Pre-Analysis Plan: Impact of Media Exposure on Eco-Anxiety and Climate-Related Actions Among Florida Residents

1 Introduction

1.1 Abstract

This study examines how media exposure to a hurricane-related event affects eco-anxiety levels and influences climate-related actions among Florida residents.Specifically, the study examines the effect of viewing a video about Hurricane Helene's impact on North Carolina residents on eco-anxiety levels and subsequent actions, compared to a control group that did not receive the video exposure.. Understanding how media portrayals of climate events impact eco-anxiety and behaviors can inform strategies and policies that foster constructive climate engagement and mental well-being.

1.2 Motivation

This study seeks to understand how exposure to media coverage of hurricanes influences eco-anxiety and shapes climate-related behaviors in Florida residents.Previous research has linked eco-anxiety to pro-environmental actions (Clayton and Karazsia, 2020; Hickman et al., 2021; Tucholska et al., 2024), but few studies have examined how specific climate-related media, such as hurricane coverage, impacts these outcomes. Understanding the effect of media exposure to hurricane-related events is crucial because it provides insights into how such exposure shapes emotional responses, such as eco-anxiety, and drives behavioral changes. This knowledge is vital for designing targeted communication strategies that leverage media to promote adaptive climate actions and mitigate maladaptive responses. By identifying the pathways through which media influences eco-anxiety and behavior, this study can inform policymakers and media creators on how to effectively address public climate engagement. This study investigates the impact of media exposure to a hurricane-related event as a treatment on levels of eco-anxiety. It further examines how this eco-anxiety influences climate-related actions in the short and long term. Furthermore, it examines eco-anxiety, Tolerance of Uncertainty, and trust in government as potential mediating factors that shape the pathway from media exposure to these actions. Focusing on Florida residents, who frequently experience the effects of climate events like hurricanes, helps us understand how living in a high-risk area impacts people's emotions and behaviors. Eco-anxiety in these regions is especially significant because it may push individuals to take actions, like preparing for disasters or reducing their environmental impact. Additionally, in places like Florida, where climate events are common, eco-anxiety might lead to greater involvement in pushing for policies that address climate risks.

1.3 Research Questions

1. How does exposure to hurricane-related media impact eco-anxiety in Florida residents?
2. How does eco-anxiety, influenced by media exposure, shape immediate and long-term climate-related actions in Florida residents?
3. To what extent does media exposure to a climate-related event influence climate-related actions through its effects on eco-anxiety, trust in government, and Tolerance of Uncertainty as potential mediators?
4. How do individual factors, such as income, past climate experiences, and education etc., affect eco-anxiety and climate-related actions?

2 Empirical Analysis

2.1 Variables

Main Variables of Interest

- **Eco-Anxiety**:
  - **Definition**: Measures the level of anxiety related to climate change, using an adapted scale from Hickman et al. (2021).
  - **Dataset Representation**: Survey responses indicating levels of worry, negative emotions, and overall impact on daily functioning.
- **Climate-Change Actions**:
  - **Definition**: Captures participants' behaviors and preparedness actions related to climate change, categorized by short-, medium-, and long-term actions.
  - **Dataset Representation**:
    - **Short-Term Actions**: Focuses on immediate concerns and preparedness actions following a hurricane, beginning with identifying the primary risk, then assessing other associated risks, preparing emergency supplies, and taking protective actions.
    - **Long-Term Actions**: Consideration of relocating or moving out of Florida due to climate-related risks.
- **Trust in Government**:
  - **Definition**: Evaluates participants' level of trust in the Florida government's handling of climate-related issues, adapted from Hickman et al. (2021).
  - **Dataset Representation**: Responses on trust in the Florida government's action, transparency, and perceived protection regarding climate change.
- **Intolerance of Uncertainty** :
  - **Definition**: Assesses individuals' comfort with uncertainty, measured by the Uncertainty Scale—Short Form (IUS-12).
  - **Dataset Representation**: Survey responses indicating agreement with statements about Tolerance of Uncertainty.
- **Control Variables (Demographics)**:
  - **Dataset Representation**: Age, gender, income, education level, race/ethnicity, marital status, household size, ZIP code, and past experience with climate change.

2.2 Balancing Checks

Balance Between Treatment and Control Groups

- **Objective**: Ensure that random assignment has achieved balance between the treatment and control groups on key demographic and background variables.
- **Specification**: Conduct t-tests and regression analysis with treatment assignment as the dependent variable to test for mean differences.
- **Variables**: Include demographic variables such as age, gender, income, education level, race/ethnicity, marital status, household size, ZIP code, and past climate-change experience.

