Original Research

Using Preprint Sources in Science News: Do Transparent Disclosures Enhance Credibility?

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Abstract

This study tested whether the transparent use of preprint sources affects the perceived credibility of science news and scientists. In an experiment, U.S. adults read a news report describing COVID-19 research as a "preprint" (with varying levels of detail) or as simply a "study." There were no main effects of disclosing preprint status, but indirect effects emerged. For those who noticed the disclosure, both brief and fuller depictions of a study's preprint status enhanced the credibility of the reporting and the scientists behind the research. However, perceiving the science to be uncertain negatively mediated the effects of preprint disclosure on credibility appraisals among Republicans.

Keywords

science journalism, scientific uncertainty, transparency, source credibility, public understanding of science

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Preprints, or scientific manuscripts uploaded to a public server without formal peer review (Berg et al., 2016), have been a part of public science discourse for years (Alperin et al., 2024). Yet the media's use of preprint sources was uncommon up until the coronavirus disease 2019 (COVID-19) pandemic, when the novel crisis sparked a need for rapid access to emerging scientific information (Fleerackers et al., 2024; Massarani et al., 2021). In the early stages of the pandemic, COVID-19 preprints gained widespread coverage in media outlets around the world (Fleerackers, Riedlinger, et al., 2022; Massarani & Neves, 2022; Simons & Schniedermann, 2023; Van Schalkwyk & Dudek, 2022). Preprint servers such as *bioRxiv* and *medRxiv* saw an explosion of COVID-19 research, nearly 30% of which was featured in at least one news article—a rate about 100 times higher than news coverage of non-COVID-19 preprints during this time (Fraser et al., 2021; see also Kodvanj et al., 2022). This coverage helped scientists share important discoveries with the public; for example, about the airborne nature of viral transmission and effective preventive measures such as social distancing (Fraser et al., 2021).

Despite such benefits, this trend also exposed risks of broad dissemination of preprints, including the potential to spread misinformation. The COVID-19 pandemic saw reports of several high-profile preprints that turned out to be flawed (Caulfield et al., 2021; Majumder & Mandl, 2020; Saitz & Schwitzer, 2020; Van Schalkwyk et al., 2020). Preprints comprised about one-third of early retracted coronavirus research, although the reasons for these retractions were not always clear (Santos-d'Amorim et al., 2021). COVID-19 preprints also appeared to undergo more changes between initial posting and subsequent publication in a peer-reviewed journal compared to preprints on other topics (Brierley et al., 2022). While many of these preprints underwent only minor changes (Majumder & Mandl, 2020; Zeraatkar et al., 2022), others saw their conclusions change in major ways (Brierley et al., 2022). In addition, a sizable number of preprints never reached publication in a scientific journal (Drzymalla et al., 2022; Otridge et al., 2022). These findings highlight the amplified scientific uncertainty that may be associated with preprint research, particularly during a crisis such as a pandemic.

This amplified uncertainty—paired with the widespread news coverage and social media attention to preprints (Fleerackers, Riedlinger, et al., 2022; Fraser et al., 2021; Otridge et al., 2022; Urman et al., 2022)—raised concerns about the potential for preprints to harm public discourse about COVID-19 (and beyond). Scholars worried that flawed preprints could spread misinformation and confusion, result in ill-informed decision-making, and potentially

damage public trust in science (Brierley, 2021; Caulfield et al., 2021; Saitz & Schwitzer, 2020; Santos-d'Amorim et al., 2021). To stave off these risks, journalists and other science communicators were advised to be transparent about the un-peer-reviewed status of the evidence when using preprint sources (e.g., Khamsi, 2020; Nadella & Navathe, 2020). Such disclosures[1] were expected to help public audiences understand the tentative nature of the science, as well as strengthen public trust in science communication by signaling honest and accurate reporting (Caulfield et al., 2021; Khamsi, 2020; Van Schalkwyk & Dudek, 2022). However, current research evidence is lacking about whether public audiences perceive preprint disclosures this way—or perceive them at all.

In the current study, we examined whether people notice details about preprint status in a news report about COVID-19 research, and if so, whether this information is interpreted as an indicator of preliminary science and a marker of trustworthy communication. We varied the amount of detail provided to compare the effects of a brief versus fuller disclosure of preprint status, representing the variability in actual news coverage (Fleerackers, Riedlinger, et al., 2022; Oliveira et al., 2021). Finally, given the political polarization of COVID-19 (Bruine de Bruin et al., 2020; Kerr et al., 2021), we tested whether prior stance toward the scientific topic—in this case, represented by party affiliation—influenced the effects of preprint status disclosure on the audience's perceptions of the disclosure, the science, and the credibility of the sources, as well as their intentions to engage in the precautionary behavior supported by the preprint research (i.e., social distancing). This study contributes insights to help guide public dissemination of preprints, especially in future outbreaks (Johansson et al., 2018; Marani et al., 2021).

