Exploring People's Attitudes and Behaviors for Weather Forecast Information

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NCAR

How often do you get forecasts from the sources listed below?

1. Local TV stations
2. Cable TV stations
3. Newspapers
4. Telephone weather information source
5. Commercial or public radio
6. NOAA Weather Radio
7. NWS webpages
8. Other webpages
9. Cell phone, PDA, other electronic device
10. Friends, family, co-workers, etc.

How much confidence do you have in forecasts for weather 3 days from now?

- Very low
- Low
- Medium
- High
- Very high

Motivation

- Numerous weather forecasts are provided daily … and are of great benefit!
- But, the meteorological community is always looking to provide *better information in better ways* to serve the *range of users* of weather forecast information

Motivation (cont.)

- Yet, there's little empirical knowledge about *people's sources, perceptions, interpretations, preferences, uses, and values* of weather information
- A *clearer picture* of the public arena of weather forecast information today would provide a *foundation* to help us provide more *usable information* in better ways to meet people's needs for weather forecasts

Objectives

- To help the meteorological community provide usable weather forecast information more effectively
- … by better understanding people's sources, perceptions, and uses of weather forecast information
- … and by exploring relationships between these aspects and other variables

Part 1 of Methodology: Survey

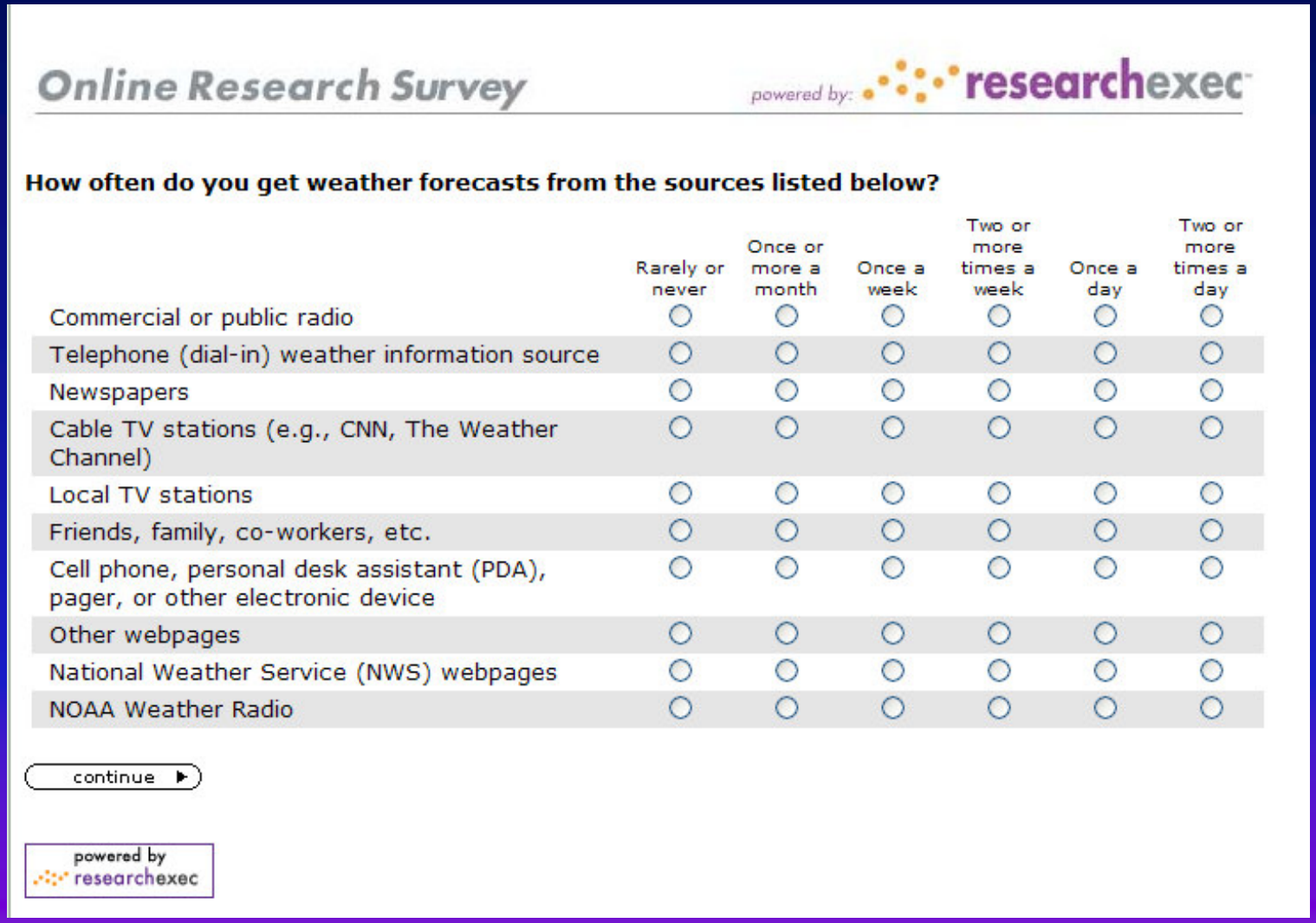
- Nationwide survey of U.S. public in November 2006
- Pre-tested during development and implementation
- Implemented as controlled-access web survey
- Respondent population:
  - is geographically diverse with responses from every state
  - has similar gender and race distribution to the U.S. public
  - is slightly older and more educated

