

The subnational impact of the mortality of international migrants on estimates of county-level period life expectancy in Sweden, 1990-2023.

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ABSTRACT

Migrants are increasingly contributing to national life expectancy (PLE) gains due to their lower mortality risks and increasing population sizes. Migrants' mortality risks and settlement patterns vary across regions. However, prior work has focused almost exclusively on national-level trends and little is known about the between-region differences in migrants' impact on PLE

Using comprehensive Swedish register data from 1990–2023, we adopted a subnational perspective and assessed whether there is spatial variation in the impact of international migrants on PLE within a major migrant host country. We operationalised the gap in PLE between (a) the total resident population, (b) native-born population and (b) migrant population of each county.

Over time, migrants in nearly every county experienced a remarkable reversal, from lower to higher life expectancy than the native-born population of each county. Importantly, however, there was considerable spatial variation in the timing of the reversal and magnitude of the negative effects in the 1990s and positive effects in the 2010s that have the potential to impact county-level comparisons of life expectancy within Sweden. We also reveal an important gender difference in the effect of migrants on life expectancy.

We provide unique insight into how life expectancy trends differ within Sweden among the total population, native-born and foreign-born population and report how the effect of migrants has transformed. These findings add to a small body of evidence from a select number of high-income countries that show migration status is playing an increasingly relevant role in shaping national mortality outcomes.

KEY WORDS

Migrant health, national life expectancy, international migrant mortality

HIGHLIGHTS

- We assessed for spatial variation in the impact of migrants on PLE in Sweden
- Migrants' impact reversed over time, from negative to positive
- By 2023, migrants had higher PLE than the native-born across most counties
- There were spatial and gender differences in the timing and magnitude of the effect
- Migrants are playing an increasing role in shaping national mortality outcomes

Introduction

National statistical agencies routinely publish national and subnational estimates of period life expectancy (PLE), one of the most widely used summary measures of population health used to inform a wide array of public health and social policies¹. An emerging body of work reports that migrant populations are exerting a growing, positive effect on national PLE (in Australia², Denmark³, Finland³, Norway³, and the US⁴) through their uniquely low mortality risks^{5,6} and increasing population sizes⁷. All studies so far have focused their analyses at the national-level, so we know next-to-nothing about potential spatial variation in the regional impact of migrants on PLE. This is important for two reasons. **First**, for reasons of both context (e.g., availability and access to healthcare and welfare services, social cohesion and urbanicity) and composition (i.e., personal characteristics such as age, income, education, and employment status), regional differences in mortality *within* countries are often larger than national differences in mortality between countries are. **Second**, because migrants typically exhibit uneven settlement patterns, concentrating in regions with large metropolitan centres and/or clustering within specific ethnic groups, there is likely to be spatial variation in the size, origin composition, and mortality risks of migrants. It is vital to gauge how this affects the direction and size of inequalities in regional PLE.

The **aim** of our study is to enrich this body of work with a subnational perspective and assess whether there is spatial variation in the impact of international migrants on PLE within a major migrant host country. We conduct our study in Sweden, where regional differences in mortality in Sweden are persistent and pervasive. Among men, for example, a gap of 2.32 years in life expectancy at birth between the highest performing (Kronoberg) and lowest performing county (Gävleborg) in 1991-5 grew to 2.55 years in 2021-4 (Halland [highest] versus Västernorrland [lowest]). Over the same time, Sweden's migrant population has increased from 9% of the total resident and registered population to just over 20%⁸, and migration flows into the country have changed from intra-Nordic labour migrants to flows from outside Europe for a range of reasons (i.e., family, work, education, and asylum)⁹. Prior work in Sweden reports that life expectancy among migrants is lower than among non-migrants in 1990 (and migrants have a negative effect on national life expectancy), but accelerates at a comparatively faster rate over time to the point where migrant life expectancy exceeds native-born life expectancy by 2019 (and migrants no longer have a negative effect on national life expectancy)^{3,8}. This is attributed to the changing composition of Sweden's migrant population to non-European migrants with lower mortality risks.

Here, using register data to generate lifetables, we ask and answer the question: do we report these same effect of migrants on life expectancy in Sweden's twenty-one counties that has been documented at the national-level, or does the "average" effect of migrants at the national-level mask differences in the size and direction of migrants' impact upon life expectancy in specific counties?