Balance Between Attritors and Non-Attritors (if needed)

- **Objective**: Verify that attrition does not introduce bias by comparing those who completed the survey to those who did not.
- **Specification**: Run logistic regressions with an attrition indicator as the dependent variable to test for differences between groups.
- **Variables**: Include key demographic variables (age, gender, income, education level, race/ethnicity, marital status, household size, ZIP code) and initial responses to early survey questions (e.g., initial eco-anxiety levels) to detect systematic differences.

2.3 Mediation Analysis

This analysis investigates whether eco-anxiety, Tolerance of Uncertainty, or trust in government mediates the relationship between video exposure and climate-related actions.

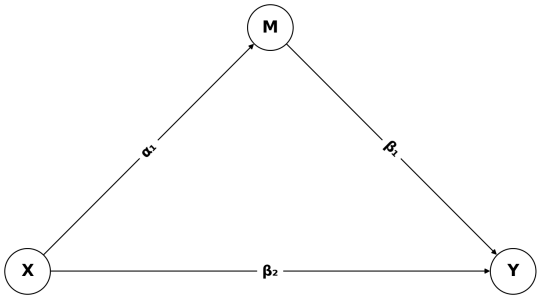

Figure 1: X to M to Y Mediation Model

X represents our treatment, video exposure. M is a mediator including eco-anxiety, trust in government, or Tolerance of Uncertainty. And Y represents climate-related actions.

Mediation Hypothesis 1 (MH1): Eco-Anxiety as a Mediator
Hypothesis:The information shock caused by media exposure to a hurricane increases engagement in climate-related actions both directly and indirectly by heightening eco-anxiety, which further motivates pro-environmental behaviors.

Equations:

1. Path $X \to M$ (Effect of Media Exposure on Eco-Anxiety):

$$Anxiety = \alpha_0 + \alpha_1 \cdot Video + \epsilon_1$$

2. Path $M \to Y$ (Effect of Eco-Anxiety on Climate-Related Actions) and $X \to Y$ (Effect of media exposure on Climate-Related Actions):

$$Action = \beta_0 + \beta_1 \cdot Anxiety + \beta_2 \cdot Video + \epsilon_2$$

Indirect Effect: The $\alpha_1 \cdot \beta_1$ represents the indirect effect of media exposure on climate-related actions through eco-anxiety.
Direct Effect: The coefficient β_2 represents the direct effect of media exposure on climate-related actions, independent of eco-anxiety.
Total Effect: The total effect of media exposure on climate-related actions is the sum of the direct effect (β_2) and the indirect effect ($\alpha_1 \cdot \beta_1$).

Mediation Hypothesis 2 (MH2): Trust in Government as a Mediator

The information shock caused by media exposure to a hurricane decreases engagement in climate-related actions both directly and indirectly by reducing trust in government, which discourages pro-environmental behaviors.

Equations:

1. Path $X \to M$ (Effect of Media Exposure on Trust in Government):

$$Trust = \gamma_0 + \gamma_1 \cdot Video + \epsilon_3$$

2. Path $M \to Y$ (Effect of Trust in Government on Climate-Related Actions) and $X \to Y$ (Effect of media exposure on Climate-Related Actions):

$$Action = \delta_0 + \delta_1 \cdot Trust + \delta_2 \cdot Video + \epsilon_4$$

Indirect Effect: The product $\gamma_1 \cdot \delta_1$ represents the indirect effect of media exposure on climate-related actions through trust in government.
Direct Effect: The coefficient δ_2 represents the direct effect of media exposure on climate-related

actions, independent of trust in government.
Total Effect: The total effect of media exposure on climate-related actions includes the direct effect (δ_2) and the indirect effect ($\gamma_1 \cdot \delta_1$).

Mediation Hypothesis 3 (MH3): Tolerance of Uncertainty as a Mediator

The information shock caused by media exposure to a hurricane increases engagement in climate-related actions both directly and indirectly by enhancing tolerance of uncertainty, which further motivates pro-environmental behaviors.

Equations:

1. Path $X \to M$ (Effect of Media Exposure on Tolerance of Uncertainty):

$$Uncertainty = \eta_0 + \eta_1 \cdot Video + \epsilon_5$$

2. Path $M \to Y$ (Effect of Tolerance of Uncertainty on Climate-Related Actions) and $X \to Y$ (Effect of media exposure on Climate-Related Actions):

$$Action = \theta_0 + \theta_1 \cdot Uncertainty + \theta_2 \cdot Video + \epsilon_6$$

Indirect Effect: The product $\eta_1 \cdot \theta_1$ represents the indirect effect of media exposure on climate-related actions through Tolerance of Uncertainty.
Direct Effect: The coefficient θ_2 represents the direct effect of media exposure on climate-related actions, independent of Tolerance of Uncertainty.
Total Effect: The total effect of media exposure on climate-related actions includes the direct effect (θ_2) and the indirect effect ($\eta_1 \cdot \theta_1$).

