What Defines a Severe Thunderstorm?

Perceptions from a Cross Section of Residents of the Lower Rio Grande Valley of South Texas

Barry S. Goldsmith
NOAA/National Weather Service, Brownsville, Texas

Dr. Kathleen Sherman-Morris
Mississippi State University, Starkville, MS

Joshua J. Schroeder
NOAA/National Weather Service, Brownsville, Texas

98th AMS Annual Meeting/13th Symposium on Societal Applications, Austin, TX

October 21, 2021

The Lower Rio Grande Valley of Texas

- **Population (US): 1,357,910**
- **Hispanic: 91%**
- **Gender: Male – 48.7%; Female – 51.3%**
- **Spanish Spoken at Home: 80.4%**
- **English "Not Spoken Well": 31.4%**

Source: US Census, American Community Survey 2016 Update

Survey "Drivers"

- Informal surveys of multiple publics, including hundreds of prospective Skywarn® spotters, indicated minimal knowledge of NWS severe thunderstorm definition in the Rio Grande Valley
- The vast majority of responses when asked "what defines a severe thunderstorm" were *heavy rain/flooding* and *lightning*
- This *formal* survey aimed to prove/ disprove the hypothesis that heavy rain/flooding and lightning define a severe thunderstorm

Survey Development/Methodology

- Semi-structured interview (questionnaire) created by authors (October 2017)
- Specifically designed to be “open to interpretation” with few prompts/probes
- “Person on the Street” interviews conducted during peak of the holiday shopping season (December 2017)
- Permission granted to conduct brief, 5 to 7 minute interviews, by selected locations including two Storm Ready Communities
- Interviewer attempted to reach a fair cross-section of Rio Grande Valley residents to minimize bias

