What Defines a Severe Thunderstorm?

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

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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

Interview Locations

Residential Locations

Rio Grande Valley Respondent Residences

n=33

(3) Edinburg

(3) Mission
(1)
McAllen* San Juan
(8)
(1) Hidalgo
Mercedes
(2)
(6) Harlingen
(1) San Benito

Brownsville
(8)

Google earth
Image Landsat / Copernicus
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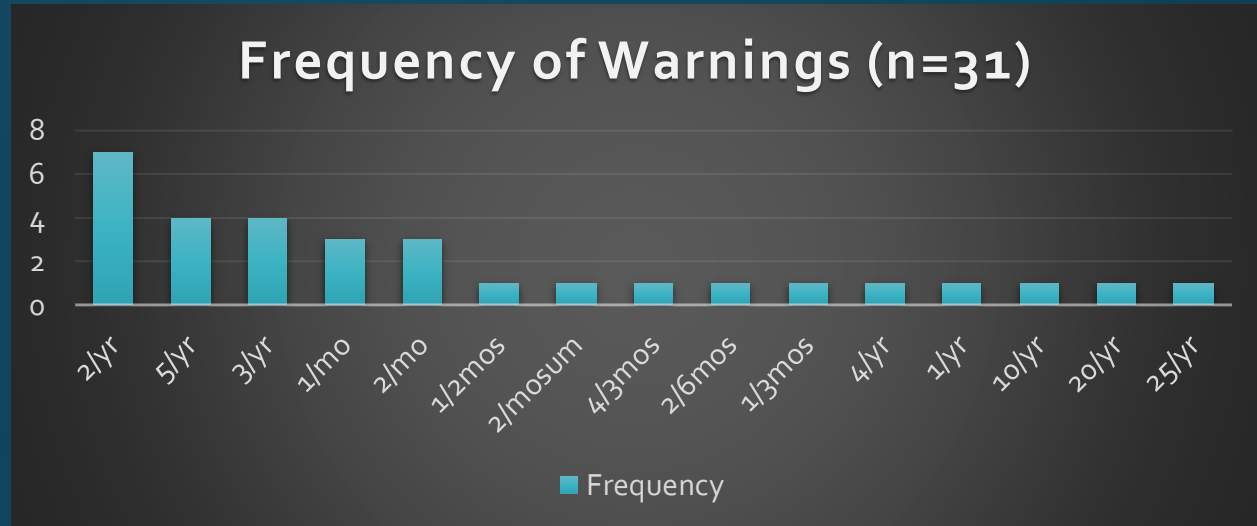Data SIO, NOAA, U.S. Navy, NGA, GEBCO

