frontiers | Frontiers in Environmental Science

TYPE Original Research
PUBLISHED 21 October 2022
DOI 10.3389/fenvs.2022.789361

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Science and Environmental Communication, a section of the journal Frontiers in Environmental Science

RECEIVED 04 October 2021
ACCEPTED 05 October 2022
PUBLISHED 21 October 2022

CITATION
Gibson KE, Sanders CE, Lamm AJ and Lamm KW (2022), Examining the impact of media use during the COVID-19 pandemic on environmental engagement.
Front. Environ. Sci. 10:789361.
doi: 10.3389/fenvs.2022.789361

Examining the impact of media use during the COVID-19 pandemic on environmental engagement

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The COVID-19 pandemic led to global public health campaigns enacting strict orders to slow the spread of the disease. The public health initiatives were communicated broadly through diverse news sources and social media channels, spreading both factual information and misinformation about the environmental benefits related to the shelter-in-place orders. This quantitative study of United States residents (N = 1,048), guided by selective exposure theory, examined if demographics, news and/or social media source use, and public knowledge of environmental changes that took place as a result of COVID-19 shelter-in-place orders predicted intent to engage in environmentally-conscious behavior. Results indicated demographics and social media used predicted intent to engage in environmentally-conscious behaviors. Intent to engage in environmental behaviors is critical for environmental sustainability and the media may provide one avenue for engaging the public in environmental behaviors. Discussion points include environmental communication strategies and understanding messaging strategies within the politicization process of communicating about environmental issues during the COVID-19 pandemic.

KEYWORDS

COVID-19, environmental engagement, environmental knowledge, media, selective exposure

Introduction

Coronavirus Disease 2019 (COVID-19) was declared a pandemic by the World Health Organization (WHO) on 11 March 2020 after causing 4,291 deaths in 114 countries within a 3-month timespan (Bavel et al., 2020). Public health campaigns around the globe called for increased hand washing, social distancing, and wearing masks in public places to slow the spread of the virus (Bavel et al., 2020). One of the most controversial policy decisions made by many global leaders was to require their citizens to shelter in place to prevent the spread of COVID-19; thereby ensuring health care systems were able to accommodate sick patients. The shelter-in-place (SIP) orders

had both positive and negative impacts on the natural environment (Zombrano-Monserrate et al., 2020). For example, the COVID-19 SIP orders reduced air pollution in many parts of the world (Muhammad et al., 2020; Ogen, 2020) due to reduced industrial production and a decrease in automobile and air travel (Lohmann and Aref, 2020). Orders also had a positive indirect effect on beach cleanliness due to the presence of fewer tourists (Zombrano-Monserrate et al., 2020).

There were also negative effects of the SIP orders, such as reduced recycling due to concerns about the spread of COVID-19 among employees in recycling centers and increased waste due to companies requesting the public leave reusable bags and containers at home when purchasing food and beverages (Zombrano-Monserrate et al., 2020). Additionally, increased online food ordering (Zombrano-Monserrate et al., 2020) and large amounts of personal protective equipment (PPE), such as gloves and masks (Saadat et al., 2020), added to the volume of waste produced. According to Frenkel et al. (2020), "as the coronavirus has spread across the world, so too has misinformation about it [. . .]" (p. 3), which likely caused the spread of misinformation about the direct and indirect environmental impact of the COVID-19 SIP orders within the public sphere. Previous research on misinformation was in the context of social media during the 2016 U.S. presidential election (Roozenbeek et al., 2020) when fake news was a far-reaching public concern (Grinberg et al., 2019). Misinformation dominated the media landscape during COVID-19, and ranged from harmful health advice like ingesting bleach to threats to international relations due to conspiracies about the origin of the virus that were politically motivated (Roozenbeek et al., 2020).

Misinformation about the environmental impacts of the COVID-19 pandemic appeared within both mainstream news channels as well as social media (Frenkel et al., 2020). For example, conflicting information was released about dolphin sightings in the Venetian canals due to the absence of humans due to behavior changes related to the SIP orders (Daly, 2020). The dolphin images were released on popular social media sites, including Instagram and Twitter, with text indicating the dolphins were swimming in the Venetian canals. However, the posts were misleading as the dolphins were filmed a few hundred miles away in the Mediterranean Sea, providing false information about positive environmental benefits of human behavioral patterns related to the SIP orders. Similarly, there was substantial media coverage about the clarity of water in the Venetian canals due to the absence of tourism related to the SIP orders (Daly, 2020). The water clarity in the canals did improve as sediment in the water remained at the bottom of the canal due to the lack of boats that typically cause turbidity and the lack of tourism (Braga et al., 2020). However, water clarity was often mistaken with less water pollution or cleaner water, which was not a result of the absence of tourism related to the SIP orders (Link, 2020). The rapid, large-scale spread of posts providing inaccurate information demonstrated how quickly misinformation can spread during a time of crisis (Daly, 2020) and the increasingly important role of social media in crisis communication (Austin et al., 2012; Spence et al., 2016). Complex emotions surrounding COVID-19 have also negatively impacted the acquisition of factual information as people shared sensationalized and emotionally-driven stories despite their factual inaccuracy (Bavel et al., 2020).

