Congressional Budget Office
Nonpartisan Analysis for the U.S. Congress

The Effects of Changing Temperatures on the Medicare Population

September 2026

Introduction

In this slide deck, the Congressional Budget Office examines how changing temperatures affect people who are enrolled in Medicare.

First, the agency examines the impact of daily changes in temperature on the utilization of and spending on emergency department visits and on deaths. Second, CBO examines how those outcomes are affected by projected changes in temperatures caused by climate change. It analyzes outcomes with and without incorporating the effects of climate adaptation.

Terms Used in This Report

Climate adaptation (also referred to as adaptation). Actions taken in response to realized or anticipated changes in the climate.

Climate regions. The coldest, middle, and hottest thirds of zip code tabulation areas, as ranked by average annual cooling degree days from 2000 to 2019.

Cooling degree days (CDDs). A measure of cooling demand that is calculated on the basis of how much warmer the average daily temperature is than 65°F. (1 degree = 1 CDD.) For example, an 80°F day has 15 CDDs, whereas days with temperatures of 65°F or lower have 0 CDDs. Higher CDD values indicate a greater demand for cooling.

Dollars. Unless otherwise noted, all dollar amounts are presented in real (that is, adjusted to remove the effects of inflation) 2019 dollars.

Terms Used in This Report (continued)

Emergency department (ED) spending. Consists of spending for emergency department visits. For people who are admitted to the hospital from the ED, such spending includes the inpatient hospital stay.

Zip Code Tabulation Area (ZCTA). Representations of zip code service areas developed by the Census Bureau for statistical data tabulation.

Summary

Overview

CBO finds that historically, the relationship between temperature and health outcomes varies by climate region. Cold days increase emergency department visits and spending in the coldest and hottest regions but reduce both outcomes in moderate climates. Hot days increase deaths in cold and moderate regions. Cold days increase deaths in hot regions.

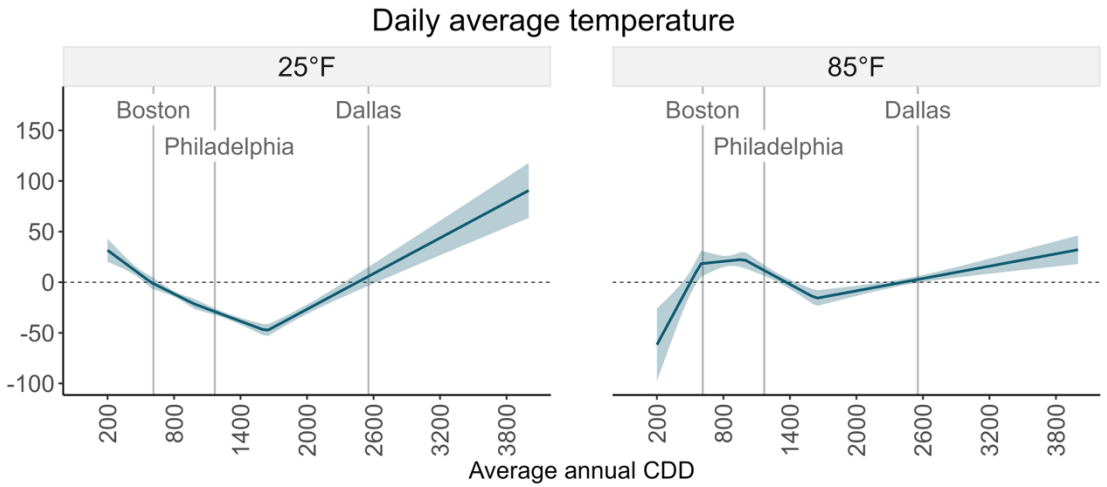
Projected effects also differ across climate regions. Accounting for adaptation, hotter temperatures are projected to reduce ED visits and spending in cooler regions, increase both outcomes in regions with moderate climates, and increase ED visits but reduce spending in the hottest regions.

Overall, higher temperatures and expected adaptation are projected to reduce ED spending and deaths and increase ED visits. The reduction in ED spending is driven by two factors: Warmer regions will experience even fewer cold days, and colder regions are projected to reduce their vulnerability to hot days, likely through adaptations such as expanded access to air conditioning. The reduction in deaths is driven by warmer regions, which will experience fewer cold days and are projected to further adapt to hot days as their average climate gets hotter. ED visits are projected to increase even as ED spending decreases: as regions with hot climates adapt to higher temperatures, the composition of visits shifts toward lower-cost encounters.

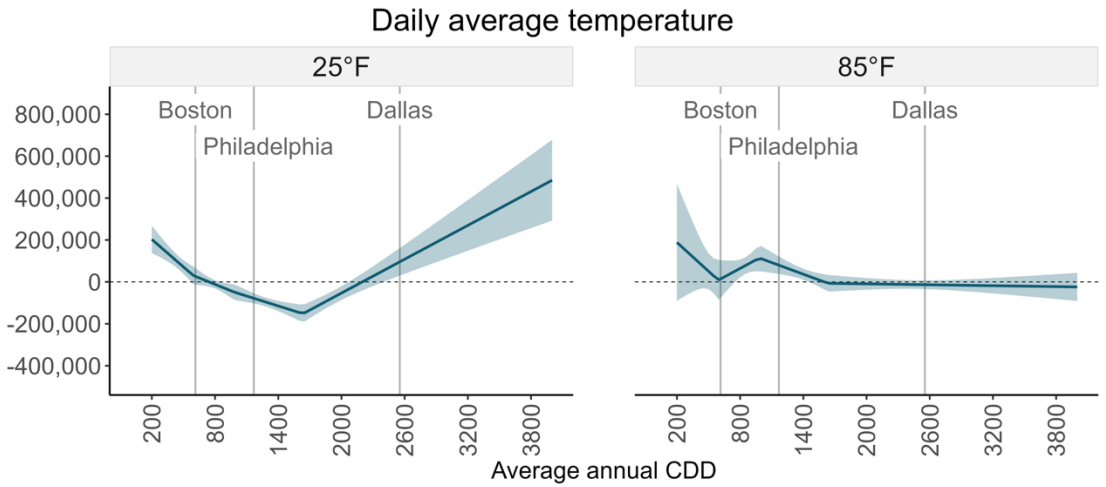
CBO’s analysis does not account for the costs of adaptation or the effects of climate change other than those on temperature.

Estimated Effects of Temperature on Emergency Department Visits and Spending

ED visits per 100,000 enrollees



Dollars per 100,000 enrollees



In CBO's assessment, an 85-degree day in a colder climate (comparable to Boston) increases ED visits by 19 and ED spending by $14,000 per 100,000 Medicare enrollees. A 25-degree day has a negligible effect on ED visits and increases ED spending by $26,000 per 100,000 enrollees.

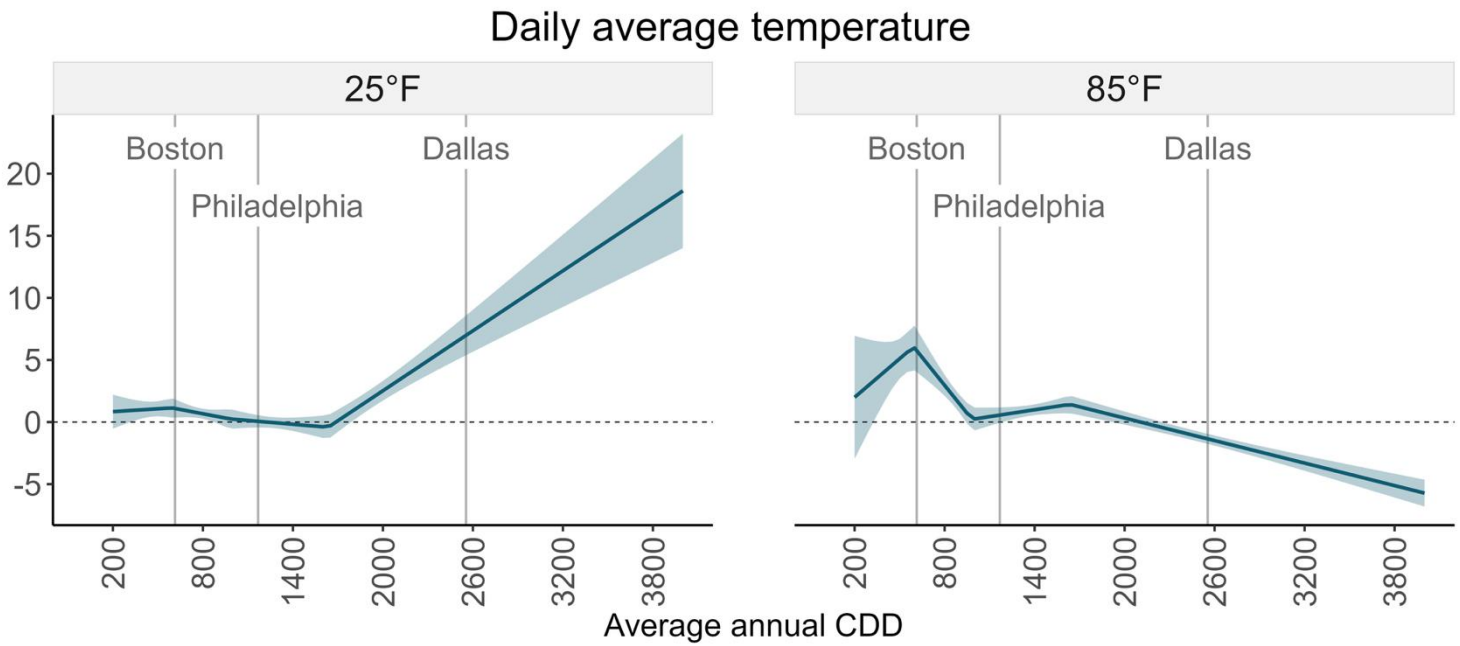
By contrast, an 85-degree day in a hot climate (comparable to Dallas) has a minimal effect on ED visits and ED spending; however, a 25-degree day increases ED visits by 6 and ED spending by $96,000 per 100,000 enrollees.

Data source: Congressional Budget Office, using data from the Centers for Medicare & Medicaid Services (CMS) and the National Oceanic and Atmospheric Administration (NOAA). Shaded regions indicate 95 percent confidence intervals. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile of average annual CDD values, respectively, among ZCTAs.

Daily average temperatures were chosen to illustrate the effects of a very hot day and a very cold day.

Estimated Effects of Temperature on Deaths

Deaths per 100,000 enrollees



An 85-degree day in a colder climate (comparable to Boston) is estimated to increase deaths by 6 per 100,000 Medicare enrollees; a 25-degree day is estimated to have a minimal effect on deaths.

By contrast, an 85-degree day in a hot climate (comparable to Dallas) is estimated to have a minimal effect on deaths; a 25-degree day is estimated to increase deaths by 7 per 100,000 enrollees.

Data source: Congressional Budget Office, using data from CMS and NOAA. Shaded regions indicate 95 percent confidence intervals. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile of average annual CDD values, respectively, among ZCTAs.

Daily average temperatures were chosen to illustrate the effects of a very hot day and a very cold day.

Summary of CBO's Main Findings, 2030 to 2075

CBO projects that if no climate adaptation occurred, temperature changes resulting from climate change would increase ED spending by about $4 billion from 2030 to 2075.

Accounting for adaptation, changing temperatures would have the following effects:

- Per 100,000 enrollees, ED visits would increase by 700, ED spending would decrease by $2.6 million, and deaths would decrease by 120 in 2075;

- In total, ED visits would increase by 18 million, ED spending would decrease by $55 billion, and mortality would be reduced by 2.5 million through 2075.

The net effects of temperature change are driven by the middle range of the temperature distribution, which is where the majority of days fall.