N=1520 completed responses, but 3.6% of people say they never use weather forecasts … this analysis based on N=1465 responses

Survey questions

- Some questions based on previous survey research; some developed to investigate fundamental research questions
- Included questions about:
  - Sources, perceptions, uses, and values of weather forecast information
  - Perceptions of, interpretations of, and preferences for weather forecast uncertainty information
  - Use of weather forecast uncertainty information
  - Weather salience (Alan Stewart, U. of Georgia)
  - Demographics, weather-related behavior

Screenshot of sources question



Online Research Survey

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How often do you get weather forecasts from the sources listed below?

	Rarely or never	Once or more a month	Once a week	Two or more times a week	Once a day	Two or more times a day
Commercial or public radio	○	○	○	○	○	○
Telephone (dial-in) weather information source	○	○	○	○	○	○
Newspapers	○	○	○	○	○	○
Cable TV stations (e.g., CNN, The Weather Channel)	○	○	○	○	○	○
Local TV stations	○	○	○	○	○	○
Friends, family, co-workers, etc.	○	○	○	○	○	○
Cell phone, personal desk assistant (PDA), pager, or other electronic device	○	○	○	○	○	○
Other webpages	○	○	○	○	○	○
National Weather Service (NWS) webpages	○	○	○	○	○	○
NOAA Weather Radio	○	○	○	○	○	○

continue ▶

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There is a science to doing surveys!

Part 2 of Methodology: Regressions

1. Demographics (from survey)
   - Gender, age, employment, education, race, income, years residing in current location
2. Weather-related behavior (from survey)
   - Percent of work & leisure time outdoors, mean weekly hours traveling to work & working outside at home
3. Forecast accuracy (matched by zip code)
   - RMSE of max T fcsts, Brier score for PoP fcsts
   - NWS verification data – 12-hr periods, out to 7 days, at WFO county warning area level
4. Weather variability (matched by zip code)
   - Mean absolute 24-hr difference in max T and precip
   - NCDC observation data – data from 1600+ sites, averaged to WFO county warning area level

Get at people's experiences with weather

Weather forecast research questions

1. How often do people get weather forecast information?
2. For what reasons do people use forecasts?
3. What weather forecast parameters are important to people?
4. How much confidence do people have in different types of weather forecasts?

