

Working Title:

# **Stalling life expectancy improvements across districts of the European Union – A study on within- and cross-border patterns and the contribution of age and cause specific mortality**

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## Abstract

Stalling improvements in life expectancy have been observed in several high-income countries, including the UK and the US, during the past decade. Existing research has attributed these unfavorable trends to stagnating declines in mortality among working-age and older populations, especially from cardiovascular diseases. Studies on slowing life expectancy improvements among EU member states have mainly focused on country comparisons or regional analyses within single countries. Our study extends this research by exploring potentially stagnating life expectancy patterns at the district level within and across 20 EU member states, accounting for age- and cause-specific contributions to these trends. We use harmonized mortality data by age, sex and groups of causes of death at the NUTS-3 level from 1995–2022 from the REDIM project to estimate life expectancy and its improvements at the district level over time. We further apply spatial clustering analysis to identify regions with stagnating life expectancy. For these regions, we decompose the changes in life expectancy by age and cause using linear integral decomposition.

Based on initial research, we expect to find clusters of decelerating and potentially stalling life expectancy improvements within and across old and new EU member states, likely driven by slowing declines in cardiovascular mortality at middle and older ages, particularly among men.

## Background

Life expectancy at birth has been on the rise in most high-income countries over the last decades (Leon 2011; Mackenbach 2013). Since the early 2010s, these steady improvements have started to slow down and a number of high-income countries witnessed a decline in life expectancy around 2014–2016 (Ho and Hendi 2018). Even though most countries recovered from this setback, life expectancy increases in the US and the UK have remained stagnant (Leon, Jdanov, and Shkolnikov 2019) and the US witnessed declines in three consecutive years after 2014 (Woolf and Schoemaker 2019). Also EU member states experienced a decline in life expectancy improvements during the first decades of the 21<sup>st</sup> century but no consistent pattern of stalling improvements (Kabir and O'Brien 2023). Nevertheless, studies from single EU countries such as Germany suggest that life expectancy improvements fall also short of their potential (Jasilionis et al. 2023).

The overall trend of stalling life expectancy gains in high-income countries has been attributed to a slowing of mortality declines among working-age and older age groups, as well as to limited further reductions in deaths especially from chronic diseases. Two review studies from the US and the UK show deteriorating improvements in age-specific mortality for women and men, particularly above age 75 in England (Murphy 2021) and among non-Hispanic white and black women and men between the ages of 15 and 64 but also above age 65 (Harper, Riddell, and King 2021). While for the US, lacking improvements in averting deaths from cardiovascular diseases (CVD) have been suggested as the prime reason underlying the stagnation of mortality decreases (Mehta, Abrams, and Myrskylä 2020), the results for the UK are less conclusive. A study from Scotland shows that a strong deceleration in circulatory mortality improvements contributed to stalling life expectancy increases but also suggested other causes of death like dementia and drug-related deaths as major factor (Ramsay et al. 2020). Also research on other high-income countries suggests that the rate of CVD mortality decline has slowed down considerably between 2000 and 2015 (Lopez and Adair 2019). However, circulatory mortality seems to play a less prominent role in England and Wales and stagnating improvements in other causes of death are more important here (Murphy 2021).

There is no single reason for the observed stagnation in life expectancy gains but existing research suggests a similar set of problems that may help to explain these trends. Increasing poverty and widening health inequalities exacerbated by implemented austerity measures and inadequate social protection are suggested as a prime reason for stagnating and declining life expectancies (McCartney et al. 2022; Ruckert and Labonté 2017). It is also argued that austerity measures affect quality of and access to health care which in turn may also determine widening health inequalities and slowing improvements in averting certain causes of death (Doetsch et al. 2023; Stuckler et al. 2017). Finally, it has been argued that austerity measures have further increased the number of people living in precarious conditions, characterized by unstable labor markets, rising job insecurity and inadequate statutory welfare provision (McKee et al. 2017).

Experiences of precariousness and the additional consequences of austerity policies vary considerably across European regions. Studies from economic geography suggest substantial regional differences in central domains of precariousness and of experiencing the ramifications of austerity (Ballas, Dorling, and Hennig 2017; Kitson, Martin, and Tyler 2011). Despite these geographically heterogenous patterns of potential factors contributing to life expectancy stagnation, most research on Europe has neglected this regional dimension, focusing instead on national-level comparisons across EU member states (Kabir and O'Brien 2023) or on life expectancy trends in selected EU countries in comparison with the US or UK (Ho and Hendi 2018; Leon et al. 2019; Murphy 2021). These studies reported quite

heterogeneous developments at the country level, which may have contributed to widening differences in life expectancy but not necessarily to a stagnation of life expectancy gains. Still, focusing on country-level developments may mask crucial differences at smaller geographic scales, as suggested by the findings from economic geography. Studies on life expectancy developments at small regional scales have focused primarily on overall levels and regional differences in life expectancy, but they have often been limited to single-country settings (Hrzic et al. 2023; Janssen et al. 2016). Only recent studies have analyzed small-scale regional life expectancy dynamics within the European Union, suggesting spatial patterns of high and low life expectancy within and across EU countries (Sauerberg et al. 2023, 2024; Stroisch et al. 2025). Especially the study by Sauerberg et al. (2024) suggests regionally different patterns in terms of life expectancy improvements but has discussed this in terms of general EU convergence and divergence trends.

In this study, we seek to extend this research by focusing explicitly on trends of life expectancy stagnation at the district level across the EU. We aim to unravel potential clusters within and across national borders and to determine which age groups and causes of death contribute to these unfavorable dynamics.

## Data and Methods

We draw on population and death counts collected from national statistical offices for regional units of 20 Western and Central Eastern European Countries for the years 2000-2020, the period during which stalling life expectancy has been observed in other high-income countries. This country selection includes Portugal, Spain, Italy, France, Switzerland, Belgium, the Netherlands, Germany, Denmark, Sweden, Finland, Poland, Czechia, Slovakia, Hungary, the Baltic States and Romania. We focus on small spatial units classified as NUTS-3 or LAU-1.

Based on this information, we estimate district-level life expectancy at birth and rates of life expectancy improvements for men and women over time. As death counts may be fluctuating for such small regional units, especially for younger age groups and specific causes of death, we will apply cohort-period smoothing techniques to obtain complete mortality estimates (Camarda 2019). We will further use cluster analysis to determine groups of regions with similar improvements over time. For this analytical step, we will explore standard clustering methods but also apply density-based spatial clustering with noise (DBSCAN). For clusters of potentially stagnant or slowed life expectancy improvements, we estimate the age- and cause-specific contribution to the life expectancy changes over time using linear integral decomposition methods (Horiuchi, Wilmoth, and Pletcher 2008).

## Expected Results

This is an exploratory study which seeks to identify regions with stagnating life expectancy increases across districts of the European Union. Based on existing research, we expect to find clusters of low life expectancy improvements in both Western and Central Eastern European countries. These clusters might be situated in areas characterized by higher precariousness and the negative consequences of austerity policies, including former industrial regions that have experienced economic transformation and social instability, as well as economically lagging areas. Such patterns would be consistent with spatial patterns identified in the US and the UK.

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