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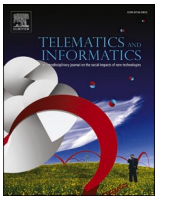
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Not doomed: Examining the path from misinformation exposure to verification and correction in the context of COVID-19 pandemic

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ABSTRACT

Misinformation exposure has attracted growing scholarly attention. While much research highlights misinformation exposure's negative impacts, this study argues that its positive effects should also be noted. By using a more precise measurement of misinformation exposure and a path model, this study outlines a path from misinformation exposure to anti-misinformation behaviors, partially mediated by misperceptions in the context of COVID-19. Findings indicate that exposure to popular but widely-denounced COVID-19 misinformation via social media had positive effects on verification intention. Frequent exposure to misinformation on social media is associated with lower misperceptions, suggesting a healthy dose of skepticism toward the platform and low internalization of misinformation. Special attention, however, needs to be paid to online news websites and personal contacts as misinformation sources. More tailored interventions and communication strategies to reduce misperceptions and increase media-literate behaviors are needed for younger, conservative, and ethnic minority individuals. Theoretical and practical implications are further discussed.

Misinformation exposure is never rare in the current media landscape where social media disseminate doctored or false narratives, more than 10 % of online news sites spread deceptive or inaccurate information, and friends or family members who hold misperceptions try to influence close others with fabricated or erroneous claims (e.g., NewsGuard, 2019). The circulation of misinformation has reached a peak during the Coronavirus (COVID-19) pandemic, forming an "infodemic" in which the life-threatening misinformation has ballooned exponentially (e.g., World Health Organization [WHO], 2020a). For instance, 700 people died after drinking toxic methanol alcohol in Iran because they wrongly believed it can cure COVID-19 (Forrest, 2020). Similarly, unwarranted claims about COVID-19 have also prevented people from adopting essential precautionary measures including getting the vaccine, wearing masks, and maintaining social distance (e.g., Ahmed et al., 2020; Loomba et al., 2021).

Given the detrimental effects of misinformation, much research has endeavored to examine anti-misinformation strategies (e.g., Ansar and Goswami, 2021; Velichety and Shrivastava, 2022). On one hand, some tendered evidence-backed suggestions to counter misinformation via data science approaches (e.g., Chauhan and Palivela, 2021; Kar and Aswani, 2021) and media literacy interventions (e.g., Kahne and Bowyer, 2017). Some, on the other hand, reported an intractable negative impact of misinformation exposure on subsequent behavioral decision-making (e.g., Lewandowsky et al., 2012; Pluviano et al., 2017). The rather mixed findings indicated that certain aspects regarding misinformation exposure may remain under-explored and this study hereby attempts to provide the pieces needed to complete the puzzle.

First, prior literature centered on misinformation exposure via new media but failed to compare differences between diverse

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patterns of exposure (e.g., media-mediated vs interpersonal; Liu and Huang, 2020; Valenzuela et al., 2019). Considering both media exposure and social approval would influence information and health decision-making (e.g., Auxier and Anderson, 2021; Xiao and Borah, 2020; Yang et al., 2014), whether these sources have similar or different impacts and which source carries more weight on attitude and behaviors merit further investigation.

Second, media literate behaviors such as information verification and misinformation correction have attracted growing scholarly interest (e.g., Bode and Vraga, 2021; Tully et al., 2020; Vraga and Bode 2020). However, little is known regarding the precise connection between these behaviors and misinformation exposure. Indeed, a recent national survey showed that around 80 % of respondents think misinformation awaits prompt attention and solutions (Mitchell et al., 2019). This overwhelming agreement demonstrates individuals' weariness of misinformation exposure and the skepticism fostered in an environment of misinformation overload (e.g., Gottfried et al., 2020; Guynn, 2016). As such, frequent misinformation exposure may lead to intentions to engage in more rigorous fact-checking or debunking.

However, this process may not be smooth. Previous literature revealed that misinformation exposure would easily result in misperceptions among individuals with certain types of personalities and cognitive capabilities compared to the general public (e.g., Zhu et al., 2010a, 2010b). Inherent demographic factors such as age, gender, and political orientation may also exert influences on perceptions and behaviors (e.g., Borah et al., 2022; Xiao et al., 2021). These characteristics may create uncertainties in rational decision-making including verification and correction. With this in mind, this study employs a survey of American adults to further understand the nuances of misinformation exposure and to articulate the path from misinformation exposure via different types of sources to verification and correction behaviors.