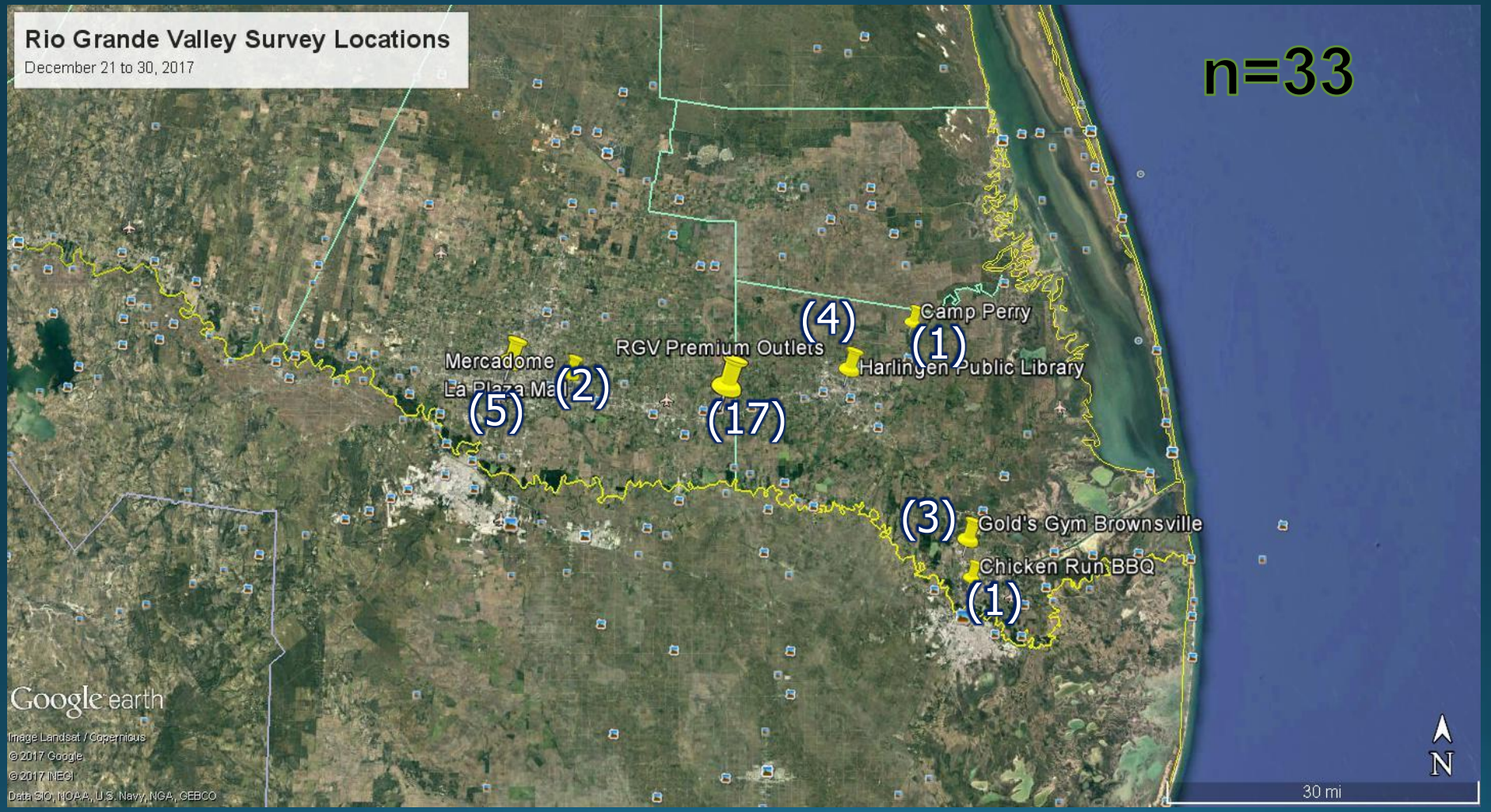
SIMON℠

StormReady®

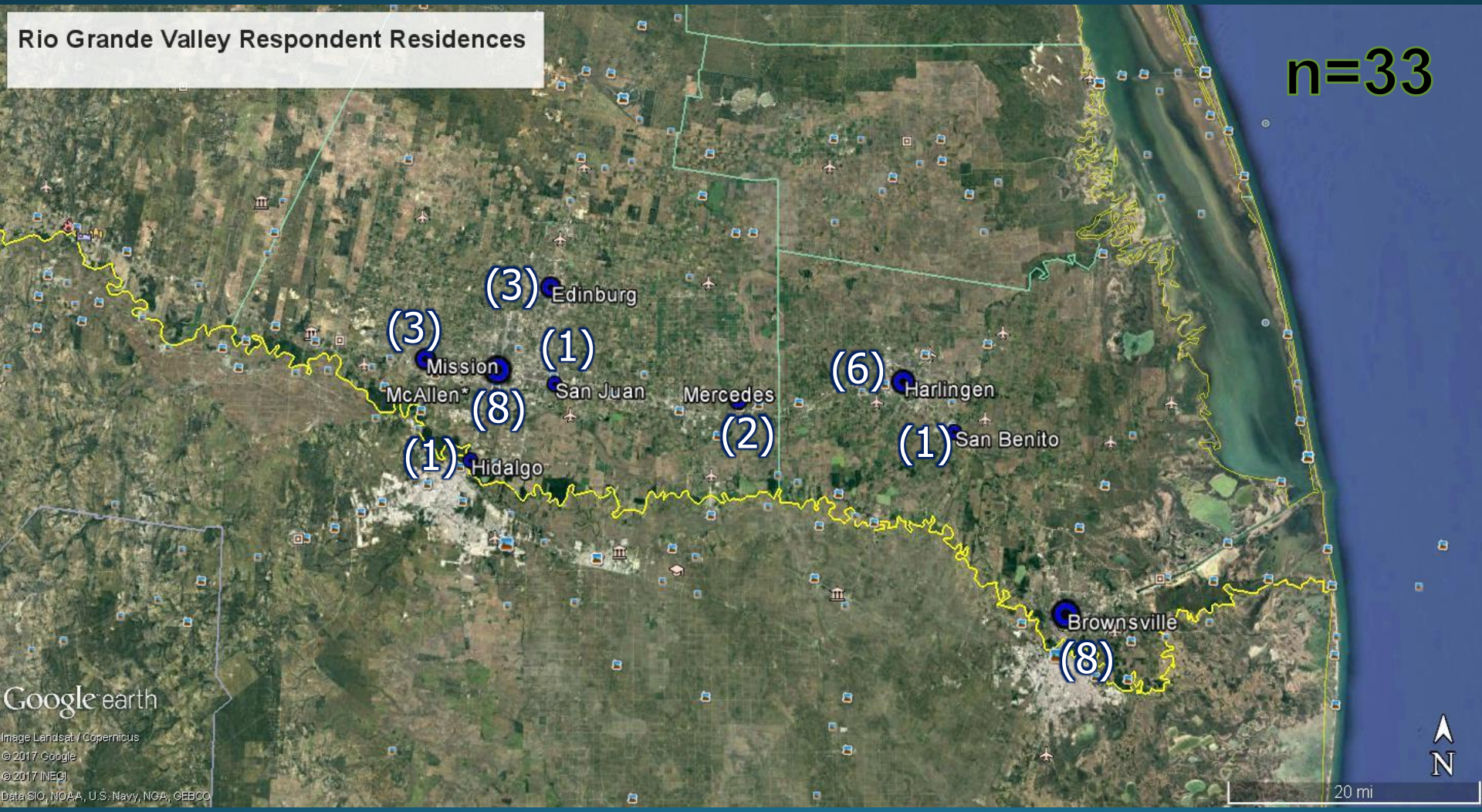
GOLD'S GYM®

Harlingen Public Library

Interview Locations



Residential Locations

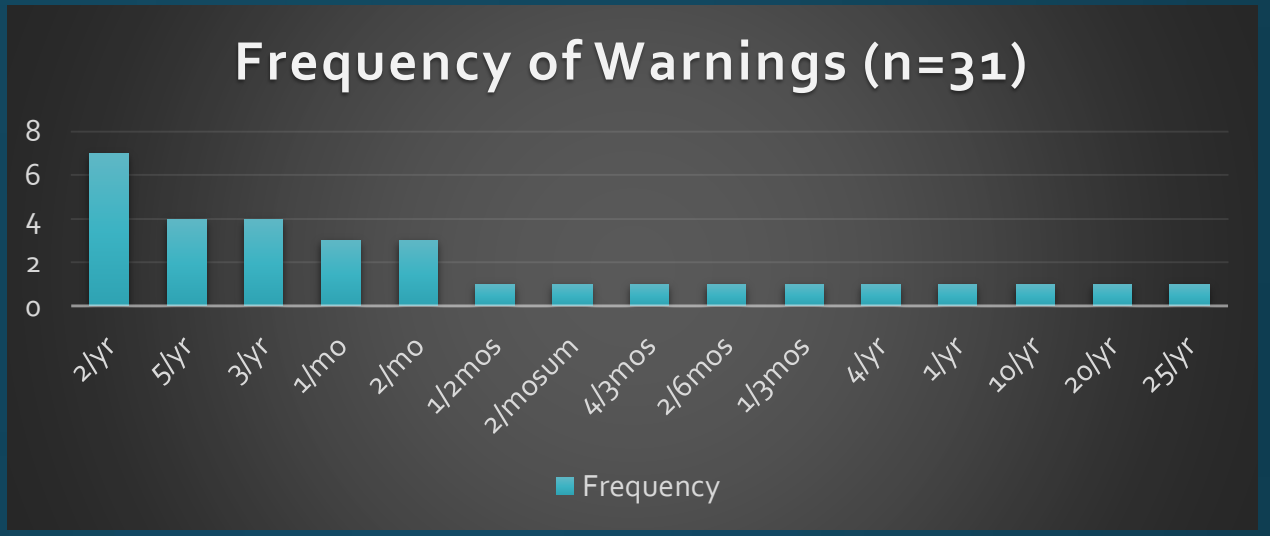


Survey Demographic Baseline

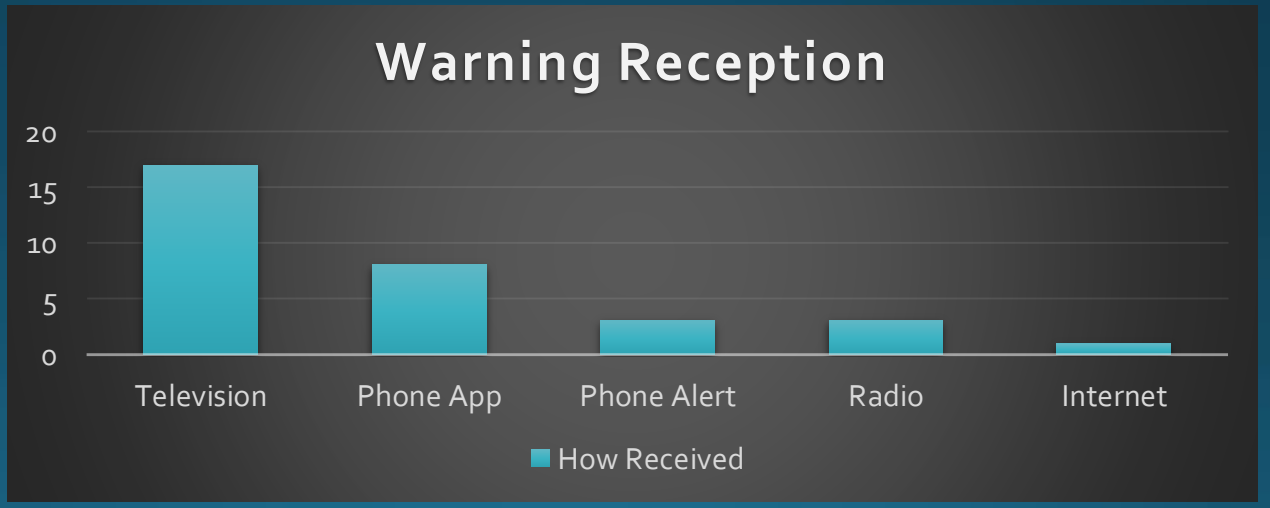
- Completed Interviews: 33
  - Declined Interviews: About 20
  - Out of Area/Mexican Nationals: About 25
