Tornado Risk Perceptions and Sheltering Behavior during the COVID-19 Pandemic in 2020

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COVID-19 shifted people's hazard priority and tornado sheltering behaviors. People were more aware of COVID-19 related risks than tornado risks for using public shelters during 2020.
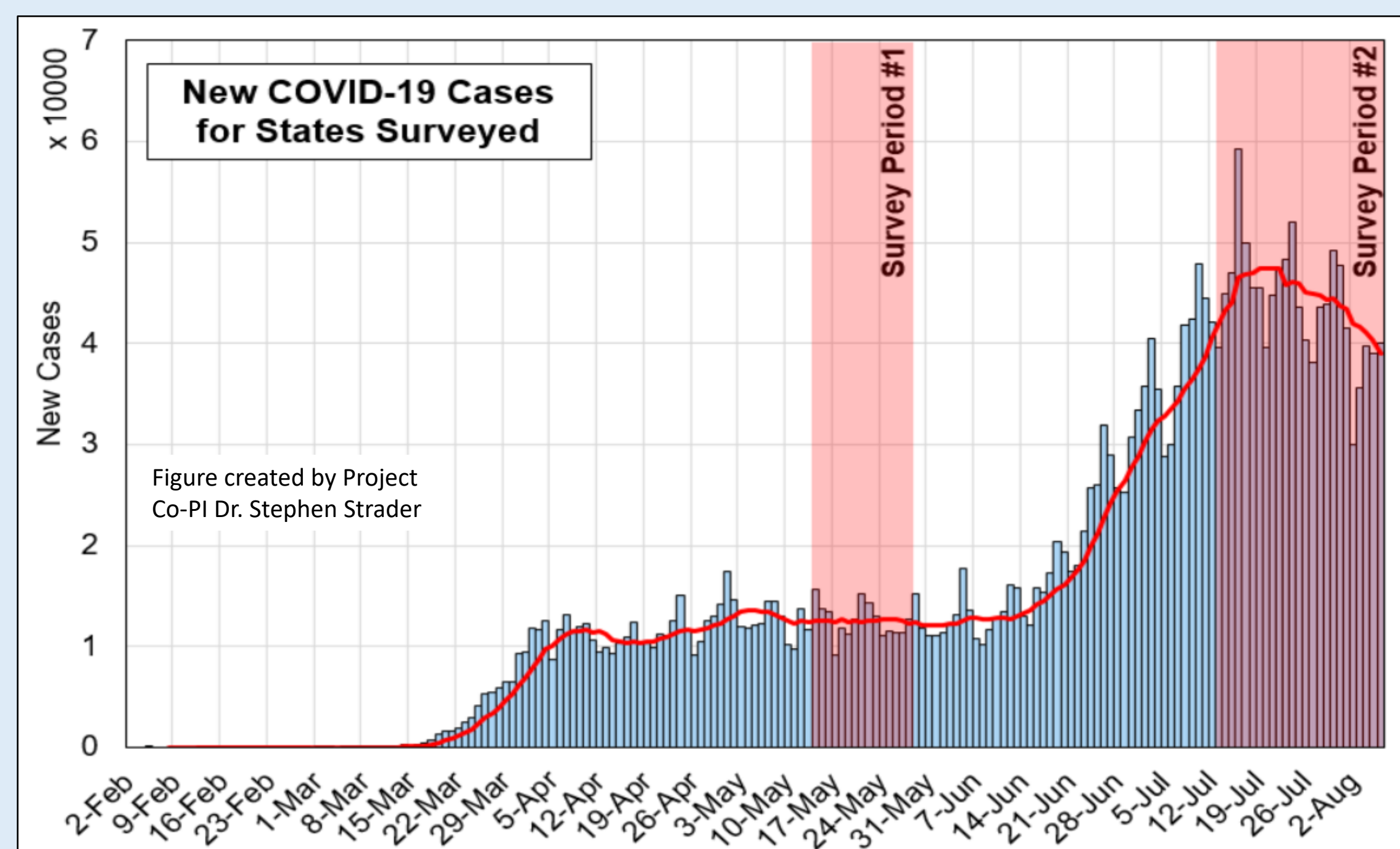
Background and Research Questions

