Social Factors as Modifiers of Hurricane Irene Evacuation Behavior in Beaufort County, NC

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Background

Hurricane Evacuation Behavior

Encouraging residents in high-risk areas to evacuate before a hurricane makes landfall is one of the few ways to reduce hurricane-related morbidity and mortality. However, many factors have been shown to discourage an individual's decision to evacuate. In light of this problem, public health interventions must increase rates of evacuation, especially among high-risk groups.

Unfortunately, previous studies have found inconsistent associations between evacuation in high-risk groups.

One proposed explanation for this inconsistency is that social factors – such as social capital, social cohesion, and social control – modify the relationship between other risk factors and evacuation behaviors. If these trends hold across populations, it could have important implications on the groups targeted for tailored interventions as part of the hazard mitigation planning process.

Hurricane Irene

▪ Began over the Atlantic Ocean on August 20, 2011, and was declared a federal emergency by the President of the United States on August 25, 2011.
▪ Made landfall in North Carolina as a Category 1 hurricane (winds up to 95 mph) on August 27, 2011.
▪ Responsible for at least 43 deaths in the US and Canada and caused 6.25 million people to lose power.
▪ On August 25, 2011, Beaufort County ordered a mandatory evacuation for all households in the 100-year flood plain and residents living in mobile homes. All other residents were under a voluntary evacuation order.

Beaufort County, NC

At the 2010 Census, Beaufort County, NC, had 47,759 residents and 19,941 occupied households. Permanent residents were 68.2% white, and 87.2% had lived in the same home for one year or longer. Just 6.3% of residents spoke a language other than English at home. Over 4 in 5 adults were high school graduates (81.5%). The median household income was $40,653, and 17.2% of the population was below the poverty level.

Lingering damage from Hurricane Irene in Beaufort County, NC, captured during data collection on October 7-8, 2011.

Acknowledgements

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Methods

Sample Selection

We used a stratified two-stage cluster sampling method to select 30 clusters containing 210 weighted random starting points for door-to-door interviews in Beaufort County, NC (Figure 1).

Figure 1. Map of 30 clusters in Beaufort County, NC.
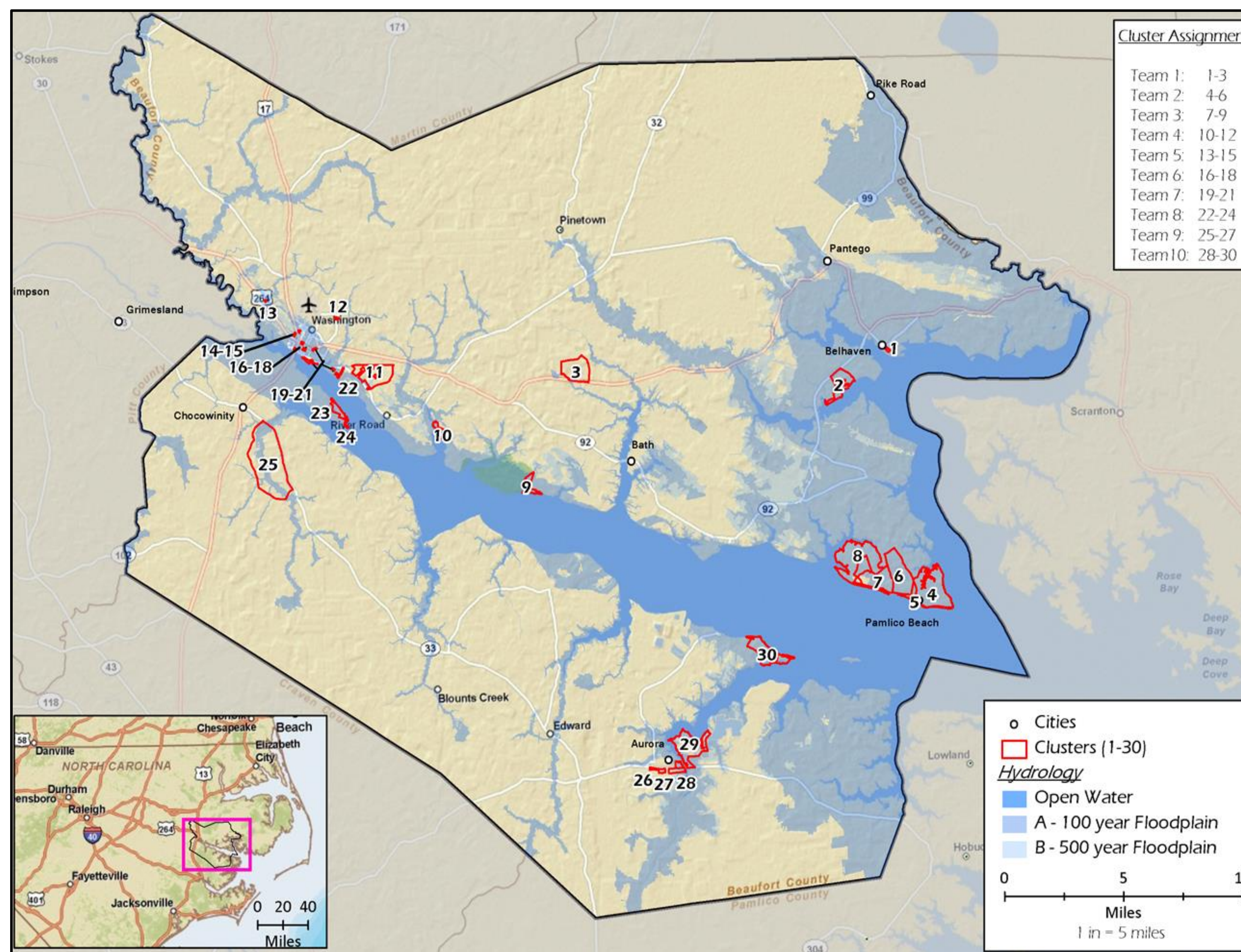
Data Collection