2.4 Subgroup Analysis

This analysis examines how the effects of media exposure on eco-anxiety and climate-related actions vary across specific demographic subgroups, providing a nuanced understanding of which populations are more sensitive to media exposure and guiding targeted climate communication and intervention strategies.

Subgroups of Interest:

- **Income Level**
- **Education Level**
- **Family Size**
- **Past Climate-Change Experience**

Approach:

- Conduct interaction analyses to examine how media exposure combined with each subgroup characteristic influences eco-anxiety and climate-related actions.
- Use interaction terms between treatment assignment (media exposure) and each subgroup variable.

$$Action = \beta_0 + \beta_1 \cdot Video + \beta_2 \cdot Subgroup + \beta_3 \cdot (Video \times Subgroup) + \beta_i \mathbf{X} + \epsilon$$

2.5 Additional Analysis

Depending on initial findings, further analyses may be conducted.

3 Sampling

3.1 Sampling Frame

- **Eligible Population**: The target population for this study consists of adult residents of Florida.
  - **Characteristics**: Participants must be 18 years or older and currently reside in Florida.
- **Expected Sample**:

- **Sample Size**: The expected sample size is approximately 800, with 400 participants in the treatment group and 400 in the control group.
- **Sample-Population Differences**: While the sample will represent Florida residents, there may be slight demographic variations compared to the broader Florida population.

3.2 Statistical Power

- **Effect Size and Power**: This study is designed to detect a medium effect size with an alpha level of 0.05 and a statistical power of 80%.
- **Sample Sourcing**: Data will be collected via Dynata, a reputable survey platform, ensuring a representative and reliable sample from the target population.

Single Hypothesis Power Analysis

Objective: To determine the required sample size n for each hypothesis test (H1-H4) to achieve a power of 80% with an alpha level of 0.05.

Power Analysis Equation:

For each individual hypothesis, the required sample size n can be calculated as follows:

$$n = \left(\frac{Z_{\alpha/2} + Z_{\beta}}{|\mu_i - \mu_0|/\sigma} \right)^2$$

where:

- $Z_{\alpha/2}$ is the critical value for the significance level $\alpha = 0.05$.
- Z_{β} corresponds to the desired power level (e.g., 0.8, giving $Z_{\beta} = 0.84$).
- $|\mu_i - \mu_0|$ is the effect size (the difference in means between treatment and control), derived from a pilot study measuring the difference in means between the treatment and control groups. This pilot data provides a realistic estimate of the expected treatment effect for our power analysis.
- σ is the standard deviation.

The treatment and control means, μ_i and μ_0, are derived from the observed values of the outcome variable in the treatment and control groups, respectively:

- **Treatment Group Mean** (μ_i): Calculated as the average value of the outcome variable for participants exposed to the intervention (e.g., media exposure to a hurricane).
- **Control Group Mean** (μ_0): Calculated as the average value of the outcome variable for participants not exposed to the intervention or exposed to a neutral condition.

In this study, these means were initially estimated using pilot data, which measured participant responses under both treatment and control conditions. These estimates provide a foundation for determining effect sizes and calculating sample sizes for power analysis.

Multiple Hypothesis Testing Power Analysis (Bonferroni Correction)

Objective: To determine the required sample size n for each hypothesis test while controlling for multiple hypothesis testing using the Bonferroni correction.

Adjusted Significance Level:

Given our hypotheses, we apply the Bonferroni correction to control for the family-wise error rate, which refers to the probability of making at least one Type I error (false positive) across multiple hypothesis tests. The adjusted significance level for each test is:

$$\alpha_{adjusted} = \frac{\alpha}{4} = \frac{0.05}{4} = 0.0125$$

Adjusted Sample Size Equation:

To calculate the required sample size with the adjusted alpha level, we use:

$$n = \left(\frac{Z_{\alpha_{adjusted}/2} + Z_{\beta}}{|\mu_i - \mu_0|/\sigma} \right)^2$$

where:

- $Z_{\alpha_{adjusted}/2}$ corresponds to the adjusted alpha level (e.g., for $\alpha_{adjusted} = 0.0125$, $Z_{\alpha_{adjusted}/2} \approx 2.24$).
- Other terms remain the same as in the single hypothesis power analysis.