Preprint Disclosure as a Potential Transparency Cue

The news media is an important avenue for disseminating scientific evidence to the public. In the United States, trust in both the news and scientists wavered during the early stages of the COVID-19 pandemic, with polls showing declining trust among both Democrats and Republicans (albeit lower baselines and steeper declines for Republicans; Gallup, 2024; Pew Research Center, 2023). While Americans' confidence in science has historically been higher for Democrats than Independents and Republicans (Lee, 2021), especially for science related to public health impacts (McCright et al., 2013), early failures to communicate transparently about uncertainties related to COVID-19 science had impacts on trust in science communication that crossed party lines (see

Ratcliff et al., 2022). This underscored the need for greater transparency in public communication about COVID-19 and future health crises, including transparency about evidence from preprints and other preliminary research (Caulfield et al., 2021; Saitz & Schwitzer, 2020).

In general, public trust in the media can be strengthened by increasing transparency and reducing perceptions of sensationalized and biased reporting (Fawzi et al., 2021; Fisher et al., 2021; Van Scoy et al., 2021). Similarly, scholars argue that trust in science can be enhanced by reducing perceptions of unreliable evidence and avoiding exaggerated accounts of discoveries in the media (Figdor, 2024; Jamieson, 2018). To this end, researchers have begun exploring the potential benefits of transparent reporting strategies, such as revealing the journalist's decision-making process (Masullo et al., 2022; Varnum et al., 2024) and providing detailed information about sources (Bhuiyan et al., 2021; Loosen et al., 2020; Wang & Ophir, 2024). Research also suggests that transparency in the form of disclosing study flaws (Hendriks et al., 2016) and providing information about the process of discovery (Nagler et al., 2023) can enhance positive perceptions of science and scientists. Along these lines, providing details about preprint sources in science reporting could serve as a transparency cue that enhances the credibility of both science news and the scientists who authored the preprint.

Preprint disclosure has been considered a form of communicating scientific uncertainty (Fleerackers, Riedlinger, et al., 2022; Nanayakkara & Hullman, 2020). Although scholars have yet to develop formal theories about the effects of communicating scientific uncertainty (see Ratcliff et al., 2022; van der Bles et al., 2019), mounting evidence shows that public audiences are generally favorable toward scientific uncertainty disclosures. Specifically, research finds that depicting science as preliminary or mentioning its limitations tends to enhance perceived credibility of the sources (e.g., journalists and scientists) among public audiences (for reviews, see Guo et al., 2025 and Gustafson & Rice, 2020). This credibility boost has been attributed to an understanding that uncertainty is an inherent part of science, leading individuals to interpret uncertainty disclosure as an accurate and realistic portrayal of scientific research (Jensen, 2008; Ratcliff & Wicke, 2023; Steijaert et al., 2021).

Preprints introduce a unique source of scientific uncertainty, however. Preprint research can be viewed as preliminary evidence that is likely to be revised and refined during the process of scientific peer review, or it can be viewed as low-quality evidence that would not pass scrutiny and is unworthy of publication. To date, little is known about how public audiences view preprints. If viewed like other forms of uncertainty, individuals might see

the use of preprints as a normal aspect of science dissemination and interpret preprint disclosure as a transparent gesture. This, in turn, might enhance the credibility of the sources—including perceptions that a news report is trustworthy and balanced (Jensen, 2008) and that the scientists behind the preprint are trustworthy and competent (Hendriks et al., 2016)—and increase intentions to act on the study's findings (Song & Zahedi, 2007). On the contrary, if preprint research is viewed as unreliable (Wingen et al., 2022) or too preliminary to warrant dissemination, source credibility and intentions may drop when preprint status is disclosed. Alternatively, transparency about preprint status could enhance the credibility of a news report while casting doubt on the credibility of the research and the scientists who posted the preprint. A final possibility is that preprint disclosure has no impact on perceptions of the science or sources, and no bearing on behavior, because people are unfamiliar with the concept of a preprint. The last possibility aligns with results of research using student samples (Cataldo et al., 2023; Cyr et al., 2021), as well as findings of another study by our team (Ratcliff et al., 2024). These varied possibilities underscore the need to examine how preprint disclosure affects *perceived disclosure* and *perceived uncertainty*, as credibility evaluations and behavioral intentions based on the research likely hinge on these perceptions.

Is a Detailed Disclosure Better Than a Simple One?

Disclosures of preprint status in news reporting vary in whether and to what extent "preprint" is defined (e.g., by explaining that the study has not been peer-reviewed and published in a scientific journal; Fleerackers, Riedlinger, et al., 2022). Effects of preprint disclosure might differ based on the amount of detail provided, especially if audiences have limited familiarity with the concept of a preprint (Cyr et al., 2021). Past work found that fuller disclosures of research limitations enhanced the credibility of journalists and scientists compared to brief disclosures (Jensen, 2008). Fuller depictions of sources of uncertainty, such as a study's preprint status, might be more likely to get noticed. They might also increase perceptions that the research is uncertain. However, while lengthy explanations could facilitate public understanding of preprints, these may be unrealistic in the context of news reporting, where time or space is limited. Lengthy disclosures may be even less realistic when science is shared in bite-sized formats, such as in X posts or TikTok videos. This inspired us to test two shorter formats: a *brief disclosure* with a single interpretative cue and an *expanded disclosure* with three simple interpretative cues.

