

Evacuation Behavior Survey for No-Notice Emergency Scenarios

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Outline

- Background and motivation for the survey
- Survey Objectives
- Design Challenges
- Selected Results
- Conclusions



Background

- Existing work on evacuation surveys
 - Advance-notice events – mostly focusing on natural disasters (i.e. hurricanes, tsunamis)
 - Post-event studies (effects of earthquakes, flooding, etc.)
- Much less research on no-notice events
 - Generally man-made disasters (i.e. terrorist attacks, industrial accidents, etc.)
- More understanding needed of individual behavior in such scenarios
 - Generally assumed that individuals follow government orders and evacuate to reception centers/shelters/etc.



Survey Objectives

- Predict individual travel behavioral responses to evacuation warnings:
 - Induced demand (resource gathering, meeting family, etc.)
 - Evacuation travel patterns
 - Shelter-in-place vs. evacuate and shadow evacuations
- Collected as part of larger effort to simulate transportation network impacts of no-notice emergencies
- Attempt to collect data for modeling evacuation travel patterns
 - Individual stated intentions for reacting to hypothetical emergency scenarios in Chicago area
 - Scenarios vary in terms of location, severity, government recommendations
 - Responses all based on observed day travel patterns



Primary Challenges in Survey Design

- Cost and time constraints necessitated web collection
- Collection of travel patterns for entire household by proxy individual
- Unfamiliarity of the scenario for the average household (i.e. stated behavior may not be representative)
- Collecting useful data which allows for model estimation across multiple design criteria:
 - Timing of the event
 - Location of the event
 - Severity of the event (impact and event radius)
 - Government Recommendation
 - Interplay between the above factors and the household travel patterns)



Survey Design Features

- Web-based survey
 - Allows high degree of customization and tailoring of survey
 - Minimizes data collection costs
 - Can cause potential coverage errors
 - Low response rates due to email based sampling
- Location data collected through Google Maps API
 - Intensive Javascript customization for each respondent
- Sampling procedure:
 - 20,000 emails sent by marketing provider – containing introductory material and link to survey
 - 324 responses received





THE UNIVERSITY OF
CHICAGO



Emergency Evacuation Response Survey

We thank you in advance for your help. We are conducting this survey to find out how people would react in the event of an emergency evacuation. Your answers are very important for planning and scientific research.

The survey is completely anonymous and will not take too long to complete. We will ask you for demographic information of you and other household members. Importantly, we will ask you about the decisions that you would make in the event of a city emergency.

Please answer the best you can, as your responses are extremely valuable for the successful completion of this study. Please begin now.

For more information about about the Transportation Research and Analysis Computing Center (TRACC) at Argonne National Laboratory, please visit our website at www.tracc.anl.gov

Please press 'Begin' to start the survey:

Begin





Emergency Evacuation Response Survey

Please enter a **name or nickname** for each household member. These can be anything such as "John", "First son", "Friend 1", etc. as long as it is meaningful to you.

After entering names, select the **relationship** of each household member to you.

	Enter a nickname for use in survey	Relationship Status
Adult 2	<input type="text" value="Jane"/>	<input type="text" value="Spouse"/>
Child 1	<input type="text" value="Sally"/>	<input type="text" value="Child"/>
Child 2	<input type="text" value="Tom"/>	<input type="text" value="Child"/>

Please select

Demographic data collection form

What was your approximate household income in the past year?

Less than \$25,000
 \$25,000 to \$50,000
 \$50,000 to \$75,000
 \$75,000 to \$100,000
 Over \$100,000
 no response

Do you own or rent your home (primary residence)?

Own
 Rent
 no response

Are there any disabled individuals under your care / in your household?

Yes
 No
 no response

Are there any pets in your home? Check all types that

Dog
 Cat
 Other
 no response

Indicate whether the following technologies are used by your household members (check all that apply):

Cellphone
 Smartphone or PDA
 Internet
 In-vehicle Navigation



For each map shown below, move the marker for each family member to their locations *Yesterday* at each time shown. If you (or other household members) are generally traveling at the times shown, move the marker to your destination location.