1. Misinformation exposure

Often defined as false or inaccurate information, misinformation could inflame social conflicts (Valenzuela et al., 2019), decrease institutional trust (Kim and Cao, 2016), precipitate public health crises (WHO, 2020a), and inflict economic damage (Velichety and Shrivastava, 2022). In the COVID-19 pandemic, misinformation has raised a range of negative consequences. For example, Jolley and Paterson (2020) revealed that exposure to COVID-19-related misinformation was correlated with anger, which in turn promoted justification for violence. Loomba et al. (2021) also showed that exposure to COVID-19 vaccination-related misinformation significantly induced a higher level of perceived risks of vaccination and vaccine hesitancy. Unfortunately, misinformation exposure may be ineluctable in the current age in which new media technologies endow every-one with rapid and unfiltered access to consume and disseminate information on the Internet (e.g., Aswani et al., 2021; Kar and Aswani, 2021). Three types of sources may play a particularly important role in exposing individuals to misinformation: social media, online news media, and interpersonal communication.

Social media are arguably the most obnoxious breeding field for misinformation (e.g., Vosoughi et al., 2018; Velichety and Shrivastava, 2022; WHO, 2020a). Prior studies found that misinformation is 70 % more likely to be shared than truthful information on social media platforms such as Twitter (Vosoughi et al., 2018); social media's distinctive features (e.g., hashtags, likes) particularly catalyze the propagation of misinformation (e.g., Aswani et al., 2021; Kar and Aswani, 2021); social media sites such as Facebook are also more likely to direct users to websites that spread misinformation (Guess et al., 2020). National surveys also showed that not only do the majority of individuals blame social media for spreading misinformation but individuals who mainly use social media as information sources are also less knowledgeable and engaged with current events (Auxier, 2020; Mitchell et al., 2021). International studies further indicated that the fear of social media misinformation and its negative influences is not confined to the U.S. but has rippled through multiple countries and economies (e.g., Smith et al., 2019). More worryingly, the impacts of misinformation could be aggravated through echo chambers formed in social networks (e.g., Aswani et al., 2021; Törnberg, 2018).

Online news media are slightly complicated in the era of misinformation. In part, it is an online extension of traditional news media outlets that serve the public good and play a crucial role in creating an informed citizenry (e.g., Anderson and Rainie, 2017). In part, however, it can be a fertile ground for misinformation proliferation. For instance, by examining 3,000 news and information websites, NewsGuard (2019) reported that 11 % of these news sites publish health-related misinformation that may compromise informed citizenry and cause confusion. Prior research also found that seeking information on news media is positively associated with misinformation engagement (Xiao and Su, 2022). With nearly 70 % of American adults preferring to stay informed of current events and affairs via news websites compared to social media (53 %), an investigation of misinformation exposure via online news sites is imperative (Shearer, 2021).

Misinformation exposure via interpersonal communication has not yet received enough scholarly attention, despite its common occurrences (e.g., Jaramillo, 2017; Shah, 2020). Scholars further indicated that unlike public venues including social media and news websites, misinformation exposure in the context of interpersonal communication can be rather private; information exchange is also not technological but more fluid with verbal and nonverbal cues, which inevitably add subtleties and uncertainties to the examination of communication effects (e.g., Malhortra, 2020). Moreover, individuals tend to conform to important referents' approval (e.g., peers, family) in decision-making and behavior adoption (e.g., Yang et al., 2014). Therefore, probing misinformation exposure at an interpersonal level provides a more granular understanding of exposure to misinformation that may differ in influencing subsequent behaviors.

2. Fighting misinformation: verification and correction

Notably, prior misinformation-related cross-sectional research centered on the type or frequency of media usage (e.g., Allington

et al., 2020; Bode and Vraga, 2021; Enders et al., 2021; Jamieson and Albarracín, 2020; Su, 2021). Though the results seemingly substantiated a positive correlation between information exposure via a range of media sources and outcomes derived from misinformation, they failed to capture the nuanced details of information exposure (e.g., Su, 2021; Xiao et al., 2021). That is, misinformation exposure amid a public crisis or event only accounts for a portion of information exposure via these sources, and misinformation engagement can be quite concentrated and constrained on certain media platforms (e.g., Altay et al., 2020; Grinberg et al., 2019; Xu et al., 2020). More importantly, authoritative organizations and media companies have taken a variety of measures to address misinformation including removing dubious accounts and posts, issuing scathing statements to debunk misinformation, and featuring tragedies induced by misinformation in newspapers (e.g., Forrest, 2020; Fung, 2021; WHO, 2020b). Individuals nowadays are not only much warier of misinformation and its lethal consequences (e.g., Gottfried et al., 2020; Mitchell et al., 2019) but also become more concerned about its negative impacts on close others including family and friends (e.g., Tandoc et al., 2020; Wagner and Boczkowski, 2019).