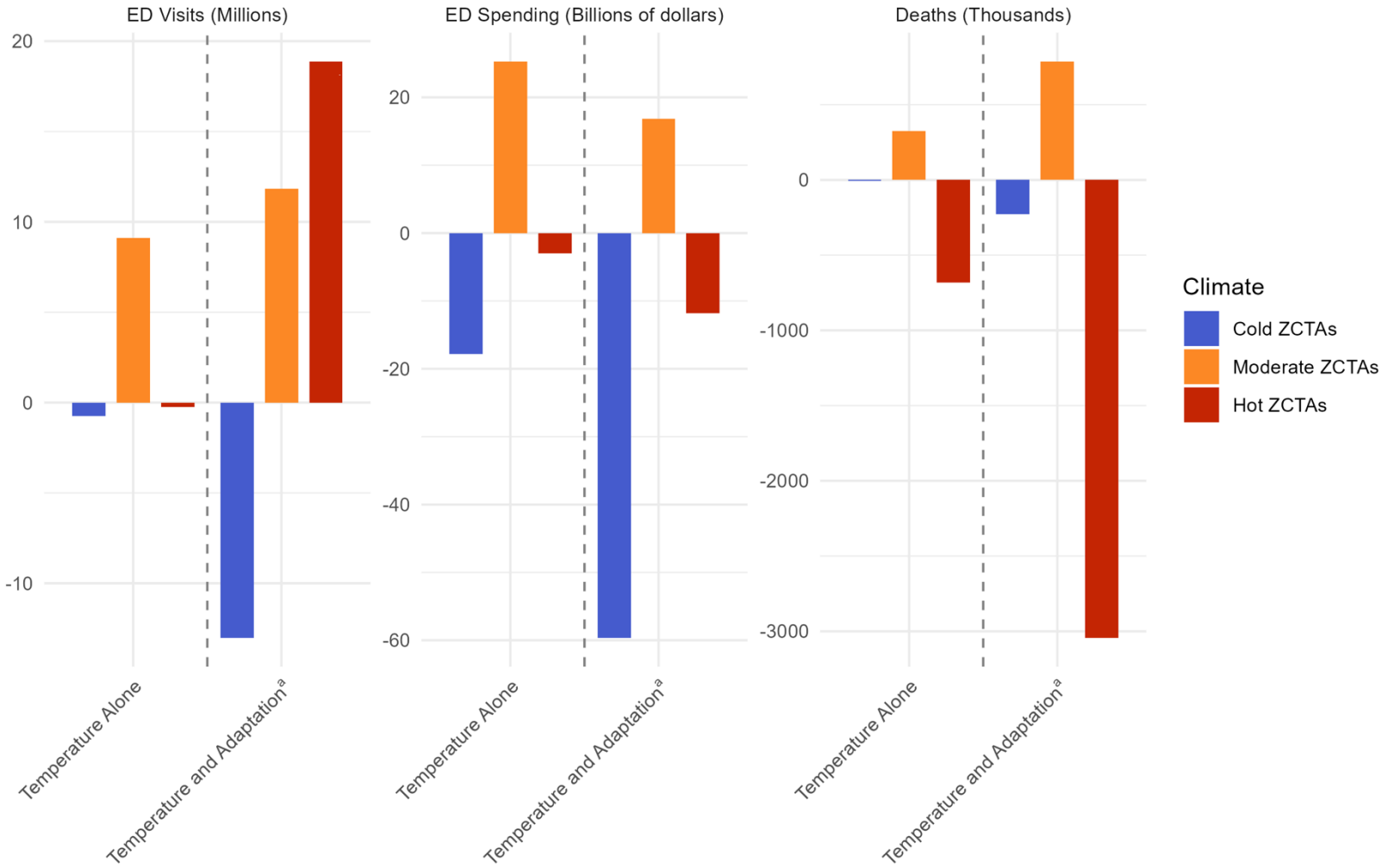
Summary of CBO's Main Findings, 2030 to 2075 (continued)

	Per 100,000 Medicare enrollees, 2075			Total, 2030 to 2075		
	ED visits (thousands)	ED spending (millions of 2019 dollars)	Deaths (thousands)	ED visits (thousands)	ED spending (millions of 2019 dollars)	Deaths (thousands)
Calculated using average temperatures from 2015 to 2019	44	200	4	1,800,000	8,100,000	160,000
Effect of changing temperatures relative to 2015 to 2019						
Absolute change	+ 0.25	+ 0.18	- 0.015	+ 8,000	+ 4,000	- 360
Percent change	+ 0.6	+ 0.1	- 0.4	+ 0.5	+ 0.1	- 0.2
Effect of changing temperatures and climate adaptation relative to 2015 to 2019[a]						
Absolute change	+ 0.7	- 2.6	- 0.12	+ 18,000	- 55,000	- 2,500
Percent change	+ 1.6	- 1.3	- 3.1	+ 1.0	- 0.7	- 1.6

Data source: Congressional Budget Office, using data from CMS, the National Aeronautics and Space Administration (NASA), and NOAA.

a. Results account for a 30-year moving average of CDDs.

Projected Cumulative Effects of Changing Temperatures, by Climate Region



Accounting for adaptation, CBO found the following:

- Climate change would increase ED visits. That increase is driven by increases in moderate and hot regions that are larger than decreases in visits in cold regions.
- ED spending would be lower, driven by reductions in spending in cold regions.
- The projected decline in deaths is largely attributable to a decline in deaths in warmer areas.

If no climate adaptation occurred, the direction of the changes in outcomes would largely be the same, but their magnitudes would differ.

Data source: Congressional Budget Office, using data from CMS, NOAA, and NASA.

a. Results account for a 30-year moving average of CDDs.

Temperature and Health

Effects of Temperature on Health

Climate change is expected to increase average temperatures and affect the frequency of relatively hot and cold days, which in turn affects human health.

The net effects of changing temperatures on health and federal health care spending are uncertain because those effects are determined by a complex interaction of several factors, including the following:

- The increase in the number of hot days,
- The decrease in the number of cold days, and
- How people adapt to changes in temperature.

Spending on health care, health care utilization, and deaths could increase or decrease depending on the relative magnitude of each of those factors.

The effects of those factors may be particularly pronounced in elderly populations. Many people in those populations are enrolled in Medicare, so changes in their health care use and spending have implications for the federal budget.

Existing Literature

An established body of literature examines the effects of temperature on deaths, and a growing body of literature examines the effects on health care utilization.

The studies' scopes differ in many ways:

- **Geographical area:** multinational, national, state;
- **Age range:** all ages, all adults, adults age 65 or older;
- **Insurance coverage:** all types, Medicare, full duals (that is, people who are enrolled in Medicare and Medicaid and who are eligible to receive all Medicaid benefits);
- **Outcomes:** deaths, ED visits, hospitalizations;
- **Type of analysis:** historical relationships, projections of future outcomes; and
- **Climate change scenario:** rate of climate change, future year analyzed.

CBO's Contribution to the Existing Literature

CBO expands the existing literature on the relationship between temperatures and health care utilization (ED visits and spending) and the effects of climate change and adaptation in the following ways:

- CBO's analysis has a national scope and therefore accounts for a wider range of climates and temperatures than the existing literature does (see, for example, White 2017; Gould and others 2025).
- CBO's estimates include all enrollees in the Medicare fee-for-service (FFS) program (for an example of existing literature, see Kim and others 2024).
- The agency's analysis shows how its projections depend on the pace of adaptation to climate change.
- CBO estimates the effects of future climate change on Medicare spending. (Previous studies have focused on visits and hospitalizations.)

CBO also validates existing work on the effects of temperature on deaths among Medicare enrollees and among people in older age groups (Heutel, Miller, and Molitor 2021; Burke and others 2025). CBO's regression results are consistent with existing estimates based on similar temperature data.

Data and Methods

Data Sources

Medicare Outcomes

- Daily counts of ED visits and spending per 100,000 FFS enrollees, by ZCTA (2000 to 2019).
  - Also disaggregated to inpatient (IP) and outpatient (OP) visits and spending; IP involves a hospital stay, but OP does not.
- Daily deaths per 100,000 enrollees, by ZCTA (2000 to 2019).
  - Includes FFS and Medicare Advantage (MA) enrollees.
- Data about outcomes are from the Centers for Medicare & Medicaid Services.

Weather

- Daily average temperature and precipitation data are from the National Oceanic and Atmospheric Administration's nClimGrid-Daily (2000 to 2019).
- Daily projections of average temperature are from the National Aeronautics and Space Administration's Earth Exchange Global Daily Downscaled Projections (NEX-GDDP) (2030 to 2075).
- Historical data and future projections were matched to ZCTAs and weighted by inverse distance to the center of the ZCTA.

Daily average temperature is the simple mean of daily minimum and maximum temperatures. Daily projections of temperature are available at a 25 kilometer by 25 kilometer grid level.

ZCTAs change over time; for this analysis, ZCTAs were assigned to a unique geographic cluster of one or more ZCTAs that remains stable throughout the sample period.

Econometric Specification

$$h_{isty} = f(temp_{it};\ \overline{CDD}_i) + \gamma x_{it} + g(\xi_{it}) + \alpha_{id} + \delta_{sy} + \varepsilon_{isty}$$

h_{isty} is the 28-day sum of the health outcome (ED visits or spending per 100,000 Medicare FFS enrollees or deaths per 100,000 Medicare enrollees) in ZCTA i, in state s, on date t, in year y.

$f(temp_{it};\ \overline{CDD}_i)$ is a flexible function of a day's average temperature ($temp_{it}$)

- The effect is estimated relative to a 65-degree day.
- The effect can differ depending on the annual average of cooling degree days of ZCTA i.

As a ZCTA gets warmer, people living in that ZCTA may adapt to hot days; for example, they may install new or improved air conditioning. CBO's projections of future outcomes account for that adaptation by incorporating the assumption that each ZCTA's $\overline{CDD}_i$ evolves along with its climate, so $f(temp_{it};\ \overline{CDD}_i)$ also evolves.

CBO's approach also controls for precipitation (x_{it}), lags and leads of temperature and precipitation (ξ_{it}), and ZCTA-day of year (α_{id}) and state-year (δ_{sy}) fixed effects.

How CBO Projected the Effects of Climate Change

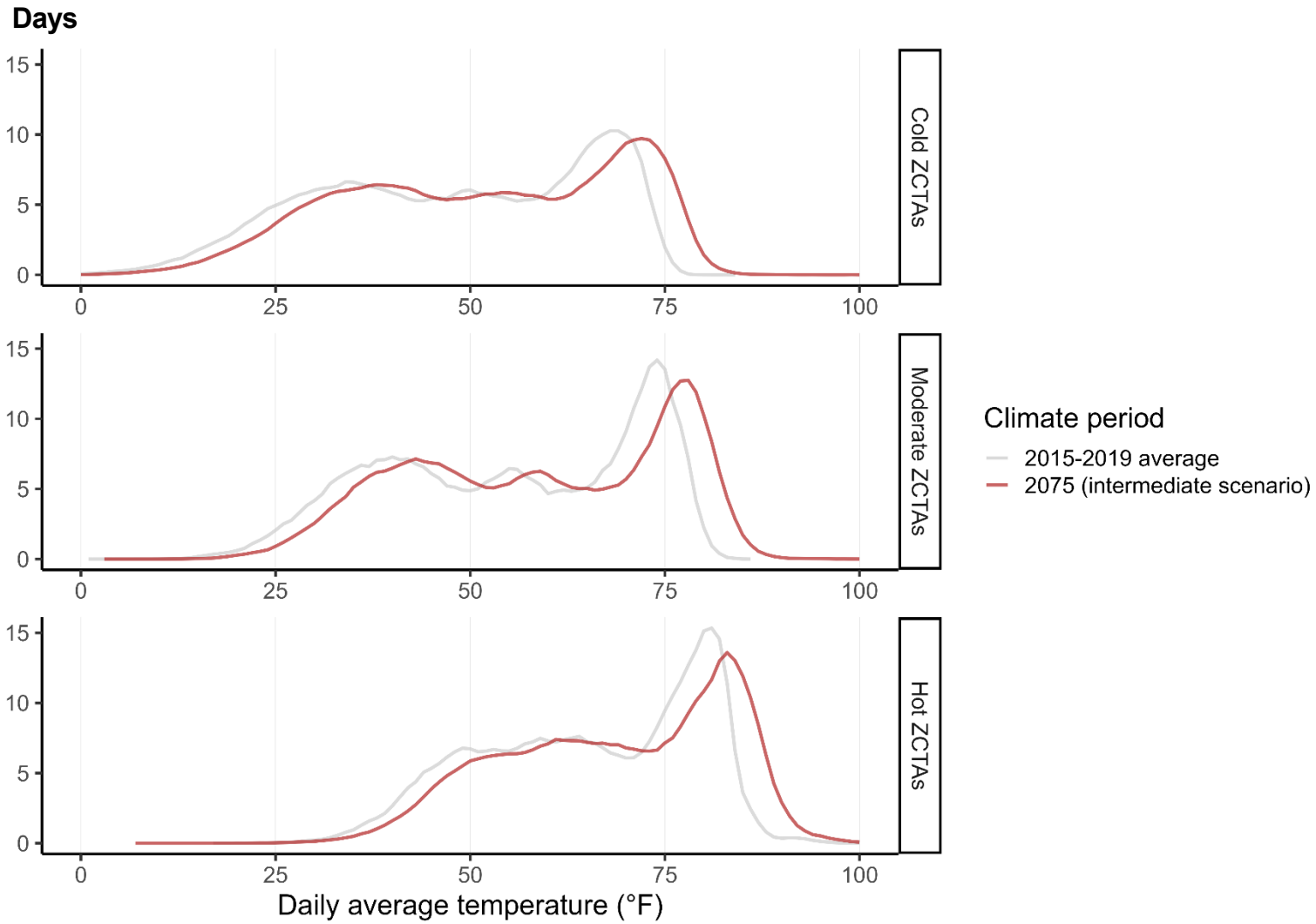
First, CBO used data from NEX-GDDP to project daily temperature outcomes for each ZCTA from 2030 to 2075 under an intermediate climate scenario (SSP2-4.5).

Next, CBO projected how future Medicare ED spending, ED visits by Medicare enrollees, and deaths would differ under SSP2-4.5, relative to a world in which the climate remained at its average over the 2015–2019 period. For that analysis, CBO modeled the effects of temperature on ED visits and spending as being the same for FFS and MA enrollees.

Finally, the agency projected forward ZCTA-specific enrollment by allowing enrollment by age group to grow according to CBO's projected growth in enrollment by age group.

NASA's NEX-GDDP data are available from www.nccs.nasa.gov/services/data-collections/land-based-products/nex-gddp-cmip6. SSP2-4.5 is defined as an intermediate greenhouse gas emissions scenario in the Climate Model Intercomparison Project (CMIP6) used in the Intergovernmental Panel on Climate Change's 6th Assessment Report (IPCC 6th AR, www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf).

Changes in Daily Average Temperatures, by ZCTA



Climate change shifts the average daily temperature distribution. Across all climates, extreme heat is much less common than days between 70°F and 80°F.

The modal temperature over the 2015–2019 period is around 70°F for cold ZCTAs, 75°F for moderate ZCTAs, and 80°F for hot ZCTAs.

Under SSP2-4.5, the whole distribution shifts a few degrees warmer by 2075, so the changes in Medicare-related outcomes will be driven mostly by the shift of the peak.

