

How seasonal mortality shapes life expectancy in Europe (2000-2019)

Isabella Marinetti | March 30, 2026



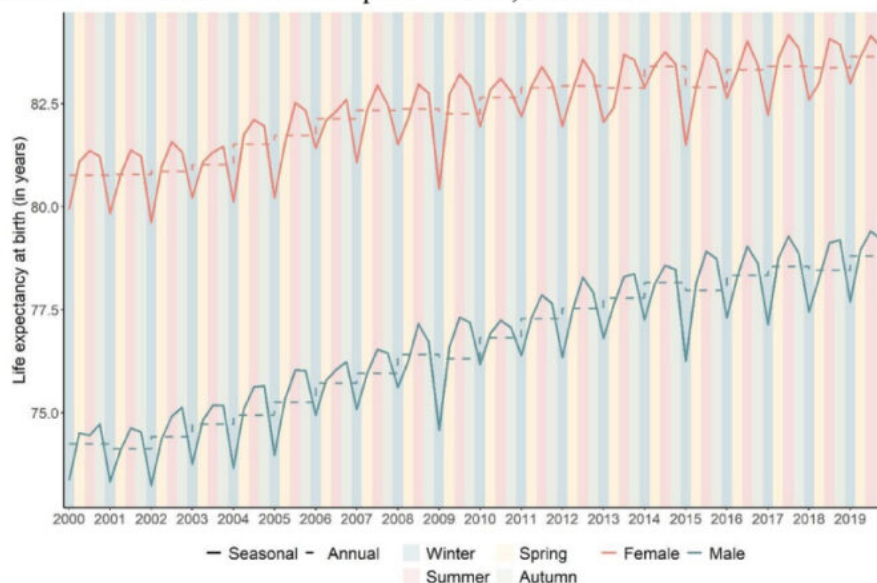
Mortality in Europe follows a clear seasonal pattern, with more deaths during winter months especially, but their impact on life expectancy is often overlooked. Using data from 20 countries, Isabella Marinetti investigates how these patterns affect longevity and why they remain relevant in the context of population ageing and climate change.

Mortality does not occur evenly throughout the year. Deaths follow clear seasonal patterns, rising during cold winters and flu epidemics and sometimes during periods of extreme heat (Rau, 2007). Despite this regularity, evidence on seasonal mortality and its impact on life expectancy remains very limited. In fact, life expectancy is typically measured on an annual basis, hiding the role of recurring seasonal mortality peaks. As Europe's population ages and climate-related risks intensify, understanding how seasonal mortality shapes life expectancy has become increasingly urgent. In a recent paper (Marinetti et al. 2025), we examined how seasonal mortality continued to shape life expectancy across 20 European countries in the early 21st century, before the outbreak of COVID-19.

A substantial and persistent burden

To assess how much the seasons matter when studying mortality patterns, we compared observed mortality with a scenario without seasonal spikes: no winter flu epidemics or summer heatwaves. The results reveal a visible and surprisingly stable and pattern. Across Europe, men lost around 1.1 years of life expectancy annually because of seasonal mortality, while women lost about 0.8 years (Figure 1). This translates to roughly 400,000 premature deaths each year across the 20 countries studied.

Figure 1. Annual (dotted line) and seasonal (solid line) life expectancy at birth by sex, median across the selected 20 European countries, 2000-2019.



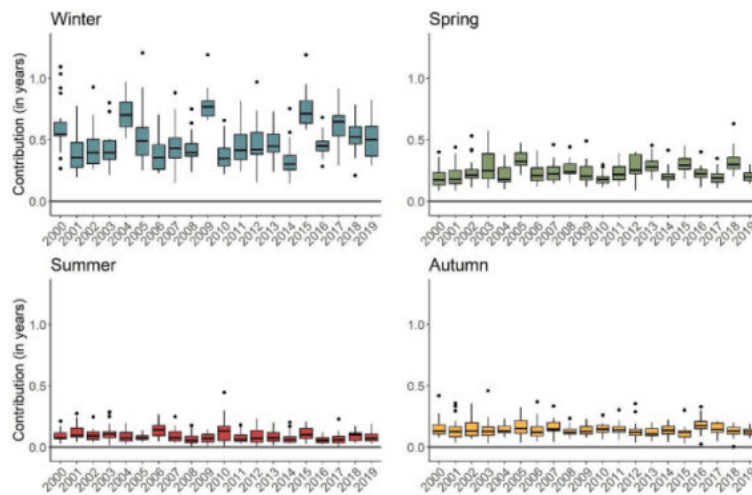
Source: Marinetti et al. (2025).

