Projecting Future Temperature-Related Mortality in Europe under Global Climate Change

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1. Introduction

Amid ongoing warming, concerns are growing about how extreme temperatures will shape future mortality burdens. (Gasparrini et al., 2017; Huang et al., 2011; Vicedo-Cabrera et al., 2018). Addressing this challenge is widely recognised as essential for the identification of new health risks, socioeconomic, demographic and spatial vulnerabilities, policies intervention, and adaptation strategies (García-León et al., 2024; Lloyd et al., 2023; Masselot et al., 2025; Watts et al., 2015).

Historically cold temperature has accounted for the larger share of temperature-attributable mortality (R. Chen et al., 2018; Zhao et al., 2021). However, the number of heat-stress days is rising, as indicated by the growing count of days on which the daily maximum Universal Thermal Climate Index (UTCI)[1] exceeds heat-stress thresholds (Fiala et al. 2011). This shift is particularly concerning given Europe's aging population. Older adults are more susceptible to extreme temperatures (K. Chen et al., 2024; Shibasaki et al., 2013), and the share of people aged 65 and over in the EU is projected to reach around 30% by 2050 (European Union, 2023). This makes Europe particularly vulnerable to extreme temperatures and raises pressing questions about future mortality trajectories. Research on future temperature-attributable mortality spans diverse datasets, spatial scales, and methodological frameworks. Broadly, the literature clusters in three themes: (1) studies focused on exposure (heat-only, cold-only, or combined); (2) studies quantifying the role of demographic change, especially population ageing; and (3) studies assessing adaptation and policy measures that may reduce vulnerability over time. -Evidence consistently indicates that extreme cold events are becoming less frequent in some areas, such as northern Europe, while still exerting substantial health impacts in mid-latitude regions. In contrast, extreme heat events are becoming increasingly common in southern and Mediterranean areas. Previous studies are primarily conducted in urban areas, often neglecting

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[1] The Universal Thermal Climate Index (UTCI) is defined as the physiological comfort of the human body under specific meteorological conditions (Bröde et al., 2012).

rural regions (Gasparrini et al., 2017; Zhao et al., 2021), and predominantly focus on projecting heat-related mortality, with limited attention to cold-related mortality (Basu, 2009; Hajat et al., 2009; Heiden et al.,2020). Moreover, there are still few studies that integrate SSP framework with RCP scenarios (IPCC, 2023).

Our study aims to understand three key aspects of the future effects of extreme temperatures on older mortality. We start from the present European baseline, providing a reference point for the relationship between extreme temperatures and mortality among people aged 65 and above. Secondly, we assess the direction and extent to which the temperature-related deaths among older adults are expected to change across the continent by the end of the century (2030–2099) under different SSP-RCP scenarios. Third we discuss the broader demographic consequences of these future deaths providing valuable insights into the evolving risks of extreme temperatures.

To achieve this, we first model the relationship between temperature and mortality in Europe using a combination of historical population records, mortality data, and meteorological information. The historical data cover the period from 2014 to 2022 at the NUTS2 level for 28 European countries, encompassing both rural and urban areas. We then project future temperatures for the period 2030–2099 and estimate excess death rates (per 100.000) at the regional level. We incorporate RCP scenarios to account for future changes in emissions, in combination with General Circulation Models (GCMs) to capture future climate variables.

The remainder of the chapter is structured as follows. It begins by outlining the background and the framework of future scenarios, followed by a description of the data and methods employed. The subsequent sections present the results, which are then discussed. Finally, the chapter concludes with a summary of the main findings and their implications.

2. Background

4.2.1. Literature in the European Context

Average global temperatures continue to rise due to anthropogenic climate change (IPCC, 2023). The impact of future warming temperature on human mortality is still unclear, and many questions persist regarding how mortality patterns may evolve under global climate change. Literature is investigating whether cold-related mortality will remain dominant, be surpassed by heat-related mortality, or whether both will lead to increasingly severe mortality peaks. These outcomes depend not only on the nature of climatic hazards but also on a range of factors, including the geographical location, demographic and socioeconomic vulnerabilities, adaptive capacity, and the specific future scenarios considered (Martìnez-Solanas et al., 2021; Rai et al., 2022; de Schrijver et al., 2023). Altogether, these elements contribute to the considerable complexity of projecting future temperature-related mortality.

