# Fighting Fire or Fighting War: Examining the Framing Effects of COVID-19 Metaphors

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# Fighting Fire or Fighting War: Examining the Framing Effects of COVID-19 Metaphors

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**ABSTRACT**

Metaphorical language describing the COVID-19 pandemic as a war has been pervasive in public discourse (e.g. "the pandemic is a war," "the virus is an enemy," and "the vaccine is a weapon"). This study employs an online survey experiment ($N = 551$ U.S. adults) to examine the impact of war metaphors compared to non-metaphorical literal frames and fire metaphors (e.g. "the pandemic is a wildfire"). War metaphors exhibited little advantage over literal frames across a variety of desirable outcomes (i.e. the adoption of pro-health behaviors against COVID-19, perceived solidarity and collective responsibility to curb the pandemic, and intentions to discuss and share the health news with others). However, this study revealed some benefits of war metaphors over fire metaphors. Compared with fire metaphors, health news featuring war metaphors increased both positive emotions and perceived threats of COVID-19, which in turn promoted pro-health behaviors against COVID-19 and perceived solidarity to cope with the public health crisis. Moreover, positive emotions in response to war metaphors also indirectly encouraged the retransmission of science-based COVID-19 health news. This study thus showcased the benefits and limitations of war metaphors and revealed the mediating roles of perceived threats and positive emotions in explaining war metaphorical framing effects. Implications of using war and fire metaphors for communicating about public health crises are also discussed.

Since the beginning of the COVID-19 pandemic, metaphorical language describing the pandemic as a war (e.g., the virus as the enemy) has been pervasive in public discourse (e.g., Chapman & Miller, 2020). Leveraging war-related metaphors is not a novel persuasive strategy: war metaphors (e.g., President Johnson's War on Poverty) have been routinely used to frame social problems (Flusberg et al., 2018). As a framing device, metaphors emphasize problems, causal relationships, moral evaluations, and solutions by associating the target domain (e.g., pandemic) with the metaphor's source domain (e.g., war) to accomplish persuasive goals (Burgers et al., 2016), though scholars have noted a need for more systematic research on metaphorical framing effects (McLeod et al., 2022; Van Stee, 2018).

The extensive use of war metaphors in COVID-19 discussions comes as no surprise (Chapman & Miller, 2020). War metaphors communicate the gravity of a public health emergency like COVID-19 pandemic and motivate individuals toward proactive health perceptions and behaviors (Semino, 2021). Moreover, war metaphors foster a sense of solidarity and collective identity, facilitating resilience in the face of adversity (Berrocal et al., 2021). However, existing research documenting war metaphor applications (e.g., Castro Seixas, 2021; Semino, 2021) should be supplemented by empirical evidence to verify potential benefits. At the same time, criticism of war metaphors for evoking excessive negative emotions, overstating threats, and reducing coping self-efficacy in public health contexts (e.g., Flusberg et al., 2018; Hauser & Schwarz, 2020; Semino, 2021) has led researchers to propose fire metaphors (e.g., pandemic as wildfire) as an alternative frame (Semino, 2021). While some evidence has supported the persuasive potential of metaphorical frames over literal frames, research needs to look into the relative effectiveness of the two metaphorical frames. More research is thus needed to understand such metaphorical framing effects, especially in the public health crisis context (Brugman et al., 2022; Van Stee, 2018).

This study fills the gaps and compares the effects of literal frames, war, and fire metaphors in COVID-19 health news on three outcomes: a) intentions to adopt pro-health behaviors against COVID-19, b) perceived collective responsibility to curb the pandemic, and c) intentions to discuss and share health news. We also tested four potential effects mediators: perceived COVID-19 threat, self-efficacy, positive and negative emotions. Our results expand metaphorical framing research by offering empirical evidence on the benefits, limitations, and psychological mechanisms of war metaphors. Finally, we discuss the implications of using war and fire metaphors for communicating about public health crises.

## Literature review

### *War metaphorical frames in public health crises*

According to Conceptual Metaphor Theory (Lakoff & Johnson, 1980), metaphors can frame the understanding of complex, abstract concepts (e.g., pandemic) by relating them to familiar, concrete concepts (e.g., war). The constituent elements of the target domain can be projected onto the

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constituent elements of the source domain due to the conceptual correspondences between them. As such, one concept is structured in terms of another, activating associated ideas to help people understand an unfamiliar concept with a familiar one. For example, coping with cancer can be referred to as a "fight" against the cancer enemy or as a "journey" toward recovery, suggesting different interpretations of the illness experience (Semino et al., 2016). Meta-analyses show that metaphorical frames outperform non-metaphorical literal frames in affecting issue-related beliefs and attitudes in political discourse and are more persuasive than literal frames (Brugman et al., 2019; Van Stee, 2018). Though the benefits of metaphors are acknowledged, research is needed to systematically understand frame application in contexts like health communication (Van Stee, 2018).

War metaphors are extensively used in public health contexts (Benzi & Novarese, 2022; Flusberg et al., 2018), where wars have been declared against diseases such as cancer and AIDS. War metaphors are often used to describe health issues, especially for emerging health crises (Flusberg et al., 2018), such as new infectious diseases like Ebola (Balteiro, 2017) and COVID-19 (Chapman & Miller, 2020). Early in the COVID-19 pandemic, war metaphors were thought to be particularly effective in informing the public about the pandemic and urging them to adopt pro-health behaviors against it. Flusberg et al. (2018) argued that war metaphors tap into widely shared schematic knowledge that organizes how we think and communicate in different situations.

Using war metaphors to describe the pandemic activates a cluster of associations related to war (Lakoff & Johnson, 1980; Table 1). For instance, as a structural metaphor, war metaphors can activate the entailment that "war requires soldiers," which in this case would correspond to health professionals (Bates, 2020). The spreading virus could be framed as an "escalating war;" and vaccines as "weapons" against the COVID-19 "enemy." Thus, war metaphors facilitate understanding by connecting complex pandemic concepts to concrete war concepts. As a result, war metaphors can effectively communicate threat of health problems and motivate responsive actions (Benzi & Novarese, 2022; Flusberg et al., 2018). For example, warfare language increased intentions to get influenza vaccines (Scherer et al., 2015) and to use sunscreen to prevent skin cancer (Landau et al., 2018). Thus, we expect war metaphors to promote precautionary pro-health behaviors against COVID-19:

**H1:** Compared to literal frames, health news featuring war metaphors will increase intentions to adopt pro-health behaviors against COVID-19.

The use of war metaphors in public health crisis communication also has the potential to foster solidarity and collective responsibility, by promoting "we-are-in-this-together" spirit (Semino, 2021). Militaristic representations of social problems often aim to mobilize people under a common banner against a shared enemy (Berrocal et al., 2021; Cohen, 2011; Flusberg et al., 2018). In war metaphorical terms, efforts to curb the COVID-19 pandemic is a universal fight against the virus as a shared enemy, where individuals are presented as part of a unified collective (e.g., "the nation" or "the people") (Berrocal et al., 2021; Gjerde, 2021). By constructing collective identities and appealing to a sense of collectivism and nationalism, war metaphors can make solidarity salient and encourage a unified collective effort to curb the crisis. Hence, we predict:

**H2:** Compared to literal frames, health news featuring war metaphors will increase perceived collective responsibility to curb the COVID-19 pandemic.

Disseminating science-based health information is crucial during a public health emergency (Sutton et al., 2020), and war metaphors can aid in this endeavor. Without quality information, health misinformation can spread rampantly (van der Linden, 2022; Wang et al., 2019), resulting in an "infodemic" that threatens public health, as seen during the COVID-19 pandemic (Islam et al., 2020) and other virus epidemics such as Zika and Ebola (Fung et al., 2016; Sharma et al., 2017). To manage crises like a pandemic and the accompanying infodemic, health messaging should educate the public about the science of the health threat, dispel unfounded falsehoods, and instruct and motivate precautionary measures against threats in a timely manner (Vaughan & Tinker, 2009). War metaphors can be of help in this regard. Messages using war metaphors tend to be attention-grabbing, memorable, and emotionally evocative compared to non-metaphorical language (see Flusberg et al., 2018). These message properties are found to be linked to better message dissemination (Kim, 2015, 2021). Indeed, war metaphors were more prevalent than other metaphors for discussing COVID-19 (Wicke et al., 2020), and may have retransmission advantages when conveying health information. However, evidence of the influence of metaphorical

**Table 1.** Using structural metaphors of war and fire to describe COVID-19.

| Metaphor | Entailments | Application to COVID-19 |
|---|---|---|
| War | • War can escalate quickly | • Rapid spread of virus |
| | • War requires an enemy | • COVID-19 virus is an enemy |
| | • War requires soldiers | • Health professionals are needed to stop the virus spreading |
| | • War requires weapons to combat enemy | • Vaccines are required to prevent the virus |
| | • War can be lost | • Failure in curbing the virus spread |
| Fire | • Wildfire is destructive and hard to control | • The virus is destructive and hard to control |
| | • Wildfire progresses and spreads quickly | • Virus spreads quickly |
| | • Wildfire requires fire fighters | • Health professionals are needed to stop the virus spreading |
| | • Wildfire requires protective equipment | • Vaccines are required to prevent the virus |
| | • Trees fuel wildfires and cause others to catch fire | • Infected patients can transmit the virus to others |

language on communicative intentions, such as sharing and discussion, is needed. Thus, we ask:

**RQ1:** Compared to literal frames, will health news featuring war metaphors increase communicative intentions to share and discuss the news of COVID-19?