Climate Adaptation, Health, and Health Care Utilization

Carleton and others (2024) define climate adaptation as “any behavior, investment or other decision taken in direct response to realized or anticipated changes in the climate.”

Adaptation could result in increases or decreases in health care utilization.

- Utilization could increase if adapting to warmer climates increased vulnerability to colder weather.

- Utilization could decrease if people and localities made defensive investments (such as installing indoor heating and cooling) or if localities increased outreach about heat-related illnesses as their climates warmed.

CBO compared spending, visits, and deaths and temperature for places with different average climates to estimate differences in the relationship between outcomes and temperature. The difference in outcomes is attributed to climate adaptation.

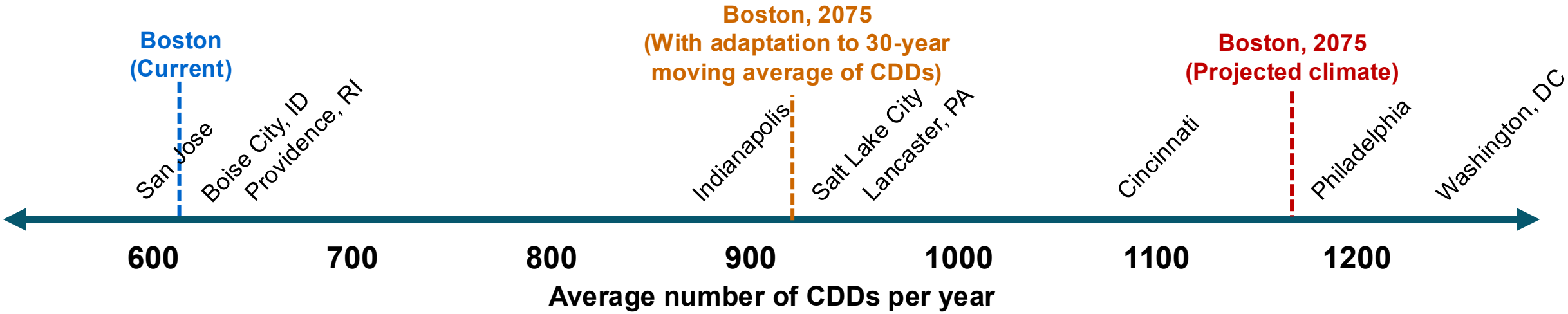
Climate adaptations would be costly, and those costs are not included in CBO’s projections.

How CBO's Projections Account for Adaptation

In CBO's regressions, the effects of daily temperature vary by the average climate of the ZCTA. Because of climate change, a locality's climate will evolve over time.

CBO's central estimate models localities as having implemented adaptations based on the most recent 30 years of weather (30-year moving average of projected CDDs). That is analogous to a location's climate normal, a commonly used approach to account for adaptation in the literature (Bento and others 2023).

For example, in CBO's projections, Boston's response to 2075 temperatures is based on the average historical response of places with current-day climates close to Boston's projected 30-year moving average of CDDs in 2075.



Note: Positions of Core Based Statistical Areas (CBSAs) are approximate. The figure shows the three CBSAs (among the 100 CBSAs with the largest population in the United States) with the average CDD closest to the three Boston climate cases under SSP2-4.5.

Alternative Measures of Adaptation

To model adaptation in its central estimate, CBO assigned to each ZCTA the 30-year moving average of its projected CDDs. CBO also estimated the effects without adaptation and with immediate and full adaptation.

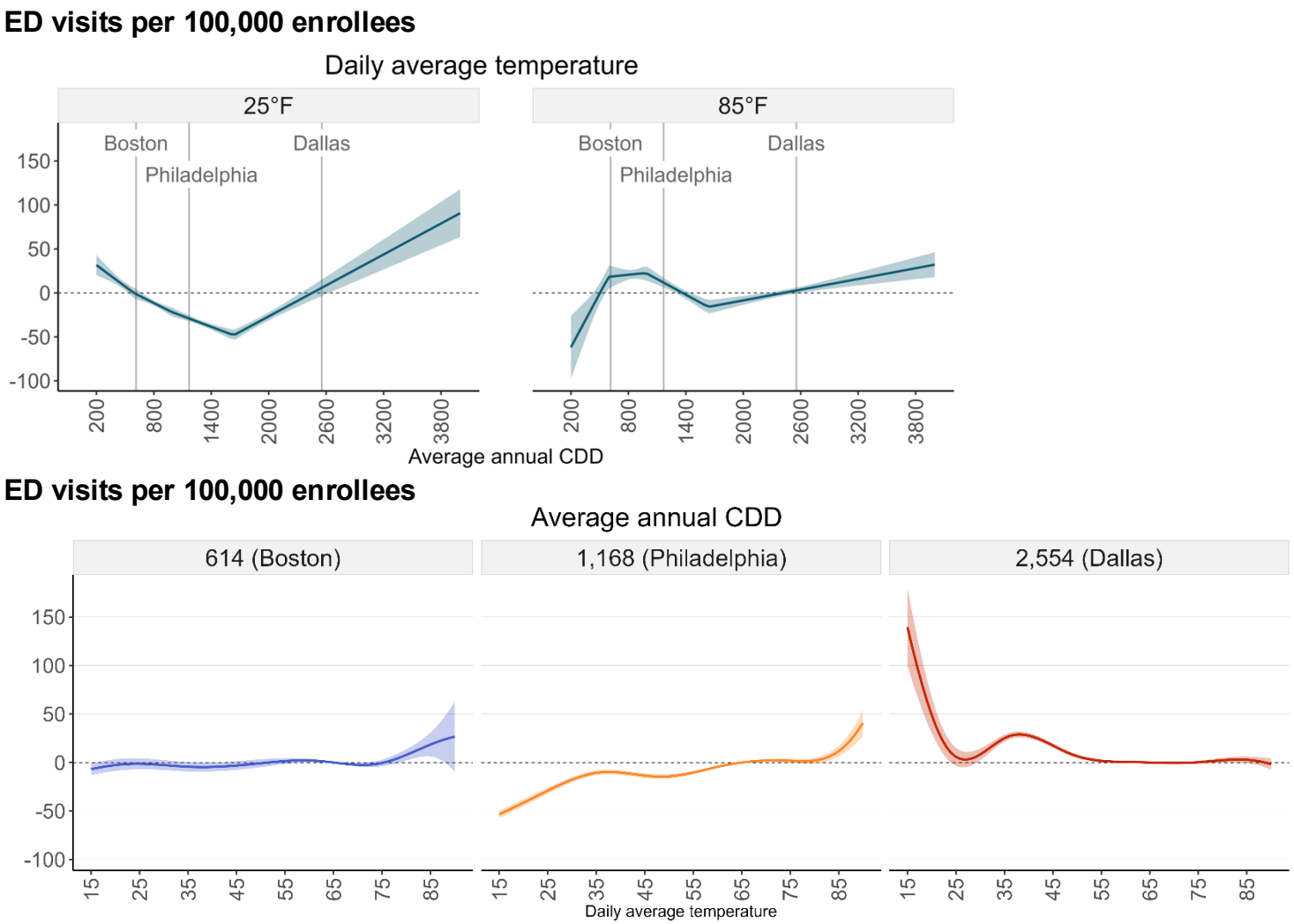
Consider projecting outcomes for a ZCTA in 2060:

	No adaptation	30-year moving average (preferred specification)	Immediate and full adaptation
Daily Temperatures in 2060	Projected 2060	Projected 2060	Projected 2060
Basis for projecting response to daily temperature in 2060	Average CDDs, 2000 to 2019	Projected average CDDs, 2030 to 2059	Projected average CDDs, 2060
Addendum			
Response of localities and residents	Make no changes relative to recent history; response in 2060 is the same.	Gradually notice changes in climate and implement adaptation measures.	Immediately respond to the new climate every year.

Unless otherwise noted, projected results employ our preferred adaptation specification using the 30-year moving average CDD.

Main Findings for the 2000–2019 Period

Estimated Effect of Temperature on Emergency Department Visits



The top panel shows the estimated effects of cold (25°F) and hot (85°F) daily average temperatures in different climates. The bottom panel shows the effects of different daily average temperatures for a specific annual CDD for a representative cold, moderate, and hot ZCTA.

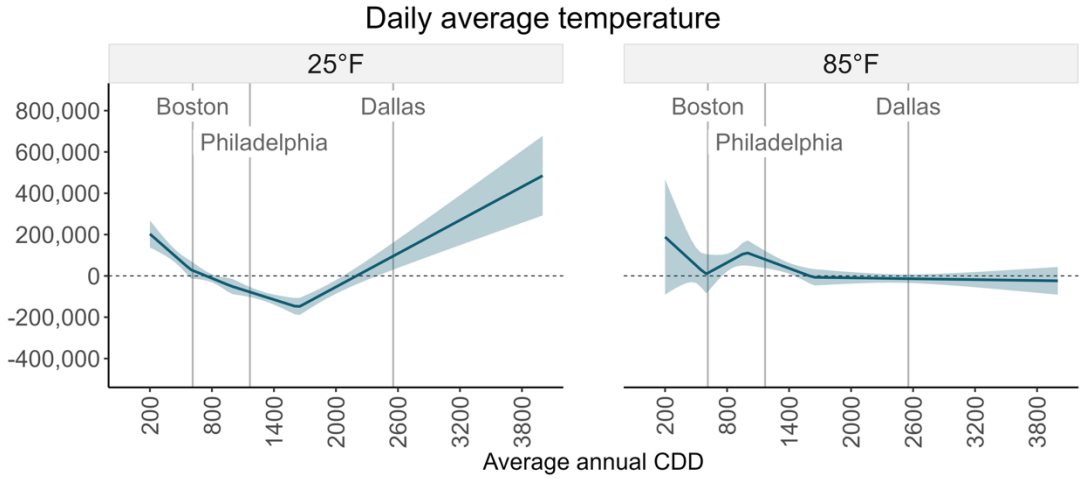
The relationship between temperature and ED visits varies across climates and is nonlinear.

In a climate like Boston's or Philadelphia's, ED visits increase as temperatures rise, but the opposite is true in climates like that of Dallas. In those climates, there is also a noticeable increase in visits on days when the temperature is near freezing.

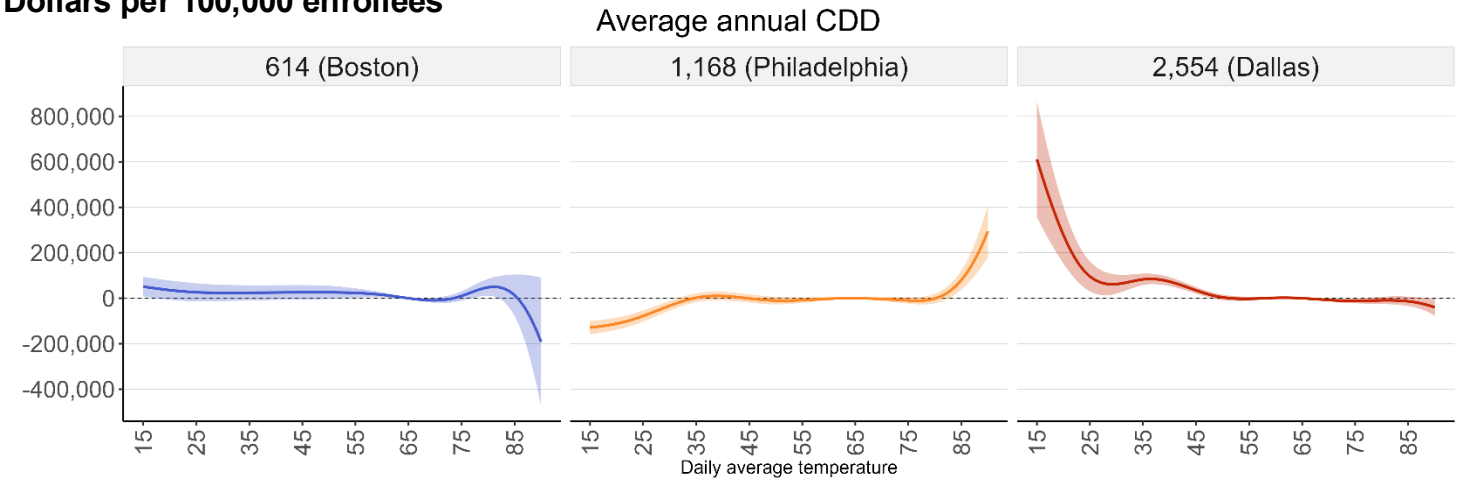
Data source: Congressional Budget Office, using data from CMS and NOAA. Shaded regions indicate 95 percent confidence intervals. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile of average annual CDD values, respectively, among ZCTAs.