Numerous studies in the literature have approached this issue from different perspectives, using a variety of climate measures, datasets, geographical resolution, and methodological approaches. The literature investigating future temperature-related mortality can generally be divided into studies focusing on cold, heat, or both types of temperature exposure, which may be analysed jointly or separately. Studies investigating exclusively the heat-related mortality are predominantly concentrated in urban areas, given their higher vulnerability to heatwaves (Baccini et al., 2011; Ignjacevic et al., 2024; Wu et al., 2025). A high level of data granularity if frequently available for urban settings, making them particularly attractive for researchers studying both future cold- and heat-related mortality (Masselot et al., 2025). Other studies investigate the future effects of temperature on mortality across both urban and non-urban settings, with some focusing exclusively on heat (Relvas et al., 2025; Kendrovski et al., 2017), while others include both future cold- and heat-related mortality (Fonseca-Rodríguez et al. 2023; García-León et al., 2024; Masselot et al., 2025; Rodrigues & Carvalho, 2025).

Geographical location plays a key role in determining the impact of present and future temperature-related mortality, as it shapes the level of heat and cold hazard experienced. Studies consistently show that cold events are projected to become less severe and less frequent, above all in northern European latitudes, while extreme heat events are no longer described as rare events in the Mediterranean region (World Weather Attribution, 2024a). A recent assessment by Copernicus reports that the number of winter days classified as ‘extreme cold stress’ in northern Europe has declined from around 4% in the 1980s to about 2% in the last decade and this trend is expected to continue in the coming decades (Copernicus, 2021). However, cold temperatures are still projected to have more detrimental effect, particularly across European mid-latitude regions, whereas heat-related mortality is expected to rise substantially, especially among vulnerable populations, due to the combination of more frequent heatwaves and limited adaptive capacity in many regions (Lee et al., 2025; World Weather Attribution, 2021, 2024b).

Other studies have investigated the role of demographic change in temperature extremes future deaths. These studies highlight that in rapidly aging regions, the risk of dying for being exposed to extreme temperatures is expected to increase substantially by 2050 and the end of the century (García-León et al., 2024; Lee & Kim, 2016). On the other end, other literature focus on the role of adaptation measures and policy interventions. They show the modifying effect the temperature–mortality relationship over time (Ballester et al. 2011; Rai et al. 2022; Wu et al. 2025). A study conducted by Vicedo-Cabrera and colleagues (2018) show that heat-related vulnerability declined faster than the rate of warming across most countries, indicating effective adaptation and increased population resilience to rising temperatures, while for the cold the behaviour remains more uncertain.

4.2.2. Scenario Framework, Methodological Approaches and Climate Modelling

Concerning the methodological approaches used to project future temperature-related mortality, they vary considerably depending on the research objectives, the variables involved, and the disciplinary perspective of the study. In environmental epidemiology, the most common approach apply exposure–response risk functions to simulated future exposure distributions generated by climate models under specific emission scenarios (García-León et al., 2024; Gasparrini et al., 2017; Martínez-Solanas et al., 2021; Vicedo-Cabrera et al., 2019). Conversely, approaches more frequently used in environmental economics and social sciences, focus primarily on establishing the causal relationship between temperature and mortality (Kathana et al., 2024; Honda et al., 2013; Hsiang, 2016; Risto Conte Keivabu et al., 2024). In these cases, projections often follow the so-called counterfactual projection method, which consists of estimating counterfactual outcomes through regression models, subtracting these counterfactuals from the observed data to obtain attributable anomalies, and then comparing these anomalies across scenarios to quantify temperature-related mortality under varying levels of anthropogenic climate change (Mahoney et al., 2017).