### *Drawbacks of war metaphors and fire metaphors*

War metaphors are used to characterize the COVID-19 pandemic and promote preventative measures, collective responsibility, and health news retransmission. Yet, researchers observed that war metaphors may have limited overall influence in the COVID-19 context (e.g., Panzeri et al., 2021). For example, describing the pandemic as a war rather than a struggle reduced the perceived spread of COVID-19 (Schnepf & Christmann, 2022). Moreover, criticism of war metaphors has been growing. We discuss these critiques and examine fire metaphors as an alternative frame below.

War metaphors can be misleading in health messaging, resulting in unintended effects. For instance, war metaphors imply that soldiers are needed in a war against the pandemic (Table 1). While healthcare workers can be implied to be soldiers in the war, it is hard to conceptualize the role of individual citizens in this uncontrollable war. War metaphors are not useful in explaining how contagion occurs and how self-limiting activities like social-distancing help "fight" the war. War metaphors can also be misleading in understanding the patient-disease relationship. For instance, war metaphors may blame patients who cannot recover from cancer, implying that these patients have "lost the battle" (Hendricks et al., 2018). Framing the pandemic as a war may wrongly suggest that COVID-19 patients "lost the battle" because they did not fight hard enough, or even frame patients as the enemy for spreading the virus (see Benzi & Novarese, 2022). Moreover, war metaphors might overstate threats and decrease self-efficacy, resulting in fatalism and decreased intentions to take preventative actions (Hauser & Schwarz, 2015, 2020).

Responding to these critiques, researchers proposed alternative metaphors to re-frame the pandemic, one of which is fire metaphors put forth by the #ReframeCovid initiative (Semino, 2021). According to Conceptual Metaphor Theory (Lakoff & Johnson, 1980), an abstract concept can be defined metaphorically by various concrete concepts, each of which captures certain aspects of the abstract concept. This means an abstract concept, like the COVID-19 pandemic, can be understood in different metaphorical definitions, creating different inferences and evaluations of the pandemic. Researchers argue that fire metaphors can effectively frame an infectious pandemic. A metaphor is effective if 1) the source domain contains a salient knowledge structure, 2) this knowledge structure is well-known to the audience, and 3) the comparison of the target to the source domain is clear and accurate (Flusberg et al., 2018). Like war metaphors, these properties can be seen in fire metaphors. Schematic knowledge of a typical fire is well-defined. Fires are familiar and image-rich to most people across cultural contexts. There are different actors (e.g., firefighters, victims, etc.) and clear evolutionary processes in fires (e.g., beginning, spread, end, and aftermath). These properties make fires suitable for metaphorical exploitations (Semino, 2021).

According to Semino (2021), the representation of the pandemic as a fire is also apt due to the clear mapping between the source domain (i.e., fire) and the target domain (i.e., pandemic). Like a pandemic, fires are destructive and hard to control. Because fires also progressively increase their damage by spreading quickly, fire metaphors are suitable for describing the spread of a contagious virus and conveying the danger and urgency. Fire metaphors can also explain how contagion happens during the pandemic. For example, infected people can be thought of as trees that fuel a wildfire and spread the virus by "breathing out invisible embers," which cause others to "catch fire" (Tufekci et al., 2020). In these scenarios, fire metaphors explain the pandemic without blaming patients. They also accurately represent various aspects of the pandemic, which is crucial in effective communication about epidemiology (Briand et al., 2021; Vaughan & Tinker, 2009). Table 1 summarizes how war and fire can be exploited metaphorically to understand COVID-19.

Although few studies have examined the effectiveness of applying fire metaphors to public health crises, existing research provides promising evidence. First, like war metaphors, fire metaphors are also frequently used in public discourse, especially when the social issue under discussion concerns power, authority, and legitimacy (e.g., Charteris-Black, 2016; Hart, 2018). Second, fire metaphors also have framing power. For example, describing civil disorder as fire burning legitimizes police use of water cannon (Hart, 2018). With that said, the power of metaphors could be greatly affected when applied to different target domains (Van Stee, 2018). Thus, it is critical to assess the applicability of fire metaphors in health news. Because no research has investigated the effectiveness of fire metaphors in communicating public health crises, nor comparing it to competing frames, we raise research questions and ask if fire metaphors are a suitable alternative to war metaphors:

**RQ2:** Compared to fire metaphors, will health news featuring war metaphors increase a) intentions to adopt pro-health behaviors against COVID-19; b) perceived collective responsibility to curb the pandemic; and c) intentions to share and discuss the news?

### *Mechanisms of war metaphors*

Although ample evidence supports the framing power of metaphors, more research is needed to examine which mechanisms are more influenced by metaphorical frames (Burgers et al., 2016; Flusberg et al., 2018). According to Cognitive Metaphor Theory, different metaphors can evoke different emotions, considerations, and interpretive frames about a given topic (Lakoff & Johnson, 1980). Thus, COVID-19 health news using fire metaphors might promote different perceptions and emotions regarding the pandemic from news featuring war metaphors. However, less research has investigated how metaphorical framing effects differ between

different source domains for the same target domain (Brugman et al., 2022). Below, we discuss four mechanisms that might channel the effects of war in relation to fire metaphors: perceived threat, self-efficacy, negative and positive emotions.

### *Communicating threats of the COVID-19 pandemic*

As discussed, war metaphors can effectively communicate the urgency and severity of a social problem. For example, war metaphors increased perceived urgency and risks surrounding climate change issues, compared with framing climate change as a race (Flusberg et al., 2017). Framing UV radiation as an enemy also increased the perceived worry about skin cancer risks for people who fear enemy confrontation (Landau et al., 2018). Thus, framing the COVID-19 pandemic as a war should also heighten the perceived virus threat.

However, framing the pandemic as a war may exaggerate the COVID-19 threat. Coupled with a lack of certainty and efficacy, warfare framing could damage mental health and promote a sense of powerlessness (Burnette et al., 2022; Degner et al., 2003; Flusberg et al., 2018). While it is important to take the virus seriously, describing the pandemic as a war can lead people to perceive the situation as more dire than it actually is, implying that the virus is invincible and that the enemy must be fought with extreme measures. Fire metaphors, on the other hand, may reduce the intensity and extremity of these attributes and are perceived as less damaging and threatening than a war (e.g., McCaffrey, 2006). Thus, we expect war metaphors will make the threat of the virus more salient:

**H3:** Compared to fire metaphors, health news featuring war metaphors will increase the perceived threat of COVID-19.

The evoked threat perceptions can then influence the intentions to adopt pro-health behavioral intentions. Ample evidence suggests that heightened threat perceptions are at the core of promoting and adopting health behaviors (Brewer et al., 2007; Sheeran et al., 2014). Metaphorical framing research has also shown that threat perceptions in response to war metaphors motivate the adoption of actions aimed at dealing with challenging situations (see Flusberg et al., 2018). In addition, the perceived threat of health problems could facilitate collective responsibility to address them. For example, COVID-19 threat can increase cooperation and solidarity to curb the pandemic (Baute & de Ruijter, 2022; Berrocal et al., 2021). Similarly, perceived threat can increase communicative intentions, such as message discussing and sharing (Duong et al., 2021; Paek et al., 2016). Thus, we predict:

**H4:** Perceived threat will mediate the relationship between the experiment conditions and a) intentions to adopt pro-health behaviors against COVID-19; b) perceived collective responsibility to curb the pandemic; c) intentions to share and discuss the news.

### *Influencing self-efficacy*

War metaphors can also influence perceived self-efficacy, a perception that is closely related to perceived threat. Perceived self-efficacy is also an essential determinant of health management intentions, attitudes and behaviors, as it reflects individuals' capabilities to organize and execute the actions required to produce desired end states (e.g., Bandura, 1977; Holden, 1992; Sheeran et al., 2016). Thus, it is important to understand how COVID-19 war metaphors influence perceived self-efficacy and how such perceptions, in turn, affect the desirable outcomes of interest to this study.