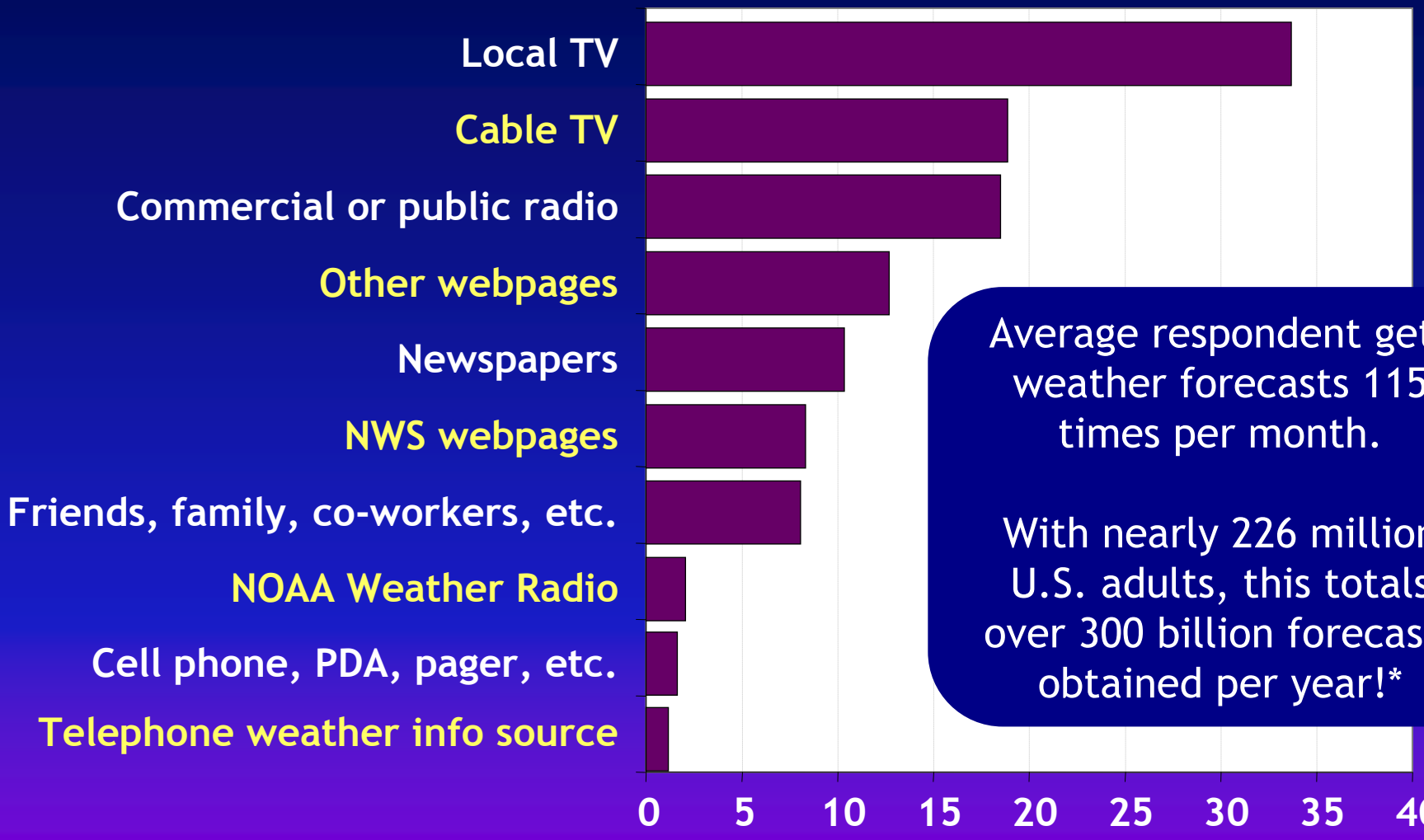
For each question, will look at:
(a) overall survey responses
(b) how demographics, behavior, and weather experience affect responses

Results

How often do you get forecasts from the sources listed?

- Response options → recoded to lower-bound quantitative count of sources per month
  - Rarely or never → 0 times per month
  - Once or more a month → 1
  - Once a week → 4
  - Two or more times a week → 8
  - Once a day → 30
  - Two or more times a day → 60

Mean # of forecasts obtained per month



Average respondent gets weather forecasts 115 times per month.