As such, this study argues that viewing or hearing misinformation claims about COVID-19 that have been widely and repeatedly debunked may trigger media-literate behaviors including verification and correction. Verification refers to information-seeking actions through fact-checking services when encountering ambiguous information (Brandtzaeg et al., 2016). Simply put, it emphasizes a process of "making sure." Correction takes one step further and refers to posting rebuttals to inaccurate claims (Vraga and Bode, 2020). It emphasizes a process of "taking action" following the "making sure." Both behaviors are extremely vital in combatting misinformation and scholars have called for interventions to enhance verification behaviors and establish a norm of social correction (e.g., Liu and Huang, 2020; Tully et al., 2020; Vraga and Bode, 2020). Although no study to date has specifically examined the relationship between misinformation exposure and verification and correction, some empirical evidence provided preliminary support. For instance, Xiao et al. (2021) suggested that healthy skepticism about media information promotes the intention to clarify ambiguities by seeking and checking more information. Tandoc et al. (2020) found that, albeit rare, individuals intend to correct misinformation when misinformation may impact people with whom they share close relationships. Thus, in light of the reviewed literature, this study aims to parse out the influence of misinformation exposure from information exposure and take into consideration individuals' evolving cognitive and behavioral competence in the COVID-19 pandemic. Thus, the first two research questions are proposed:

RQ1a: How does misinformation exposure via a) social media, b) online news media, and c) interpersonal communication influence verification intention?

RQ1b: How does misinformation exposure via a) social media, b) online news media, and c) interpersonal communication influence correction intention?

3. Misperceptions, a mediator

Undeniably, misinformation exposure is often linked to misperceptions, defined as "cases in which people's beliefs about factual matters are not supported by clear evidence and expert opinion" (Nyhan and Reifler, 2010, p. 305). As research suggested, gullibility may be rooted in certain individuals' genes that they develop misperceptions more easily than others and can rarely be rid of misperceptions once exposed to misinformation (e.g., Zhu et al., 2010a, 2010b). For example, individuals with greater confirmation bias, preexisting misbeliefs, and less trust in scientists may be more likely to form misperceptions (Scherer and Pennycook, 2020); people who lack critical thinking and analytical reasoning are more receptive to misinformation (Greene and Murphy, 2020; Roozenbeek et al., 2020); individuals with particular combinations of personalities (e.g., low harm avoidance and low cognitive abilities) tend to fall prey to misinformation.

Therefore, misinformation exposure for these individuals may result in heightened misperceptions. Heightened misperceptions may in turn associate with decreased verification and correction intentions and the underlying mechanism is related to the lower level of new media literacy skills among these individuals (e.g., Zhu et al., 2010a, 2010b). Consisting of *consuming* skills and *prosuming* skills, new media literacy equips individuals with a healthy dose of skepticism, critical thinking, and information skills to navigate through the complex information environment (Chen et al., 2011; Lin et al., 2013). *Consuming* skills endow individuals with the ability to "discern the true purpose underneath new media messages through an active examination of message construction, fact-checking, and source verification" (Xiao et al., 2021, p. 3; Koc and Barut, 2016); while *prosuming* skills facilitate "constant engagement and interaction for media construction" that allow for social sharing and revision to shared content (Lin et al., 2013, p. 165). As such, individuals who hold misperceptions may be insufficiently equipped with the necessary abilities and skills to perform verification and correction actions. Taken together, this study further proposes the following hypotheses:

H1: Greater misinformation exposure via a) social media, b) online news media, and c) interpersonal communication were associated with higher misperceptions.

H2a: Higher misperceptions were associated with lower verification intention.

H2b: Higher misperceptions were associated with lower correction intention.

Lastly, albeit circumstantial, multiple demographic factors including gender (Xiao et al., 2021), age (Brashier and Schacter, 2020), ethnicity (Ofcom, 2017), education (van Deursen et al., 2011), and political ideology (Pennycook et al., 2021) may affect verification and correction behaviors. For instance, women are more likely to perform media-literate behaviors than men (Xiao et al., 2021); older adults possess fewer new media literacy skills than younger generations (Arsenijević and Andevski, 2016); ethnic minorities were less proficient in critically assessing online information compared to Caucasians (Ofcom, 2017); better-educated people are more conversed in utilizing media resources (van Deursen et al., 2011). Prior research also pointed to the connection between demographic characteristics and misperceptions, albeit sometimes contradictory. For example, some found that aging may contribute to vulnerability to misinformation (Brashier and Schacter, 2020; Zhu et al., 2010a), while others found younger age was associated with greater

COVID-19 misperceptions (Borah et al., 2022). A link between political orientation and misperceptions also emerged from prior evidence. That is, conservative individuals are more likely to hold COVID-19 misperceptions than their liberal counterparts (Borah et al., 2022; Pennycook et al., 2021). Since our understanding remains limited in terms of how and to what extent demographic variables influence anti-misinformation behaviors directly and indirectly via misperceptions, the following research questions are proposed:

RQ2a: How do demographic variables (i.e., age, gender, ethnicity, political orientation) influence verification intention?

RQ2b: How do demographic variables (i.e., age, gender, ethnicity, political orientation) influence correction intention?

RQ3a: How do misperceptions mediate the relationship between demographic variables and verification intention?

RQ3b: How do misperceptions mediate the relationship between demographic variables and correction intention?