20 mi

N

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)
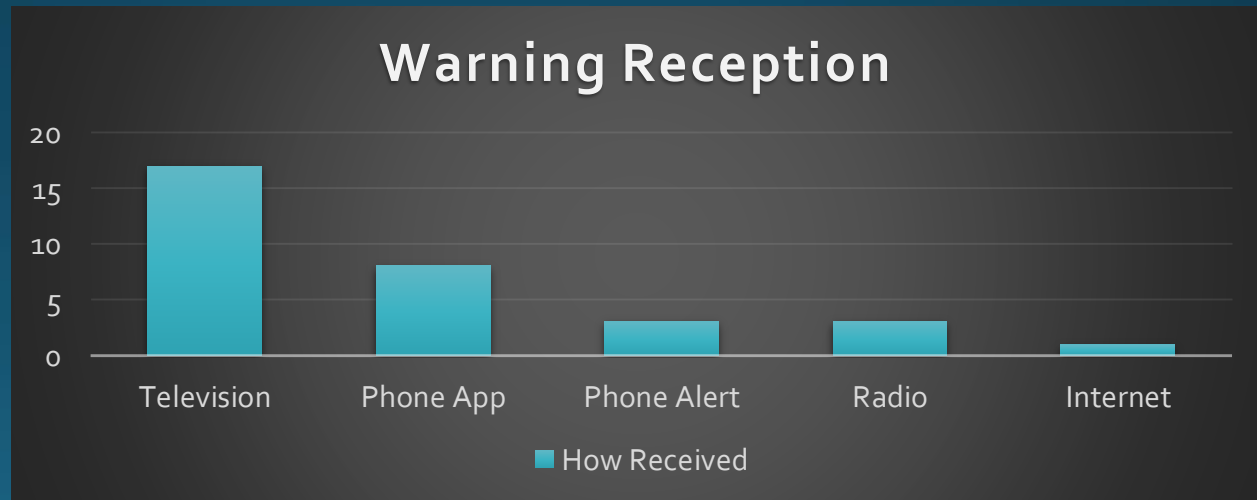 - Range: 16 to 61 years
  - Mean: 44 years
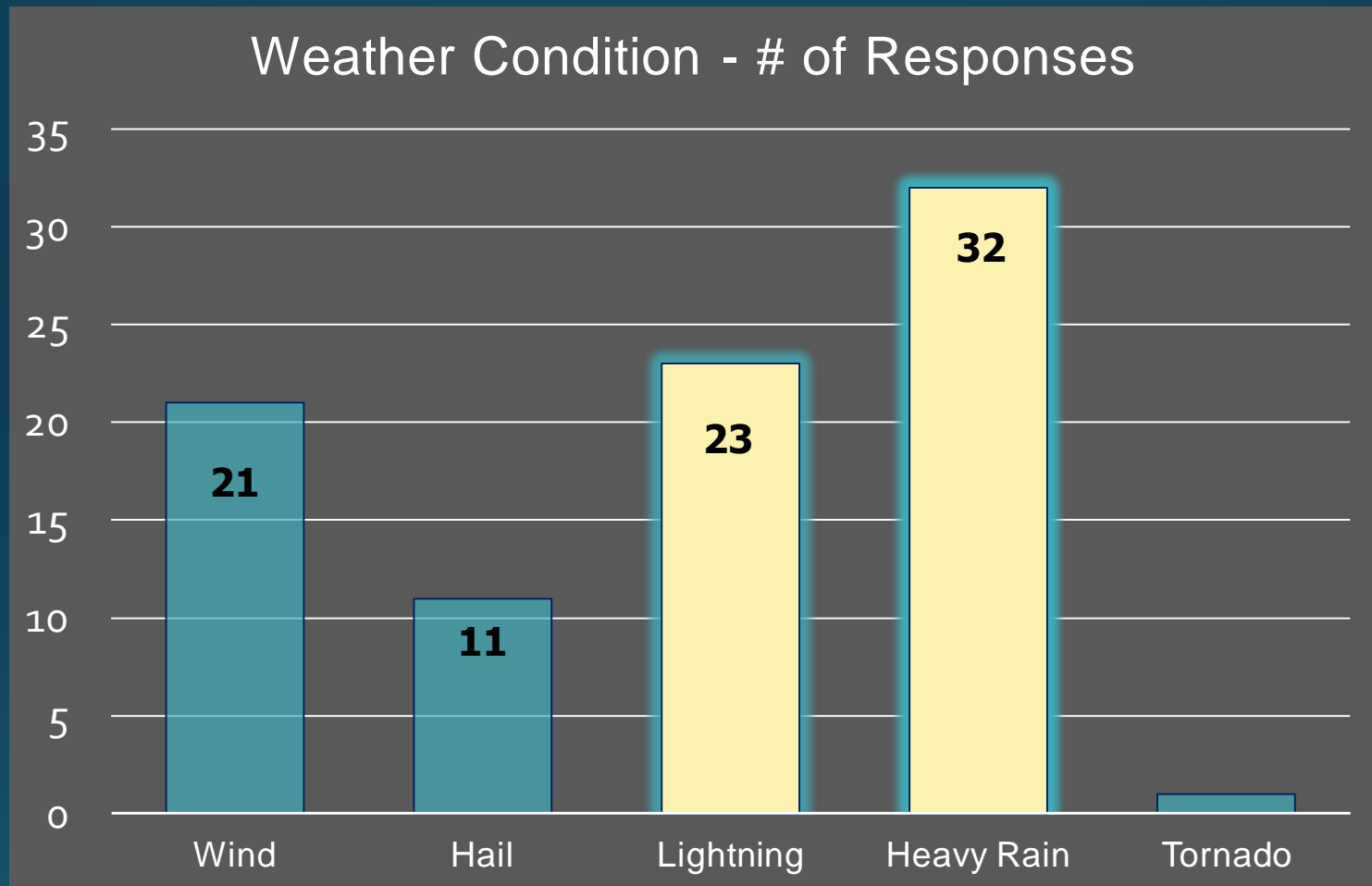
Warning Reception/Frequency Concept

Question was asked of home location, not interview location.