To understand how the future climate will unfold, key tools for predicting climate at global and regional scales are the so-called General Circulation Models (GCMs). GCMs are complex numerical models which account for physical processes of the atmosphere, oceans, and land to simulate response of global climate to the increasing greenhouse gas emission (IPCC, 2013). Climate modelling describes possible future climate outcomes, thru the greenhouse gas concentration trajectories explained by the Representative Concentration Pathways (RCP) (Moss et al., 2010). Some studies based their analyses using the RCPs (García-León et al., 2021). Other studies follow the narratives SSPs, which are described by a set of five alternative scenarios of future societal development (O’Neill et al., 2017; Striessnig et al., 2019). The first SSP scenario “SSP1 (Sustainability)” envisions an optimistic path to sustainability, with improvements in both environmental and human well-being. The second scenarios “SSP2 (Middle of the Road)” represents the baseline scenario, where historical trends continue, posing moderate challenges for adaptation and mitigation. The third scenario “SSP3 (Regional Rivalry)” predicts slow economic growth, rising inequality, and weak institutions, hindering efforts to address environmental issues. The fourth scenario “SSP4 (Inequality)” highlights different trajectories across and within countries, where environmental policies are dominated by elites, resulting in uneven development and limited adaptive capacity for vulnerable populations. The fifth scenario "SSP5 (Fossil-Fuelled Development)" sees economic growth driven by fossil fuels achieving human development goals but facing high mitigation challenges due to a high fossil fuel dependency.

When exploring future population dynamics, the RCPs and the Shared Socioeconomic Pathways scenarios (SSPs) can be integrated to form the SSP-RCP scenarios. The SSP-RCP ('SSPX-Y') scenarios are used in the last IPCC assessment report (IPCC, 2023) and combine baseline SSPs with RCP radiative forcing levels to impose global warming targets, where 'X' refers to the baseline SSP scenario and 'Y' refers to the RCP radiative forcing levels. For example, the SSP components of the SSP1-2.6 SSP-RCP scenario envisions an optimistic path to sustainability, with improvements in both environmental and human well-being ("SSP1 - Sustainability"), and the RCP components impose a 2.6 W m^{-2} level of radiative forcing in 2100, which corresponds with a related level of global warming (IPCC, 2023).

The SSP-RCP framework used in this study allows testing of different combinations of socioeconomic development and emissions, producing a range of quantitative projections:

- SSP1-2.6 (~1.5°C warming): A green-growth scenario with low emissions and sustainable socio-economic practices.
- SSP2-4.5 (~2.7°C warming): A "middle-of-the-road" scenario with moderate emissions, assuming current global development trends continue with some mitigation.
- SSP3-7.0 (~3°C warming): A high-emission scenario characterized by fragmentation and inequality.
- SSP5-8.5 (~4.9°C warming): A high-emission, fossil-fuel-intensive pathway with limited climate policies, leading to extreme warming.

Recent studies adopting combined SSP–RCP frameworks incorporate both emission trajectories and socioeconomic development patterns, following IPCC recommendations (Chen et al., 2024; Hajat et al., 2023; Masselot et al., 2025; Rai et al., 2022).

While the literature on temperature-related mortality projections is extensive and methodologically diverse, to our knowledge, few studies have applied an econometric approach with a counterfactual fixed-effects analysis to project temperature-related mortality across Europe. This thesis provides a baseline estimate of the potential impacts of future temperature variations on mortality without adjusting for future adaptation and demographic change. The analysis includes both urban and rural regions, offering a comprehensive understanding of spatial heterogeneity in temperature–mortality relationships. All four SSP-RCP scenarios are considered, covering a relevant spectrum of climate futures, which is particularly useful for risk assessments and policy discussions.

Given identified research gaps, the focus is specifically on older adults aged 65 years and above, as they are the most vulnerable to temperature extremes. The study is conducted at a fine spatial resolution (NUTS2), incorporating daily temperature variations for both heat and cold exposures.

