How do Oklahomans Adjust to Natural and Technological Hazards?

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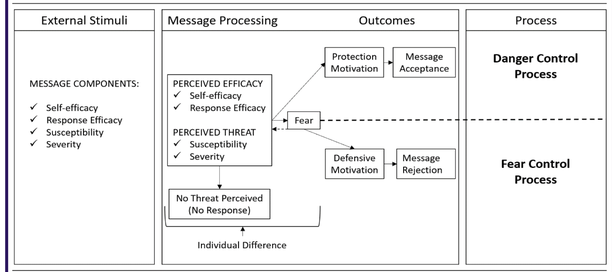
INTRODUCTION

- Oklahoma is part of "Tornado Alley", averaging 57 tornadoes per year.
- There is a history of small and mostly unnoticeable shaking, but an increase in the frequency and intensity of earthquakes have been observed since 2009.
- The increased earthquakes are believed to be a consequence of wastewater injection by the oil and gas industry.

RESEARCH OBJECTIVES

- Categorize households according to their relative level of perceived threat (risk perceptions) and perceived efficacy of protective actions to explain their overall hazard adjustment levels (the number of danger control responses undertaken) in response to tornado and induced earthquake threats.
- Understand how response costs and individual differences affect households' overall hazard adjustment levels to tornadoes and induced earthquakes.

EXTENDED PARALLEL PROCESS MODEL (EPPM)



Witte (1992)

RIMAL'S (2001) TYPOLOGY

Threat/Efficacy Categories	Low Efficacy	High Efficacy
Low Threat	Indifference Attitude	Proactive Attitude
High Threat	Avoidance Attitude	Responsive Attitude

HYPOTHESES & RQs

RHs:

- Households' overall hazard adjustment levels for tornadoes and induced earthquakes vary among **RESPONSIVE**, **PROACTIVE, AVOIDANCE, and INDIFFERENCE** attitudinal groups:
  - Responsive > Avoidance, Proactive, Indifference
  - Responsive, Avoidance, Proactive > Indifference
  - Proactive > Avoidance

RQs:

- How do response costs (i.e., monetary costs and multi-use utility) affect households' danger control responses for tornado hazards and induced earthquake hazards, respectively?
- How do individual difference factors affect households' danger control responses for tornado hazards and induced earthquake hazards, respectively?

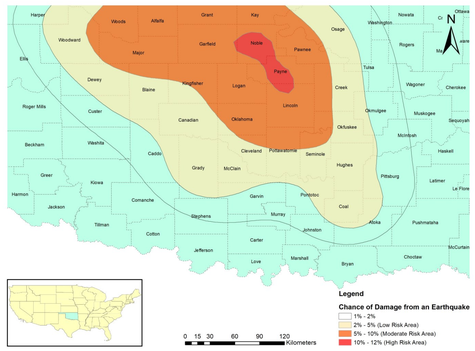
METHODOLOGY

Data Collection:

- Household survey using a disproportionate sampling procedure in Oklahoma to collect household earthquake and tornado hazard adjustment data.
- 866 completed surveys; response rate:17.86% (with $5 gift card compensation).
- Data was collected between August and November 2019.

Analyses:

- Spearman's Rank Correlation.
- Poisson Regression model, as our outcome variable (the number of danger control responses) is a count variable.
- Two degrees-of-freedom χ^2 tests.



DESCRIPTIVE STATISTICS

Demographic Variables	Census Data	Household Survey Data
Age	36.6	55.2
Bachelor's or higher	25.5%	57.4%
Income	73K	3 (55K-80K)
Homeownership	57.5%	82.4%
Female	50.4%	50.3%
Married persons	49.3%	64.5%
White	72.3%	65.1%
African American	7.3%	4.7%
Native American	7.6%	11.0%
Asian	2.2%	9.6%
Hispanic	10.6%	8.7%
# of household members under 18 years old	24.3%	21.6%
# of household members between 18-65 years old	60.4%	61.3%
# of household members over 65 years old	15.3%	17.1%

POISSON REGRESSION MODELS

# of Danger Control Responses	Tornado	Earthquake
EPPM Proactive (Base = Indifference)	+	+
EPPM Avoidance (Base = Indifference)		
EPPM Responsive (Base = Indifference)	+	+
Hazard Salience	+	
Disaster Experience		
Familiarity		
Self Knowledge	+	+
Dread		
Negative Emotions		
Married		
Income		
Own Home	+	+
Tenure	-	-
# of household members under 18		
# of household members between 18-65		
Wastewater Awareness		+
Multi-Use	+	+
Monetary Cost		
Constant		

+: Positive and significant; -: negative and significant; otherwise not significant

χ^2 TESTS

Danger Control Responses of	For Tornado	For Earthquake
Indifference < Avoidance		
Indifference < Proactive	Yes	Yes
Indifference < Responsive	Yes	Yes
Avoidance < Proactive		
Proactive < Responsive		Yes
Avoidance < Responsive	Yes	Yes

FINDINGS

- Our results support the EPPM proposition that households with responsive attitudes are most likely to adopt danger control responses for both tornado and earthquake hazards.
- The avoidance group did not have significantly more danger control responses compared to the indifference group for both tornadoes and earthquakes.
- Low threat combined with high efficacy (proactive group) leads households to adopt significantly more danger control responses for both tornado and earthquake hazards than those with neither motivation nor perceived ability (indifference group).
- Different from the earthquake case, households' tornado danger control responses do not vary between the proactive group and responsive group.
- Response cost item of multi-use strongly and positively affects households' danger control responses for both hazards.
- Hazard salience directly affects danger control responses for tornadoes but not for induced earthquakes.
- Perceived self-knowledge affects households' danger control responses for both hazards.
- The awareness of wastewater injection directly leads to a higher number of danger control responses for induced earthquakes.

IMPLICATIONS

- Local emergency managers can use our results to categorize households into different groups based on their perceived threat and perceived efficacy, which they can use to customize strategies to promote households' overall hazard adjustment levels according to households' categorizations and hazard types.
- Our results also contributes to the literature by identifying and comparing individuals' perceptions and adjustment drivers (i.e., salience, response costs, knowledge, wastewater awareness, demographics) in both natural hazards and induced hazards.
- Our categorization of households into different attitudinal groups will facilitate future research that attempts to address factors leading to household hazard adjustments.

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