate change.

While the GBM describes the connection between consensus estimates and behavioral response, it does not provide information on how the perceived scientific or social consensus is formed, and few studies have adapted it to COVID-19 or the spread of conspiracy theories (e.g., Kerr & van der Linden, 2022). In their study, Kerr and van der Linden (2022) examined the GBM regarding support for containment measures during the COVID-19 pandemic. Their findings generally supported the model, but they used a norm manipulation that assumed a fixed percentage of consensus in society that did not necessarily reflect public opinion, and they did not provide a clear explanation of how this consensus was achieved. Hence, we must take a closer look at how consensus is actually informed by public opinion. Moreover, while research has found several predictors of belief in conspiracy theories related to COVID-19 (Uscinski et al., 2020), among them a rejection of expert information, denialism, and conspiracy thinking, there are only few studies to date on the reverse association that is how conspiracy theories affect public opinion. One study that has addressed this showed in the context of populist communication that populist conspiracy theories activate populist attitudes more than mere exposure to populist ideas that can fuel support for populist ideology in society (Hameleers, 2021). Furthermore, Romer and Jamieson (2021) were able to show that the use of different media outlets (conservative vs. mainstream) can shape conspiracy beliefs, which in turn shape prevention behavior. However, the effects of conspiracy theories on the formation of consensus perceptions and their influence on corresponding behaviors in the context of the COVID-19 pandemic have hardly been examined, particularly not using (quasi-)experimental methods. In this study, we thus investigate a possible impact of exposure to conspiracy theories on public perception.

Public Opinion Research

To make consensus judgments, one must be able to assess the public opinion. For this purpose, we build on the spiral of silence theory to explain the

formation of public consensus, and the GBM to examine the function of consensus beliefs for public action.

The *spiral of silence theory* claims that people are interested in the public opinion because of an inherent fear of isolation that must be expected if a person's opinion or behavior differs from that of others (Noelle-Neumann & Petersen, 2004). To prevent isolation and behave socially adaptive, public opinion is assessed both through the observation of the social environment and from observations of mass media (Kepplinger, 2016). In other words, the theory suggests that mass media provide a sense of what the prevailing opinion in society is, and since we humans do not want to be isolated, they provide a normative orientation. However, the theory does not explain in what way mass media conveys cues to assess public opinion. The *persuasive press inference*, developed by Gunther (1998), proposes that people make judgments about public opinion by drawing inferences from the general content of press coverage, for instance, its tone or frequency. When people perceive a positive tenor in the news, they estimate public opinion more favorably (Zerback, 2016), and when they are exposed to news about crime more often, they are more likely to believe that crime has increased over the past 10 years, regardless of crime statistics, resulting in adjusted attitudes toward sentences (Windzio & Kleimann, 2006)

Also, other factors, such as the display of opposing opinions can influence the perception of consensus. Because the balance of reporting is understood to be part of journalistic objectivity (Westerståhl, 1983), it is often mistakenly equated with the need to present two opposing sides equally, even though the actual distribution of opinions differs from this balanced view. This is referred to as *false balance* in reporting (Brüggemann & Engesser, 2017). In several experiments, Koehler (2016) was able to demonstrate that when were exposed to contradictory statements by scientists about climate change, they perceived less consensus among scientists in general (Koehler, 2016). Because dissenting opinions are more scandalous and attract more viewers, minority opinions are often overrepresented, which could affect consensus perceptions, and in turn, other key beliefs like efficacy of political and private action (van der Linden et al. 2015, 2017, 2019).

Adapted GBM and Hypotheses

To study such effects, we adapted the GBM to the new context and added media coverage as a possible influence on perceived consensus in society (see Figure 1). The study uses video clips of actual media reports, because videos were more effective in changing consensus beliefs in prior research (Goldberg et al., 2019), and to increase the ecological validity of this study

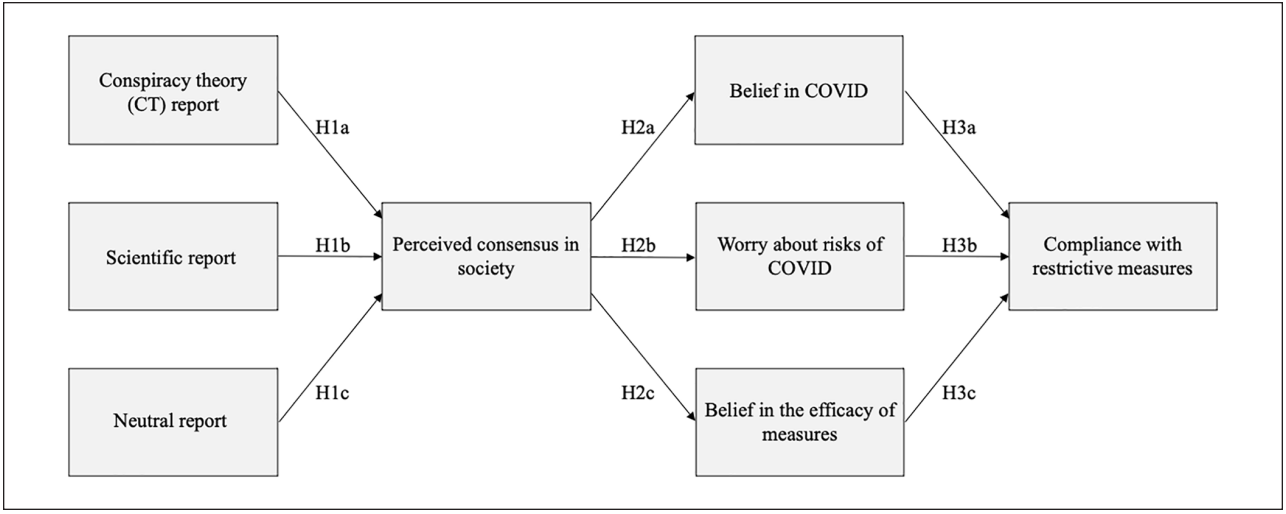

Figure 1. Adapted Gateway Belief Model (van der Linden et al., 2019).
Note. Conspiracy theory report: report containing conspiracy theories; scientific report: report about COVID-19 research; neutral report: report about a political summit.

compared with previous studies on GBM in COVID-19 (Kerr & van der Linden, 2022).

