Analyzing the Equity Implications of Alternative Climate Change Mitigation Interventions to Reduce Transportation Emissions

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Shifting the United States transportation system away from fossil-fuel powered vehicles is a major focus of climate change mitigation efforts, given that the transportation sector is the largest contributor to the country's greenhouse gas emissions. Actions to mitigate these emissions also have important implications for local traffic-related air pollution, for which there has been heightened exposure in lower income communities and communities of color. Many strategies could reduce overall emissions from transportation sources, but studies have not formally assessed the extent to which these strategies reduce existing exposure inequities. In this study, we evaluated the impacts of a set of hypothetical interventions to reduce transportation emissions in the Northeast and Mid-Atlantic United States, considering the aggregate health benefits as well as the implications for equity. Our interventions were motivated in part by potential responses to the Transportation and Climate Initiative (TCI), with multiple alternative emissions reductions strategies co-designed with members of environmental justice organizations from TCI states. We modeled the air pollution implications of each scenario using an emissions and dispersion modeling platform (MOVES-SMOKE-CMAQ with application of the Decoupled Direct Method) to characterize air pollution sensitivities across source sectors and geographic locations. We compared concentration patterns of fine particulate matter (PM2.5) between baseline and post-intervention using multiple quantitative inequality indicators from the peer-reviewed literature that were responsive to interests of environmental justice organizations. Our analyses indicate that emission control scenarios that targeted public transportation and other sources geographically concentrated in urban areas will lead to the greatest reductions in racial and ethnic air pollution inequality. Modeling platforms that quantify exposure and health co-benefits of climate mitigation strategies in high spatial detail with an explicit emphasis on equity, including through collaboration with representative organizations from impacted communities, can provide insight about optimal policies responsive to environmental justice concerns.

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