

# ShakeOut and ShakeAlert: Enhancing Earthquake Preparedness Through Drills and Early Warning

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Who Participates in the Great  
ShakeOut? Why  
Audience Segmentation Is the Future  
of Disaster  
Preparedness Campaigns

# The Great Southern California ShakeOut

- Launched in 2008 by the Southern California Earthquake Center and USGS Earthquake Hazards Program
- Located in greater Los Angeles area
- *Drop, cover, and hold on* drill conducted in schools, worksites, businesses, and other settings
- 18,411 individuals and organizations signed up to participate in drill

Shake  
Out™



Great ShakeOut  
*Earthquake Drills*

# The Great Southern California ShakeOut

- The initial launch of the drill involved a variety of communication and outreach initiatives:
  - 7.8 earthquake scenario on California's San Andreas fault
  - Drill manual to inform disaster planning
  - Print materials and billboards to promote participation in the drill
  - Educational video games
  - Community outreach meetings
  - Social media groups
  - Tabletop exercises
- These initiatives were based on risk communication best practices and theoretical drivers of behavior change to influence social cognitive factors that influence preparedness

# Research Methods

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- **Data Collection:** A cross-sectional online survey was conducted five months after the launch of the Great ShakeOut drill in April 2009
- **Study Sample:** The survey was sent to the full registry of individuals signed up to participate in the ShakeOut campaign and drill and was completed by 2052 people
- **Research Questions:** We asked survey participants about participation in the different ShakeOut activities and questions on social cognitive factors that may have been influenced by the campaign and drill

# Research Variables

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## ShakeOut Behaviors:

- Participated in the “drop, cover and hold on” drill
- Practiced a disaster plan
- Helped others prepare for the ShakeOut
- Participated in a earthquake preparedness meeting in workplace or school
- Joined a MySpace ShakeOut group
- Joined a Facebook ShakeOut group
- Played the Beat the Quake game
- Signed up to play AfterShock game



# Research Variables

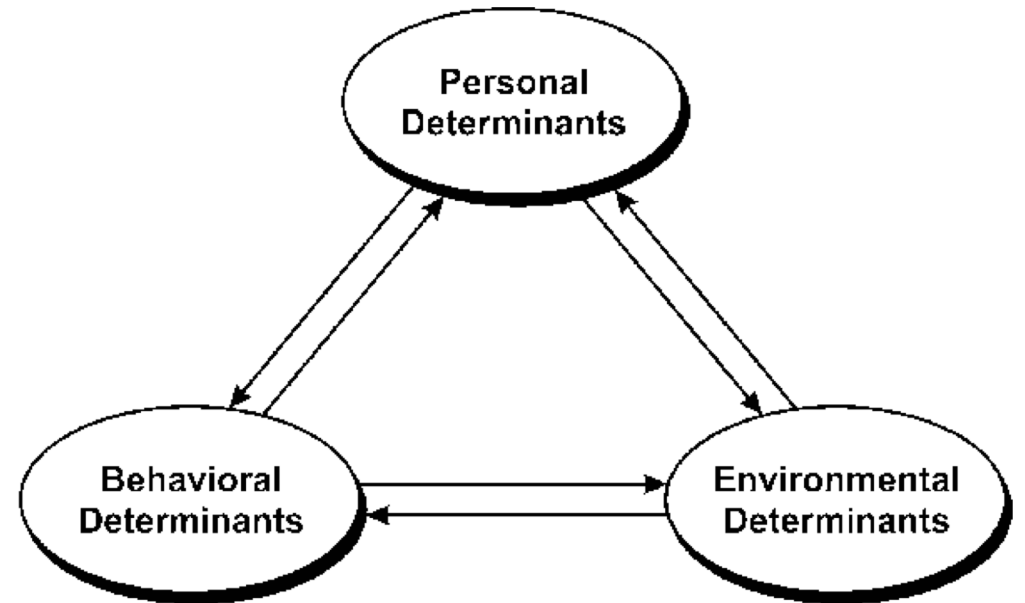
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## Social Cognitive Factors Related to Earthquake Preparedness:

- Knowledge
- Interpersonal communication
- Personal responsibility
- Self-efficacy
- Outcome efficacy