Throughout the pandemic, the news confronted people with conflicting opinions about COVID-19 by politicians, scientists, and citizens. While in Germany, for instance, it is assumed that about 10% of the German population endorse COVID-related conspiracy beliefs (Kuhn et al., 2021), seeing reports on conspiracy theories, anti-COVID restrictions protests, and people not complying with health-protective policies may have led to a misperception of the distribution of opinion among viewers and thus consensus in society about the seriousness of COVID is assessed lower (H1a). This perception could in turn influence one's attitudes (H2). For instance, it could lead to a lower risk assessment since consensus serves as a heuristic suggesting that the virus cannot be that threatening given that so many people do not believe in it and do not follow the rules. These attitudes can negatively influence compliance with behavioral measures (H3), because they are deemed irrelevant if COVID is not considered a substantial threat. In contrast, viewing scientific reports—reports that contain scientific facts—might lead viewers to believe that there is a high level of consensus in society that the virus is serious because research findings about COVID-19 are presented as facts that are incontrovertible and therefore should be believed by the general population (H1b). Thus, risk assessment could increase (H2) and adherence to measures could become more likely (H3). Hypotheses H1c to H3c refer to the comparison with a news report about a COVID summit (i.e., neutral), which we expect to be less impactful than the other reports. The study tests these hypotheses via a randomized controlled online trial, where exposure to conspiracy theories is manipulated by presenting different news reports. Participants will therefore either watch a news report that contains conspiracy theories, scientific research on COVID-19 or a report on a COVID-19 summit (i.e., neutral report). The complete listing of the hypotheses can be found in Online Appendix B1.

Methods

This study was preregistered with the Open Science Framework (OSF) (https://osf.io/wgt56). The preregistration describes study design, hypotheses, methods, and statistical analysis. The study also received approval from an ethics committee (Ethics Committee at the University Medicine Greifswald: BB 074/21) and is consistent with the American Psychological Association's (2017) Ethical Principles in the Conduct of Research with Human Participants.

In the next section, all measures, manipulations, and exclusions in the study are disclosed, as well as the method of determining the final sample size.

Sample Size Estimation

The present study assumed a moderate effect size of $f = .2$, a power of 0.95, an alpha error level of 5%, leading to a required sample size of $n = 390$, as estimated with G*Power version 3 (Faul et al., 2007). Since a drop-out rate of 20% was assumed, a sample size of $n = 470$ subjects was to be recruited (see Online Appendix B2 for more information).

Recruitment

The recruitment of the subjects was managed by SoSci Panel, a non-commercial online panel that consists of a German sample. This sample is not representative of the German population, as the approximately 55,000 active participants have an above average education, and a below average age (Leiner, 2012). Participants take part in the studies voluntarily (Leiner, 2016). In this study, participants were offered an incentive in the form of a draw of 10 gift vouchers worth €15 each.

SoSci Panel invited participants to take part in the study via email (see https://osf.io/258g9/ for the wording of the invitation). Since the experiment took place online, it was a prerequisite that the subjects had access to the internet via a smartphone, computer, or another digital device. In addition, subjects had to be of legal age (at least 18 years old) and fluent in German. Data were collected during July 7, 2021, and August 1, 2021, at which time few restrictions were in place to reduce infection rates and incidences of COVID-19 were comparably low.

Exclusion Criteria

In addition to inclusion criteria of the panel, participants had to have seen the video and pass the attention check that required them to answer a question about the content of the video correctly.

Missing Data Handling

Frequencies and patterns of missing values were examined using Little's test of missing completely at random (Little, 1988). If missing values are $\leq 5\%$ (Dong & Peng, 2013), and data were missing at random, indicated by either computational missing value analysis (Little's test) or manual inspection of

missing data patterns, complete cases were analyzed. Otherwise, multiple imputation was planned (see preregistration).

Procedure

In the beginning of the study, subjects were informed about the procedure and the objectives of the study, and subsequently asked to give informed consent. As a cover story, participants were told they would be asked to rate news broadcasts about COVID-19, which was debriefed at the end of the study. A random number generator embedded in the SoSci online survey assigned subjects to one of three groups (1:1:1 ratio). First, all three groups watched their assigned excerpt of a public German TV news program and then answered the questionnaire. After completing the study, participants were debriefed and given access to accurate information since subjects were confronted with conspiracy theories that made factually incorrect assumptions. They were referred to the website "zusammengegencorona.de," which contains scientifically validated information on COVID and was initiated by the German Federal Ministry of Health. Finally, subjects were able to make comments and take part in a prize draw.

Material

Stimulus Material. All three videos were excerpts from the Tagesschau or Tagesthemen, which are daily public news broadcasts on German television, produced by the *ARD* network. The videos were not manipulated or altered to maintain high ecological validity. Permission to use the videos was granted by the ARD. In the following, we provide short descriptions of each broadcast (for legal reasons, the video files cannot be shared but transcripts of the videos are presented at https://osf.io/258g9/).