- Gender: 18 male (55%), 15 female (45%)
- Ethnicity: 29 Hispanic (88%), 4 White (12%)
- Primary Language Spoken:
  - English – 21 (64%)
  - Spanish – 10 (30%)
  - Both Equally – 2 (6%)
- Age (n=32)
  - Range: 16 to 61 years
  - Mean: 44 years

Warning Reception/Frequency Concept

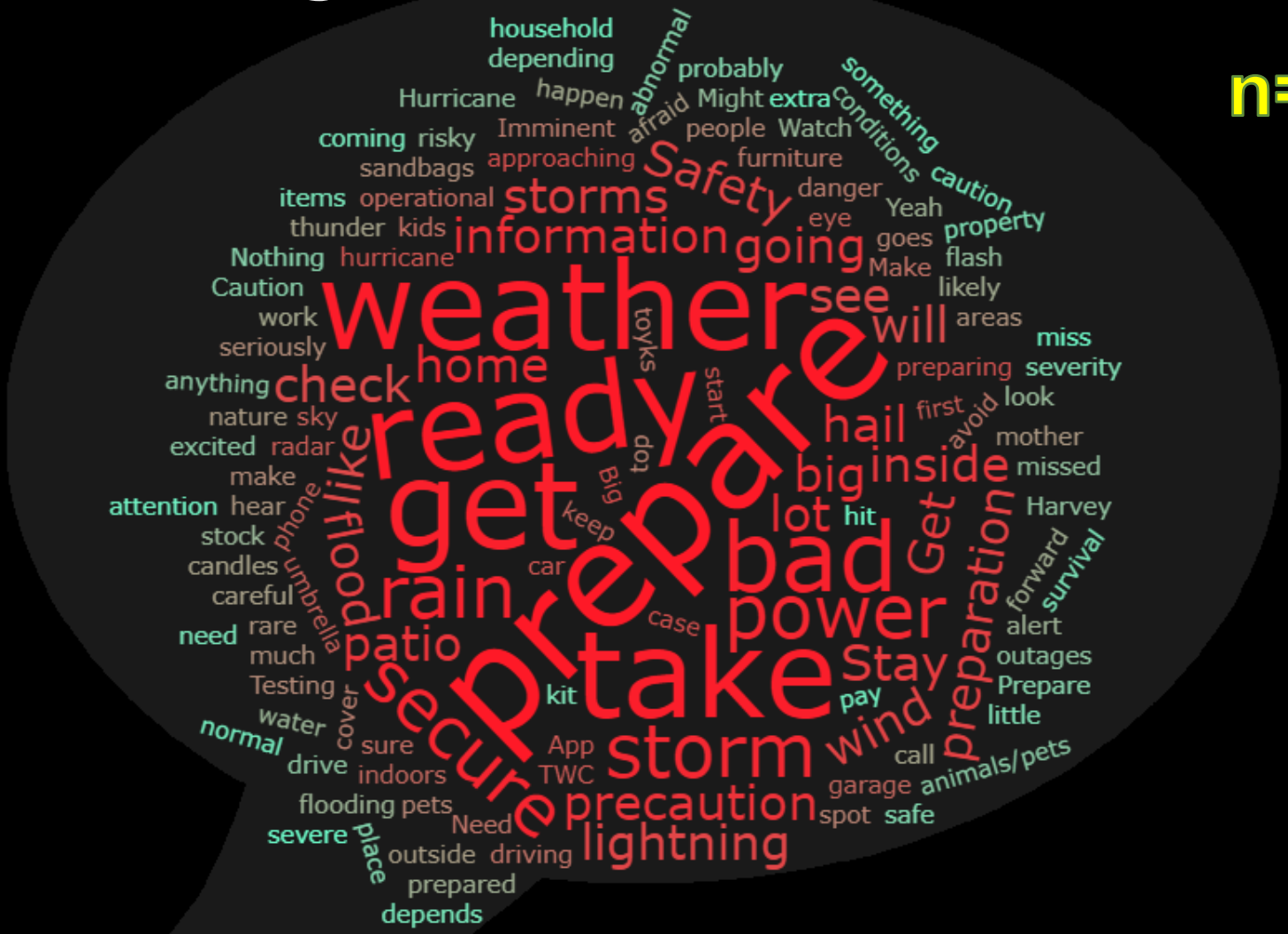
Question was asked of home location, not interview location.