Summary Table

Hypothesis	Treatment Mean	Control Mean	SD	Single Hypothesis n	Multiple Hypothesis n
H1	40.333	43.857	8.000	164	234
H2	1.500	1.300	0.515	302	428
H3	0.333	0.143	0.439	170	242
H4	2.167	3.000	1.244	72	104

Table 1: Summary of Means, Standard Deviations, and Required Sample Sizes for Single and Multiple Hypothesis Testing

Note: The treatment mean, control mean, and standard deviations are based on preliminary data from the pilot study, which provided initial estimates of participant responses. The method of assigning values for each variable may vary based on data collection and study design considerations.

3.3 Assignment to Treatment

- **Assignment Method**: Participants will be randomly assigned to either the treatment group (exposed to a hurricane-related video) or the control group (no video exposure).
- **Source of Exogenous Variation**: Exogenous variation is introduced by the random assignment to either the video treatment or control, allowing for an assessment of the media's impact on eco-anxiety and behaviors.

3.4 Attrition from the Sample

- **Anticipated Attrition**: Minor attrition is expected, potentially around 5-10%.
  - **Evidence Basis**: This estimate is based on typical completion rates for online surveys using Dynata.
  - **Mitigation Strategies**: To minimize attrition, we provide straightforward, step-by-step instructions at the beginning of the survey to reduce confusion and encourage completion.
- **Impact on Power Calculations**: Expected attrition is unlikely to affect statistical power significantly due to the initial sample size planning, which accommodates a minor loss in participant completion.

4 Fieldwork

4.1 Instruments

- **Data Collection Instruments**: The primary instrument is an online structured survey hosted on Dynata, covering eco-anxiety, action behaviors, trust in government, uncertainty, and demographic data.
- **Development and Usage**: The survey draws on established scales and measures to assess eco-anxiety, behavior, and related constructs, adapted as needed for relevance to Florida residents.
  - **Eco-Anxiety**: Adapted from Hickman et al. (2021).
  - **Video**: Sourced from YouTube to illustrate hurricane impact.
  - **Actions**: Custom-developed to assess climate-related preparedness and behaviors.
  - **Trust in Government**: Adapted from Hickman et al. (2021).
  - **Uncertainty**: Measured using the Uncertainty Scale—Short Form (IUS-12).
  - **Past Experience**: Adapted from Clayton and Karazsia (2020).
  - **Demography**: Standard demographic questions on age, gender, income, etc.

4.2 Data Collection

- **Timeline**: The data collection phase is expected to take approximately two weeks.
- **Process**: Participants will complete the survey online. Random assignment to treatment or control will occur upon starting the survey, after which respondents in the treatment group will view the video before answering survey questions.
- **Confidentiality Measures**: All survey responses are anonymized and securely stored, ensuring participant confidentiality throughout data collection.

4.3 Data Processing

- **Timeline**: Data processing will take approximately one week after collection.
- **Process**: Data cleaning, coding, and preparation for analysis will be conducted to ensure data quality.
- **Confidentiality Measures**: Processed data will be stored on encrypted systems accessible only to authorized research personnel. Identifying information will not be retained to maintain participant anonymity.
- **Data Ownership**: The research team and affiliated institution will hold ownership of the processed data.
- **Post-Study Storage**: Data will be stored securely for future research or verification purposes, adhering to institutional guidelines and IRB requirements.

5 Research Team

5.1 Principal Investigators

- **Jinyang Li** (Graduate Student): Responsible for the overall coordination of the study, including study design, overseeing data collection, and conducting primary analyses. Leads the writing and editing of all reports and publications.
- **Di Fang** (Advisor): Provides guidance on study design and assists with analysis interpretation, offering expertise in experiment design and analysis.
- **Weizhe Weng** (Advisor): Advises on environmental questions and contributes to writing, especially in sections relating to eco-anxiety and climate-related impacts.
- **Rodolfo M. Nayga, Jr.**: Provides the research topic, secures funding, and offers final comments and feedback to refine the study

6 Deliverables

6.1 Main Products

- **Research Paper**: Comprehensive paper detailing the methodology, findings, and implications of the study. This will be submitted to an academic journal focused on environmental psychology or behavioral science.
- **Policy Brief**: A concise summary of findings with recommendations for policymakers and stakeholders.
- **Conference Presentation**: Presentation for an academic or practitioner conference to share the results and insights gained from the study.

7 Budget

7.1 Estimated Costs

- **Participant Recruitment via Dynata**: $4,000

7.2 Funding Sources

Funding is anticipated from Texas A&M University, with additional potential supplemental support from grants focused on climate psychology and environmental research.

References

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