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

Frequency of Warnings (n=31)

Categories (x-axis): 2/yr, 5/yr, 3/yr, 1/mo, 2/mo, 1/2mos, 2/mosum, 4/3mos, 2/6mos, 1/3mos, 4/yr, 1/yr, 1o/yr, 2o/yr, 25/yr

■ Frequency

Warning Reception

Categories (x-axis): Television, Phone App, Phone Alert, Radio, Internet

■ How Received

The Meaning of a Severe Thunderstorm

Elements of a Severe Thunderstorm

Weather Condition - # of Responses

- Wind: 21
- Hail: 11
- Lightning: 23
- Heavy Rain: 32
- Tornado: (no value shown)

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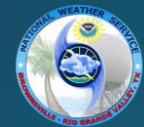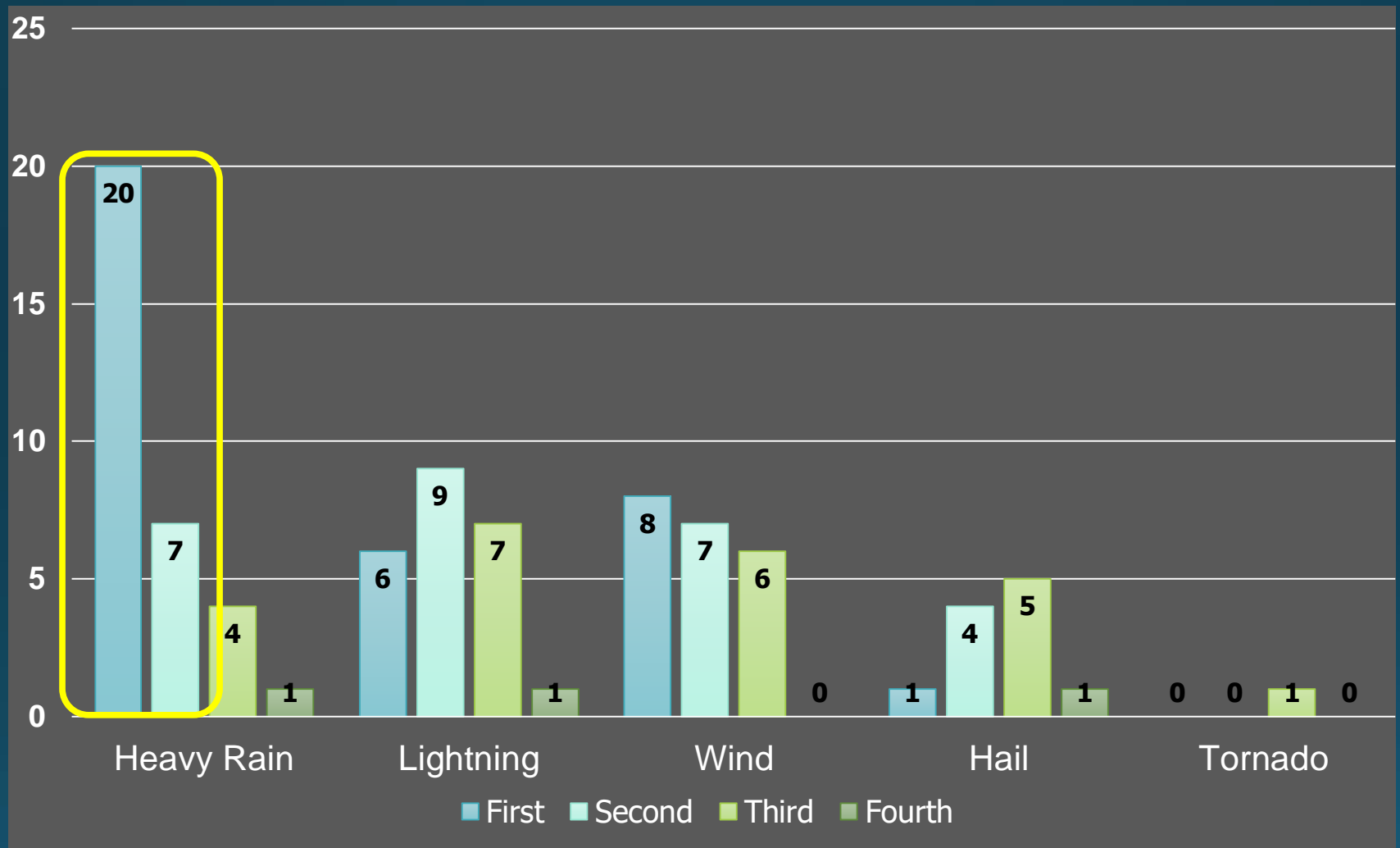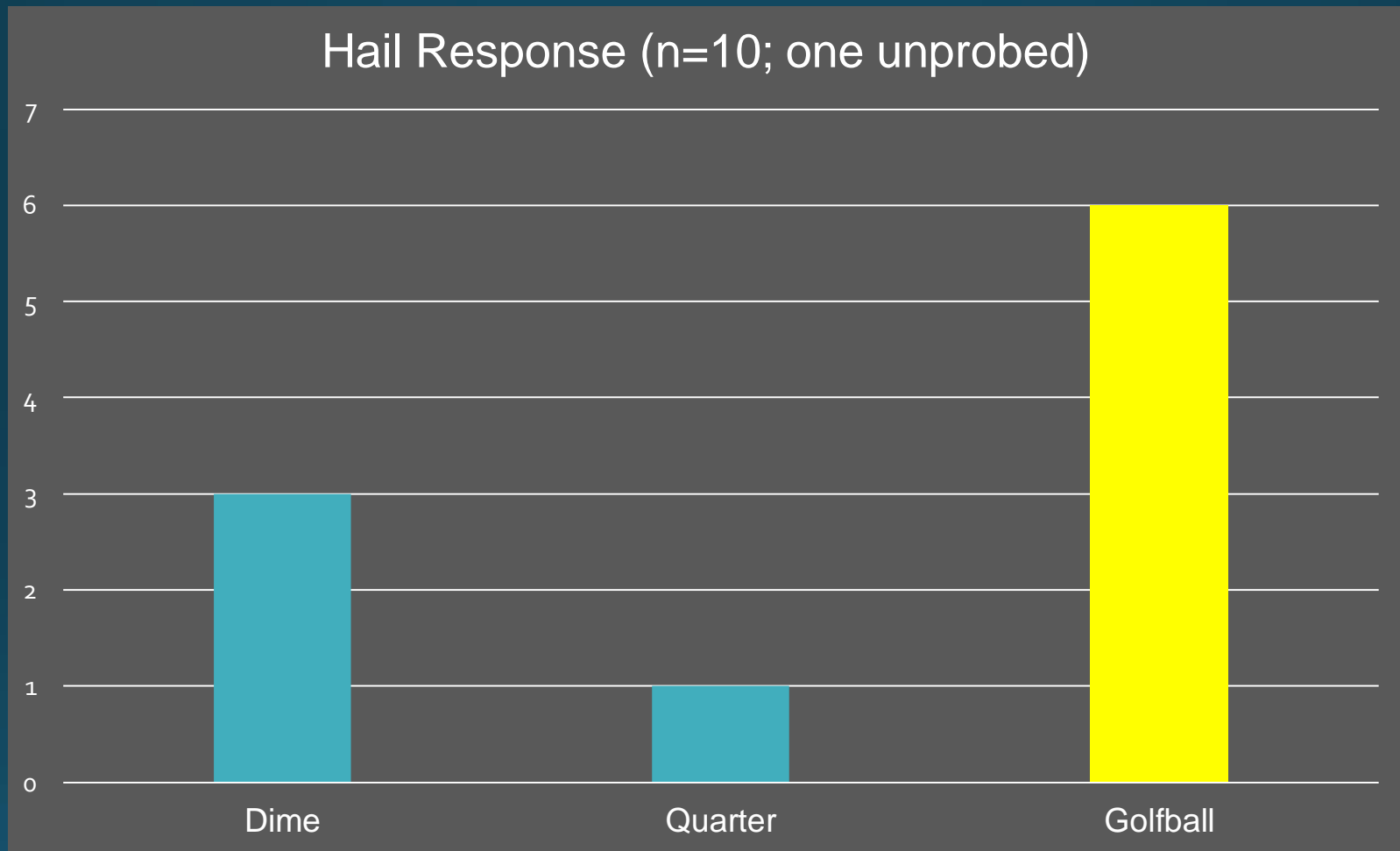
98th AMS Annual Meeting/13th Symposium on Societal Applications, Austin, TX