The COVID-19 pandemic coincided with the increased seasonal risk of tornadoes in the central and eastern United States in 2020. This study adds to the growing literature on hazard-pandemic interactions in which protective behaviors for one hazard can increase exposure to another hazard. Our research questions are:

1. In what ways did risk & vulnerability beliefs related to tornadoes & COVID-19 evolve from Spring to Summer of 2020?
2. Which factors—including those related to COVID-19—were the most influential on participants' stated likelihood of using a public tornado shelter during the spring & summer of 2020?
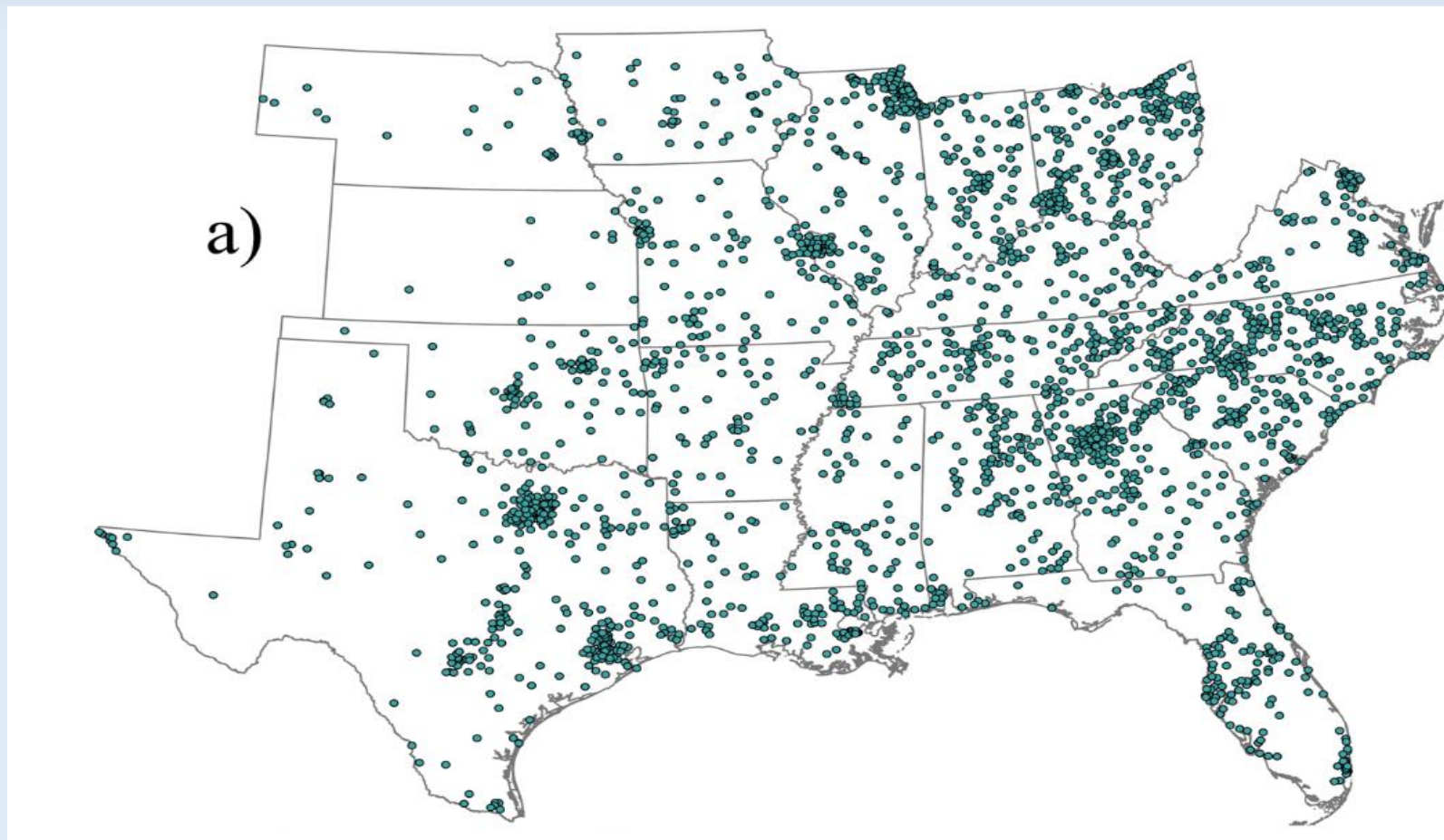
Data Collection