## Demographics and Personal Characteristics:

- Gender
- Age
- Race/ethnicity
- Income
- Personal experience with a disaster



# Data Analysis

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- Descriptive statistics
- Factor analysis
- Two-step cluster analysis
- Chi-square
- Multiple linear regression



# Results

**Table 1.** Demographic Characteristics of the Sample ( $N = 2052$ ) Compared to 2010 CA Census Data.

	<b>Study Sample</b>	<b>Census Data</b>
Gender *	Female 66.1%	Female 50.3%
Race/ethnicity *	White 74.4% Hispanic/Latino 14.3% Asian/Pacific Islander 7.4% African American 3.8%	White 57.6% Hispanic/Latino 37.6% Asian/Pacific Islander 13.4% African American 6.2%
Age *	48.8 Years	35.2 Years
Income *	\$65,309	\$59,540

\* Sample and census significantly different based on independent  $t$ -test ( $p < 0.01$ ).|

# Results

**Table 2.** Factors derived from participation in ShakeOut activities ( $N = 2052$ ).

	Factor Analysis				
	Frequency of Participation (%)	Drop, Cover, Hold	Interpersonal	Games	Social Media
	Loading				
Drop, cover and hold during drill	71%	<b>0.902</b>	0.090	0.038	-0.014
Practice a Disaster Plan	39%	-0.311	<b>0.728</b>	0.088	-0.005
Help others prepare for Shakeout	39%	0.117	<b>0.781</b>	0.062	0.015
Participate in a meeting	33%	0.311	<b>0.645</b>	0.022	-0.036
After Shock game	8%	-0.001	0.024	<b>0.841</b>	0.012
Beat the Quake game	12%	0.042	0.108	<b>0.814</b>	0.025
Join Facebook	3%	0.116	-0.057	0.124	<b>0.750</b>
Join MySpace	0.3%	-0.136	0.042	-0.087	<b>0.763</b>
Explained variance		13.2%	19.8%	17.6%	14.2%

Note: Values in bold indicate which items load to each factor.

# Results

**Table 3.** Frequency distribution of ShakeOut activities and demographic variables in each derived cluster ( $N = 2052$ ).

	Minimal Cluster	Basic Drill Cluster	Community-Oriented Cluster	Interactive and Games Cluster
Participation	26%	38%	20%	16%
Basic				
Drop, cover, hold	0%	100%	100%	79%
Interpersonal				
Practice Plan	39%	15%	76%	52%
Help others	29%	15%	89%	53%
Attend Meeting	23%	15%	74%	43%
Game				
Aftershock game	0%	0%	0%	53%
Beat the Quake	0%	0%	0%	75%

# Results

	Minimal Cluster	Basic Drill Cluster	Community-Oriented Cluster	Interactive and Games Cluster	
Demographics					Chi-Square ( <i>p</i> value)
Female Gender	63%	71%	67%	70%	11.29 <sup>a</sup> (0.010)
Race/Ethnicity					
White	80%	69%	77%	76%	19.42 <sup>a</sup> (<0.001)
African American	2%	3%	5%	4%	5.68 (0.128)
Latino	9%	14%	18%	15%	16.10 <sup>a</sup> (0.001)
Asian/Pacific Islander	8%	7%	8%	5%	3.41(0.333)
Income					
<\$25,000	16%	15%	11%	12%	4.60 (0.204)
\$25,000–\$49,999	19%	21%	22%	22%	1.54 (0.673)
\$50,000–\$74,999	25%	26%	25%	25%	0.07 (0.995)
>\$75,000	41%	38%	42%	40%	1.76 (0.624)
Age					
18–29	7%	11%	7%	9%	9.22 <sup>a</sup> (0.027)
30–39	12%	15%	11%	18%	9.10 <sup>a</sup> (0.028)
40–49	21%	25%	29%	26%	8.45 <sup>a</sup> (0.038)
50–59	29%	28%	31%	32%	2.78 (0.426)
60+	31%	21%	23%	14%	31.95 <sup>a</sup> (<0.001)

<sup>a</sup>  $p < 0.05$ .

