Household Dislocation in Lumberton

Lumberton Weekly Meeting

June 22, 2020

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Outline

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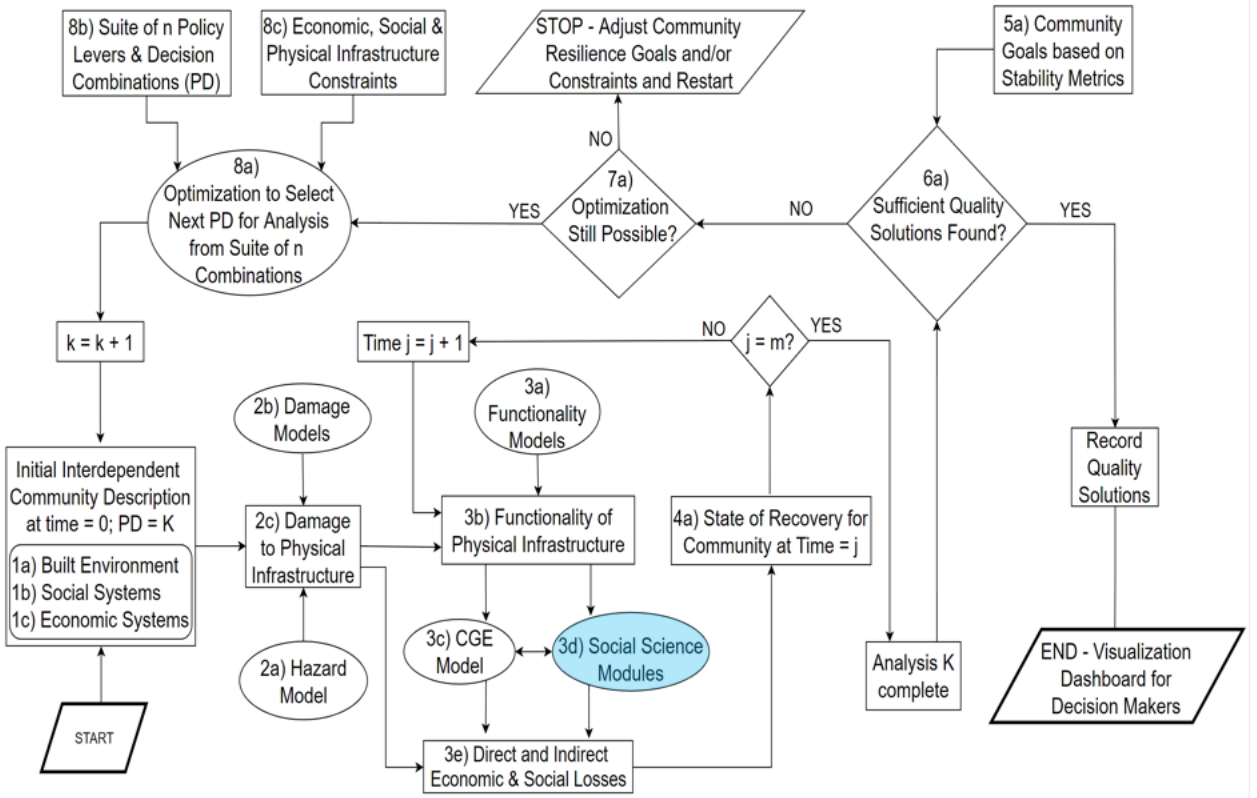
  - Dislocation Time Model



Current Household Dislocation Algorithm

- IN-CORE GitHub page
  - https://github.com/IN-CORE/pyincore/blob/master/pyincore/analyses/populationdislocation/populationdislocationutil.py

```
84          # coefficients for the Logistic regression model
85          coefficient = {"beta0": -0.42523,
86                         "beta1": 0.02480,
87                         "beta2": -0.50166,  # single family coefficient
88                         "beta3": -0.01826,  # black block group coefficient
89                         "beta4": -0.01198}  # hispanic block group coefficient
90
91          disl_prob = np.zeros_like(d_sf)
92          try:
93              disl_prob = 1.0 / (1 + np.exp(-1.0 * (coefficient["beta0"] * 1 +
94                                                    coefficient["beta1"] * (value_loss * 100) +
95                                                    coefficient["beta2"] * d_sf +
96                                                    coefficient["beta3"] * percent_black_bg +
                                                      coefficient["beta4"] * percent_hisp_bg)))
98          except Exception as e:
99              print()
                # raise e
101
102         return disl_prob
```

$$\Pr Dis_{jk} = \frac{1}{\left\{1 + e^{-\left[b_0 + b_1 \times \left(\%VLOSS_{jk}\right) + b_2 \times \left(D\_SF_{jk}\right) + b_3 \times \left(\%BLACK_{bg\,k}\right) + b_4 \times \left(\%HISP_{bg\,k}\right)\right]}\right\}}$$