Integrating the research questions and hypotheses leads to the path model shown in Fig. 1, in which this study probes the direct and indirect relationships between misinformation exposure, demographics, and anti-misinformation behavioral intentions.

4. Method

4.1. Data collection

Data were collected in May 2021 with an online survey conducted via Amazon MTurk. A total of 448 adults participated in the survey; 38 individuals who failed to complete the survey or missed answers to critical questions were excluded. The final sample consisted of 410 individuals ranging in age from 18 to 75 ($M = 33.98$, $SD = 10.79$). Slightly over half of the participants were female (58.29 %), and most of them were Caucasian (68.54 %), followed by African American (11.46 %), Hispanic (5.61 %), Asian (8.54 %), Native American (3.17 %), and other (2.68 %). 65.12 % of participants received a Bachelor's degree or above. The majority (79.26 %) indicated that they often encountered news and information that contain misleading content.

4.2. Measures

Misperceptions. Adapted from previous research (Lynas, 2020; Valenzuela et al., 2019), participants were asked to evaluate eight widely spread misinformation claims about COVID-19. Responses were recorded on a Likert scale ranging from "strongly disagree" (0) to "strongly agree" (6) and were averaged to form a scale of misperceptions with higher scores denoting greater misperceptions ($M = 1.72$, $SD = 1.71$, $\alpha = 0.94$). Items included "drinking bleach and methanol cures COVID-19," "Bill Gates intends to implant microchips in people via COVID-19 vaccination," "5G radiation is the real cause of COVID-19," "COVID-19 is just a type of flu," "COVID-19 death rates are inflated," "The COVID-19 vaccine will infect people with COVID-19," "wearing a mask does not protect you from COVID-19," and "The COVID-19 vaccine will alter people's DNAs."

Misinformation exposure. The first five most popular and widely debunked misinformation claims were chosen from the eight pieces of misinformation (Lynas, 2020; WHO, 2021). Participants were asked to indicate how often they have read each claim on a) social media, b) online news websites, and c) family/friends/coworkers. Answers were recorded on a Likert-type scale ranging from "not at all" (0) to "a lot" (6). Responses were averaged to form scales of misinformation exposure on social media ($M = 2.71$, $SD = 1.63$,

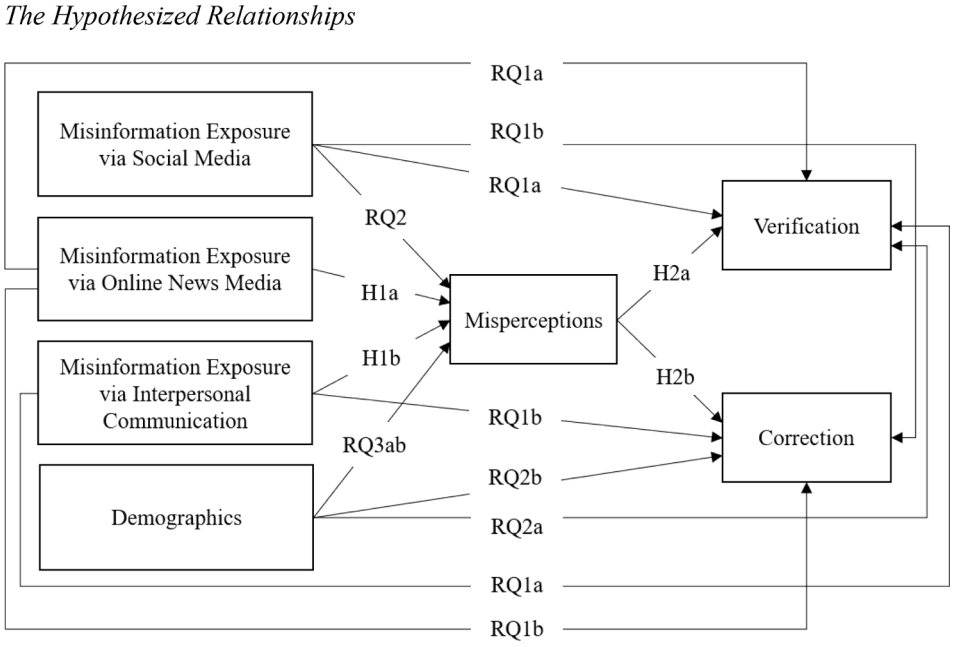


Fig. 1. The hypothesized relationships.

$\alpha = 0.86$), misinformation exposure on online news websites ($M = 1.68$, $SD = 1.72$, $\alpha = 0.91$), and misinformation exposure via interpersonal communication ($M = 2.29$, $SD = 1.66$, $\alpha = 0.87$) with higher scores denoting more frequent misinformation exposure via these sources.

Verification. Adapted from previous research (e.g., Liu and Huang, 2020), verification intention was measured by asking participants to indicate their level of agreement with an item: "when in doubt, I check sites specialized in detecting incorrect information." Responses were recorded on a Likert-type scale ranging from "strongly disagree" (0) to "strongly agree" (6) with a higher score denoting greater intention to correct misinformation ($M = 4.71$, $SD = 1.89$).