A crisis is defined as an event that consists of "high levels of uncertainty, confusion, disorientation, surprise, shock, and stress" (Seeger et al., 2003, p. 125). Numerous studies suggest it is critical for crisis communication, such as communicating about the facts surrounding COVID-19, to be clear and concise to yield effective message uptake (Dawes et al., 2004; Netten and van Someren, 2011). According to a Pew Research Center (2020) study, 48% of the United States (U.S.) public reported encountering fake or fabricated news about COVID-19. Additionally, in the same study, individuals that identified as Republicans indicated viewing more "made-up news" about the pandemic than individuals that identified as Democrats (Pew Research Center, 2020, p. 14).

While negative emotions about COVID-19 exacerbated the spread of misinformation in social and news media, there was also been an opportunity to promote environmental awareness simultaneously with crisis information related to the pandemic. However, information obtained from news sources must be accurate and factual to encourage members of the public to become engaged, long-term stewards of the environment. Therefore, this research focused on the influence of news and social media sources and level of knowledge of environmental changes resulting from the COVID-19 SIP orders on respondents' likelihood to engage in future environmental behaviors.

Conceptual framework

Four concepts influenced the framework of the study: self-identified characteristics (education level and political affiliation/ideology), selective exposure to media, knowledge of environmental changes related to the SIP orders, and intent to engage in environmentally-conscious behavior. Figure 1 demonstrates the proposed framework, detailing how education level and political affiliation/ideology influences selective exposure to both news and social media, which in turn influences knowledge of environmental changes. Finally, knowledge of environmental changes then influences one's intent to engage in environmentally-conscious behavior (see Figure 1). Each component of the conceptual framework is described below.

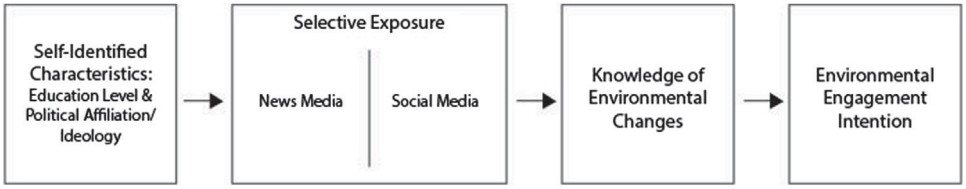

FIGURE 1
Conceptual Framework of Selective Exposure to Media and its Influence on Knowledge of Environmental Changes and Engagement Intention.

Self-identified characteristics: Education level and political affiliation/ideology

Those with higher levels of education generally display higher levels of knowledge, contributing to a disparity within the knowledge gap of a population. According to Tichenor et al. (1970), "as the infusion of mass media information into a social system increases, higher socioeconomic status segments tend to acquire this information faster than lower socioeconomic status population segments" (p. 159). Within the new media landscape, which includes both traditional news media as well as social media, there is not as strong of a direct linear relationship between education level and media literacy. Gerosa et al. (2021) found that education level did not play a role in believing false news information related to COVID-19. They did find, however, that social media, in contrast with news media, was associated with lower levels of knowledge and fake news beliefs.

In addition to the findings of Gerosa et al. (2021), political affiliation and ideology is often associated with belief in fake news information. Pedro Baptista et al. (2021) found the belief and dissemination of fake news was related to a more conservative political ideology as well as lower education levels. Additionally, media consumers with a conservative ideology are more likely to associate mainstream news sources with the term "fake news," specifically when discussing more liberal media outlets such as The Cable News Network (CNN; van der Linden et al., 2020). Thus, there may be a relationship between education level, political affiliation, and political ideology related to knowledge of fake news within the media landscape, but more exploration is needed to operationalize the relationship between these constructs.

Selective exposure to media

The media plays a crucial role in informing the public about global sustainability as well as engaging ordinary citizens in environmental issues (Zhao, 2009; Arlt et al., 2011; Olausson, 2011; Östman, 2014). However, because the public has the ability to selectively engage with certain media platforms (Rubin, 2002), individuals are not passive in the media sources they consume (Katz et al., 1973; Katz et al., 1974; Hennessy et al., 2016); rather, individuals are selective in that they purposefully and strategically engage in media that satisfies their interests and needs (Konijn and Hoorn, 2005; Konijn et al., 2007). Selective exposure refers to a psychological preference for experiencing like-minded content in media (Festinger, 1964; Gvirsman, 2014). The preference for information consistent with one's attitudes, values, and beliefs reduces cognitive dissonance, or the undesirable feelings that arise from experiencing contradictory cognitions (Stroud, 2014). With the growing number of news sources available for science information, both accurate and inaccurate, it is difficult for individuals to avoid selective media exposure (Feldman et al., 2014; Jamieson and Hardy, 2014).