Transparency Cues in a Polarized Context

Whether scientific uncertainty disclosures are viewed positively or negatively is thought to depend, in part, on the audiences' prior issue beliefs (Gustafson & Rice, 2020). It is possible that individuals who are already skeptical of science on a particular topic will be less impressed by transparency cues, especially in the form of disclosing preprint status—which skeptics might readily interpret as proof of rushed science.

The current study focused on preprint research about a COVID-19 "superspreader" event given its broad relevance at the time of data collection. The COVID-19 pandemic was highly politically polarized in the United States, with Democrats tending to accept and Republicans tending to reject science promoting the efficacy of precautionary behaviors such as mask-wearing and social distancing (Bruine de Bruin et al., 2020; Kerr et al., 2021). For example, research found that people living in Republican counties were less likely to follow certain space-based recommendations (i.e., stay at home) compared to people living in Democratic counties (Roberts & Utych, 2021). Thus, political partisanship could moderate the impact of conveying preprint status about research that highlights the importance of social distancing (see Rekker, 2021). Varied interpretations of the message and the science, based on one's prior stance, could affect perceived source credibility and, in turn, intentions to engage in behaviors promoted by the sources (Song & Zahedi, 2007).

The Current Study

To summarize, this study examined how a public audience evaluates a news report featuring a COVID-19 preprint when its preprint status is disclosed. We posed research questions instead of hypotheses given the lack of evidence on the effects of preprint disclosure. We tested whether a brief or expanded disclosure affects evaluations of news credibility (i.e., balance and trustworthiness of the news report), scientist credibility (i.e., competence and trustworthiness of the scientists responsible for the research), and issue-relevant behavioral intentions, either directly (RQ1) or indirectly via perceptions of preprint disclosure or scientific uncertainty (RQ2). Given the political polarization of COVID-19, we examined whether aligning more closely with the Democrat or Republican party moderates these direct or indirect effects (RQ3). Finally, we tested whether preprint disclosure indirectly influences intentions through effects on perceived credibility of the sources (RQ4). Embedded in each RQ is a comparison of whether audiences evaluate a brief preprint disclosure differently than a more detailed one.

Method

Study Design and Procedure

We conducted a between-participants experiment comparing three versions of a news report. Participants were randomly assigned to one of the three conditions: (a) control with no preprint mention, (b) preprint disclosure with a brief description, or (c) preprint disclosure with an expanded description. Prior to reading the news report, participants provided demographic information. Following the report, they responded to questions about their perceptions of the sources and their behavioral intentions related to the findings of the preprint study. We hired Qualtrics Panel Services to collect a sample of at least 400 U.S. adults.[2]

Data collection occurred in March of 2021, roughly a year into the COVID-19 pandemic. At the time of the survey, the United States was nearing 30 million COVID-19 cases, the death toll was estimated to be about 544,000, and many states were lifting mask mandates (Maan, 2021). Multiple vaccines had been authorized and were available to the public. Guidance from the Centers for Disease Control and Prevention (CDC) in March 2021 was that vaccinated people could meet with other fully vaccinated people without masks or social distancing, while unvaccinated individuals were recommended to meet outside and practice social distancing (CDC, 2021). While superspreader events were less prominent in the news than the previous year, concern and coverage were still common at the time of our study (e.g., Diaz, 2021; Kiefer, 2021).

Experimental Messages

The stimuli were based on a real news report describing a preprint study that identified Mardi Gras as a superspreader event, linking it to a surge in COVID-19 cases in Louisiana (Kiefer, 2021). We modified preprint disclosure in ways that reflected existing preprint news coverage (Fleerackers, Riedlinger, et al., 2022) and scholarly definitions of the term (Berg et al., 2016). Specifically, we varied whether the news report described the research as simply a "study" (control condition) or as a "preprint" with contextualizing clues (i.e., mentioning that the study had not undergone peer review, was posted online by the authors, or was not yet published in a scientific journal). To operationalize the level of disclosure, we used one cue to represent *brief* disclosure and three cues to represent *expanded* disclosure (see Box 1). The brief disclosure condition used the contextual cue contained in the original news report. Mirroring the original news report, all versions of the stimuli featured an interview with the scientist responsible for the research, but descriptions of preprint status were provided by the journalist. Full stimuli are presented in Supplement S1.

Box 1. Experimental Manipulations.

Condition	Manipulations
Control	No mention of preprint status. Journalist simply described the research as "a study."
Brief Preprint Disclosure	Journalist described the study as a "preprint" that "has yet to go through scientific peer review."
Expanded Preprint Disclosure	Journalist described the study as a "preprint" that "has yet to go through scientific peer review" and said the study was "released by the authors" and "has not yet been published in a scientific journal."

Measures

Demographics. To characterize the sample, we collected data on participants' age, gender, education, race/ethnicity, political views (party affiliation and ideology), and whether they had ever had COVID-19. Given the politically polarized context, we used a binary variable to capture political party affiliation for RQ3, asking whether participants see themselves as closer to the Republican or Democratic party.[3]

Mediators

Perceived preprint disclosure. Using a measure developed for this study, participants rated agreement with two statements: "The article acknowledged that the study is a preprint" and "The article stressed that the research has not undergone scientific peer review" (1 = *strongly disagree*, 5 = *strongly agree*). These two items were combined to make a composite variable (M = 3.63, SD = .98).

