Chapter 6: Synopsis

Exposure to ozone pollution has serious health risks. Damage to lungs and impacts to cardiovascular health are of particular concern for vulnerable populations including children, the elderly, and the disadvantaged whose health may already be compromised. The current regulatory standards for ozone exposure were established to protect human health; however, direct monitoring of individual exposure is seldom done. Our data suggest that outdoor recreationists were exposed to several times the regulatory standard of 65 ppb for vulnerable populations on a number of observed days and locations.

The development of the monitoring approach described here had three iterations. Experiment 1 was a proof of concept and exploration of potential system errors. Experiment 2 was a more extensive use of personal monitoring to evaluate potential differences in ozone exposure based on differing urban structure, but in relative proximity. We know that significant differences in tree cover, industrial activity, and housing were related to the differences in socioeconomic strata. We did not know how highly variable ozone concentrations would be from one day to the next, making passive ozone concentrations taken on different days across communities impossible to compare directly. Furthermore, the codependence of affluent communities being located along the coast where the air tends to be cleaner and disadvantaged communities being located inland where air quality typically is poorer prevented robust interpretation of the data. Our original impetus for moving the passive monitors from the observer’s torso to the head was to further reduce cross-sampler variability. However, we also speculate that placing the passive monitor on a hat might better represent the ozone exposure to the mouth and nose and thus the respiratory system.

Experiment 3 added two new parks in an affluent inland community and two new parks in a disadvantaged coastal community to address the codependence of clearer air at the coast and higher air pollution loads inland. Observation periods were paired so that an affluent community was matched to a disadvantaged community for each of the observation periods. This greatly increased the sensitivity of the study.

The most remarkable modification was placing the passive samplers on the observer’s head. Although we expected better replication because of more uniform air circulation, we did not expect the apparent exposure to increase by nearly an order of magnitude. Upon further study, it seems clear that while humans are moving through the environment, the environment is constantly moving around their bodies. Unlike the effort to monitor “ambient conditions” in which samplers are protected from the direct impacts of wind because diffusion is the primary mechanism for ozone to chemically react with the treated filters, when it comes to
human exposure, wind, body movement, and position are the mechanisms by which ozone is delivered to the respiratory system.

Several other protocol modifications could be made if the study were to continue, such as the following:

- Make direct comparisons of samplers worn on both the head and the torso by the same individual.
- Add meteorological data from each of the parks during the observation period (to clarify the influence of weather on ambient ozone variability).
- Explore geographic and topographic effects more broadly (to assist in understanding potential risks to outdoor recreationists and lead to better mitigation measures).

The future forecast for southern California is hotter, dryer, and longer summers. Research suggests that this will likely lead to increases in ozone concentrations regionwide, with areas currently experiencing high ozone levels likely to experience the largest increases in ozone concentrations. Because these high ozone areas are frequently situated in disadvantaged communities where health concerns are already elevated (Winter et al. 2019), it seems likely that increased ozone concentrations will add to the health burdens of recreationists who reside in these communities.

References