Seasonal mortality, therefore, is not a marginal or rare phenomenon. It is a recurring and predictable pattern that interacts strongly with population ageing: deaths at ages 65 and above account for between 70 and 90 per cent of its overall impact. Perhaps most striking is what did not change. These figures remained remarkably stable across two decades, even in years without major health crises. The seasonal burden persisted despite Europe becoming wealthier, healthier, and better equipped to cope with severe weather.

Winter remains the dominant threat

Every winter, cold weather and respiratory infections significantly increase mortality rates, with a life expectancy loss of about 0.55 years on average (Figure 2). This effect is particularly strong among older people, whose immune systems are more fragile and who are more vulnerable to complications such as pneumonia or heart failure (Analitis et al., 2008). The winters associated with strong influenza epidemics (2004-2005, 2009-2010, and 2014-2015) correspond closely to the sharpest annual drops in life expectancy in our data (Figure 1).

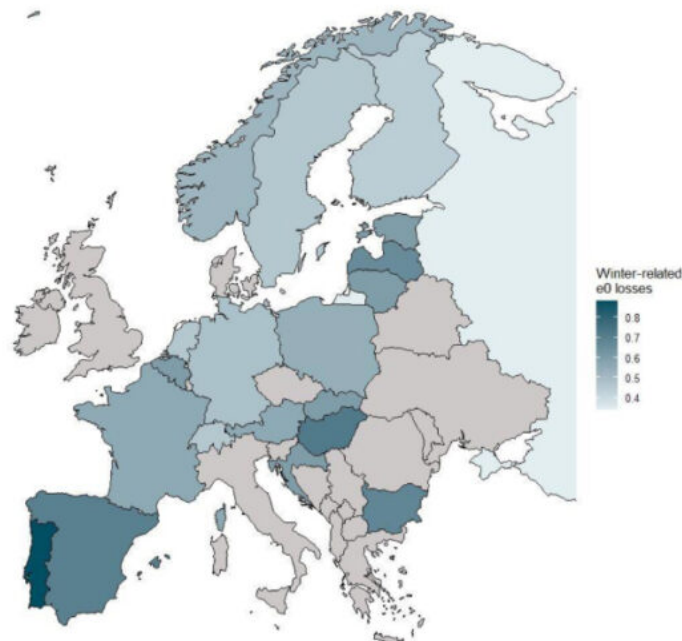
Figure 2. Contributions of season-specific excess mortality to the total differences between theoretical (no winter peaks) and observed life expectancy at birth, total population, 20 European countries, 2000-2019.



Note: Median, interquartile range and outliers
 Source: Marinetti et al. (2025).

Yet, seasonal impacts vary widely across countries, even in recent years (Figure 3). In Portugal, Bulgaria, and Spain, winter alone reduces life expectancy by 0.6 to 0.85 years annually. By contrast, Northern European countries such as Sweden and Finland, despite facing colder winters, show much smaller seasonal losses, likely reflecting better-insulated homes, strong health systems, and widespread flu vaccination coverage (Füssel, 2010; Hajat & Kosatky, 2010)

Figure 3. Winter-related losses in life expectancy (e_0) in Europe, average, 2015-2019.



Source: Marinetti et al. (2025).