Perceived scientific uncertainty. Participants rated whether the research described in the news report seemed *certain, known for sure, established, without any doubt, settled*, and *able to be firmly relied on*. Participants rated agreement on a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). Scores were reversed so that a high score represented perceived uncertainty (M = 3.85, SD = 1.51). The six-item scale was reliable (α = .95).

Outcomes

News credibility (balance and trustworthiness). Participants evaluated the news report's depiction of the research in terms of whether it was *balanced* (i.e., fair, accurately represented, realistic, and open-minded) and *trustworthy* (i.e., honest, ethical, trustworthy, and reliable), using scales adapted from Abdulla et al. (2004). Responses were on a 7-point scale (1 = *not at all*, 7 =

very much), and each subscale was reliable (balanced: $M = 5.06$, $SD = 1.47$, $\alpha = .92$; trustworthy: $M = 4.92$, $SD = 1.54$, $\alpha = .93$).

Scientist credibility (competence and trustworthiness). Participants evaluated the scientists responsible for the research in terms of their *competence* (i.e., expert, competent, intelligent, trained) and *trustworthiness* (i.e., trustworthy, honest, ethical), using scales adapted from McCroskey and Teven (1999). Participants rated agreement on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*), and each subscale was reliable (competent: $M = 3.87$, $SD = .74$, $\alpha = .87$; trustworthy: $M = 3.75$, $SD = .86$, $\alpha = .90$).

Social distancing intentions. Given that the research presented in the news report pertained to social distancing to limit the spread of COVID-19, we assessed related intentions as an outcome variable. Participants were asked in both the pretest and posttest how likely they were to "Engage in social distancing" and "Put a distance between yourself and other people" to slow the spread of COVID-19 (1 = *extremely unlikely*, 7 = *extremely likely*). These two items were combined to make a composite variable. Overall, intentions were high in both the pretest ($M = 6.00$, $SD = 1.60$) and the posttest ($M = 6.03$, $SD = 1.51$).

Data Analysis Plan

Analyses were conducted in SPSS v29. We used univariate analyses of variance (ANOVAs) with Bonferroni-adjusted pairwise comparisons to answer RQ1. We used the PROCESS macro to conduct tests of moderation (Model 1), simple and serial mediation (Models 4 and 6), and moderated mediation (Model 58) with 5000 bootstraps (Hayes, 2018). Because our predictor variable had three levels, we used indicator coding in PROCESS to create two contrasts: one comparing the control condition (no preprint mention) to the brief disclosure condition and one comparing the control condition to the expanded disclosure condition. Pretest intentions were covaried when examining intentions as an outcome for RQ2–RQ4.

Results

Participant Characteristics

To ensure data quality, we removed cases if participants did not correctly answer two open-ended attention-check questions (Griffin et al., 2022). Of 467 participants, 34 failed one or both checks (e.g., by providing an off-topic, nonsensical, or blank response), resulting in a final sample of 433

Table 1. Main Effects of Preprint Disclosure (RQ1).

Response variables	Control (n = 147)	Brief disclosure (n = 148)	Expanded disclosure (n = 138)	
Between-participant effects				
Perceived disclosure	3.19 (.89)[a]	3.77 (.92)[b]	4.07 (.90)[c]	$F(2, 430) = 34.82$, $p < .001$
Perceived uncertainty	3.68 (1.39)[a]	3.79 (1.42)[ab]	4.11 (1.68)[b]	$F(2, 430) = 3.20$, $p = .04$
News balance	5.06 (1.40)	5.11 (1.48)	5.01 (1.54)	$F(2, 430) = 0.17$, $p = .85$
News trustworthiness	5.04 (1.40)	4.85 (1.54)	4.86 (1.67)	$F(2, 430) = 0.71$, $p = .49$
Scientist competence	3.92 (.77)	3.86 (.71)	3.86 (.83)	$F(2, 430) = 0.24$, $p = .79$
Scientist trustworthiness	3.80 (.84)	3.74 (.86)	3.71 (.90)	$F(2, 430) = 0.47$, $p = .63$
Within-participant effects				
Social distancing intentions	Pre: 6.00 (1.60) Post: 5.93 (1.63)	Pre: 6.17 (1.35) Post: 6.26 (1.18)	Pre: 5.81 (1.80) Post: 5.88 (1.66)	$F(1, 432) = .28$, $p = .60$

Note. Table reports means (SDs in parentheses) and results of one-way ANOVAs with Bonferroni-adjusted pairwise comparisons. Means that do not share a common superscript are significantly different from each other ($p < .05$).

participants.[4] Half the sample was female (50.1%, n = 217), and half had a formal education beyond 12th grade (49.2%, n = 213). Participants were mostly non-Hispanic (89.8%, n = 389) and White (80.1%, n = 347), with a median age of 50 (range = 18–94). Slightly more individuals affiliated with the Democratic Party (54%, n = 234) than the Republican Party (46%, n = 199). Full demographic characteristics are reported in Supplement S2.

