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RESEARCH ARTICLE



Media Use, Environmental Mediators, and Pro-environmental Behaviors across and within Countries

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ABSTRACT

This study develops a model of direct association of exposure to environmental media content, and indirect association through environmental attitude and environmental efficacy, with pro-environmental behaviors. It also considers secondary media roles of exposure to general news media and involvement in mediated civic activism. The model and hypotheses are tested through Hayes Process mediation models, using secondary, cross-sectional survey data from 11,000 respondents across 11 countries. The model is well-supported overall and within countries, and the secondary media variables have generally consistent effects within countries. Socio-demographic covariates have varying relationships with environmental attitude, environmental efficacy, and pro-environmental behaviors, overall, and within countries. In line with social cognitive theory, these results suggest that media use related to environmental issues does not have to raise individuals' pro-environmental attitude or efficacy (though it does) to increase engagement in pro-environmental behavior.

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Environmental media content; mediated civic activism; pro-environmental behaviors; mediation model; multiple countries

Introduction

Although extreme weather events are occurring with increasing frequency and severity, until recently most individuals did not directly experience these and other major environmental disruptions without extensive travel and/or scientific knowledge (McDonald et al., 2015). Many nonexpert audiences, therefore, obtain information about the environment through different types of media (Klinger & Metag, 2021), such as the traditional mass media, the Internet, and social media (Hansen, 2011; National Science Board, 2018; Taddicken, 2013). Media coverage emphasizes some topics or issues over others, with changes over time and media channels, generating agenda-setting and media-framing effects (Klinger & Metag, 2021). Therefore, media use can influence people's awareness of environmental issues, their perception and assessment of environmental issues, their attitudes and emotions about environmental topics, and their pro-environmental behavior (Klinger & Metag, 2021). A better understanding of how media content and use are associated with pro-environmental behaviors can provide policymakers and designers of communication campaigns with the information they need to promote environmental action. Although extensive research examines media effects on pro-environmental behaviors in relatively homogenous samples, to date few studies examine this relationship across countries (Klinger & Metag, 2021) – a necessary perspective in responding to the global nature of environmental issues.

After briefly describing the core concepts in the study: pro-environmental behaviors, environmental attitude, and environmental efficacy, the following section reviews how media exposure

to environmental content may be associated with pro-environmental behaviors directly and indirectly through both attitude and efficacy. Further, it summarizes how general news media and mediated civic activism serve as controls for the general media context, along with standard socio-demographic covariates. The subsequent section considers whether these relationships are consistent, or vary, across a sample of countries. These discussions are represented in a series of hypotheses, a research question, and an overall model. The methods, results, and discussion sections follow.

Pro-environmental behaviors, environmental attitude, and environmental efficacy

Pro-environmental behaviors

Kollmuss and Agyeman (2002) define PEB as “behavior that consciously seeks to minimize the negative impact of one’s actions on the natural and built world (e.g. minimize resource and energy consumption, use of non-toxic substances, reduce waste production”, p. 240). Fundamentally, environmental problems arise from the moral hazard issue and associated negative externalities: performing PEBs often requires individuals to prioritize the long-term collective health of a region or the planet over their own individual interests. For example, PEBs such as recycling or taking alternative modes of transportation often result in immediate personal costs to the individual in the forms of time, expense, or inconvenience, but the environmental benefits of performing these actions are rarely directly experienced by the individuals themselves (Culiberg, 2014; McCarty & Shrum, 2001). Furthermore, an individual’s PEB is difficult to associate with larger outcomes (both perceived as well as actual; Thøgersen & Grønhøj, 2010). As issues of environmental degradation become increasingly pressing and publicized (Hansen, 2011; IPCC, 2021), motivating engagement in pro-environmental behaviors (PEBs) is both timely and necessary. PEB can include both *private PEB* (individual actions that benefit the environment such as shopping with reusable bags) and *public PEB* (actions requiring some type of direct group behavior such as planting trees or indirect such as signing a petition to support environmental policies; Hamann & Reese, 2020; Piya-pong, 2020; though there are other typologies; see Lee et al., 2014).

Environmental attitude as antecedent of pro-environmental behaviors

Environmental attitude (EA) can be defined as “a psychological tendency expressed by evaluating the natural environment with some degree of favour or disfavour” (Milfont & Duckitt, 2010, p. 80). These evaluative tendencies influence “beliefs, affects, and behaviours regarding human-environment relations” (p. 81; see also McDonald, 2014). Two foundational theories underlying these claims are the theory of planned behavior (Ajzen, 1991) and the value-belief-norm model (Stern, 2000; noted by Gifford & Sussman, 2012). Although both theories propose causal relationships, the specific mechanisms differ: the theory of planned behavior suggests that individuals automatically evaluate behavioral outcomes from their underlying EAs, and select actions that they perceive have favorable consequences (Ajzen, 1991), while the VBN proposes that “attitudinal factors create a general predisposition to act” (Stern, 2000, p. 418), but notes that this causal factor may also interact with contextual variables such as social norms and material incentives.

Two aspects of EA are *environmental values* and *environmental concern*. While *environmental values* are general guiding principles that often remain stable over time (Dietz et al., 2005; Milfont & Duckitt, 2010), *environmental concern* represents people’s care or anxiety about environmental issues, which can vary depending on people’s knowledge of environmental issues (Olivos et al., 2021), the salience of specific environmental consequences (Jenner, 2012), and the affect associated with an EA (Schultz et al., 2005). Across ages, behavior types, and nationalities, people’s EA is often positively associated with, or influences, their behavioral intentions and enacted PEB (e.g. Axelrod & Lehman, 1993; Bilandzic & Kalch, 2022; Kim et al., 2013; Lee et al., 2014). Gifford and Sussman

(2012) note, however, that the relationship is often weak or inconsistent. Furthermore, the theory of cognitive dissonance suggests that simply performing a PEB can also induce enduring changes in EA (Eilam & Trop, 2012).

Environmental efficacy as antecedent of pro-environmental behaviors

Efficacy, or the belief that one has capabilities to “organize and execute the courses of action required to produce given attainments,” allows individuals to feel that their actions are worthwhile and achievable (Bandura, 1997, p. 3). The theoretical basis for the direct effect of efficacy on PEB is grounded in the theory of planned behavior (Cheung et al., 1999; Heeren et al., 2016; Oreg & Katz-Gerro, 2006; Wang et al., 2019), social cognitive theory (Doherty & Webler, 2016; Hamann & Reese, 2020), and protection motivation theory (Kim et al., 2013; Wang et al., 2019). These theories indicate that self-efficacy focuses attention (Kanfer et al., 1996), strengthens motivation (Abraham et al., 2015), affects perception of goal difficulty and goal commitment (Locke & Latham, 2002), helps assign resources to the goal (Vancouver et al., 2008), and fosters searching for better strategies (Taberner & Hernández, 2011, p. 611).