Conspiracy theory report (Group 1). The video (November 18, 2020; duration = 1:48 minutes) shows public protest against infection prevention legislation, with participants presenting signs that indicate conspiracy theory beliefs (e.g., Guilty Bill Gates). The video also presents short interviews of three participants and it states that the crowd represents persons with conspiracy beliefs (from the *Querdenken Initiative*) as well as right-wing extremists and violent hooligans.

Neutral report (Group 2). The video (February 25, 2021; duration = 2:38 minutes) shows a ministerial conference on COVID-19, discussions surrounding a digital vaccination pass. It refers to deliberations of the heads of state and government at the EU special summit that have agreed to work

more closely together on the vaccination strategy, but that have not agreed on an EU-wide vaccination card yet. The video then quotes several elected representatives of EU member states (Sebastian Kurz, Angela Merkel) and producers of vaccines to discuss short supply of vaccines and the possibilities of infection prevention.

Scientific report (Group 3). The video (January 26, 2021; duration = 3:37 minutes) presents research of the university hospital *Charité Berlin*. It presents current findings on causes, conditions, and consequences of COVID infections, and shows interviews with several researchers working on vaccinations, biobanking, and bodily reactions to COVID infections. All researchers agree on the seriousness of the pandemic.

Measures. The following section presents the measures of the adapted GBM (see Figure 1), followed by the attention check of the experiment, and then the covariates. If not stated otherwise, GBM-related items were adapted from van der Linden et al. (2019). All items and related instructions can be found at https://osf.io/258g9/.

Perceived consensus in society. Participants were asked to assess the consensus in society that COVID-19 is a serious virus on a scale from 0 to 100%.

Attitudes regarding COVID-19. Participants indicated their belief in COVID-19 by stating whether they take COVID seriously using a 5-point scale. In addition, they reported their worry regarding COVID by stating whether they were very concerned about the health consequences of an infection with COVID using a 5-point scale. Both items were adapted and contextualized by van der Linden et al. (2019). Finally, they also indicated their belief in the efficacy of the measures by rating five infection prevention measures (e.g., physical distancing, wearing face masks) in terms of their perceived efficacy on a 5-point scale. These five ratings of the belief in the efficacy of the measures were averaged for the analysis (Cronbach's $\alpha = .84$). The items of the scale were adapted from Rees et al. (2020).

Compliance with containment measures. Subjects rated how regularly they adhered to five COVID-19 containment measures on a 5-point scale. The items were adapted from Rees et al. (2020); mean scores were used for the analysis (Cronbach's $\alpha = .80$).

Attention check. As an attention check, subjects were asked about the content of the video (item: "The video shown contained images of . . .";

response options: “Public protests,” “ Scientific investigations,” “ A special EU summit”). Participants who did not choose the correct response were excluded from the study.

Covariates. Covariates comprised sociodemographic data that are age, gender, educational background, and vocational training as well as direct (i.e., participants are/were infected) or indirect COVID-19 experience (i.e., a family member is/was infected). Both types of experiences were associated with increased risk perception in a previous study of the German population (Tomczyk et al., 2020). Current vaccination status was also assessed. Gender, educational background, and vocational training were re-coded as dummy variables for the analysis, since many categories had very low cell frequencies. A detailed description of the transformation is provided in Online Appendix B3.

Statistical Analyses

First, we calculated descriptive statistics of the sample. Second, we tested H1a to H1c using an analysis of variance (ANOVA) with a contrast analysis, and an analysis of covariance (ANCOVA) to control for covariates (age, gender, educational background, vocational training, infection status, and vaccination status). The analysis was performed with SPSS version 27, and Epsilon and Omega squared were reported as effect sizes (Yigit & Mendes, 2018). Third, we tested H2 and H3 via a path analysis. In a first step, correlations between model components were examined via Bravais-Pearson (for continuous variables), Spearman (for categorical variables), and point-biserial (for dichotomous and continuous variables) correlation coefficients. Following Cohen (1988), correlations were classified as weak ($|r| \leq .29$), medium ($.30 \geq |r| \leq .49$), and strong ($|r| \geq .50$). In a second step, we tested a path model of the GBM using Mplus version 8.7 (Muthén & Muthén, 1998–2017) with robust maximum likelihood estimation, and report standardized path coefficients, and squared multiple correlations (R^2) as effect sizes. To assess quality of model estimation, the following fit indices were calculated and reported: chi-square test, comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) (Schreiber et al., 2006). For a good model fit, the chi-square test should not become significant ($p > .05$), CFI should be greater than .95, TLI should be greater than .90, and RMSEA should be lower than .08. All analyses assumed an alpha error of 5%.

Results

Descriptive Analysis

In total, 472 participants took part in the study. Of these 472 participants, 417 were over 18 years of age and thus met the minimum age requirement. In this sample, one participant failed the attention check that required subjects to indicate what video content they were exposed to. In addition, four persons were excluded because they did not want to state their gender or reported a diverse gender. As four cases were not enough to form a separate group for statistical comparisons, these cases were excluded.

Metric variables were subjected to outlier analysis. In particular, inadmissible data were excluded, for instance, if a person entered a number above 100 in a question about a percentage (0–100%), this case was excluded, which was true for one case.

