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004 EPA STAR Graduate Fellowship Conference *Next Generation Scientists—Next Opportunities*

Partitioning the Effects of Weather and Air Pollution on Human Mortality in Santiago, Chile

NTRODUCTION

ne of the greatest challenges in modern epidemiology has been antifying the impact on human health of prolonged exposure to air llution. Meanwhile, because of the growing concern over the health nsequences of climate change, numerous studies have examined the pact of extreme weather conditions on health. Yet most studies only eculate as to the combined impacts of both weather and air pollution. ese impacts are often claimed to be "synergistic" or "interactive", but w studies have measured whether the combined effects are tagonistic, additive, or non-linear.

TUDY AIM

Identify regional
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sociated with poor air
ality and elevated
use-specific mortality

) Quantify the
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mbined impacts of
eather and pollution on
man mortality rates.

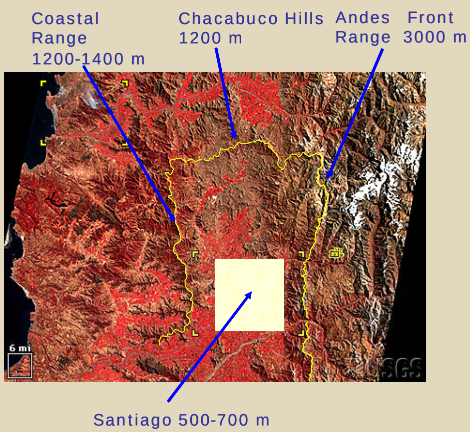

Figure 1. Santiago, Chile: Regional topography forms a closed basin, trapping air pollution

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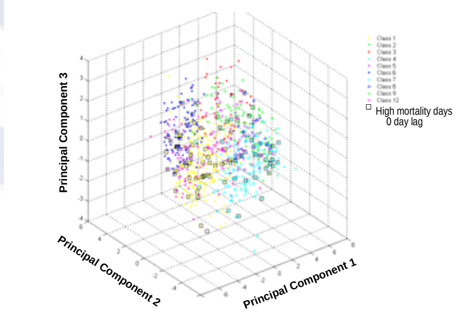

Figure 2. Results of the cluster analysis for weather classes. High-mortality classes were determined based on a the density of high-mortality days.

RESULTS

NO2 levels were significantly associated with total and respiratory mortality, though the relationship was weaker than that of temperature or dew point with mortality. The effect of extreme weather was strongest at short lag times (zero to three days), while the effect of pollution was strongest at longer lag times (three to six days).

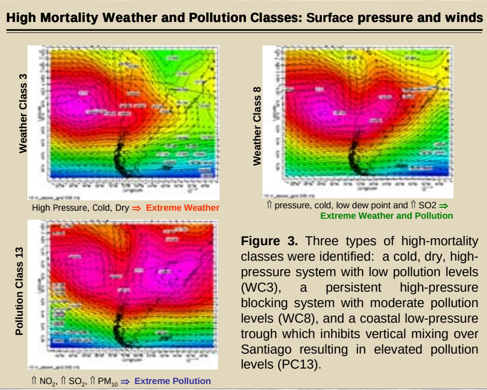

Figure 3. Three types of high-mortality classes were identified: a cold, dry, high-pressure system with low pollution levels (WC3), a persistent high-pressure blocking system with moderate pollution levels (WC8), and a coastal low-pressure trough which inhibits vertical mixing over Santiago resulting in elevated pollution levels (PC13).

METHODS

Each day in the study period was assigned to both a weather class and a pollution class using a synoptic temporal classification scheme (Figure 2). Stressful pollution and weather conditions were characterized using descriptive statistics. Forward stepwise multiple regression was used to determine the relative importance of weather and pollution variables in explaining the variation in excess deaths.

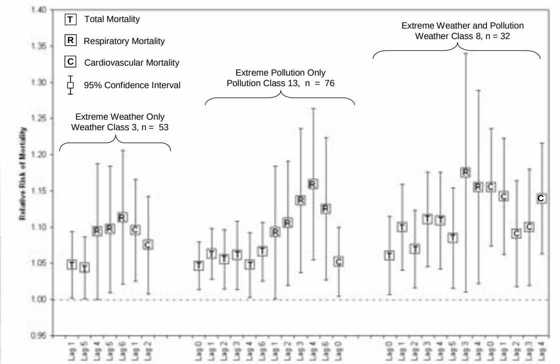

Figure 4. Differential impacts of pollution and weather on mortality: Cardiovascular deaths were more sensitive to extreme weather conditions, while respiratory deaths were more sensitive to high pollution levels.

CONCLUSIONS and BROADER IMPACTS

Pollution levels and weather conditions were both significantly associated with the number of excess deaths. The effect of simultaneous extreme weather and elevated levels of pollution on total mortality was approximately equal to their independent effects, indicating that their combined impact is additive, rather than antagonistic or synergistic. Applications of this methodology include improving pollution warnings and weather watch systems and helping to define research priorities with respect the human health impacts of global climate change.

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