In 2020, using Qualtrics, we collected 3,060 survey responses in May and 2,981 responses in July/August. In total, we have over 6,000 complete responses and 123 variables. We intentionally oversampled households living in manufactured or mobile homes such that they accounted for 50% of responses. New COVID-19 case rates in the study area were roughly 3x higher in late July in comparison to late May. The survey questions covered the topics of risk perception and perceived vulnerability to tornadoes (1), infectious diseases in general (2), and COVID-19. In addition, there were questions about tornado sheltering past experiences and future intentions, as well as respondents' home and household characteristics.
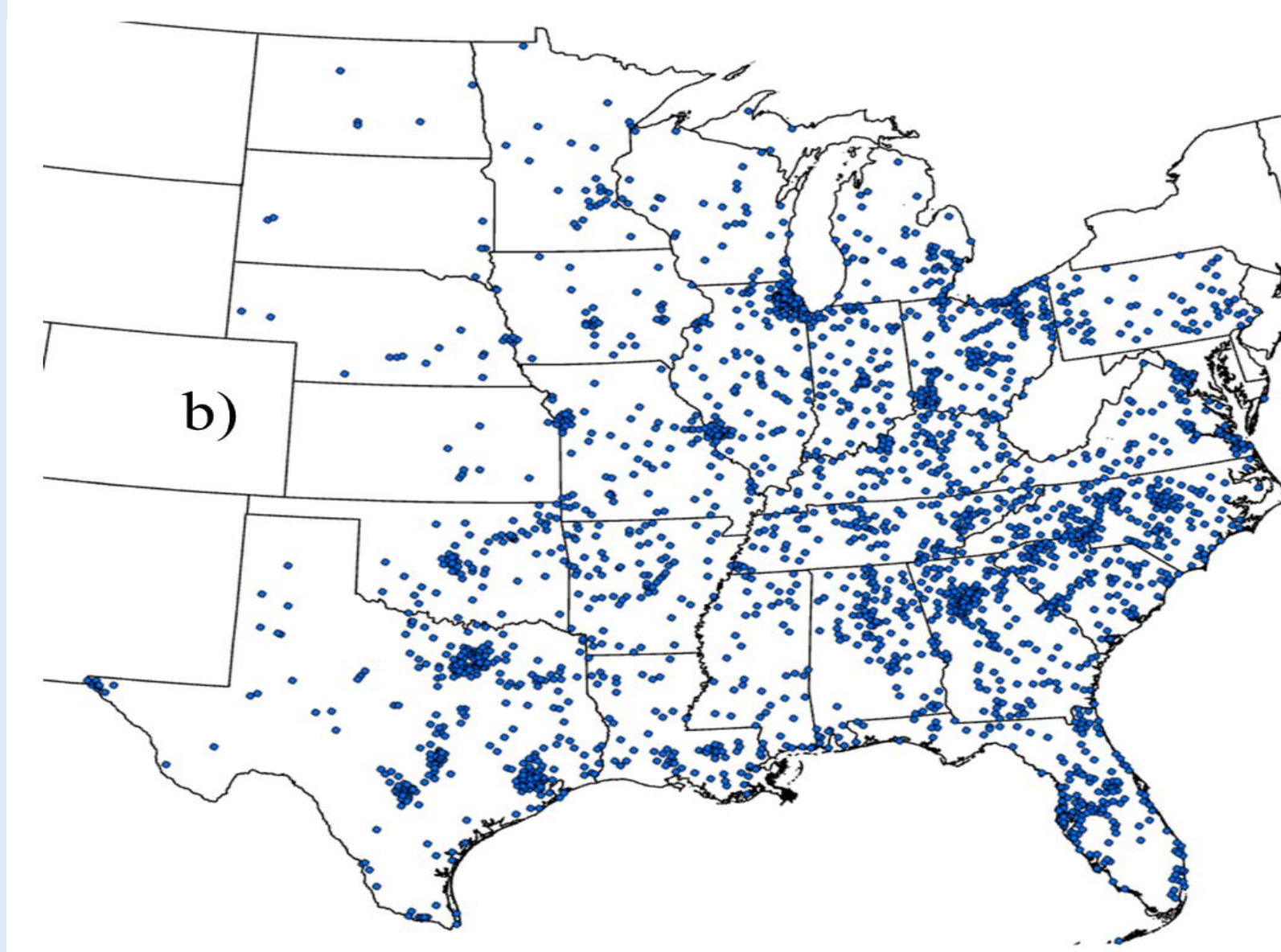

