Gender, Pandemic, and the Present and Future of Global Environmental Protection

Objectives

Amid the challenges posed by the global COVID-19 pandemic, understanding how the crisis shapes people' environmental behaviors and consciousness becomes paramount. This study aimed to unravel the implications of the global pandemic on individuals' environmental protection activities, environmentally prioritized attitudes, and confidence in future environmental protection movements, and explore the gender heterogeneity in the impacts.

Methods

Data and participants

To evaluate the influence of the global COVID-19 pandemic exposure on global environmental protection, we integrated data on the global COVID-19 pandemic. This covered daily COVID-19 case numbers from each country, region, or territory, sourced from the World Health Organization (WHO) COVID-19 Detailed Surveillance Data. This information was then combined with the individual data from the Integrated Values Surveys (IVS) dataset for comprehensive analysis.

IVS, that formed the basis of our study, integrated repeated queries from the World Value Survey (WVS) and the European Values Study (EVS). We enrolled participants from countries where surveys were conducted both before and after 2020, the year of the pandemic outbreak. After excluding individuals with missing data on the outcome measure or any covariate, our final analysis comprised 54,951 individuals aged 15 years and older from 18 countries representing all continents except Antarctica, as detailed in Table 1. Each country underwent surveys at least twice from 1996 to 2022. Among the participants, 31,046 were interviewed between 1996 and 2014, while 23,905 were interviewed between 2020 and 2022.

Exposures

In this study, the term "global COVID-19 pandemic exposure" denoted whether individuals have encountered the global COVID-19 pandemic events from 2020 to the end of 2022, rather than indicating infection with the SARS-CoV-2 virus. In this study, it was regarded as a disruptive event shock. Exposure to the pandemic was measured by assessing both the temporal differences in the occurrence of the pandemic during interview periods and the geographical variances in its intensity at the severity level.

Concerning the assessment of temporal exposure, we categorized individuals interviewed from 2020 to 2022 as part of the post-pandemic group (exposure group), signifying their encounter with the global pandemic. In contrast, those interviewed before 2020, notably between 1996 and 2014 in the IVS, formed the pre-pandemic group (reference group).

For assessing the severity of exposure, this study employed the incidence of confirmed COVID-19 cases within the survey year in a given country or region as the primary indicator. Then, we standardized this indicator to mitigate any dimensional effects. The standardized incidence (SI) can be obtained using the following formula:

$$SI_i = (\frac{c_i^t}{Pop_i^t} \times 100\% - \mu)/\sigma \quad (1)$$

where Pop_i^t represented the total population of the ith administrative region in the survey year t as, and C_i^t denoted the cumulative number of COVID-19 cases during the same survey

year in the ith administrative region. Then the incidence during the survey year t for the ith administrative region can be calculated as the ratio of C_i^t to Pop_i^t, and μ and σ denoted the mean and standard deviation of this ratio, respectively.

Outcomes

The conclusions of the study were drawn from an analysis of both the current behaviour state and the long-term trend in the future global environmental protection.

In the short term, we measured the environmental protection activities (active or not) of the respondents by their self-reported data regarding their engagement as volunteers in environmental organizations. Concerning the potential long-term trends in the future environmental protection, we measured individuals' attitudes toward the importance of environmental protection (environmentally prioritized or not) and their confidence in future environmental protection movements (confident or not).

Statistical analysis

We utilized Logistic Regression models employing the Difference-in-Differences (DID) methodology to evaluate the influence of exposure to the pandemic shock on participants' environmental protection activities, attitudes, and confidence. This approach involved accounting for the dual differences in the timing of pandemic event exposure and the severity of COVID-19 across diverse countries or regions.