Open ended: These were the only answers provided. List included *15* total options



The Meaning of a Severe Thunderstorm

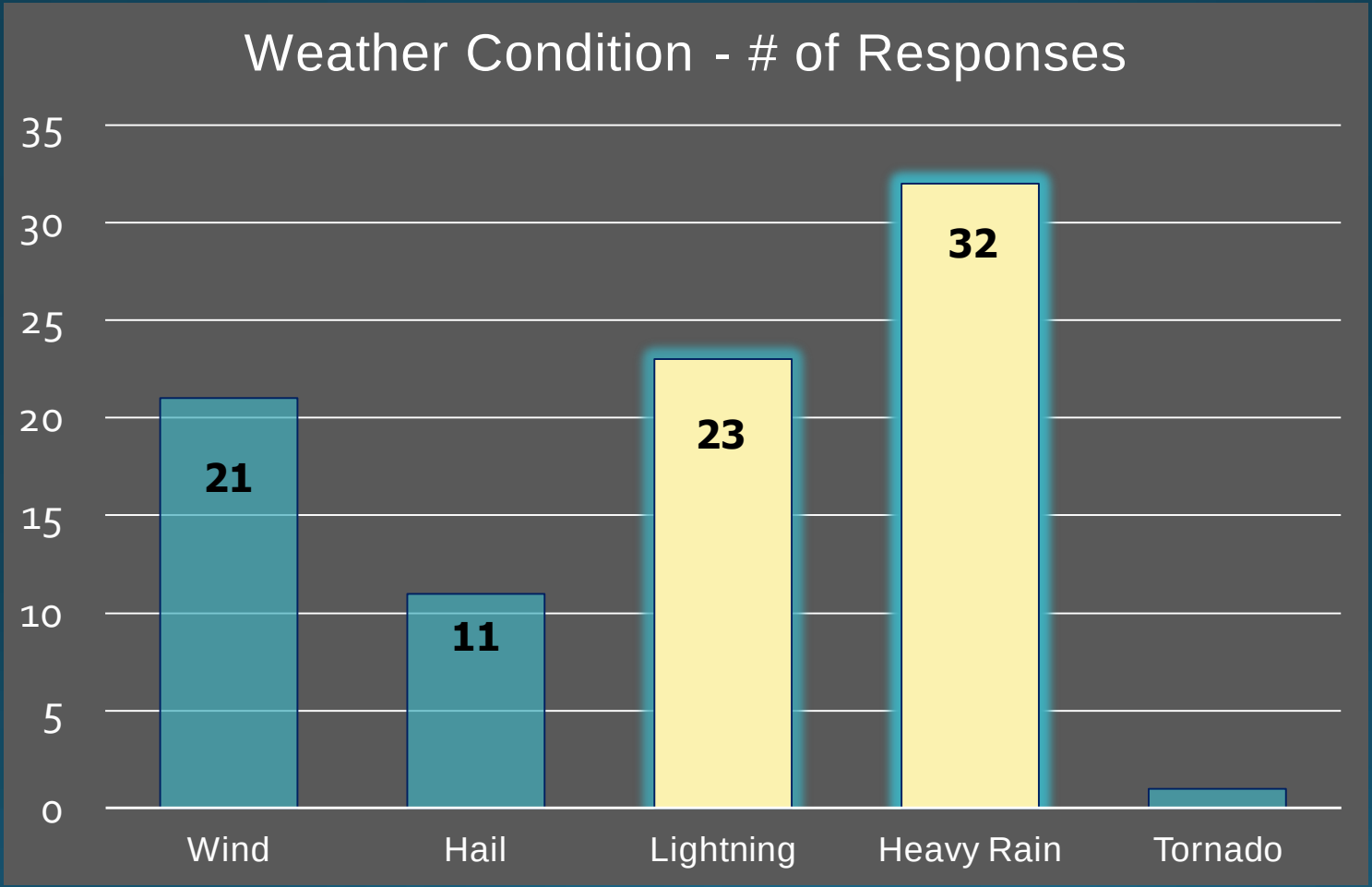


n=33

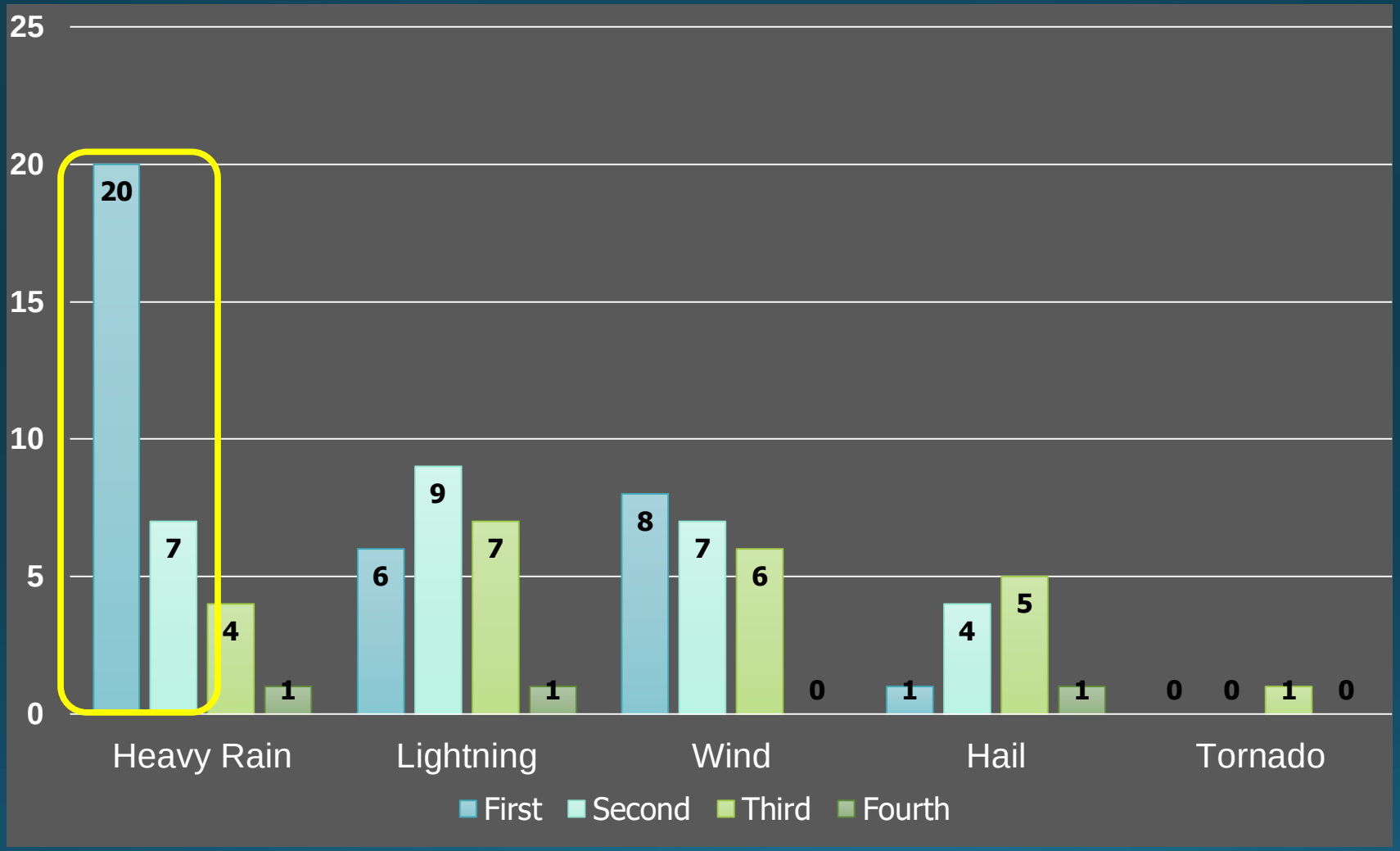
98th AMS Annual Meeting/13th Symposium on Societal Applications, Austin, TX