When applied in health communication, war metaphors have been criticized for stripping people of control (e.g., Semino, 2021; Sontag, 1978). Growing evidence suggests that war-metaphor health messages can de-motivate individuals and reduce self-efficacy, making disease prevention and treatment appear more challenging and fostering powerlessness and fatalistic attitudes (Degner et al., 2003; Hauser & Schwarz, 2015, 2020). This powerless sense and fatalism are particularly concerning in the context of the long-term infectious pandemic, where "victory" in the "war" is elusive (Semino, 2021). By contrast, though wildfires can also be hard to control, there are various mitigation treatments to manage wildfire danger (Moritz et al., 2014), which can instill confidence in people who know and trust these treatments. Thus, waging war against COVID-19 may decrease self-efficacy compared with managing a COVID-19 wildfire.

**H5:** Compared to fire metaphors, health news featuring war metaphors will decrease perceived self-efficacy.

Self-efficacy perceptions have been associated with a variety of health-related outcomes. Higher self-efficacy, or perceptions about one's own abilities to organize strategies and act to achieve desired outcomes, is a reliable predictor of health management intentions and behaviors (Holden, 1992; Sheeran et al., 2016). On the other hand, lower levels of self-efficacy coupled with high perceived threat can reduce the motivation to take actions to manage health problems, even leading to denial, defensive avoidance, or reactance (Witte, 1998; Witte & Allen, 2000). This becomes particularly concerning during the early stages of a public health crisis characterized by uncertainty, elevated threat levels, and limited efficacy.

Additionally, self-efficacy perceptions can motivate collective efforts to handle adversaries or challenges. For example, self-efficacy perceptions provide the ground for individuals to engage in collective pro-environment actions (Jugert et al., 2016), and empower them to address shared challenges (Suresh & Walter, 2022). Furthermore, self-efficacy can encourage the use and discussion of health information (e.g., Rimal & Real, 2003; van Munster et al., 2022). Thus, we believe that in the context of COVID-19, higher self-efficacy should also be linked to higher perceived collective responsibilities to curb the COVID-19 pandemic and higher communicative intentions to share and discuss health news:

**H6:** Self-efficacy will mediate the relationship between the experiment conditions and a) intentions to adopt pro-health behaviors against COVID-19; b) perceived collective

responsibility to curb the pandemic; c) intentions to share and discuss the news.

### Evoking negative emotions

Although it is widely known that metaphors influence how people think about social issues and evaluate information, metaphors' effects on emotions have been underemphasized in existing literature, and scholars have called for more research on the role of metaphor-induced emotions in metaphorical framing (Hendricks et al., 2018; Flusberg et al., 2018; Landau et al., 2018). Linguistic analyses suggest that negative emotional connotation is one of the primary functions of war metaphors (Alexandrescu, 2014; Coleman, 2013). Indeed, a key reason why war metaphors are omnipresent is that they can "reliably express an urgent, negatively-valenced emotional tone that captures attention and motivates actions" (Flusberg et al., 2018, p. 1). Empirical evidence supports this argument. Framing police as warriors instead of guardians elicited more negative emotions (Thibodeau et al., 2017). Also, worriedness in response to war metaphors promotes prevention behaviors against skin cancer, highlighting emotions as an important mechanism for metaphor effects (Landau et al., 2018).

However, framing diseases as a war can induce excessive negative emotions by exaggerating the threat of diseases (Flusberg et al., 2018; Semino, 2021). Moreover, war metaphors in health communication often imply infection or lack of recovery from a disease as defeat. Such implied personal failures may elicit detrimental negative emotions among message-receivers, especially patients. For example, patients who conceptualized cancer as an enemy, or the illness situation as a battle, experienced more anxiety and depression compared with those who thought of cancer treatment as a journey (Degner et al., 2003). Framing cancer as a battle can put the blame on a patient who fails to recover from the illness, making the patient appear guilty than framing cancer as a journey (Hendricks et al., 2018). Though no study has compared war and fire metaphors, we argue that fire metaphors are less likely to evoke excessive negative emotions. As discussed earlier, fire metaphors convey a more accurate representation of COVID-19 threats without attributing the blame for spreading the virus to the patients. They do not imply personal failures for the patients, reducing the possibility of evoking emotions like guilt and anxiety. Thus, we predict:

**H7:** Compared to fire metaphors, health news featuring war metaphors will increase negative emotions.

Negative emotions can in turn affect the intentions to adopt pro-health behaviors against COVID-19. Negative emotions in response to threat information presented in health messaging motivate pro-health behaviors, though excessive negative emotions paired with low efficacy perceptions could result in unintended effects (Tannenbaum et al., 2015; Witte & Allen, 2000). In line with the current evidence on the persuasiveness of negative emotional appeals, war metaphors may promote health behaviors through evoking negative emotions (Flusberg et al., 2018). We expect the negative emotions produced by war metaphors to be positively associated with adoption of pro-health behaviors against COVID-19.

Negative emotions are often linked to collective responsibility as well. For example, anger about insufficient climate protection motivates collective climate-protective commitment and activities (Kals & Russell, 2001). Appealing to self-efficacy and guilt feelings also increased commitment to solving community problems (Suresh & Walter, 2022). Thus, we expect negative emotions in response to war metaphors to be associated with perceived collective responsibilities against the pandemic. Negative emotions could also influence retransmission of health news. Empirical evidence supporting the role of emotional evocativeness in enhancing content retransmission is robust. Negative emotional experiences can stimulate social interactions, including discussing and sharing experiences with others (see Rimé, 2009). Content that is emotionally evocative and negatively-valenced often grabs audience's attention and is frequently retransmitted, inducing more commenting and sharing (e.g., Berger & Milkman, 2012; Zheng et al., 2022; Zillmann et al., 2004). Thus, we predict:

**H8:** Negative emotions in response to war metaphors will mediate the relationship between the experiment conditions and a) intentions to adopt pro-health behaviors against COVID-19; b) perceived collective responsibility to curb the pandemic; c) intentions to share and discuss the news.

### Evoking positive emotions

Despite its dominant negatively-valenced emotional connotation, warfare representation of social issues can also elicit encouraging positive emotions. In difficult situations, such potential to evoke positive emotions can facilitate resilience and coping. For example, framing treatments for health problems, like mental health issues and cancer, as a battle could have positive emotional associations, such as the hope for a future victory in resolving the problems (Reisfield & Wilson, 2004) and pride in being a successful fighter (Coll-Florit & Climent, 2022). War metaphors also unite people behind a common banner against a shared enemy (Cohen, 2011), creating feelings of solidarity. For instance, the War on Cancer and the War on Poverty both resulted in inducing hope and compassion toward addressing the given issues, motivating increases in funding for cancer research and anti-poverty policies (Almond et al., 2011; Mukherjee, 2011). In the context of COVID-19, we argue that war metaphors can induce positive emotions, such as feelings of hope, compassion, and pride. However, empirical evidence is currently lacking. In addition, fire metaphors can also arouse similar positive emotions: fighting fires requires collective efforts; firefighters are praised in heroic terms; success in managing fires is viewed as a victory, etc. Thus, we ask:

**RQ3:** Compared to fire metaphors, will health news featuring war metaphors increase positive emotions?

Growing evidence on the persuasive power of positive emotions shows that positive emotions can motivate changes in belief, attitude, and behavioral intentions (e.g., Chadwick, 2015; Myrick & Oliver, 2015; Nabi & Myrick, 2019). Positive emotions, such as hope and compassion, can increase adoption

of pro-health behaviors related to sun safety, tobacco cessation, precautions against COVID-19, etc. (Chou & Budenz, 2020; Nabi & Myrick, 2019; Yang et al., 2019). Thus, we expect a similar positive association between positive emotions evoked by war metaphors and pro-health behaviors against COVID-19.

Extant research suggests that positive emotions are also linked to collective responsibility for a shared problem. For example, positive feelings, such as pride about in-group pro-environmental behaviors and hope for a better-anticipated future motivated subsequent commitment and behaviors to address the shared issue of environmental protection (Bissing-Olson et al., 2016; Schneider et al., 2017). Positive emotions are also a consistent predictor of information retransmission (Rimé, 2009). Research found that health news with positive emotions invited more frequent retransmissions (Kim, 2015). In the context of COVID-19, messages with positive emotional connotations were particularly prevalent in public discourses (Chang et al., 2022). Discussions of scientific research regarding COVID-19 with positive emotions also have better transmissibility than negative emotions (Luo et al., 2022). Thus, we ask about the mediating role of positive emotions:

**RQ4:** Will positive emotions in response to war metaphors mediate the relationship between the experiment conditions and a) intentions to adopt pro-health behaviors against COVID-19; b) perceived collective responsibility to curb the pandemic; c) intentions to share and discuss the news?