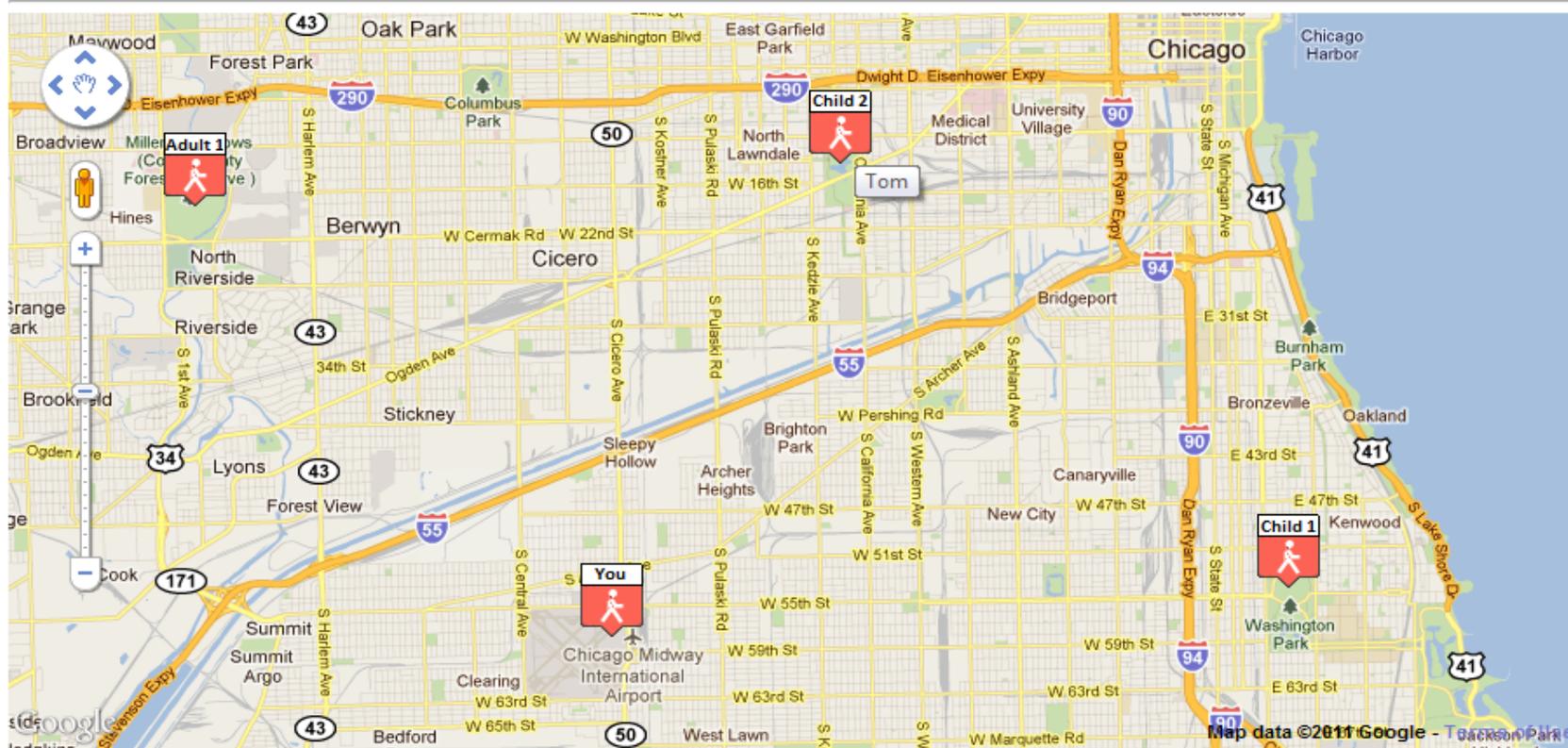
To pick the locations, drag the location pins with the mouse or use the search boxes with address, city/state, zipcode, etc. Try to place the location markers as accurately as possible.

For a quick tutorial on how to use Google Maps in this survey click [here](#).