The probability of a participant (designated as j) exhibiting positive environmental protection activities, attitudes, and confidence during period k, considering pandemic severity l, denoted as p=P(y_{jkl}=1|x), can be obtained from the Logistic Regression models using the following formulation:

$$\ln\left(\frac{p}{1-p}\right) = \alpha_0 + \beta_{kl}(Period_k \times Severity_l) + \gamma_k Period_k + \theta_l Severity_l + \delta X_{jkl} + \varepsilon_{jkl} \ (3)$$

Furthermore, we investigated potential heterogeneity in the pandemic's effects by conducting separate analyses for male and female samples to discern any gender-specific variations.

Results

Among the 54,951 study participants, 2,141 participants actively engaged in environmental protection activities, 30,531 held environmentally prioritized attitudes, and 33,082 expressed confidence in environmental protection movements, constituting 3.90%, 55.56%, and 60.20% respectively. The proportions of positive environmental activities, attitudes, and confidence all showed an increase after the pandemic (**Table 1**). However, we cannot currently ascertain whether this rise was attributed to the pandemic or stemmed from other time trends with similar effects.

The environmental protection and the severity of COVID-19 pandemic in each country is shown in **Figure 1**. The trend is much the same between SI and environmental protection attitudes and confidence. And the peak value of SI was in Europe and the environmental protection attitudes and confidence of European were also generally higher among all the countries included in our study. However, considering the countries where the trends between SI and environmental protection attitudes and confidence were inconsistent such as in Vietnam and Armenia, while the trend of environmental activities across nations seems to be opposite to SI. Therefore, whether the COVID-19 pandemic brought about the improvement of global environmental protection needs to be further explored.

Table 1. Environmental protection activities, attitudes, and confidence, by period.

Environmental protection	Total	Period		P
		Pre-pandemic	Post-pandemic	
	N (%)	N (%)	N (%)	
Activities				<0.0001
Active	2,141 (3.90)	1,030 (3.32)	1,111 (4.65)	
Not	52,810 (96.1)	30,016 (96.68)	22,794 (95.35)	
Attitudes				<0.0001
Environmentally prioritized	30,531 (55.56)	16,364 (52.71)	14,167 (59.26)	
Not	24,420 (44.44)	14,682 (47.29)	9,738 (40.74)	
Confidence				<0.0001
Confident	33,082 (60.20)	18,464 (59.47)	14,618 (61.15)	
Not	21,869 (39.80)	12,582 (40.53)	9,287 (38.85)	

Note: The cells display the frequencies and distribution percentages categorized by individuals' environmental protection activities, attitudes, and confidence.
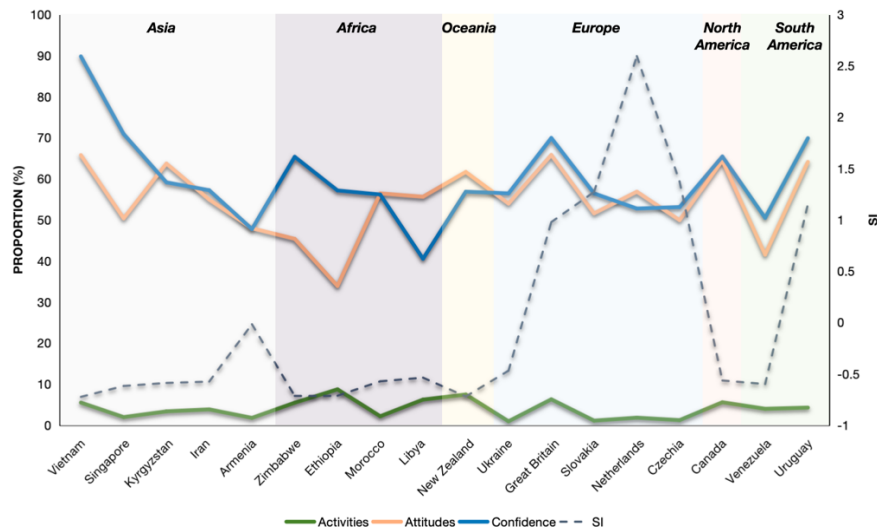
Figure 1. The environmental protection and the severity of COVID-19 pandemic by country