October 21, 2021

Sense of Lightning in a Severe Thunderstorm

n=20
(3 not probed)

Sense of Wind in a Severe Thunderstorm

Wind Response (n=20; one unprobed)
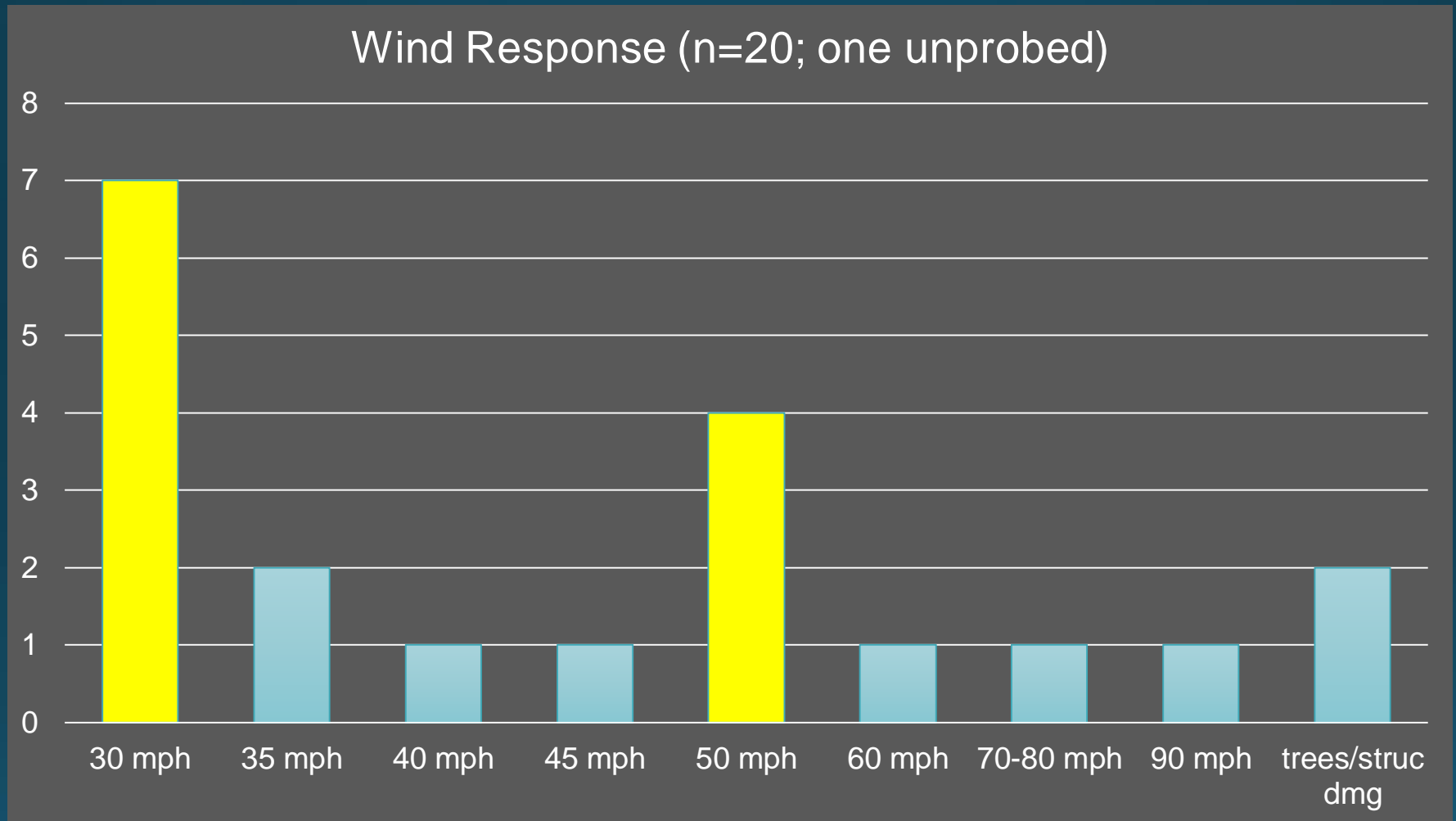
Sense of Hail in a Severe Thunderstorm