October 21, 2021

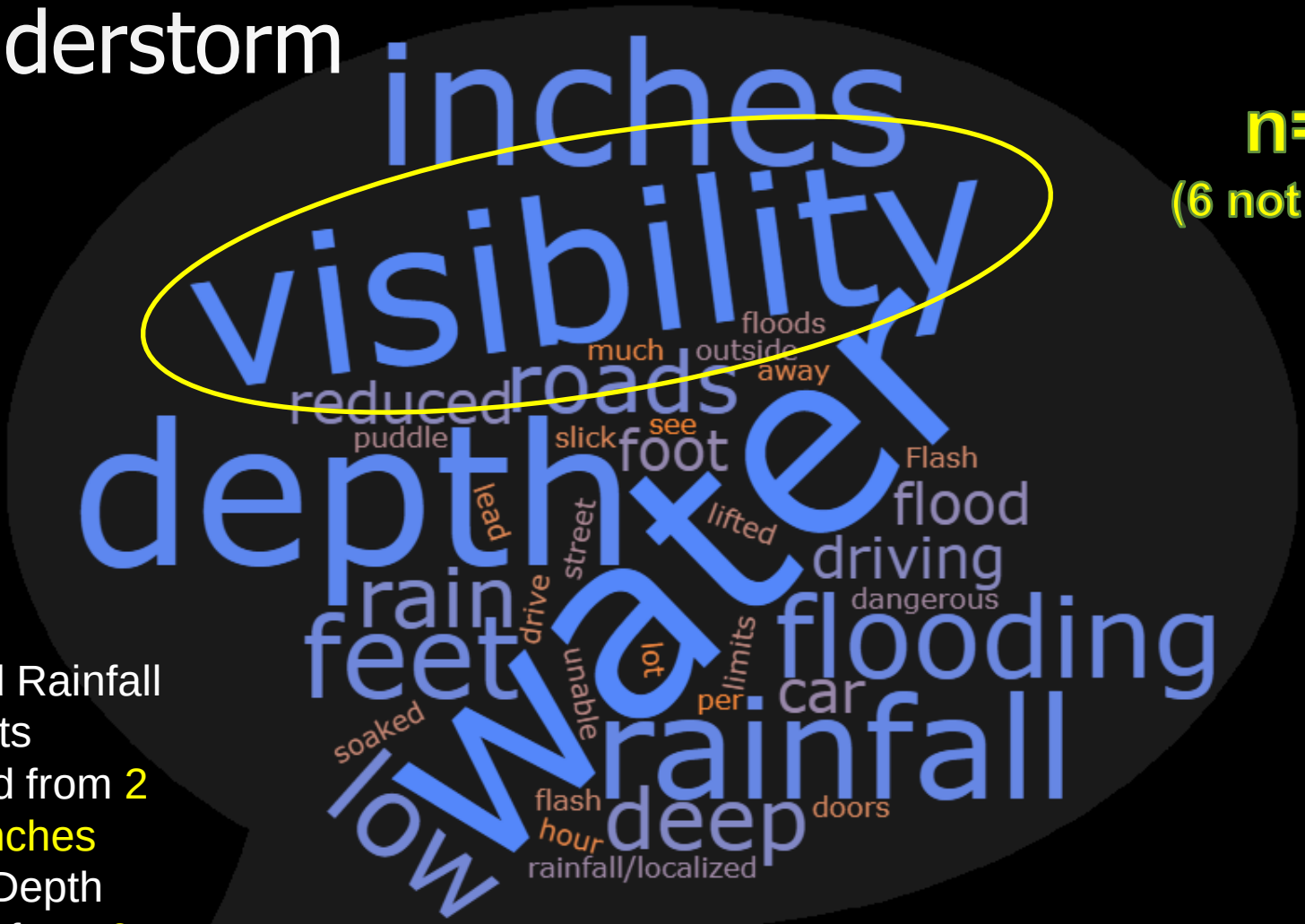
Elements of a Severe Thunderstorm



Highest Ranked Elements of a Severe Thunderstorm



Sense of Heavy Rain in a Severe Thunderstorm



n=26
(6 not probed)