Some studies distinguish between *self-efficacy* (an individual’s perception of their own efficacy) and *collective efficacy* (a group’s shared belief in its abilities to perform a given activity; Bandura, 1997; Barth et al., 2016; Chen, 2015; Jugert et al., 2016). Researchers consistently find that higher levels of environmental self- or collective efficacy correlate with or lead to increased engagement in a wide range of PEBs (e.g. Abraham et al., 2015; Chen, 2015; Gan & Gal, 2018; Hamann & Reese, 2020; Jugert et al., 2016). The only constructs and scale development of environmental efficacy overall (that we have found; referring to nature, rather than, say, organizational resources) are by Sellers et al. (2013) and Moeller and Stahlmann (2019). Even so, their definitions – “the degree to which an individual feels capable of, and also wants to make a difference on the environment by engaging in PEB” (Sellers et al., 2013, p. 171) and “People’s beliefs in their capabilities to produce desired effects in the environment by their own actions” (Moeller & Stahlmann, 2019, p. 6) – do not take into consideration collective aspects. Therefore, we define *environmental efficacy* as the perceived ease of or confidence in performing or attaining pro-environmental actions, whether directly or indirectly, by oneself (self) or by a group (collective).

Media exposure relationships with environmental attitude, environmental efficacy, and pro-environmental behaviors

Exposure to environmental content

Because of the media’s central role in communicating environmental issues, *traditional media* (print and broadcast) exposure to environmental content may influence PEB directly by providing examples and cues to action, as well as indirectly by creating a more favorable EA or a stronger sense of EEF (Arlt & Wolling, 2016; Feldman et al., 2012; Gore & Knuth, 2009; Klinger & Metag, 2021). *Social media* provide a newer form of exposure through three key attributes: “the ability to deliver individualized messages simultaneously to those with access; the control of the content shared by each individual involved; and the dependence of social media on technology” (O’Neill & Boykoff, 2010, p. 234). In addition, social media can have larger audiences (Painter et al., 2017) and greater coverage of climate change (Boykoff, 2011) than traditional media. However, the tailored algorithms and individualized content selection of social media also increase the possibility of selective exposure, meaning that social media may not reach audiences who are most in need of or are not supportive of the environmental information (Boykoff, 2011; O’Neill & Boykoff, 2010), and thus may have less influence on EA (Östman, 2014). Still, Feldman et al. (2012) note that selective exposure is also common among viewers of cable news (traditional media), indicating that the

reciprocal relationship between EA and environmental media exposure operates through many media channels.

Exposure to environmental content and pro-environmental behaviors

Most research on the relationship between media use and PEB has measured intentions rather than behaviors (Klinger & Metag, 2021), yet intention does not always predict later behavior (e.g. Ajzen, 1991). However, in a few studies that measured behavior, a relationship between media consumption and PEB emerged. For example, Chen et al. (2019) demonstrated that when the media state that climate change is occurring, major media coverage of both climate change and global warming has a positive influence on hybrid vehicle sales. Huang (2016) reported that environmental self-efficacy was positively associated with environmental media content use, which in turn was positively related to PEB. Direct effects of environmental media on PEB are grounded in social cognitive theory, which suggests that modeled behaviors (whether mediated or not) inspire similar actions (Bandura, 2001). Still, relationships between environmental knowledge (learned through various types of media, such as talking, reading, or watching about it) and environmental behaviors are variable and sometimes non-significant (Gifford & Sussman, 2012, p. 70).

Exposure to environmental content and environmental attitude

Much research has supported the relationship between media use and EA (e.g. Klinger & Metag, 2021); for example, media use is related to climate awareness (Arlt & Wolling, 2016), and concern about climate change (Lowe et al., 2006). In particular, research has shown that the amount of media attention devoted to environmental issues is positively associated with the amount of public salience (Ader, 1995) and public concern (Harring et al., 2011) for the issue. Direct effects of environmental media on EA are grounded in agenda-setting theory, which proposes that content selected to appear in mass media channels shapes consumers' perception of reality (McCombs & Shaw, 1972). The type of media may also be relevant to EA: Gifford and Sussman (2012) review research (based on results from 20 to 35 years ago) showing that environmental concern was higher for those who read newspapers than for those who watched general TV, though not so for those who watched more science or nature content on TV.

Exposure to environmental content and environmental efficacy

Exposure to mediated environmental content may be associated with efficacy in several ways. First, media content can explicitly mention and enhance efficacy components. For example, Mitchell Turner et al. (2021) noted that slightly less than a third of radio content and nearly a quarter of newspaper content during the Ebola outbreak between 2014 and 2015 included at least one mention of self-efficacy. Second, content, including cues to action, may be directly associated with efficacy. For example, Bieniek-Tobasco et al. (2019) thematically analyzed interviews with 73 viewers of a climate change documentary. Although major themes included existing obstacles to climate change efficacy and low levels of perceived individual and collective response efficacy, the documentary did seem to have a positive influence on efficacy through fostering emotional engagement and motivation. Third, the behavior of characters, celebrities, opinion leaders, politicians, or role models in media can influence viewers' efficacy levels (e.g. Dalrymple et al., 2013). Fourth, how media frame climate change issues can affect audience members' perceived climate change efficacy (Tuitjer & Dirksmeier, 2021). Furthermore, the heightened efficacy that consumers derive from the media may be self-reinforcing; Lu and Luqiu (2020) demonstrated that people who felt a sense of political efficacy were more likely to engage with news organizations and content, which can provide additional opportunities for the media to communicate efficacy information.

Covariates

General news media and mediated civic activism as controls

We control for two more general kinds of media use: general news media exposure and mediated civic activism. *General news media exposure* can serve both to indicate potential awareness of general issues and events in the news, and also as a broad context for making sense of environmental-specific content. For example, Zhang and Skoric (2018) reported a positive association between news media use by Hong Kong respondents and their environmental engagement and environmental consumerism, and Östman (2014) showed a positive relationship between adolescent consumption of mass media news and PEB. Still, individual media channels show varying effects: although use of newspaper and other print media has been associated with climate change knowledge (Nisbet et al., 2015; Zhao, 2009), beliefs (Thaker et al., 2017), and risk perception (Thaker et al., 2017), Arlt and Wolling (2016) found a slight negative effect of print media on problem awareness and Siemer et al. (2009) reported that print media was not a predictor of environmental concerns. Similarly, while some scholars suggest that the visual aspect of television can increase recall (Schill, 2012), arouse emotion (Smith & Joffe, 2009), and promote understanding of abstract global issues (Beck, 2009), other evidence suggests that television exposure has either no (Zhao, 2009) or negative (Nisbet et al., 2015) influences on environmental knowledge and attitudes.

Separately, individuals may participate in general *mediated civic activism* such as writing articles for publication or posting to online forums or blogs. Involvement in some mediated civic activism behaviors may promote engagement in others (for example, PEB). The reasoning behind this is twofold. First, many civic activism efforts integrate individuals into a network of other activists, who can then provide additional opportunities for civic engagement (Botetzagias & van Schuur, 2012; Farrell, 2013; Omoto et al., 2010). Second, individuals often integrate their activism behaviors into their social identity (Botetzagias & van Schuur, 2012; Schulte et al., 2020), which can then inspire additional identity-consistent activism behaviors (Omoto et al., 2010).