Data & Methods

We use the collection of administrative register data "*Refu-Gen*" at Stockholm University. This data is accessible for research under ethical approval from the Swedish Ethical Review Authority. "*Refu-Gen*" comprises pseudonymised linked, longitudinal micro-level data from several administrative registers that covers the entire resident, registered population of

Sweden from 1968 to 2023. To align with previous studies, we focus on the years 1990 onward (up to 2023)^{3,8}. We use data from the total population register, migration register, and death register. Specifically, we use the variables: sex (to estimate PLE separately for men and women), year of birth, country of birth, year of death, county of residence in a given year, and a variable indicating continued residence in Sweden at the end of a calendar year. From these variables we further derive exact age, the exact age-at-death, and peoples' nativity status.

We define international migrants as being born in a country other than Sweden (i.e., born in Sweden vs. born abroad). We conduct our analysis at "län" or "county" level. While the number of counties has varied over time due to territorial changes and divisions or mergers of existing counties, we harmonize our definition of counties to the twenty-one counties that still exist in Sweden today. It is at this level of geographic administrative subdivision that *Statistics Sweden* (the agency responsible for producing official statistics) produces its regional life expectancies¹⁰.

We first collapse the register data into an aggregated format for deaths and population sizes by year (1990 to 2023), age (in single years from 0-1-years old to open-ended interval 95-years+), sex (male and female), and nativity status (migrant and non-migrant). Next, we calculate age-specific death rates and mid-year estimates. We calculate mid-year estimates, and not person-years, so as to maximise the comparability of our estimates with the estimates of Wallace et al. (2022).

These age-specific death rates and midyear estimates are fed into R package Demography (see¹¹) to generate period lifetables. The calculations forming the basis of the lifetable function in R package Demography can be found in Chiang, 1984; Keyfitz & Caswell, 2005; S. Preston et al., 2001. We generate lifetables and period life expectancy values between ages 20 and 70 (PLE20_70) for (a) the total resident population of each county, (b) native-born population of each county and (b) migrant population of each county. Lifetables are closed at 95+. We opt for partial life expectancies rather than life expectancy at birth due to very low (and often non-existent) numbers of migrants, and deaths of migrants, younger than age 20 and older than age 70 at the county level. Previous research has outlined the biases associated with calculating life expectancy at birth among migrants (see detailed discussion in the supplementary materials of [this](#) article). Relatedly, we calculate 3-year rolling averages of PLE20_70 to counteract noise from year-to-year variability and to improve comparability across subpopulation and counties. Therefore, our first set of estimates in 1992 represent a rolling average of 1990, 1991 and 1992. Our final set of estimates in 2023 represent a rolling average of the years 2021, 2022, and 2023.

Importantly, we recognise that life expectancy at birth (PLE0) is more widely used to support policy and planning by governments and health organizations and so replicate (and include as online supplementary materials) all table and figures from the main paper for PLE0. We also compare our total population county-level estimates for PLE0 to estimates from Statistics Sweden as a measure of quality (also see the online supplementary materials). To quantify the impact of migrants on subnational life expectancies we operationalise the gap in PLE_20_70 between the total population and native-born population, as well as between the foreign-born

population and native-born population. This is consistent with prior published research to have examined the influence of the mortality of migrants on national life expectancy estimates^{2-4,15}.

Results

Figure 1 provides initial descriptive trends over time to contextualise the changing mortality and migration dynamics of Sweden. **Figure 1A** shows large variation in PLE_20_70 across all counties in Sweden. Some counties like Stockholms (highlighted), for example, experienced a rapid increase in PLE_20_70 resulting in the county transitioning from having one of the lowest PLE_20_70 in 1990 to one of the highest PLE_20_70 values in 2023. Other countries, such as Uppsala and Norbottens, which have the highest and lowest PLE_20_70 respectively in 2024, have maintained their positions. **Figure 1B** shows that the differences in PLE_20_70 between the highest and lowest performing counties and see a gradual decline across the three decades, from three quarters of a year in 1990 to half a year by 2023. Over time, **Figure 1C** shows that all counties experienced a sharp growth in their relative shares of migrants. Nevertheless, there remains sizeable variation in the % of migrants' resident in the different counties that indicate migrants have varying potential to influence PLE_20_70 in the different counties. For example, a 23%pt. difference between Stockholms (34%) and Gotlands (11%) in 2023. And finally, when comparing different migrant groups, **Figure 1D** suggests that this increase in shares of migrants is focused among a rapid increase in migrants born in non-European countries over time. By 2023, and even in Hallands, the county with the lowest % of migrants (of all migrants living in that country) born outside of Europe, 5 of every 10 migrants was born outside of Europe. Yet, there is still a 25%pt. difference between Gavleborg (the county with the highest share at 75%) and Hallands (the county with the smallest share at 50% of all migrants residing in the county).