Missing value analysis revealed a small number of missing values. Overall, 0.78% or 132-item ratings were missing. The examination of the missings per variable showed that six variables had at least one missing value. All variables had a missing rate lower than 5% with the highest rate for the variables age, educational background, and vocational training (1.5% each). Little's test indicated values were not missing completely at random, χ^2 (377) = 520.77; $p < .001$, $\varphi = .18$, yet visual inspection did not reveal any patterns that would point toward nonrandom missing, and the number of missing values was very low. Therefore, complete cases were used in the further course of the analysis.

Ultimately, 395 subjects (mean age = 47.36 years, *SD* =17.69, range = 18–89 years; 53.9% female) were eligible for analysis, which was in line with the a priori sample size estimation ($n = 390$). In our sample, 15.4% of the participants reported a lower secondary education, 26.1% completed vocational training. Concerning COVID-19 experiences, 46.3% of subjects stated that they themselves and/or close acquaintances had already contracted COVID-19, and 85.3% of subjects reported that they had been vaccinated at least once. The three groups to which subjects were assigned were of equal size (conspiracy theory report group: 32.4%, neutral report group: 34.4%, scientific report group: 33.2%) and did not differ significantly in age, gender, educational background, vocational training, infection status, or vaccination status (see Table 1). There was a high level of belief in the seriousness of COVID ($M = 4.52$, $SD = .79$). At the same time, participants, on average, exhibited little to some fear of contracting COVID ($M = 2.72$, $SD = .92$). They also reported high levels of belief in the efficacy of restrictive measures to contain COVID ($M = 3.88$, $SD = .84$), and very high levels of self-reported compliance ($M = 4.44$, $SD = .62$).

Table 1. Descriptive Statistics and experimental group comparisons (conspiracy theory report, neutral report, scientific report) of the analysis sample (n = 395).

	Group						
	Conspiracy Theory	Neutral	Scientific	Total	Group differences	Skewness	Kurtosis
Covariates							
Group size (*n* [%])	128 (32.4)	136 (34.4)	131 (33.2)	395 (100)			
Age (in years; *M* [*SD*])	48.84 (17.87)	46.27 (17.67)	47.06 (17.58)	47.36 (17.69)	$F(2,392) = .72$, $p = .49$, $\omega^2 = .00$, $\varepsilon^2 = .00$	0.02	−1.23
Gender					$X^2(2) = 4.06$, $p = .13$, $\varphi = .10$	0.16	−1.99
Female (*n* [%])	70 (54.7)	81 (59.6)	62 (47.3)	213 (53.9)			
Male (*n* [%])	58 (45.3)	55 (40.4)	69 (52.7)	182 (46.1)			
Level of education					X^2 (2) = 1.14, $p = .57$, $\varphi = .05$	−1.92	1.70
Lower secondary education (*n* [%])	23 (18.0)	18 (13.2)	20 (15.3)	61 (15.4)			
Upper secondary education (*n* [%])	105 (82.0)	118 (86.8)	111 (84.7)	334 (84.6)			
Vocational training					χ^2 (6) = 2.78, $p = .84$, $\varphi = .08$	−1.54	1.49
No further education (*n* [%])	5 (3.9)	8 (5.9)	7 (5.3)	20 (5.1)			
Ongoing education (*n* [%])	7 (5.5)	11 (8.1)	12 (9.2)	30 (7.6)			
Vocational training (*n* [%])	37 (28.9)	36 (26.5)	30 (22.9)	103 (26.1)			
Tertiary education (*n* [%])	79 (61.7)	81 (59.6)	82 (62.6)	242 (61.3)			
Infection status					χ^2 (2) = 1.83, $p = .40$, $\varphi = .07$	−0.15	−2.00
Infected (self and family/friends) (*n* [%])	56 (43.7)	60 (44.1)	67 (51.1)	183 (46.3)			
Not infected (*n* [%])	72 (56.3)	76 (55.9)	64 (48.9)	212 (53.7)			
Vaccination status					χ^2 (2) = 3.56, $p = .17$, $\varphi = .10$	2.00	2.02
Vaccinated (*n* [%])	103 (80.5)	119 (87.5)	115 (87.8)	337 (85.3)			
Not vaccinated (*n* [%])	25 (19.5)	17 (12.5)	16 (12.2)	58 (14.7)			
Items							
Belief in COVID (*M* [*SD*])	4.47 (0.83)	4.54 (0.83)	4.56 (0.73)	4.52 (0.79)	$F(2,392) = .44$, $p = .65$, $\omega^2 = .00$, $\varepsilon^2 = .00$	−1.95	3.97
Worry about COVID (*M* [*SD*])	2.64 (0.94)	2.87 (0.94)	2.65 (0.88)	2.72 (0.92)	$F(2,392) = 2.63$, $p = .07$, $\omega^2 = .01$, $\varepsilon^2 = .01$	0.17	0.36
Assessment of consensus in society (*M* [*SD*])	75.48 (13.27)	71.08 (14.64)	71.73 (11.74)	72.72 (13.39)	$F(2,392) = 4.15$, $p = .02$, $\omega^2 = .02$, $\varepsilon^2 = .02$	−0.762	1.19
Scales							
Belief in efficacy of measures (*M* [*SD*])	3.79 (0.90)	3.91 (0.81)	3.96 (0.81)	3.88 (0.84)	$F(2,392) = 1.41$, $p = .25$, $\omega^2 = .00$, $\varepsilon^2 = .00$	−1.01	0.77
Compliance with measures (*M* [*SD*])	4.43 (0.65)	4.45 (0.62)	4.44 (0.60)	4.44 (0.62)	$F(2,392) = .06$, $p = .94$, $\omega^2 = .00$, $\varepsilon^2 = .00$	−1.86	4.24

Note. Coding: education: 1 (lower secondary education) to 2 (upper secondary education); vocational training: 1 (no education) to 5 (tertiary education); infection status: 1 (infected) to 2 (not infected); vaccination status: 1 (vaccinated) to 2 (not vaccinated).