Bivariate Correlations

Bivariate correlations between all study variables are reported in Supplement S3.

Main Effects of Preprint Disclosure (RQ1)

Table 1 reports means, standard deviations, and main effects for all response variables. There were main effects of preprint disclosure on perceived

disclosure and perceived uncertainty. Answering RQ1, preprint disclosure had no main effect on ratings of news balance or trustworthiness nor on ratings of scientist competence or trustworthiness. A repeated-measures ANOVA showed no meaningful difference between pretest and posttest social distancing intentions.[5]

Indirect Effects of Preprint Disclosure (RQ2)

RQ2 asked whether disclosing preprint status would indirectly influence evaluations of news report credibility, scientist credibility, or behavioral intentions via perceived preprint disclosure and/or perceived uncertainty. First, we examined whether perceived disclosure mediated the relationship between the experimental message and perceived uncertainty. There was no evidence of mediation (see Supplement S4), and the correlation between perceived uncertainty and perceived preprint disclosure was nonsignificant ($r = .03$, $p = .48$; Supplement S3). Given this, we tested the two perceptions as parallel mediators (PROCESS Model 4).

For news balance and news trustworthiness, results showed the two perceptions acting in opposite ways: perceived disclosure *positively* mediated the effects of disclosing preprint status, while perceived uncertainty *negatively* mediated the effects (see Table 2). The positive indirect effects via perceived disclosure were significant for both the brief and expanded disclosure conditions but stronger for the latter. However, the negative indirect effects via perceived uncertainty were only significant for the expanded disclosure condition, as there was no main effect on perceived uncertainty for the brief condition. A similar but slightly weaker pattern emerged for scientist competence and scientist trustworthiness, with perceptions of disclosure and uncertainty mediating the effect of preprint disclosure in opposite ways.

Finally, the expanded disclosure had a very small negative indirect effect on social distancing intentions via perceived uncertainty. No other indirect effects emerged for intentions. Effect sizes are reported in Table 2 and path coefficients are presented in Supplement S5.

Moderating Role of Political Party (RQ3)

RQ3 asked whether political party affiliation would moderate the direct or indirect effects of preprint disclosure on news credibility, scientist credibility, or behavioral intentions. To answer this, we used PROCESS Model 1, which tests the influence of the moderator on the direct pathway, and Model 58, which tests moderation of indirect effects on both the *a* and *b* pathways—that is, the paths between preprint disclosure and perception, and

Table 2. Indirect Effects of Preprint Disclosure via Perceptions (RQ2).

	Perceived preprint disclosure			Perceived scientific uncertainty		
Outcomes	Indirect effect	*SE*	95% CI	Indirect effect	*SE*	95% CI
News balance						
Brief disclosure	**.22**	.06	[.12, .35]	−.05	.07	[−.18, .09]
Expanded disclosure	**.34**	.07	[.21, .49]	**–.18**	.08	[−.34, –.03]
News trustworthiness						
Brief disclosure	**.18**	.05	[.09, .30]	−.06	.08	[−.22, .11]
Expanded disclosure	**.28**	.07	[.15, .42]	**–.22**	.09	[−.40, –.04]
Scientist competence						
Brief disclosure	**.07**	.03	[.03, .13]	−.03	.04	[−.11, .05]
Expanded disclosure	**.11**	.03	[.04, .18]	**–.11**	.05	[−.21, –.02]
Scientist trustworthiness						
Brief disclosure	**.10**	.03	[.04, .16]	−.03	.05	[−.12, .06]
Expanded disclosure	**.15**	.04	[.07, .23]	**–.13**	.05	[−.23, –.02]
Social distancing intentions						
Brief disclosure	.06	.03	[.00, .13]	−.02	.02	[−.06, .02]
Expanded disclosure	.09	.05	[−.01, .18]	**–.05**	.03	[−.10, –.01]

Note. Table reports results for parallel mediation models with disclosure (vs. control) as the predictor and perceptions as mediators. Effects appearing in bold are considered statistically significant, as the confidence interval does not include zero.

between perception and each outcome. Model 58 allows for testing both perception mediators in parallel.

Political party did not moderate any direct pathways. Nor did it change the positive indirect effects of disclosure via perceived disclosure for any outcome (see Table 3). However, political party did influence the indirect effects of disclosure via perceived scientific uncertainty. For the expanded disclosure condition, negative indirect effects via perceived uncertainty *only* emerged for Republicans (Table 3), as Democrats did not perceive the research to be more uncertain (see Supplement S6 and S7). When replacing party affiliation with ideology, similar effects emerged. Ideology did not moderate any direct pathways nor the positive indirect effects via perceived disclosure on credibility ratings, but it moderated the indirect effects via perceived uncertainty: in the expanded disclosure condition, negative effects via perceived uncertainty emerged for moderates and conservatives but not liberals (Supplement S8). For intentions, there was only a small negative indirect effect of perceived uncertainty for conservatives.

Table 3. Political Party as a Moderator of Indirect Effects (RQ3).