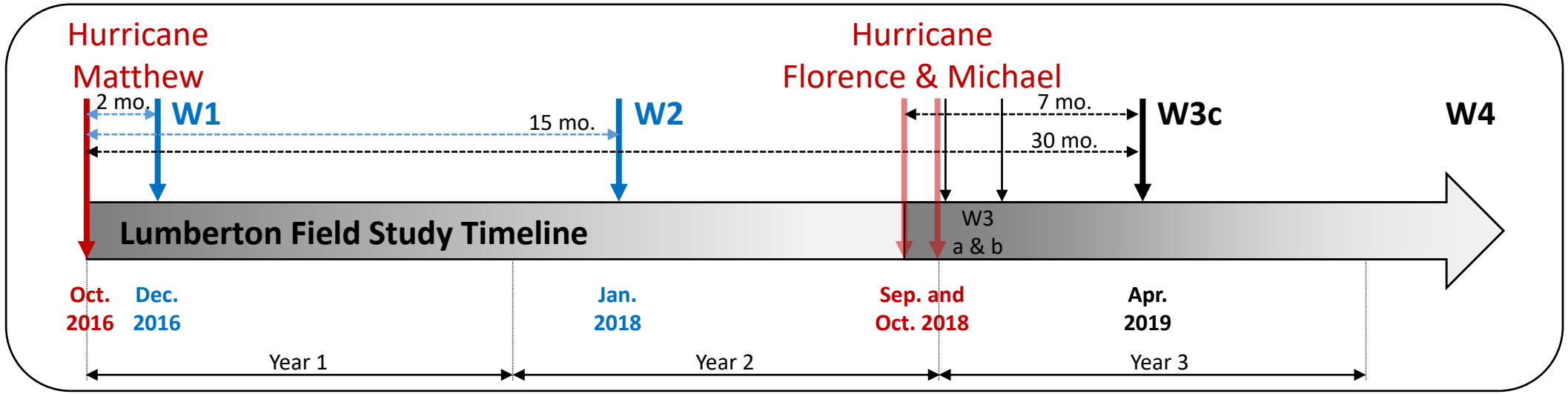
Damage: percent value loss of residential structure (damage level)

Building type: single-family residential (dummy variable)

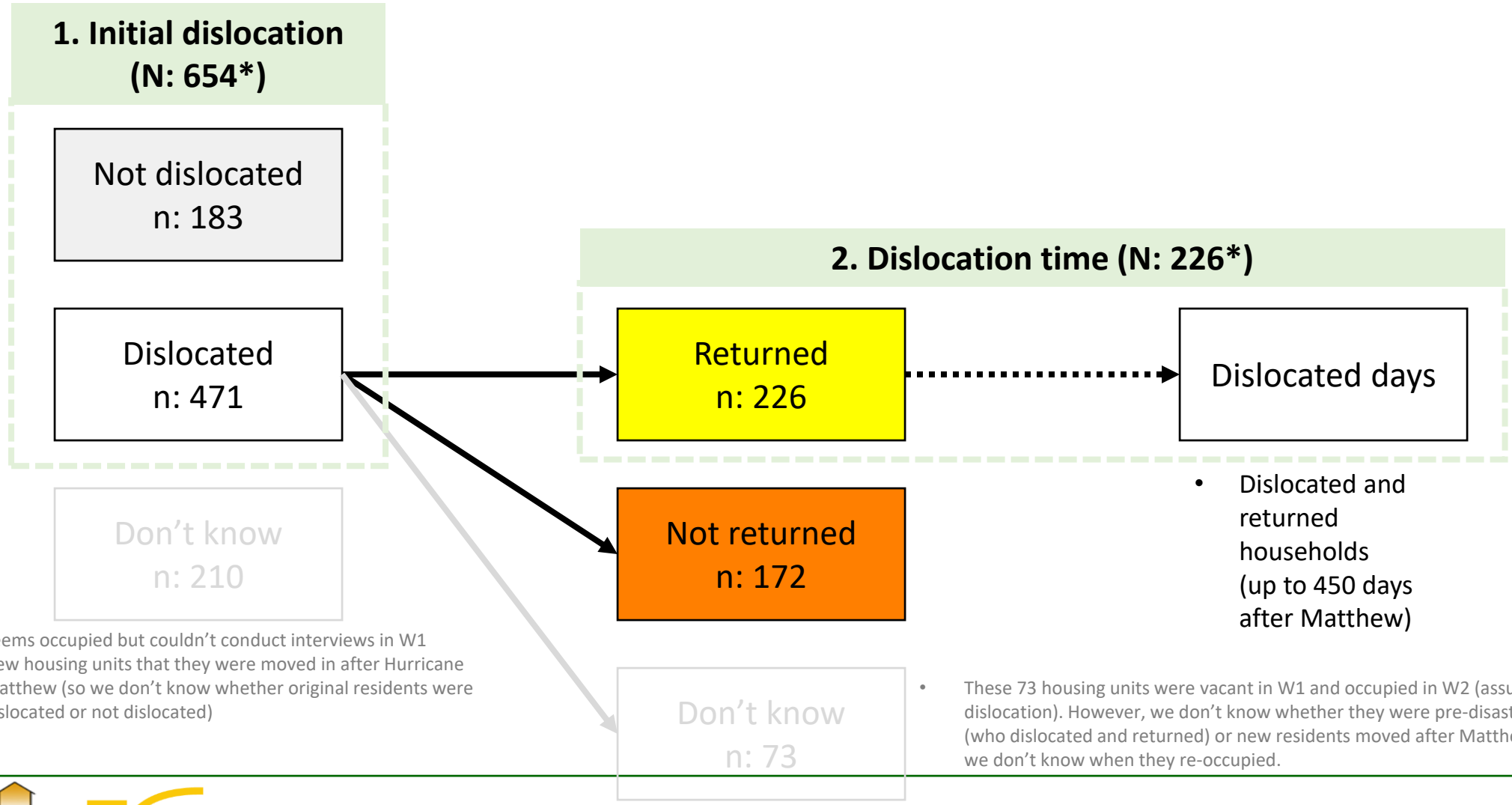
Race-ethnicity (aggregated) Percent of Black and Hispanic population in Block Group