With nearly 226 million U.S. adults, this totals over 300 billion forecasts obtained per year!*

** Accounts for 3.6% of respondents who never use weather forecasts.*

N=1465

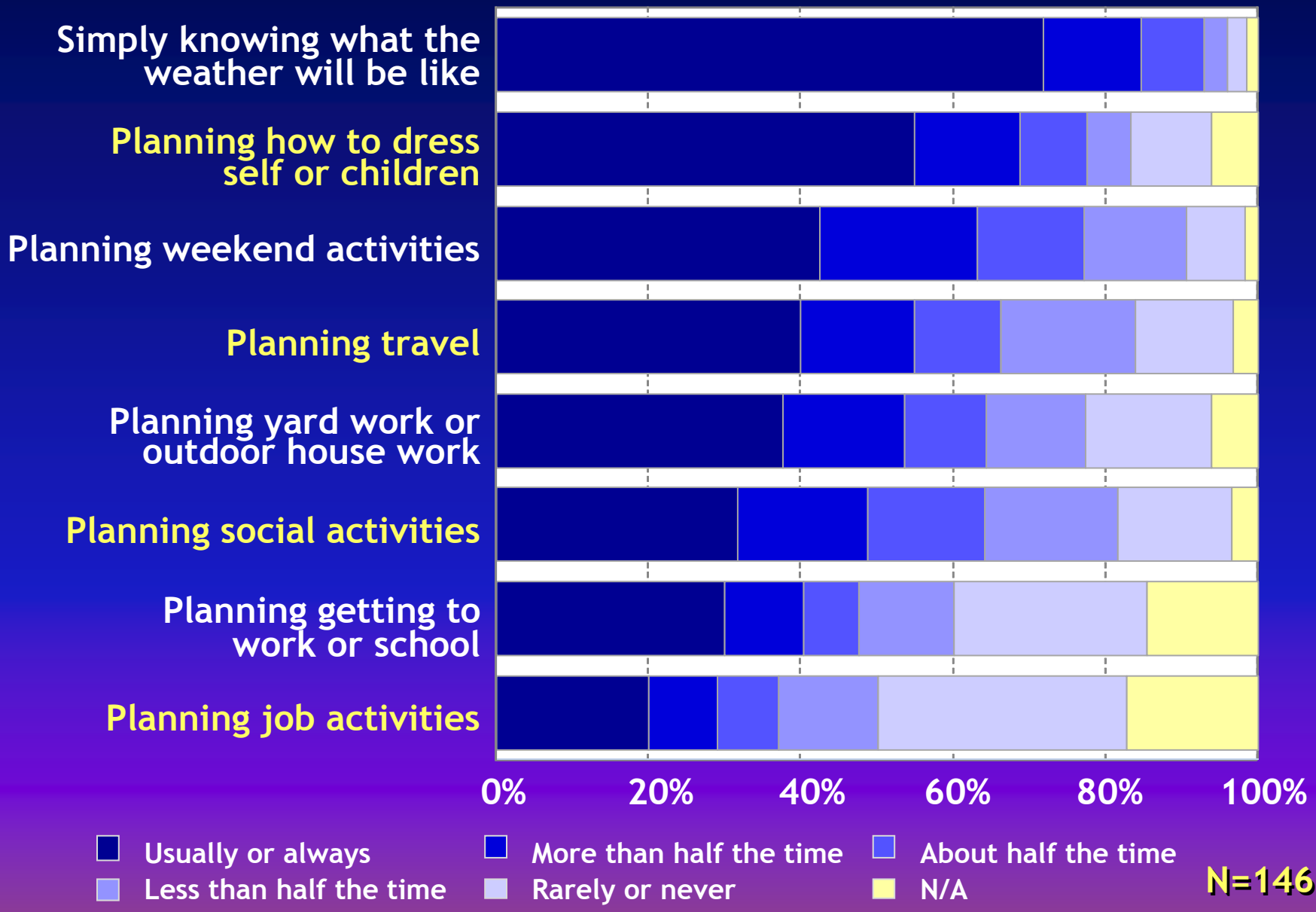
Y = Individuals' total frequency of getting forecasts

	X_i = Significant variables, p<0.1	More frequently
Demographics	Age	+
	Race	Non-white
	Income	+
	Years of residence	+
Behavior	% work time outside	+
	% leisure time outside	+
	Mean weekly hours traveling to work	+
Accuracy	Brier score of PoP (precip forecast error)	+