Socio-demographics

Research has identified a variety of socio-demographic associations with EA, EEF, and PEB. For example, Eden (1993) explains that higher socio-economic status weakens financial constraints, thus enabling individuals to prioritize environmental purchases and sacrifices, while proximity to “green” geographic locations (in terms of both physical and social landscapes) enables both pro-environmental attitudes and behaviors. Xiao and Hong (2010) note that, while gender differences in EA and PEB are often observed in empirical studies, the effects are inconsistent across countries and behavior types. Further, Gifford and Sussman (2012) state that environmental attitudes “rise and fall with current events and vary with age, gender, socioeconomic status, nation, urban-rural residence, religion, politics, values, personality, experience, education, and environmental knowledge” (p. 65). Following commonly cited covariates in the environmental literature, this study includes the socio-demographic influences of age, gender, geographic location, socioeconomic status, education, and social norms (Eden, 1993; Farrow et al., 2017; Kim et al., 2013; Lam, 2006; McDonald, 2014; Piyapong, 2020; Smith et al., 2021; Williams & Moore, 1991).

Country variation

Until recently, most research on media effects of environmental communication has been limited to northern developed countries, despite evidence that countries in the Global South are most vulnerable to climate change impacts (Boykoff, 2011; Klinger & Metag, 2021), though there is an increasing number of multi-country and cross-cultural environmental studies (Tam & Milfont, 2020). Yet the nature and scope of media, and their portrayal of environmental issues, are not uniform across countries, which can spur differences in EA, EEF, and PEB across national boundaries (Klinger & Metag, 2021; Oreg & Katz-Gerro, 2006; Wang, 2017). For example, both the content and

presentation of mediated information are framed to reflect the norms and values of their intended audiences (Boykoff, 2011; O'Neill et al., 2015). These frames change across time periods, major events, and available narratives and visuals, all of which can vary by country (O'Neill et al., 2015). In an examination of 150,000 top print news articles published between 1996 and 2010 across 27 countries, Schmidt et al. (2013) found that countries that signed the Kyoto Protocol had more coverage of climate change issues than those that did not.

Countries also vary in the extent to which media coverage describes controversy surrounding environmental issues. For example, media in the United States (and to a lesser extent in the United Kingdom; Smith & Joffe, 2009) report much more climate skepticism and scientific controversy around the occurrence of climate change and environmental issues in general than media in other countries (Olausson, 2009; Painter & Ashe, 2012; Zamith et al., 2013). Media coverage of climate controversy can perpetuate a sense of uncertainty (Gustafson & Rice, 2020; Rebich-Hespanha et al., 2015; Rice et al., 2018), potentially reducing audiences' EA, EEF, and PEB. The social context in which individuals are embedded can influence their political ideology, cultural worldview, interest in an environmental issue, and skeptical preconceptions, all of which can strongly influence media effects (Klinger & Metag, 2021). Political contexts also influence the kind of information that the media provide audiences. In some cases, governments exert substantial control over media, reducing residents' abilities to access environmental information (Klinger & Metag, 2021). These factors can lead individuals to selectively expose themselves to media that align with their own political ideology or cultural worldview (Newman et al., 2018), to selectively attend to, process, and interpret the mediated information in a way that confirms their preexisting beliefs (Klinger & Metag, 2021; Newman et al., 2018), or to not have access to a variety of environmental content at all.

Model, hypotheses, and research question

Figure 1 portrays the general model motivated by the above discussions, while Table 1 presents the respective hypotheses and research question.

Method

Sample

The data consist of survey responses from 1000 adults 18 years or older in each of 11 countries: United States, Mexico, Brazil, United Kingdom, South Africa, Kenya, China, South Korea, Australia, United Arab Emirates, and Indonesia, for a total sample size of 11,000. The survey data were collected in January and February 2019 by Ipsos for the National Geographic Society. Thus the data are secondary and cross-sectional.

All surveys were conducted online, except for in Kenya, which were obtained via computer-aided face-to-face interviews. Interviews were conducted in English, the native language, or English and multiple languages in South Africa and Kenya. For countries with high Internet adoption, Ipsos reports that the sample is "nationally representative." The implication is that Internet usage is sufficiently high that census quota samples from within the Internet user survey pools are representative of the general adult population. Samples from countries with low Internet use are not representative of the general population, but, via quota samples from the survey pool, are representative of the country's Internet users. (Ipsos does not report the country usage categorizations, but the International Telecommunication Union (2022) reports that from 2017 to 2019, Internet adoption was 87% or more in United Arab Emirates, South Korea, UK, US, and Australia; while 70% or less in Mexico, Brazil, South Africa, China, and Indonesia.) Thus, some differences (if any) in results between those two sets of countries may be related to differential representativeness of the samples due to disproportional Internet adoption. Ipsos reports that age and gender quotas were applied to

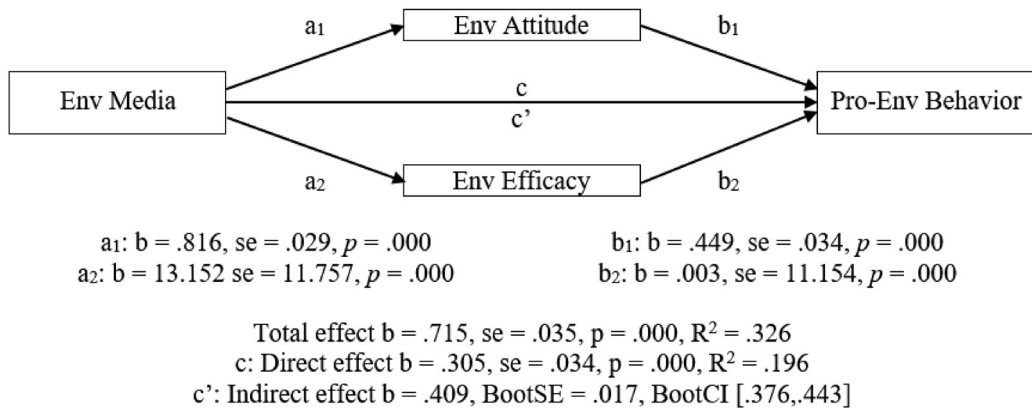


Figure 1. Model.

Note: Covariates include: Country indicator codes, news media, mediated civic activism, age, gender, location, SES ladder, education, environmental norms. Each of the model path estimates controls for all the covariates (Hayes, 2022, p. 134). While this visual model, in accord with relevant theories, implies causal relationships, the analyzed data are cross-sectional, so cannot provide causal tests.

Table 1. Hypotheses and research question.

H1: Environmental attitude is positively associated with pro-environmental behaviors.
H2: Environmental efficacy is positively associated with pro-environmental behaviors.
H3: Exposure to environmental media content is positively associated with pro-environmental behaviors.
H4: Exposure to environmental media content is positively associated with environmental attitude.
H5: Environmental attitude mediates the association of environmental media content with pro-environmental behaviors.
H6: Exposure to environmental media content is positively associated with environmental efficacy.
H7: Environmental efficacy mediates the association of environmental media content with pro-environmental behaviors.
RQ1: In what ways do the hypothesized relationships (H1–H7) differ across countries?

reflect census data, so the data are not weighted. Socio-demographics of age and gender, along with residential location, socio-economic ladder, education, and descriptive environmental social norms, are included as covariates in the following analyses.