Lumberton Dataset

- Household dislocation based on the Wave 1 and Wave 2 datasets
  - Matthew landfall: Oct. 8, 2016 (Lumber river peaked: Oct. 11, 2016)
  - Wave 1 conducted from Nov. 27 to Dec. 5, 2016 (2 months after HM)
  - Wave 2 conducted from Jan. 20 to Jan. 28, 2018 (15 months after HM)
- Initial dislocation & dislocation time up to 15 months (450 days)



Household Dislocation in Lumberton



- Dislocated and returned households (up to 450 days after Matthew)

- Seems occupied but couldn't conduct interviews in W1
- New housing units that they were moved in after Hurricane Matthew (so we don't know whether original residents were dislocated or not dislocated)

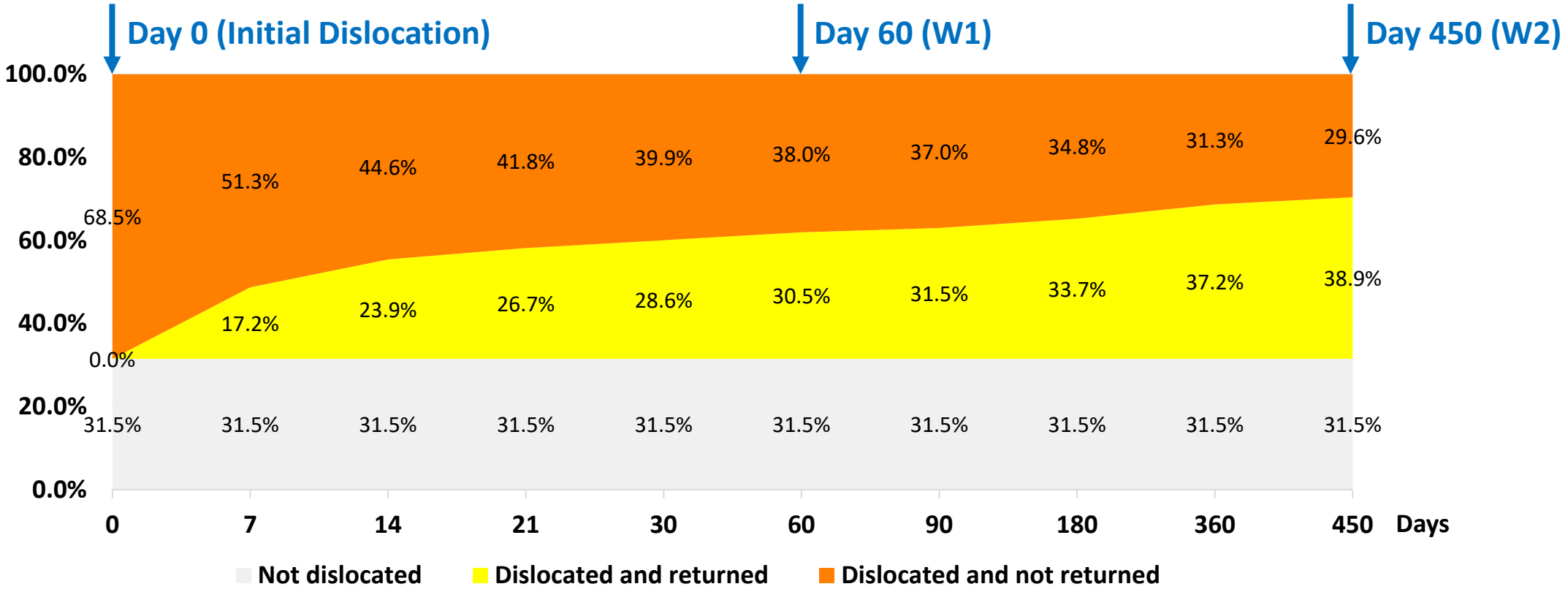
- These 73 housing units were vacant in W1 and occupied in W2 (assuming initial dislocation). However, we don't know whether they were pre-disaster residents (who dislocated and returned) or new residents moved after Matthew. Besides, we don't know when they re-occupied.