We conducted a comprehensive analysis of the impact of the global pandemic shock on environmental protection activities, attitudes, and confidence using the DID approach, accounting for both the temporal and severity aspects of COVID-19 exposure (**Table 2**). The results indicated a significant decrease in the likelihood of individuals actively engaging in environmental activities (OR: 0.34, 95% CI: 0.23~0.51, p<0.0001) following the pandemic, after adjusting for potential confounding factors. However, pandemic exposure was associated with an increased prioritized attitude (OR: 1.35, 95% CI: 1.18~1.54, p<0.0001) and enhanced confidence in environmental protection movements (OR: 1.16, 95% CI: 1.01~1.32, p=0.030).

The negative effects on environmental activities were consistent across male and female adults, with no observed heterogeneity in gender. Conversely, the positive impact of the pandemic on environmental attitudes was significant only among females (OR: 1.55, 95%CI: 1.30~1.86, p<0.0001), while the positive effect on confidence in environmental actions was significant only among males (OR: 1.23, 95%CI: 1.00~1.50, p=0.049).

Table 2. The impact of the global pandemic on environmental protection.

Outcomes	Total sample		By gender				P for interaction
			Female sample		Male sample		
	AOR (95% CI)	*P*	AOR (95% CI)	*P*	AOR (95% CI)	*P*	
Environmental protection organization activities	0.34 (0.23 to 0.51)	<0.0001	0.29 (0.17 to 0.50)	<0.0001	0.44 (0.23 to 0.83)	0.011	0.531
Environmental protection importance attitudes	1.35 (1.18 to 1.54)	<0.0001	1.55 (1.30 to 1.86)	<0.0001	1.12 (0.92 to 1.37)	0.271	0.154
Environmental protection movement confidence	1.16 (1.01 to 1.32)	0.030	1.13 (0.94 to 1.35)	0.196	1.23 (1.00 to 1.50)	0.049	0.552

Note: AOR, adjusted odds ratios, controlling for exact age, sex, educational level, religious beliefs, marital status, employment status, income level, and self-rated health, and the nation and survey year fixed effects.

Conclusion and discussion

This study utilized global-level data to examine the impact of the global COVID-19 pandemic on current and future environmental protection from the perspectives of individual activities, attitudes, and confidence. Our findings indicated a significant reduction in individuals' short-term environmental activities during the pandemic, accompanied by an increased prioritization of environmental importance attitudes and enhanced confidence in future environmental movements. Furthermore, we found that women exhibited greater sensitivity to the pandemic's positive impact on environmental attitudes, while men displayed heightened sensitivity in the domain of confidence in future environmental movements.

Women are more pro-environmental and greater levels of concern about environmental problems than men have become an increasingly widespread conclusion in the field of environmental sociology. Gender socialization theory argues that boys and girls acquire different values and learn different social expectations from society's dominant culture through early childhood socialization. Briefly, boys both East and West are emphasized that masculinity means being competitive, independent, and unemotional and they are expected to take on more economic roles in the family and social sphere when they grow up. However, in most cultures around the world, girls are expected to be less competitive and competent but to be compassionate and empathetic and in turn becoming a nurturing caregiver triggers their values of nurturance to increase environmental concern. Some studies argue that differences in perceived vulnerability to risk can explain the gender gap found in environmental surveys, which means that women are more concerned about environmental issues than men because of higher health-risk perceptions. Therefore, attention needs to be paid to women who feel more vulnerable during emergencies as well as to promote environmental responsibility and social empathy among men from childhood. Conversely, several studies indicated that men trusted certain institutions and their associated actions more than women, which may explain why men were more confident than women about the future of the environmental movement.

However, it is important to note that research in this area varies, and additional evidence is needed to further support the gender heterogeneity observed in our study and warrant further analysis in future research. Nevertheless, this study offers valuable insights into the complex relationship between gender, global crises, and individual environmental protection. The findings provide policymakers with crucial information for developing post-pandemic strategies to advance the SDGs.