## Methods

### Participants and procedure

An online survey experiment was conducted in May 2022 with 551 American adults (recruited from Qualtrics panels) with an average age of 48.09 (SD = 18.11). As shown in Table 2, 288 (52.3%) participants were female, 261 (27.4%) male and 2 (0.4%) preferred not to respond. 384 (69.7%) participants identified themselves as White, while 167 (30.3%) identified as non-White. 221 (40.1%) respondents identified themselves as Democrat, 131 (25.6%) as Independent, 160 (29%) as Republican, and 29 (5.3%) as other political ideologies.

Eligible participants were randomly assigned to one of three versions of COVID-19 news stories featuring either fire metaphors ($n = 195$), war metaphors ($n = 178$), or a literal (non-metaphorical) frame ($n = 178$).[1] All participants read a news story about the threat of the COVID-19 pandemic and the recommended actions to prevent COVID-19. The story was labeled as a commentary issued by a politically neutral source to avoid partisan source cues: The Associated Press, a reliable and balanced outlet based on independently curated media bias ratings (Ad Fontes Media, 2022). After the stimuli exposure, participants answered manipulation check questions and rated emotional reactions, intentions to adopt pro-health behaviors against COVID-19, communicative intentions, and perceived collective responsibility to curb COVID-19. Demographics and political ideology were also obtained.[2]

### Stimuli (see Appendix A for details)

In all conditions, the stimulus messages are in the same compositional form and share identical background information about the COVID-19 pandemic with a similar word length (around 300 words). The two metaphor conditions and the literal frame condition differ only according to the presence of either war or fire metaphors. In the literal frame condition, the news describes the threats of COVID-19 and how people can adopt preventative measures to prevent COVID-19 and curb the pandemic, without using metaphorical expressions. In the two metaphorical language conditions, we adopted the conceptual metaphor perspective proposed by Lakoff and Johnson (1980) and manipulated the two metaphors at the concept level (Brugman et al., 2019). Participants in the two metaphor conditions read a news commentary describing COVID-19 as either a war or a wildfire, featuring corresponding metaphorical expressions related to the two metaphors. For example,

**Table 2.** Descriptive information of variables by experimental conditions.

| | Experimental conditions | | | | |
|---|---|---|---|---|---|
| | *War metaphor* ($n = 178$) | *Fire metaphor* ($n = 195$) | *Literal frame* ($n = 178$) | *P-value* | *Overall* ($n = 551$) |
| Health intentions | 3.85 (.94) | 3.71 (1.00) | 3.89 (0.98) | .150 | 3.81 (0.97) |
| Collective responsibilities | 3.78 (.91) | 3.68 (.872) | 3.85 (0.81) | .141 | 3.77 (0.87) |
| Communication intentions | 2.97 (1.16) | 2.79 (1.21) | 3.04 (1.22) | .113 | 2.93 (1.20) |
| Self-efficacy | 3.85 (.96) | 3.74 (.999) | 3.87 (1.00) | .344 | 3.82 (0.99) |
| Perceived threat | 3.35 (.92) | 3.09 (.942) | 3.33 (0.91) | .013 | 3.25 (0.93) |
| Negative emotions | 2.66 (.95) | 2.68 (.915) | 2.72 (0.96) | .827 | 2.68 (0.94) |
| Positive emotions | 3.28 (1.01) | 2.99 (1.04) | 3.32 (0.96) | .002 | 3.19 (1.01) |
| Age | 47.5 (17.7) | 48.6 (18.8) | 48.1 (17.8) | .854 | 48.1 (18.1) |
| Income | 2.90 (1.56) | 2.70 (1.52) | 2.86 (1.55) | .406 | 2.81 (1.54) |
| Ideology | 3.96 (1.71) | 3.95 (1.77) | 3.91 (1.85) | .963 | 3.94 (1.77) |
| Race | | | | | |
| Non-White | 60 (33.7%) | 59 (3.3%) | 48 (27.0%) | .384 | 167 (30.3%) |
| White | 118 (66.3%) | 136 (69.7%) | 130 (73.0%) | | 384 (69.7%) |
| Ethnicity | | | | | |
| Hispanic | 142 (79.8%) | 166 (85.1%) | 144 (80.9%) | .361 | 452 (82.0%) |
| Non-Hispanic | 36 (2.2%) | 29 (14.9%) | 34 (19.1%) | | 99 (18.0%) |

Standard deviations are reported in parentheses for continuous variables. To obtain the *P*-values, ANOVA tests were conducted for continuous variables, and Chi-squared tests of independence were conducted for categorical variables.

the war metaphor message describes how the healthcare workers were overwhelmed by "the battle against the COVID-19 enemy," whereas in the fire metaphor condition, the message depicts that the healthcare workers were exhausted by "the raging blazes of COVID-19 fire." These two messages also promote preventative measures metaphorically. For example, vaccines are referred to as the "best weapons to fight the (COVID-19) war" in the war metaphor condition, and as the "firewall to cut off the (COVID-19) fire spread" in the fire metaphor condition.

### Measures

***Pro-health behavioral intentions.*** Participants were asked seven questions items about how likely they would be to adopt measures that can help curb the COVID-19 pandemic (1=*Extremely unlikely*, 5=*Extremely likely*), including getting the COVID booster shots if offered, wearing a mask when indoors, frequent COVID-19 tests, washing hands frequently, social distancing, taking flu shots,[3] and avoiding touching the mouth, nose and eyes with unclean hands ($M = 3.81$, SD = 0.97, $\alpha = 0.88$).

***Communication intentions.*** Participants were asked to answer four questions about intentions to discuss and share the health news they read with close others and with others online (1=*Extremely unlikely*, 5=*Extremely likely)*, for example, how likely were they to share the news commentary privately with a person they know, such as friends, family members, and acquaintances; how likely were they to discuss this news commentary publicly, such as to participate in online discussions. The communicative intention score was created by averaging the ratings of the four questions ($M = 2.93$, SD = 1.20, $\alpha = 0.90$).

***Perceived collective responsibility.*** Perceived collective responsibility was measured by averaging participants' agreement to six statements about perceived solidarity with others and collective responsibility to curb the COVID-19 pandemic *(1=Strongly disagree, 5=Strongly agree)*, for example, "We should be united because we all can be infected by coronavirus;" "It is our common responsibility to contain the spread of the virus" ($M = 3.77$, SD = 0.87, $\alpha = .87$).

***Perceived threat.*** Participants rated their agreements *(1=Strongly disagree, 5=Strongly agree)* to the four statements about perceived susceptibility to COVID-19 and the severity of the disease (Champion & Skinner, 2008; Jones et al., 2015). For example, "I am at risk of getting COVID-19;" "I believe that getting COVID-19 would be a serious threat to me." Scores were averaged into a perceived threat index ($M = 3.25$, SD = 0.93, $\alpha = 0.70$).

***Perceived self-efficacy.*** Participants indicated the extent to which they agreed that they were capable of protecting themselves from COVID-19 *(1=Strongly disagree, 5=Strongly agree)* by responding to five statements. For example, "I can protect myself from getting COVID-19 if I get vaccinated;" "I am capable of preventing COVID-19 if I get vaccinated and mask up" (Witte, 1998; $M = 3.77$, SD = 0.87, $\alpha = 0.90$).

***Emotions.*** Participants indicated whether they felt the following positive emotions over the course of reading the news story (1=*Strongly disagree*, 5=*Strongly agree*): hopeful, proud, optimistic, touched, encouraged, compassionate, and moved ($M = 3.19$, SD = 1.01, $\alpha = 0.93$). Similarly, negative emotional reaction was measured by averaging feelings of disgust, afraid, fear, scared, anxiety, anger, and sadness ($M = 2.68$, SD = 0.94, $\alpha = 0.87$).

***Manipulation check and covariates.*** A manipulation check question was posed at the end of the survey: "What is the word that best describes the analogy you just saw? In the message you saw, the pandemic was compared to a race/wildfire/war/none of the above." Participants' demographic information and political ideology were also obtained.

### Analyses

To examine the effectiveness of war metaphors compared to literal frames, in total, three Ordinary Least Squares regression models were run with the following dependent variables: a) intentions to adopt measures against COVID-19; b) perceived collective responsibility to curb the pandemic; and c) intentions to discuss and share the health news. Demographic information and political ideology were entered as covariates in the conditional models. Because similar results were obtained from the conditional and unconditional models (Appendix B), we report the results from the conditional models below.