While selective exposure to media may be benign related to some information (e.g., hobbies), it is a critical issue when impacting policies influenced by political affiliation and ideology, such as climate change (Hennessy et al., 2016). Scholars have found that selective exposure to media exacerbates the extremities of people's attitudes, resulting in polarization (Bennett and Iyengar, 2008; Iyengar and Hahn, 2009; Stroud, 2010; Gvirsman, 2014). McCright and Dunlap (2011) evaluated Gallup polling data between 2001 and 2010 regarding public belief that global warming effects have already begun and found there was a growing gap between Democrats and Republicans/liberals and conservatives. Similarly, Dunlap and McCright (2008) evaluated public opinion on global warming and found Democrats were more likely to think the media does not greatly exaggerate global warming and that there was consensus among the scientific community about global warming whereas Republicans held a contrary perspective. For example, politically selective exposure to news sources affected public awareness of the 2014 walrus haul out that involved unprecedented numbers of walruses gathered on a beach due to a decrease in Artic Sea ice caused by climate change (Hennessy et al., 2016). Hennessy et al. (2016) found news channels, levels of news exposure and viewing, and political ideology were strong predictors of respondents' exposure to information about the haul out. In another example, Anderson et al. (2018) evaluated media coverage of the

bushfires in Australia in 2009, also known as Black Saturday, and found the crisis response by the media was influenced by an ideological conflict in Australia. These examples demonstrate how political environments in a nation can strongly influence public perceptions of environmental issues, depending on an individual's position on the political continuum and engagement in selective exposure behavior.

Many popular news media sources align with a political leaning in the U.S., such as Democrat or Republican and liberal or conservative (Pew Research Center, 2014). According to a 2014 Pew Research study, Fox News tended to have a conservative audience, whereas the Columbia Broadcasting System (CBS) News and the American Broadcasting Company (ABC) News audience were more consistently moderate. The National Broadcasting Company (NBC) News audience was more consistently liberal (Pew Research Center, 2014). Fox News was identified as the main source of news coverage for conservatives; and while the NBC audience was more consistently liberal, there was not one main source of news coverage among liberals (Pew Research Center, 2014). High levels of politicization and polarization within media contribute to a complex science communication environment (Kahan, 2012). In times of crisis, these communication challenges are exacerbated, particularly when combined with individuals' value differences surrounding environmental issues (Hart et al., 2020). Polarization of news outlets during the COVID-19 pandemic significantly impacted engagement in social distancing, masking, and vaccination behaviors to mitigate the spread of the disease (Ash et al., 2020; Hornsey et al., 2020; Simonov et al., 2020; Hao et al., 2021; Kahane, 2021). Consumption of right-leaning news media sources in the U.S., such as Fox News, correlated with non-compliance with preventative health behaviors related to COVID-19 due to the spread of misinformation about the virus (Motta et al., 2020; Simonov et al., 2020; Kahane, 2021).

Selective exposure also influences interactions on social networking sites. Social media users tend to follow or befriend other users with similar viewpoints. For example, the Pew Research Center (2014a) found conservatives were more likely to have friends who are like-minded on Facebook. Pearce et al. (2014) analyzed individuals using Twitter and how they interacted with a report by the Intergovernmental Panel on Climate Change and found individuals who shared a similar stance on climate change often interacted with one another. Social networking sites may increasingly foster selective exposure behavior due to the constant barrage of information presented to users, triggering further polarization attitudes (Spohr, 2017). The customizability of social networking sites, mediated through technology, allows for echo chambers that reduce users' cognitive dissonance associated with encountering information that challenges their values, attitudes, and beliefs (Dylko et al., 2017).

Knowledge of environmental changes and engagement intention in the media landscape

Recent studies have demonstrated that the media affects public knowledge of environmental issues (e.g., Zhao, 2009; Arlt et al., 2011; Olausson, 2011; Östman, 2014; Wallace, 2018). Guo et al. (2019) evaluated the risk perception of nuclear radiation post-Fukushima in the Japanese public and found individuals who trusted the media were more likely to consider themselves knowledgeable about nuclear radiation. According to Ho et al. (2014), "perceived threats of environmental risks may heighten people's reliance on media for information about the environment" (p. 93). However, the public is often unable to determine if the news presented to them about the environment is factual or fake. Wallace (2018) found "[. . .] until audiences are provided with the tools to critically engage with fake fact media there is the tangible threat of fake facts [. . .] permeating and ultimately degrading integral sites for promoting environmental ethics and sensitivity" (p. 803). Similarly, Littlefield and Quenette (2007) found media outlets "implicitly have the ability to create a view of reality reflecting their perspective" (p. 43) during times of crisis. Wallace (2018) defined fake facts as those that "eschew the established ethos and reliability of [credible] networks [. . .] in order to gain viewers and increase spreadability *via* entertainment value instead of educational value" (p. 791). Fake facts often are used in the promotion of fake news, or "news content published on the internet that aesthetically resembles actual legitimate mainstream news content, but that is fabricated or extremely inaccurate" (Pennycook and Rand, 2021, p. 389). Misinformation caused by fake facts may negatively influence public knowledge of environmental changes that occur during times of crisis.

The media also plays an important role in public engagement with environmental issues (e.g., Zhao, 2009; Arlt et al., 2011; Olausson, 2011; Östman, 2014; Wallace, 2018). Östman (2014) examined the relationship between news media use and environmental engagement in Swedish adolescents and found the news media raised awareness of environmental issues, thereby promoting pro-environmental behavior. Zhang and Skoric (2018) evaluated the links between news and social media on environmental engagement in Hong Kong, China and found news media use had a positive relationship with environmental activism and consumerism. Additionally, recreational social media use had a positive relationship with environmental consumerism but a negative relationship with environmental activism. Furthermore, respondents who indicated using social media for political reasons had a positive relationship with environmental activism and consumerism. Skoric and Zhang (2019) examined environmental engagement predictors in China and found news media consumption, opinion leadership, and Weibo use (a social networking site) significantly predicted environmental

engagement among Chinese citizens. Environmental knowledge among the Chinese public was partly mediated by this effect.

