The U.S. Public's Perceptions of Weather Forecasts and Forecast Uncertainty: Results from a Survey

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Overview of talk

- Motivation and approach
- Results from a nationwide survey that included questions on the public's views on
  - Everyday weather forecasts
    - Lazo et al., *BAMS*, in press
  - Weather forecast uncertainty and uncertainty information
    - Morss et al., *Weather and Forecasting*, 2008
- Future related work

Motivation

- To help the meteorological community and NOAA provide more useful weather forecast information, including uncertainty
  - By building empirical knowledge about users' needs, perceptions, interpretations, preferences, and uses of weather forecast information
  - Here: focus primarily on the U.S. public
- Despite forecasts' prevalence, we have a limited overall picture about how the public obtains, perceives, and uses them
- Significant interest in and attention to communicating forecast uncertainty (e.g., NRC, AMS, NWS, WMO)

Study design and data

- Nationwide (U.S.) survey in November 2006
- Survey developed iteratively, pre-tested
- Controlled-access, web-based implementation, with respondents provided by survey sampling company
- Analysis based on N=1465 respondents
- Respondent population is geographically diverse and similar to U.S. public, but somewhat older, more educated

Weather forecast research questions

- From where and how often do people get weather forecast information?
- For what locations or regions do people get forecasts?
- What times of day do people get forecasts?
- ***What weather forecast parameters are important to people?***
- ***For what do people use forecasts?***
- What is people's willingness to pay for forecasts?

(See Lazo et al. 2009 for all results)

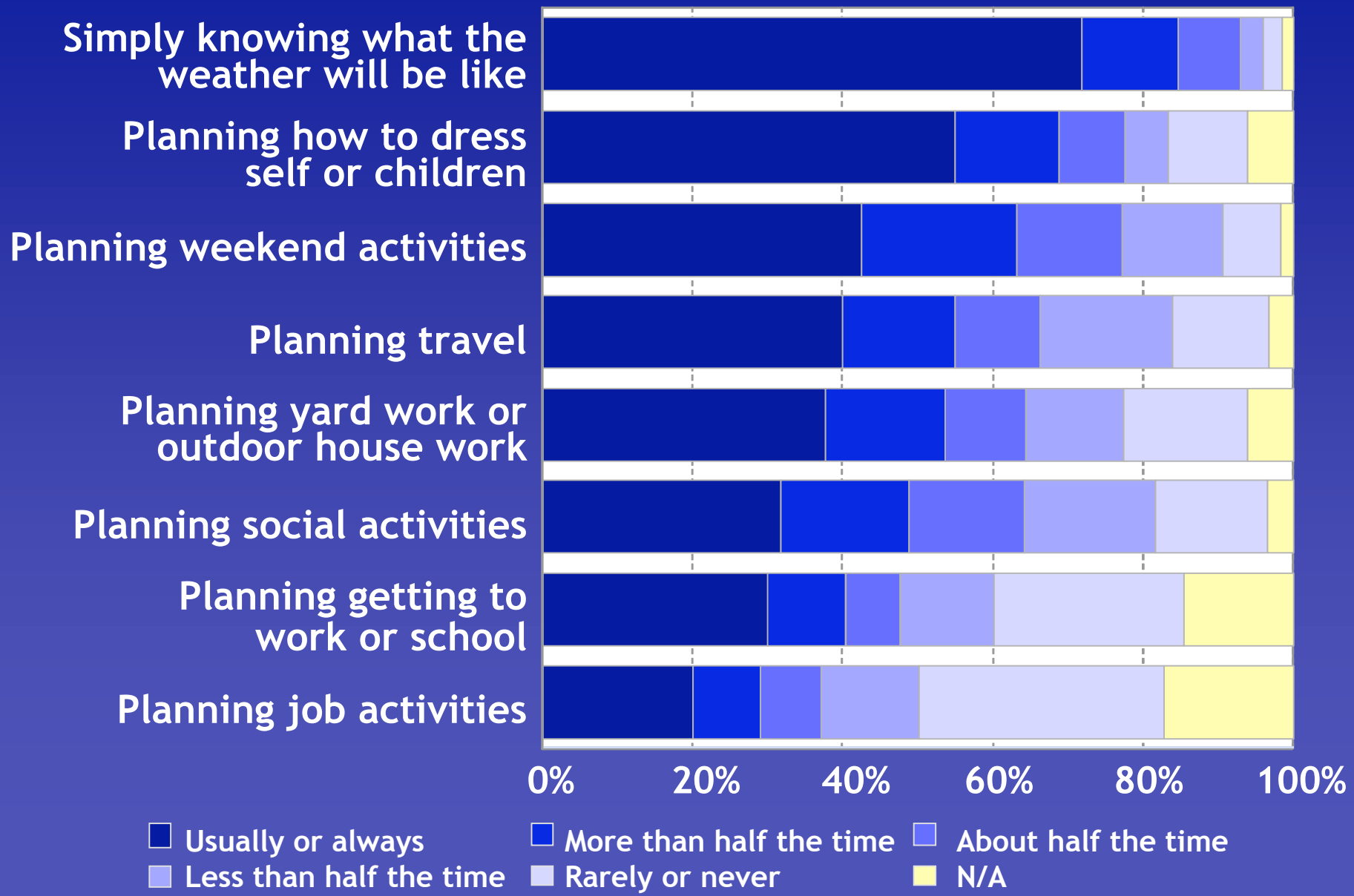
How important is it to you to have this information as part of a weather forecast?