Door-to-door interviews were conducted on October 7-8, 2011. A group of 14 volunteers from UNC's Team Epi-Aid and four staff members from the UNC Center for Public Health Preparedness collected the data in two-person teams using handheld GPS-enabled computers running ArcPad 10.0 geographic information systems (GIS) software. The survey instrument contained 21 questions for the participant and four questions for the interviewer to answer about each respondent and their home.

Data Analysis

We used generalized linear modeling to analyze data from a cross-sectional stratified two-stage cluster sample of residents of Beaufort County, NC. This analysis produced crude risk differences (RDs) to estimate the association between failure to evacuate from Hurricane Irene and a number of demographic and social factors. We assessed effect measure modification on the additive scale through stratified analyses of the key social and demographic factors.

Conclusions

In Beaufort County, NC, there is evidence that social factors modified the association between demographic characteristics and failure to evacuate from Hurricane Irene. As such, special attention should be given to households with special needs residents with high social capital or social cohesion, males with high social capital, elderly residents with high social cohesion, and non-white residents with high social cohesion when planning future disaster evacuation communications for residents of high-risk coastal counties.

Results

Of the 226 attempted interviews, 205 were completed (response rate of 90.7%).

None of the demographic factors or measures of social control, social capital, or social cohesion assessed in this study produced statistically significant RD estimates for failure to evacuate at an alpha of 0.05 (Table 1).

However, significant effect measure modification was present for homes with special needs residents in relation to both social capital via social interactions (among no special needs residents, RD = -0.24, 95% CI: -0.37, -0.11; among special needs residents, RD = 0.44, 95% CI: 0.05, 0.84) and social cohesion via markers of territoriality (among no special needs residents, RD = -0.01, 95% CI: -0.19, 0.17; among special needs residents, RD = 0.50, 95% CI: 0.17, 0.83) (Figure 2).

Evidence of potentially significant effect measure modification was present between gender of respondent and social capital via organization membership, elderly residents and social cohesion via markers of territoriality, and race/ethnicity and social cohesion via markers of territoriality.

Table 1. Study population demographics, social factors, and the risk of failing to evacuate from Hurricane Irene (n=205).