Estimated Effect of Temperature on Emergency Department Spending

Dollars per 100,000 enrollees



Dollars per 100,000 enrollees

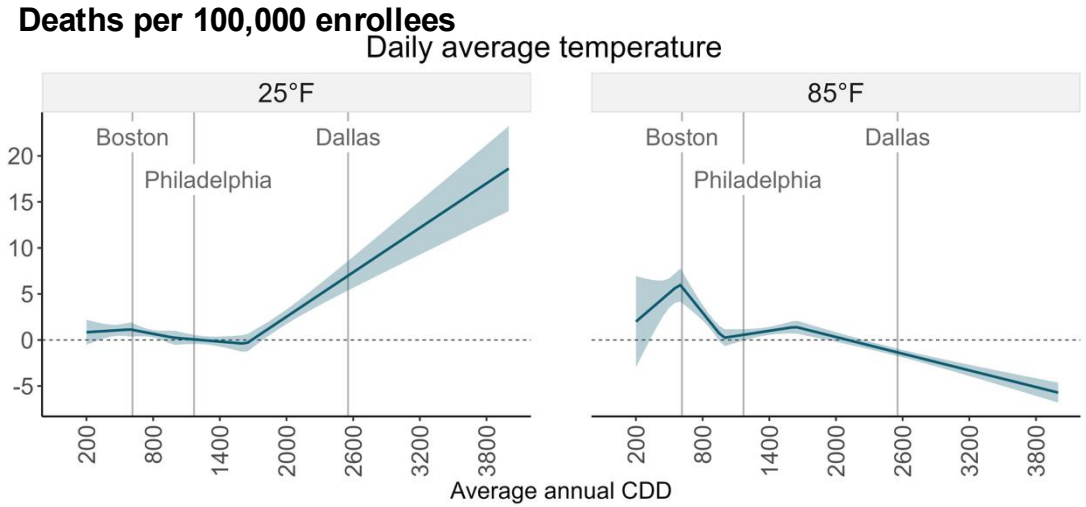


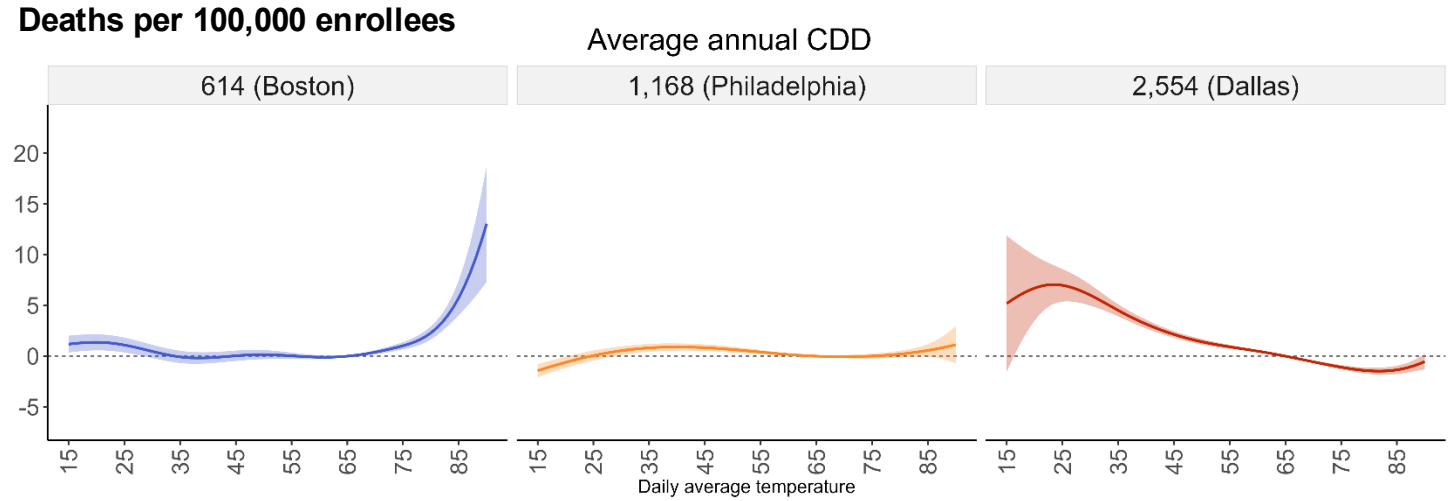
Cold and hot days have similar effects on ED spending as they have on ED visits.

The main difference is that in regions with the fewest CDDs on average (that is, those with even fewer CDDs than Boston), hot days reduce ED spending but not ED visits.

Data source: Congressional Budget Office, using data from CMS and NOAA. Shaded regions indicate 95 percent confidence intervals. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile of average annual CDD values, respectively, among ZCTAs.

Estimated Effect of Temperature on Deaths





Cold days increase deaths in hot climates, but do not have much of an effect in cold or moderate climates.

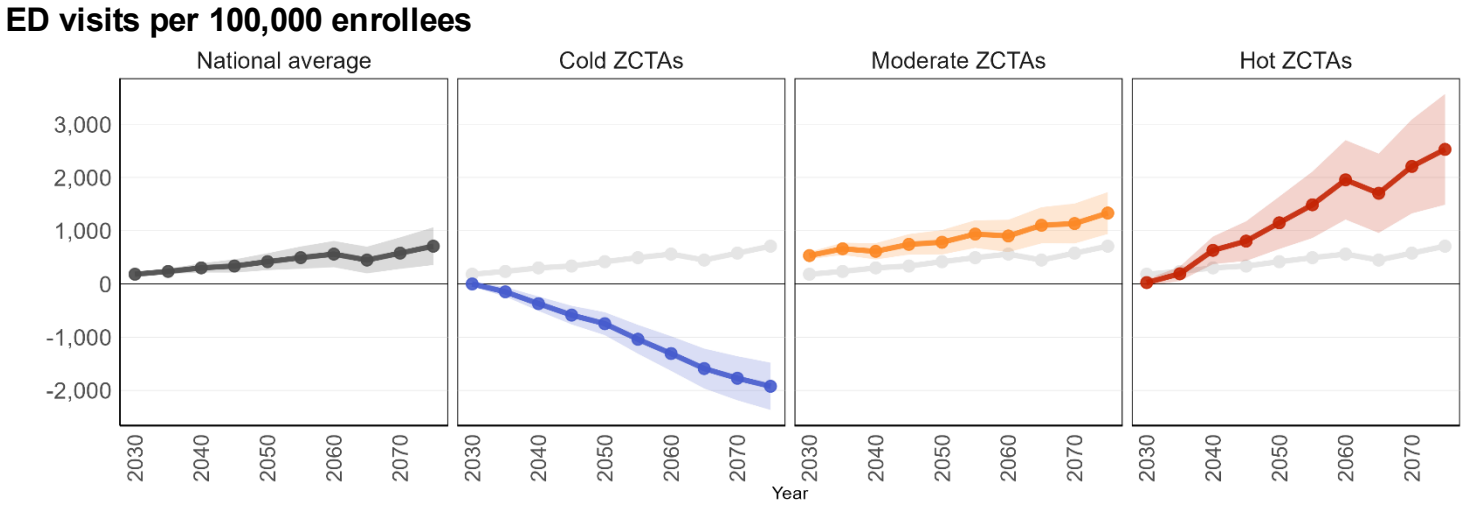
Hot days increase deaths in cold climates, but not in hot climates.

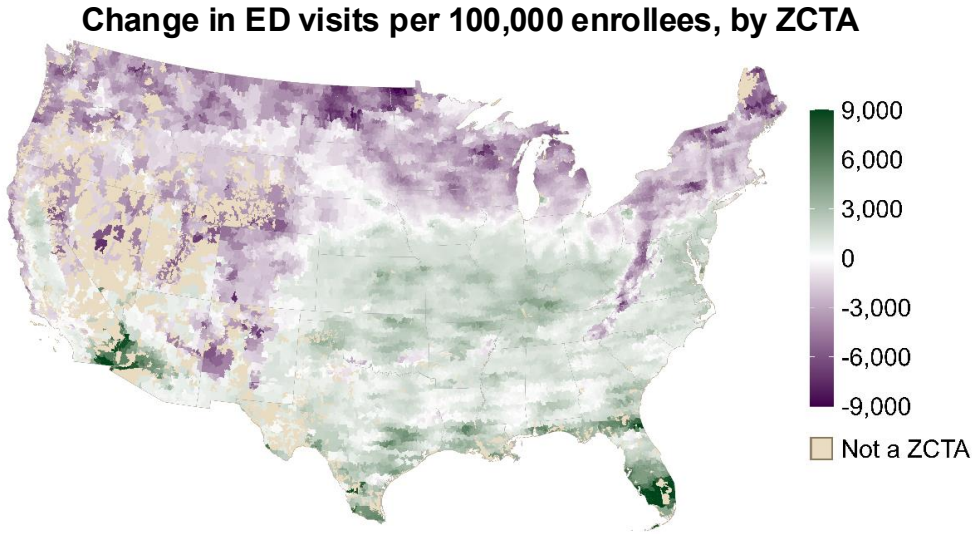
Overall, CBO's estimates are consistent with those of previous studies that used similar data and methods.

Data source: Congressional Budget Office, using data from CMS and NOAA. Shaded regions indicate 95 percent confidence intervals. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile of average annual CDD values, respectively, among ZCTAs.

Main Findings for the 2030–2075 Period

Projected Change in Emergency Department Visits Per 100,000 Enrollees, by Climate



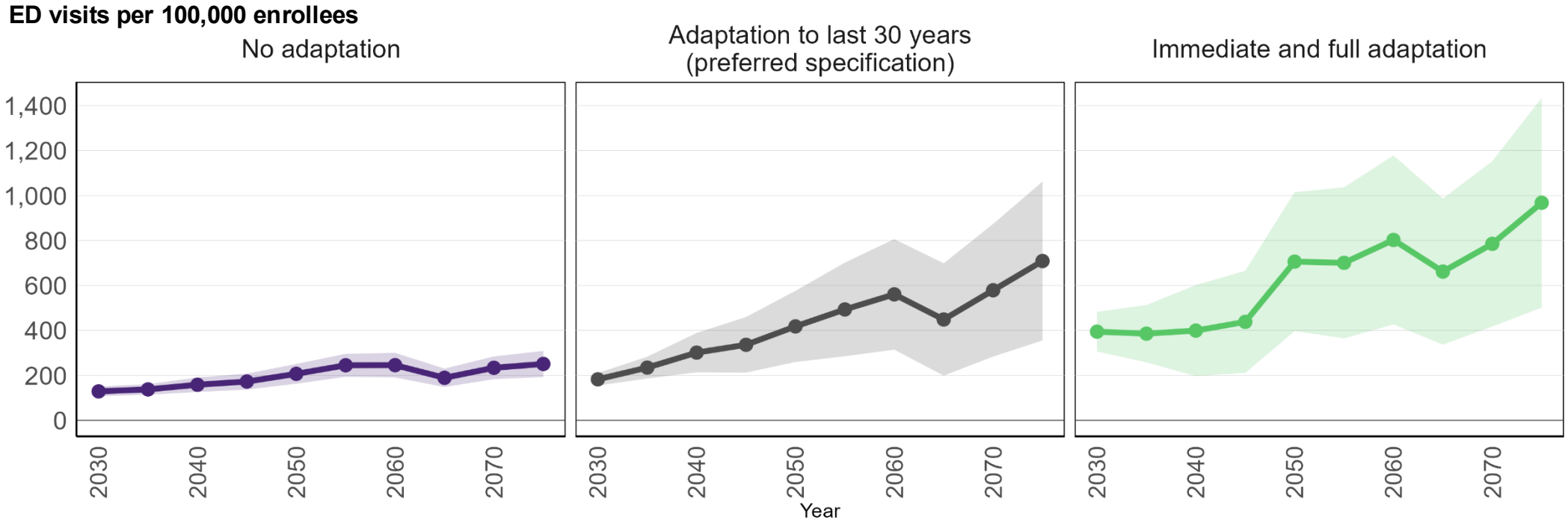


In CBO's projections, ED visits in hot areas and areas with a moderate climate increase over the 2030–2075 period. Those increases are largely offset by a decrease in ED visits in cold areas.

On average, ED visits are projected to increase by 709 visits per 100,000 enrollees by 2075.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals.

Projected Change in Emergency Department Visits, by Adaptation Scenario

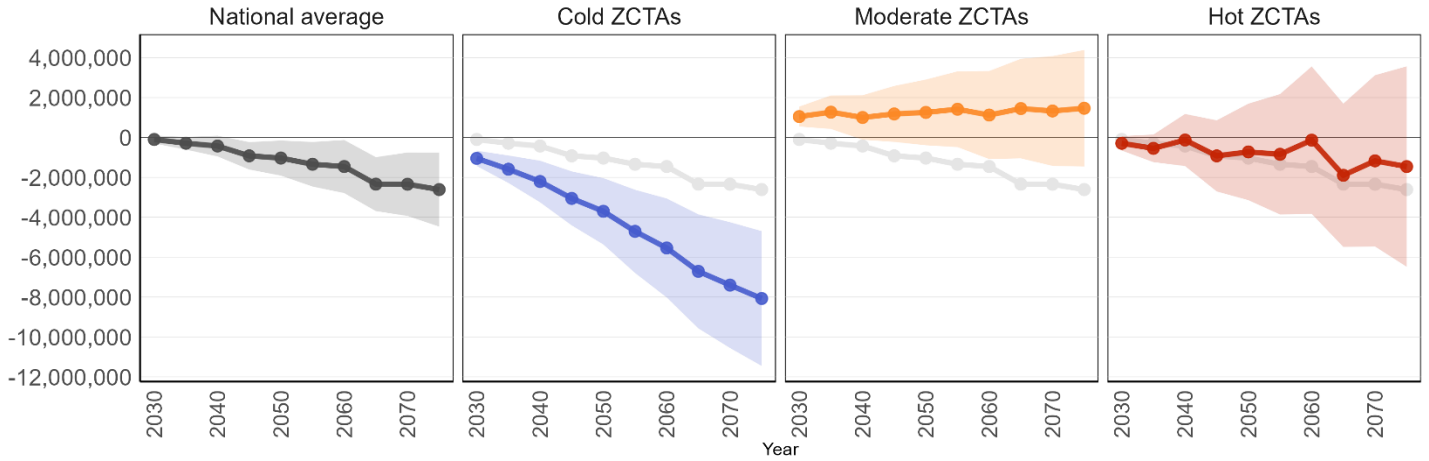


In CBO's projections, ED visits increase under all three scenarios, but the increase is significantly larger under the scenarios with adaptation. The projected increase under the scenario with no adaptation is attributable to an increase in visits in moderate ZCTAs. (Hot and cold ZCTAs are projected to have minimal changes in ED visits.) Under the preferred specification scenario, CBO projects an increase in visits on hot days in hot ZCTAs and a decrease in visits on cooler days in cold ZCTAs.