Studies have demonstrated that environmental knowledge can have a positive influence on engagement in pro-environmental behaviors (Liobikienė and Poškus, 2019). Due to knowledge being perceived as a precondition for behavior change, many environmental interventions focus on education through knowledge transfer (Frick et al., 2004). The relationship between knowledge and pro-environmental behavior may be more complex, however, than the initial linear and transfer-oriented knowledge models suggest (Frick et al., 2004). In addition, knowledge of environmental changes that occur in times of crisis may aid in explaining environmental engagement post-SIP orders. Thus, more research is needed to investigate the relationship between environmental knowledge and engagement in pro-environmental behavior.

While under normal circumstances media plays a large role in affecting public environmental knowledge and engagement (e.g., Zhao, 2009; Arlt et al., 2011; Olausson, 2011; Östman, 2014), this effect may be exacerbated due to the risk of the COVID-19 pandemic. With literature indicating potential causal factors influencing health behaviors during COVID-19, further research is needed to investigate relationships between news sources, social media use, and intent to engage in environmental protection behavior due to the influence of the politically polarized media environment during the pandemic. Therefore, communicators must first determine what media sources the public uses to receive information about environmental issues during the pandemic in order to determine how to effectively disseminate information to influence intent to engage in natural resource protection behaviors accounting for barriers presented by selective exposure.

Purpose and methods

The purpose of this study was to determine if media sources and knowledge levels related to the environmental changes resulting from the COVID-19 SIP orders impacted intent to engage in environmental behaviors in the future during the COVID-19 shelter-in-place orders. The following research objectives were used to guide the study:

1) Identify news sources and social media sources the U.S. public used to obtain COVID-19 information while most states were under shelter-in-place orders;
2) Identify public knowledge levels and environmental engagement intention levels related to the environmental changes resulting from the COVID-19 shelter-in-place orders;
3) Determine if demographics, news sources, social media sources, and knowledge of environmental changes predicted future environmental engagement intention levels related to the environmental changes resulting from COVID-19 shelter-in-place orders.

Survey measures

The survey instrument included demographic, Likert-type, select-all-that-apply, multiple choice, and true/false questions. One select-all-that-apply question was used to determine the social media platforms respondents used when most states were under the COVID-19 SIP orders. Options included Facebook, Instagram, and Twitter. The variables in the scale were subsequently coded into three dichotomous variables for data analysis. Respondents who indicated they used the social media platform were coded as one and respondents that indicated they did not use the platform were coded as 0.

Five questions were used to determine the news sources (on television or online) respondents used when most states were under COVID-19 SIP orders with a five-point Likert-type scale (1 = Almost constantly; 2 = About once a day to several times a day; 3 = Once to several times a week; 4 = Less than once a week; 5 = Never). The questions asked respondents to indicate how often they used the following news sources: Fox News, CBS News, NBC News, and ABC News. The scale responses were subsequently re-coded into dichotomous variables for data analysis. Specifically, respondents who indicated they used a news source less than once a week or more were coded as one and respondents who indicated they never used a news source were coded as 0.

Nine knowledge questions were used to determine public knowledge levels related to the environmental changes resulting from the COVID-19 SIP orders. These items were sourced from Link (2020). Seven questions were true/false and asked respondents if the global SIP orders related to reducing the spread of COVID-19 have led to: 1) short-term reductions in air pollution around the world (true), 2) the hole in the ozone above the Arctic closing (false), 3) increased recycling (false), 4) increased medical waste filling landfills (true), 5) less overall trash accumulation (true), 6) cleaner canals in Venice (false), and 7) a reduction in atmospheric CO_2 levels (false). Two questions were multiple choice. The first multiple-choice question asked respondents to indicate what percentage of the normal pollution in New York City has been reduced as a result of measures used to contain the COVID-19 virus. The answer choices were 100%, 75%, 50%, 25%, and 0% (correct answer, 50%). The second multiple-choice question asked respondents to indicate the results associated with the reduction in air pollution resulting from COVID-19 virus health and safety containment measures. The answer choices were improved cardio-pulmonary health, atmospheric CO_2 levels dropping, and average temperatures dropping across the world (correct answer, cardio-pulmonary health). Public knowledge levels related to

the environmental changes resulting from the COVID-19 SIP orders were measured rather than traditional environmental knowledge because of their sensationalized media presence during the SIP orders. A limitation to using multiple choice and true/false knowledge questions for measurement is the research assumes the respondent is not guessing the answer they selected (Ruth et al., 2017).