HRRCProjects\SponsoredResearch\IN-CORE\Text\Population Dislocation\Stata data and do files\Dislocation_3av6_Matthew_HH_Modeling_2020-06-18.do

* Weighted number of observations

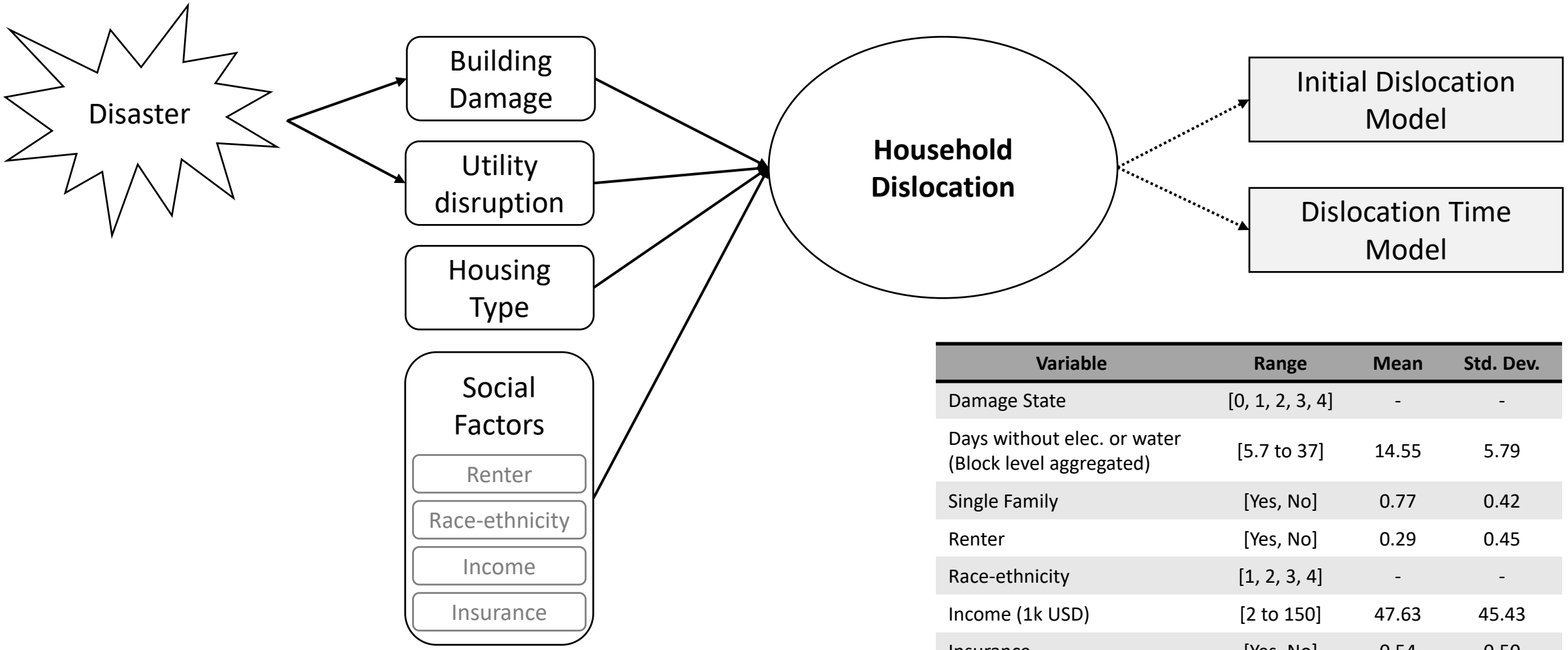
Household Dislocation in Lumberton

- Dislocation & return patterns from day 0 to day 450 (N: 226*)
  - Based on “dislocated & returned” households before Wave 2



* Weighted number of observations

Variables

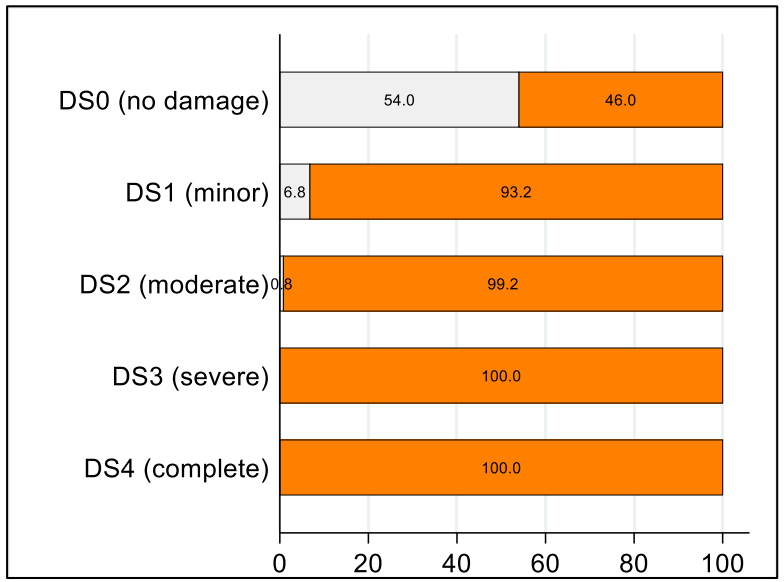


Variable	Range	Mean	Std. Dev.
Damage State	[0, 1, 2, 3, 4]	-	-
Days without elec. or water (Block level aggregated)	[5.7 to 37]	14.55	5.79
Single Family	[Yes, No]	0.77	0.42
Renter	[Yes, No]	0.29	0.45
Race-ethnicity	[1, 2, 3, 4]	-	-
Income (1k USD)	[2 to 150]	47.63	45.43
Insurance	[Yes, No]	0.54	0.50