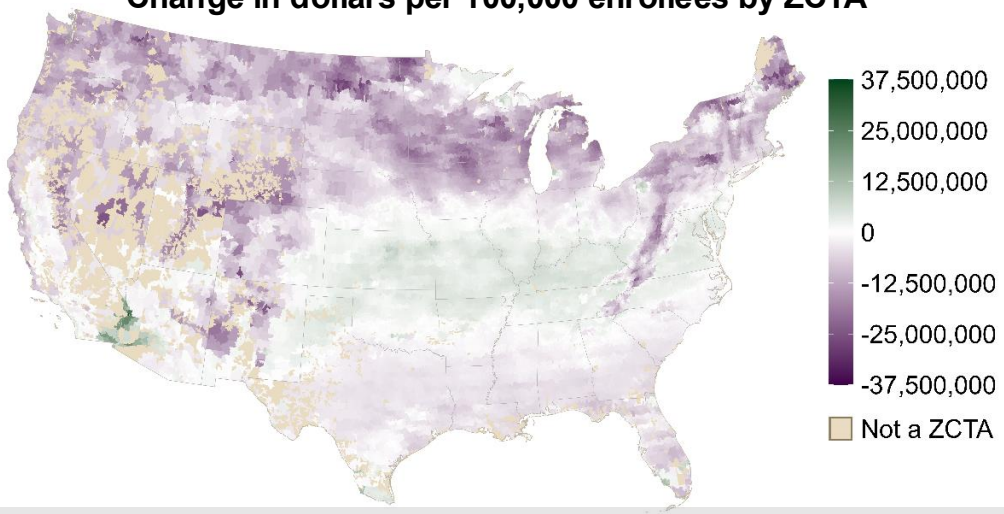
Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Shaded regions indicate 95 percent confidence intervals.

Projected Change in Emergency Department Spending, by Climate

Dollars per 100,000 enrollees



Change in dollars per 100,000 enrollees by ZCTA



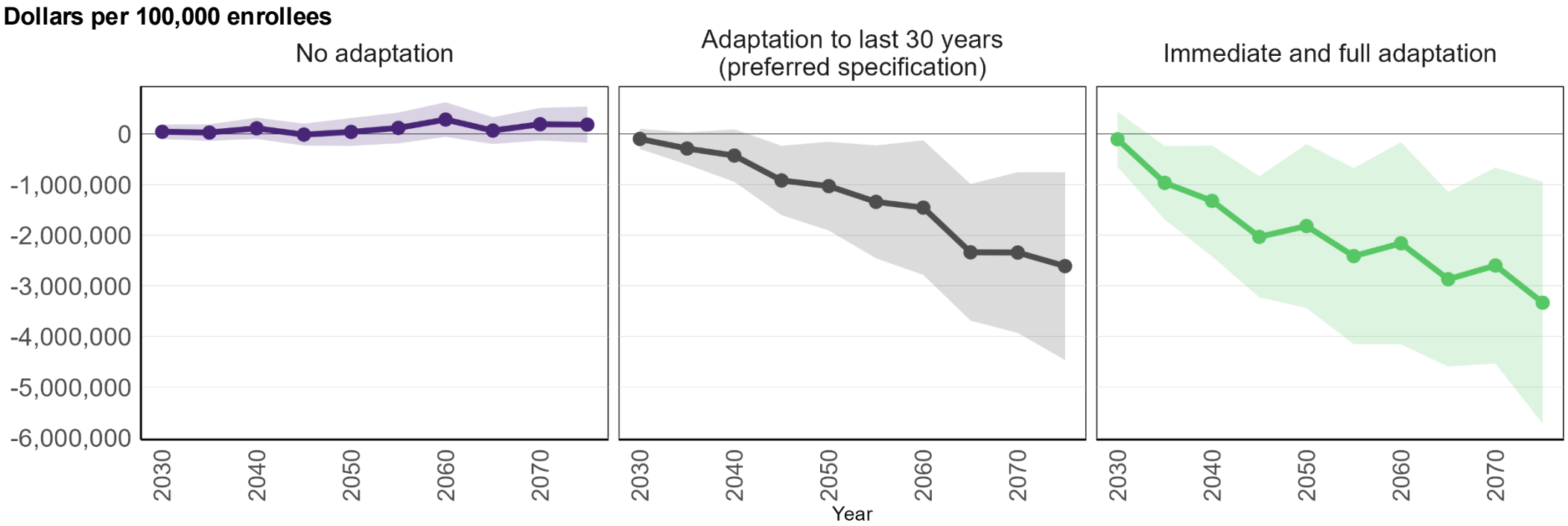
Over the 2030–2075 period, ED spending is projected to decrease in cold areas as those areas adapt to more frequent hot days and benefit from fewer cold days.

That decrease in ED spending in cold areas is partially offset by a projected increase in areas with a moderate climate.

On average, ED spending is projected to decrease by about $2.6 million per 100,000 enrollees by 2075.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals.

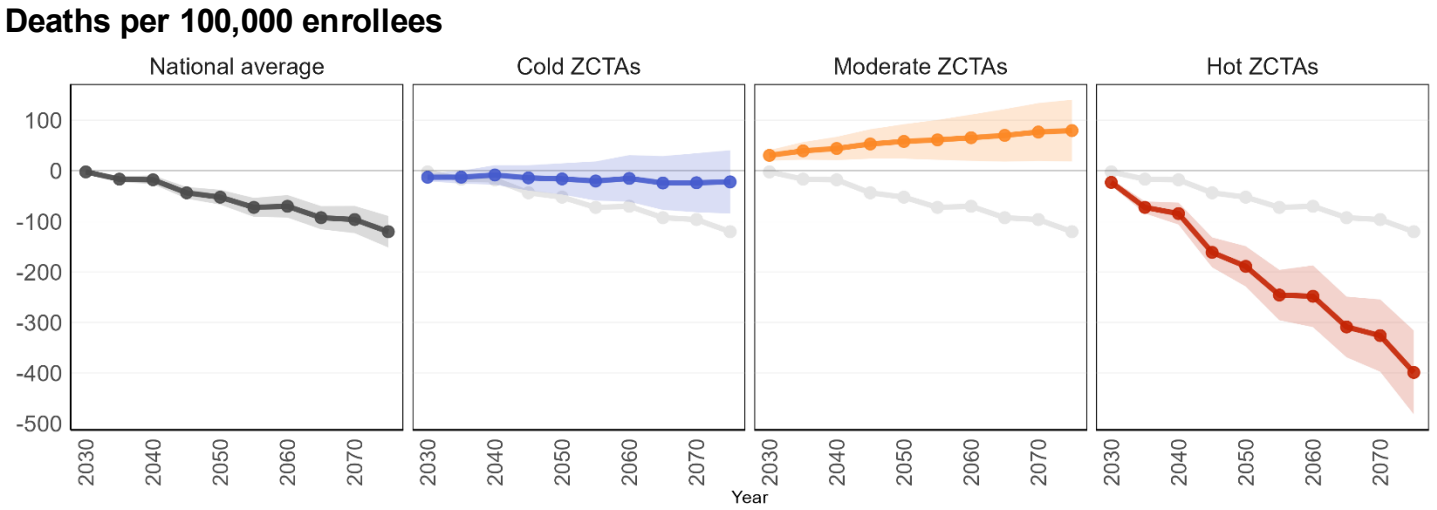
Projected Change in Emergency Department Spending, by Adaptation Scenario

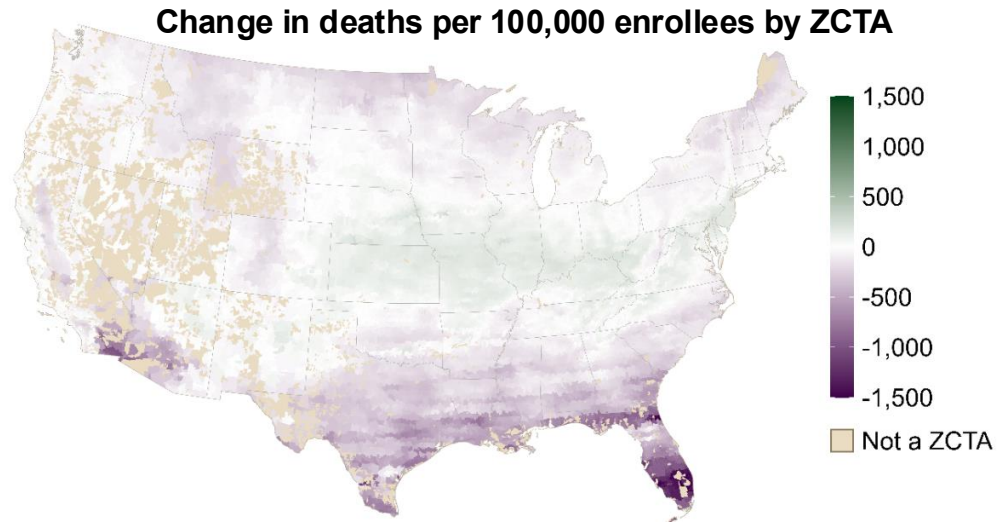


Under the scenario with no adaptation, ED spending is slightly higher in 2075. The increase is driven in part by cooler areas not adapting to more warm days and warmer areas not adapting to fewer cold days. Under the scenarios with adaptation, ED spending decreases; evidence suggests that the decrease is driven by a change in the composition of visits. The decline in visits and spending on cooler days is primarily driven by a decrease in inpatient stays in cold climates, and the increase in visits on hot days in warmer areas is roughly split between inpatient and outpatient visits.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Shaded regions indicate 95 percent confidence intervals.

Projected Change in Deaths, by Climate



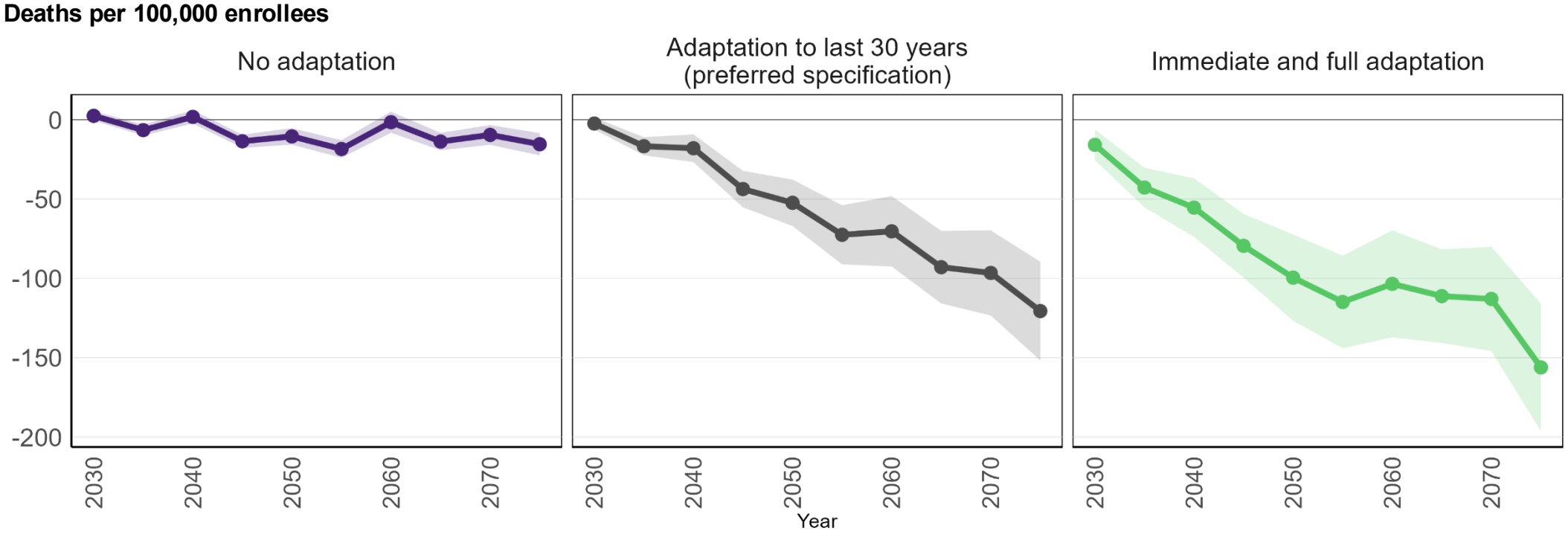


In CBO's projections, deaths decrease in hot areas and, to a lesser extent, cold areas over the projection period. Those decreases are partially offset by an increase in deaths in areas with relatively moderate climates.

On average, deaths are projected to decrease by 121 deaths per 100,000 enrollees by 2075.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals.

Projected Change in Deaths, by Adaptation Scenario



In CBO's projections, deaths decrease under all three adaptation scenarios, but the decrease is significantly larger under the scenarios with adaptation. The overall change in deaths is largely attributable to changes in hot ZCTAs. Deaths are projected to decline in hot ZCTAs as they experience fewer cold days and adapt to the changing climate because adaptation will reduce deaths on warmer days.

Data source: Congressional Budget Office, using data from CMS, NOAA, and NASA. Shaded regions indicate 95 percent confidence intervals.

