



Air Pollution-Related Health Disutility and Mitigation Policy Favorability Amongst California's San Joaquin Valley Residents: A Health Economics Perspective on Equity

Gilda Zarate-Gonzalez PhD MPH MS, Paul Brown PhD, Ricardo Cisneros PhD MPH



Rationale

Outdoor air pollution has been recognized as a likely cause of respiratory disease and is a main driver of climate change. In California's San Joaquin Valley (SVJ) exposure to O₃, NO₂, and PM_{2.5} has been associated with increases in asthma and respiratory symptoms visits to the emergency department, and hospitalizations. It is unknown if residents of the region are experiencing differential costs and what air pollution mitigation and control interventions they favor.

Objective

To examine what air pollution mitigation policies and interventions residents are likely to support and determine predictors. The study includes air quality information symmetry assessment, and distributional equity of health-related quality of life (HRQoL) amongst the region's residents.

Study Design and Participants

A total of 310 adults residing in the SVJ participated in the survey with 34% reported having been diagnosed with asthma by a healthcare practitioner. The cross-sectional online survey asked about health status and conditions, self-protective behaviors, attitudes toward air pollution recommendations, air quality information knowledge, and mitigation behaviors, as well as whether their views are favorable or unfavorable. The EuroQOL-5D-3L instrument was utilized to assess HRQoL distribution and policy favorability.

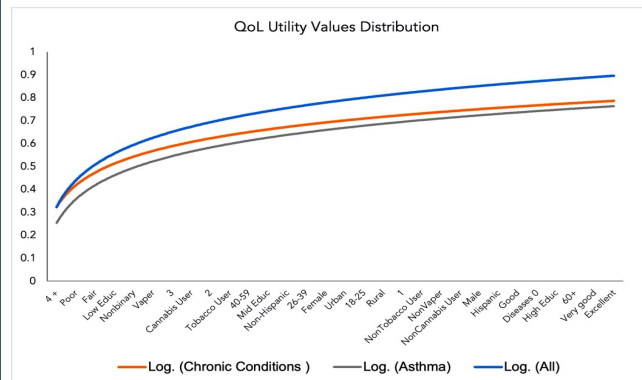
Statistical Analysis

Multivariate logistic regression was used to assess the characteristics of residents with association to health utility values, conditional on other covariates. To explore what policies and interventions are supported by SVJ residents, principal component analysis (PCA) was used using varimax rotation. PCA is a type of multivariate analysis for feature extraction and observation of trends, clusters, and outliers. Each component is orthogonal by design and is appropriate for complex data while the extemporary theoretical framework is applicable in exploratory research. Predictors of latent factors were obtained using regression modeling to understand the characteristics, relationship, and magnitude of support for policies and interventions to mitigate air pollution exposure.

Results: Value of Health

All three groups reported higher utility values when responding to the state of their current general health was excellent ($U=.825$). People with chronic conditions sensitive to air pollution reported a higher utility when their general health was good ($U=.777$) compared to people with asthma ($U=.747$), and all ($U=.763$). People with asthma consistently reported the lowest mean utility values for all categories (Figure 1). By the number of chronic conditions, people with no chronic conditions reported the highest utility value ($U=.771$), compared to people with asthma who reported comorbidities that are made worse by air pollution ($U=.135$). Those residents who reported not living within one mile of a freeway or highway reported higher utilities in every health state, as well as those residents who were not tobacco, vape, or cannabis users.

Figure 1. Health Utility Values by Health State



Latent Factors

Latent factors revealed were concerns for charge, expense, and car in the adoption of hybrid and electric vehicles. Differential interest in the involvement of local and non-local organizations in regulating air quality for the region was found. Factors that must be considered during policy and intervention formulation are directed costs and who will pay. Residents support air pollution control, and preservation of public space (Table 1), as well as being concerned with the persistence of adverse symptoms due to poor air quality and having to adopt additional personal actions to protect themselves, their children, and elders from air pollution exposure.

Table 1. Mitigation and Control Policies Rotated Factor Loadings (Varimax)

	Factor 1	Factor 2	Acceptability Mean (SD)
"During the COVID-19 period or shelter-in-place, I have sensed/experienced good clean air and I don't want to go back to the air pollution levels we previously had"	0.306	0.433	3.22 (1.27)
"Cities must take effective measures to protect citizens from air pollution, even if this requires reallocating public space to walking, cycling and public transport"	0.767	0.326	3.59 (1.21)
"Cities must take effective measures to protect citizens from air pollution, even if it means preventing polluting cars from entering the city"	0.743	0.256	3.23 (1.29)
"I think we need to resume our normal lives soon and must accept that air pollution will rise again"	-0.522	0.582	3.07 (1.32)
"More public space in your nearest town/ city should be reserved for public transport (e.g., by expanding bus lanes)"	0.316	0.690	3.30 (1.05)
"More public space in your city and nearest towns should be reserved for cycling"	0.415	0.742	3.51 (1.03)
"More public space should be reserved for pedestrians"	0.380	0.724	3.62 (1.00)
"More policies should be adopted to stop polluting cars and trucks from entering the city, for example through Zero-Emission Zones"	0.743	0.269	3.28 (1.21)
"More companies should allow their workers to continue working from home or telecommuting"	0.542	0.288	3.96 (0.98)
"More cities and counties should work together to create clean, fast and reliable regional transportation systems to connect the Central Valley"	0.714	0.250	4.11 (1.01)

Predictors

Socioeconomic factors and health state were significant explanatory variables. Left-wing ideologies predicted favorability for policies that charge polluters to clean the air, control air pollution emissions, public space preservation, and interventions that reduce health symptoms and ease the health burden of air pollution. Right-wing political views were a negative predictor for HEV charge, HEV car attributes, and having local organizations intervening in air pollution emission control.

Conclusion

This study provides analytical evidence of distributional costs related to endemic poor air in the SVJ region of California. People with asthma and chronic conditions report higher costs in quality of life. Local policymakers could invest in cohesive and democratic public health strategies that encourage trust in agencies and stakeholders, with the end goal of promoting equitable adoption of individual, household, and community protective policies and behavior change. Whether it is at the macroeconomic (structural) or microeconomic (individual and household) level, health economics offers a lens through which preferences of decision-makers, health outcomes, and health costs can be assessed to adopt cost-effective mitigation and control measures of air pollution and avoid adverse health outcomes.