Longevity and Environmental Perception: Introducing Life Years Without Pollution or Noise Across Europe

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Introduction and Background

Environmental degradation poses a growing threat to public health and life expectancy across Europe. In Europe, fine particulate matter caused 238,000 premature deaths in 2021, followed by 49,000 deaths from nitrogen dioxide (NO_2) and 24,000 due to acute ozone exposure (EEA, 2023). These pollutants exacerbate chronic diseases such as asthma, cardiovascular conditions, and type 2 diabetes, while also contributing to substantial morbidity and hospital admissions. Noise pollution, largely stemming from transport sources, is increasingly recognized as the third major environmental health risk after air pollution and temperature-related factors. Chronic exposure to transport noise leads to 66,000 premature deaths annually in Europe, causes around 50,000 new cardiovascular cases, and results in a loss of 1.3 million healthy life years each year (EEA, 2025).

Such data underscore the need to address environmental health risks. However, policy effectiveness is not solely determined by objective exposure data, but also by public perception. As Noël, Landschoot, Vanroelen, and Gadeyne (2022) emphasize, public perceptions define the margins for policy action and vary across cultural, political, and socioeconomic contexts. Subjective assessments of environmental risk can alter individual behaviors, influence political support, and shape societal responses to environmental challenges. Studies have shown that perceived severity of air pollution health risks impacts the use of protective measures such as air purifiers and changes in outdoor activity (Bahrami et al., 2024; Ban et al., 2019; Lin et al., 2017). Furthermore, individuals' attention to media, interpersonal discourse, and knowledge levels play critical roles in shaping environmental risk awareness (Xu et al., 2021; Saksena, 2011).

Risk perception also affects mental and physical health directly and indirectly. High perceived exposure may lead to stress-related mental health outcomes (Baldwin, Cave, Rawstorne, 2020), while low perception levels may reduce protective action, increasing susceptibility to physical harm. As Dietz et al. (2007) and Boso et al. (2018) note, perceptions can influence not only personal choices but also broader engagement with environmental policy efforts. Also, growing environmental awareness has led to an increasing proportion of people valuing their rights to access environmental resources, including those that are intangible. Subjective environmental indicators are systematically incorporated into the monitoring framework for the Sustainable Development Goals, reflecting their relevance to both policy and public perception (Eurostat, 2025; Remko et al. 2025).

Building on these insights, this research proposes a novel indicator „years of life without pollution or noise" which combines objective mortality conditions and subjective assessments of environmental exposure. This indicator combines life table values with individual-level perceptions of exposure to quantify lost life expectancy across European countries. The concept of "life years without pollution or noise" rests on two key principles. First, the ability to live is a basic condition for enjoying any aspect of life's quality. Yet, in light of the fact that environmental stressors are now major drivers of illness and premature death, this approach goes beyond mere survival. It incorporates how individuals perceive their exposure to pollution and noise. The idea is that living longer is not enough on its own, what matters is living in surroundings that people consider acceptable and health-promoting. In this view, a satisfying environmental context becomes a vital element of both physical health and overall well-being. In addition to proposing this indicator, our research also examines its spatial variation across European countries.

Data and Method

The authors propose "life years without pollution or noise" as composite indicators that integrate objective mortality conditions derived from life table with subjective assessments of exposure to environmental stressors, specifically pollution and noise. These indicator aim to capture not only the duration of life but also the quality of environmental conditions in which life is lived.

Two criteria are considered in constructing “life years without pollution or noise”. First, being alive is a fundamental prerequisite for experiencing any form of quality of life. However, given that environmental stressors are among the leading contributors to mortality and health risks today, this analysis integrates individuals’ perceptions of pollution and noise exposure. Mere survival is no longer considered sufficient; instead, it is paired with subjective evaluations of environmental conditions, suggesting that life should ideally be lived in an environment that the population finds satisfactory an essential foundation for good health and overall well-being. The basis of “life years without pollution or noise” is life expectancy as a widely used demographic indicator that is calculated on the basis of observed age-specific mortality rates. Bearing in mind that being alive is a necessary precondition for enjoying any quality of life, the length of life was chosen as the first criterion for the calculation of “life years without pollution or noise”. “Life years without pollution or noise” uses period life expectancy in its absolute value (mean years of life expected under current mortality conditions) as the basis for calculation. Abridged life tables were derived from complete life tables available through Eurostat, serving as the foundation for calculating life expectancy across national populations.