Please indicate locations at 2:00 P.M. (Yesterday)

You:	Chicago Midway International Airport, S Cicero Ave	<input type="text"/>	<input type="button" value="🔍"/>
Jane (Adult 1)	Des Plaines Ave, Forest Park	<input type="text"/>	<input type="button" value="🔍"/>
Sally (Child 1)	Morgan Dr, Chicago	<input type="text"/>	<input type="button" value="🔍"/>
Tom (Child 2)	Burkhardt Dr, Chicago	<input type="text"/>	<input type="button" value="🔍"/>

Average day household travel pattern



Locations at 9 A.M. ✓

Locations at 2 P.M.

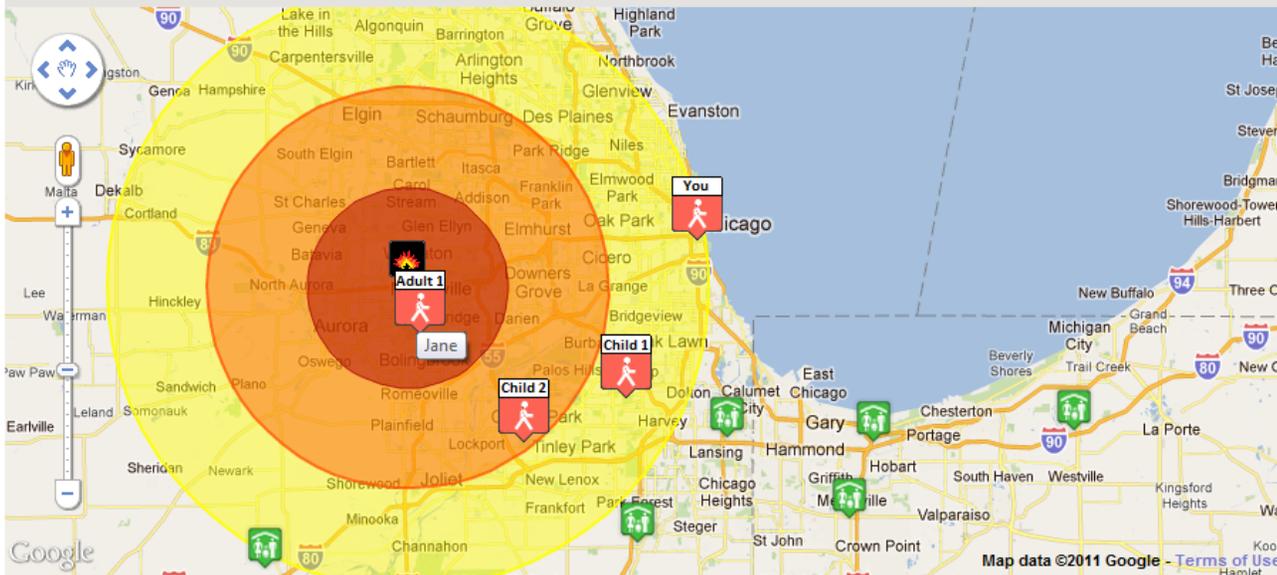
Locations at 7 P.M.

SCENARIO 1 DESCRIPTION:

An emergency event has occurred at 7PM within 10 miles of Jane. Government authorities have determined that there is high risks present to individuals in the area and have ordered that individuals evacuate immediately. Authorities have set up evacuation shelters as shown.

At this time you and your other household members are at the locations shown below and you have NO ACCESS to a vehicle.

Considering the current locations of you (and members of your household) and your knowledge of the event, please answer the following questions describing how you would respond.