Hypothesis 1: Group Differences in Consensus Assessments

The assessment of societal consensus that COVID should be taken seriously differed statistically significantly between groups, $F(2, 392) = 4.15$, $p = .02$, $\omega^2 = .02$, $\varepsilon^2 = .02$. However, it was rated highest in the group that watched the conspiracy theory video ($M = 75.48$, $SD = 13.27$), and lower in the groups that watched the neutral report ($M = 71.08$, $SD = 14.64$) or the scientific report ($M = 71.73$, $SD = 11.74$), which contradicted the Hypotheses 1a to 1c that assumed lower consensus assessments in the conspiracy group. Contrasts supported this observation in that participants in the conspiracy group assumed higher consensus than participants of the other conditions ($M_{\text{Diff}} = 4.07$, $SE = 1.43$, $p < .001$), while scientific consensus did not differ from the neutral condition ($M_{\text{Diff}} = -1.55$, $SE = 1.42$, $p = .28$). The results were fairly similar in the ANCOVA, when covariates were included. Groups differed significantly in their perceived consensus, $F(2, 385) = 4.82$, $p = .01$, $\omega^2 = .02$, $\varepsilon^2 = .02$, with the conspiracy group reporting higher perceived consensus than the remaining two groups. A sensitivity power analysis ($\alpha = .05$, $\beta = .80$, $n = 395$) showed that the analysis was sensitive to detect an effect of $\omega^2 = .01$ or $\varepsilon^2 = .01$.

Hypothesis 2: Perceived Consensus Predicts Attitudes Regarding COVID-19

To test the associations between consensus assessments, and attitudes regarding COVID-19, we conducted bivariate correlations (see Online Appendix B4) before constructing a path model to test the adapted GBM. All three hypotheses were supported by significant positive correlations between perceived consensus and belief in the seriousness of COVID, Hypothesis 2a, $r(393) = .23$, $p < .001$; worry about the potential risks of COVID, Hypothesis 2b, $r(393) = .13$, $p = .01$; and belief in the efficacy of measures, Hypothesis 2c; $r(393) = .20$, $p < .001$. These associations also remained significant in the path model (see Figure 2). Moreover, male gender was positively correlated with consensus beliefs, age with efficacy beliefs, tertiary education, and vaccination status with risk perception regarding COVID-19 (see Online Appendix B4).

Hypothesis 3: Attitudes Regarding COVID-19 Predict Compliance

The associations between attitudes regarding COVID-19 and compliance were tested in accordance with Hypotheses 3a through 3c. The analysis supported Hypothesis 3a by showing a positive correlation between risk

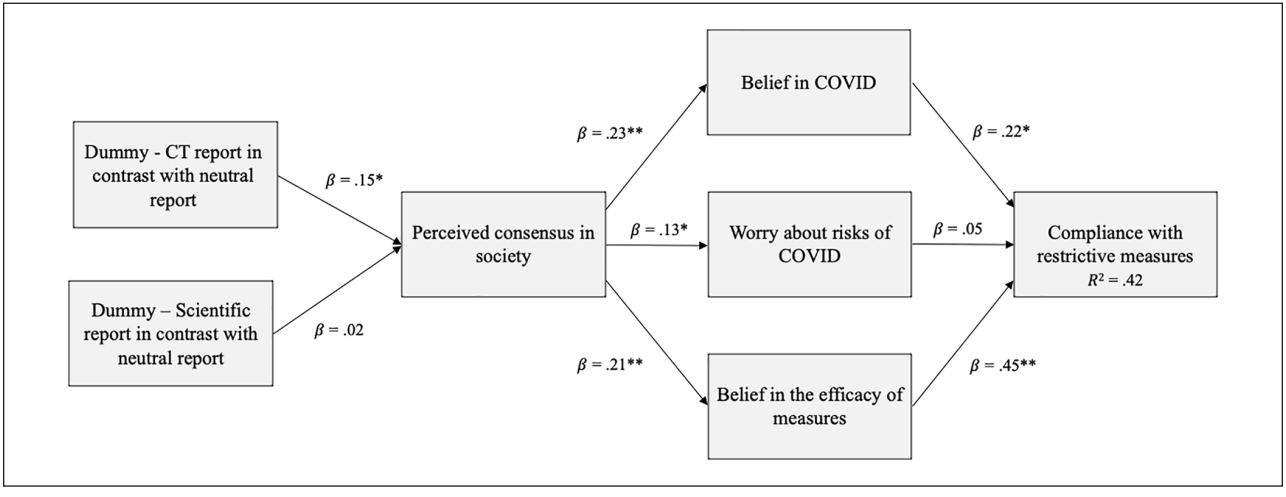

Figure 2. Adapted Gateway Belief Model With Calculated Path Coefficients for the Impact of Reports about Conspiracy Theories (CT) or Scientific Findings versus Neutral Reports on Consensus Beliefs, Psychological Predictors and Intentions of Compliance with Restrictive Measures (n = 395).
*$p < .05$. **$p < .001$.

perception and compliance, $r(393) = .58$, $p < .001$. This was consistent in the path model. Hypothesis 3b that worry about the potential risks of COVID predicts the compliance was partly supported by the data, with a positive bivariate correlation, $r(393) = .38$, $p < .001$, but a non-significant path coefficient ($\beta = .05$, $p = .21$, 95% CI [–.03, .13]). Finally, Hypothesis 3c assumed that the belief in the efficacy of measures predicts the compliance with restrictive measures was tested and supported by a strong positive association, $r(393) = .66$, $p < .001$, that remained significant in the path model.