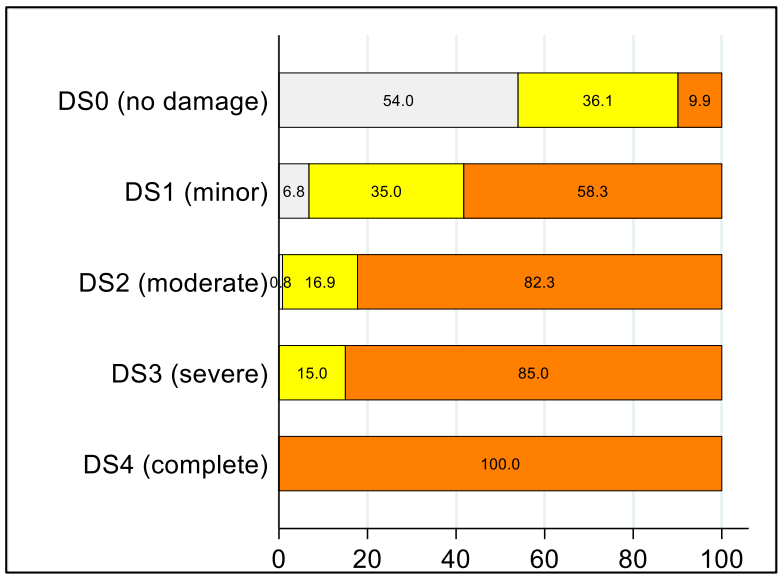
Building Damage

- Initial and short term household dislocation was driven by building damage
- There were other variations related to the dislocation time

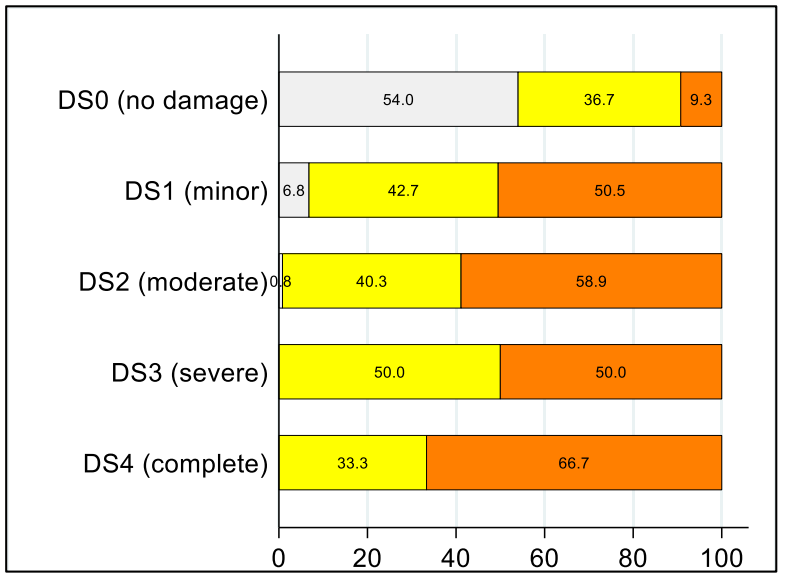
Day 0 (Initial Dislocation)

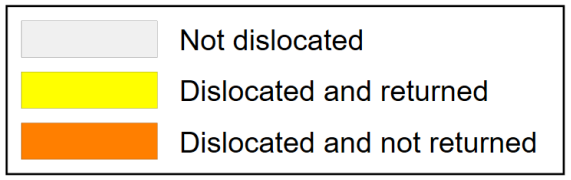


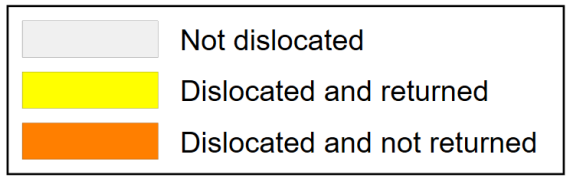
Day 60 (W1)

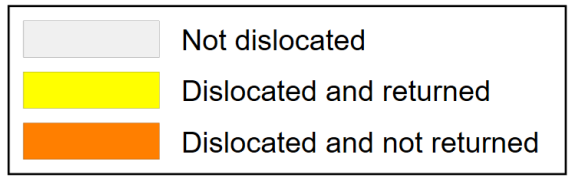


Day 450 (W2)