New COVID-19 Cases for States Surveyed

Figure created by Project Co-PI Dr. Stephen Strader

List of Variables used	
Dependent variable	Prefer Public Shelter Despite COVID19 (ord 7)
Independent variables	Composite Torn Risk (comp. 3 items)
	Composite Torn Neg Affect (comp. 3 items)
	Composite Perceived Infect (comp. 4 items)
	Composite Perceived Resist (comp. 3 items)
	Composite COVID Risk (comp. 3 items)
	Composite COVID Neg Affect (comp. 3 items)
	Manufactured Home (binary)
	Single Family House (binary)
	Mobile Homes RVs Tiny Homes (binary)
	Republican (binary)
	Democrat (binary)
	NWS Southern Region (binary)
	NWS Eastern Region (binary)
	Children Under 18 (binary)
	Adults 65 or Older (binary)
	Black African American (binary)
	Male Gender (binary)
	Percent All Cases New Jun Aug 2020 (cont.)
	Percent All Cases New Apr May 2020 (cont.)

Survey locations May (Spring) 2020

Survey locations July/August (Summer) 2020

Factors Influencing the Likelihood of Using a Public Tornado Shelter in Spring of 2020

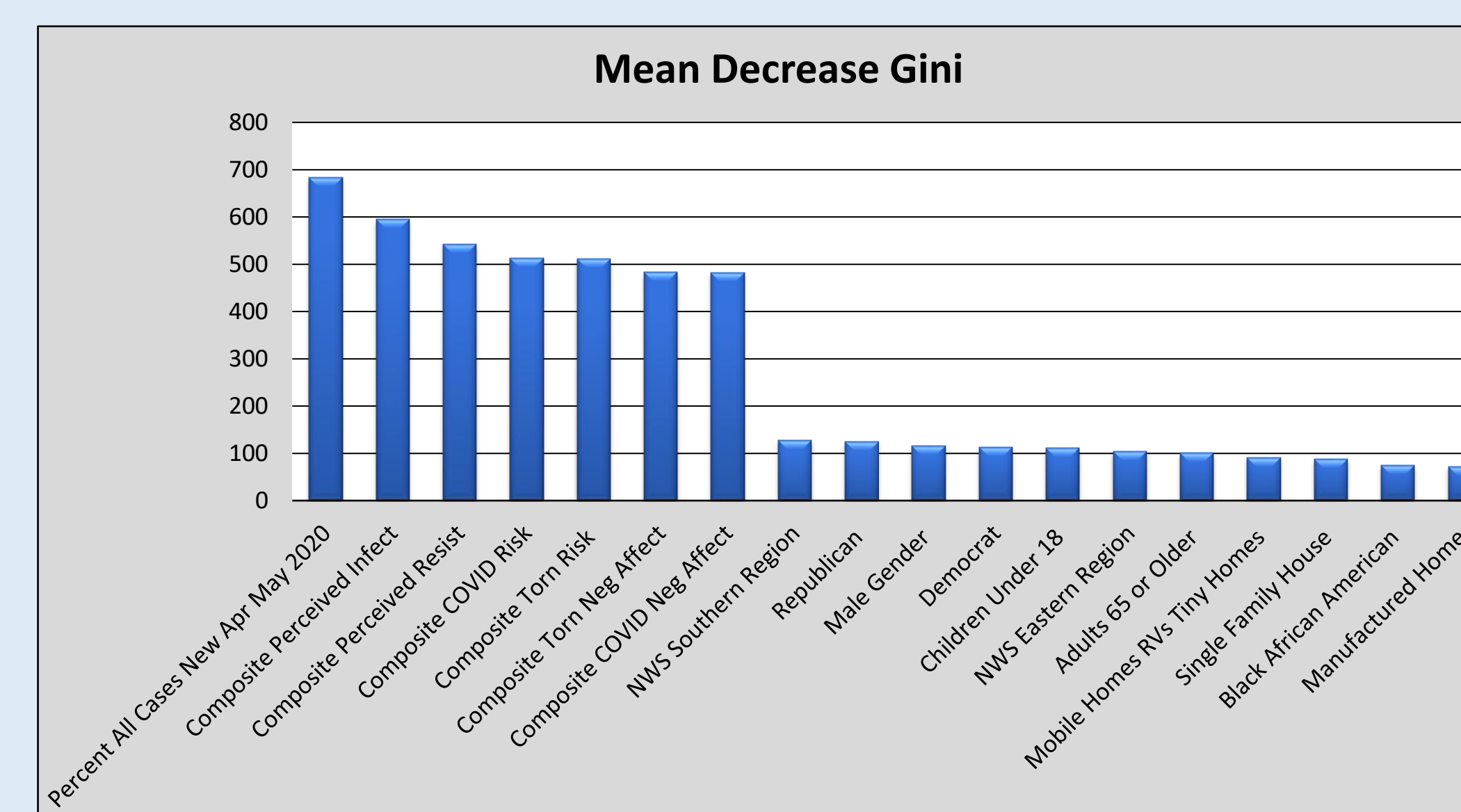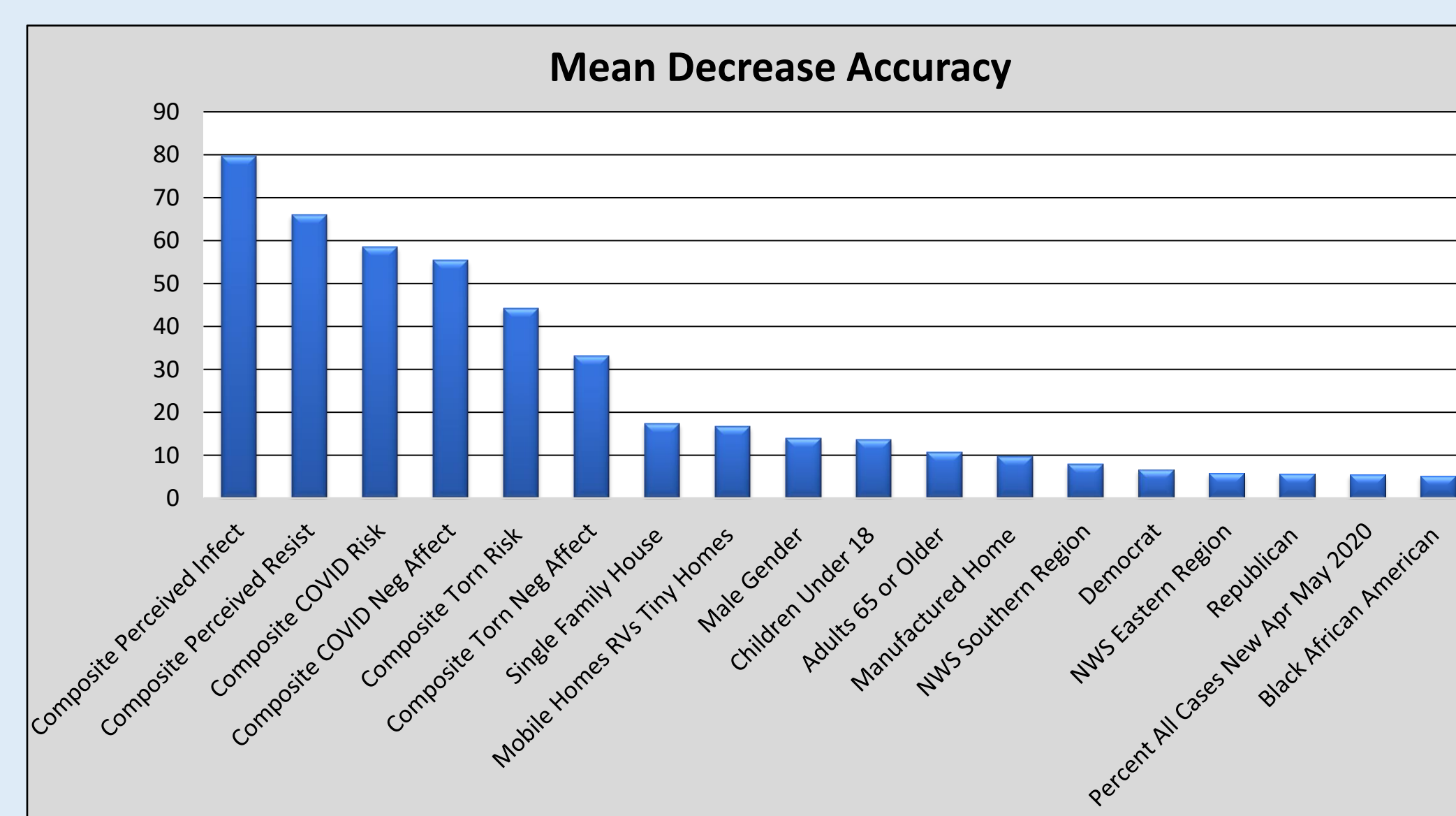### Factors Influencing the Likelihood of Using a Public Tornado Shelter in Summer of 2020