Sensitivity Analysis

Sensitivity Specifications

CBO conducted the following sensitivity checks:

- Different functional form for temperature,
- Alternative measure of average climate,
- Alternative gridded temperature data,
- Shorter outcome window (14-day instead of 28-day),
- Different sets of fixed effects,
- Differential responses by age group, and
- Interaction of temperature with a ZCTA's average household income.

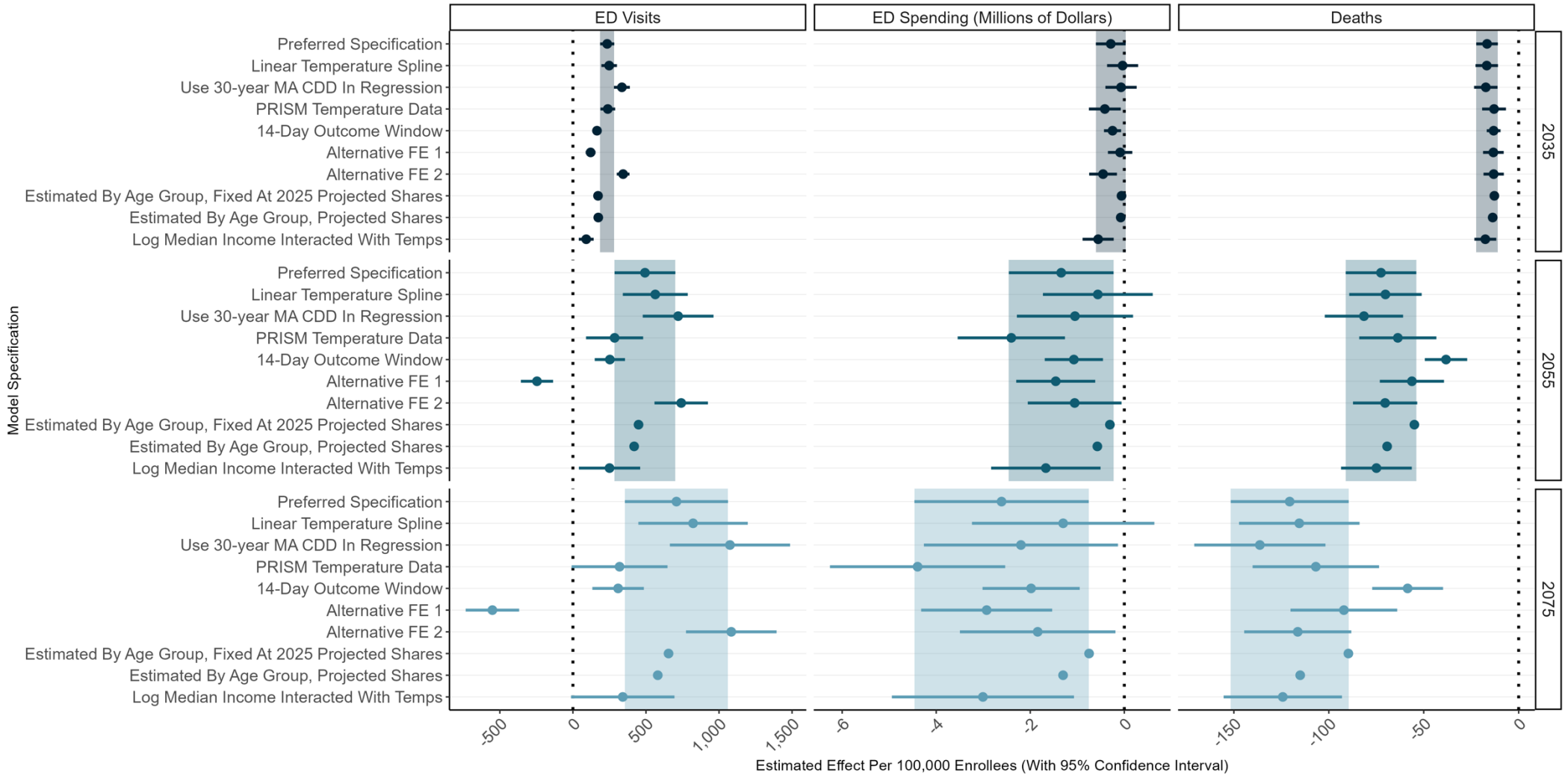
The results were generally in line with the main specification.

The appendix describes results based on a more severe warming scenario and provides a breakdown of the agency's projections along two additional dimensions:

- Inpatient visits and spending versus outpatient visits and spending and
- Mortality of Medicare Advantage enrollees versus the mortality of FFS enrollees.

Additional specification checks are shown in the appendix.

Sensitivity Analysis of Projected Effects by Outcome and Year



Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals from the preferred specification, and horizontal lines represent 95 percent confidence interval from each of the different model specifications. Alternative FE 1 uses finer geography-year FE: (Hospital Referral Region*year); Alternative FE 2 uses coarser ZCTA-seasonality FE: (ZCTA*month-of-year).

Limitations

Limitations

CBO's analysis links a person's ZCTA of residence (observed once per year) to daily temperatures in that ZCTA. But people do not always seek health care services in their ZCTA of residence. For example, they may move permanently, move seasonally (for example, "snowbirds" who move south in the winter), or travel. The literature on movers and snowbirds suggest that they represent small shares of the Medicare population on average, but those shares are likely to be higher for certain geographic areas.

CBO's analysis reflects the assumption that people do not move in response to changes in temperatures.

Projections only account for the effects of temperature change and not for other climatological factors.

Estimated adaptation effects reflect historical responses to a relatively stable climate and do not account for potential technological change.

ED visits and spending may not be representative of the 2075 FFS population if FFS enrollees in 2075 are different from current or historical FFS enrollees.

Appendix

Related Research—Health Care Utilization

Study	Geographical scope	Temperatures	Age range	Insurance coverage	Outcomes Studied	Period	Adaptation
Kim and others (2024)	United States	Heat waves in warm months	65 or older	Full duals[a]	ED visits, hospitalizations (heat-related and overall)	Historical	No
White (2017)	California	All	All	All	ED visits	Historical, projection	No
Gould and others (2025)	California	All	All	All	ED visits, hospitalizations	Historical, projection	No

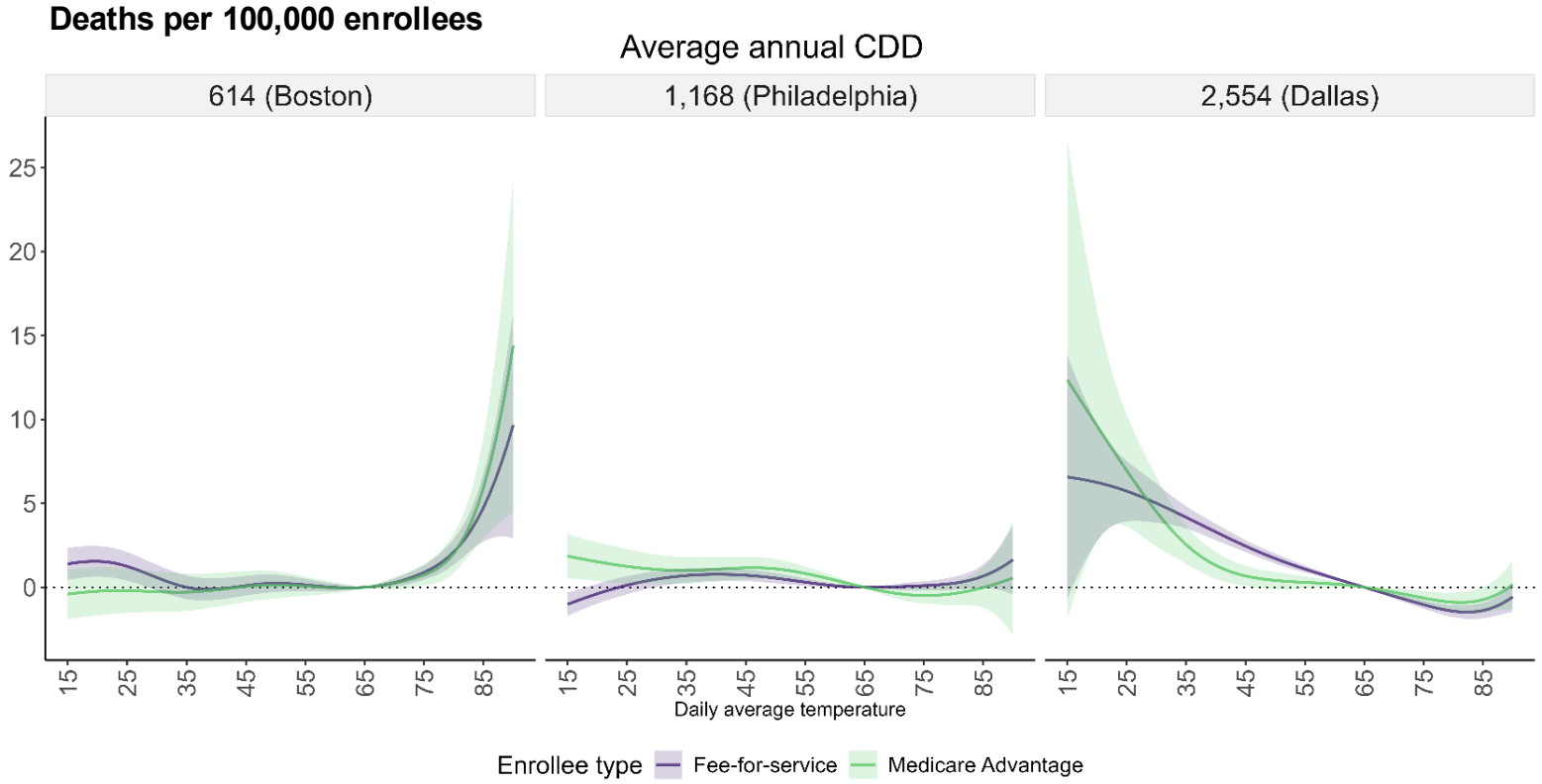
a. Full duals are people who are enrolled in Medicare and Medicaid and who receive full Medicaid benefits.

Related Research—Deaths

Study	Geographical scope	Temperatures	Age range	Insurance coverage	Outcomes	Period	Adaptation
Carleton and others (2022)	40 countries	All	All	All	Deaths	Historical, projection	Yes
Heutel, Miller, and Molitor (2021)	United States (ZCTA)	All	65 or older	Medicare	Deaths (annual rate)	Historical, projection	Yes
Khatana and others (2024)	United States (county)	Extreme heat and cold	18 or older	All	Deaths (number)	Historical, projection	No
Kim and others (2024)	United States (ZCTA)	Heat waves in warm months	65 or older	Full duals enrolled in FFS or MA[a]	Deaths (incidence rate)	Historical	No
Gould and others (2025)	California	All	All	All	Deaths (rate)	Historical, projection	No

a. Full duals are people who are enrolled in Medicare and Medicaid and who receive full Medicaid benefits.

Change in Deaths Among People Enrolled in Medicare Fee-for-Service and Medicare Advantage, 2000 to 2019

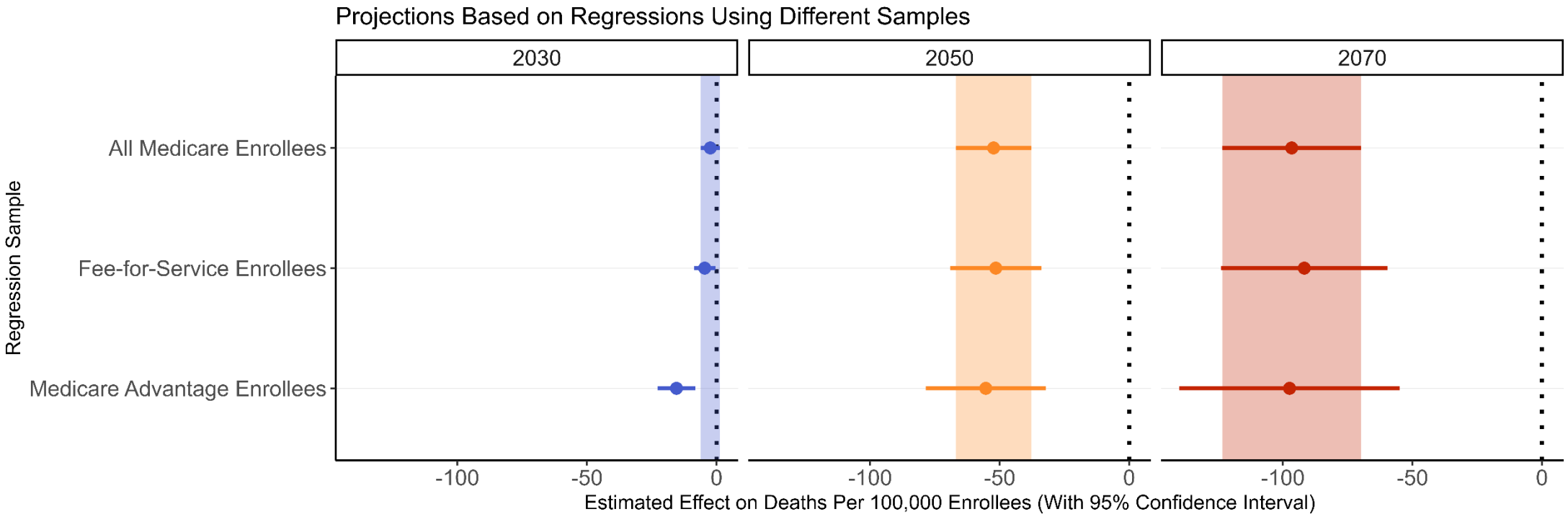


CBO does not have comprehensive claims data for those enrolled in Medicare Advantage, so those estimates are extrapolated from the agency's FFS-based estimates in its projections of ED visits and spending.

