

***Evacuation vs. shelter-in-place:  
How will residents respond?***

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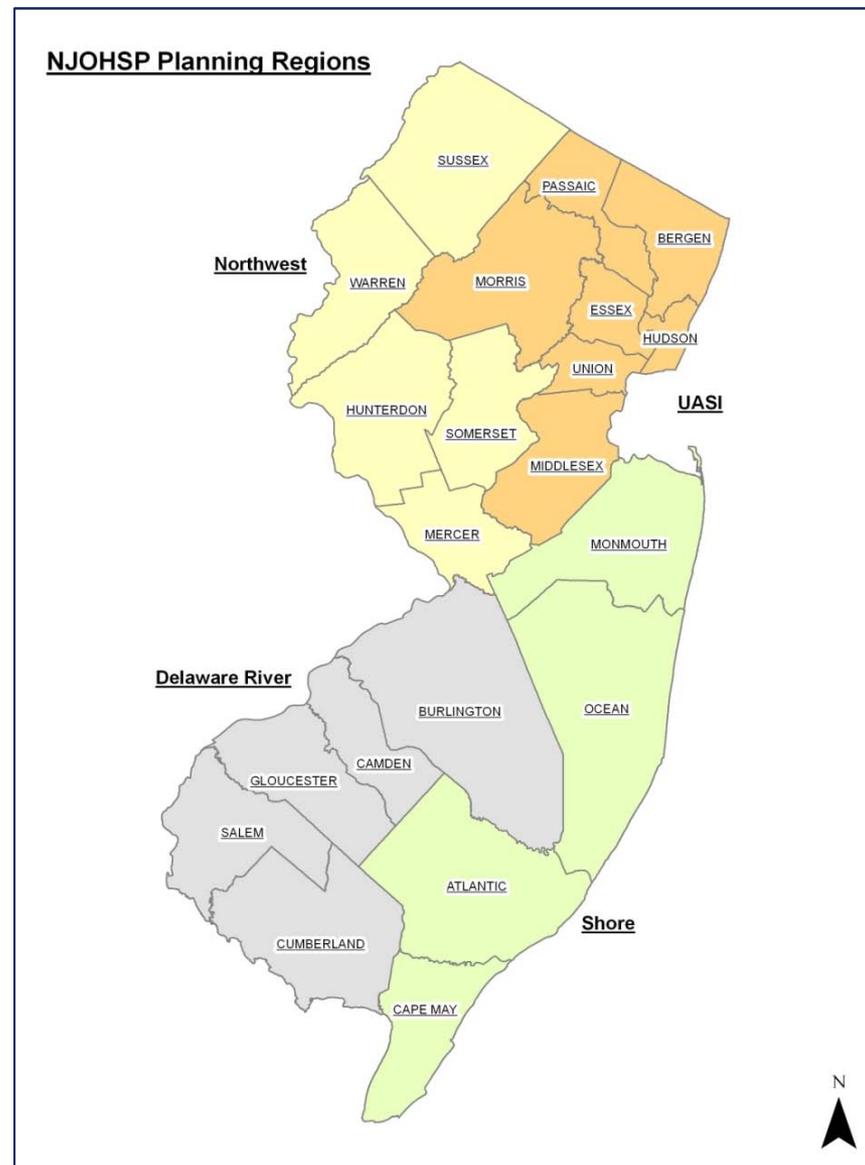
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# New Jersey Regional Mass Evacuation Planning Studies