Seven questions were used to determine how likely the public is to intend to engage in environmentally-conscious behavior in the future as a result of the COVID-19 outbreak with a five-point Likert-type scale (1 = Very unlikely; 2 = Unlikely; 3 = Undecided; 4 = Likely; 5 = Very likely). The scale was adapted from Owens and Lamm (2017). Respondents were allowed to select Not applicable if the item did not apply to them. Respondents who selected Not Applicable received a mean score for that item. The questions prompted respondents to indicate how likely they were to engage in the following activities: 1) join an environmental conservation organization, 2) buy a specialty license plate that supports environmental protection efforts, 3) volunteer for a stream cleanup or wetland restoration event, 4) volunteer to keep public greenspaces/parks available and healthy, 5) vote for a candidates who support environmental conservation, 6) vote to support environmental conservation programs, and 7) support restrictions issues by their local government that protect the environment. Respondents' intent to engage in environmentally-conscious behavior score was calculated based on the average response to the seven items used to determine how likely a respondent was to engage in environmental behavior in the future as a result of the COVID-19 outbreak. Reliability was calculated post hoc ($\alpha = 0.91$). The real limits of the scale were: 1.00—1.50 = Very unlikely; 1.51—2.50 = Unlikely; 2.51—3.49 = Undecided; 3.50—4.49 = Likely; 4.50—5.00 = Very likely.

Data collection

The survey instrument was researcher-developed and then reviewed for face and construct validity by a panel of external experts in survey design, communications research, and environmental conservation (Lamm et al., 2020). The University of Georgia Institutional Review Board approved the study and then the survey instrument was pilot tested for content validity with 50 individuals who were representative of the sample. All scales were deemed reliable based on Cronbach alpha coefficients 0.70 or higher and full data collection commenced.

Data were collected from U.S. residents in May 2020 *via* Qualtrics, an online survey platform. The targeted population was U.S. residents age 18 or older who were representative of the population based on age, gender, race, ethnicity, and geographic location. One limitation of online surveys is only residents with access to a computer and internet access have the ability to participate in the study, which may be exacerbated by COVID-19, impacting the generalizability of the results (Ary et al., 2010). Non-probability opt-in sampling methods were used to locate respondents for this research (Baker et al., 2013; Wiśniowski et

TABLE 1 Demographics of respondents (N = 1,048).

	F	%
Sex		
Male	502	47.9
Female	546	52.1
Age		
18–34 years	227	21.7
35–54 years	438	41.8
55 + years	383	36.5
Race*		
White	896	85.5
Black	83	7.9
Asian	41	3.9
American Indian or Alaska Native	34	3.2
Other	20	1.9
Ethnicity		
Hispanic	73	7.0
Non-Hispanic	975	93.0
Education		
Less than 12th grade	18	1.7
High school diploma	140	13.4
Some college	190	18.1
2-year college degree	104	9.9
4-year college degree	268	25.6
Graduate or Professional degree	328	31.3
Family Income		
Less than $24,999	156	14.9
$25,000 - $49,999	195	18.6
$50,000 - $74,999	148	14.1
$75,000 - $149,999	295	28.1
$150,000 - $249,999	181	17.3
$250,000 or more	73	7.0
Political Affiliation		
Republican	383	36.5
Democrat	405	38.6
Independent	186	17.7
Non-affiliated	65	6.2
Other	9	0.90
Political Ideology		
Very liberal	112	10.7
Liberal	200	19.1
Moderate	393	37.5
Conservative	218	20.8
Very conservative	125	11.9

Note: *Respondents were allowed to select more than one race.

TABLE 2 News sources used (N = 1,048).

	Never %(*F*)	Less than once a week %(*F*)	Once to several times a week %(*F*)	About once a day to several times a day %(*F*)	Almost constantly %(*F*)
Fox News	29.5 (309)	7.7 (81)	17.3 (181)	30.6 (321)	14.9 (156)
CBS News	25.0 (262)	10.9 (114)	22.8 (239)	32.2 (337)	9.2 (96)
NBC News	24.9 (261)	7.1 (74)	26.9 (282)	31.9 (334)	9.3 (97)
ABC News	24.0 (252)	10.1 (106)	22.1 (232)	33.6 (353)	10.0 (105)

at., 2020). Public opinion research often uses non-probability sampling techniques (Baker et al., 2013). For example, Gorham et al. (2017) used non-probability opt-in sampling to determine Florida residents' critical thinking styles and levels of engagement in water conservation behaviors.

Sample population demographics

A total of 1,048 individuals completed the survey. The 2010 Census data was used to weight the data on geographic location, age, gender, and race to ensure the respondents were representative of the population of interest (U.S. Census Bureau, 2010). The respondents were 52.1% female and 47.9% male (Table 1). The average respondent was White (85.5%), 35 years and older (78.3%), and had at least some college education (84.9%). The majority of respondents were Democrat (38.6%) or Republican (36.5%), with few individuals indicating Independent (17.7%), non-affiliated (6.2%), or other (0.90%). One limitation of the study was that respondents were disproportionately White compared to the general U.S. population, which may have influenced the results of the present study. Table 1 includes the demographic profile of respondents.

TABLE 3 Social media sources used (N = 1,048).

	Did not use %(*F*)	Platform used %(*F*)
Facebook	20.0 (210)	80.0 (838)
Instagram	46.3 (485)	53.7 (563)
Twitter	51.6 (541)	48.4 (507)

TABLE 4 Knowledge of environmental changes test score (N = 1,048).