Analysis

We used a Random Forests (RF) classification ensemble approach to model preferences of using a public shelter in the event of a tornado warning, despite the risk of COVID-19. The application of RF is appropriate to our data because the independent variables consist of binary, continuous, and ratio data types. RF models also avoid model overfit by using resampling & an ensemble approach. We used two metrics, Mean Decrease Accuracy (MDA) and Mean Decrease Gini (MDG), to identify the most influential features for the stated likelihood of using a public shelter (3). MDA measures the decrease in accuracy of the model when a particular feature is removed or shuffled randomly. MDG measures the total reduction of Gini impurity that a specific feature contributes over all trees in the RF. For MDA and MDG, the larger the value, the more influential the variable.
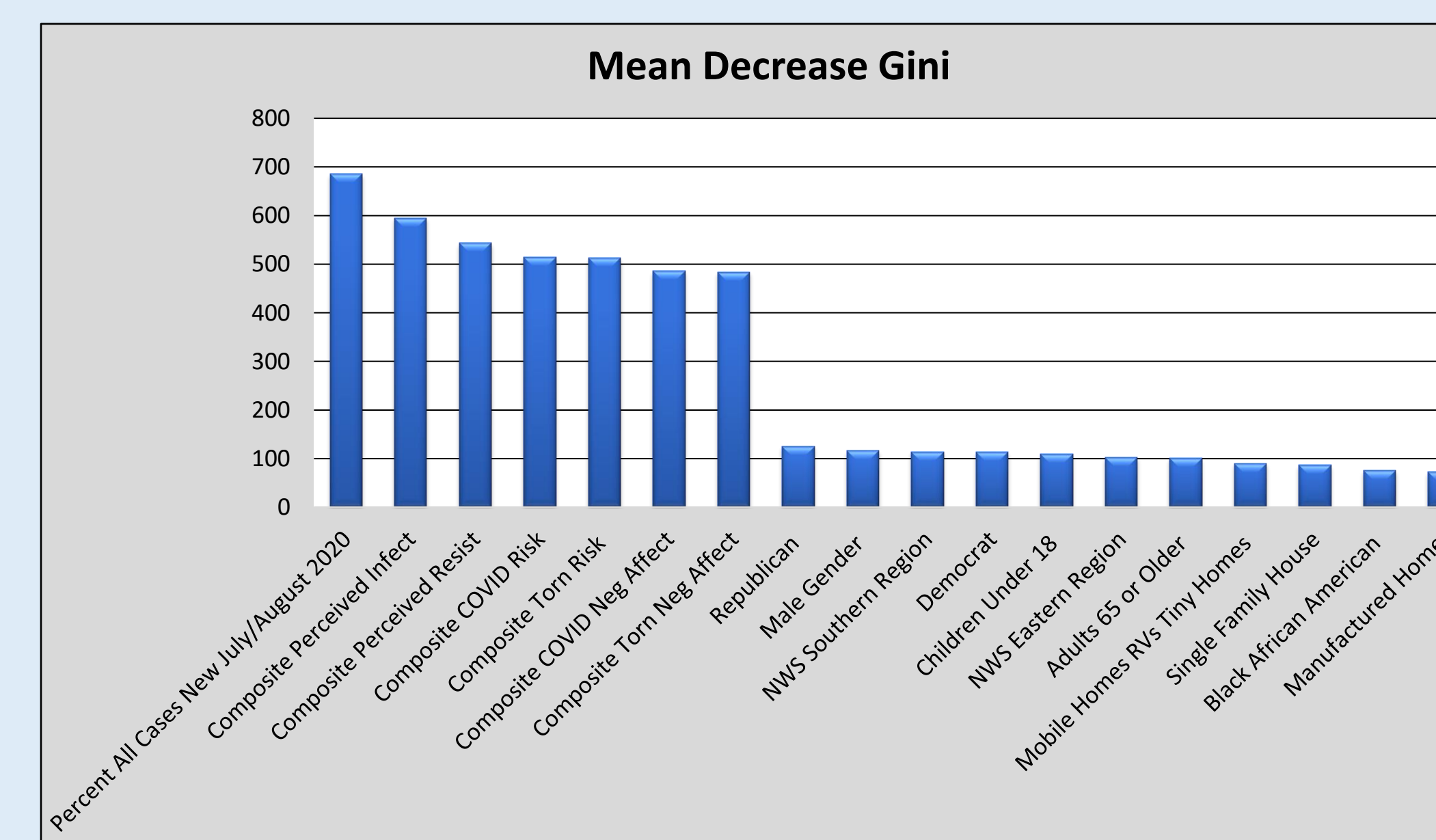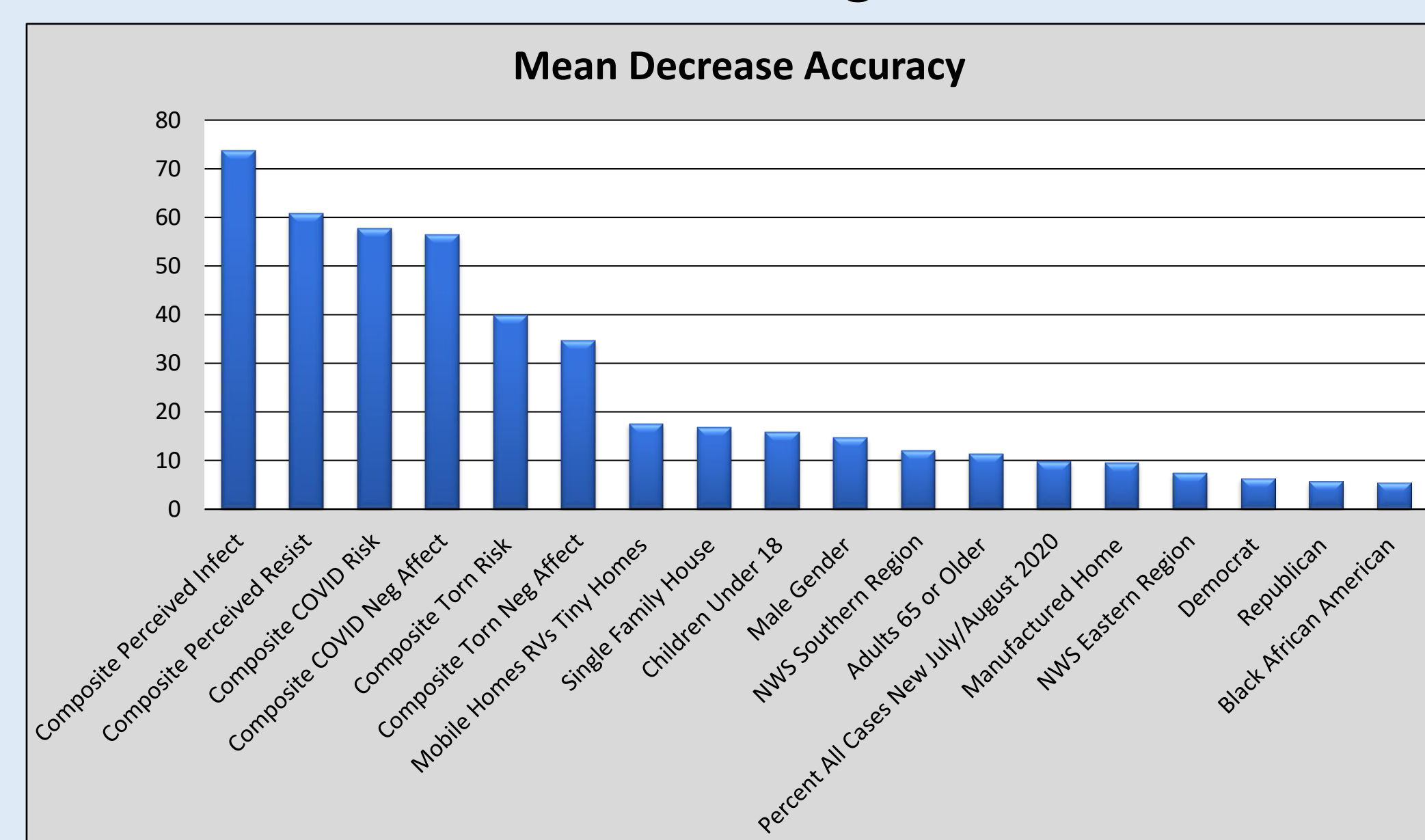
Key Findings