Measures

We analyzed the measures as provided in the 2019 Ipsos/National Geographic Society survey; we do not have access to their research or literature justification for the specific items, except as noted. Therefore, the measures are not necessarily those commonly used in the literature, and (due to overall survey length considerations) are limited in the number of constituent items. Still, they do represent key subdimensions of the central concepts, have face and construct validity, exhibit sufficient reliability, and behave as proposed. For each survey concept that had multiple items, the items were randomized on the survey across participants. A table of principal components analyses of relevant multi-item scales, all supporting their respective scale unidimensionality, is available from the authors. Based upon those results, we report the subscale and scale Cronbach alphas.

Pro-environmental behaviors

Participants were asked to indicate how frequently they personally engaged in six PEBs over the past 12 months, with response options ranging from 1 (*never*) to 5 (*all the time*). Kaiser (1998) notes that “... there is no agreement about which behavior domains can be aggregated. A common way of aggregation is an empirical one,” such as by factor analysis (Kaiser, 1998, p. 397). Thus, the principal component analysis of PEBs demonstrated that three of five items loaded onto one factor (*public PEBs*; “Avoid products with ingredients that are bad for the environment,” “Talk to friends

or family about an environmental issue,” and “Used social media to share information about an environmental issue”; $\alpha = .76$), while the remaining two loaded onto another factor (*private PEBs*; “Recycle,” “Use your own reusable shopping bags”; $\alpha = .60$). One item did not load cleanly onto either component and was removed. For the combined measure of pro-environmental behaviors, because of unequal number of items for each (two and three), we computed the mean of the two separate means (for the five items, $\alpha = .71$).

Environmental attitude

The degree to which participants *value nature* was assessed through six items from the Moral Conviction Scale & Values Scale (Chan et al., 2016), including “Conserving natural resources is important for the country’s economy,” “Conserving nature is a reflection of my core moral beliefs and convictions,” “Nature is important to me, to who I am as a person,” “Protecting nature is important for people’s health,” and “Being in/seeing nature brings people pleasure or satisfaction,” with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*; $\alpha = .84$). Participants’ *environmental concern* was measured by asking participants to indicate their level of concern for five global issues including “Habitat loss,” “Plastic pollution,” “Global climate change,” “Species at risk of extinction,” “Air pollution,” and “Lack of clean drinking water,” with response options ranging from 1 (*not at all concerned*) to 5 (*very concerned*; $\alpha = .88$). For the combined measure of EA, because of unequal number of items for each (six and five), we computed the mean of the two separate means (α of the 11 items = .89).

Environmental efficacy

Participants’ level of *self-efficacy* was measured by asking participants to “Please rate how confident you are that YOU AS AN INDIVIDUAL can attain the following goals in the next 10 years,” with four items including “Protect habitats,” “Reduce plastic pollution in our oceans,” “Reduce use of fossil fuels (e.g. petroleum, natural gas, coal),” and “Save animals at risk of extinction,” with response options ranging from 0 (*cannot do at all*), 50 (*moderately can do*), to 100 (*highly certain can do*; $\alpha = .85$). Participants’ levels of perceived *collective efficacy* were measured by asking participants to “Please rate how confident you are that YOUR COUNTRY can collectively attain the following goals in the next 10 years,” with the same four items and response scale used to measure self-efficacy ($\alpha = .89$). A measure of general environmental efficacy was created by taking the mean of the eight items ($\alpha = .89$). Related to the issue of secondary data limitations, the assessment of large-scale outcomes within the next 10 years likely captures less variance in PEB than efficacy examined on a shorter timescale, and related to more specific outcomes (e.g. Bandura, 2006).

Media variables

Exposure to environmental media content. Participants responded to “How do you typically learn about issues that affect the environment?” They were instructed to select all that apply from a list of eight items, including “Print or online publications,” “Television shows or documentaries,” “Facebook,” “Instagram,” “Twitter,” “YouTube” (these previous four items were not displayed in China), “WhatsApp,” “Weibo” (these two items in China only), and “Books.” The possible responses to each were 0 (*no*) or 1 (*yes*). Two indices (traditional media and social media) were created by summing the number of items participants indicated. Because of the unequal number of items for traditional media (three: print, television, books) and for social media (maximum of 5), we used the mean of the two separate means to calculate a general measure of exposure to environmental content. Because these are count measures, we do not report an associated reliability.

Exposure to general news media. General news media exposure was measured through one item that asked participants, “On average, how many major news websites, print newspapers or news magazines do you read daily?” The possible responses were 0, 1, 2, 3, or 4 or more.

Mediated civic activism. Participants were asked, “In the past 12 months, have you participated in any of the activities listed below?” Five of the 19 given civic activism behaviors involved media

(e.g. “Contacted a politician,” “Wrote a letter to the editor,” “Called into a live news broadcast,” “Wrote an article for a publication,” and “Posted to online forum or blog”; we presume that few people can directly, personally meet with a politician). The possible response to each was 0 (*no*) or 1 (*yes*). The count of these five behaviors comprised participants’ mediated civic activism score; thus we do not report an associated reliability.

Control variables

Age. Participants indicated their age in years.

Gender. This question offered choices of “male,” “female,” “other,” and “prefer not to say.” As less than .2% total reported the last two, those were dropped from analyses, and gender was recoded as 0 (*male*) and 1 (*female*).

Residential location. Participants were asked to indicate whether they currently live in a 1 (*rural*), 2 (*suburban*), or 3 (*urban*) area.

Socio-economic ladder. To assess participants’ relative socioeconomic status, participants were asked to respond to question 2 adapted from the MacArthur Scale of Subjective Social Status (University of California, San Francisco, 2008; the site provides literature review and justification for the measure). This item included a picture of a 10-rung ladder ranging from 1 (*at bottom*) to 10 (*at top*) and stated,

The ladder below represents where people stand in your country’s society. At the top of the ladder are the people who are the best off, those who have the most money, most education, and best jobs. At the bottom are the people who are the worst off, those who have the least money, least education, worst jobs, or no job. Please select the rung that best represents where you think you stand on the ladder.

Education. Participants’ level of education was assessed by asking participants, “Which of the following comes closest to the last level of education you completed?” with various responses appropriate to the country; thus, this measure was standardized within each country.

Environmental social norms (descriptive). Participants’ perception of descriptive environmental social norms was assessed by asking, “What percentage of people do you think engage in environmentally friendly behaviors, such as buying recycled, organic, or biodegradable products or saving energy in your country?” to which participants responded with a percentage from 0 to 100.