Note:

- Quoted Rainfall Amounts Ranged from 2 to 10 inches
- Water Depth ranged from 6 inches to 2+ feet

98th AMS Annual Meeting/13th Symposium on Societal Applications, Austin, TX

October 21, 2021

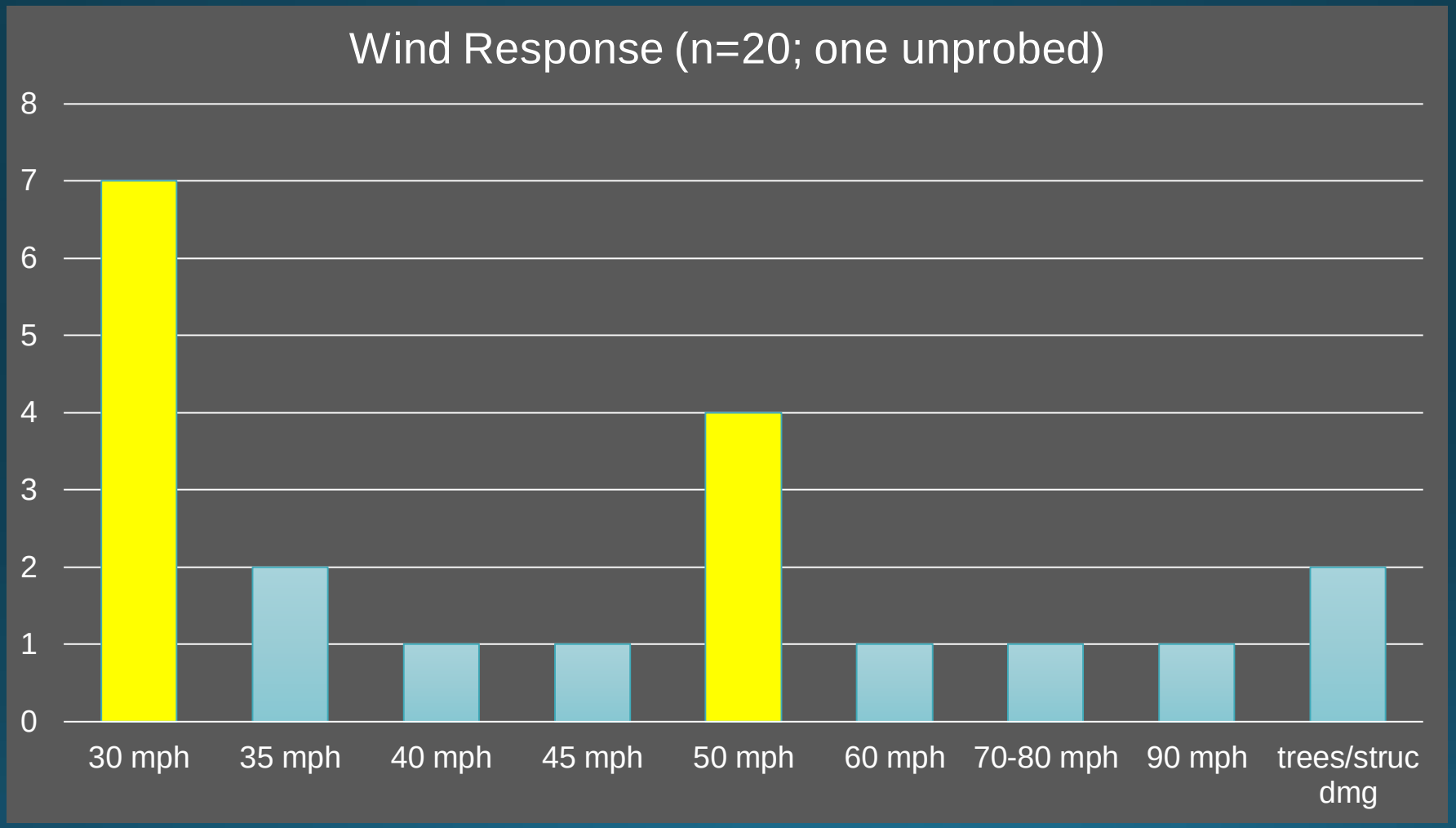
Sense of Lightning in a Severe Thunderstorm

n=20
(3 not probed)