Emergency Hazard Level:



Emergency Scenario varies by:

- Time
- Location
- Severity
- Radius
- Government Recommendation

Scenario 1 Response:

Considering the scenario presented above where the government has ordered that individuals evacuate, how likely would you be to:

	Very Unlikely		Neutral		Very Likely
Go about your day as usual	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stay where you are and seek shelter	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Make additional trips and / or evacuate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Evacuate if you heard others were evacuating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
Evacuate if people near you were evacuating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

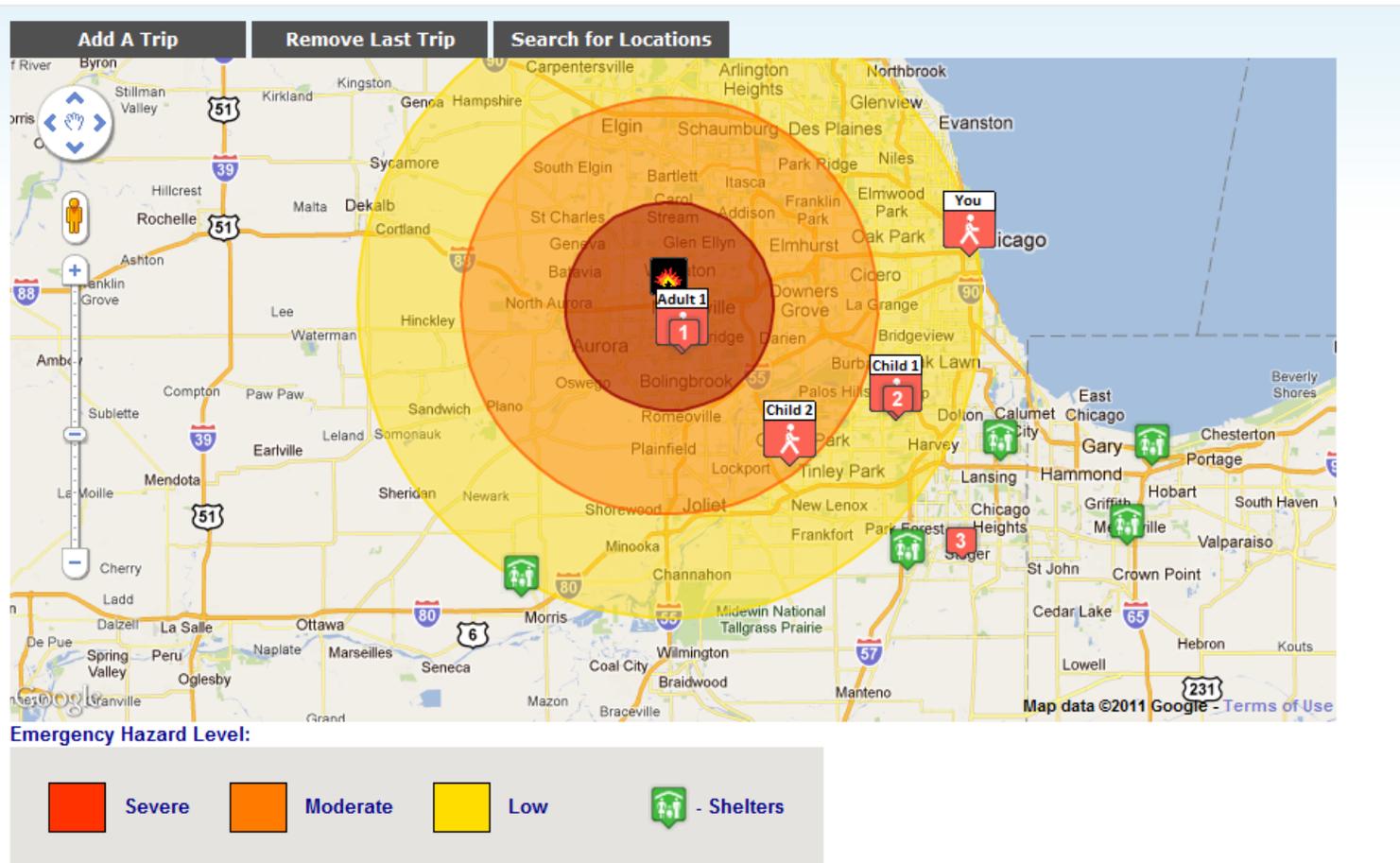


Add any stops you would make below, select the purpose for making the stop, and write any location information (i.e. address, city/state, zipcode).