3. Data

4.3.1. Mortality and Population Data

We collected observed weekly mortality data by age group, sex, and NUTS2 from Eurostat. As population exposures, we gathered the annual population data from Eurostat, available from the Eurostat by age group, sex, and NUTS2. We compiled the file at a monthly level covering the historical period 2014 – 2022. We computed monthly mortality rates as the ratio of death counts to monthly population exposures.

4.3.2. Current and Projected Meteorological Data

For the daily meteorological information, we used the E-OBS from Copernicus Climate Data Store (CDS) with a version 29.0e gridded at 0.1° x 0.1° for the period 2014 to 2022 (Copernicus Climate Change Service, 2024; Cornes et al., 2018). As control variables we utilized the solar radiation, relative humidity, precipitation, and wind speed recorded in each NUTS2 region. These listed variables are widely found to significantly alter people’s thermal sensations, comfort level, and thermoregulatory efforts (Fang et al. 2004; Li et al. 2024; Yang et al. 2024). We used the temperature data to compute the average number of days in each temperature range. Section 4.4 of the Research Methods describes how the average number of days in each temperature range was calculated.

For the projected daily temperatures, we used the NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP-CMIP6) dataset, which provides a global downscaled climate scenario (NCCS, 2024a). The NEX-GDDP-CMIP6 is derived from the General Circulation Model (GCM) runs conducted under the Coupled Model Intercomparison Project Phase 6 (CMIP6) and across all four “Tier 1” greenhouse gas emissions scenarios known as Shared Socioeconomic Pathways (SSPs) (NCCS, 2024b). Using thresholds fixed to the current period, we calculated the monthly mean number of projected extreme-temperature days across four climate change scenarios: RCP2.6, RCP4.5, RCP7.0 and RCP8.5.

4. Methods

To estimate the overall relationship between temperature and human mortality in Europe, a Poisson regression is employed with region by month, and year by month Fixed Effects (FE). The equation can be described as follows:

$$\log[E(Y_{nt})] = \log(E_{nt}) + \sum_j \theta_j TEMP_{nt}^{j} + X_{nt}\beta_{nt} + \alpha_{nw} + \delta_{yw} \qquad \textit{(Equation 1)}$$

where Y_{nt} is the monthly counts of deaths in month-year t and NUTS2 region n; E_{nt} is an offset term capturing the exposure to death risk in the NUTS2 region n and month-year t; *TEMP* captures the number of days in temperature range j, in month-year t and NUTS2 region n; the coefficients Θ_j is the effect on mortality of exchanging one day in the comfort zone for a day in the j-th bin; the covariates $X_{nt}$with associated coefficients β_{nt} are the control variables; α_{nw} captures NUTS2 region by month fixed effects; δ_{yw} account for year by month fixed effects. The standard errors are clustered at the NUTS2 level. Daily average temperature bins were created using percentiles from the temperature distribution for each NUTS2 unit over the study period. We counted the number of days per month in each NUTS2 that fell within a temperature range. Eleven ranges were established: 1) ≤ - 6° C, 2) > -6° ≤ -3°C, 3) > -3° ≤ 0°C, 4) > 0° < 3°C, 5) ≥ 3° < 9°C, 6) ≥ 9° < 15°C (comfort zone, excluded from analysis), 7) ≥ 15° < 18°C, 8) ≥ 18° < 21°C, 9) ≥ 21° < 24°C, 10) ≥ 24° < 27°C, and 11) ≥ 27°C.

The extrapolated temperature - mortality curve calculated in the historical period (2014-2022) is then replicated along the whole projection period accounting for the new temperatures. The temperature–mortality relationship among older adults is estimated as the difference between deaths observed during extreme-temperature days and counterfactual deaths under future temperature exposure scenarios. By applying the estimated regression coefficients and substituting projected counts of extreme temperature days for each region under the 10-years interval future periods (e.g., 2030–2039, 2040-2049, etc.), corresponding to their respective SSP–RCP scenarios, we projected the number of extreme temperatures–related deaths through the end of the 21st century. Excess mortality rates were expressed per 100,000 population as

$$Rate = \frac{Counterfactual - Fitted}{Population} \times 100{,}000 \qquad (\textit{Equation 2})$$

representing the number of excess deaths per 100,000 older adults. Results were aggregated across 100 Monte Carlo iterations to quantify uncertainty and summarized across NUTS2 regions to assess spatial heterogeneity in temperature-related mortality.