To examine the differences between war and fire metaphors as well as the mechanisms underlying such differences, three parallel mediation models were estimated with the same set of dependent variables (Figure 1): intentions to adopt pro-health behavioral intentions (panel a); perceived collective responsibility (panel b); and intentions to discuss and share the news (panel c). The same set of mediators was entered in all models: perceived threat of COVID-19, self-efficacy, positive and negative emotions. Parallel mediation assumes comparable mediators, allowing us to examine the contribution of all mediators while accounting for the associations among them (Hayes, 2017). The reference group of comparison in all models was fire metaphor, with path coefficients estimated based on Hayes PROCESS Model 4. Demographic information and political ideology were controlled in all models. Indicator codings were used for the multi-categorical independent variable with three levels (war vs. fire vs. literal frame) (Hayes, 2017). *R* (version 4.1.1) was used.

## Results

### Manipulation checks and descriptive analyses

Chi-square test results showed that the participants successfully recalled the metaphorical frame manipulation. Participants in the war metaphor condition were more likely to recall a news commentary featuring war metaphors ($\chi^2 = 58.93$, $p < .001$). Similarly, participants in the fire metaphor condition were more likely to indicate that the stimuli message contained fire metaphors ($\chi^2 = 68.31$, $p < .001$).

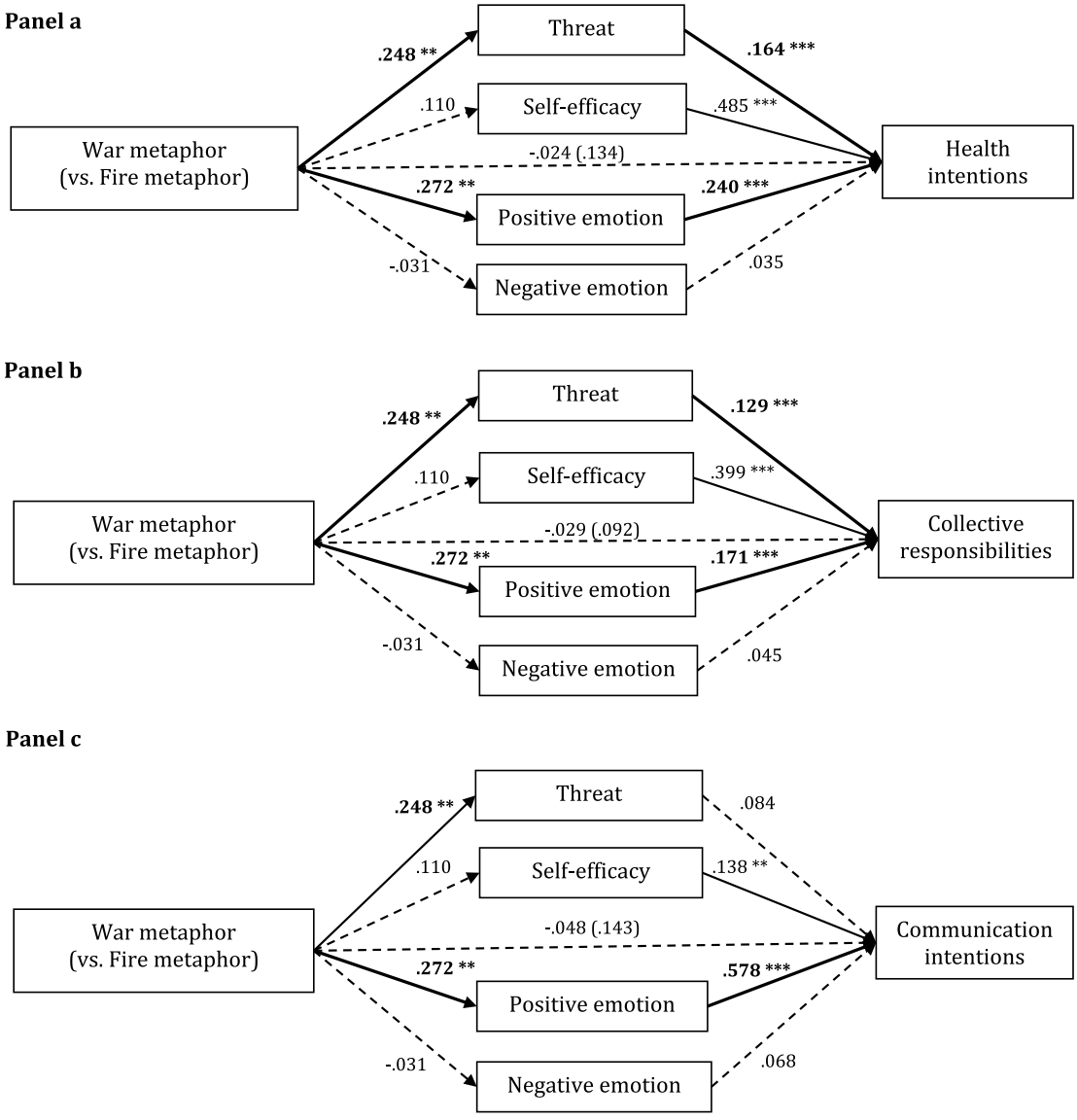


**Figure 1.** Parallel mediation models predicting pro-health behavioral intentions, communication intentions and perceived collective responsibilities. *Note*. Total effects were reported in parentheses. Participants' demographic information, such as age, income, gender, race, ethnicity, along with political ideology were entered in all models as covariates. *p < .05; **p < .01; ***p < .001.

### *Predicting pro-health behavioral intentions*

Results show the ineffectiveness of war metaphors in predicting more pro-health behavioral intentions compared to literal frames (Appendix B). War metaphors failed to significantly increase intentions to adopt pro-health behaviors against COVID-19 ($b = -.023$, $p = .818$), compared to the literal condition. H1 was not supported.

With that said, our results reveal some benefits of war metaphors over fire metaphors. First, as shown in Table 3 and Figure 1: panel a, no significant total effect was detected. That is, fire and war metaphors did not differ significantly when predicting pro-health behavioral intentions ($b = .134$, $p = .167$). However, war metaphors significantly increased the perceived threat of COVID-19 ($b = .248$, $p = .009$), which was positively related to intentions to adopt pro-health behaviors against COVID-19 ($b = .164$, $p < .001$). The indirect effect of the experimental manipulation on pro-health behavioral intentions through perceived threat was significant ($B = .041$, 95% CI [0.008, 0.087]). H3 and H4a were supported. Compared to fire metaphors, war metaphors also induced more positive emotions ($b = .272$, $p = .007$), which were then positively associated with adoption of pro-health behaviors ($b = .240$; $p < .001$). The significant indirect effect ($B = .066$, 95% CI [0.015, 0.123]) supports positive emotion as a mediator of the effect of metaphorical framing on pro-health behavioral intentions.

Our data did not support the mediating roles of negative emotions and self-efficacy (Figure 1: panel a). Compared to fire metaphors, war metaphors did not significantly decrease self-efficacy ($b = .110$, $p = .259$) with an insignificant indirect effect ($B = 0.053$, 95% CI [−0.044, 0.147]), rejecting H5 and H6a. Compared to fire metaphors, war metaphors also did not significantly increase negative emotions ($b = -.031$, $p = .749$) with an insignificant indirect effect ($B = -.001$, 95% CI [−0.011, 0.009]), rejecting H7 and H8a.