Questions Answered Correctly	*F*	*%*
0 - None Correct	0	0.0
1	15	1.4
2	96	9.2
3	252	24.0
4	343	32.7
5	210	20.0
6	99	9.4
7	26	2.5
8	6	0.6
9—All Correct	1	0.1

Statistical analysis plan

Descriptive statistics were used to identify news sources and social media sources the U.S. public used to obtain COVID-19 information and to identify public knowledge levels and intent to engage in environmentally-conscious behavior levels related to the environmental changes resulting from the COVID-19 SIP orders. Variance of Inflation Factor (VIF) and multicollinearity tolerance coefficient (MTC) were used to determine any issues of high multicollinearity that may impact the regression analysis (Cohen, 1988). Multiple linear regression models, which are commonly used in the social sciences when several independent variables are used to predict one dependent variable, were used to predict intent to engage in environmentally-conscious behavior levels related to the environmental changes resulting from the COVID-19 SIP orders. Data were analyzed using SPSS 26 (Chicago, IL).

Results

Descriptive statistics

Survey respondents were asked to indicate how often they used news sources to obtain COVID-19 information while most states were under the SIP orders (Table 2). Respondents were likely to use Fox News (45.5%), ABC News (43.6%), CBS News (41.4%), and NBC News (41.2%) at least once a day. The majority

TABLE 5 Results of Variance of Inflation Factor (VIF) and Multicollinearity Tolerance Coefficient (MTC) used to determine multicollinearity for environmental engagement intention regression analysis (N = 1,048).

-	Model 1		Model 2		Model 3		Model 4	
	VIF	*MTC*	*VIF*	*MTC*	*VIF*	*MTC*	*VIF*	*MTC*
Demographics								
Less than high school education	1.056	0.947	1.065	0.939	1.07	0.935	1.07	0.935
High school education	1.328	0.753	1.408	0.71	1.412	0.708	1.416	0.706
Some college education	1.412	0.708	1.51	0.662	1.511	0.662	1.512	0.661
2-year college education	1.26	0.794	1.314	0.761	1.328	0.753	1.331	0.751
Graduate school education	1.558	0.642	1.612	0.62	1.625	0.615	1.625	0.615
Democrat political affiliation	1.576	0.635	1.58	0.633	1.636	0.611	1.637	0.611
Independent political affiliation	1.349	0.741	1.368	0.731	1.371	0.729	1.371	0.729
No political affiliation	1.19	0.84	1.198	0.835	1.208	0.827	1.209	0.827
Other political affiliation	1.028	0.973	1.033	0.968	1.035	0.966	1.036	0.966
Very liberal political belief	1.221	0.819	1.242	0.805	1.256	0.796	1.256	0.796
Liberal political belief	1.336	0.749	1.336	0.748	1.354	0.738	1.357	0.737
Conservative political belief	1.363	0.734	1.38	0.724	1.398	0.716	1.398	0.715
Very conservative political belief	1.288	0.776	1.296	0.772	1.313	0.762	1.314	0.761
Social Media Sources								
Facebook			1.099	0.91	1.107	0.903	1.11	0.901
Instagram			1.433	0.698	1.443	0.693	1.444	0.692
Twitter			1.572	0.636	1.689	0.592	1.69	0.592
News Sources								
Fox News					1.484	0.674	1.491	0.67
CBS News					3.032	0.33	3.038	0.329
NBC News					2.642	0.379	2.656	0.377
ABC News					2.497	0.4	2.498	0.4
Knowledge of Environmental Changes							1.038	0.964

of respondents used ABC News (75.8%), Fox News (70.5%), CBS News (75.0%), and NBC News (75.1%) at some point during the week while most states were under the SIP orders.

Survey respondents were asked to indicate which social media platforms they used when most states were under the COVID-19 SIP orders (Table 3). Over half of respondents used Facebook (80.0%) and Instagram (53.7%) when most states were under the COVID-19 SIP orders. Less than half of respondents used Twitter (48.4%) when most states were under the COVID-19 SIP orders.

Respondents' knowledge of environmental changes test scores could range from zero (no items were answered correctly) to nine (all items were answered correctly). Overall, respondents' knowledge of environmental changes levels were moderate (M = 4.02, SD = 1.29). The majority of respondents (76.7%) answered three to five knowledge questions correctly (Table 4). Only one respondent answered all nine questions correctly and zero respondents answered none of the questions correctly. Respondents' intent to engage in environmentally-conscious behavior score could range from one (very unlikely) to five (very likely). Overall, respondents' intent to engage in environmentally-conscious behavior scores indicated respondents were undecided (M = 3.25, SD = 1.12).

Multicollinearity diagnostics and multiple linear regression analyses

VIF and MTC were conducted prior to the regression analysis to assess multicollinearity diagnostics (Table 5). VIF should be less than 10 and tolerance should be greater than 0.10 to ensure no issues of multicollinearity. Based on the findings, the rate of multicollinearity among the independent variables should not affect the results of this study (Cohen, 1988).

A series of regression models were used to determine if demographics, social media sources used, news sources used, and knowledge of environmental changes predicted intent to engage in environmentally-conscious behavior in the future related to the environmental changes resulting from COVID-19 SIP orders. Initially, a multiple linear regression model was

TABLE 6 Predicting the likelihood of intent to engage in future environmentally-conscious behavior using Demographics, Social Media Use, News Media, and Knowledge of Environmental Changes (N = 1,048).