	Perceived preprint disclosure			Perceived scientific uncertainty		
Outcomes	Index of moderated mediation	*SE*	95% CI	Index of moderated mediation	*SE*	95% CI
News balance						
Brief disclosure	.10	.12	[−.14, .33]	.24	.15	[−.04, .54]
Expanded disclosure	.24	.14	[−.03, .51]	**.39**	.17	[.08, .74]
News trustworthiness						
Brief disclosure	−.05	.11	[−.26, .16]	.27	.17	[−.05, .59]
Expanded disclosure	.00	.13	[−.25, .27]	**.41**	.18	[.06, .77]
Scientist competence						
Brief disclosure	.01	.05	[−.09, .11]	.12	.08	[−.03, .28]
Expanded disclosure	.04	.06	[−.08, .17]	**.18**	.09	[.01, .36]
Scientist trustworthiness						
Brief disclosure	−.03	.06	[−.16, .08]	.15	.09	[−.02, .34]
Expanded disclosure	−.01	.08	[−.16, .14]	**.22**	.11	[.02, .43]
Social distancing intentions						
Brief disclosure	−.02	.07	[−.16, .11]	.08	.05	[−.01, .19]
Expanded disclosure	.00	.09	[−.19, .18]	**.13**	.06	[.02, .26]

Note. Table reports results for moderated mediation models with disclosure (vs. control) as the predictor and perceptions as mediators. Effects appearing in bold are considered statistically significant, as the confidence interval does not include zero. A significant effect indicates that the effect only emerged for Republicans (see Supplement S7).

Serial Indirect Effects of Disclosure on Intentions (RQ4)

Given the results for RQ2, we proceeded with RQ4, testing whether indirect effects of disclosure on credibility might have downstream effects on intentions. Tests of serial mediation, controlling for political party and pretest intentions, showed no indirect effects on intentions via perceived disclosure (or perceived uncertainty) and source credibility. These null results held when controlling for ideology in place of political party, as well as when neither was covaried.

Discussion

Preprints gained traction in the public dissemination of scientific findings during the COVID-19 pandemic (Fleerackers et al., 2024; Fraser et al., 2021;

Massarani et al., 2021), prompting recommendations that journalists and other science communicators be transparent about their un-peer-reviewed nature. This study is among the first to experimentally test whether conveying information about a study's preprint status influences public perceptions. Other experiments with public audiences found that disclosing a study's preprint status either had no effect on perceptions of the research and related outcomes (Ratcliff et al., 2024; Wicke et al., 2025) or lowered the perceived credibility of the research (but only when an explanation of peer review was provided; Wingen et al., 2022). This may lead science communicators to conclude that mentioning details about a study's preprint status is unnecessary or even disadvantageous—but is that the right conclusion?

In this study, we observed no negative direct effects of disclosure and found evidence of positive indirect effects on the credibility of the news report and the scientists who authored the preprint, contingent on the audience *perceiving* the preprint disclosure. Although it was the journalist who described the research as a preprint, increased credibility of the news report likely transferred to perceptions of the scientist sources, similar to past research (Jensen, 2008). While even a brief disclosure was perceptible and produced positive indirect effects in the current study, the effects were enhanced by including more detail in the disclosure (i.e., including three contextual clues instead of one). These positive indirect effects of disclosure on credibility emerged for both Republicans and Democrats and for individuals across the political ideology spectrum. This finding is encouraging given that perceiving scientific sources as trustworthy and unbiased can enhance support for scientific research, especially among conservatives (Ophir & Jamieson, 2021). In all, this suggests that disclosing preprint status may serve as a source transparency cue that lay audiences appreciate (Loosen et al., 2020).

At the same time, negative indirect effects of preprint disclosure emerged for all outcomes when participants perceived the research to be uncertain. This only occurred for the expanded disclosure and only for Republican (or moderate and conservative) individuals, as Democrat (or liberal) participants did not find the research more uncertain when described as a preprint. It is interesting that only conservatives and moderates viewed the preprint research as tentative and that this had negative repercussions for credibility. After all, perceiving the science to be tentative arguably reflects an accurate understanding of the nature of preprints (Nanayakkara & Hullman, 2020; Ratcliff et al., 2024). Moreover, this perception should not necessarily impact how audiences rate the credibility of news reports or scientists, given that all science contains some uncertainty (Gustafson & Rice, 2020) and there can be value in sharing preliminary science when uncertainty is transparently disclosed (Figdor, 2024). Given the political polarization surrounding COVID-19 science in the

United States (Kerr et al., 2021)—especially with respect to preprints (Urman et al., 2022)—respondents likely interpreted preprint status as a marker of uncertainty only when the research threatened their beliefs (see, e.g., Abhari & Horvát, 2024). Political conservatives were less likely to engage in social distancing and other precautionary behaviors during the first year of the pandemic (Bruine de Bruin et al., 2020; Jensen et al., 2025; Roberts & Utych, 2021). Partisan differences in trust in the news and scientists (Gallup, 2024; Lee, 2021; Pew Research Center, 2023) and in openness to learning about preliminary science (Ratcliff et al., 2023) likely also influenced how the preprint disclosure affected credibility appraisals. To better understand the influence of these factors, it would be helpful to measure these audience characteristics in future studies as well as to replicate our study in scientific contexts that are non-partisan.