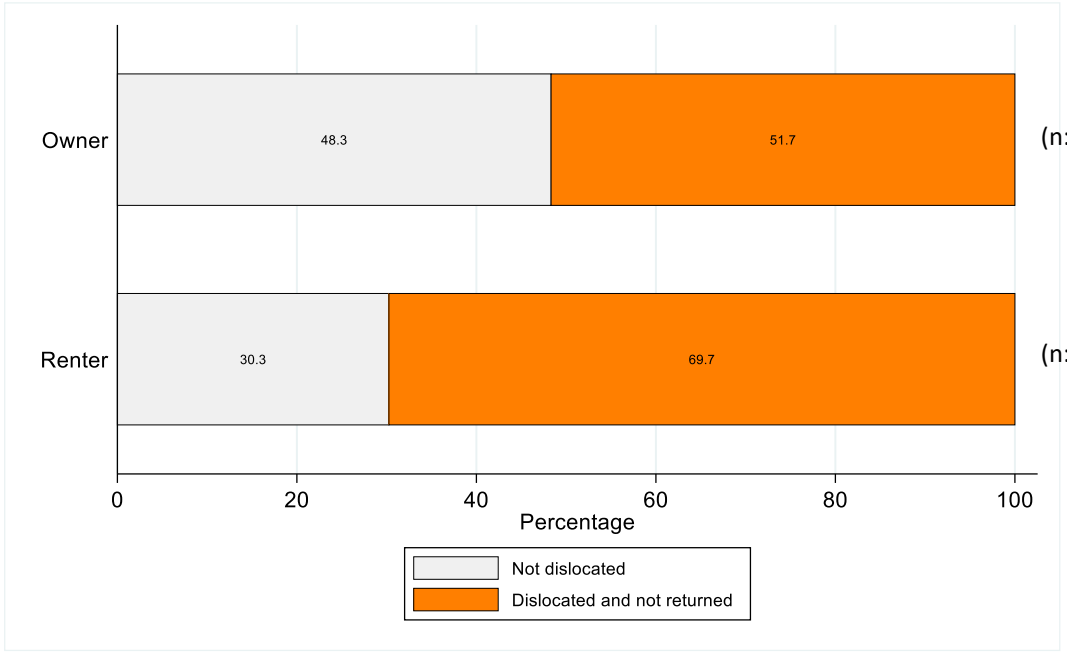




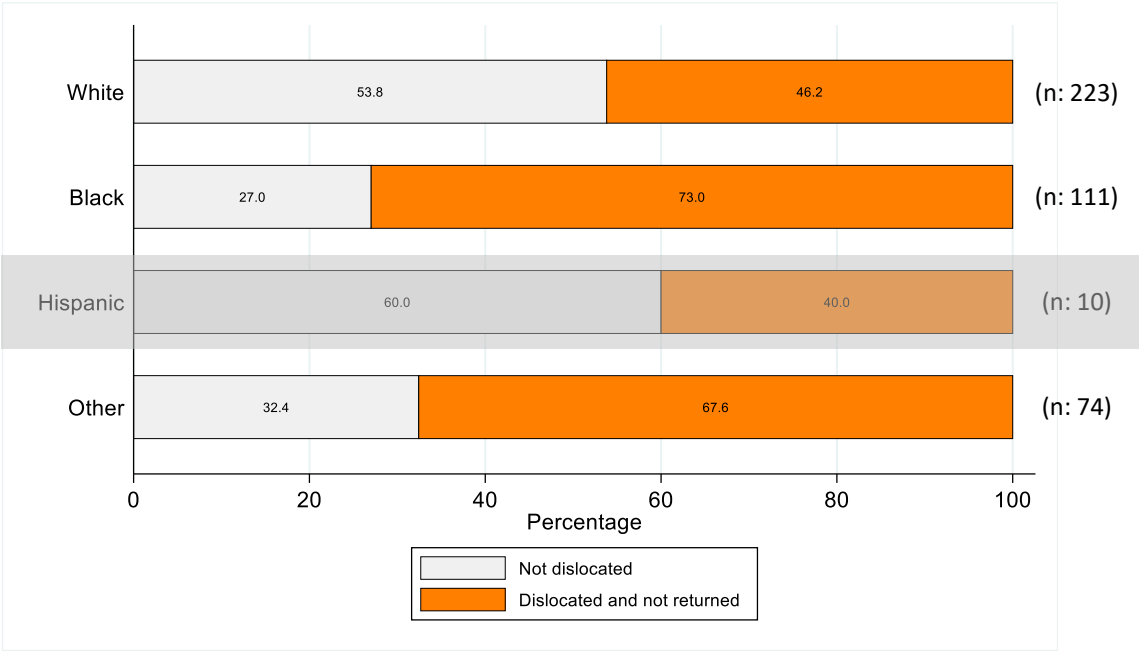
Tenure and Race-ethnicity

- Initial dislocation (day 0)

Tenure



Race-ethnicity



[DRAFT] Initial Household Dislocation Model

- Binomial logistic regression model
  - Not dislocated = 0 and dislocated = 1
    - Model 1: damage, utility disruption, and building type
    - Model 2: social factors
    - Model 3: all variables
- Result
  - Damage state (DS1 and DS2+) dictates the initial dislocation
    - All DS3 and DS4 households were dislocated
  - Positive: utility loss, renter, and insurance
  - Negative: single family, White household, higher income

Variable	Model 1 Coef.	Model 2 Coef.	Model 3 Coef. (OR)
Building Damage			
DS1	2.77***		2.20*** (9.05)
DS2+	5.31***		4.83*** (124.96)
Days without elec. or water	0.03*		0.05* (1.05)
Single family	-0.60**		0.42 (1.51)
Renter		0.34	0.75* (2.10)
Race-ethnicity			
White		-0.51	-0.68* (0.51)
Black		0.51	0.23 (1.26)
Hispanic		-0.48	-1.06 (0.35)
Income (1k USD)		-0.01***	-0.01*** (0.99)
Insurance		0.83***	0.78** (2.18)
N	653	339	339
Pesudo R2	0.32	0.09	0.32