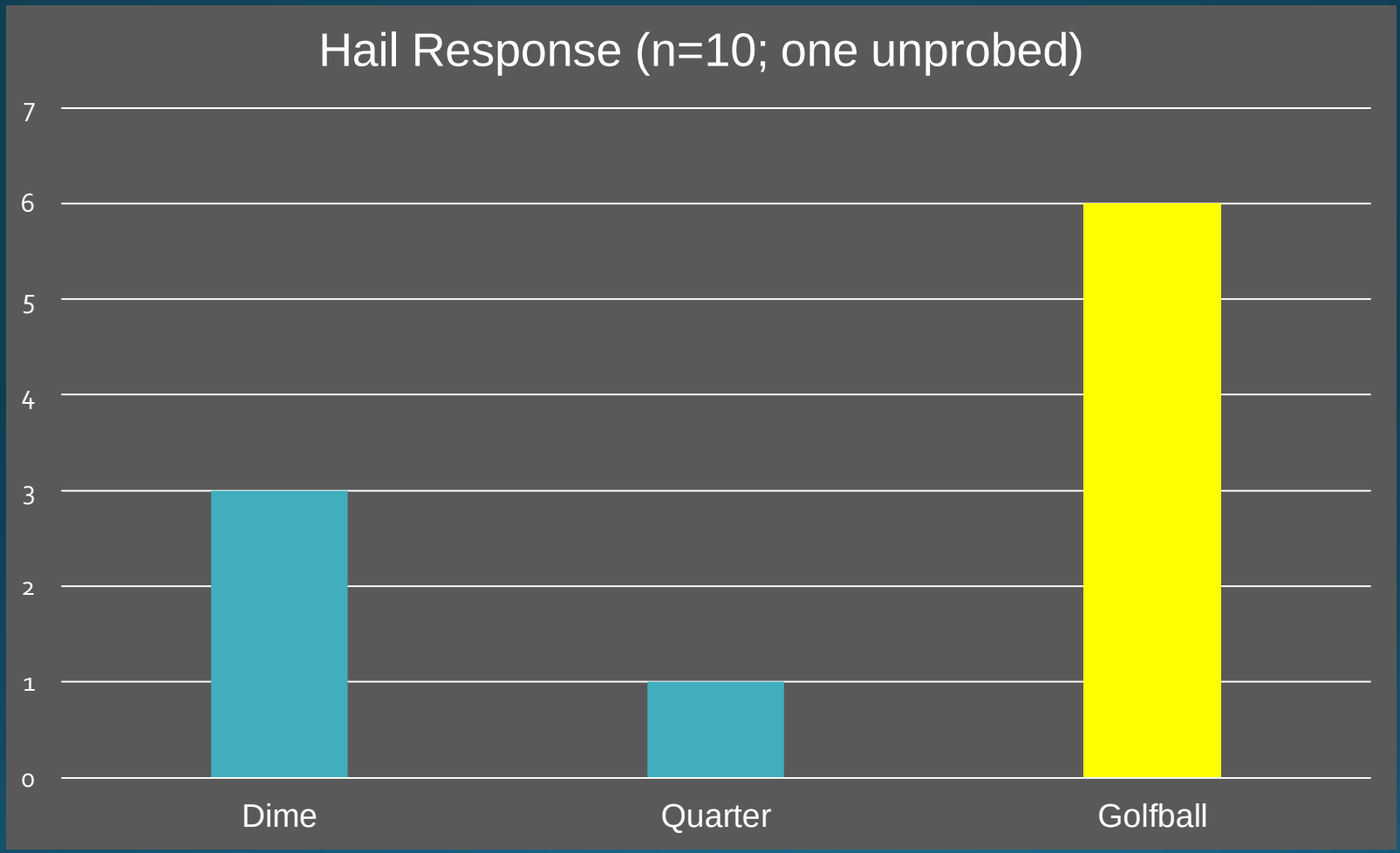
98th AMS Annual Meeting/13th Symposium on Societal Applications, Austin, TX

October 21, 2021

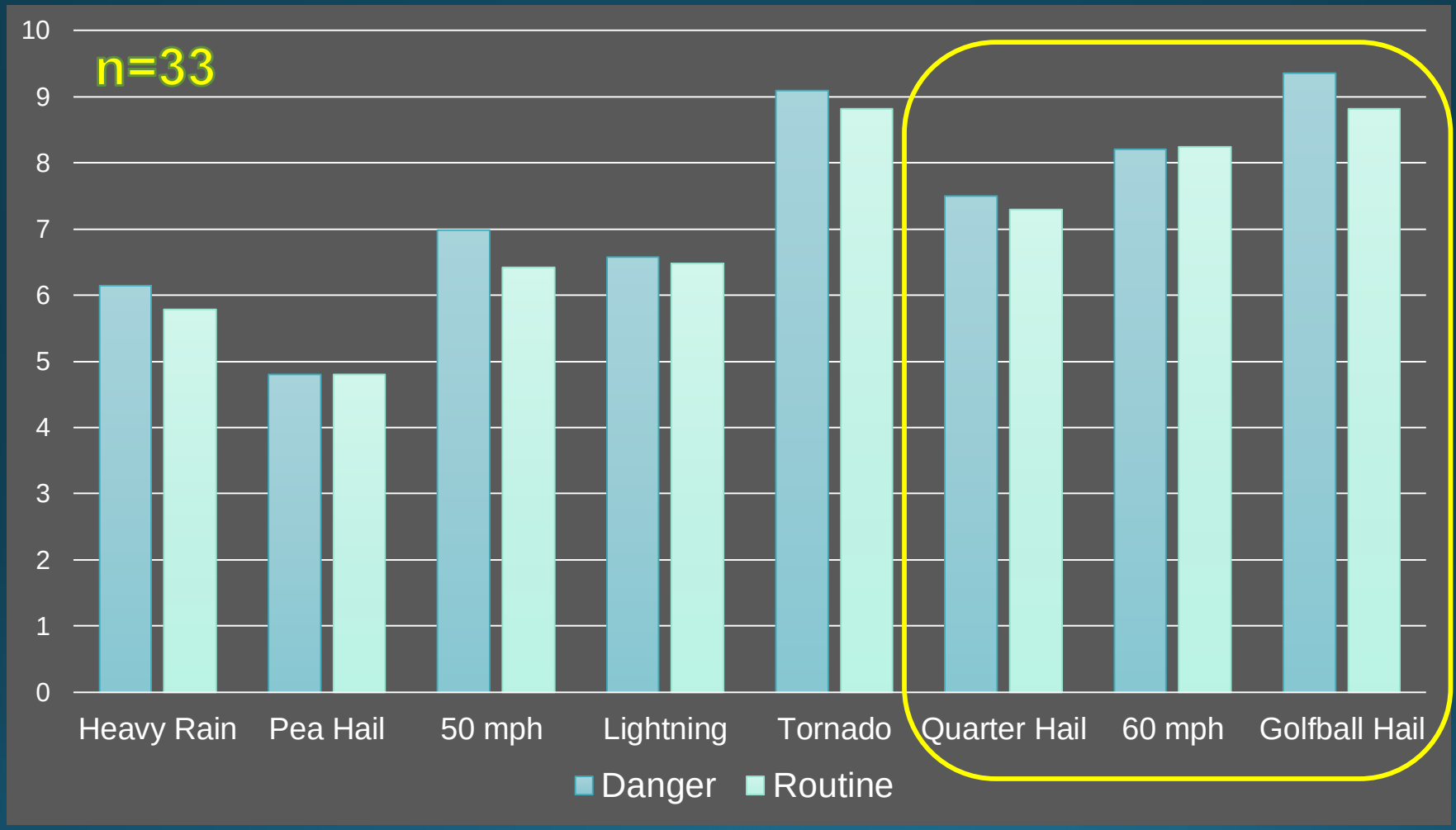
Sense of Wind in a Severe Thunderstorm



Sense of Hail in a Severe Thunderstorm



Danger Perception and Affect on Daily Routine (1-10 Rating Scale)