The limited effects of preprint disclosure on behavioral intentions might be attributable to the context and time of data collection. Social distancing intentions were already high among participants in the pretest (see Table 1). Data collection occurred 1 year into the COVID-19 pandemic and a couple of months after Biden succeeded Trump as President, when social distancing had become a norm (CDC, 2021). Given this, there is a chance that preprint disclosure would have had a stronger influence on intentions earlier on. To better understand the impact of the media's use of preprint sources on public decision-making, it will be important to examine the effects of conveying preprint status in news coverage of topics where audiences have not already formed strong opinions. Studies in other national and political contexts as well as in non-crisis contexts are also needed.

Practical and Theoretical Implications

Our findings suggest there is value in reporting details about preprint status in public science communication, just as there is value in conveying other sources of scientific uncertainty, as audiences clearly take note of these disclosures even when their effects are minor. While all science is accompanied by some level of uncertainty, preprint research may be especially susceptible to it, as findings can change, sometimes in important or unexpected ways, during the peer-review process (Brierley et al., 2022; Majumder & Mandl, 2020; Zeraatkar et al., 2022). This uncertainty may be further amplified during a crisis, like a pandemic, where scientists face pressures to share their work earlier, often in a less polished state, than they would in other public communication and outreach contexts (Brierley et al., 2022). Widespread dissemination of study results that have not undergone formal peer review is inherently risky, as the findings of these studies may be perceived as definitive, especially by those who lack an understanding of the peer-review

process (Fleerackers et al., 2025). Disclosing a study's preprint status gives audiences an opportunity to understand this potential for heightened uncertainty. It may help the public better understand the processes of scientific discovery and peer review (Jamieson, 2018; Nagler et al., 2023) and buffer against loss of trust in the news and scientist sources if the evidence changes between preprint and publication (Dries et al., 2024).

Content analyses of media coverage of COVID-19 preprints found that news reports seldom defined the term *preprint* and, when they did, those definitions were often brief and superficial (Fleerackers, Riedlinger, et al., 2022; Massarani & Neves, 2022; Oliveira et al., 2021; Van Schalkwyk & Dudek, 2022). Potentially, this reflects an assumption among journalists that the public would not understand the information or find it useful, as suggested by interview-based research with journalists from the Global North (Fleerackers, Moorhead, et al., 2022). Although general audiences seem to have limited familiarity with preprints and the broader peer-review process (Cataldo et al., 2023; Fleerackers et al., 2025; Wingen et al., 2022), the findings of the current study and those of Wingen et al. (2022) suggest that most individuals do notice and evaluate descriptors of preprint status when some explanation is provided for context. In other reporting contexts, the efficacy of transparency cues has been mixed, leading researchers to suggest they must be prominent to be effective (Masullo et al., 2022; Varnum et al., 2024). Although our results show that it is the *perception* of a disclosure that affects credibility, our findings indicate that even a short disclosure is likely sufficient. However, merely mentioning preprint status without interpretive cues or explanations is unlikely to have any impact (Wingen et al., 2022).

Our observation of positive indirect effects of preprint disclosure on source credibility, via perceived disclosure, was replicated in another study by our team (Wicke et al., 2025). While still preliminary, this finding has theoretical grounding. In the United States, a majority of the public sees science as iterative (National Science Board, National Science Foundation, 2022) and reports being interested in learning about tentative science and the caveats and limitations of research (Ratcliff et al., 2023). Therefore, transparent disclosures about the state of scientific evidence, including its (un)peer-reviewed status, should—*when noticed*—enhance source credibility for most audience groups. So far, the cognitive mechanisms driving different responses to scientific uncertainty messages are not well understood (Guo et al., 2025; Ratcliff et al., 2022). Results of this study shed light on two potential mechanisms: perceived disclosure and perceived uncertainty. As scholars work to translate broad frameworks of scientific uncertainty communication (e.g., Ratcliff & Wicke, 2023; Van der Bles et al., 2019) into concrete, testable theories, our findings suggest it makes sense to consider the potential roles of

perceptions of disclosures and of scientific uncertainty. Moving forward, it will be important to better understand the relationship between these two perceptions, since they were not correlated in our study (see Supplement S3) and appear to impact audiences in opposite ways (also see Wicke et al., 2025).

In addition, further research examining which factors influence these perceptions will be valuable. An emerging body of research suggests that audience characteristics—such as age, education, factual science literacy, and preferences for learning about scientific uncertainty—may act alongside message features to shape how audiences understand or perceive preprints (Cyr et al., 2021; Fleerackers et al., 2025; Ratcliff et al., 2024). However, existing research has largely focused on student samples, the U.S. context, and/or COVID-19 research specifically. Moreover, scholars have not yet identified the mechanisms underpinning these differing audience responses, leaving many important questions unanswered.