Risk perception of COVID-19 remained mostly the same from spring to summer of 2020, both in terms of negative affect (fear, worry) and risk of exposure. Respondents considered hazard priorities more decisively away from tornadoes and toward COVID-19. The results suggest that COVID-19 experiences and risk perceptions negatively influenced the likelihood of going to a public tornado shelter during spring and summer of 2020. Yet, tornado risk exposure and perceived negative impact, and additional household-specific variables were also important for intended use of public tornado shelters.

References

(1) Ash, K.D., M.J. Egnoto, S.M. Strader, W.S. Ashley, D.B. Roueche, K.E. Klockow-McClain, D. Caplen, & M. Dickerson, 2020: Structural Forces: Perception and Vulnerability Factors for Tornado Sheltering within Mobile and Manufactured Housing in Alabama and Mississippi, *Weather, Climate and Society*, 12:453-472.
(2) Duncan, L.A., M. Schaller, and J.H. Park, 2009: Perceived Vulnerability to disease: Development and validation of a 15-item self-report instrument, *Personality and Individual Differences*, 47:541-546.
(3) Han, H., X. Guo, H. Yu, 2016:Variable selection using Mean Decrease Accuracy and Mean Decrease Gini based on Random Forest Variable selection using Mean Decrease Accuracy and Mean Decrease Gini based on Random Forest, 7th IEEE International Conference on Software Engineering and Service Science (ICSESS), Beijing, pp. 219-224, doi: 10.1109/ICSESS.2016.7883053.