Overall, the path model resulted in very good model fit ($\chi^2 = 12.59$, $df = 9$, $p = .18$; CFI = .99, TLI = .99, and RMSEA = .03, 95% CI [.00, .07]). However, squared multiple correlations showed that only 2% of the variance of the assessment of consensus could be explained through the manipulated condition. Conspiracy theory report condition was positively associated with consensus assessments compared with the neutral condition ($\beta = .15$, $p = .01$, 95% CI [.04, .27]). The comparison of scientific report and neutral report condition was not significant ($\beta = .02$, $p = .69$, 95% CI [–.09, .13]). Despite significant associations with attitudes, perceived consensus did not explain much variance in the variables belief in COVID ($R^2 = .05$), worry about COVID ($R^2 = .02$), and belief in the efficacy of measures to contain the virus ($R^2 = .04$). However, the compliance with containment measures was explained through proximal, attitudinal predictors ($R^2 = .42$). We also tested a model with covariates, which showed excellent model fit ($\chi^2 = 9.48$, $df = 9$, $p = .39$; CFI = .99, TLI = .99, RMSEA = .01, 95% CI [.00, .06]). When covariates were taken into account, 8.8% of the variance of perceived consensus was explained. The model also explained more variance in the variables belief in COVID ($R^2 = .32$), worry about COVID ($R^2 = .11$), belief in the efficacy of measures ($R^2 = .26$), and finally, compliance with restrictive measures ($R^2 = .43$). Overall, compliance was also indirectly affected by the exposure to conspiracy theories ($\beta = .02$, $p = .02$, 95% CI [.002, .03]) via efficacy beliefs but not by exposure to scientific reports ($\beta = .00$, $p = .97$, 95% CI [.00, .00]).

Regarding covariates, four variables showed noticeable associations with the GBM, namely, gender, age, vaccination status, and infection status (see Online Appendices B5–B8 for path coefficients of all path models). Males reported higher consensus beliefs than females ($\beta = .18$, $p < .001$, 95% CI [.08, .27]), and higher age was positively related to efficacy beliefs ($\beta = .11$, $p = .04$, 95% CI [.01, .21]). People without direct or indirect COVID-19 experiences (i.e., infection status = 1) were less likely to appraise the seriousness of COVID-19 ($\beta = –.10$, $p = .02$, 95% CI [–.18, –.02]), while people who were already vaccinated at the time of the survey reported stronger beliefs in COVID ($\beta = .50$, $p < .001$, 95% CI [.39, .61]), worry about

COVID ($\beta = .29$, $p < .001$, 95% CI [.20, .39]), and beliefs in the efficacy of measures ($\beta = .45$, $p < .001$, 95% CI [.35, .54]). A sensitivity power analysis ($\alpha = .05$, $\beta = .80$, $n = 395$) showed that the analysis was sensitive to an effect of $R^2 = 0.03$.

As a sensitivity analysis, a more rigorous form of the GBM was tested (see Online Appendix B9). To do this, the experimental condition was removed from the model to test a configuration that fully aligns with the GBM. The analysis achieved similar results, with the path between worry and compliance not being significant.

Discussion

This study examined the impact of news reports about COVID-19 on perceived consensus regarding the seriousness of COVID, and its implications for individual attitudes, and compliance with containment measures, based on the GBM. The study showed that, contrary to the hypotheses, the group that had seen the conspiracy theory report rated consensus higher than the groups that had seen the neutral or the scientific report.

The remaining paths of the adapted GBM, however, were largely supported: Perceived consensus showed small to moderate positive correlation with personal belief in the seriousness of COVID, the worry about the risks of COVID, and the belief in the efficacy of measures. Moreover, these attitudes were positively correlated with the compliance with containment measures. Most of the hypothesized pathways remained significant in the path model, with the exception of the pathway between worry about COVID, and compliance.

News Coverage and Perceived Consensus in Society

One major finding was that viewing news reports about public protests led to higher as opposed to lower consensus estimates. This positive bias in estimates could be explained by social identity theory (Tajfel & Turner, 1979), namely, the salience of one's social identity (Lalonde & Silverman, 1994). When a person is confronted with another group whose opinions clearly differ from their own group, this can make their own group affiliation salient, as the confrontation can be perceived as a threat (Branscombe et al., 1999). In an intergroup context, this can lead to social identity influencing attitudes and behaviors (Jonas et al., 2014). Related to the results of the study, this could mean that when a person who considers themself to be part of a group that takes COVID seriously but is then confronted with a group that does not,

their social identity becomes salient, because the confrontation with the out-group is perceived as a threat. This threat could in turn lead the person to want to strengthen their in-group by estimating the consensus reflecting their own group's opinion to be higher, and thus making their own group seem larger. This is also coherent with the spiral of silence theory (Noelle-Neumann & Petersen, 2004). The theory postulates that people who see themselves in agreement with the climate of opinion are more likely to express their opinion publicly than people who see themselves in contradiction to it (Kepplinger, 2016). Making one's own group seem larger would legitimize it again to express one's own opinion publicly and in turn strengthens the own social identity. Thus, reports on conspiracy theories might be beneficial for persons that already perceive COVID as a serious threat by evoking adaptive social cognitions. Since we did not examine compliance behaviors, though, the link between intention and action is subject to future research.