The second criterion addresses the question in what extent have total life years actually been spent without a subjective sense of pollution or noise. This criterion is based on a subjective assessment of exposure to pollution and noise. The authors use 2023 Survey of Income and Living Conditions (SILC) data for most EU countries and Serbia. The dataset contains two environmental variables, i.e. household exposure to the noise from neighbours or from the street and exposure to pollution, grime or other environmental problems. The authors use share of individuals exposed to either noise or pollution by gender and age groups from EU-SILC, and combines those shares with gender and age-specific life tables. The authors use the method firstly applied by Sullivan (1971) for calculating the life years without noise or pollution. Based on the two environmental variables available in EU-SILC authors calculate the share of population that is not exposed to neither noise nor pollution by gender and age intervals. Years without exposure to the noise or pollution are calculated by weighting age-specific person-years lived in a life table with the share of population not exposed to the either noise or pollution. In this analysis, authors focus on the age group 20–24 when calculating “life years without pollution or noise”. This decision is grounded in methodological considerations, as previous studies incorporating subjective assessments into life table calculations have similarly excluded the youngest age groups (Aayushma et. al. 2025; Lutz et al. 2018; Lutz et al. 2021, Yung, 2008, Miric, 2021). The rationale lies in the fact that children and adolescents may not be fully aware of, nor perceive, environmental risks in their surroundings. Additionally, in this case, the number of observations for age 0 is very limited when separating those exposed and those not exposed. It is also evident that exposure levels do not vary significantly across age intervals.

Main results

On average across Europe, the remaining life years without pollution or noise amount to 45.5 for women aged 20–24 and 43.3 for men in the same age group which is approximately 17.4 and 14.4 years less than the expected life expectancy, respectively.

In contrast to the spatial pattern of life expectancy in Europe, the life years without pollution or noise reveal a markedly divergent trend. While Southern European and Mediterranean countries enjoy the highest life expectancy in Europe, they rank among the lowest when it comes to life years without pollution or noise. Malta stands out as the country with the lowest number of life years without noise or pollution at age 20–24 (39.1 years for women and 37.4 years for men). Consequently, it exhibits the largest gap compared to expected life expectancy, amounting to as much as 34 years for women and 31.4 years for men at mentioned age. Malta is followed by other Mediterranean countries, such as Greece, Spain, and France, where the number of life years without pollution or noise ranges between 40 and 42 for both sexes at age 20-24. In these countries, the gap compared to life expectancy amounts to approximately 20 to 22 years.

On the other hand, several Eastern European countries, including former Yugoslav republics, demonstrate significantly higher values in terms of life years without pollution or noise, with a notably smaller gap compared to overall life expectancy. For example, Slovakia and Croatia stand out as countries where women aged 20–24 can expect to live approximately 53 to 54 years, and men around 49 to 50 years, in conditions without pollution or noise. Following Slovakia and Croatia, countries such as Poland, Czech Republic, Lithuania, and Serbia also report relatively high values for this indicator, with individuals aged 20–24 expected to live, on average, around 47 to 48 years without pollution or noise. Moreover, these countries are characterized by the smallest gaps between life expectancy and life years without pollution or noise. In Slovakia and Croatia, this gap falls below 10 years, while in other mentioned Eastern European countries, such as Poland, Lithuania, and Serbia, it remains around 15 years. Additionally, several Scandinavian countries, most notably Sweden and Denmark,

also rank high on the scale of life years without pollution or noise. For example, in Sweden, women aged 20–24 can expect to live approximately 52 years, and men around 51 years without pollution or noise.
The third cluster of countries is distinguished by moderate levels of estimated life years without environmental stressors such as pollution or noise. Among women aged 20–24, these values range between 45 and 46 years, while for men in the same age group, they fall between 43 and 44 years. This group predominantly comprises Central European nations, including Austria and Hungary, alongside a small and heterogeneous subset encompassing Belgium in Northern Europe and Cyprus in the South.
It can be stated with confidence that these differences are largely driven by cross-national variations in subjective perceptions of environmental quality. The smallest loss in years of life is observed among men and women in Eastern European countries, reflecting the highest levels of satisfaction with the environment, namely, the largest proportion of individuals not exposed to pollution or noise. In contrast, Southern European and Mediterranean countries, which exhibit the lowest proportion of non-exposed individuals, simultaneously experience the greatest loss in years of life. This pattern reflects a marked reversal in the spatial distribution of years of life across Europe. Eastern European countries now occupy the top of the scale, exhibiting the highest values of life years without pollution or noise despite poorer objective mortality conditions, while Southern and Mediterranean countries are positioned at the bottom, with the lowest levels of this indicator despite more favorable objective mortality conditions. The cross-country differences in life years without pollution or noise at age 20-24 are much bigger than the differences in life expectancy. The difference in life years without pollution or noise between these two country groups (Eastern European versus Southern and Mediterranean) amounts to as much as 9.7 years among women and 7 years among men aged 20–24.