**Table 3.** Path coefficients for parallel mediation models predicting pro-health intentions, perceived collective responsibilities, and communication intentions.

| Path | Effect | SE | *P* | LLCI-ULCI |
|---|---|---|---|---|
| ***DV 1: Pro-health intentions*** | | | | |
| Total effect | 0.134 | 0.097 | 0.167 | −0.056, 0.325 |
| Direct effect | −0.024 | 0.067 | 0.716 | −0.155, 0.107 |
| Indirect effect through perceived threat | 0.041 | 0.020 | 0.023 | 0.008, 0.087 |
| Indirect effect through self-efficacy | 0.053 | 0.048 | 0.262 | −0.044, 0.147 |
| Indirect effect through positive emotion | 0.066 | 0.028 | 0.013 | 0.015, 0.123 |
| Indirect effect through negative emotion | −0.001 | 0.005 | 0.815 | −0.011, 0.009 |
| ***DV 2: Collective responsibilities*** | | | | |
| Total effect | 0.092 | 0.087 | 0.286 | −0.078, 0.262 |
| Direct effect | −0.029 | 0.066 | 0.665 | −0.159, 0.102 |
| Indirect effect through perceived threat | 0.032 | 0.016 | 0.034 | 0.006, 0.070 |
| Indirect effect through self-efficacy | 0.044 | 0.039 | 0.263 | −0.037, 0.118 |
| Indirect effect through positive emotion | 0.047 | 0.021 | 0.020 | 0.011, 0.092 |
| Indirect effect through negative emotion | −0.001 | 0.006 | 0.795 | −0.013, 0.010 |
| ***DV 3: Communication intentions*** | | | | |
| Total effect | 0.143 | 0.119 | 0.230 | −0.091, 0.377 |
| Direct effect | −0.048 | 0.097 | 0.616 | −0.238, 0.141 |
| Indirect effect through perceived threat | 0.021 | 0.018 | 0.163 | −0.006, 0.060 |
| Indirect effect through self-efficacy | 0.015 | 0.016 | 0.325 | −0.013, 0.050 |
| Indirect effect through positive emotion | 0.157 | 0.063 | 0.009 | 0.037, 0.287 |
| Indirect effect through negative emotion | −0.002 | 0.008 | 0.793 | −0.019, 0.015 |

This table presents path coefficients for parallel mediation models of Hayes Process Model 4. $N = 551$. Reference group of comparison is the *Fire metaphor* condition (i.e., *Fire vs. War metaphor*). *P*-values for indirect effects were obtained by normal theory test (i.e., Sobel test). LLCI and ULCI represent lower and upper limit bootstrap confidence intervals using 5,000 bootstrap samples. Participants' demographic information, such as age, income, gender, race, ethnicity, along with political ideology were entered in all models as covariates.

### Predicting collective responsibility and solidarity

When predicting perceived collective responsibility, results show that war metaphors had little advantage over literal frames (Appendix B). War metaphors did not significantly increase perceived collective responsibility ($b = -.071$, $p = .420$), rejecting H2.

However, we discovered promising patterns in the parallel mediation model predicting perceived solidarity (Figure 1: panel b). Again, we did not find significant total effects of war metaphors on perceived collective responsibility ($b = .092$, $p = .286$), meaning that war and fire metaphors performed similarly in this regard. Compared to fire metaphors, war metaphors significantly increased perceived COVID-19 threat ($b = .248$, $p = .009$). Such perception in turn significantly increased perceived shared responsibility ($b = .129$, $p < .001$) with a significant indirect effect ($B = .032$, 95% CI [0.006, 0.070]), supporting H4b. Compared to fire metaphors, participants felt significantly more positive emotions after reading war metaphors ($b = .272$, $p = .007$), which promoted perceived shared responsibility ($b = .171$; $p < .001$) with a significant indirect effect ($B = .047$, 95% CI [0.011, 0.092]).

Our data did not support the mediating roles of self-efficacy and negative emotions. There was no significant difference between war and fire metaphors in triggering negative emotions ($b = -.031$, $p = .749$), and no significant association between negative emotions and perceived solidarity ($b = .045$, $p = .143$). The indirect effect was insignificant ($B = -.001$, 95% CI [−0.013, 0.010]), rejecting H8b. Reading war metaphors did not significantly decrease self-efficacy ($b = .110$, $p = .259$), compared to fire metaphors, though self-efficacy was positively associated with perceived collective responsibility ($b = .399$, $p < .001$). The indirect effect was not significant ($B = .044$, 95% CI [−0.037, 0.118]), rejecting H6b.

### Predicting health news sharing and discussion

When predicting health news sharing and discussion, our results again did not support the superiority of war metaphors over literal frames (Appendix B). War metaphors failed to facilitate more news retransmission than the literal condition ($b = -.092$, $p = .450$).

Nevertheless, we again discover the advantages of war metaphors compared to fire metaphors when predicting health news sharing and discussion (Figure 1: Panel c). Although no significant total effect of war metaphors on communication intentions was detected ($b = .143$, $p = .230$), war metaphors induced significantly more positive emotions, compared to fire metaphors ($b = .272$, $p = .007$), which were positively associated with health news sharing and discussion ($b = .578$, $p < .001$). The indirect effect was significant ($B = .157$, 95% CI [0.037, 0.287]), confirming the mediating role of positive emotions (RQ4c). Although war metaphors increased perceived threat compared to fire metaphors, the perception was not significantly associated with communicative intentions ($b = .084$, $p = .077$), causing an insignificant indirect effect ($B = .021$, 95% CI [−0.006, 0.060]), rejecting H4c. Because war metaphors failed to increase self-efficacy and negative emotions, compared to fire metaphors, the indirect effects of self-efficacy ($B = .021$, 95% CI [−0.006, 0.060]) and negative emotions ($B = -.002$, 95% CI [−0.019, 0.015]) were not significant, failing to support self-efficacy (H6c) and negative emotions (H8c) as mediators.

## Discussion

War metaphors are ubiquitous in COVID-19 discourse (Chapman & Miller, 2020) as they are arguably effective in communicating the gravity of COVID-19 and uniting people behind a common mission of curbing the pandemic (Semino, 2021). However, systematic research on war metaphors in communicating public health crises is still lacking, suggesting a need for empirical evidence to verify these potential benefits.

This study failed to demonstrate the advantages of war metaphors over literal frames in promoting intentions to adopt measures against COVID-19, building perceived solidarity and collective responsibility toward the pandemic, and motivating retransmission of health news. Exploratory analyses showed that, compared to the literal frame, war metaphors also did not significantly influence self-efficacy, threat perceptions, positive, and negative emotions (Appendix B). These results reinforce other recent empirical findings suggesting that war metaphors have limited effectiveness in pandemic situations. For example, war metaphors were ineffective in promoting social distancing and mask-wearing (Schnepf & Christmann, 2022). Perhaps war metaphors work well for some individuals but not others, causing null overall effects. Metaphorical framing effects differ greatly depending on various factors, such as topic contexts and message formalities (Brugman et al., 2019; Van Stee, 2018). For example, Panzeri et al. (2021) failed to find an overall framing effect of war metaphors on COVID-19 reasoning. However, they showed that war metaphors were more influential with people who are right-winged and people who gather information from independent information channels and social media. This suggests the need to explore audience moderators and contextual influences in future metaphorical framing research.

In response to criticisms that war metaphors overstate threats and evoke excessive negative emotions, fire metaphors (i.e., framing COVID-19 as a wildfire) have been proposed as an alternative (Semino, 2021). Our results suggest that war metaphors outperformed fire metaphors in COVID-19 messaging, contrary to the critique. We found that, compared to fire metaphors, war metaphors significantly increased perceived threats of COVID-19, which in turn promoted pro-health behavioral intentions against COVID-19. This is consistent with research demonstrating that war metaphors might be helpful as an initial call to convey threats of social problems and motivate threat-coping actions (Flusberg et al., 2018).

We also provide evidence supporting the rallying effects of war metaphors in uniting people facing public health crises (Flusberg et al., 2018; Semino, 2021). We demonstrated that health news with war metaphors indirectly built solidarity and promoted perceptions that individuals should all work together to curb the COVID-19 pandemic, by evoking positive emotions and heightening COVID-19 threat. Thus, war metaphors can be useful in constructing collective identities and solidarity to cope with shared adversity.

Our study also revealed the motivating effects of war metaphors on communicative intentions to share and discuss health news via positive emotions. Retransmission of science-based information is crucial to managing a public health emergency, when the public is in dire need of such information to obtain scientific knowledge about the crisis, dispel unfounded falsehoods, and learn precautionary measures against the threats (Sutton et al., 2020; Vaughan & Tinker, 2009). We found that war metaphors can facilitate health news retransmission. Compared with fire metaphors, war metaphors evoked more positive emotions, which in turn encouraged news discussing and sharing. Thus, war metaphors may have important retransmission advantages over other frames.

Interestingly, in our data, one of the key pathways through which war metaphors influence the desired outcomes is via positive emotions. Current research on war metaphors focuses on the effects of triggering negative emotions, especially anxiety and fear (Flusberg et al., 2018; Hendricks et al., 2018). However, similar to Schnepf and Christmann (2022), we did not find evidence of such negative effects of war metaphors. On the contrary, our study showed that war metaphors can evoke positive emotions, which then promote pro-health behavioral intentions, perceived collective responsibility for coping with shared health problems, news sharing and discussion. Such mediating effects remain, even after controlling for the effects of negative emotions. Thus, we confirm that positive emotions are one of the core mechanisms underlying war-related metaphorical framing effects. This is in line with the growing scholarly calls to highlight the persuasive potential of positive emotions (e.g., Fredrickson, 2013; Myrick & Oliver, 2015; Nabi & Myrick, 2019).