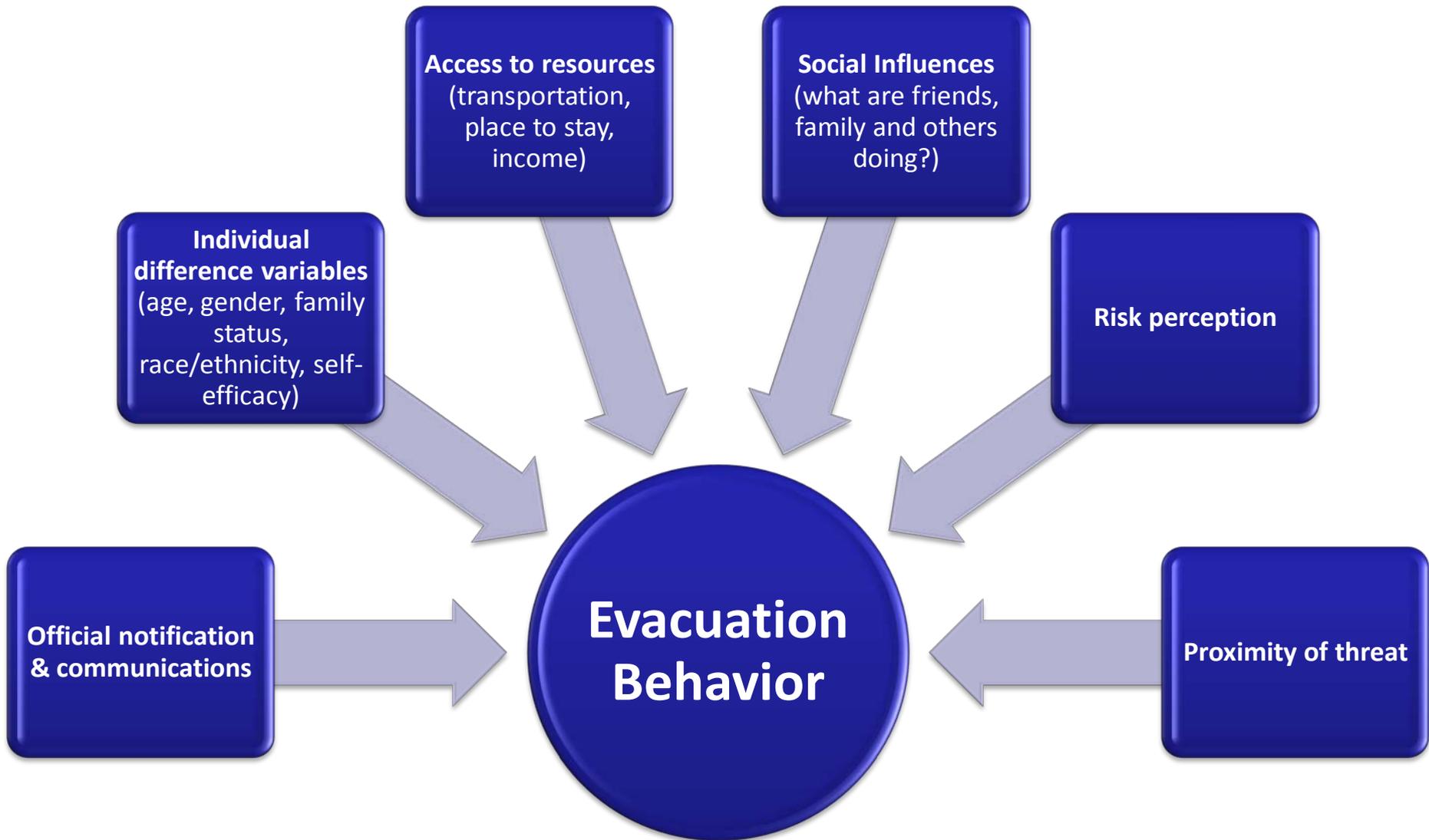
- UASI Region (7 counties)
  - Plan reviews & gaps analysis
  - Behavioral studies (2 surveys)
  - Transportation resource inventory
  - Regional evacuation travel demand model
  - Regional mass evacuation plan & annexes
  
- 3 Non-UASI Regions (14 counties)
  - Tasks & products same as above
  - Except...transportation model & plan writing in future phases



## Key Study Questions:

1. How prepared is the region to undertake mass evacuation operations in the event of disaster?
2. How might different disasters affect transportation infrastructure (highways & transit)?
- 3. What evacuation travel demand may result from different types of disasters?**
4. How will transportation systems perform under disaster conditions and travel demand?

# Theoretical Foundation for Predicting Evacuation Behavior



## Survey Methods and Design

- Surveys conducted Aug 12 to Oct 15, 2008 (UASI) & Feb 6 to Mar 18, 2009 (Non-UASI)
- Respondents drawn from 4 random samples (n=3,618)

	<b>7-county UASI Region Sample</b>	<b>Newark Oversample</b>	<b>Jersey City Oversample</b>	<b>14-county Non-UASI Region Sample</b>
<b>No. of completed interviews</b>	<b>1,418</b>	<b>400</b>	<b>400</b>	<b>1,400</b>
<b>AAPOR3 Response Rate</b>	<b>20.4%</b>	<b>21.6%</b>	<b>20.1%</b>	<b>21.9%</b>
<b>AAPOR3 Cooperation Rate</b>	<b>33.1%</b>	<b>36.7%</b>	<b>36.2%</b>	<b>36.9%</b>

*Response rate = number of completed interviews / potentially eligible respondents in sample*  
*Cooperation rate = number of completed interviews / potential respondents ever contacted*

## Evacuation Behavior Survey – Questionnaire Design

- Series of general primer questions:
  - disaster preparedness and risk perception
  - past evacuation experience
  - evacuation destination and mode choice
- Evacuation likelihood questions under different scenarios
- Response-dependent follow-up questions
- Socio-economic and demographic questions