	Study Population n	%	Evacuated n	%	Failed to Evacuate n	%	Risk Difference (95% Confidence Interval)
Age							
Born after 1952	93	45.37	24	25.81	69	74.19	0.04 (-0.09, 0.17)
Born before 1953	111	54.15	33	29.73	78	70.27	REF
Missing	1	0.49					
Race/Ethnicity							
White	148	72.2	44	29.73	104	70.27	REF
Non-white	56	27.32	12	21.43	44	78.57	0.08 (-0.06, 0.23)
Missing	1	0.49					
Gender							
Female	131	63.9	34	25.95	97	74.05	REF
Male	73	35.61	22	30.14	51	69.86	-0.04 (-0.18, 0.10)
Missing	1	0.49					
Home Ownership							
Rent home	48	23.41	12	25.00	36	75.00	REF
Own home	155	75.61	45	29.03	110	70.97	-0.04 (-0.18, 0.12)
Other	2	0.98					
Home Type							
Multi-unit or mobile home	69	33.66	15	21.74	54	78.26	REF
Single-family home	135	65.85	41	30.37	94	69.63	-0.09 (-0.22, 0.05)
Missing	1	0.49					
Resident 65+ years-old							
No	124	60.49	33	26.61	91	73.39	REF
Yes	81	39.51	24	29.63	57	70.37	-0.03 (-0.17, 0.11)
Resident <18 years-old							
No	162	79.02	50	30.86	112	69.14	REF
Yes	43	20.98	7	16.28	36	83.72	0.15 (0.00, 0.29)
Resident with special needs							
No	169	82.44	42	24.85	127	75.15	REF
Yes	32	15.61	14	43.75	18	56.25	-0.19 (-0.39, 0.01)
Missing	4	1.95					
Social Control Score							
<6	42	20.49	12	28.57	30	71.43	REF
6	163	79.51	45	27.61	118	72.39	0.01 (-0.16, 0.18)
Social Cohesion Score							
<6	82	40.00	24	29.27	58	70.73	REF
6	123	60.00	33	26.83	90	73.17	0.02 (-0.11, 0.16)
Social Cohesion: Markers of Territoriality							
None	165	80.49	48	29.09	117	70.91	REF
1 or more	40	19.51	9	22.50	31	77.50	0.07 (-0.10, 0.23)
Social Capital: Organizations							
None	70	34.15	19	27.14	51	72.86	REF
1 or more	135	65.85	38	28.15	97	71.85	-0.01 (-0.15, 0.13)
Social Capital: Social Interaction							
<15 hellos per day & < 5 visits	70	34.15	14	20.00	56	80.00	REF
≥15 hellos per day or ≥ 5 visits	135	65.85	43	31.85	92	68.15	-0.12 (-0.25, 0.01)
Social Capital: Volunteerism							
No	98	47.80	26	26.53	72	73.47	REF
Yes	106	51.71	31	29.25	75	70.75	-0.03 (-0.16, -0.11)
Missing	1	0.49					

Figure 2. Key stratified risk differences plots.
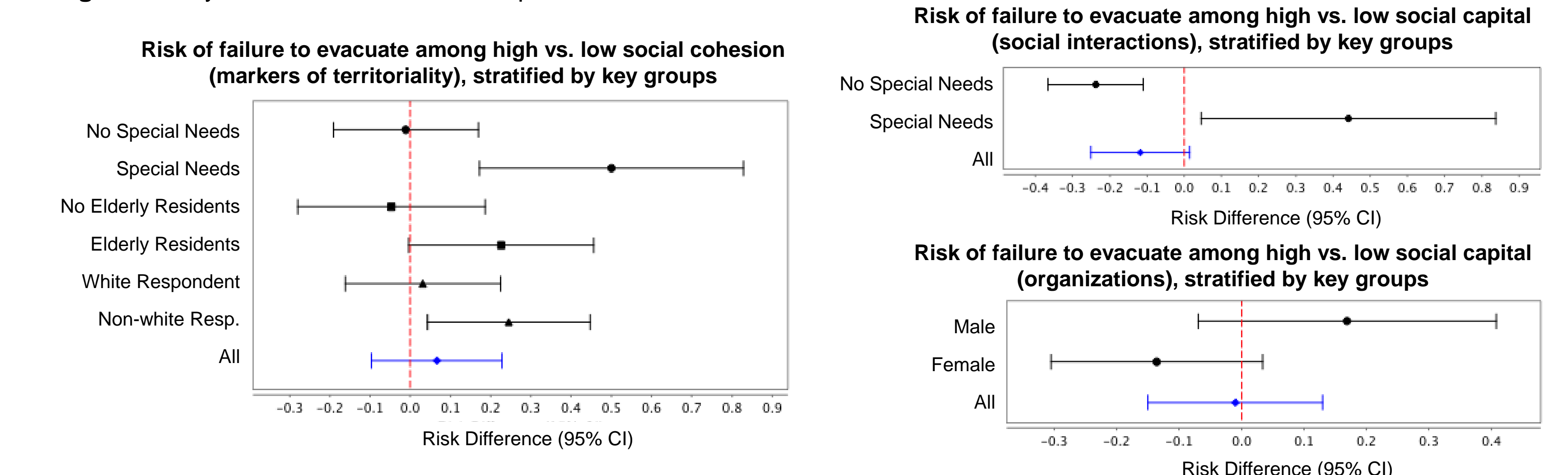
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