Another explanation for this observation is based on the concept of cognitive dissonance that describes an aversive state in which two cognitions are inconsistent with each other (Festinger & Carlsmith, 1959). Since this state is perceived as unpleasant, the motivation to end this state arises. For this purpose, either cognitions (e.g., attitudes or values) or behavior are adjusted (Gruman et al., 2017). In this study, one might assume that most subjects already perceived COVID a serious virus (which is supported by high mean values), therefore, the measures are warranted, and compliance is necessary. However, once subjects were confronted with a video in which people state that COVID does not exist and that they do not comply with measures, this might have triggered dissonance. One could get the impression that society is polarized and that there seems to be considerable doubt about COVID and the measures taken to contain the virus, which could diminish one's reasons for complying with the measures and consequently the justification for one's behavior. This line of reasoning would correspond to previous research on climate change, where viewing contradictory opinions reducing consensus estimates (e.g., Koehler, 2016). The resulting dissonance could then be eliminated by adding consonant cognitions (i.e., a higher consensus estimation). Results of the study showed that people in the conspiracy theory report condition reported a high belief in COVID ($M = 4.47$, $SE = .83$) and a high compliance with measures ($M = 4.43$, $SD = .65$). In this regard, the groups did not significantly differ (see Table 1). However, post hoc analysis indicated that there were differences across the groups in the association of consensus estimates, and attitudes and behaviors in regard to COVID. While the conspiracy theory report condition showed a medium to strong positive correlation between the consensus estimate and belief in COVID, $r(128) = .41$, $p < .001$, and a medium positive correlation between the consensus estimate

and compliance, $r(128) = .29$, $p < .001$, the scientific report condition did not show these associations, $r(131) = .17$, $p = .06$; $r(131) = .02$, $p = .80$. This suggests that the higher subjects rated their own belief in COVID, and their compliance with measures, the higher they rated the consensus that COVID is a serious virus, but only when they viewed the conspiracy theory report. This could indicate that there was a cognitive dissonance present in the subjects viewing the conspiracy theory report that led to higher estimation of consensus. However, further inquiry is needed to confirm this assumption.

Finally, in interpreting this result, the news reports used in the study should be considered. While the three reports did show a high ecological validity, the reports differ in duration, content, and structure. Following the elaboration likelihood model (Petty & Cacioppo, 1986), for instance, one could assume that longer reports require more focused attention and could lead to more elaborate processing that might affect personal opinion more strongly. The different types of topics might also be of varying interest to the respondents, leading to differences in involvement and processing. However, we decided to maximize ecological validity, and these potential trade-offs are subject to further research.

Particular attention should be paid to the conspiracy theory report. Since this report depicts an excerpt from a real-world mass media channel it is reasonable to argue that it was following the *protest paradigm* (Chan & Lee, 1984). Previous research on protest coverage has shown that the mass media often delegitimizes protesters who challenge the status quo, resulting in coverage supportive of the status quo (McLeod & Detenber, 1999). The protest paradigm encompasses techniques, such as creating a violent crime narrative, in which the report focuses on the protest as a conflict between the protestors and the police instead of focusing on the claims and demands of the protestors (McLeod & Hertog, 1992). Other characteristics of the paradigm involve the reliance on official sources to increase credibility which in turn reinforces the status quo, or the use of cues to public opinion that portray protesters as a minority (McLeod & Detenber, 1999). Parallels can be seen between the type of reporting on protests described here and the news report on protests against COVID measures used in the study. McLeod and Detenber (1999) demonstrated in a study that news reports showing high support for the status quo led to significantly lower ratings of public support. The authors argue that the spiral of silence theory suggests that lower estimates of public support for protesters leads viewers to speak out less in support of protesters (Noelle-Neumann & Petersen, 2004). These assumptions may indicate that the report used in this study shows high status quo support, which in turn leads to the protesters being viewed as a minority, which is associated with higher consensus estimates that COVID-19 is a serious virus. Therefore, further research

is needed to determine whether news reports that are less supportive of the status quo would lead to different outcomes.

Analysis of the Adapted GBM

The adapted GBM assumed that higher risk perception would lead to higher compliance intentions. While the model showed good model fit, and most paths were significant, this was not the case for worry about COVID. Because worry was strongly associated with belief in COVID, and belief in the efficacy of measures, this may have reduced the predictive power of worry. Moreover, other variables could have had a moderating effect on the relationship of worry and compliance. The analysis of covariates showed that vaccination status accounted for a large proportion of the variance in a person's attitudes toward COVID. This association may be explained partly by the fact that people who believe in COVID are also more likely to have sought vaccination (Zampetakis & Melas, 2021), but it could also be explained by cognitive dissonance. If people have already made the decision to get vaccinated, they need to retrospectively justify that decision by, for example, expressing a higher belief in COVID or higher worries about health-related risks. The use of stratified models in the analysis might have provided more insight into how certain characteristics affect GBM functioning, for example, the impact of vaccination status on model paths. However, the sample size was insufficient for this type of analysis.

Interestingly, while van der Linden et al. (2019) found that affective judgments (i.e., worry about climate change) had a higher influence on support for public action than cognitive judgments (i.e., belief in global warming and belief in human causation), in this study, cognitive judgments had a bigger impact on behavioral measures (i.e., compliance) than affective judgments (i.e., worry about risks of COVID). A possible explanation for that difference could be that a very large proportion of the sample was already vaccinated, and since vaccination reduces the impact of COVID, worry may be less important (García-Montero et al., 2021). In addition, compliance is not entirely voluntary, as some regulations are mandated by the government and penalties are imposed for non-compliance (e.g., wearing face masks in certain settings) (Naumann et al., 2020). Consequently, not worrying about the risks of COVID does not mean that a person is no longer complying with the rules.