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

- Response options
  - Rarely or never
  - Less than half the time
  - About half the time
  - More than half the time
  - Usually or always
  - Not applicable to me

Use of weather forecasts



Y = Use of forecasts for dressing yourself or children

	X_i = Significant variables, p<0.1	Increased use
Demographics	Gender	Female
	Age	–
	Race	Non-white
	Years of residence	+
Accuracy	Brier score of PoP (precip forecast error)	–
Variability	Variability in max T	+

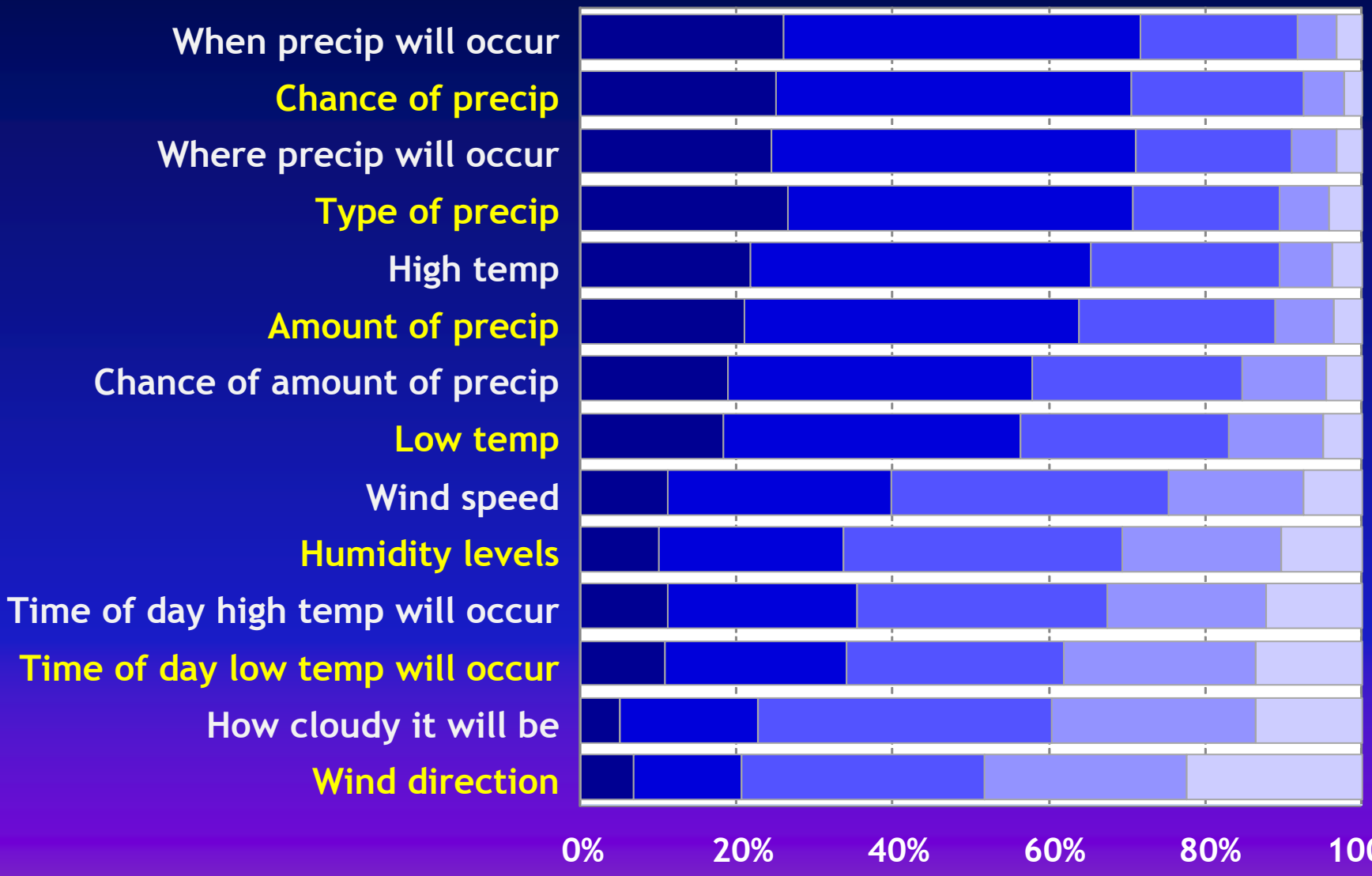
Y = Use of forecasts for planning weekend activities