Analysis

Following the presentation of descriptive statistics and basic correlations, the model in [Figure 1](#) was tested using Hayes Process v.4.1 model 4 (with two mediators), with 5000 bootstrap samples, heteroscedasticity-consistent inference HC3 (Davidson-Mackinnon), and 95% confidence intervals (Hayes, 2022).¹ Results are first reported for the overall sample (N = 11,000 across 11 countries), and then for each country (up to N = 1000 each). The overall sample does not have enough countries for a multi-level model; further, we are not hypothesizing any specific differences (and thus cross-level interactions) across countries. Therefore, to control for country-level variance, and avoid non-robust cluster errors in the overall analyses, we used country indicator codes (with US as referent) in a general linear model, one of the alternate approaches recommended by Bryan and Jenkins (2016).

Results

Overall

Descriptives and correlations

[Table 2](#) displays descriptive statistics overall and for each country. Overall, EA was quite positive, with $M = 4.28$ out of a possible 5. EEF was slightly below the middle of the 0–100 range, $M = 47.59$. PEB was substantial, with $M = 3.58$ out of a possible 5. However, exposure to environmental content

and involvement in mediated civic activism were both quite low, with $M = .34$ out of a possible 4, and $M = .43$ out of a possible 5, respectively. On the other hand, exposure to general news media was at the middle of the scale ($M = 1.96$ out of 4).

The correlations in Table 3 show that, despite the low levels of environmental content exposure, it was significantly positively correlated with all the main model variables ($p < .001$), most strongly with EA ($r = .333$) and general news media ($r = .305$). PEB was most strongly correlated with environmental media ($r = .260$) and EA ($r = .424$).

Process regressions with mediators and covariates

Tables 4 (EA, EEF) and 5 (PEB outcome and total) provide specific coefficients for the relevant main variables and all covariates for each respective path. Nearly 18% of the variance in attitude was explained by the model ($R^2 = .178$; $F(\text{HC3})(19,10957) = 128.85$; $p = .000$), and over 13% of efficacy ($R^2 = .134$; $F(\text{HC3})(19,10957) = 81.12$; $p = .000$).

Exposure to environmental content was positively associated with (a_1) EA (unstandardized $b = .816$, $se = .029$, $p < .001$, 95% CI [.759, .873]). Exposure was also positively associated with (a_2) EEF (13.152, 1.110, $p < .001$, [10.959, 15.345]). Note that some country factors did not have significant associations with EA (UK, South Korea, Australia, UAE), or with EEF (South Africa, South Korea, Australia, UAE). Curiously, the UK association with EEF was significantly negative. All socio-demographics were significantly positively associated with EA: i.e. respondents who were older, female, more urban, higher on the SES ladder, with more education, and with higher descriptive environmental social norms all reported more positive EA.

However, results were much more mixed for EEF. Age and SES ladder had negative coefficients, while environmental norms were positively associated with EEF, and gender, location, and education had no significant associations. Concerning the two media covariates, general news media exposure was positively associated with both EA and EEF. However, mediated civic activism was negatively associated with EA, but nonsignificantly negatively with EEF.

Nearly a third of the variance in PEB was explained in the total regression ($R^2 = .326$; $F(\text{HC3})(21,10955) = 245.83$; $p = .000$). Exposure to environmental content (c) ($b = .305$, $se = .034$, $p < .001$, [.239, .371]), (b_1) EA (.449, .011, $p < .001$, [.426, .471]), and (b_2) EEF (.003, .000, $p < .001$, [.003, .004]) were all positively associated with PEB. Here, two countries were not significantly associated with PEB (Kenya and Indonesia). All socio-demographics except location had significant associations with PEB, but with SES ladder again negatively so. For this stage of the model, both general news media and mediated civic activism were positively associated with PEB.

Table 6 presents the specific total, direct, and indirect effects of exposure to environmental content, EA, and EEF on PEB. The total effect of environmental content and the two mediating paths on PEB was positive ($b = .715$, $se = .035$, $p < .001$, 95% CI [.647, .782]). Exposure to environmental content was positively directly associated with PEB (c) (.305, .034, $p < .001$ [.239, .371]), and indirectly associated with PEB (c') (.409, .017, [.376, .443]). This indirect effect occurred through EA (a_1 , b_1) (.366, .016, [.335, .398]), and EEF (a_2 , b_2) (.042, .005, [.033, .054]). Finally, the difference (contrast) between the indirect effects of EA and EEF was significant ($b = .323$, $se = 0.17$, 95% CI [.289, .356]), indicating that EA had a much stronger indirect association than did EEF (Hayes, 2022, p. 178).

By country

Descriptives

Because of the large sample sizes, overall ANOVAs by country were significant for each variable in Table 2 (details available upon request). Brazil and Indonesia reported the most positive EA and the highest EEF, with US the least positive on both, whereas Mexico, China, and UAE indicated the highest PEB, with US reporting the lowest. Media exposure to environmental content was highest

Table 2. Descriptives, overall and by country.

Model concepts	All	US	Mex	Bra	UK	SA	Ken	Chi	SK	Aus	UAE	Indo
Env. attitude (Mean of means of Valuing and Concern) [1–5.5 max]	4.28/.63	4.06/.72	4.57/.49	4.47/.54	4.10/.65	4.44/.55	4.36/.61	4.23/.51	4.08/.58	4.09/.68	4.19/.73	4.52/.49
Env. efficacy (Mean of Self and Collective efficacy) [0–100 max]	47.59/ 22.74	42.50/ 23.57	53.72/ 23.34	51.58/ 24.28	40.85/ 21.35	43.76/ 22.66	50.06/ 18.22	50.28/ 21.88	42.97/ 19.65	44.35/ 23.34	50.39/ 23.71	53.05/ 22.53
Pro-env. behavior (Mean of means of Private and Public PEB) [0–5 max]	3.58/.76	3.19/.88	3.77/.71	3.62/.79	3.69/.58	3.56/.84	3.35/.74	3.79/.59	3.45/.70	3.66/.63	3.76/.83	3.56/.73
Env. media (Mean of means of Traditional and Social media) [0–4 max]	.34/.21	.27/.18	.39/.20	.41/.21	.28/.18	.41/.20	.28/.21	.28/.17	.28/.17	.28/.18	.40/.23	.42/.23
General news media [1–4 max]	1.96/1.23	1.31/1.21	1.99/1.11	2.43/1.14	1.30/1.08	1.83/1.21	1.78/1.05	2.43/1.06	2.19/1.25	1.35/1.17	2.33/1.11	2.62/1.14
Mediated civic activism [0–5 max]	.43/.78	.39/.68	.31/.66	.44/.82	.36/.69	.41/.73	.21/.49	.58/.91	.37/.70	.43/.76	.71/1.03	.49/.87
Age	41.14/ 15.28	48.62/ 18.61	40.13/ 14.36	41.35/ 14.30	47.66/ 17.45	37.67/ 13.97	34.00/ 12.18	41.11/ 13.59	44.40/ 14.17	45.66/ 15.86	33.65/ 9.89	38.26/ 13.20
Gender 0 (M) 1 (F)	.49/.50	.52/.50	.52/.50	.52/.50	.50/.50	.53/.50	.51/.50	.49/.50	.51/.50	.51/.50	.27/.45	.50/.50
Location	2.48/.70	1.96/.73	2.78/.52	2.87/.43	2.03/.71	2.26/.71	2.61/.66	2.88/.36	2.79/.53	2.04/.59	2.47/.77	2.56/.65
1 (Rural) %	12.2	28.6	5.0	3.5	24.1	15.7	9.6	1.1	5.9	15.7	17.2	8.4
2 (Suburban) %	26.0	47.3	12.5	6.3	49.1	42.8	19.9	10.0	8.9	65.1	18.2	27.7
3 (Urban) %	59.8	24.1	82.5	90.2	26.9	41.5	70.5	88.9	85.2	19.2	64.6	63.9
SES ladder	5.26/1.94	5.67/1.97	4.75/1.53	5.35/1.76	5.92/1.90	5.63/1.87	5.77/1.85	5.18/1.61	5.89/1.84	5.70/2.02	3.53/1.82	4.49/1.63
Education (Z-score) ^a	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00	.00/1.00
Env. social norms	40.06/ 22.51	39.61/ 21.01	33.17/ 19.44	33.98/ 21.69	42.71/ 21.84	33.74/ 21.23	43.19/ 22.29	42.40/ 23.75	35.88/ 21.62	45.88/ 22.53	47.73/ 23.56	42.32/ 22.48
N (listwise)	10,977	990	994	1000	997	1000	1000	1000	1000	996	1000	1000