Correction. Adapted from previous research (e.g., Tully et al., 2020), correction intention was measured with an item asking participants to indicate how likely they would debunk a misinformation post when they see it. Responses were recorded on a Likert-type scale ranging from "not at all likely" (0) to "extremely likely" (6) with a higher score denoting greater intention to correct misinformation ($M = 3.74$, $SD = 1.82$).

Demographics. Age, gender, ethnicity, and education were measured using single-answer multiple-choice questions. To make meaningful interpretations, ethnicity was recoded into a dichotomous variable with "Caucasian" and "Non-Caucasian." Political orientation was measured on a Likert-type scale ranging from "very conservative" (0) to "very liberal" (6) ($M = 3.16$, $SD = 1.86$).

4.3. Data analysis

As shown in Table 1, all multi-item measures demonstrated robust internal reliability and convergent validity with all Cronbach's alpha values greater than 0.75, composite reliability (CR) scores greater than 0.7, and average variance extracted (AVE) values greater than 0.6 (Malhotra, 1993). This study further tested the discriminant validity of the measures using the Heterotrait-Monotrait ratio (HTMT; Henseler et al., 2015). All values were lower than the threshold criteria of 0.85, indicating a strong discriminant validity of all measures (Voorhees et al., 2016; Table 1).

Statistical analyses were conducted using SPSS Amos 26 software. Following the two-index presentation format suggested in prior literature (e.g., Hu and Bentler, 1999; Hooper et al., 2008), the comparative fit index (CFI) and the standardized root mean square residual (SRMR) were used to evaluate model fit. The cutoffs for model acceptability were a CFI of 0.96 or higher and an SRMR of 0.09 or lower. The current model was an adequate fit for the data (CFI = 0.968, SRMR = 0.035).

5. Results

RQ1ab inquired about the direct influence of misinformation exposure via various sources on misinformation verification and correction. Results demonstrated a significant and positive relationship between misinformation exposure via social media and verification intention (Fig. 2). That is, individuals exposed to widely debunked misinformation on social media more often, are more likely to perform verification actions. RQ2ab probed the direct influence of age, gender, ethnicity, education, and political orientation. Results showed significant positive effects of age and political orientation on verification intention, and negative effects of ethnicity on correction (Fig. 2). Simply put, older age and liberal political orientation were linked to greater verification intention; Ethnic minorities are less likely to correct misinformation compared to Caucasians.

H1 posited a positive effect of misinformation exposure via social media, online news sources, and interpersonal communication on misperceptions (Fig. 2). Results indicated that misinformation exposure to online news media were associated with the highest misperceptions, followed by interpersonal communication ($\beta_{\text{online news}} = 0.57$, $SE = 0.05$, $p < .001$; $\beta_{\text{interpersonal communication}} = 0.19$, SE

Table 1
Construct reliability and validity.

Internal Reliability and Convergent Validity										
Measures	*M*	*SD*	α	CR	AVE					
Misinformation Exposure via Social Media	2.71	1.63	0.86	0.90	0.64					
Misinformation Exposure via Online News Media	1.68	1.72	0.91	0.94	0.75					
Misinformation Exposure via Interpersonal Communication	2.29	1.66	0.87	0.90	0.65					
Misperceptions	1.72	1.71	0.94	0.95	0.70					
Discriminant Validity (HTMT)										
	1	2	3	4	5	6	7	8	9	10
1. Misinformation Exposure via Social Media										
2. Misinformation Exposure via Online News Media	0.72									
3. Misinformation Exposure via Interpersonal Communication	0.83	0.83								
4. Misperceptions	0.49	0.82	0.70							
5. Verification	0.19	0.09	0.10	0.10						
6. Correction	0.26	0.19	0.22	0.09	0.35					
7. Age	0.12	0.08	0.05	0.13	0.06	0.05				
8. Gender	0.09	0.15	0.11	0.17	0.07	0.03	0.11			
9. Ethnicity	0.19	0.02	0.03	0.03	0.05	0.06	0.03	0.03		
10. Education	0.21	0.25	0.21	0.20	0.10	0.02	0.24	0.03	0.07	
11. Political Orientation	0.13	0.33	0.31	0.55	0.16	0.01	0.15	0.07	0.04	0.12