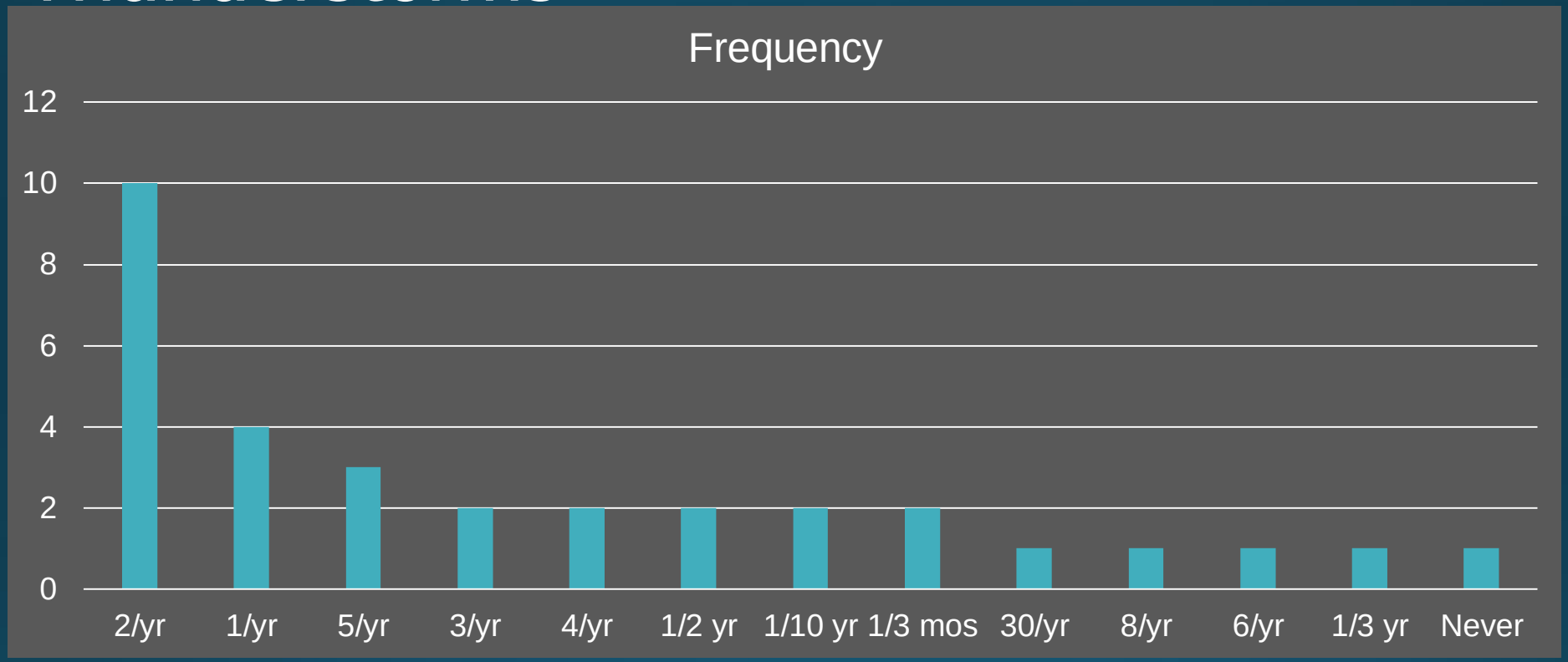


Would They Liked to Be Warned For…

- …Heavy Rain: **97%** (n=32)
- …Tornado: **100%** (n=32)
- …Pea Sized Hail: **68%** (n=31)
- …Quarter Sized Hail: **100%** (n=32)
- …50 mph Wind: **97%** (n=31)
- …60 mph Wind: **97%** (n=31)
- …Frequent Lightning: **87%** (n=31)
- …Golfball sized Hail: **100%** (n=32)

"Warned" was defined as an alert message on television, smart phone, radio, etc.

Frequency of NWS-Defined Severe Thunderstorms



- Frequency of 2 per year, 5 per year, and 3 per year of NWS criteria-defined severe thunderstorms closely matched the perceived frequency of warning issuances.
- At 23.2 events/year for entire Rio Grande Valley (1996-2016), 2 to 5 events/year for individual communities may be reasonable perception.

Survey Conclusions and Next Steps

- Survey revealed what hypothesis suspected: Rio Grande Valley residents perceive a “Severe” Thunderstorm to contain heavy rain and frequent lightning
- Sense of “Severe” wind was below actual NWS criteria; sense of “Severe” hail was above NWS criteria
- While there was little difference between “danger” and “routine” perception, the highest averages were more in line with NWS defined wind and hail criteria
- With sole exception of pea sized hail, nearly all respondents desired warning messages for conditions below NWS severe or flood criteria
- Next steps: Conduct simple statistical tests (Student’s-t, etc) on some of these data

Questions to Ponder

- Are results related to event frequency? In past twenty years, number of NWS-defined severe weather events in the Rio Grande Valley is less than 3% of those in North Texas; one third of those in North Texas when normalized for population
- Would matching the message to the hazard remove confusion on defining a severe thunderstorm (i.e. “golfball sized hail” warning)?
- If local ***perception*** of a severe thunderstorm includes conditions that are very likely under a warning (blinding rain), are warnings actually ***more*** effective despite NWS not officially verifying on sub-severe criteria?
- Would additional “person on the street” interviews across the nation provide a stronger baseline of how wide cross-sections of residents understand NWS warning messaging?

Questions?

Contacts:

Barry S. Goldsmith
barry.goldsmith@noaa.gov
956-572-1492

Joshua J. Schroeder
joshua.schroeder@noaa.gov
956-504-1432 ext. 224

@wxdancer

Dr. Kathleen Sherman-Morris
kms5@mstate.edu
662-268-1032 x242