5. Results

4.5.1 Future temperature related deaths and regional disparities

The projected change in temperature-related mortality rates vary considerably by location. Figure C.1 shows the excess death rates (per 100.000) across NUTS2 European regions under the four climate and socio-economic scenarios. The map highlights substantial regional differences in projected excess death rates related to temperatures. The greatest reduction in temperature-related mortality is projected for Northern Europe, with Finland experiencing decreases of 6.21 and 7.85 excess deaths per 100,000 older adults under SSP1-2.6 and SSP2-4.5, respectively, and northern Sweden showing an even larger reduction of 11.71 and 13.75 deaths per 100,000 under SSP3-70 and SSP5-8.5 scenarios. In contrast, Southern Europe faces the highest increase in temperature-related mortality, particularly in Portugal, where excess death rates rise by 9.55 under SSP2-4.5 and 14.26 per 100,000 under SSP5-8.5, and in Italy with an increase in excess death ratios of 10.73 under SSP1-2.6, and 13.05 under SSP3-7.0 scenarios.

Figure C.2 extends the historical mortality series into the future (2030–2099), assuming stable population dynamics and considering all the four SSP-RCP scenarios. The projections reveal distinct patterns for the scenarios:

- Under SSP1-2.7, excess death rates decrease and remain stable around zero, reflecting a mortality level like that experienced in historical years.
- Under SSP2-4.5, excess death rates initially decline until reaching a minimum of 0.002 per 100,000 in the period 2050–2059. However, after this point, mortality rates gradually rise, peaking at 1.585 per 100,000 by the end of the century.
- Under SSP3-7.0, excess mortality follows an increasing trend, reaching its peak of 3 per 100,000 in 2080–2089, before declining by the end of the century.
- Under SSP5-8.5, excess mortality follows a continuously increasing trend, reaching its highest value of 4.72 per 100,000 by the end of the century.

A discussion of these results follows in the next section.