	Model 1	*Model 2*	*Model 3*	*Model 4*
R^2	0.238***	0.336***	0.356***	0.357***
ΔR^2		0.098***	0.020***	0.001
Demographics				
Less than high school education	-0.404	-0.225	-0.239	-0.236
High school education	-0.524***	-0.241*	-0.23*	-0.225*
Some college education	-0.508***	-0.228*	-0.234**	-0.231**
2-year college education	-0.477***	-0.211	-0.164	-0.17
Graduate school education	0.521***	0.346***	0.323***	0.323***
Democrat political affiliation	0.046	0.076	0.053	0.051
Independent political affiliation	-0.048	0.072	0.081	0.08
No political affiliation	-0.136	-0.079	-0.033	-0.035
Other political affiliation	-0.572	-0.42	-0.38	-0.374
Very liberal political belief	0.392***	0.235***	0.257**	0.258*
Liberal political belief	0.177*	0.17*	0.168*	0.163*
Conservative political belief	-0.369***	-0.287***	-0.279***	-0.277***
Very conservative political belief	-0.391***	-0.344***	-0.288**	-0.287**
Social Media Sources				
Facebook		0.185*	0.176*	0.172*
Instagram		0.261***	0.245***	0.243***
Twitter		0.614***	0.522***	0.52***
News Sources				
Fox News			0.075	0.08
CBS News			0.128	0.133
NBC News			0.133	0.125
ABC News			0.134	0.133
Knowledge of Environmental Changes				-0.023

Note. *$p < .05$, **$p < .01$, ***$p < .001$.

used to determine if demographic characteristics predicted level of intent to engage in environmentally-conscious behavior in the future (see Table 6, Model 1). The model was found to be statistically significant ($F = 24.864$, $p = 0.000$) and predicted 23.8% of the variance. A high school education, some college education, and a 2-year college education predicted a negative intent to engage in environmentally-conscious behavior in the future as compared to respondents with a 4-year college degree. A graduate school education predicted a positive intent to engage in environmentally-conscious behavior in the future as compared to respondents with a 4-year college degree. In addition, very liberal and liberal political beliefs predicted a positive intent to engage in environmentally-conscious behavior in the future as compared to moderate political beliefs. Conservative and very conservative political beliefs predicted a negative intent to engage in environmentally-conscious behavior behaviors in the future as compared to moderate political beliefs.

A second model included social media sources used (Facebook, Instagram, and Twitter) as a predictor (see Table 6, Model 2). The second model was statistically significant ($F = 32.627$, $p = 0.000$) and predicted 33.6% of the variance. The change in R^2 was statistically significant indicating the second model was more effective at predicting intent to engage in environmentally-conscious behavior in the future than the first model. Within the second model, high school education and some college education predicted a negative intent to engage in environmentally-conscious behaviors in the future as compared to a 4-year college degree. A graduate school education predicted a positive intent to engage in environmentally-conscious behaviors in the future as compared to a 4-year college degree. A 2-year college education was no longer significant. In addition, very liberal and liberal continued to predict a positive intent to engage in environmentally-conscious behavior in the future as compared to moderate political beliefs. Conservative and very conservative political beliefs continued to predict a negative intent to engage in environmentally-conscious behaviors in the future as compared to moderate political beliefs. The social media platforms Facebook, Instagram, and Twitter were positive significant predictors of intent to engage in environmentally-conscious behavior in the future.

A third model included news sources used (see Table 6, Model 3). The third model was statistically significant (F = 28.409, p = 0.000) and predicted 35.6% of the variance. The change in R^2 was statistically significant, indicating the third model was more effective at predicting the intent the respondent would engage in an environmental behavior in the future than the second model. Consistent with observations in Models 1 and 2, a high school education, some college education, and graduate school education predicted intent to engage in environmentally-conscious behaviors in the future as compared to a 4-year college degree. Very liberal political beliefs and liberal political beliefs continued to predict a positive intent to engage in environmentally-conscious behavior in the future as compared to moderate political beliefs. Conservative political beliefs and very conservative beliefs continued to predict a negative intent to engage in environmentally-conscious behaviors in the future as compared to moderate political beliefs. Facebook, Instagram, and Twitter continued to predict a positive intent the respondent would engage in environmentally-conscious behavior in the future. News source use did not predict respondents' intent to engage in environmentally-conscious behavior in the future.

Finally, a fourth model included knowledge of environmental changes as a predictor (see Table 6, Model 4). The fourth model was also statistically significant (F = 27.11, p = 0.001); however, the change in R^2 was not significantly different from Model 3. Therefore, the model was deemed to be less parsimonious and less effective at predicting intent to engage in environmentally-conscious behavior than model 3, no further analysis or interpretation of results was conducted.

Discussion

This study added to the literature by determining if intent to engage in environmentally-conscious behavior during the COVID-19 pandemic was predicted by demographics, social media sources used, news sources used, and knowledge of environmental changes, which may provide a basepoint for disseminating environmental information in future crisis events. There were several limitations to this study that should be noted prior to interpretation of the results, including the use of non-probability opt-in sampling techniques. According to Wiśniowski et at. (2020), "the lack of an underlying mathematical theory akin to probability sampling is problematic with respect to achieving accuracy and measuring uncertainty (sampling error) for estimates derived from nonprobability samples" (p. 121). However, multivariate estimates, such as regression coefficients, are not as prone to the inconsistencies between probability and non-probability samples (Wiśniowski et at., 2020). Another limitation of the study was that it is specific to U.S. residents and may not be generalizable in other countries due to the specific political context of the U.S. Future studies should determine if the political polarization of news sources impacted environmental knowledge and intent to engage across various international settings.