	X_i = Significant variables, p<0.1	Increased use
Demographics	Gender	Female
	Race	Non-white
Behavior	% leisure time outside	+
Variability	Variability in max T	+
	Variability in precipitation	+

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

- Response options
  - Not at all important
  - A little important
  - Somewhat important
  - Very important
  - Extremely important

Importance of weather parameters



Y = Importance of all precipitation parameters

	X_i = Significant variables, p<0.1	More important
Demographics	Education	+
	Income	+
	Years of residence	+
Behavior	Mean weekly hours traveling to work	+
Variability	Variability in max T	+
	Variability in precipitation	+

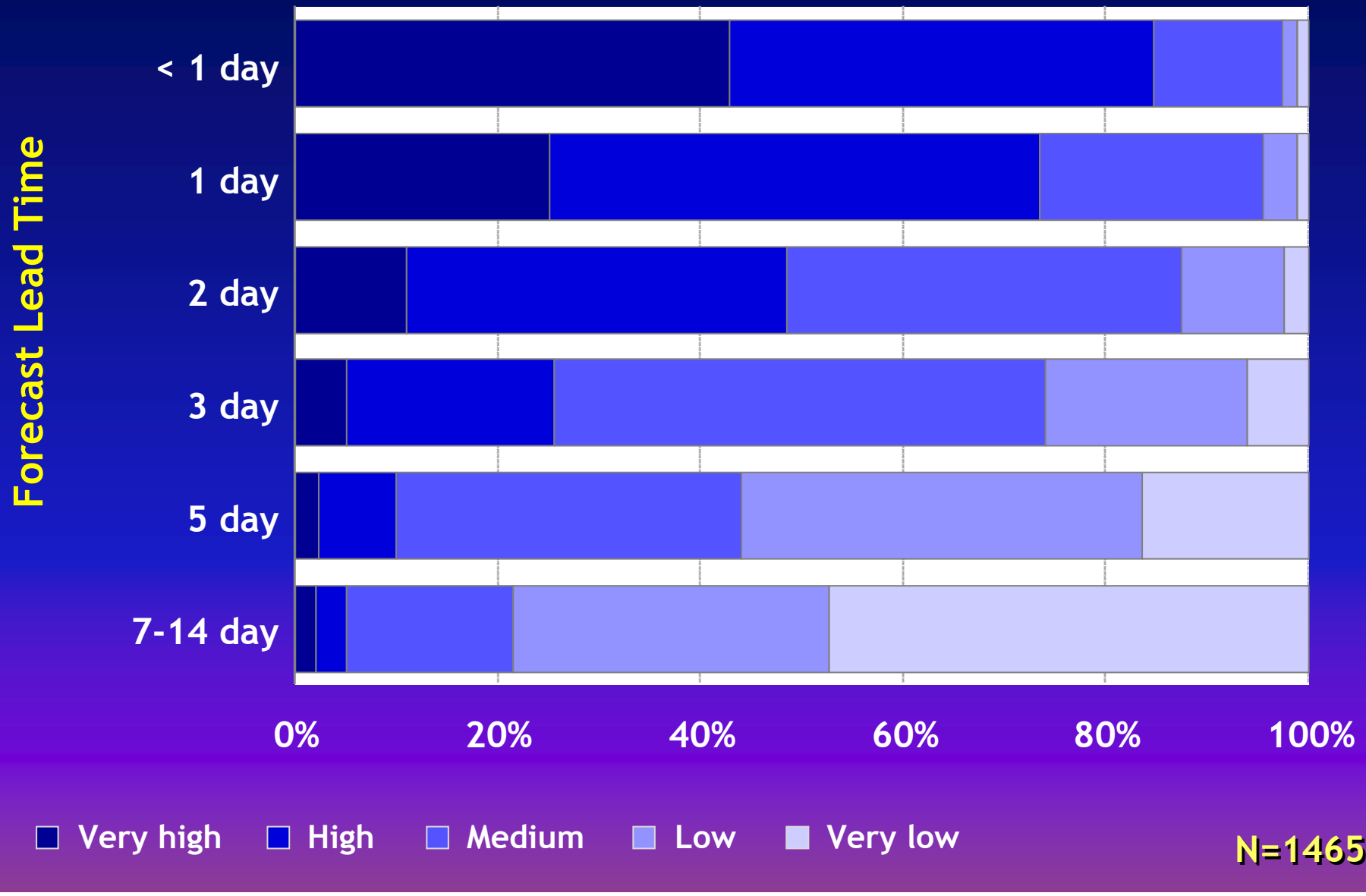
Y = Importance of all temperature parameters