Note: Values are M/SD.

^aZ-score standardized within each country.

Table 3. Correlations among main variables, overall.

	Env. media	News media	Med. civic act.	Env. attitude	Env. efficacy
Env. Media	–				
News media	.306	–			
Med. civic act.	.202	.268	–		
Env. Attitude	.333	.186	.031	–	
Env. Efficacy	.159	.119	.030	.213	–
Pro-env. behavior	.260	.223	.170	.424	.236

Note: All Pearson correlations significant $p < .001$, one-tailed. Listwise N = 11,000.

Table 4. Effects on mediators environmental attitude and environmental efficacy, overall.

	Env attitude				Env efficacy			
	b coeff [LLCI,ULCI]	se (HC3)	t	p	b coeff [LLCI,ULCI]	se (HC3)	t	p
constant	3.472 [3.381,3.562]	.046	74.959	.000	31.184 [28.057,34.310]	1.595	19.551	.000
EnvCommM	a₁ .816 [.758,.873]	.029	27.880	.000	a₂ 13.152 [10.959,15.345]	1.119	11.757	.000
Mex	.386 [.331,.442]	.028	13.708	.000	9.716 [7.600,11.832]	1.080	9.000	.000
Bra	.238 [.181,.296]	.029	8.171	.000	7.288 [5.143,9.432]	1.094	6.661	.000
UK	.025 [-.032,.082]	.029	.852	.394	-2.557 [-4.446,-.669]	.963	-2.654	.008
SA	.257 [.202,.312]	.028	9.177	.000	.068 [-1.897,2.033]	1.002	.068 .946	
Ken	.273 [.213,.333]	.031	8.911	.000	5.200 [3.356,7.044]	.941	5.528	.000
Chi	.106 [.050,.162]	.029	3.716	.000	5.311 [3.306,7.317]	1.023	5.192	.000
SK	-.043 [-.100,.014]	.029	-1.471	.141	.296 [-1.606,2.197]	.970	.305	.761
Aus	.024 [-.033,.082]	.029	.831	.406	-.161 [-2.105,1.782]	.991	-.163	.871
UAE	.050 [-.015,.115]	.033	1.518	.129	1.649 [-.551,3.850]	1.122	1.469	.142
Indo	.290 [.235,.345]	.028	10.251	.000	5.802 [3.766,7.838]	1.039	5.586	.000
NewsMed	.048 [.037,.058]	.005	8.964	.000	.567 [.178,.957]	.199	2.856	.004
MedCivAc	-.023 [-.038,-.008]	.008	-2.994	.003	-.523 [-1.090,.044]	.289	-1.809	.070
age_raw	.002 [.001,.003]	.000	4.635	.000	-.039 [-.066,-.012]	.014	-2.796	.005
Gender	.104 [.082,.126]	.011	9.337	.000	-.143 [-.951,.666]	.413	-.346	.730
area_res	.026 [.008,.045]	.010	2.755	.006	.486 [-.173,1.144]	.336	1.444	.149
ses_lad	.015 [.008,.022]	.004	4.110	.000	-.470 [-.717,-.224]	.126	-3.742	.000
zEdu	.018 [.006,.031]	.006	2.901	.004	-.137 [-.564,.290]	.218	-.628	.530
norms_p	.001 [.000,.002]	.000	3.714	.000	.277 [.257,.296]	.010	27.230	.000

$R^2 = .178$; $F(HC3)(19,10957) = 128.85$;
 $p = .000$

$R^2 = .134$; $F(HC3)(19,10957) = 81.122$;
 $p = .000$

Note: Values in bold are significant effects [inside a 95% CI not including 0].

in Brazil and Mexico, and lowest in Kenya. Exposure to general news was highest in Indonesia, Brazil, and China, and lowest in the US. Mediated civic activism was highest in the UAE and China, and lowest in Kenya and Mexico.

Table 5. Outcome and total effect on PEB, overall.

	PEB				Total effect:PEB			
	b coeff[LLCI,ULCI]	se(HC3)	t	p	b coeff [LLCI,ULCI]	se(HC3)	t	p
constant	.875 [.755,.995]	.061	14.340	.000	2.535 [2.429,2.642]	.054	46.651	.000
EnvCommM	c'.305 [.239,.371]	.034	9.062	.000	c'.715 [.647,.782]	.035	20.623	.000
EAIndex	b₁.449 [.426,.471]	.011	39.390	.000	–	–	–	–
EEFIndex	b₂.003 [.003,.004]	.000	11.154	.000	–	–	–	–
Mex	.241 [.179,.302]	.032	7.633	.000	.446 [.378,.514]	.035	12.842	.000
Bra	.118 [.053,.184]	.033	3.554	.000	.249 [.178,.320]	.036	6.877	.000
UK	.487 [.435,.538]	.026	18.417	.000	.489 [.430,.549]	.030	16.148	.000
SA	.161 [.097,.225]	.033	4.930	.000	.277 [.206,.347]	.036	7.687	.000
Ken	.003 [–.063,.069]	.034	.091	.928	.143 [.072,.213]	.036	3.942	.000
Chi	.384 [.328,.441]	.029	13.327	.000	.449 [.386,.513]	.032	13.933	.000
SK	.218 [.159,.276]	.030	7.307	.000	.199 [.133,.265]	.034	5.920	.000
Aus	.418 [.365,.471]	.027	15.443	.000	.428 [.367,.489]	.031	13.826	.000
UAE	.295 [.231,.360]	.033	8.951	.000	.323 [.249,.397]	.038	8.562	.000
Indo	–.044 [–.106,.018]	.032	–1.380	.168	.105 [.037,.173]	.035	3.039	.002
NewsMed	.058 [.046,.069]	.006	9.792	.000	.081 [.068,.093]	.006	12.650	.000
MedCivAc	.085 [.069,.100]	.008	10.812	.000	.073 [.055,.090]	.009	8.171	.000
age_raw	.003 [.002,.004]	.000	6.983	.000	.004 [.003,.004]	.000	7.827	.000
gender	.097 [.074,.121]	.012	8.028	.000	.143 [.118,.169]	.013	10.897	.000
area_res	.015 [–.005,.035]	.010	1.444	.149	.028 [.006,.050]	.011	2.513	.012
ses_lad	–.039 [–.046,–.031]	.004	–10.472	.000	–.034 [–.042,.025]	.004	–8.110	.000
zEdu	.016 [.003,.029]	.007	2.413	.016	.024 [.009,.038]	.007	3.217	.001
norms_p	.004 [.004,.005]	.000	14.939	.000	.006 [.005,.006]	.000	18.501	.000

