Using a low-cost sensor network to understand the effect of COVID-19 on particle pollution

Ember Chadwick, Katrina Le, Zheyuan Pei, Tofigh Sayahi, Anthony Butterfield, Kerry Kelly
University of Utah Department of Chemical Engineering

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The 2020 coronavirus pandemic and the widespread quarantine measures have made significant impacts on daily life worldwide. With many people now able to work and attend school from home, preliminary research has shown that air quality has improved in many urban areas. Our group takes a local, neighborhood-scale approach to quantifying this change in pollution. By utilizing data from the AQ&U network of over 100 citizen-run low-cost PM sensors throughout the Salt Lake Valley, we are able to achieve a higher spatial resolution when compared to the relatively sparse Division of Air Quality (DAQ) monitoring stations. We compared monthly average PM2.5 concentrations from February 11 - May 11 2019 with those identical sensors during the same timeframe in 2020. For those sensors with 75% complete data for each month, we performed a paired t-test. Our results showed a significant reduction in PM2.5 concentration from 2019 to 2020 for the periods from March 11-April 11 and April 11-May 11, decreases of 71.3% and 8.15% respectively. Significant decreases were also found during March and April in the Utah Division of Air Quality's PM2.5 measurements at the Hawthorne and Rose Park sites. To serve as our control period, we analyzed AirU measurements from February 11-March 11 in both years and found that concentrations actually increased by over 50% in 2020, which was likely the result of a more intense inversion event this February. A preliminary evaluation of the meteorological measurements (wind speed, direction, heat deficit) did not reveal major differences in meteorology between March and April in 2020 and 2019. These results suggest that the air quality improvement seen after March 11 2020 is due to isolation measures reducing traffic and decreasing pollutant emissions in the region. While we have observed decreases across the valley for the current year, it is important to note that the air quality has not improved by the same amount in every location. We hope that our concentrated network of sensors can provide insight as to where the smallest and largest changes have taken place. It is also relevant that March, April, and May are historically good air quality months for Salt Lake, so measurements are near or below their limit of detection (1-5 $\mu g/m^3$) during the study period. Our findings contribute to the wealth of evidence that quarantining due to COVID-19 has positively impacted the quality of our air. We hope that this empowers people to make their communities healthier by changing their own behaviors, especially during a public health crisis, as well as far into the future.