	X_i = Significant variables, $p<0.1$	More important
Demographics	Gender	Female
	Age	–
	Employment	Not full time
	Race	Non-white
Behavior	% work time outside	+
	Mean weekly hours traveling to work	+
Variability	Variability in max T	+

How much confidence do you have in weather forecasts for the times listed?

- Response options
  - Very low
  - Low
  - Medium
  - High
  - Very high

Confidence in weather forecasts



Y = Confidence in forecasts for weather 2 days from now

	X_i = Significant variables, p<0.1	More confidence
Demographics	Age	–
	Employment	Not full time
	Income	+
Behavior	% work time outside	–
	Mean weekly hours working outside at home	–
Accuracy	RMSE of max T forecasts (temp forecast error)	–
	Brier score of PoP (precip forecast error)	–
Variability	Variability in precipitation	+

Y = Confidence in forecasts for weather 3 days from now

	X_i = Significant variables, p<0.1	More confidence
Demographics	Gender	Female
	Age	–
	Employment	Not full time
Behavior	Mean weekly hours traveling to work	+
	Mean weekly hours working outside at home	–
Accuracy	Brier score of PoP (precip forecast error)	–
Variability	Variability in precipitation	+

Patterns in forecast confidence

- Less work time outside → more confidence in <1-day, 1-day, 2-day forecasts
- Less time working outside at home → more confidence in <1-day, 1-day, 2-day, 3-day forecasts
- More variability in precipitation → more confidence in <1-day, 1-day, 2-day, 3-day, 5-day forecasts
- Less error in temp forecasts → more confidence in <1-day, 1-day, 2-day forecasts
- Less error in precip forecasts → more confidence in 2-day, 3-day, 5-day, and 7- to 14-day forecasts

Key summary points

- 300 billion served!
- Weather forecasts are inherently important to people, but also are used for specific purposes
- People's sources, perceptions, and uses of forecast information are influenced by their experiences with weather
- Some consistent relationships between demographics and sources, perceptions, and uses of forecasts

Future work

- This survey is just one snapshot in time!
  - Need to conduct these surveys regularly, to see how people's sources, perceptions, and uses change
- Numerous additional research questions to pursue
  - Reasons why people's experiences with weather affect their sources, perceptions, uses in the ways they do
  - Reasons for demographic relationships
  - Relationships between demographics and people's weather-related experiences & people's interpretations of and preferences for uncertainty info
  - These questions in other contexts (e.g., high-impact weather events)

Broader implications

- Providing more *usable* information more effectively
  - Provide people information that they *actually want and use* rather than *what we think* they do (or should) want and use
  - Couple results with product development efforts and practice-based knowledge
- *Tremendous amount of methods, theories, and ideas from the social sciences to be integrated in partnership with meteorologists*
  - To provide more complete picture
  - To explore more specific contexts, questions, etc.

Thank you

- Julie Demuth (jdemuth@ucar.edu)
- Societal Impacts Program (www.sip.ucar.edu)
- References
  - Morss , R.E., J.L. Demuth, J.K. Lazo, 2008: Communicating uncertainty in weather forecasts: A survey of the U.S. public. *Wea. Forecasting*, October 2008 issue.
  - Lazo, J. K., R.E. Morss, and J.L. Demuth, 2008: 300 billion served: Sources, perceptions, uses, and values of weather forecasts. *Bull. Amer. Meteor. Soc.*, in press.