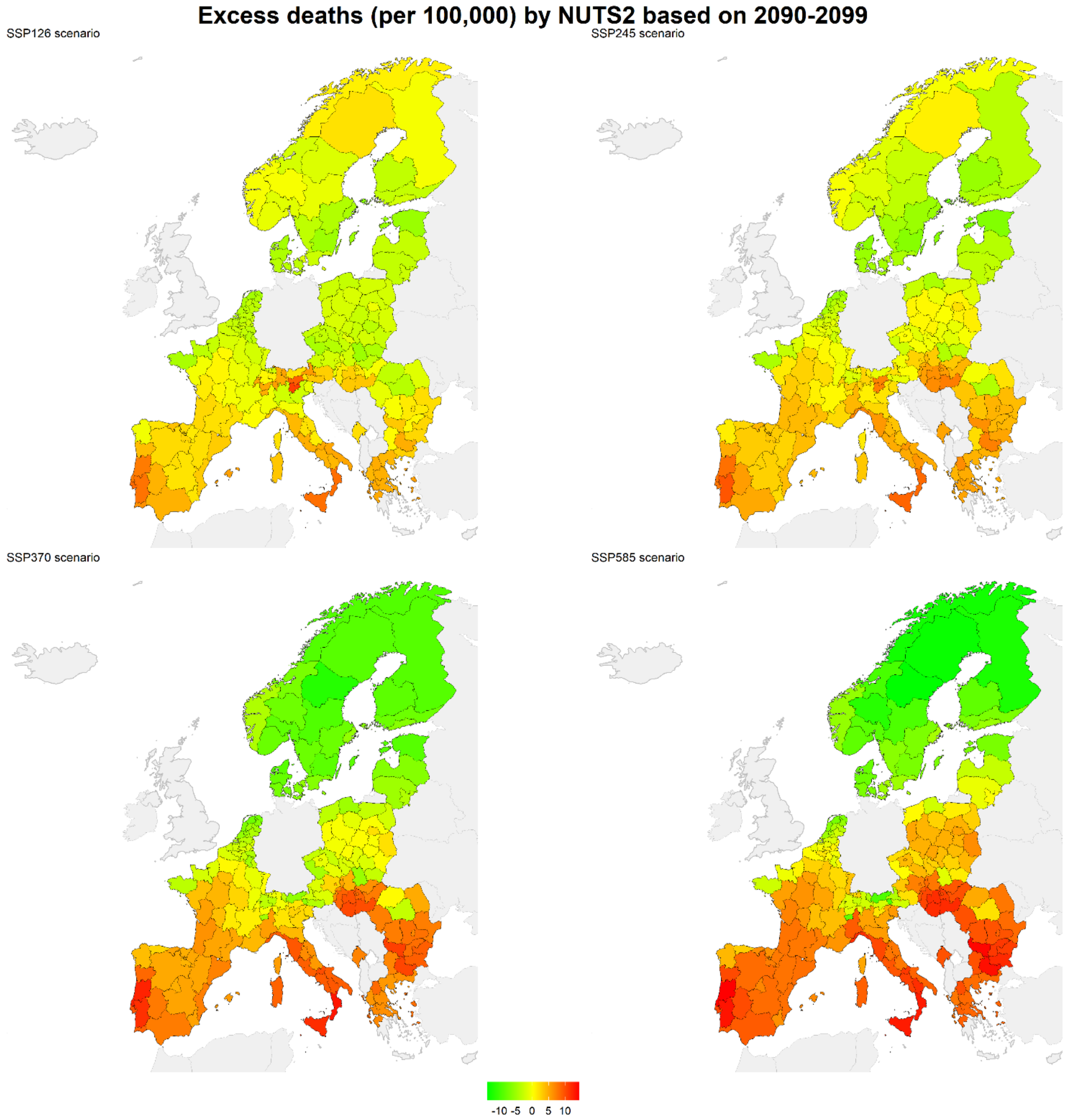

Figure C. 1 Excess death rates (per 100,000) across NUTS2 European regions under different SSP-RCP scenarios at the end of the century (2090–2099).

Note: The excess death rates range from -7.66 to +10 under SSP2-4.5 and from -13.98 to +15.22 under SSP5-8.5.