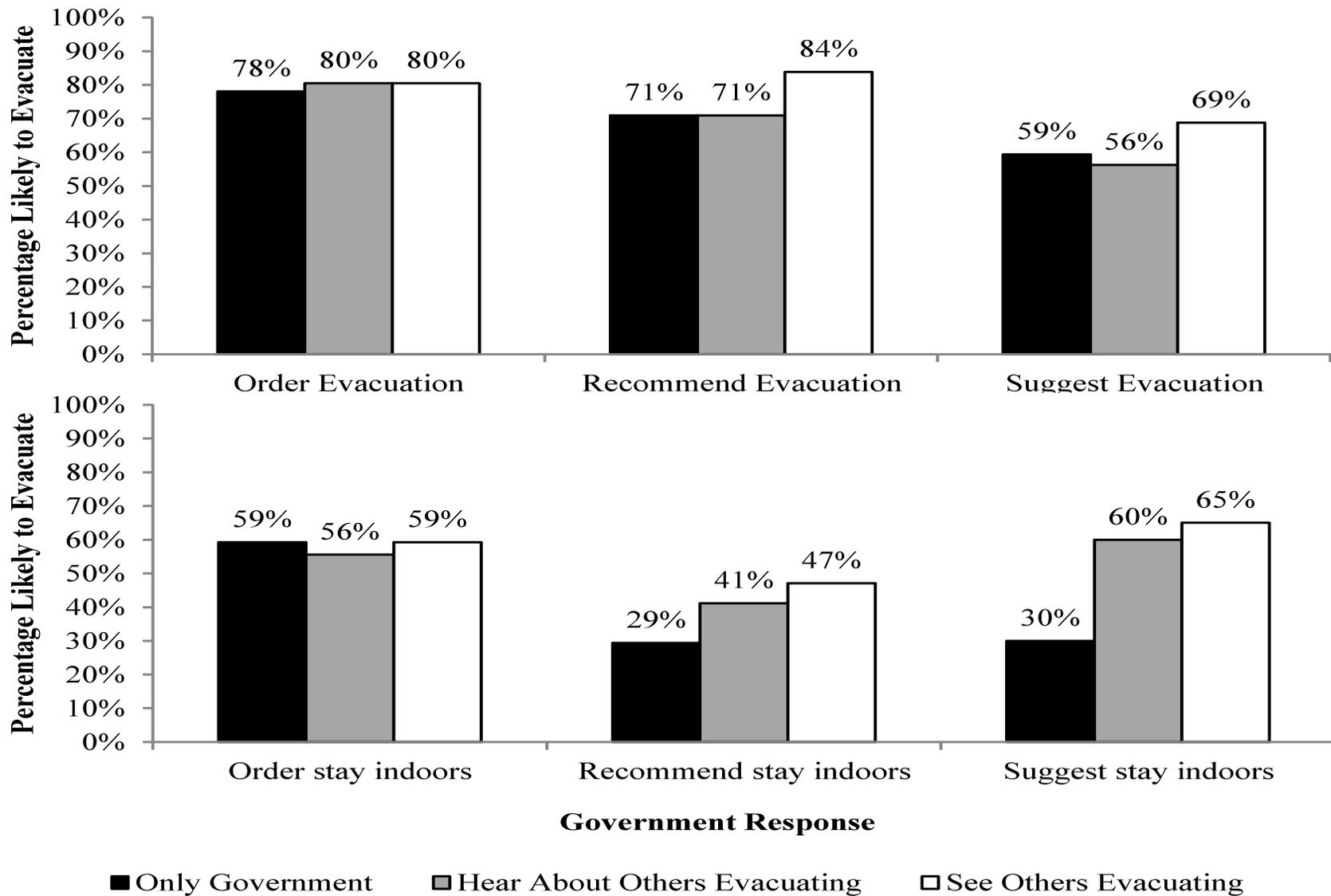
- To add new trips press the **Add Trip** button.
- When finished press the **Search Location** button and move the markers if needed.
- Press the **Next** button if you would not make any trips before evacuating.