Most important

- *Precipitation: When, where, type, chance (PoP)*
  ~70% of responses: very or extremely important
- *High temperature*
- *Amount of precipitation*
- *Low temperature*
- Wind speed
- Humidity
- Cloudiness
- Wind direction

Least important

On average, how often do you use weather forecasts for the activities listed below?

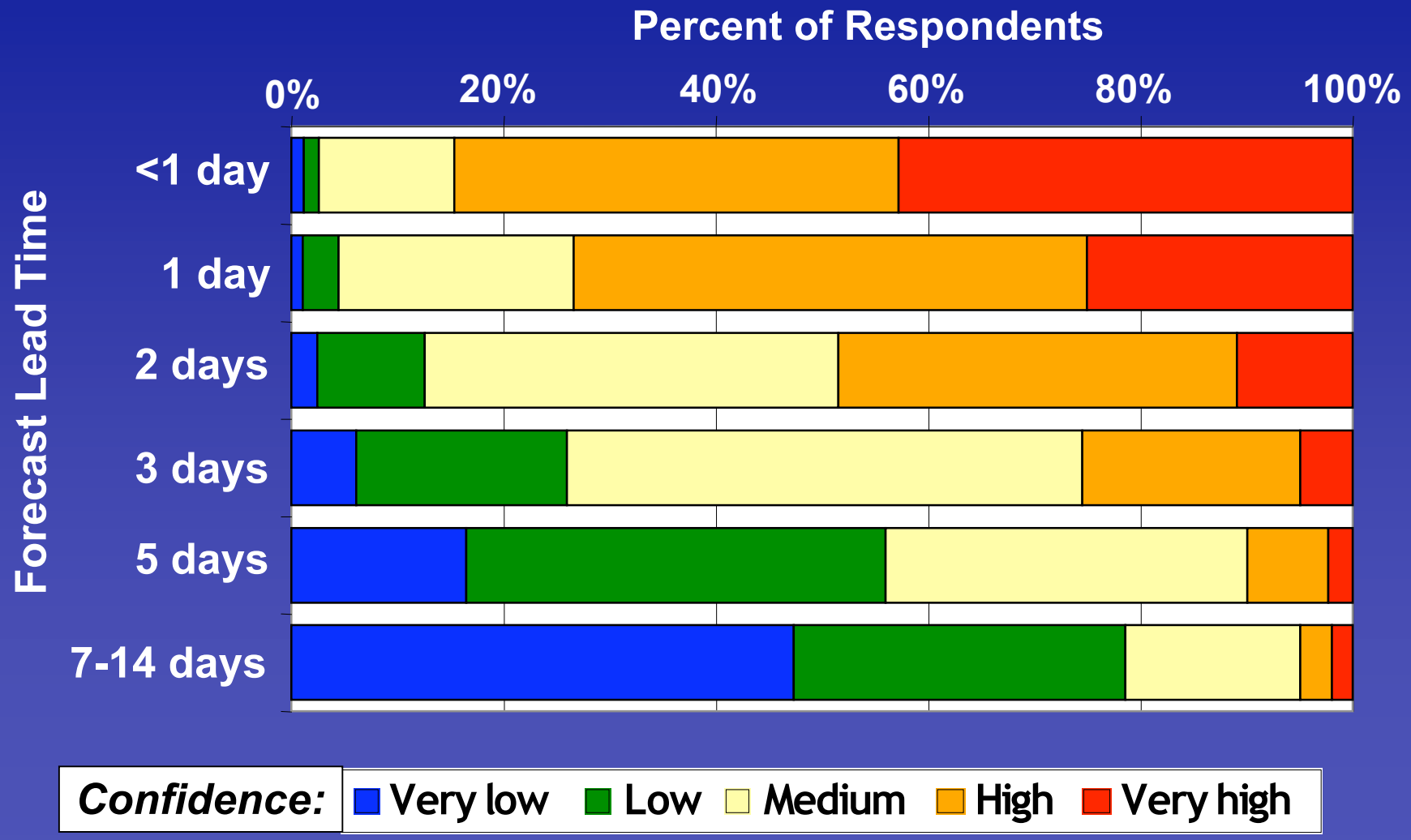


Uncertainty research questions

- Do people infer uncertainty into deterministic forecasts? If so, how much?
- ***How much confidence do people have in different types of weather forecasts?***
- ***How do people interpret a type of uncertainty forecast that is already common: Probability of Precipitation (PoP) forecasts?***
- ***To what extent do people prefer to receive deterministic forecasts vs. those that express uncertainty?***
- In what formats do people prefer to receive forecast uncertainty information?

(See Morss et al. 2008 for all results)

How much confidence do you have in forecasts …?



Interpretation of PoP

- Builds on previous related work by Murphy et al. (1980), Gigerenzer et al. (2005), others
- Asked all respondents about 2 PoP forecasts:
  - "There is a 60% chance of rain tomorrow"
  - "Rain likely tomorrow"
- Two versions of each question:
  - Closed-ended: ~90% of respondents
  - Open-ended: ~10% of respondents ("Explain in your own words")

Suppose the forecast is “There is a 60% chance of rain tomorrow”.

Which of the options do you think best describes what the forecast means?

Response option (N=1330)	Percent of respondents
It will rain tomorrow in 60% of the region.	16%
It will rain tomorrow for 60% of the time.	10%
It will rain on 60% of the days like tomorrow.*	19%
60% of weather forecasters believe that it will rain tomorrow.	23%
I don’t know.	9%
Other (please explain)	24%

* Technically correct interpretation, according to how PoP forecasts are verified (Gigerenzer et al. 2005)

