CLIMATE CHANGE & FISCAL RISK: AIR QUALITY TECHNICAL SUPPLEMENT

Assessing Morbidity Outcomes

Garcia-Menendez et al. (2015) modeled air quality and health benefits from avoided climate change under two GHG mitigation scenarios using EPA's Environmental Benefits Mapping and Analysis Program (BenMAP). BenMAP, which is used by EPA to model health benefits of air quality regulations in Regulatory Impact Analyses (RIAs), draws on concentration response functions (CRFs) that define how health outcomes change in response to changes in exposure to fine $PM_{2.5}$ and ozone.

Garcia-Menendez et al. published BenMAP results for premature mortality, which accounts for the overwhelming majority of total economic damages of degraded air quality. However, the study authors also modeled morbidity outcomes. These results were provided to OMB and CEA for the purposes of this assessment. While these morbidity results are preliminary and were not subjected to peer review alongside the mortality results, they align reasonably well with expectations given the order of magnitude of mortality results.[1] This assessment included only non-fatal myocardial infarctions (heart attacks); hospital admissions for respiratory conditions; hospital admissions for cardiovascular conditions; and emergency department visits for asthma attacks.

Modeled outcomes are shown below, adjusted for OMB population growth estimates (26 percent by 2050 and 57 percent by 2100) to reflect increases in air quality exposure expected with a denser population. This step assumes the distribution of future population growth will mirror the current U.S. population distribution. Depending on whether future population growth occurs in areas that are more or less afflicted by climate change impacts on air quality, this assumption could cause results to be too low or too high.

Mean Change in Morbidity Incidence Due to Climate Change
(Compared to Mitigation Scenario)

Health Outcome	2050	2100
Non-fatal heart attacks (Peters et al.)	4,140	22,758
Non-fatal heart attacks (pooled estimate)	483	2,681
Respiratory hospital admissions	3,508	21,382
Cardiovascular hospital admissions	1,438	7,947
Emergency room visits - asthma	3,786	21,721

Similar to EPA RIAs, non-fatal heart attacks were estimated using both Peters et al. (2001) and an equal weights pooling of four studies. These two approaches yield substantially different results, as shown above. This assessment averaged the two non-fatal heart attack estimates when presenting mean

[1] The ratios of mortality estimates to each of the morbidity estimates compare reasonably well to the ratios of avoided premature mortality to avoided morbidity outcomes across several recent EPA Regulatory Impact Assessments for air quality regulations. Although avoided mortality and avoided morbidity do not move in lock-step due to differences in the geographic distribution of air pollution across applications of BenMAP, and associated differences in demographic distribution of exposure, mortality-morbidity ratios do demonstrate consistent patterns at the order-of-magnitude scale.

results, and used the relevant confidence intervals on the pooled estimate and Peters estimate when constructing the lower and upper bound estimates, respectively. Uncertainty in this health outcome is particularly relevant for this fiscal risk assessment, as non-fatal heart attacks carry a considerably higher cost of illness and a relatively high Federal payer share, compared to other air quality-related illnesses. For more information on the Peters study and the four pooled studies, see EPA's 2015 Ozone Standards RIA (EPA, 2016).

Assessing Federal Spending Implications

Cost of illness (COI) estimates (direct medical costs only) were obtained from the EPA's 2015 Ozone Standards RIA and adjusted expected changes in health care costs. Excess cost growth for Federal health programs—the extent to which health care costs per beneficiary grow faster than GDP per capita—is assumed to be zero on average throughout the assessment period, reflecting an expectation that recent slow cost growth in Federal health programs will prove durable. Compared to CBO projections, this assumption is conservative. COI values were adjusted to the 2050 and 2100 periods simply by using projected real GDP per capita growth.[2]

Adjusted COI estimates were applied to the morbidity estimates to obtain total air quality-related health care costs due to unmitigated climate change, compared to the mitigation scenario.[3] The Federal share of these costs was isolated by applying current payer share ratios for each health condition. These ratios were derived from Medical Expenditure Panel Survey (MEPS) data. For the purposes of this analysis, only spending financed directly by Federal programs (Medicare, Medicaid,[4] VA Health Care, and other care provided by the Federal Government) was included in calculating the Federal share. In practice, however, the Federal Government also provides significant subsidies to private insurance coverage, most importantly by excluding the value of employer-provided insurance coverage from income and payroll taxation and by providing financial assistance to eligible consumers who purchase coverage through the Health Insurance Marketplaces. The cost of these subsidies would likely increase under the scenario examined in this analysis.

The share of costs estimated to be paid by Medicare specifically were then further adjusted to reflect projected growth in Medicare enrollment in excess of general population growth, using growth in Part A enrollment as a proxy. This adjustment reflects an expectation that, as a larger share of the total population is enrolled in Medicare, Medicare will pay a larger share of total health care costs for the illnesses studied. The 2016 Medicare Trustees Report projects that Part A enrollment will grow by 62 percent by 2050 and 128 percent by 2100[5] due to shifting demographics. We note that Medicare Part A does not cover physician services, outpatient hospital visits, drugs and other services. Therefore, use of Part A growth rates may not precisely reflect enrollment affected by climate-related illnesses.

[2] The baseline for this adjustment is 2011, since the raw COI estimates are in 2011 dollars.

[3] Garcia-Menendez et al. 2015 compared two alternative mitigation scenarios to a "no policy" reference scenario in which radiative forcing reaches 10 W m^{-2} by 2100. This assessment draws on study results for the more ambitious mitigation scenario, in which radiative forcing is stabilized at 3.7 W m^{-2} by 2100 (POL3.7), in order to more closely approximate the full increase in costs due to climate change relative to today.

[4] The Federal portion of Medicaid costs was assumed to hold constant at its most recent rate at the time of the analysis—61 percent, up slightly from its prior average of 57 percent.

[5] The 2016 Medicare Trustees Report long term projections are only available out to 2090. To obtain a 2100 estimate, the 2089-2090 enrollment growth rate was extended from 2090 to 2100.

A similar adjustment was not made to non-Medicare costs, reflecting an assumption that enrollment in Medicaid, VA Health Care, and other Federal health programs will grow commensurately with total population over the long term.

REFERENCES

EPA. 2015a. *Climate Change in the United States: Benefits of Global Action*. United States Environmental Protection Agency, Office of Atmospheric Programs, EPA 430-R-15-001.

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