

Applying Local Health Cost Data to Better Estimate the **Economic Burden of Air Pollution in the United States**

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Highlights

- Medical costs from hospitalizations and ED visits are 69% lower to 23% higher when using updated cost data than when using standard BenMAP-CE inputs
- Accounting for additional costs (i.e. outpatient services, home health care, and prescribed medicines) not included in BenMAP-CE increases health-related costs substantially for some but not all outcomes
- Regional medical costs vary by 33% to 144% for a given health outcome and show similar patterns across outcomes

Background

Ambient air pollution exposure causes adverse health outcomes and associated economic burdens. US EPA's Environmental Benefits Mapping and Analysis Program–Community Edition (BenMAP-CE) is widely used for estimating the health effects and economic value of air quality changes. Healthcare cost data for hospital admissions and emergency department (ED) visits in BenMAP-CE represent national averages, which obscures cost differences that exist by region and state.

Past research has found that accounting for ambulatory and other care costs in estimates of illness from air pollution increased cost estimates 35% to 43% above what BenMAP-CE calculates (Birnbaum et al, 2020). There is extensive literature on the sensitivity of reported air quality-related health outcomes to the spatial resolution of exposure estimates, choice of exposure-



4.87 -3.46 -2.41 -1.67 -1.15 -0.78 -0.47 -0.19 -0.00 ₅ concentration (μg/m³) [difference from baseline]

response function, and the spatial resolution of baseline incidence. Relatively little research has explored the effect of the spatial resolution of health costs on monetized health outcomes related to air pollution exposure or the extent to which such costs differ by age group, sex, race/ ethnicity, or expected payer.

Figure 1. CMAQ model output showing differences in PM_{2.5} concentrations between select scenarios that achieve full attainment of proposed and alternative revisions to the PM NAAQS and the baseline scenario in 2032. Annual/Daily standard levels of 10/35 µg/m³ (top panel) and 8/35 μ g/m³ (bottom panel).

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Figure 2. Comparison of standard per-incidence BenMAP-CE health costs (2015 and 2016) with updated cost data (2019). Top panels show standard BenMAP-CE cost inputs (blues), updated costs (greens), and additional costs (i.e. outpatient services, home health care, prescribed medicines) not included in BenMAP-CE (yellow). All values are in 2019 US dollars. Lost wages represent the national median wage. Bottom panels show ratios of updated costs to standard national average cost (medical costs only); black bars show national ratios and colored bars show ratios by Census Division (for hospitalizations) and Census Regions (for ED visits). Divisions/Regions are listed in increasing numerical order from left to right. See Figure 3 for colors of regions. IHD = ischemic heart disease; MI = myocardial infarctions.

> Figure 3. Nine Census Divisions (on map) and four Census Regions (in legend).





Figure 4. Average asthma hospitalization charge by state in thousand 2019 US dollars. Data from HCUPnet. Health outcomes are grouped by primary diagnosis Clinical Classification Software Refined (CCSR) category instead of ICD-10 codes as in the rest of the analysis.

Data and Methods

We calculate updated medical costs in 2019 for hospitalizations and ED visits in BenMAP-CE using data from the Healthcare Cost and Utilization Project (HCUP; Figure 2; U.S. AHRQ, 2022). Regional medical cost data from HCUP are used to determine whether and where BenMAP-CE may be underestimating or overestimating healthcare costs associated with air pollution exposure by using national averages (Figure 2, bottom panels). Additionally, we use health-related costs associated with outpatient care from HCUP, supplemented with home health care and prescription medication costs from the 2019 Medical Expenditure Panel Survey (MEPS; U.S. AHRQ, 2023), to estimate additional healthcare costs of air pollution exposure not currently included in BenMAP-CE.

Next Steps

- model data provided by EPA (see Figure 1)

References

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Calculate health-related costs by age group, sex, race/ethnicity, expected payer, and other population characteristics to explore the equity implications of using more differentiated cost data

Apply our expanded set of valuation functions to health benefits estimated to stem from proposed and alternative revisions to the primary National Ambient Air Quality Standards for fine particulate matter using CMAQ

Conduct state-level analysis using HCUP data from select states to determine how much more localized (i.e. state-level) costs differ from regional and national average costs (see Figure 4 for example)

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