$R^2 = .328$; $F(\text{HC3})(21,10955) = 245.83$;
 $p = .000$

$R^2 = .196$; $F(\text{HC3})(19,10957) = 129.76$;
 $p = .000$

Note: Values in bold are significant effects [inside a 95% CI not including 0].

Process regressions with mediators and covariates

For parsimony, Table 7 presents only the total, direct, and indirect effects of exposure to environmental content, EA, and EEF on PEB, highlighting the significant effects. However, below we also note the strongest and weakest relationships for the two media covariates, general news media and mediated civic activism. (Complete Process results by country are available from the authors.)

The total regression equation for each country was significant, ranging in variance explained from .42 in Australia and .41 in the UK to the quite low .08 in Kenya. The total statistical effect of exposure to environmental content, EA, and EEF was significant in all countries. The direct effect of environmental content was significant in all but four of the countries (Mexico, Kenya, South Korea, and UAE). Exposure to environmental content had significant indirect effects through

Table 6. Total, direct, and indirect effects on PEB, overall.

Effect Type	Effects of Env Media on PEB			
	b effect [LLCI,ULCI]	Se (HC3)	t	p
Total effect	.715 [.647,.782]	.035	20.623	.000
Direct effect	.305 [.239,.371]	.034	9.062	.000
Indirect effects (bootstrap)	b effect [Boot LLCI,ULCI]	Boot se		
Total	.409 [.375,.444]	.017		
Env attitude	.366 [.335,.399]	.016		
Env efficacy	.043 [.033,.054]	.005		
Contrast of indirect effects of Env attitude and Env efficacy	.323 [.291,.357]	.017		

Note: Values in bold are significant effects [inside a 95% CI not including 0]. Bootstrap samples for CI = 5000. N = 10,976.

EA in all countries, and through EEF in all but three countries (Kenya, China, and UAE). The contrast between the strength of the two indirect effects was significant in all countries except Kenya (because both separate indirect effects were so weak; .05, .02). However, there is noticeable variation in effect strength for the total effect (from .26 in Mexico to 1.20 in the US) and direct effect (from essentially 0 in UAE to .58 in China), total indirect effect of exposure to environmental content (from .26 in Indonesia to .66 in the US), and indirect effect through EA (from .05 in Kenya to .58 in the US). Indirect effects through EEF were similar across the countries, ranging from near 0 in China to .08 in the US and Brazil.

The strength of associations of the two media covariates on PEB in the total regression were quite similar across countries. The effect of exposure to general news media ranged from (−.03 to .11) and was significant in all countries except the UK and Kenya. The effect of involvement in mediated civic activism ranged from .02 to .11, and was significant in all countries except Kenya.

Discussion

Summary

As proposed (Figure 1, Table 1, H1–H7), in the combined multi-country sample, exposure to environmental content had both a direct association with PEB, and distinct indirect association through EA and EEF (more strongly through attitude). Although this study cannot establish causal paths, these direct and indirect associations of exposure to environmental media content may occur through a variety of processes, especially agenda-setting and media framing (e.g. Klinger & Metag, 2021). In addition to previous research demonstrating that the amount of media attention devoted to environmental issues corresponds to the amount of public salience (Ader, 1995) and public concern (i.e. attitude; Haring et al., 2011) for the issue, our results show that exposure to this environmental media content also had a direct association with PEB. That is, media related to environmental issues does not have to raise individuals' EA or their EEF in order to increase their likelihood of engaging in PEB. These results align with social cognitive theory, which postulates that behaviors can be modeled directly through mass media (Bandura, 2001), providing individuals with a set of behavioral rules to apply when considering environmentally relevant behaviors. However, the results also indicate that PEB may be increased indirectly via exposure to environmental content through strengthening positive EA.

Table 7. Effects of exposure to environmental content and mediators on PEB, by country.

Effect type	US b coeff [CI]	Mex b coeff [CI]	Bra b coeff [CI]	UK b coeff [CI]	SA b coeff [CI]	Ken b coeff [CI]	Chi b coeff [CI]	SK b coeff [CI]	Aus b coeff [CI]	UAE b coeff [CI]	Indo b coeff [CI]
Total	1.20 [.81,1.40]	.49 [.27,.72]	.70 [.47,.93]	.95 [.74,1.16]	.78 [.54,1.02]	.26 [.05,.47]	.96 [.77,1.16]	.76 [.51,1.01]	1.08 [.85,1.31]	.55 [.35,.76]	.57 [.38,.75]
Direct	.44 [.17,.72]	.20 [−.02,.41]	.37 [.13,.60]	.43 [.24,.62]	.29 [.04,.54]	.19 [−.02,.41]	.58 [.38,.77]	.22 [−.01,.45]	.49 [.28,.70]	.002 [−.18,.18]	.30 [.12,.49]
Indirect (bootstrap)											
Total	.66 [.51,.82]	.30 [.21,.39]	.33 [.22,.45]	.52 [.40,.64]	.49 [.38,.62]	.07 [.02,.13]	.39 [.29,.50]	.54 [.40,.69]	.59 [.47,.72]	.55 [.42,.69]	.26 [.19,.35]
Env attitude	.58 [.44,.72]	.26 [.18,.34]	.25 [.16,.37]	.48 [.37,.61]	.42 [.31,.53]	.05 [.003,.09]	.39 [.29,.49]	.50 [.36,.64]	.55 [.44,.67]	.54 [.40,.67]	.23 [.16,.30]
Env efficacy	.08 [.03,.15]	.04 [.01,.08]	.08 [.04,.13]	.03 [.01,.07]	.07 [.03,.13]	.02 [−.004,.06]	.002 [−.01,.02]	.05 [.01,.09]	.04 [.01,.09]	.02 [−.01,.05]	.03 [.007,.07]
Total regression											
R ²	.40	.27	.25	.41	.29	.08	.38	.38	.42	.40	.30
F(HC3)(11,df2)	(978) =	(982) =	(988) =	(985) =	(988) =	(988) = 7.9	(988) =	(988) =	(984) =	(988) =	(988) =
all <i>p</i> < .001	62.5	31.6	27.4	57.3	35.9		54.9	56.4	59.9	62.7	39.7
Contrast of indirect effects of Env attitude and Env efficacy	.50 [.35,.66]	.21 [.14,.31]	.17 [.07,.30]	.45 [.33,.59]	.34 [.23,.46]	.02 [−.03,.08]	.39 [.20,.50]	.45 [.31,.60]	.51 [.39,.63]	.52 [.39,.66]	.19 [.12,.27]
Media Covariates											
General news media	.06 [.02,.10]	.10 [.06,.14]	.07 [.02,.11]	.01 [−.02,.03]	.11 [.07,.15]	−.03 [−.08,.01]	.06 [.03,.09]	.04 [.01,.08]	.03 [.000,.063]	.08 [.04,.13]	.09 [.05,.12]
Mediated civic activism	.10 [.04,.17]	.08 [.02,.13]	.08 [.01,.14]	.11 [.07,.17]	.10 [.04,.15]	.02 [−.08,.10]	.06 [.03,.09]	.10 [.05,.15]	.10 [.05,.14]	.05 [.01,.10]	.08 [.04,.12]

