Effects of Weather on Neighborhood Human Activity

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Introduction/Research Questions

Humans clearly adjust their outdoor activities in response to meteorological conditions. For example, few people would find it comfortable to exercise outdoors or talk to neighbors in 115 degree Phoenix summer heat—or sub-zero winter temperatures in Minnesota.

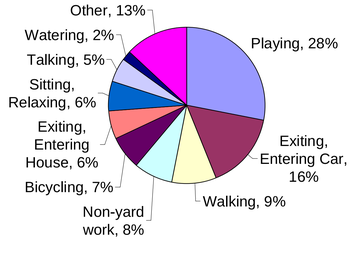
But aside from extreme situations where human responses are obvious, do daily meteorological conditions affect people's outdoor activities? This question is important because long-term climate changes can affect weather conditions and possibly change the amount of time people spend outdoors. We ask the following questions:

- What specific **meteorological conditions** affect outdoor activity? (temperature, humidity, dew point, visibility, pressure)
- What **types of people** are affected most? (age groups, genders)
- What **activities** are affected most? (exercise, socializing, play, outdoor work)

Systematic Observational Data

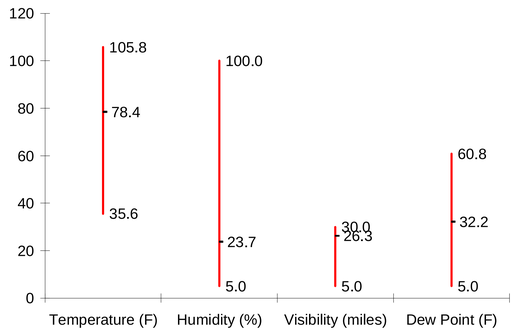
These data were observed at the North Desert Village neighborhood on the ASU Polytechnic campus. In total, **over 180 hours from 6:00 AM to 8:00 PM across 33 days** were measured in January, February, March, April, May, and September 2004.

These observations noted the precise time, location, and nature of the activity, as well as characteristics of the people involved. Over 1700 people were observed.



Williams Gateway METAR Data

These are **hourly meteorological data** from Williams Gateway airport, which is adjacent to North Desert Village. Measures include temperature, humidity, dew point, visibility, pressure, wind direction, and wind speed. Average weather conditions (mean, minimum, and maximum):



Methods of Analysis

North Desert Village observational data were merged with the hourly METAR data. The **unit of analysis** is the "observation round." An observation round is a one hour period in which data collectors walked through the five neighborhood blocks and recorded all human behavior. **N=187** observation rounds.

The **dependent variable** is the count of the people observed in the observation round.

The **independent variables** are meteorological conditions, plus several controls:

- Time of Day (early morning, mid morning, midday, early afternoon, late afternoon, early evening)
- Month (January, February, March, April, May, September)

The **statistical method** is linear regression. The data are analyzed in SAS. Poisson or negative binomial regression is planned for the future because the dependent variable is a count.

Results

1) Model predicting total people observed in an observation round

Effects of Controls:
- No effects of month.
- Significant effects of time of day; activity increases from early morning to early evening.

Effects of Meteorological Conditions:
- No significant effects of temperature or humidity. Substituting dew point for temperature and humidity also has no significant effect.
- **Significant effects of visibility**. As visibility increased, people engaged in more outdoor activities ($p<.01$)

2) Models predicting adults and children separately

Rationale: If adults and children respond differently to weather, then separate models may reveal different effects.

Effects of Meteorological Conditions:
- No significant effects of temperature or humidity for adults or children.
- **Significant effects of visibility become stronger for children** ($p<.001$). Effects of visibility for adults become weaker ($p=.07$)

3) Models predicting counts of people in specific types of activities

Rationale: Some activities, such as entering/exiting cars and houses are necessary no matter what the weather. Other activities, such as playing, walking, and working in the yard may be more responsive to weather conditions.

Effects of Meteorological Conditions:
- No large changes in effects of predictor variables when activities such as entering/exiting cars and houses were dropped from the counts.

Summary

- Temperature, humidity, and dew point are not associated with number of people engaged in outdoor activities.
- Visibility is significantly associated with people engaged in outdoor activities.
- The effect of visibility is stronger for children than for adults.

What does this mean?

- One explanation is that people choose to spend less time outdoors when there are conditions that happen to reduce visibility: pollution, fog, haze, impending rain. They are not consciously avoiding "low visibility conditions," but **people may avoid being outdoors on days that are less appealing based on "how it looks outside," rather than actual temperature and humidity**.

Future Work

Explore other aspects of weather conditions (pressure, wind speed). Preliminary analyses, however, show no impact of these factors.

Look more at specific types of activities. Separate activities into social versus non-social activities.

Look at location of activities (yards, common areas, streets).

Better coding of weather conditions. Instead of using raw temperature and humidity, create measures that form a "comfort index" that clearly summarize the most and least pleasant weather conditions in which to be outdoors.

Merging with other data: Pollution data.

Controls for day of week, controls for week day or weekend.