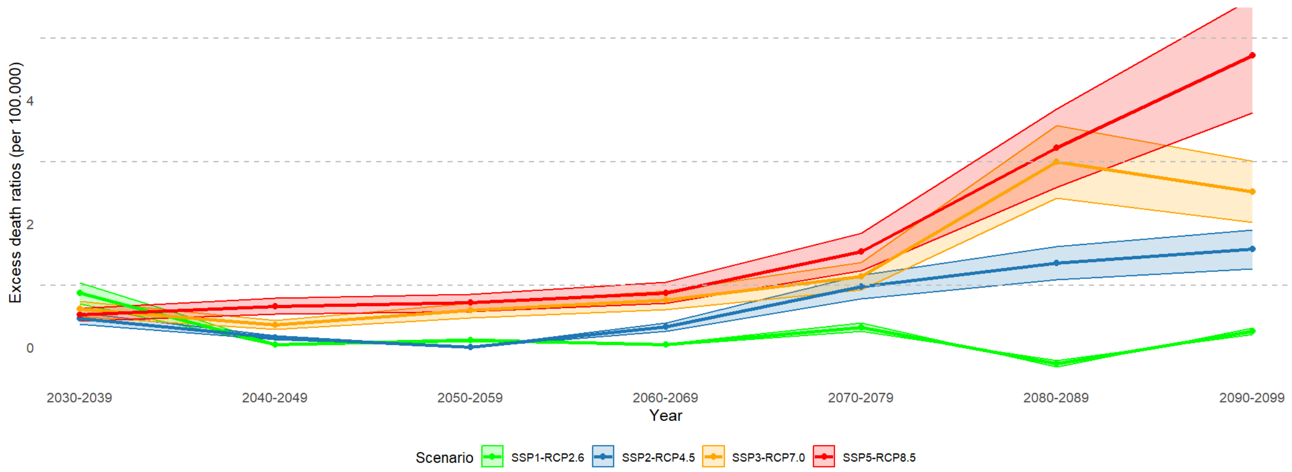

Figure C. 2 Excess death rates (per 100,000) if temperatures in 2014-2022 were as high as the end-century levels projected in the SSP-RCP scenarios

6. Discussion

Regional differences highlighted in Figure C.1 emphasize that under different emission and socio-economic scenarios, climate change can exacerbate internal disparities across Europe. While populations and infrastructure in historically warm regions are generally better adapted to high temperatures, Southern Europe appears insufficiently prepared for the unprecedented extreme heat events projected under different SSP-RCP scenarios (Marí-Dell'Olmo et al., 2019; Martínez-Solanas et al., 2022). Indeed, several studies predict a decline in cold-related deaths particularly at higher latitudes, such as in Northern Europe, and an increase in heat-related deaths particularly at lower latitudes (Carleton et al., 2022; Sarofilm et al., 2016; Seltenrich, 2015).

The pattern described in Figure C.2 highlights that under the SSP2-RCP4.5 emission scenario, we observe a reduction in temperature-attributable mortality during the first half of the century, primarily because fewer deadly cold days lower cold-related mortality. In some regions, this decline initially offsets heat-related deaths, creating a temporary benefit before mortality rates begin to rise from the mid-2050s onward, increasingly rapidly. SSP1-RCP2.6 yields the smallest projected rise in excess mortality, staying close to the historical baseline. In contrast, under the SSP3-RCP7.0 and SSP5-RCP8.5 scenarios, the overall mortality effect follows a consistently increasing trend (Carleton et al. 2022).

While expected, these findings raise several considerations. First, we have to consider that the calculation of the future excess death rates per 100,000 is performed as the difference between (i) the number of deaths that would have occurred if temperatures had remained at the levels observed during the historical period (2014–2022), and (ii) the deaths projected under different socio-economic and emissions scenarios. Since this differential references a historical period (2014-2022) during which climate change has already occurred and has already produced some consequences on human health and wellbeing, the starting point already reflects relatively high temperature-attributable mortality. On the other hand, this approach has the advantage of grounding projections in present conditions, thereby showing how impacts may evolve in the future starting from today’s climate reality.

The analyses of future temperature-related mortality in European regions highlight several converging concerns. First, the projected increased in heat-related mortality is driven by the intensification of heat extremes. This exacerbates physiological stress and elevates mortality risk, particularly among vulnerable populations. Second, there is an uneven spatial distribution of temperature-mortality effects across the region. In fact, some areas, such as Southern Europe, are negatively impacted, whereas Northern Europe experiences comparatively lower impacts. Thirdly, substantial within and cross-country heterogeneities in social, economic, demographic, and climatic factors further shape vulnerability and resilience. Differences in age structure, socioeconomic status, access to healthcare, housing quality, and adaptive capacity can amplify or mitigate the health burden of heat exposure, resulting in complex, population-specific outcomes (Benmarhnia et al., 2015; García-León et al., 2024; Martínez-Solanas et al., 2021; Masselot et al., 2025; Relvas et al., 2025; Smętkowski, 2013). Collectively, these factors must be considered, as they may not only amplify existing inequalities but also exacerbate temperature–mortality disparities between and within countries and population subgroups (Balakrishnan et al., 2022; Guan et al., 2021)