Conclusion

The analysis of life years without pollution or noise across 25 European countries reveals a striking divergence from conventional life expectancy patterns. While Southern and Mediterranean countries traditionally rank high in overall longevity, they report some of the lowest values for life years lived without pollution or noise driven by widespread perceptions of environmental stress. In contrast, several Eastern European countries, despite facing less favorable mortality conditions, demonstrate significantly higher values for this indicator and notably smaller gaps between total life expectancy and environmentally unburdened years.
These findings underscore the critical role of subjective environmental perceptions in shaping health-related expectations and well-being. The substantial disparities, up to 34 years in Malta and as low as 10 years in Slovakia and Croatia, highlight the extent to which environmental stressors diminish the lived experience of longevity.
The observed heterogeneity across Europe illustrates the complexity of environmental health assessments, where cultural, infrastructural, and policy factors intersect with individual perceptions. In many Eastern European countries, residents may be less inclined to identify noise or pollution as health concerns, particularly in contexts where environmental education is limited and public awareness campaigns are infrequent or underfunded. This can result in lower levels of subjective reporting, even when objective exposure levels are comparable to those in Western Europe. This pattern is supported by statements from the World Health Organization (WHO) and the European Environment Agency (EEA), both of which highlight persistent disparities in environmental literacy and civic engagement across Europe. The EEA notes that vulnerable populations, particularly in lower-income regions of Eastern Europe, often face structural barriers to accessing environmental data and institutional mechanisms for reporting concerns. Countries such as Bulgaria, Romania, Serbia, and others in the Western Balkans illustrate these challenges. Limited investment in environmental monitoring infrastructure, coupled with lower levels of public trust in institutions, can suppress both awareness and reporting (EEA, 2025a). Contrary to Eastern European countries, which often report low subjective exposure due to limited environmental awareness and institutional trust, Scandinavian countries combine low objective exposure with high environmental consciousness and strong institutional credibility, resulting in notably high levels of satisfaction with environmental conditions. On the other hand, Mediterranean countries report a higher share of the population identifying exposure to noise or pollution. This higher rate of subjective reporting does not necessarily indicate worse environmental conditions, but often reflects a greater level of environmental awareness, better access to information, and more active civic participation. Mediterranean countries have, in recent decades, intensified public campaigns, educational programs, and local initiatives that encourage citizens to recognize and report environmental stressors.
Importantly, the differences in life years without pollution or noise are substantially larger than those observed in total life expectancy, emphasizing the need for mortality indicators that integrate environmental dimensions in order to a more comprehensive concept of environmentally adjusted life expectancy. This framework reflects not only biological outcomes but also the influence of everyday environmental conditions on health,

behavior, and long-term risks, thereby enabling a more holistic assessment of public health inequalities and quality of life. Incorporating subjective environmental perception into mortality indicators is important because individuals' lived experience of noise, pollution, and environmental stressors directly influences physiological responses and long-term health outcomes. Chronic stress from perceived environmental discomfort, even when objective exposure is moderate, can contribute to cardiovascular, respiratory, and mental health issues. Gotink and Gadeyne (2025) found that negative subjective perception of the residential environment was independently associated with increased mortality risk, and that dissatisfaction amplified health burdens in areas with poor environmental conditions.

However, it is important to conclude by highlighting some of the limitations of subjective indicators, such as life years without pollution or noise. As WHO and EEA highlighted and as confirmed by the findings of our analysis, these measures are influenced by individual sensitivity, cultural norms, and temporary conditions, which can introduce bias and reduce comparability across regions. They may also be shaped by media narratives or social desirability, leading to underreporting or exaggeration of environmental stressors. Moreover, translating subjective data into actionable policy is challenging, as perceptions do not always align with measurable risks. Despite these drawbacks, integrating subjective indicators alongside objective metrics remains essential for capturing the lived realities of populations and guiding equitable, health-promoting interventions (Noll, 2013). Therefore, our future research will focus on identifying optimal methods for combining subjective and objective environmental indicators, and integrating them with life expectancy metrics. This approach will enhance the relevance of environmental health assessments and support the development of composite indicators that reflect both exposure and experience, ultimately contributing to more inclusive and resilient public health policies.

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