***: 99%, **: 95%, and *: 90%

[DRAFT] Dislocation Time Model

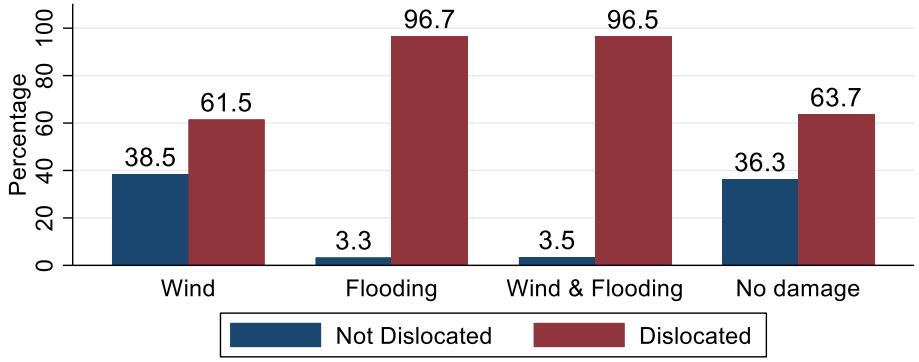
- OLS regression model
  - Dependent variable: dislocated days (from dislocated and returned households before Wave 2)
    - Model 1: dislocated days from 1 to 450
    - Model 2: log-adjusted dislocated days
- Result
  - More damage = more dislocated days
  - Positive: White and Black households, insurance
  - Negative: higher Income

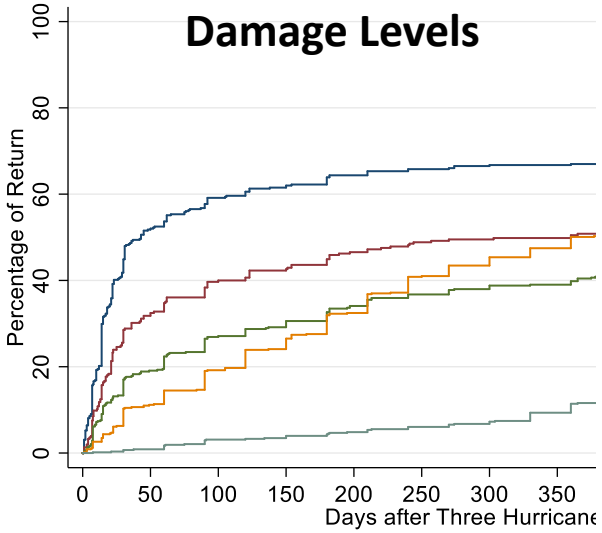
Variable	Model 1 Coef.	Model 2 Coef.
Building Damage		
DS1	46.62***	1.00***
DS2	117.95***	2.33***
DS3	129.77***	2.49***
DS4	235.16***	3.62***
Days without elec. or water	-0.11	0.02
Single Family	-25.37	-0.15
Renter	-0.62	0.26
Race-ethnicity		
White	46.76***	0.78***
Black	13.48	0.88***
Hispanic	-10.38	0.83
Income (1k USD)	-0.43***	-0.00*
Insurance	48.78***	1.06***
N	186	186
Adj. R2	0.4244	0.4884