Given our results on projected changes in temperature-related mortality, an open discussion on broader demographic implications that could reshape population structures across Europe is needed. In Southern Europe, population ageing amplifies vulnerability to extreme heat, leading to higher heat-attributable mortality (Carleton et al., 2022; Martínez-Solanas et al., 2021). This shift could strain healthcare systems, social services, and pension schemes, particularly in countries with limited adaptive capacity. Selective mortality could reduce the size of the older population in the most affected regions, paradoxically slightly lowering old-age dependency ratios in the short term, but at the cost of increased health and social vulnerabilities among survivors (Benmarhnia et al., 2015; Carleton et al., 2022). Conversely, reductions in cold-related deaths in Northern Europe may partially offset these pressures but are unlikely to fully counterbalance the long-term demographic impacts of heat extremes. Such reductions may allow a larger proportion of older adults to survive, increasing the old-age dependency ratio and placing additional long-term demands on healthcare and social support systems (García-León et al., 2024; Martínez-Solanas et al., 2021). Moreover, areas with higher socio-economic vulnerability may experience compounded health, labor, and economic consequences (Benmarhnia et al., 2015; García-León et al., 2024). These projections highlight that climate-driven mortality is both a public health concern and a critical demographic challenge, potentially shaping age structure, dependency ratios, and long-term societal resilience across Europe. The uneven spatial distribution of these effects underscores how climate-induced mortality could exacerbate demographic imbalances, amplifying regional inequalities in labor force participation, public service demand, and social resilience, while emphasizing the urgent need for targeted adaptation, health interventions tailored to local population vulnerabilities, and for equitable climate mitigation strategies to reduce intergenerational and societal disparities in future health outcomes (Grant et al., 2025).

7. Conclusion

This study finds that the change in temperature-related mortality rates is projected to vary considerably across subnational regions in Europe and SSP-RCP scenarios. Specifically, the change in temperature-related mortality rates is projected to decrease in Northern Europe, particularly Finland and northern Sweden, while increasing in Southern Europe, especially Portugal and Italy. Furthermore, projections through 2030–2099 indicate that under low-emission scenarios (SSP1-2.6 and SSP2-4.5), excess death rates remain low or even temporarily decrease, whereas in high-emission scenarios (SSP3-7.0 and SSP5-8.5) mortality continues to rise. Overall, these findings highlight significant regional disparities driven by both climatic extremes and socio-economic factors, suggesting that vulnerable populations in Southern Europe will bear the greatest burden of future temperature-related mortality.

This study is not free from limitations. First, this analysis does not account for demographic changes in the future population and is based on the population structure of the historical reference period. Moreover, the assumption of no adaptation could result in either underestimation or overestimation of impacts. Additionally, I do not consider potential changes in the Atlantic Meridional Overturning Circulation (AMOC). Data availability is another limitation, as some European regions such as lack complete death counts. Furthermore, model confidence intervals could be improved by integrating a broader range of temperature projection models.

These findings also point to new important questions. First, the results raise the question of how climate effects may impact future populations, particularly how older adults' mortality due to extreme temperatures could influence the structure and composition of the population over time. Second, deaths among older adults may be reallocated across seasons (e.g., fewer in winter, more in summer). The possibility of temporal displacement of deaths across seasons warrants further investigation. Testing for such seasonal displacement requires monthly, not annual, analyses. Third, future analyses could examine age subgroups in greater detail, such as <5, 5–65, and 65–75 years, but also very old categories ≥90 years and centenarians. This would allow exploration of longevity under prolonged exposure to high temperatures, and whether countries historically characterized by high proportions of centenarians may experience shifts or changes. Analyses stratified by sex would also allow investigation of gender differentials in reaching centenarian ages. Furthermore, life expectancy itself may be affected by changing temperature-related mortality, a question deserving specific investigation. Ultimately, the role of adaptation should be considered. Although findings in the literature may suggest that adaptation could have only limited effects (Vicedo-Cabrera et al., 2018), progressively more severe warming is likely to encounter limits to adaptation -- physiological, infrastructural, and socioeconomic -- making the scale and distribution of residual mortality risk a priority for further study.

This study contributes to a growing body of research on the future impacts of extreme temperatures on human health by examining how warming driven by anthropogenic climate change will shape future mortality patterns in Europe, considering geographical heterogeneity at the subnational level by different climate scenarios.

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