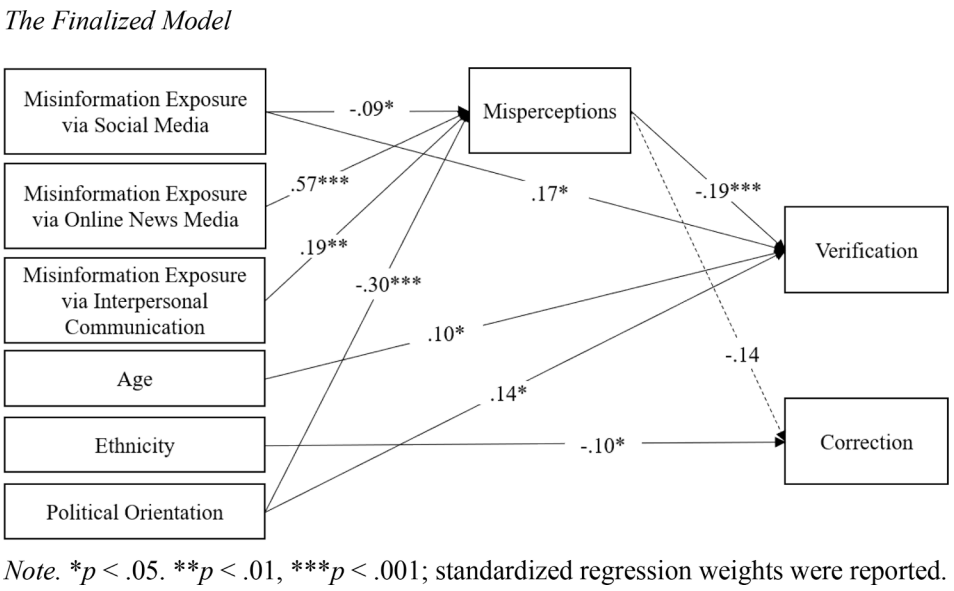


Fig. 2. The finalized model note. *p <.05. **p <.01, ***p <.001; standardized regression weights were reported.

= 0.04, p =.001). However, frequent misinformation exposure on social media were associated with lower misperceptions ($\beta_{\text{social media}}$ = −0.09, SE = 0.04, p =.029). H1 was partially supported. H2a and H2b postulated that misperceptions would be negatively associated with behaviors that help counter misinformation. Results showed that higher misperceptions were associated with lower verification intention (β = −0.19, SE = 0.08, p =.029) but not correction intention (β = −0.14, SE = 0.08, p =.101). Thus, H2a was supported and

Table 2
Bia-Corrected Bootstrap Test in Mediating Effect.

Model Pathways	Effect	95 % BootCI
Direct Path		
Misinformation Exposure via Social Media → Verification	0.17	[0.028, 0.314]
Misinformation Exposure via Social Media → Correction	0.14	[−0.002, 0.287]
Misinformation Exposure via Online News Media → Verification	0.12	[−0.061, 0.291]
Misinformation Exposure via Online News Media → Correction	0.13	[−0.048, 0.309]
Misinformation Exposure via Interpersonal Communication → Verification	0.04	[−0.130, 0.196]
Misinformation Exposure via Interpersonal Communication → Correction	0.12	[−0.041, 0.283]
Age → Verification	0.08	[0.004, 0.193]
Age → Correction	0.10	[−0.018, 0.178]
Gender → Verification	0.07	[−0.020, 0.171]
Gender → Correction	−0.02	[−0.117, 0.078]
Ethnicity → Verification	−0.06	[−0.152, 0.036]
Ethnicity → Correction	−0.10	[−0.193, −0.010]
Education → Verification	0.06	[−0.037, 0.159]
Education → Correction	−0.06	[−0.158, 0.042]
Political Orientation → Verification	0.14	[0.028, 0.257]
Political Orientation → Correction	0.04	[−0.076, 0.150]
Indirect Path		
Misinformation Exposure via Social Media → Misperceptions → Verification	0.02	[0.001, 0.052]
Misinformation Exposure via Social Media → Misperceptions → Correction	0.01	[−0.001, 0.044]
Misinformation Exposure via Online News Media → Misperceptions → Verification	−0.11	[−0.205, −0.013]
Misinformation Exposure via Online News Media → Misperceptions → Correction	−0.08	[−0.179, 0.013]
Misinformation Exposure via Interpersonal Communication → Misperceptions → Verification	−0.04	[−0.079, −0.005]
Misinformation Exposure via Interpersonal Communication → Misperceptions → Correction	−0.03	[−0.068, 0.003]
Age → Misperceptions → Verification	−0.01	[−0.023, 0.004]
Age → Misperceptions → Correction	−0.004	[−0.020, 0.003]
Gender → Misperceptions → Verification	0.01	[0.000, 0.030]
Gender → Misperceptions → Correction	0.01	[−0.001, 0.026]
Ethnicity → Misperceptions → Verification	0.004	[−0.005, 0.021]
Ethnicity → Misperceptions → Correction	0.003	[−0.003, 0.018]
Education → Misperceptions → Verification	0.003	[−0.007, 0.020]
Education → Misperceptions → Correction	0.002	[−0.005, 0.018]
Political Orientation → Misperceptions → Verification	0.06	[0.007, 0.110]
Political Orientation → Misperceptions → Correction	0.04	[−0.008, 0.096]

H2b was rejected. RQ3ab examined the indirect effect of demographics (i.e., age, gender, ethnicity, and political orientation) on anti-misinformation behaviors via misperceptions. As shown in Fig. 2, liberal political orientation was significantly associated with lower misperceptions ($\beta = -0.30$, $SE = 0.03$, $p < .001$).