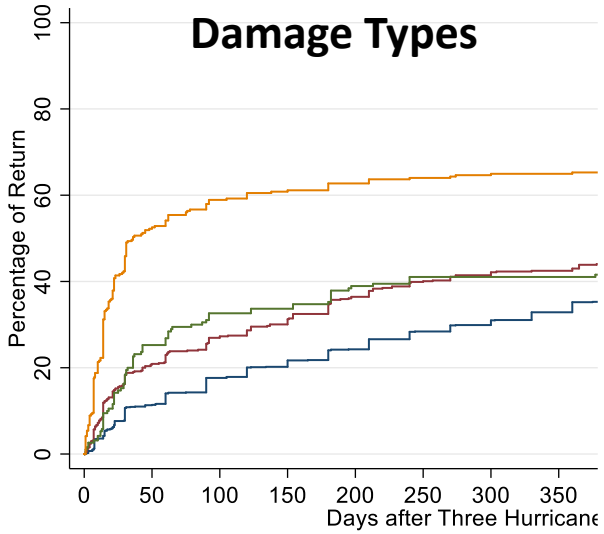
***: 99%, **: 95%, and *: 90%

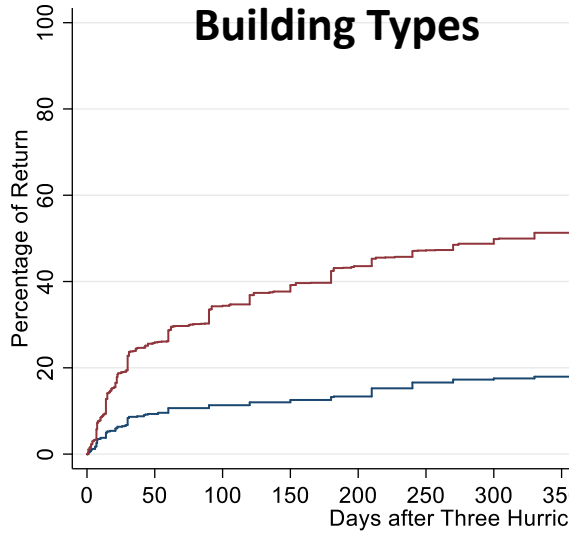
Future Plan

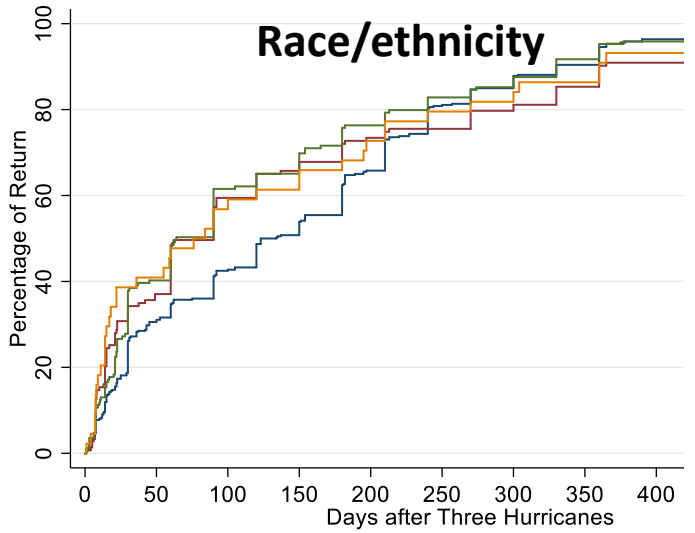
Hurricane	Date	Study Area	Primary Hazard
Andrew	Aug. 1992	Miami-Dade County, FL	Wind
Ike	Sep. 2008	Galveston Island and Bolivar Peninsula, TX	Surge Flooding
Matthew	Oct. 2016	Lumberton, NC	Riverine Flooding

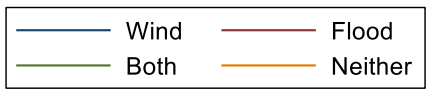


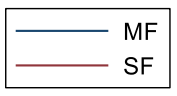


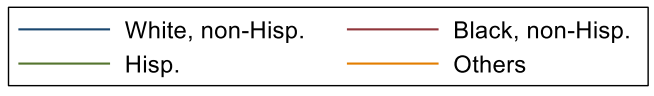












Thank you!
Questions?

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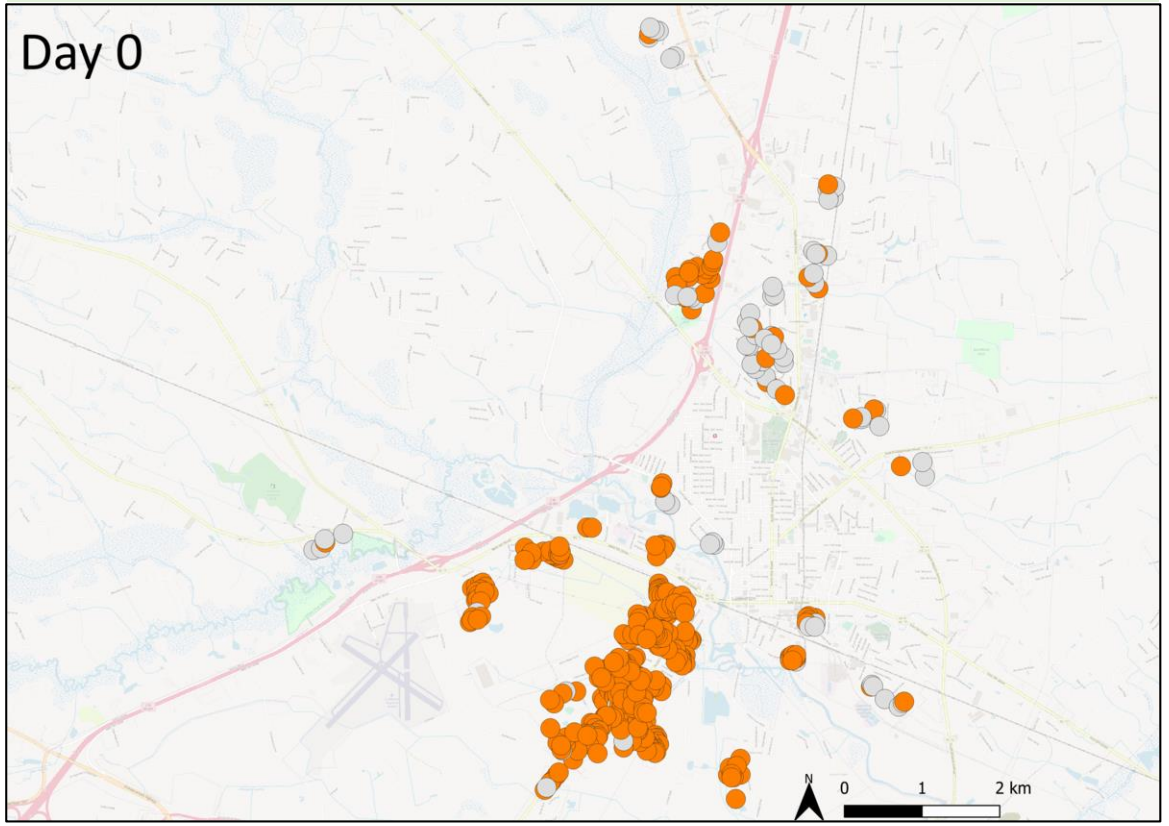
Household Dislocation (day 0 to day 360)



Building Damage and Utility Disruption Maps