Note: For parsimony, this table reports only the b effect and 95% CIs, for PEB as the outcome. The Total Regression is the overall result for the entire Process regression, including the mediators and covariates. Effects in the total regression for the two media covariates appear at the bottom. Values in bold are significant effects [inside a 95% CI not including 0].

The two other media variables (as covariates) also mattered, though to less of an extent. Exposure to general news media and involvement in mediated civic activism had significant positive associations with PEB, but mixed associations with EA and EEF. However, neither of these is conceptually related to EA or EEF per se, so these variables would not be expected to have much effect. Indeed, mediated civic activism was negatively related to both (though significantly so only with EA). One possible explanation is that the items for mediated civic activism involve political ideology motivations and identities, which are a strong influence on direction and valence of environmental attitudes and beliefs (Buttel & Flinn, 1978; Kahan, 2013). Another is that social activism in general requires personal resources, so that more of one kind (civic) may mean less of another (PEB).

Socio-demographics (as covariates) played a small and mixed role; none of the covariates had a consistent association (directional or significance) with all three of EA, EEF, and PEB. Older respondents reported more positive EA, lower EEF, and more PEB. Females also reported more positive EA and more PEB. More urban respondents had more positive EA. The association with relative SES level was quite mixed, with higher levels associated with more positive EA, lower EEF, and less PEB. There may thus be a disconnect from EA to EEF and PEB for those more well-off. Somewhat similarly, higher education was associated with more positive EA and more PEB, but not with EEF. Positive descriptive environmental norms were not related to EA but were with EEF and PEB, implying environmental norms are more associated with behavioral than attitudinal aspects; here, perceived norms seem to play an opposite role from that of SES. These varying sociodemographic effects show that there are countervailing individual or social forces associated with environmental aspects.

Finally, concerning RQ1, though there are some differences across countries (primarily for Kenya), the proposed basic model (Figure 1, H1–H7) is supported, and the relationships of the two media covariates are almost all consistent in direction and significance. The relative consistency of these results across countries clarifies existing research by expanding the sample size, and fills a well-defined gap in the literature by illuminating how these relationships operate in multiple countries, including the Global South, where there is a dearth of such research (e.g. Klinger & Metag, 2021). The persistent relationships of media exposure, EA, EEF, and PEBs, despite differences in demographics, suggest that policymakers in both the Global North and the Global South should consider the effects of environmental media when proposing initiatives to promote engagement in PEBs.

Limitations and future directions

The methods section noted the common issues with cross-sectional, secondary data. In particular, the items representing the concepts are limited and include some possible ambiguities. Furthermore, this study cannot test for or assume causality as proposed by some of the underlying theories guiding the proposed relationships, nor can each causal path among the model variables be reviewed in full. (For more information regarding the causal nature of these relationships, see Ajzen (1991), Bandura (2001), Cheung et al. (1999), McCombs and Shaw (1972), and Stern (2000).

Although one strength of this study is the comparison of results across 11 countries, this is not a sufficient number to allow for meaningful multi-level statistical tests across national boundaries. Therefore, to remove or control for variance associated with countries, the overall analyses took into account possible non-robust (or cluster) standard errors due to country-level effects by including country indicator codes as factors in respective regressions. Further, we used HC3 error corrections in the Process analyses. The analyses showed significant country effects of six of the 11 countries on EA and EEF, and of eight on PEB, indicating a moderate overall role of country differences. Except for the anomalous Kenya, the results for the separate countries generally reflect the overall cross-country results, with some variation in some effects across countries. These results indicate that the effects associated with the individual-level variables seem little influenced by

overall country-level differences. However, with more countries and multi-level modeling, and the addition of relevant country-specific measures, additional explanations can be pursued.

As an example, consider a country's press freedom. Because governmental censorship can impede individuals' access to environmental knowledge, individuals who reside in countries with less press freedom are likely to report weaker EA and EEF, and fewer PEBs, along with weaker relationships among them (Martin et al., 2016). Freedom House (2017) maintains a measure of media freedom based on the United Nations Universal Declaration of Human Rights by assigning each country a total press freedom score from 0 (*best*) to 100 (*worst*), according to data on the countries' legal, political, and economic systems (Martin et al., 2016). Press Freedom scores for the 11 countries (range 22–87; low values mean *more* press freedom, confusingly) were *negatively* correlated with the explained *variance* in PEB in the country's regression results ($r = -.26$), but because the N was so small, the results were not significant ($p = .22$, one-tailed). That is, greater country-level press freedom may contribute to explaining some of the variance in PEB currently allocated to the individual-level media, EA, EEF, and socio-demographic variables, but additional research is needed to confirm this relationship.

Conclusion

Forestalling or preventing further environmental degradation requires pro-environmental behaviors at all levels, from individuals to countries. This study shows that pro-environmental behavior is positively associated directly with exposure to environmental media content, with one's environmental attitudes, and with one's sense of environmental efficacy. Further, it demonstrates that media use is indirectly associated with pro-environmental behavior via both mediators, though more strongly through attitude. Other media use, such as exposure to general news media and involvement in mediated civic activism, also plays a small role. However, socio-demographics have varying influences. Finally, the overall model is supported for most countries, with more varying influences of socio-demographics. Thus, the general model (Figure 1) can be a basis for campaigns motivating pro-environmental behaviors in multiple countries. Although providing environmental content may motivate some engagement in PEBs, campaign designers would be wise to include all three constructs (pro-environmental attitudes, efficacy, and environmental content) in environmental media to best inspire pro-environmental action.

Note

1. HC3 (heteroscedasticity-consistent standard error estimator, form 3) corrects (i.e. uses robust standard errors) for heteroscedasticity (error variance differs across observations). Heteroscedasticity is common in cross-sectional data, and may be significant across groupings (such as, here, countries). Hayes and Cai (2007) conclude that researchers should routinely use a heteroscedasticity-consistent standard error estimator for OLS regression tests. We use the HC3 version implemented in Process.

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