	Trip Purpose:	Enter stop location (address, cross-streets, city/state, zipcode, etc.)
1st stop	Pick up Jane	S Naperville Plainfield Rd, Naperville
2nd stop	Pick up Sally	W 135th St, Palos Heights
3rd stop	Stop at home	S Independence Blvd, Crete
4th stop	Meet with others	

Induced travel demand

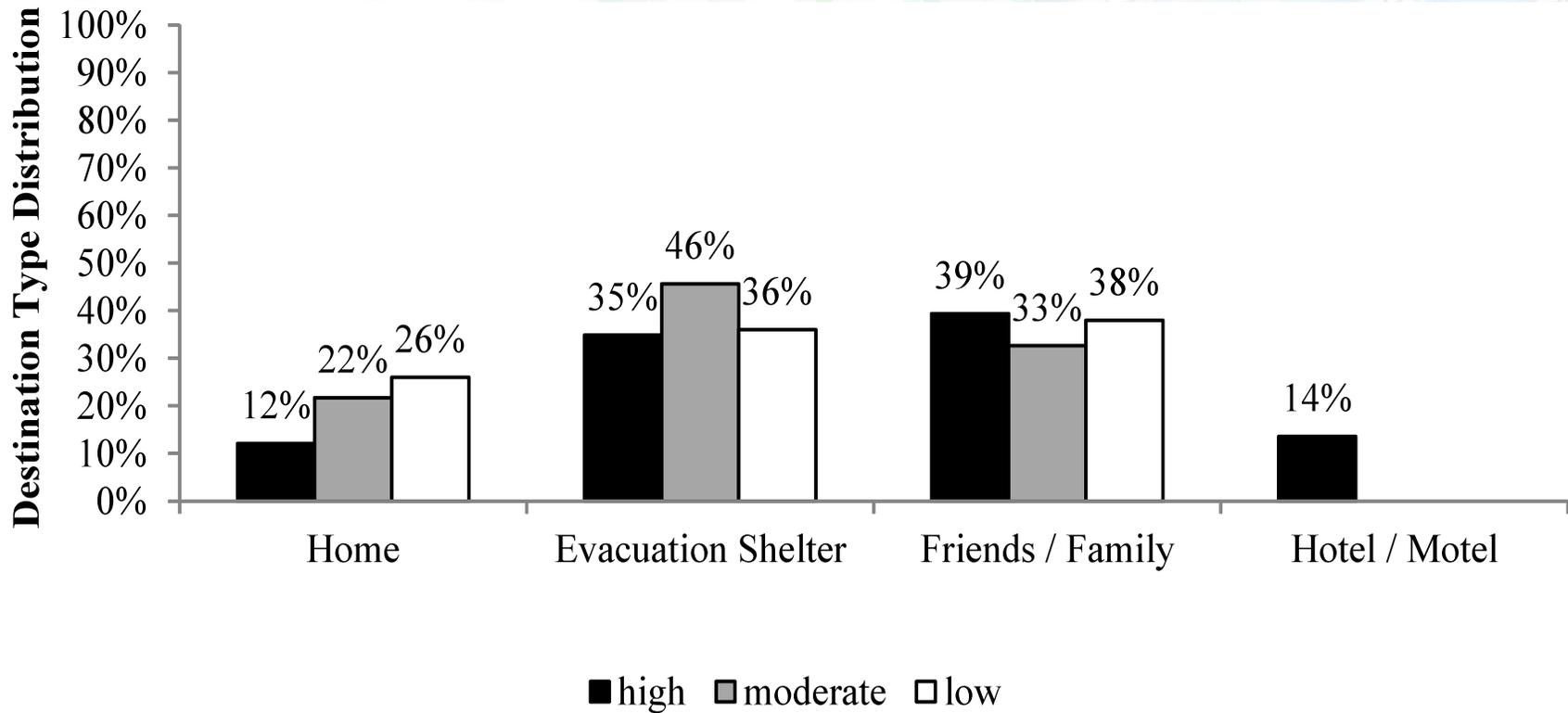


Selected Results: Evacuation Behavior by Government Response



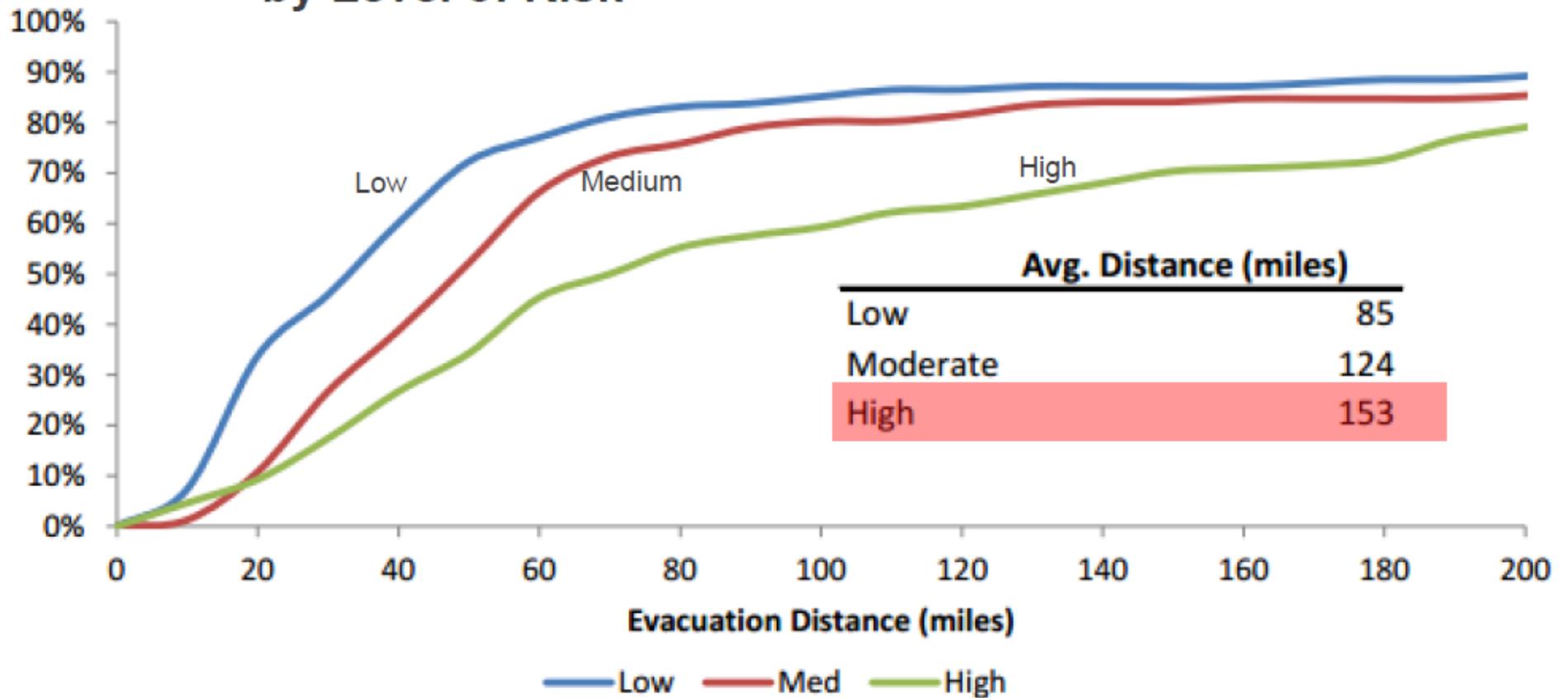
Selected Results

- Evacuation Destination by level of risk



Selected Results

Cumulative Distribution of Evacuation Distance by Level of Risk



Conclusions

- Lessons learned
- Internet-based tools facilitate allocation of complex scenarios
 - Dynamic tools seem to help convey the intention of the study
 - Visualize emergency scenarios geospatially
- Intensive specialized programming is needed
 - Google Maps API, JavaScript
- Coverage issues: validity of sample frame
 - Weighting methods needed to match known population totals
- Evacuation behavior is complex and individual responses don't often line up with government recommendations
 - Complicates planning for evacuations (i.e. evacuation routes, supply provision, reception centers, etc.)