# Results

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After controlling for demographics and personal experience with a disaster, we found that in comparison to Minimal cluster:

- Basic Drill cluster was associated with **↑ knowledge** of protective actions
- Community-Oriented cluster was associated with **↑ knowledge, self-efficacy, outcome efficacy, & interpersonal communication** of earthquake preparedness
- Interactive and Games cluster was associated with **↑ knowledge, personal responsibility, self-efficacy, outcome efficacy, & interpersonal communication** of earthquake preparedness

# Conclusions

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- Results support audience segmentation approaches
- We identified a more motivated, community-oriented and gamer audience segments that experienced greater benefit
- Targeting the highly active Community-Oriented cluster for leadership roles encourage others to become more involved in disaster preparedness
- Offering games may help “gamers” gain competencies required to prepare for disasters

# Schools, Earthquakes, and Early Warning Systems

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# Research Sites

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## Anchorage and the Matanuska-Susitna Borough, Alaska



On **November 30, 2018**, at 8:29 a.m. 7.1 M earthquake hit South Central Alaska. It was followed six minutes later by a magnitude 5.7 aftershock.

N=88

## Ridgecrest and Trona, California



On **July 3 and 4, 2019** earthquakes occurred north and northeast of the town of Ridgecrest, California and west of Searles Valley. They included three initial main shocks of 6.4, 5.4, and 7.1 M, and many perceptible aftershocks.

N=25

# Sampling Frame

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## Anchorage and the Matanuska-Susitna Borough, Alaska

### **Anchorage School District:**

- 59 elementary schools, 10 middle schools, 10 high schools, 9 Charter schools, and 15 alternative schools
- Respondents were sampled from 7 elementary schools, 2 middle schools, 3 high schools, and 1 alternative advanced science school

### **Matanuska-Susitna Borough School District:**

- 21 elementary schools, 6 middle schools, 9 high schools, and 13 non-traditional schools
- Respondents were sampled from 2 middle schools, 2 high schools, 1 K-12 Charter school, and 1 non-traditional advanced science school

# Sampling Frame

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## Ridgecrest and Trona, California

### **Sierra Sands Unified School District:**

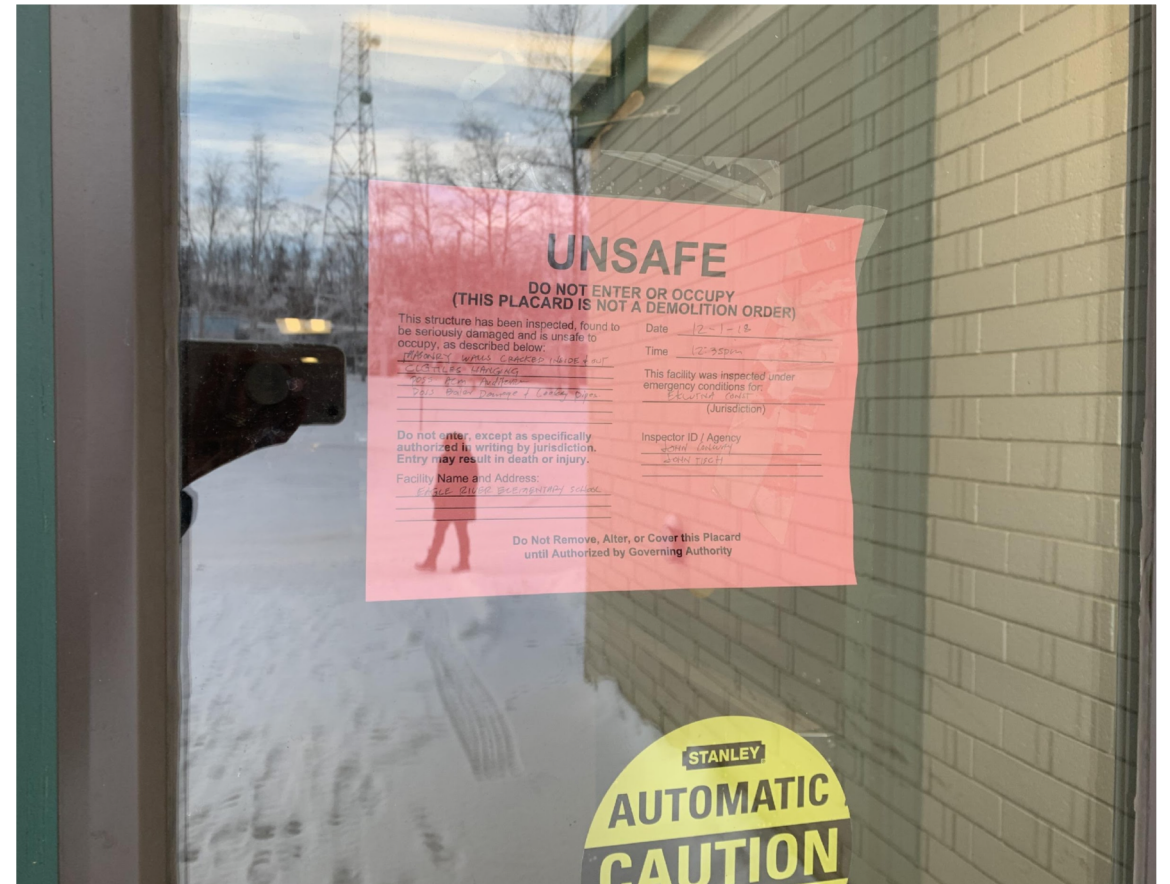
- 6 elementary schools, 2 middle schools, 2 high schools, and 1 non-traditional school
- Respondents were sampled from 2 traditional elementary schools, 1 Montessori elementary school, 2 middle schools, and 1 high school