It's worth noting that heatwaves have also recently captured public attention, and for good reason. Europe's extreme summer temperatures in recent years have caused thousands of deaths (Ballester et al., 2023). Yet our findings show that winter still has the greatest toll on life expectancy across Europe. Even the devastating 2003 heatwave reduced life expectancy at birth in France and Spain (the most affected countries) by only 0.3 years, which is less than half of winter's typical impact. Although climate change will likely raise heat-related mortality in summer, winter is unlikely to cease being a major threat. This points to a "double burden" of seasonal mortality, rather than an offset through warmer winters, as some have suggested.

Little progress, growing challenges

One might expect modern medicine, improved living standards, and stronger public health systems to reduce the seasonal burden on life expectancy. Yet we find little evidence of such progress. In most countries, seasonal losses remained almost unchanged over the 20-year period we studied. In a few cases, including Poland, Slovakia, Germany (men), and Sweden (women), the seasonal burden even appears to have increased slightly. This lack of improvement is concerning. Seasonal mortality is neither random nor unpredictable. Much of it is linked to risks that are well known and, to a large extent, preventable.

Meanwhile, two trends threaten to amplify this challenge. Europe is ageing rapidly: by 2070, about one in three Europeans will be aged 65 or older (European Commission, Directorate General for Economic and Financial Affairs, 2023), and this is precisely the age group most vulnerable to seasonal mortality shocks. At the same time, climate change is expected to increase the frequency and intensity of temperature extremes, from winter cold spells to summer heatwaves. Together, these trends suggest that seasonal mortality could become an even more pressing public health challenge in the coming decades.

Targeted and timely public policies

Seasonal mortality is predictable and largely preventable, yet it continues to claim hundreds of thousands of lives across Europe each year. Without stronger preparedness and targeted protection for vulnerable populations, the seasonal toll on life expectancy is unlikely to decline. The challenge is clear: winter preparedness must improve through early warning systems, strengthened vaccination campaigns, adequate heating subsidies, better home insulation, and efficient healthcare systems, especially in Southern and Eastern Europe, where the burden is greatest, and for older age groups. As the European populations age more rapidly and climate extremes intensify, addressing seasonal mortality is not just about improving current life expectancy; it is about preventing a growing public health crisis.

References

Analitis, A., Katsouyanni, K., Biggeri, A., Baccini, M., Forsberg, B., Bisanti, L., Kirchmayer, U., Ballester, F., Cadum, E., Goodman, P. G., Hojs, A., Sunyer, J., Tiittanen, P., & Michelozzi, P. (2008). Effects of Cold Weather on Mortality: Results From 15 European Cities Within the PHEWE Project. *American Journal of Epidemiology*, *168*(12), 1397-1408.

<https://doi.org/10.1093/aje/kwn266>

Ballester, J., Quijal-Zamorano, M., Méndez Turrubiates, R. F., Pegenaute, F., Herrmann, F. R., Robine, J. M., Basagaña, X., Tonne, C., Antó, J. M., & Achebak, H. (2023). Heat-related mortality in Europe during the summer of 2022. *Nature Medicine*, *29*(7), 1857-1866.

<https://doi.org/10.1038/s41591-023-02419-z>

European Commission, Directorate General for Economic and Financial Affairs. (2023). *The 2024 ageing report: Underlying assumptions and projection methodologies*. Publications Office. <https://data.europa.eu/doi/10.2765/960576>

Füssel, H.-M. (2010). How inequitable is the global distribution of responsibility, capability, and vulnerability to climate change: A comprehensive indicator-based assessment. *Global Environmental Change*, 20(4), 597-611. <https://doi.org/10.1016/j.gloenvcha.2010.07.009>

Hajat, S., & Kosatky, T. (2010). Heat-related mortality: A review and exploration of heterogeneity. *Journal of Epidemiology & Community Health*, 64(9), 753-760. <https://doi.org/10.1136/jech.2009.087999>

Marinetti, I., Jdanov, D. A., Jasilionis, D., Nepomuceno, M., Islam, N., & Janssen, F. (2025). Seasonality in mortality and its impact on life expectancy levels and trends across Europe. *Journal of Epidemiology and Community Health*, jech-2024-223050. <https://doi.org/10.1136/jech-2024-223050>

Rau, R. (2007). *Seasonality in human mortality: A demographic approach*. Springer.