It should also be noted that the scale used to survey compliance with measures includes a wide variety of measures that can be violated while still maintaining a high level of individual safety, such as nightly curfews. Thus, lower levels of compliance may have occurred even if a person expresses a high level of concern.

While the current study was based on the studies that were conducted by van der Linden et al. (2015, 2017, 2019) in the context of climate change, newer studies show that researchers were already able to adapt the GBM to the context of the COVID-19 pandemic (Kerr & van der Linden, 2022). In their study, Kerr and van der Linden (2022) analyzed pre-post measurements, and implemented consensus messaging as a treatment condition. We decided against consensus messaging, because in real life, people are seldomly confronted with accurate percentages of the opinion distribution, as these data are rarely available to the media, requiring time-consuming, and costly representative opinion polls. Moreover, opinions about COVID-19 were rapidly changing during the pandemic. People are thus forced to develop an individual opinion about what the consensus is among scientists or in the general population, which is why our approach has a high ecological validity.

In addition, the operationalization of GBM variables differed between studies, because they were adopted from the studies on GBM that address climate change (van der Linden et al., 2019). This is particularly worth emphasizing with regard to the behavioral component. In both contexts, studies on the GBM measured the support for public action, either by asking participants whether they think that people should do more or less to reduce global warming (van der Linden et al., 2019), or by asking whether participants support a work from home policy (Kerr & van der Linden, 2022). In contrast, we asked participants about active compliance with measures. Thus, the comparability of the two models is limited. In addition, in this study, participants were asked about the consensus in society as a salient frame of reference instead of the consensus among scientists, which was the case for the original studies.

Finally, it should be noted that the GBM has received considerable criticism in the past. For example, Kahan (2017) reports that the study by van der Linden et al. (2015) failed to report that not only did the experimental group increase their ratings of consensus after being exposed to consensus messages, but so did the control group, with no significant effect found between the two groups. This lack of effect was supported by other studies (Dixon, 2016; Kerr & Wilson, 2018). However, the critique mentioned mainly applies to the consensus messaging used in the GBM that was not featured in the present study.

Limitations

The study has some limitations. First, the videos used for the study are limited in their comparability. Since the videos are genuine news reports and were not produced specifically for this study, they are limited in their comparability and

fit (e.g., video length). In addition, the study did not include a manipulation check. Second, the sample is not representative for the German population in either its size or its composition, for example, regarding the level of education. In addition, the vaccination rate among study participants was higher than the average percentage of people vaccinated in Germany at the time of the survey (Robert Koch Institut, 2021a, 2021b). Third, when interpreting the results, the timing of the data collection must be considered. The increasing number of people being vaccinated and the comparably low incidence as well as few active restrictions could have created an increased sense of safety among the population which in turn could have affected the attitudes of the participants. Fourth, the adapted GBM was not tested as a stratified model due to the sample size.

Implications

The present study demonstrated that news coverage can have an impact on perceived consensus in society, which in turn influences attitudes and behaviors. However, since this study was one of the first to adapt parts of the GBM to the context of the COVID-19 pandemic and at the same time the first to test the influence of news coverage on perceived societal consensus, further research is. Future studies should use a sample that shows greater variance in educational and cultural background to increase generalizability.

The impact of news coverage on perceived consensus could be tested in a different context, where subjects do not already have preconceptions and experience with the issue, as it is the case with COVID. In the context of the COVID pandemic, however, subjects' preconceptions could be incorporated more directly into the analyses. In addition, subjects' usual media use (e.g., their favorite news channels), and the assessment of the tenor and objectivity of the videos could be analyzed in more detail to investigate their intent and messaging. The videos could also be modified in future studies. For example, different news sources, both in terms of source (for example, non-reputable sources) and format (print media, social media networks, etc.), could be used to examine media effects. Future research could also shed a light on the role of different types of perceived consensus (e.g., among scientists, society, social environment).

The results of this study have shown that news coverage does indeed have an impact on the consensus assessment that coronavirus is a serious virus, which in turn affects attitudes and behaviors. Therefore, it is important that the media, and news reports in particular, be aware of this responsibility. Consequently, the media should make more frequent use of concrete quantitative data from representative surveys when reporting on public opinion, to avoid misperceptions in the viewers' perception of the consensus.

Conclusion

The study showed that news coverage might influence the perception of consensus in society. We found that reports about conspiracy theories and protests seem to lead to higher, not lower, consensus perceptions when compared with neutral and scientific reports. The path analysis showed that higher perceptions of consensus in society predicted a higher belief in COVID, a higher worry about the risks of COVID, and a higher belief in the efficacy of restrictive measures to contain the virus, albeit with small effects. Belief in COVID and belief in the efficacy of measures predicted compliance with containment measures, whereas worry about risks of COVID did not. Data analysis also showed that vaccination status was a key predictor of attitudes toward COVID. Especially in the context of the global COVID-19 pandemic, attitudes and behaviors of the population are extremely important to limit the spread of the virus. Studies on influences on these attitudes and behaviors are therefore extremely important. The media play an important role in this, as they are responsible for disseminating information, especially in the context of a health crisis, and reporting on conspiracy theories may have beneficial effects to galvanize health-conscious parts of the populations.

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