Hail Response (n=10; one unprobed)

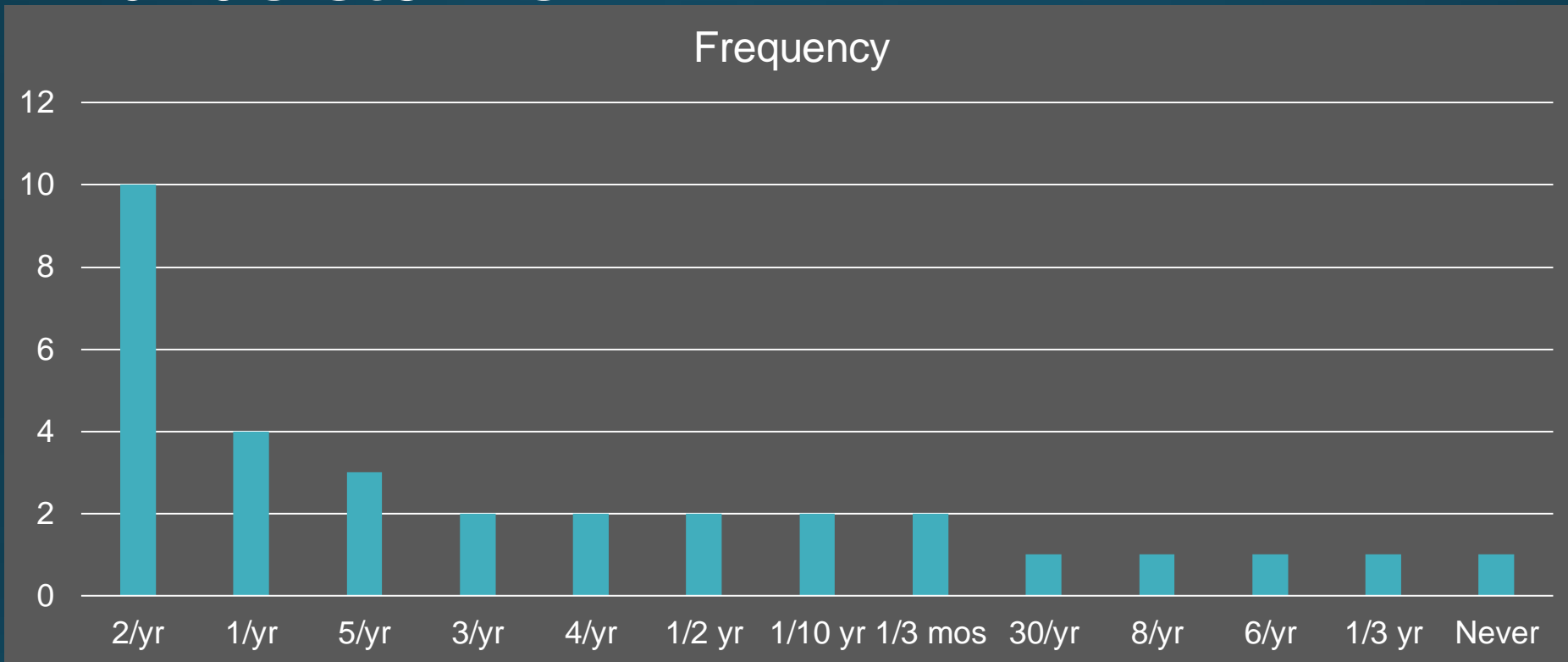# Danger Perception and Affect on Daily Routine (1-10 Rating Scale)
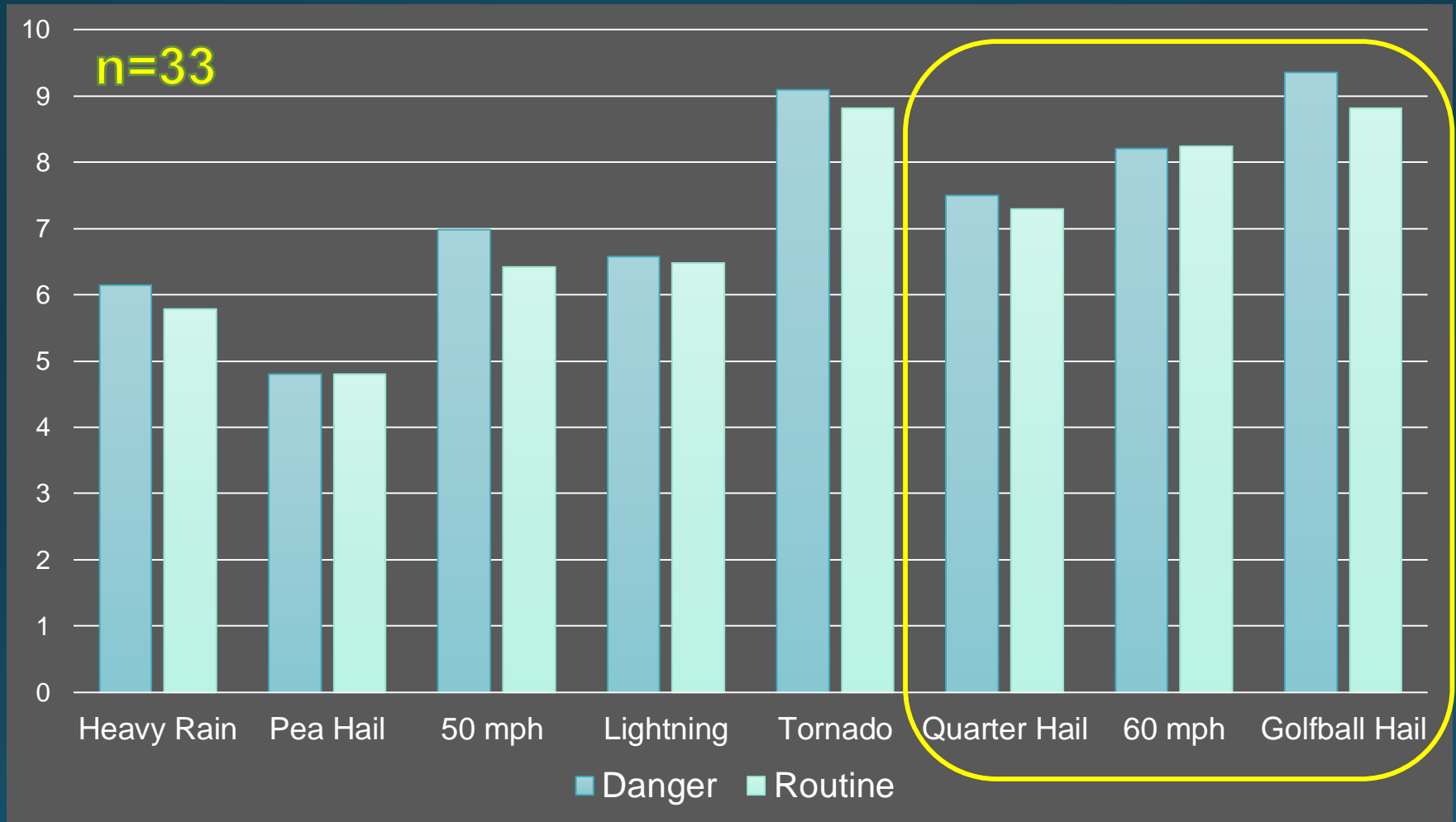
Would They Liked to Be Warned For...

- …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

2/yr	1/yr	5/yr	3/yr	4/yr	1/2 yr	1/10 yr	1/3 mos	30/yr	8/yr	6/yr	1/3 yr	Never
10	4	3	2	2	2	2	2	1	1	1	1	1

- 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.
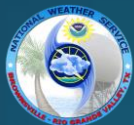
Survey Conclusions and Next Steps

- 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?
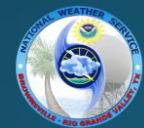
Questions?

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