The bias-corrected bootstrap tests with a 95 % CI from 5000 resamples were used to test the mediating effect (Table 2). The effect was regarded as significant if the 95 % CI did not include zero. Results showed that misperceptions played a mediating role between misinformation exposure and verification intention, and between political orientation and verification intention.

6. Discussion

Scholars have long grappled with misinformation and its insidious fallout. While much research has examined misinformation exposure and anti-misinformation strategies (e.g., Aswani et al., 2021; Bode and Vraga, 2020; Kar and Aswani, 2021; Su, 2021), our understanding of misinformation exposure patterns, demographic characteristics, and the related impacts on anti-misinformation behaviors remains limited. Thus, by comparing differences between diverse patterns of misinformation exposure (media-mediated vs interpersonal), this study outlines the path from misinformation exposure to verification and correction. The findings are relatively optimistic. That is, frequent misinformation exposure via social media, older age, and liberal political ideology are associated with greater intentions to verify information. Misinformation exposure via social media is also associated with fewer misperceptions related to COVID-19. However, findings caution that misinformation exposure via online news media and personal contacts, conservative political orientation, ethnic minority identities, and firmly-held misperceptions may inhibit positive behaviors in combatting misinformation.

6.1. Theoretical contributions

Gratifyingly, exposure to misinformation via social media has generally significant positive effects on intentions to verify COVID-19-related misinformation. These findings may seem counterintuitive at first glance since much prior research documented that social media use contributes to a series of misinformation-induced misperceptions and negative behaviors (e.g., Allington et al., 2020; Enders et al., 2021; Jamieson and Albarracín, 2020; Su, 2021). However, those studies often examined the frequency of media use rather than the frequency of misinformation exposure (e.g., Enders et al., 2021; Valenzuela et al., 2019). The current study, therefore, provides a more detailed understanding of the actual exposure to misinformation. That is, exposure to widely circulated misinformation that has been later denounced by multiple authoritative sources may have increased skepticism toward online information. Findings further show that older age and liberal ideology have positive effects on verification intention. This may attribute to the overconfidence in news judgment and overestimation of misinformation identification capabilities among these individuals. Indeed, three in four Americans tend to wrongfully overestimate their abilities to distinguish between legitimate news and misinformation and Republicans are more confident than Democrats in doing so (Lyons et al., 2021). Similar overconfidence also abounds in younger generations and they often erroneously assume that they are more capable of discerning misinformation than others (Corbu et al., 2020). Such overconfidence, however, can be quite dangerous as these individuals are also more likely to ignore their deficiencies and internalize misinformation (Borah et al., 2022; Lyons et al., 2021).

Notably, misinformation exposure of any sort was not linked to correction, while ethnicity was negatively associated with it. Specifically, ethnic minorities are less likely to correct misinformation. In line with prior research (e.g., Tandoc et al., 2020; Tully et al., 2020), these findings also demonstrate individuals' reluctance to correct misinformation and the reluctance may be more prevalent among ethnic minority individuals. Previous studies suggest that correction intention could be impacted by a complex of factors including self-efficacy and issue relevance (e.g., Tandoc et al., 2020). More importantly, correction takes one step further from verification and often entails information-seeking, information validation, and debunking, in succession (e.g., Sun, 2022; Xiao, 2022). Thus, correction may be more demanding in terms of cognition, resources, and skills, compared to verification. Future research should unearth the most influential motivation underneath correction intentions and develop promotional strategies accordingly.

Moreover, frequent misinformation exposure via news websites warrants further investigation since individuals who frequently spotted misinformation on news websites had the highest misperceptions. On one hand, these findings echo prior research in which the authors found that misinformation on social media is generally disbelieved and disregarded (Metzger et al., 2021). As such, the future of information consumption on social media is not as gloomy as someone envisaged (e.g., Anderson and Rainie, 2017). Technologies and debunking practices would help strengthen and reinforce individuals' abilities to judge the veracity of social media information. On the other, these findings demonstrate the public's confidence in mainstream news media's validity, integrity, and credibility (e.g., Jurkowitz et al., 2020). Mainstream media outlets and their online counterparts indeed provide a protective shield against misinformation (Jamieson and Albarracín, 2020). As such, individuals may process news information more heuristically based on their pre-existing credibility judgment. However, these mainstream news media's online versions are mixed with a number of deceiving news websites that mimic legitimate news outlets to publish misinformation (The Guardian, 2017). Individuals, therefore, are likely to get fooled or confused by these sites and develop misperceptions. Future research should further delve into this particular type of misinformation exposure and uncover how and to what extent those 10 % fake news websites influence individuals' perceptions and behaviors (NewsGuard, 2019).