# Potential Evacuation Response Rates

**Q: How likely are you to voluntarily self-evacuate?**

	Hurricane + Flooding		Terror Attack: IND	Terror Attack: IED	Terror Attack: Dirty Bomb		Ind. Accident: Chemical Plant	Ind. Accident: Hazmat Train
	UASI	Non-UASI	UASI	Non-UASI	UASI	Non-UASI	UASI	Non-UASI
Very likely	47%	32%	67%	38%	46%	50%	57%	30%
Somewhat likely	19%	23%	13%	26%	17%	25%	19%	17%
Not very likely	17%	27%	6%	19%	18%	10%	11%	29%
Very unlikely	14%	17%	9%	15%	14%	14%	9%	21%
DK/Refused	2%	1%	5%	2%	5%	0%	4%	3%

# Rates of Compliance with Shelter-in-place Order

**Q: If likely to self-evacuate, how likely would you be to shelter-in-place if instructed to do so?**

	Hurricane + Flooding		Terror Attack: IND	Terror Attack: IED	Terror Attack: Dirty Bomb		Ind. Accident: Chemical Plant	Ind. Accident: Hazmat Train
	UASI	Non-UASI	UASI	Non-UASI	UASI	Non-UASI	UASI	Non-UASI
<b>Very likely</b>	<b>69%</b>	<b>71%</b>	<b>67%</b>	<b>77%</b>	<b>70%</b>	<b>51%</b>	<b>71%</b>	<b>71%</b>
<b>Somewhat likely</b>	<b>20%</b>	<b>19%</b>	<b>18%</b>	<b>18%</b>	<b>19%</b>	<b>25%</b>	<b>17%</b>	<b>23%</b>
<b>Not very likely</b>	<b>6%</b>	<b>4%</b>	<b>6%</b>	<b>3%</b>	<b>4%</b>	<b>14%</b>	<b>5%</b>	<b>3%</b>
<b>Very unlikely</b>	<b>4%</b>	<b>4%</b>	<b>8%</b>	<b>2%</b>	<b>5%</b>	<b>8%</b>	<b>5%</b>	<b>3%</b>
<b>DK/Refused</b>	<b>1%</b>	<b>1%</b>	<b>2%</b>	<b>1%</b>	<b>1%</b>	<b>3%</b>	<b>1%</b>	<b>1%</b>

# Empirical Analysis

- Who may evacuate and why?
  - Prepared separate binary logistic regression models for each scenario
  - Considered the relationship between socioeconomic and demographic characteristics and stated evacuation response
  - Consistent with the approach dominant in evacuation behavior studies

## Differentiating Factors in Evacuation Decisions

Factor	Expected evacuation behavior
Risk perception high	↑
Past evacuation experience	?
Live close to disaster	↑
Pet(s) present at home	↓
Person with specific care need living at home	↓
Homeowner living more than five years at current residence	↓
Racial minority	?
Low-income	↓
Zero-vehicle household	↓
Educational attainment high	↑
English <u>not</u> primary language spoken at home	↑
Married with children under 18 living at home	↑
65 years of age or older	↓

Note: Expected evacuation behavior based on literature review

Key: ↑ = more likely to evacuate ↓ less likely to evacuate,

## Preliminary Observations from Survey Analysis

- Overall we found that regional differences matter:
  - UASI region is more densely populated, has more ethnic and linguistic minorities and poor and has more zero-vehicle households. These characteristics increase evacuation propensity
  - The Non-UASI counties have more elderly and more households with pets. These characteristics lower evacuation propensity
  - Strong risk perception was associated with higher evacuation propensity but regional differences were observed
  - Socio-economic status was more important than race in explaining likelihood of evacuation in the Non-UASI counties; while race was a stronger influence in the UASI region

## Preliminary Observations - Continued

- Across all scenarios and regions, we found strong evidence that proximity strongly influences evacuation rates
- Our modeling results also suggest :
  - Individuals from households with less than \$25,000 income as well as persons of Hispanic ethnicity are more than 3x as likely to say they will evacuate than others
  - Individuals from households with incomes in excess of \$100,000 are 50% less likely to say they will evacuate
- Likelihood of evacuation was most predictable under a hurricane scenario and results were most consistent with expected behavioral response
- Expected patterns persist under other scenarios, but the results were less likely to be statistically significant

## Preliminary Observations - Continued

- With regard to shelter-in-place compliance, overall stated rates of compliance were high
- At the same time, there appear to be some differences based on the nature and severity of threat, region of residence, as well as personal characteristics:
  - Higher income and educated appear less compliant
  - More “disadvantaged” individuals appear to be more compliant
- Analysis is on-going...

## Research to Practice

- Using the results to estimate potential evacuation demand for different threats under varying conditions and assumptions
- Incorporating the evacuation demand estimates into a regional evacuation travel demand model
- Developing a comprehensive, all-hazards public notification and communication strategy to help manage potentially unnecessary “shadow” evacuation

# Thank you!

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