However, our results must be viewed in consideration of design choices and study limitations. First, this study's stimuli did not intentionally amplify the threat of COVID-19. Thus, it is likely that when threats of a public health crisis are made more salient, war metaphors become more powerful in producing larger effects (positive or negative) in health messaging. As discussed earlier, different metaphors may be helpful in explaining different facets and phases of complex concepts like a pandemic (Lakoff & Johnson, 1980; Semino, 2021). It is possible that war metaphors might be more effective early in a pandemic, when public awareness is low and when the public needs to be convinced that the pandemic poses "a real and imminent threat" (Flusberg et al., 2018, p. 25). Future research should look into how war metaphors in health news work in more urgent, novel, and threatening situations. Another direction to explore is how multiple frames defining the same concept might work together. Also, this study was fielded in May 2022, when the pandemic was more familiar to the public, and when threat perceptions and negative emotions surrounding the pandemic were relatively stable. The timing of the experiment makes this study a conservative test of metaphorical framing effects. Second, we found null effects on self-efficacy, possibly due to the provision of identical efficacy information describing the preventative measures against COVID-19 in all conditions. Supporting this argument, efficacy perceptions in our study were relatively high across conditions (Table 2). Future research might explore whether war metaphors have stronger effects when threat salience is high, and efficacy perception is low.

Also, the literal frame condition in this study contains metaphorical expressions, such as "slowing down" and "rising." These expressions were included to easily convey the

message and reflect real-world COVID-19 news to ensure external validity. Though it is challenging to create a message about the pandemic development without any metaphorical expressions, considering how entrenched metaphors are in daily lives, we encourage future research to specify the influences of metaphorical expressions even in literal frames.

While it may be tempting to utilize war metaphors in health messaging due to the observed benefits over fire metaphors, it is crucial to exercise caution and consider the ethical implications when leveraging war metaphors. As emphasized by many researchers (see Benzi & Novarese, 2022), war metaphors may be used to provide justifications for government power grabs and may create divisions within society by establishing winners and losers. Related to this, while we found that war metaphors indirectly increased perceived solidarity and collective responsibility, the exact type of solidarity raised by warfare language remains unspecified in this study. Researchers have theorized that war metaphors may construct both exclusionary and inclusionary responses of solidarity (Berrocal et al., 2021). While war metaphors can unite people, they can also be used for "discursive othering" (p. 6), and those who are perceived as "rule-breakers" may face discrimination. In the context of COVID-19, patients can be seen as people who "broke rules" and caught the virus, leading to exclusion. This aligns with research showing that war metaphors put the blame on cancer patients who cannot recover, framing them as "defeated" (Hendricks et al., 2018). Also, war metaphors may create a conflict-focused mentality, excluding anyone who is a perceived threat. For example, war metaphors might imply that Asians are a threat, as the pandemic started in China (Berrocal et al., 2021). This study only measured general perceived solidarity to curb the pandemic but did not differentiate between inclusive and exclusive solidarity. Future research should specify the differences and test exactly which type of solidarity is formed by war metaphors. Bearing in mind these ethical considerations, we still recommend caution when employing war metaphors in health messaging, and urge future research to look into more potential unintended effects of war metaphors.

Finally, the results of this study should not be interpreted as evidence to abandon fire metaphors in public health contexts. The fire metaphor was less powerful in this study compared to war metaphors and the literal frame (Appendix B). But this could be due to metaphor familiarity, an important moderator of metaphorical effects (Van Stee, 2018). As suggested by Flusberg et al. (2018), war metaphors are "easy to begin using but very hard to stop" (p. 25): the ubiquity of war metaphors ensures that they are reliable, effective, and readily available sources of communication and meaning-making. It might be the case that the public is not as familiar with fire metaphors as they are not as widely implemented (e.g., Oliveira et al., 2020). As such, people may not fully appreciate the parallels between putting out fires and managing a pandemic. More explanations of fire metaphors and frequent use of them might enhance their effectiveness in health messaging. Future research could verify this argument, and look into other alternatives to war metaphors. Related to this, the ineffectiveness might be due to the slightly unmatched linguistic realizations of metaphorical expressions between war and fire metaphors, because we designed the two metaphorical frames to correspond to the literal frame, instead of matching the two metaphors. For example, "declare victory" in the war metaphor might elicit more positive emotions than the expression "everybody is safe" in the fire metaphor. Though some of these differences in linguistic choices are due to metaphor entailments, future research may match the linguistic realizations of the two metaphors more closely and testify if our conclusions hold.

This study suggests that health communication researchers should continue to explore the utility of both war and fire metaphors. Relative to fire metaphors, war metaphors increased the perceived risks and severity of COVID-19 and stimulated positive emotions, which in turn promoted pro-health behaviors against COVID-19 and solidarity to cope with the public health crisis. Moreover, war metaphors indirectly facilitated sharing and discussion of COVID-19 health news via positive emotions. Arguments could be made for utilizing war metaphors in health news, especially when information about an urgent threat, solidarity, positive emotions, and resilience are needed. Contrary to many critiques, we did not find evidence suggesting that war metaphors induce excessive negative emotions and decrease self-efficacy. That said, war metaphors generally did not outperform literal frames, suggesting that more research is needed to explore the moderators (e.g., political ideology) and mediators (e.g., emotions) involved in metaphorical framing effects.

## Notes

1. We conducted a 3 (Metaphor: Fire metaphor vs. War metaphor vs. Literal frame) X 2 (Recommended action consistency: metaphor-consistent vs. metaphor-inconsistent recommended action) between-subject factorial design, where participants were randomized to view one of the three versions of COVID-19 news stories and one of the two descriptions of recommended actions to prevent COVID-19. However, the interaction between the two factors was not significant. And we did not find significant main effects of recommendation consistency. Thus, we focus on reporting the effects of metaphorical framing in this manuscript and include recommendation consistency as a covariate in all analytical models.
2. The study was approved by the Institutional Review Board at the University of Wisconsin-Madison.
3. While flu shots cannot prevent the transmission of the COVID-19 virus, they can ameliorate the pandemic by reducing the number of symptomatic patients who visit healthcare providers and prevent hospitalizations (Conlon et al., 2021).

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## Data availability statement

Data available on request from the authors.

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## Appendix A. Experimental stimuli

Instruction: "You are about to read a news commentary issued by the Associated Press (AP). Please read it carefully, as you'll be asked questions about the language used in this news commentary when you're done. You'll need to read the message for at least 45 seconds to continue."