Despite these limitations, the results of the study provide important implications for environmental communicators interested in increasing environmental knowledge and engagement. Results of the analysis indicated select demographic variables and social media use predicted differences among respondents' intent to engage in environmentally-conscious behavior in the future. It is possible that crises like the COVID-19 pandemic may cause the public to largely rely on social media for environmental information due to uncertainty that emerges around crises and complex information environments across media platforms (Ho et al., 2014). Environmental communicators should be prepared to use social media platforms when sharing information during times of crisis. This can be accomplished by understanding how the public engages with and processes information during times of crisis, which differs from information processing that occurs outside of crisis environments. The average respondent had a moderate environmental knowledge score (M = 4.02, SD = 1.29) and an undecided intent to engage level (M = 3.24, SD = 1.12), indicating facts about how COVID-19 SIP orders impacted the environment needs to be improved within crisis communication initiatives (Dawes et al., 2004; Netten and van Someren, 2011).

The third regression model examining how demographics, social media sources, and news sources impacted intent to engage in environmentally-conscious behavior accounted for the greatest amount of observed variance (see Table 6, Model 3). Respondents who had very liberal political beliefs or liberal political beliefs predicted a positive relationship with intent to engage in environmentally-conscious behavior. Respondents who were conservative or very conservative predicted a negative relationship with intent to engage in environmentally-conscious behavior. News media was not a predictor of intent to engage in environmentally-conscious behavior. This finding contradicts Skoric and Zhang (2018) who found news media use had a positive relationship with environmental activism and consumerism. It is possible that news media was not a significant predictor because news sources are often aligned with a political affiliation and ideology, which were variables already accounted for in the model. For example, Fox News is primarily aligned with a conservative audience and NBC News is more consistently liberal (Pew Research Center, 2014). Moreover, Facebook, Instagram, and Twitter predicted intent to engage in environmentally-conscious behaviors in the future, suggesting social media may be an appropriate channel to elicit emotional responses that lead to environmentally-conscious behavior engagement.

The fourth regression model that added knowledge of environmental changes as a predictor was less effective at predicting intent to engage in environmentally-conscious behavior than the third model that did not include

environmental knowledge as a predictor. This finding contradicts Skoric and Zhang (2019) who found environmental knowledge mediated environmental engagement among Chinese citizens. It is possible cultural factors play a role in the predictors of environmental engagement as the research of Skoric and Zhang (2019) was conducted in China whereas the present study was conducted in the U.S. It is also possible that general environmental knowledge plays a stronger role in predicting environmental engagement as compared to knowledge of environmental changes that occur during a crisis. Moreover, Frick et al. (2004) explained that the relationship between knowledge and environmental behavior may be more complex and less linear than most models assume. It is possible that during times of crisis a more complex model is needed to explain intent to engage in activities than knowledge of environmental changes. Future research is needed to warrant this claim, however, as the findings of this study are preliminary and knowledge has been a significant predictor of environmental engagement previously. The positive intent to engage in environmentally-conscious behavior associated with liberals and social media users lends the question: is exposure to sensationalized environmental benefits from overzealous media sources more beneficial in encouraging environmental engagement than factual environmental impact information?

Literature provides insight as to why some respondents may have engaged in selective exposure behaviors to certain media landscapes as compared to others. Similar to the findings of Hennessy et al. (2016), selective exposure to media sources about important environmental matters may cause negative consequences because politically polarized media does not expose the public to all information about a specific issue. This was especially relevant during the COVID-19 pandemic as there was a high degree of politicization of news coverage for COVID-19 related information (Hart et al., 2020). Future studies would benefit from determining the best way to expose the public to environmental information through different platforms. Testing environmental messages (with both factual and emotional frames) on both news and social media platforms could provide insight into how to proactively communicate about the environment during times of crisis. Doing so would proactively ensure communicators are prepared when issues arise. Given the public will continue to engage in selective exposure to media, compounded by a politicized media environment, building consensus about environmental issues while dealing with a growing media platform will only become more difficult (Feldman et al., 2014; Jamieson and Hardy, 2014).

The results of this study should be treated as preliminary as the novelty and context of COVID-19 in the era of online news and social media make it difficult to compare respondents' knowledge of environmental changes and intent to engage in environmentally-conscious behavior to previous risk events. However, it is important environmental communicators determine the type of information the public receives and how they process information during the pandemic to effectively share environmental impact and encourage future engagement in environmentally-conscious behaviors. Given the pandemic was global in nature, and this study focused on U.S. citizens, similar studies should be conducted around internationally to determine if worldwide messaging strategies could have a greater impact on the environment. Working collectively, communicators prepared for times of crisis can capitalize on the focused attention among information consumers that is generated by crises, thereby encouraging increased environmentally-conscious behavior.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the University of Georgia Institutional Review Board. The participants agreed to participate in this study by selecting yes at the start of the survey.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Funding

This work was supported by the USDA National Institute of Food and Agriculture, Hatch project 1021735. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the National Institute of Food and Agriculture or the United States Department of Agriculture.

Conflict of interest

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

Publisher's note

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