Cloudy with a Chance of Collisions: A Weather and Safety Traffic Analysis

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Introduction

In Utah alone, a crash occurs every 8.8 minutes (2023)

Prior research isolates crash factors (e.g., time of day, driver behavior), rarely accounting for **weather**

This study examines how weather conditions influence crash severity

Data & Method

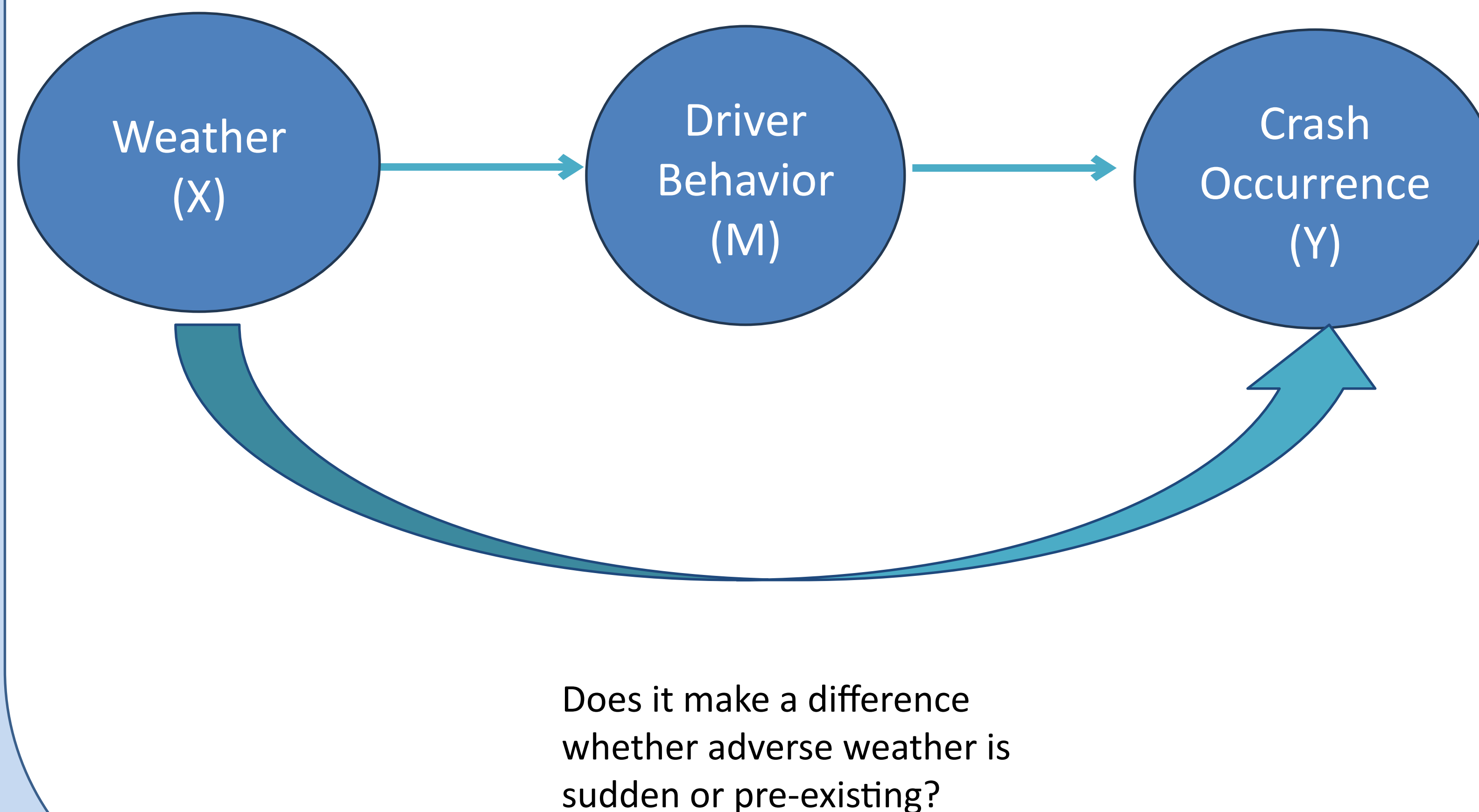Dataset: NYC Open Collision Data (2024 >38k records) + Weather Data via Visual Crossing API

Features added: Temp, precipitation, wind speed, and weather conditions

ML Model: Random Forest to identify predictors of crash severity

Causal Framework: Logistic Regression to compare sudden vs. pre-existing adverse weather

Causal Inference Question:

Are more severe accidents during bad weather caused by the weather itself, or because cautious drivers stay home, leaving riskier drivers on the road?

Weather (X) → Driver Behavior (M) → Crash Occurrence (Y)

Does it make a difference whether adverse weather is sudden or pre-existing?

Key Findings

The distinction between sudden vs. pre-existing weather conditions does not meaningfully impact crash outcomes:

- Driver behavior remains consistent
- Crash severity (injuries/fatalities) is not significantly different

Sudden vs. pre-existing bad weather does not significantly influence crash severity

Contributing factors (AKA driver behavior) do not hold a significant impact

There is no significant difference in fatality rates between crashes occurring during a sudden weather change and pre-existing adverse weather

Implications

- Controlling for whether the weather was sudden or forecasted had no significant impact on accident severity. This suggests that nearly the entire effect of weather on accidents is direct, with little to no indirect influence through driver selection.