| Literal frame condition | War metaphor condition | Fire metaphor condition |
|---|---|---|
| Commentary: COVID-19 Continues to **Spread** in the US<br>COVID-19 infections continue to **spread** across the U.S. At the beginning of this past summer, the nation had high hopes for a return to normal, as the pandemic **appeared to be slowing down**. But now as COVID-19 is once again **rising**, it is clear that this COVID-19 **pandemic** is far from over.<br>The number of people infected with COVID-19 is again filling up hospitals, and driving deaths from the coronavirus **pandemic** in some areas to the highest levels of the entire pandemic. Our healthcare workers have been **challenged** by **the growing number of COVID-19 patients**.<br>With no end in sight to the sickness and death brought by the COVID-19 **disease**, it is time to step up the effort to **reverse** the **growing coronavirus trend** so we can return to a semblance of normalcy. We won't be free from this deadly **pandemic** unless we join together to **do our part** to end the **pandemic**.<br>Say yes to vaccines! Getting vaccinated is the single best **protective tool** against the COVID-19 **virus**, and it is the best way to **thank** our **healthcare workers** in COVID-19 pandemic. Vaccines are effective in **preventing** COVID-19 **infection**, especially in preventing severe illness and death. Vaccines are absolutely our best **protection** to **contain the pandemic** and restore the freedoms we cherish most. Mask up! Don't **relax your pandemic precautions** yet, especially with the new variants and winter on the way. Masks provide **protection** from the risk of **being infected by** the coronavirus. Get tested. The pandemic is **not over yet**. If you develop even mild respiratory symptoms, remain vigilant and get tested, because if you know you are infected, you can take actions to prevent **spreading the virus** to others. | Commentary: The **War** against COVID-19 Continues in the US<br>COVID-19 infections continue their **onslaught** across the U.S. At the beginning of this past summer, the nation had high hopes for a return to normal, as the **enemy appeared in retreat**. But now as COVID-19 is once again **surging**, it is clear that this COVID-19 **war** is far from over.<br>The number of people infected with COVID-19 is again filling up hospitals, and driving deaths in the coronavirus **war** in some areas to the highest levels of the entire pandemic. Our healthcare workers have been **overwhelmed in the battle against the** COVID-19 **enemy**.<br>With no end in sight to the sickness and death brought by the COVID-19 **enemy**, it is time to step up the effort to **win** the coronavirus **war** to return to a semblance of normalcy. We won't be free from this deadly **battle** unless we join together to **muster our wartime resolve** until **we can declare victory**.<br>Say yes to vaccines! Get yourself vaccinated when you can – it is the single best **weapon to repel the COVID-19 enemy**, and it is the best way to **salute** our **soldiers** on the **battle lines** of COVID-19. Vaccines are an effective **shield** against COVID-19 **attacks**, and especially against severe illness and death. Vaccines are absolutely our best weapons to **fight the war** and restore the freedoms we cherish most. Mask up! Don't **let your guard down** yet, especially with the new variants and winter on the way. Masks provide **protective armor** against the risk of **being attacked by** the invisible coronavirus **enemy**. Get tested. We haven't **declared victory** yet. If you develop even mild respiratory symptoms, remain vigilant and get tested, because if you know you are infected, you can take actions to prevent **the battle from escalating** to others. | Commentary: COVID-19 Continues to Spread Like **Wildfire** in the US<br>COVID-19 infections continue to **spread like wildfire** across the U.S. At the beginning of this past summer, the nation had high hopes for a return to normal, as the COVID-19 **fire** appeared to be **smoldering out**. But now as COVID-19 has again **reignited**. It is clear that this COVID-19 **fire** is far from **extinguished**.<br>The number of people infected with COVID-19 is again filling up hospitals, and driving deaths in the COVID-19 **wildfire** in some places to the highest levels of the entire pandemic. Our healthcare workers have been **exhausted by the raging blazes of** COVID-19 **fire**.<br>With no end in sight to the sickness and death brought by the COVID-19 **wildfire**, it is time to step up the effort to **put out** the coronavirus **fire** to return to a semblance of normalcy. We won't be free from this deadly **inferno** unless we join together to do our part to **extinguish the fire** until **everybody is safe**.<br>Say yes to vaccines! Getting vaccinated is the single best **fire protection against the raging blaze** of COVID-19, and it is the best way to **applaud** our **first responders** on **fire lines** of COVID-19. Vaccines are effective in **suppressing** the COVID-19 **wildfire**, and especially in preventing severe illness and death. Vaccines are absolutely our **firewall** to **cut off the fire spread** and restore the freedoms we cherish most. Mask up! Don't **give up on fireproofing** yet, especially with the new variants and winter on the way. Masks provide a **fire blanket to stifle** the risk of **catching fire** from the invisible coronavirus **sparks**. Get tested. We **are not out of the woods** yet. If you develop even mild respiratory symptoms, remain vigilant and get tested, because if you know you are infected, you can take actions to prevent **sparks being thrown off** to others. |

## Appendix B: Supplementary results of data analyses

**Table B1.** OLS regression models comparing war and fire metaphors with literal frames in predicting health intentions, collective responsibility, and communication intentions.

| | Health intentions | | Collective responsibility | | Communication intentions | |
|---|---|---|---|---|---|---|
| | *Unconditional model* | *Conditional model* | *Unconditional model* | *Conditional model* | *Unconditional model* | *Conditional model* |
| War metaphor | −0.043 | −0.023 | −0.072 | −0.071 | −0.068 | −0.092 |
| | (−0.245–0.160) | (−0.218–0.172) | (−0.252–0.108) | (−0.245–0.103) | (−0.317–0.181) | (−0.331–0.147) |
| Fire metaphor | −0.187 | −0.157 | −0.175 | −0.164 | −0.251* | −0.235* |
| | (−0.385–0.011) | (−0.348–0.034) | (−0.351–0.001) | (−0.334–0.006) | (−0.495 – −0.008) | (−0.469 – −0.001) |
| Recommendation | −0.072 | −0.117 | 0.043 | −0.002 | −0.115 | −0.133 |
| [Inconsistent] | (−0.235–0.091) | (−0.274–0.040) | (−0.101–0.188) | (−0.141–0.138) | (−0.315–0.086) | (−0.325–0.059) |
| Age | | 0.007** | | 0.009*** | | −0.013*** |
| | | (0.002–0.012) | | (0.005–0.014) | | (−0.019 – −0.007) |
| Political ideology | | −0.137*** | | −0.102*** | | −0.099*** |
| | | (−0.183 – −0.091) | | (−0.143 – −0.062) | | (−0.155 – −0.043) |
| Income | | 0.091*** | | 0.075** | | 0.052 |
| | | (0.037–0.145) | | (0.027–0.123) | | (−0.013–0.118) |
| Gender [Male] | | −0.140 | | 0.031 | | 0.147 |
| | | (−0.307–0.027) | | (−0.117–0.180) | | (−0.058–0.351) |
| Gender [Other] | | 0.352 | | −0.380 | | 0.360 |
| | | (−0.952–1.657) | | (−1.542–0.782) | | (−1.237–1.957) |
| Race [White] | | 0.011 | | 0.001 | | −0.075 |
| | | (−0.170–0.191) | | (−0.160–0.162) | | (−0.296–0.145) |
| Ethnicity | | 0.085 | | 0.057 | | 0.229 |
| | | (−0.131–0.301) | | (−0.135–0.249) | | (−0.036–0.493) |

*N* = 551. Reference group of comparison is the *Literal frame* condition (i.e., control condition). p < .05 **p < .01 ***p < .001. 95%CI are reported in parentheses.

**Table B2.** OLS regression models comparing war and fire metaphors with literal frames in predicting self-efficacy, threat perceptions and positive and negative emotions.

| | Self-efficacy | | Threat | | Positive emotions | | Negative emotions | |
|---|---|---|---|---|---|---|---|---|
| *Predictors* | *Estimates* | *p* | *Estimates* | *p* | *Estimates* | *p* | *Estimates* | *p* |
| (Intercept) | 3.671 | <.001 | 3.513 | <.001 | 3.959 | <.001 | 3.283 | <.001 |
| | (3.321–4.020) | | (3.172–3.854) | | (3.596–4.321) | | (2.939–3.628) | |
| War metaphor | −0.010 | .918 | 0.026 | .788 | −0.043 | .679 | −0.069 | .486 |
| | (−0.207–0.186) | | (−0.165–0.218) | | (−0.247–0.161) | | (−0.262–0.125) | |
| Fire metaphor | −0.121 | .217 | −0.222 | .020 | −0.315 | .002 | −0.038 | .694 |
| | (−0.312–0.071) | | (−0.409 – −0.035) | | (−0.514 – −0.116) | | (−0.227–0.151) | |
| Recommendation[Inconsistent] | −0.008 | .920 | −0.007 | .931 | −0.122 | .144 | 0.028 | .728 |
| [Inconsistent] | (−0.166–0.150) | | (−0.161–0.147) | | (−0.285–0.042) | | (−0.128–0.183) | |
| Age | 0.012 | <.001 | −0.002 | .317 | −0.006 | .031 | −0.012 | <.001 |
| | (0.007–0.017) | | (−0.007–0.002) | | (−0.011 – −0.001) | | (−0.017 – −0.007) | |
| Political ideology | −0.155 | <.001 | −0.062 | .007 | −0.121 | <.001 | −0.023 | .315 |
| | (−0.201 – −0.109) | | (−0.107 – −0.017) | | (−0.169 – −0.074) | | (−0.068–0.022) | |
| Income | 0.057 | .038 | 0.068 | .011 | 0.048 | .094 | 0.000 | .988 |
| | (0.003–0.111) | | (0.015–0.121) | | (−0.008–0.104) | | (−0.053–0.054) | |
| Gender [Male] | 0.029 | .735 | −0.001 | .988 | 0.008 | .928 | 0.070 | .409 |
| | (−0.139–0.196) | | (−0.165–0.162) | | (−0.166–0.182) | | (−0.096–0.235) | |
| Gender [Other] | 0.026 | .969 | 0.217 | .739 | −0.128 | .854 | −0.846 | .199 |
| | (−1.284–1.337) | | (−1.062–1.496) | | (−1.488–1.233) | | (−2.139–0.447) | |
| Race [White] | 0.042 | .650 | 0.011 | .903 | 0.030 | .754 | 0.105 | .251 |
| | (−0.139–0.223) | | (−0.166–0.188) | | (−0.158–0.218) | | (−0.074–0.283) | |
| Ethnicity [Non-Hispanic] | 0.175 | .114 | −0.150 | .163 | 0.009 | .935 | −0.138 | .205 |
| | (−0.042–0.392) | | (−0.362–0.061) | | (−0.216–0.234) | | (−0.352–0.076) | |

*N* = 551. Reference group of comparison is the *Literal frame* condition (i.e., control condition). 95%CI are reported in parentheses.