### **Trona Joint Unified School District:**

- 1 elementary school and 1 high school
- Respondents were sampled from both schools

# Research Methods

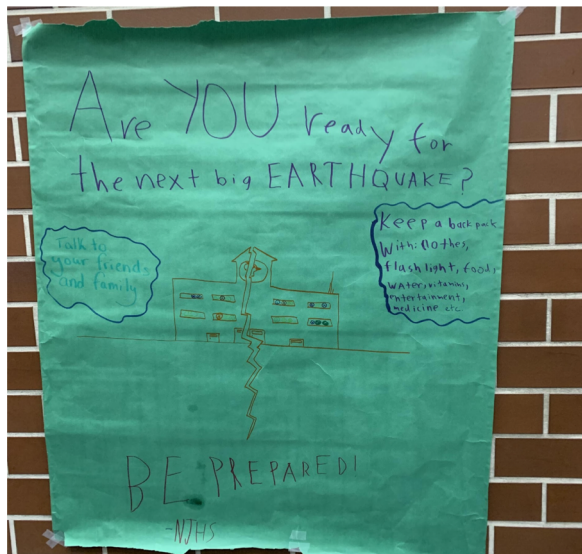
- **Study Sample:** K-12 school administrators, emergency managers, building officials, teachers, parents, students, and engineers.
- **Data Collection:** We conducted in-depth interviews and focus groups with 88 participants in Alaska in January and 25 participants in California in February 2020.
- **Research Questions:** We asked study participants about their recent earthquake experiences, gaps between preparedness and protective action decision-making, and their perceptions of EEW systems.



# Preliminary Findings: Alaska

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- Earthquake drills occur at least two times/year in the schools
- 3 schools experienced severe damage and remain closed
- Students and staff displaced from closed locations joined other district schools
- Mixed emotional impacts were reported—parents and teacher reactions influenced students
- Most common action taken by students was to drop, cover, and hold on; some ran out of buildings
- There are mixed feelings about EEW—some respondents feel funding would be prohibitive to other safety approaches such as strengthening buildings



# Preliminary Findings: California

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- Earthquake drills occur at least once/year
- 2 schools remain closed
- Some students are still recovering emotionally
- Students were displaced to other district schools
- Teachers report that schools need better plans for special needs students and for students not in classrooms
- Respondents appeared receptive to EEW—but suggest it should: 1) be free and equally accessible to all schools; 2) have clear messaging and protocols for implementation; 3) offer mobile and alert system access



# Implementing EEW

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## Barriers

- Limited/diverted funding
- Disruption in classroom
  - Issues with “over-drilling” from various hazards
- Increased anxiety
  - Confusion on Alert Systems (shooter vs. earthquake vs. other hazard)
  - Confusion Among Adults about Recommended Protective Actions

## Benefits

- Advanced warning to help students stay safe
- Reduced panic among teachers and administrators



# Implementing EEW

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## Recommendations

- EEW must be integrated with existing drills to be effective
- Mitigation should be prioritized and coupled with EEW for structurally unsafe sites
- More to come! Analyses still under way.