Limitations and Additional Future Directions

Several limitations of this study should be noted. First, our sample was not representative of the United States population in all respects. For example, participants' median age was 50, whereas the median population age is closer to 40 (U.S. Census Bureau, n.d.). Having a disproportionately older sample might have influenced responses to preprint disclosure, necessitating future replications. In addition, our political party affiliation measure was dichotomous (Republican/Democrat) and did not allow participants to select an Independent/Other option.

Second, we collected data during the initial stages of COVID-19 and cannot say whether the same results would have emerged in other stages of the pandemic, nor whether they will replicate in other scientific contexts. While our findings are specific to a particular time and context, they are likely to become relevant again, as pandemics are expected to become increasingly frequent in the future (Marani et al., 2021), and preprints—despite their potential risks—offer important opportunities for timely communication during these and other crises (Alperin et al., 2024; Johansson et al., 2018). Yet, as noted previously, it will be important to test the effects of preprint disclosure in a range of scientific contexts. Future work on public engagement with preprints needs to consider the increasing complexity of the politicization of science and public trust in scientists (Lee, 2021; McCright et al., 2013; Rekker, 2021). If preprints support one's beliefs, the willingness to accept the evidence as accurate—regardless of political ideology—likely increases (Chang, 2015). Perhaps this effect is higher for one party over the other, but examining more instances and effects of preprints related to fringe science, politically charged

scientific topics, and unproven remedies that have grassroots support during a public health emergency would help provide communicators with valuable insights into how to navigate pandemic communication in the future.

Third, our measures and operationalizations can likely be improved upon. We developed a measure of perceived preprint disclosure for this preliminary study, as none existed at the time. Our use of what might typically be considered a manipulation check variable was somewhat unconventional. However, given that public audiences have limited understanding of preprints, we deemed it possible that not everyone would detect the disclosure, and that credibility evaluations would depend on whether it was noticed (indeed, our results suggest this is the case). Yet there may be different or better ways to assess perceptions of preprint disclosure. Relatedly, it may be worth exploring the effects of alternative forms of preprint disclosure. For instance, research could test the usefulness of metaphors that build on the public's intuitive understanding of preprints—e.g., as rough drafts or "previews" of final research papers (Fleerackers et al., 2025)—or of including more interpretable descriptions of peer review (e.g., as a process of formal review or critique, as Ivan Oransky suggests; see Khamsi, 2020). In future studies, including an unrelated-message or no-message condition could also provide a useful baseline against which to evaluate the effects of preprint disclosure.

Conclusion

Our findings extend experimental research on communicating scientific uncertainty to the realm of preprints and have practical implications for a changing science communication landscape. In this study, we examined how a public audience evaluates disclosures of preprint status in a news report featuring a COVID-19 preprint. We observed positive indirect effects on the credibility of both the news reporting and the scientists, suggesting that many individuals perceived the depiction of preprint status as a transparent disclosure. However, it was only viewed as a marker of tentative evidence by Republican respondents, with negative downstream effects. This highlights the influence of prior beliefs and politicization of science in public evaluation of preprints (similar to other types of uncertainty disclosures; Gustafson & Rice, 2020). Yet it could also be a function of poor understanding of the concept of a preprint (Fleerackers et al., 2025). The latter underscores a need to include contextual details that enhance understanding when sharing preprint research with the public.

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Ethics Approval

The questionnaire and methodology for this study were approved by the Human Research Ethics committee of the University of Utah (approval # 00131482).

Consent to Participate

Informed consent was obtained from all individual participants included in the study.

Data

The data underlying this article are available upon request from the authors.

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Notes

1. We use the term "disclosure" to refer to a journalist's depiction of a scientific study as a preprint (e.g., by labeling it a "preprint," referring to it as unvetted or un-peer reviewed, etc.). We borrow this term from other research on the communication of uncertainty in science (e.g., Guo et al., 2025; Jensen, 2008; Ratcliff & Wicke, 2023).
2. This study was embedded in a single wave of a larger national study of public perceptions of COVID-19 communication over time (see Jensen et al., 2025). The larger study collected data from approximately 400 participants in each

wave. Therefore, our sample size was determined by parameters of the larger project. Results of the larger study are reported elsewhere and not duplicated with the data presented here.

3. Although our focus was on political party affiliation given polarized COVID-19 viewpoints between Republicans and Democrats (Kerr et al., 2021), we also measured political ideology on a five-point scale ranging from 1 = *very liberal* to 5 = *very conservative* ($M = 3.09$, $SD = 1.12$). We report supplementary tests of moderation with ideology in the main text and in Supplement S6.
4. To address a reviewer query, we repeated all analyses with the 34 low-quality cases included ($N = 467$) to determine whether results differed. Results were highly similar except that the effect of expanded preprint disclosure on perceived uncertainty was no longer statistically significant, $F(2, 464) = 2.02$, $p = .13$. Because our attention checks were designed to identify inattentive respondents and bots (Griffin et al., 2022), we exclude these cases from the analyses we report in this article.
5. Although pretest intentions differed slightly across experimental groups (see Table 1), the difference was not statistically significant (χ^2 [24, 433] = 25.54, $p = .38$), so we did not control for pretest intentions except when posttest intentions was the outcome.

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