Lastly, when misperceptions come into play, a part of the positive relationship between misinformation exposure via social media and verification intention becomes negative. The personality and media literacy factors may be responsible for this drastic change. Prior literature indicates that certain individuals (e.g., low analytical ability; low harm avoidance) are more susceptible to misinformation compared to the general population (e.g., Greene and Murphy, 2020; Zhu et al., 2010a, 2010b). These people are also more

likely to have lower new media literacy skills that can protect themselves in an environment plagued by ambiguous and incorrect information (e.g., Chen et al., 2011; Lin et al., 2013). With lower new media literacy skills, they are ill-equipped to engage with media content and perform verification and correction behaviors (e.g., Chen et al., 2011; Lin et al., 2013). Furthermore, the mediating effect of misperceptions between political orientation and verification illustrates a deep political polarization on COVID-19-related issues (Gollwitzer et al., 2020; Pennycook et al., 2021). Much research shows that politicians appear as equally or more frequently as scientists in the news coverage (Hart et al., 2020) and conservative party leaders are on the frontline spreading conspiracy theories (Hellinger, 2018). Exposure to these misleading and biased media reports may inevitably result in misperception formation and misinformation engagement, which render conservative individuals more vulnerable to misinformation (e.g., Borah et al., 2022; Romer and Jamieson, 2021).

6.2. *Practical implications*

The overall results buttress the importance of anti-misinformation measures guided by the data science approach (e.g., Chauhan and Palivela, 2021) and the social correction approach (e.g., Bode and Vraga, 2020). Prior research shows a disturbing effect of media trust in facilitating misperceptions (e.g., Jiang et al., 2021; Wagner and Boczkowski, 2019). For instance, for social media news consumers with blind trust in social media, even if they have the cognitive abilities to identify misinformation, they remain extremely vulnerable to the influences of misinformation (Xiao et al., 2021). This study, however, implies that repetitive debunking practices may decrease the blind trust toward dubious media sources, which eventually leads to anti-misinformation behaviors among civilians. Findings also reflect the fruitful efforts made by social media companies and health organizations to purify the social media environment (e.g., Fung, 2021; Lerman, 2020; WHO, 2020b). For example, Facebook took down 7 million posts publishing COVID-19-related misinformation and put warning notes on 98 million borderline misinformation posts (Lerman, 2020). These deletions and warnings may have enhanced individuals' skepticism toward information encountered with less-to-none internalization. Moreover, by examining the direct and indirect influences of demographic characteristics on anti-misinformation behaviors, this study calls for more tailored interventions and communication strategies to reduce misperceptions and increase media-literate behaviors among younger, conservative, and ethnic minority individuals.

6.3. *Limitations*

This study should be interpreted with a few limitations in mind. This study used MTurk to collect survey data despite the ongoing debate about the validity of MTurk samples (e.g., Berinsky et al., 2012; Paolacci and Chandler, 2014). The decision is twofold. First, it has a national and representative participant pool compared to convenient samples of students frequently used in communication research (e.g., Meltzer et al., 2012). Second, MTurk's participants are quite relevant to the current study since they are identified as regular consumers of information regarding current news and affairs (Huff and Tingley, 2015). With that said, future research is recommended to replicate this study with a preferably larger sample retrieved from other online or offline platforms to strengthen the validity. Second, the survey used a path model with a cross-sectional design, which can infer but not test the causality of theory-driven hypotheses and questions (Bullock et al., 1994). Third, this study did not measure whether individuals had verified or corrected the exact misinformation claims in the past, considering memory retrieval is attention-demanding and erodes their attention span (Healey and Miyake, 2009). Instead, their general propensity for verification and correction was measured. Thus, future research could use a context-specific measurement to provide a more refined and comprehensive picture of individuals' behavioral decision-making.

7. Conclusion

Despite the limitations, this study contributes to the previous literature in three important ways. First, as plenty of misinformation-related countermeasures have been put in place, the issue of misinformation exposure becomes more complicated and multi-faceted. While keeping in mind its potentially negative consequences, its positive effects on information verification intentions should also be noted. Second, more scholarly and practical efforts should be devoted to examining online news websites and personal contacts as sources of misinformation exposure. Misinformation lurking on those deceptive news platforms or interpersonal echo chambers may have worse impacts on individuals' decision-making. Third, formerly-held misperceptions and demographic differences are worthy of in-depth exploration. In particular, strategy development should take into consideration the personal, political, and literacy factors that may facilitate and consolidate misperceptions. In sum, these findings should prompt scholars to keep probing effective strategies to combat misinformation, encourage practitioners to keep implementing interventions to debunk misinformation, and motivate individuals to stay alert to misinformation, and perform self-checks about personal- or skill-wise vulnerabilities. The battles against misinformation will likely go on, but eventually, the war will be won.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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