Using available information, CBO assessed the potential differences between the FFS and MA populations in the sample by separately estimating the effects of temperature on death in the two populations. The response functions were generally similar.

Data source: Congressional Budget Office, using data from CMS and NOAA. Shaded regions indicate 95 percent confidence intervals. Estimates are from separate regressions, so the confidence intervals do not account for correlations between the two subpopulations.

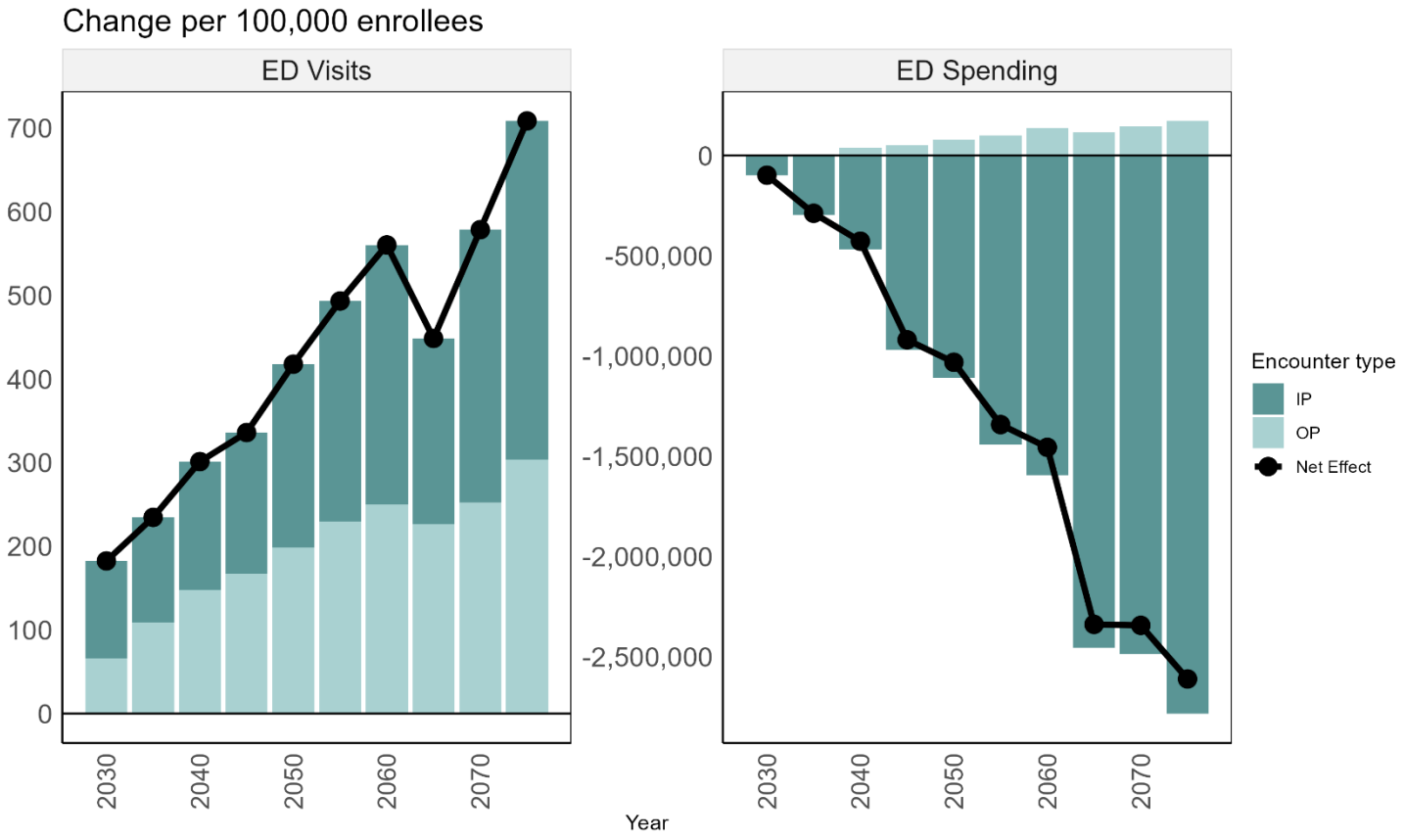
Projected Change in Deaths Among People Enrolled in Medicare Fee-for-Service and Medicare Advantage



Projections of future mortality are similar whether using response functions estimated using all Medicare enrollees, only fee-for-service enrollees, or only Medicare Advantage enrollees.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals of the estimates based on all Medicare enrollees.

Changes in Inpatient and Outpatient Emergency Department Visits and Spending

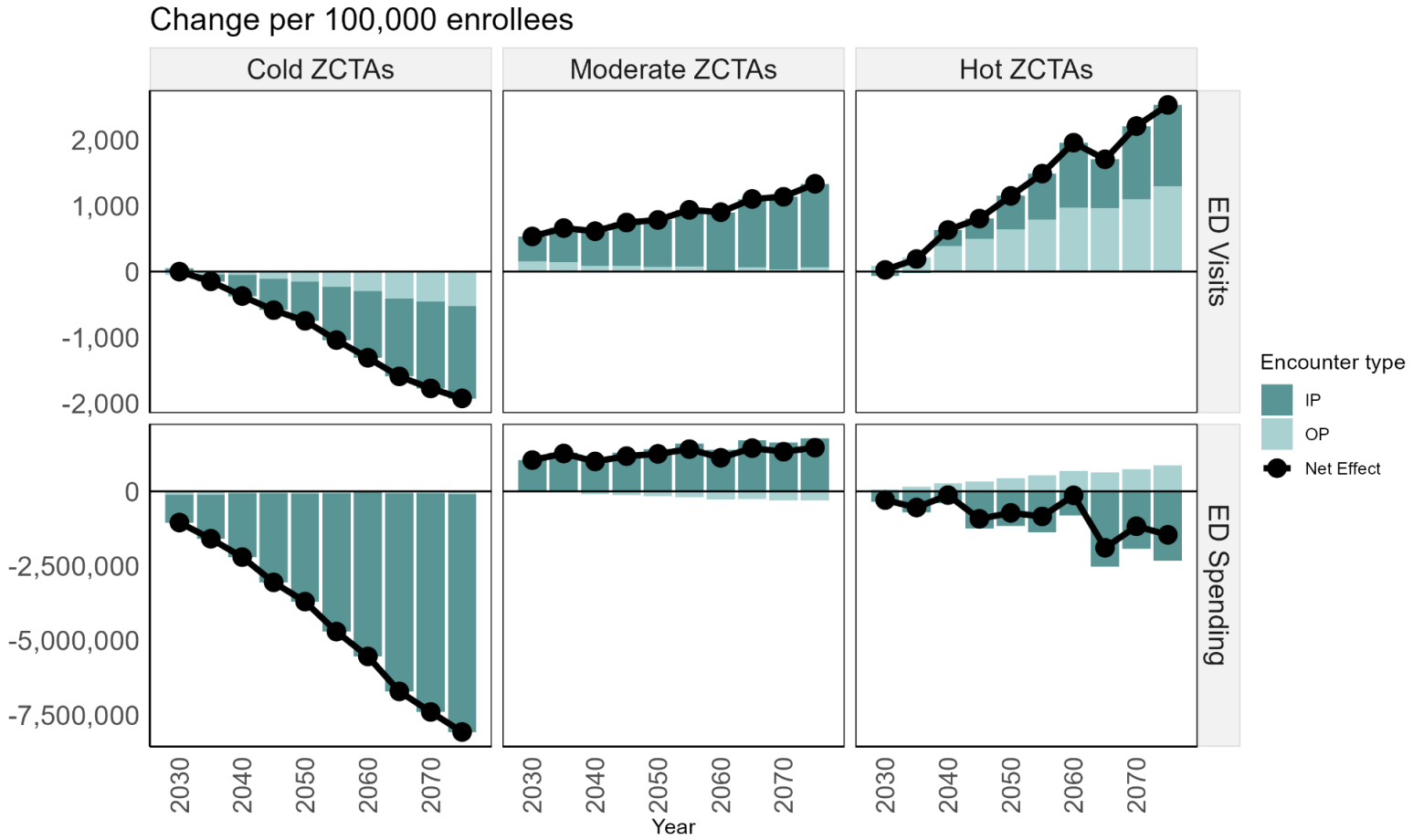


Over the 2030–2075 period, the number of ED visits are projected to increase. That increase is driven about equally by increases in inpatient and outpatient visits. Over the same period, inpatient ED spending is projected to decrease. Outpatient spending is projected to slightly increase, but by less than inpatient spending is projected to decrease.

Those results suggest that the average inpatient visit would be less costly, driven in part by the composition of ED visits in different climates.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days.

Changes in Inpatient and Outpatient Emergency Department Visits and Spending, By Climate

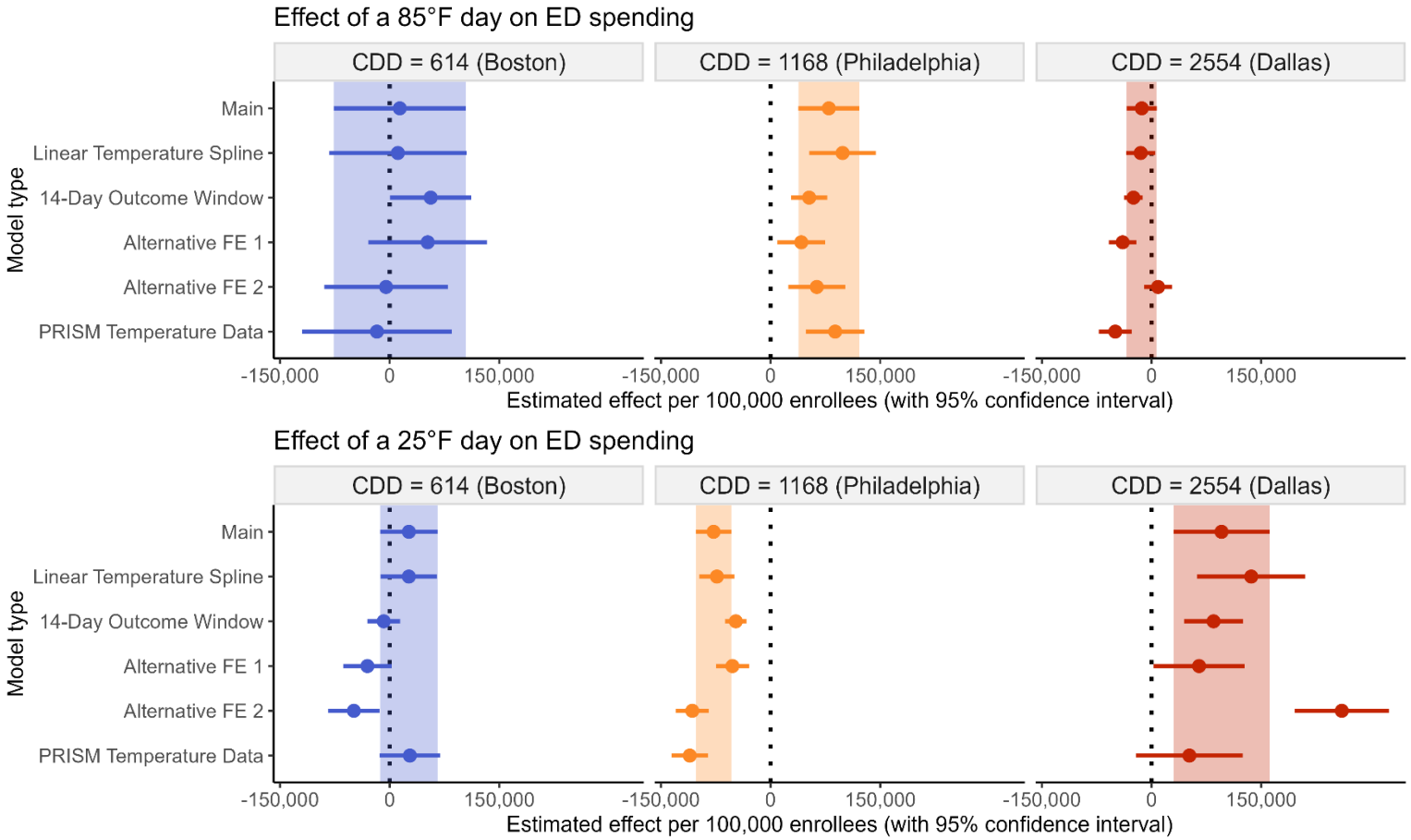


The direction of the effects on spending and visits may be the same within each climate region.

Inpatient spending decreases in hot ZCTAs (but that decrease is not statistically significant), and inpatient visits increase. Those countervailing effects suggest that the intensity of inpatient visits decreases in hot ZCTAs.

Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days.

