How air pollution changed during COVID-19 in Park City, Utah

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As luck would have it, the air quality sensors that University of Utah researcher Daniel Mendoza and his colleagues installed in Park City, Utah in September 2019, hoping to observe how pollution rose and fell

through the ski season and the Sundance Film Festival, captured a far more impactful natural experiment: the COVID-19 pandemic.

Throughout the pandemic, the air sensors watched during lockdowns as air pollution fell in residential and commercial areas, and then as pollution rose again with reopenings. The changing levels, the researchers found, which behaved differently in residential and commercial parts of the city, show where pollution is coming from and how it might change in the future under different policies.

"The lockdown period demonstrated how low pollution levels can be and showed what the background pollution is in the area," says Mendoza, a research assistant professor in the Department of Atmospheric Sciences and visiting assistant professor in the Department of City & Metropolitan Planning. "The very low levels of $PM_{2.5}$ [fine particulate matter] can be considered an aspirational target and could spur increases in renewable and low-polluting energy sources."

The study, supported by the Sustainability Office of Park City, is published in *Environmental Research*.

Good timing

Before this study, neither Park City nor Summit County, Utah had a long-term record from regulatory air quality sensors. Although the population of Park City is much smaller than the Salt Lake Valley, its geography still creates temperature inversions that can trap and concentrate emissions from cars, businesses and other sources. Mendoza, who also holds appointments as an adjunct assistant professor in the Pulmonary Division at the School of Medicine and as a senior scientist at the NEXUS Institute, and his colleagues set up sensors at two different locations, one atop the building of the KPCW radio station, in Park City's "Old Town" district, representing a bustling commercial area. The

other was located at the Park City Municipal Athletic & Recreation Center, in an affluent residential area.

"We are looking to study other areas, including the Salt Lake Valley, but we wanted to focus on Park City because of the novelty of having sensors installed there," Mendoza says. In contrast to the Salt Lake Valley's diverse set of industrial and residential emissions, Park City's emissions are primarily related to heating and on-road traffic. It was already set to be a fascinating study.

"However, as we all know, COVID-19 happened and we had a natural experiment," he says. As restrictions and precautions went into effect, the research team tracked how emissions changed.

Lockdown

Emissions declined during the lockdown period across the city but decreased more in commercial areas. Many residents stayed at home and many offices shifted to remote work. But the emissions, Mendoza says, shifted to the residential areas.

"Due to exposure concerns, many people ordered food, groceries, etc. to be delivered to their homes," he says. "Furthermore, many companies have been allowing people to work from home, at least for part of the week, so car trips moved to residential areas instead of commercial areas."

Studying two clearly different locations in the same city is an important feature of the research, Mendoza says. "The intra-city variability is something that has not been studied in detail and can help us understand potential future emission and pollution patterns, particularly as teleworking is becoming a more viable and accepted option."

The findings can't be directly extrapolated to larger cities, but it stands to reason, Mendoza says, that air pollution emissions may have similarly shifted in many cities from a central city signal to a more dispersed residential pattern. "While traditionally residential areas have had cleaner air, this was not necessarily the case during and following the lockdown periods," he says.

Rebound

The sensors kept watch as activity largely returned to a form of normal in May and June 2020. By the end of the study period in late July 2020, commercial emissions hadn't yet returned to pre-pandemic levels, while residential emissions had made a full rebound. The researchers noted that the emissions rose over a course of two months.

"I think it's comparatively easy to lock down a place—businesses and activities shut down," Mendoza says. "However, reopening takes much more time and thought."

The researchers carefully checked their data and ruled out the possibility that the changes in emissions were due to changing seasons or meteorology. They concluded that changes in human activity produced a measurable change in air quality—a finding with broad implications. Pandemic-level emissions could serve as a baseline, for example, for air pollution reduction goals. The study also showed that residential heating and cooling are significant components of the air quality equation—something for policymakers to consider in the transition to a low-carbon energy economy.

Air pollution has improved following other events in the past, such as the Great Recession of 2008, says Tabitha Benney, associate professor of political science and a co-author on the paper. But those prior events weren't monitored with an inter-city perspective. So the observed trends

in Park City, with residential emissions rebounding faster than commercial emissions, came as a surprise.

"However, at the county level, it appears that pollution remains low over the entire study period," she says. "It is only when we use the inter-city perspective that such patterns become apparent. This has important implications for other urban areas as well."

More information: Daniel L. Mendoza et al, Intra-city variability of fine particulate matter during COVID-19 lockdown: A case study from Park City, Utah, *Environmental Research* (2021). DOI: 10.1016/j.envres.2021.111471

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