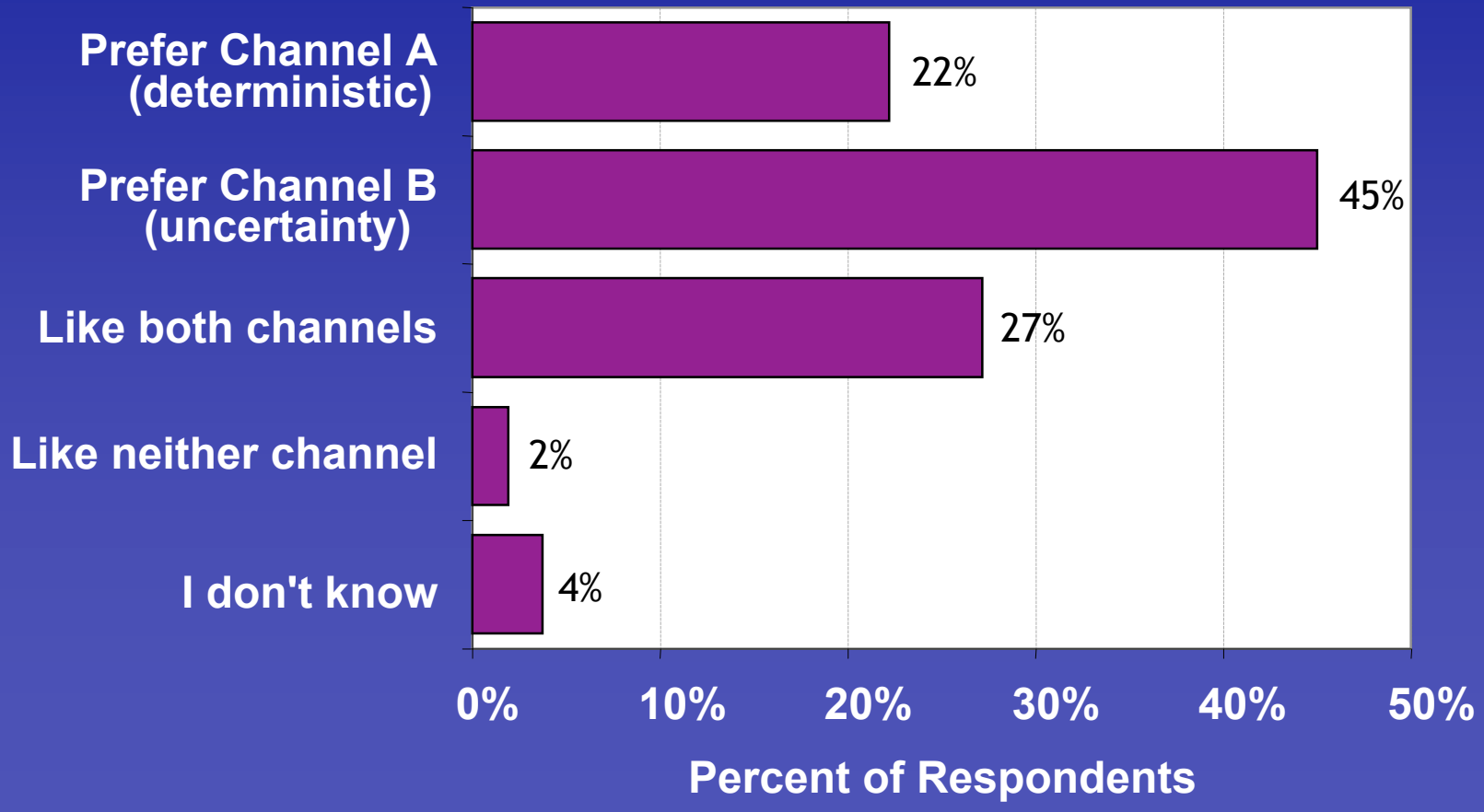
PoP: Open-ended interpretations

- Many responses repeat PoP, without clarification
- Few offered options from multiple choice version
- Variety of other responses, some from “personal” or “use” perspective
- Most people don’t know technically correct definition of PoP — 60% chance of what?
  - But asking about PoP from a meteorological perspective may have limited relevance …

    People must infer what the forecast means for their interests

Suppose you are watching the local evening news

- Channel A: high temperature will be 76°F tomorrow
- Channel B: high temperature will be between 74°F and 78°F tomorrow.



Summary of results

- People access forecasts frequently, for a variety of reasons
- Precipitation and temperature forecast information is most important to people
- Most people have some understanding of relative uncertainty in forecasts
- Most people don't understand the technical definition of PoP, but they find it useful
- Majority of people like non-deterministic forecast information, and many prefer it

$\Rightarrow$ The key is developing "effective" (understandable, usable) communication formats

Ongoing and future related work

- Further analysis of data from this survey, including:
  - how responses relate to sociodemographics and respondents' weather-related experiences
  - respondents' use of uncertainty information
- Follow-on surveys
- Further research on interpretations of and preferences for various forecast formats, for different weather types
- Integrate results with meteorological knowledge to improve forecast communication

  $\Rightarrow$ Iterative, dynamic process that connects learning from forecast users with product development

Questions?

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More results from survey:

Lazo et al.: 300 billion served: Sources, perceptions, uses, and values of weather forecasts. *BAMS*, in press.

Morss et al.: Communicating uncertainty in weather forecasts: A survey of the U.S. public. *WaF*, 2008.

Demuth et al., Morss et al., in preparation