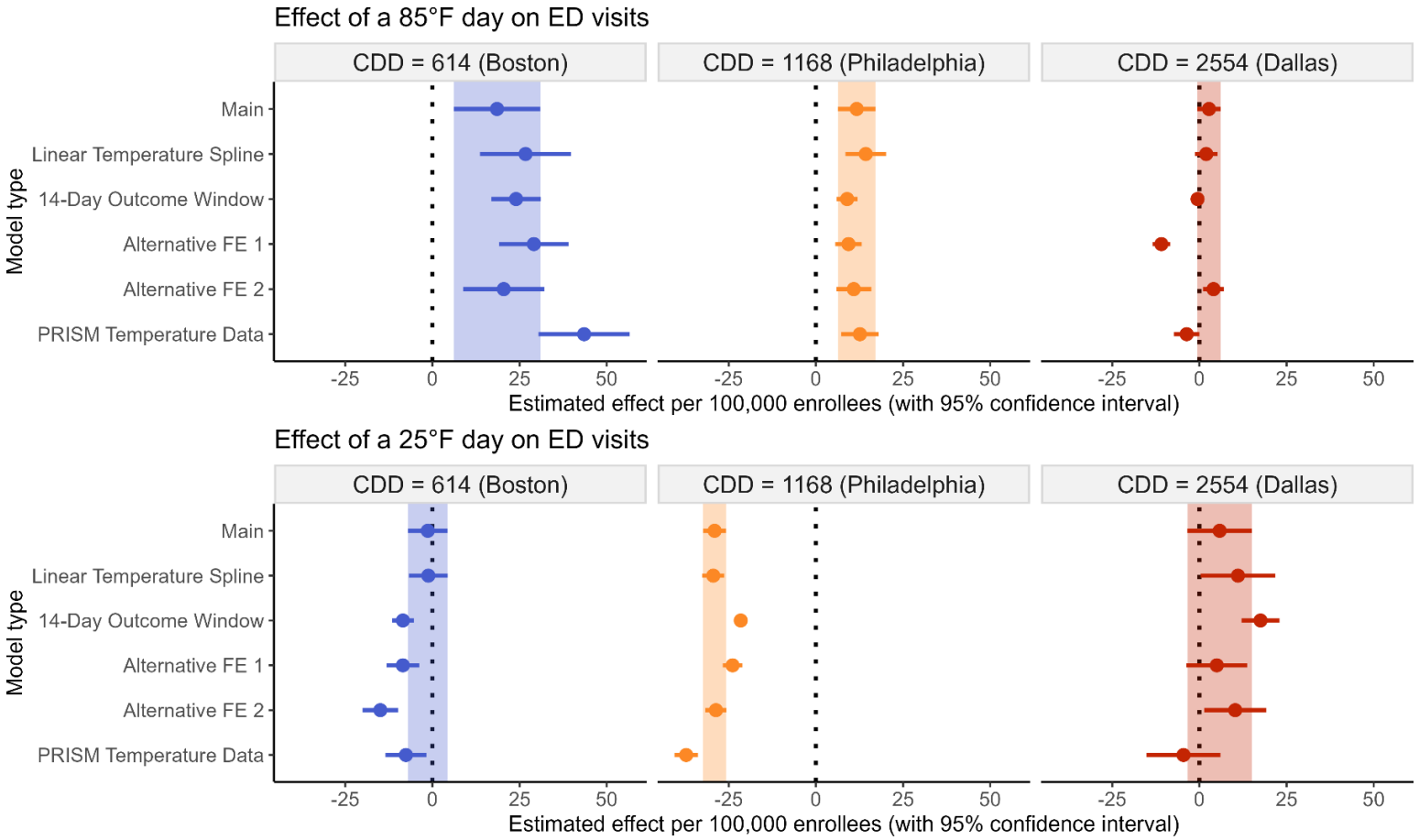
Robustness Checks: Emergency Department Spending



Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals from the main regression specification. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile CDD values, respectively, among ZCTAs.

Main specification: ZCTA*day-of-year and state*year FE; Alternative FE 1 uses finer geography-year FE: (Hospital Referral Region*year) FE; Alternative FE 2 uses coarser ZCTA-seasonality FE: (ZCTA*month-of-year).

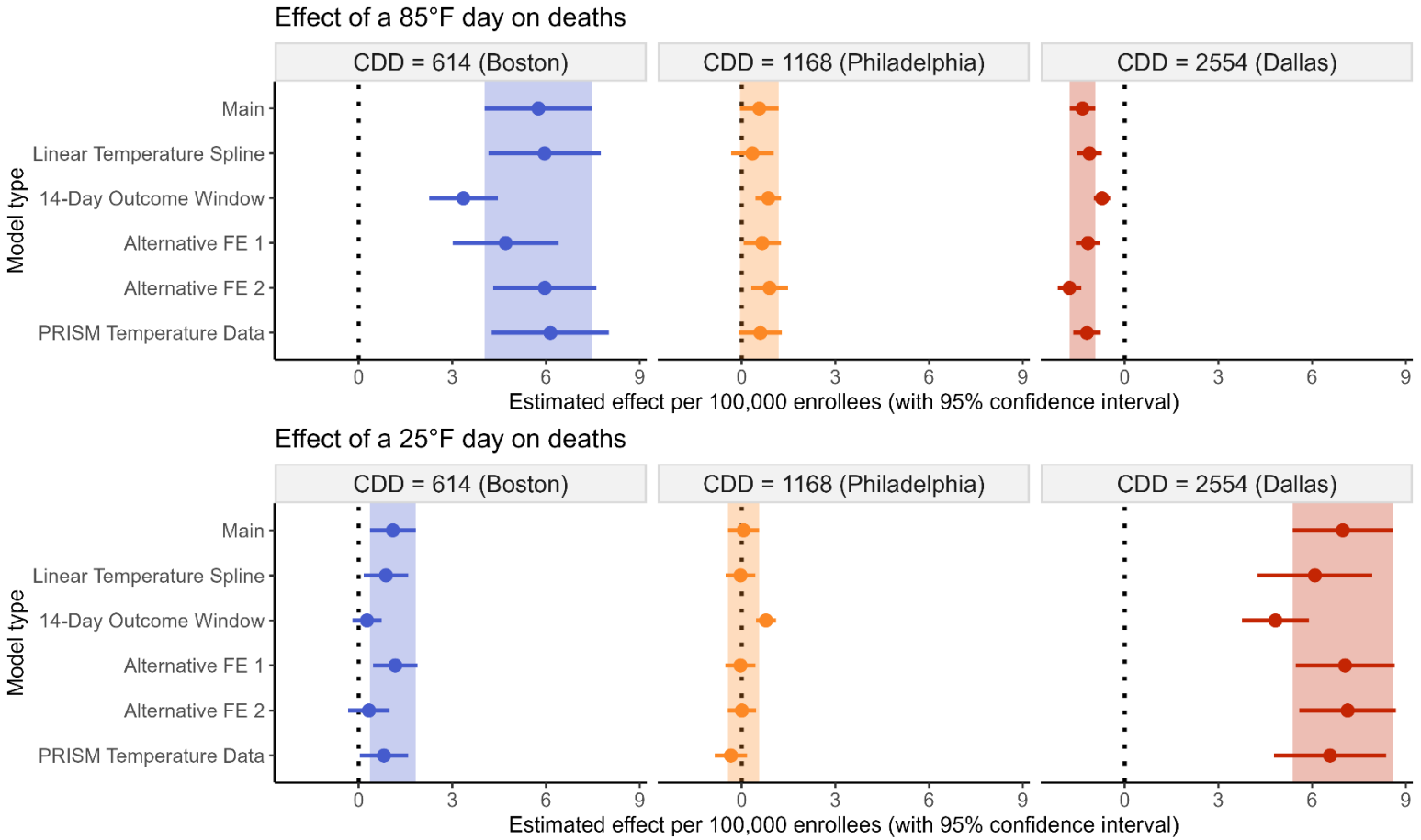
Robustness Checks: Emergency Department Visits



Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals from the main regression specification. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile CDD values, respectively, among ZCTAs.

Main specification: ZCTA*day-of-year and state*year FE; Alternative FE 1 uses finer geography-year FE: (Hospital Referral Region*year) FE; Alternative FE 2 uses coarser ZCTA-seasonality FE: (ZCTA*month-of-year).

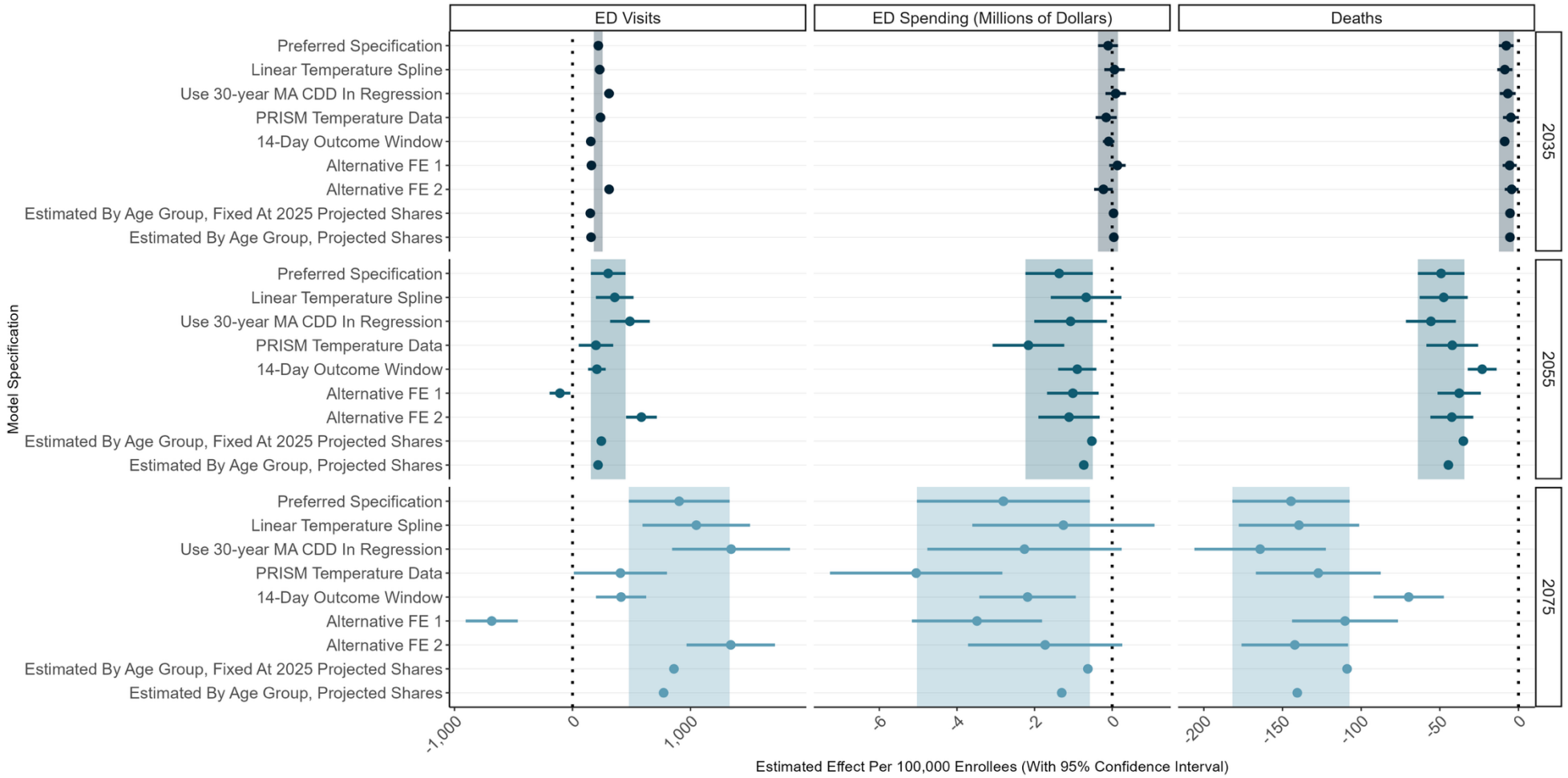
Robustness Checks: Deaths



Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals from the main regression specification. Boston, Philadelphia, and Dallas represent the 17th, 50th, and 83rd percentile CDD values, respectively, among ZCTAs.

Main specification: ZCTA*day-of-year and state*year FE; Alternative FE 1 uses finer geography-year FE: (Hospital Referral Region*year) FE; Alternative FE 2 uses coarser ZCTA-seasonality FE: (ZCTA*month-of-year).

Sensitivity Analysis of Projected Effects Under Climate Change Scenario SSP3-7.0



Data source: Congressional Budget Office, using data from CMS, NASA, and NOAA. Results shown include adaptation to a 30-year moving average of cooling degree days. Shaded regions indicate 95 percent confidence intervals from the preferred specification, and horizontal lines represent 95 percent confidence interval from each of the different model specifications. Alternative FE 1 uses finer geography-year FE: (Hospital Referral Region*year); Alternative FE 2 uses coarser ZCTA-seasonality FE: (ZCTA*month-of-year). SSP3-7.0 is defined as a high greenhouse gas emissions scenario; SSP2-4.5 and SSP3-7.0 fall in the middle of the five projected emissions scenario in the IPCC Sixth Assessment Report (www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf).

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About This Document

In keeping with the Congressional Budget Office's mandate to provide objective, impartial analysis, the document makes no recommendations.

David Adler, Noelia Duchovny, Evan Herrnstadt, and Jared Jageler (formerly of CBO) led the analyses. Chris Zogby provided help with the construction of the data. Tamara Hayford, Ben Hopkins, Caroline Nielsen (formerly of CBO), Asha Saavoss, Chad Shirley, and Chapin White (formerly of CBO) provided comments. The document was prepared with guidance from Nicholas Chase, Joseph Kile, and Aditi Sen. Joshua Silverman fact-checked the document.

Jeffrey Kling reviewed the document, and Caitlin Verboon edited it. The document is available at www.cbo.gov/publication/62555.

CBO seeks feedback to make its work as useful as possible. Please send comments to communications@cbo.gov.

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Director