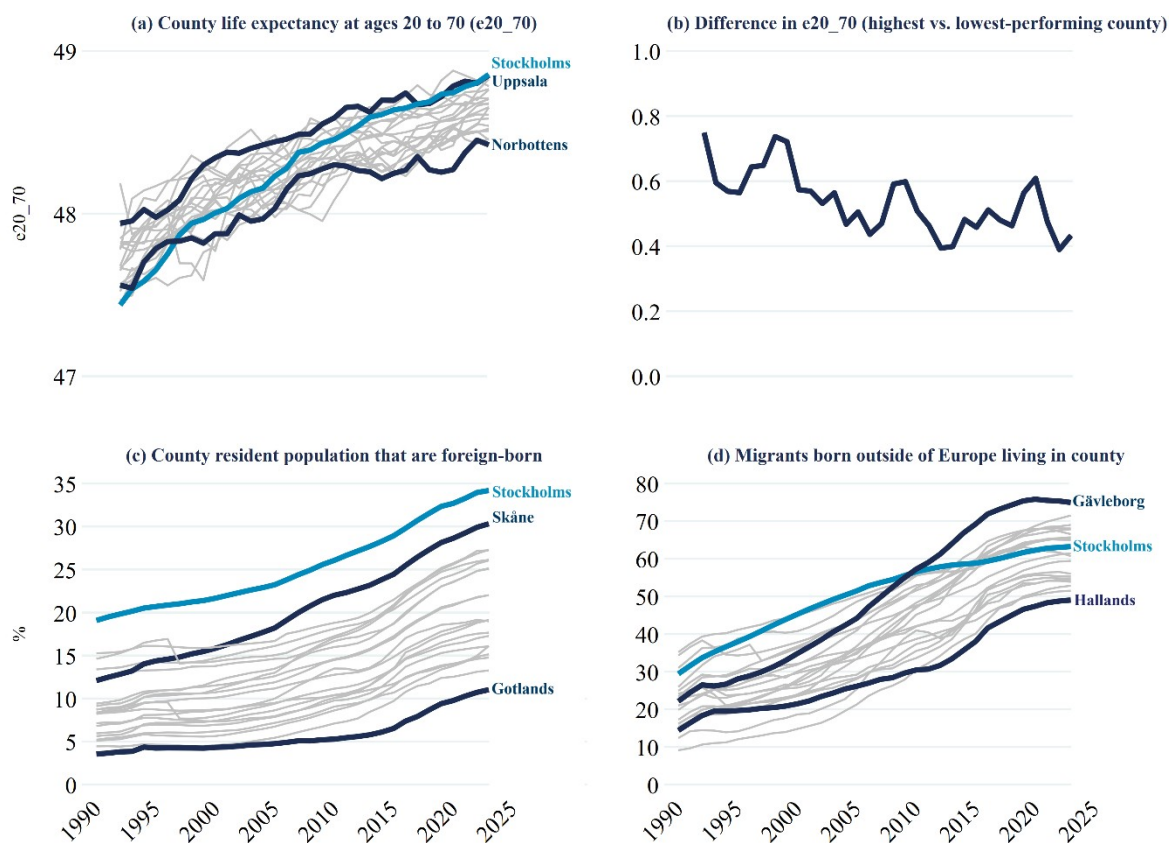


Figure 1 Temporal trends in Sweden between 1990 and 2023: (1A) The total population partial life expectancy (20-70 years) by region; (1B) The difference between the highest and lowest regional values of partial life expectancy (20-70 years); (1C) The % share of the resident population that are foreign born, by region; (1D) The % of migrant residents born outside of Europe by region (of all migrants in the country).

Figure 2 presents the temporal trends in 3-year rolling averages for PLE_{20_70} between 1992 and 2023 by nativity, sex and region. Overall, we observe a consistent increase in PLE across all counties over time among the total population, native-born and migrants. Across the total population at the national level, the average PLE for males rose from 47.06 years in 1992 to 48.31 years in 2023. These figures were 48.34 and 49 years for females, respectively. Over time, there is also evidence of convergence between the native-born and foreign-born populations. In 1992, PLE_{20_70} is lower among migrants across all counties. However, migrant PLE_{20_70} increases at a faster pace than native-born PLE_{20_70} where by 2023, life expectancy among migrants has either caught up to, or exceeded that, of the native-born population. These findings are pronounced among men. Counties like Örebro, Västergötland, Södermanlands, Norrbottens and Hallands illustrate prolonged and pronounced negative differences in PLE_{20_70} between foreign-born and native-born populations. Some counties, such as Skåne, Uppsala and Stockholms however, were outliers to this pattern, showing only a slightly lower PLE_{20_70} at the start of the 1990s.

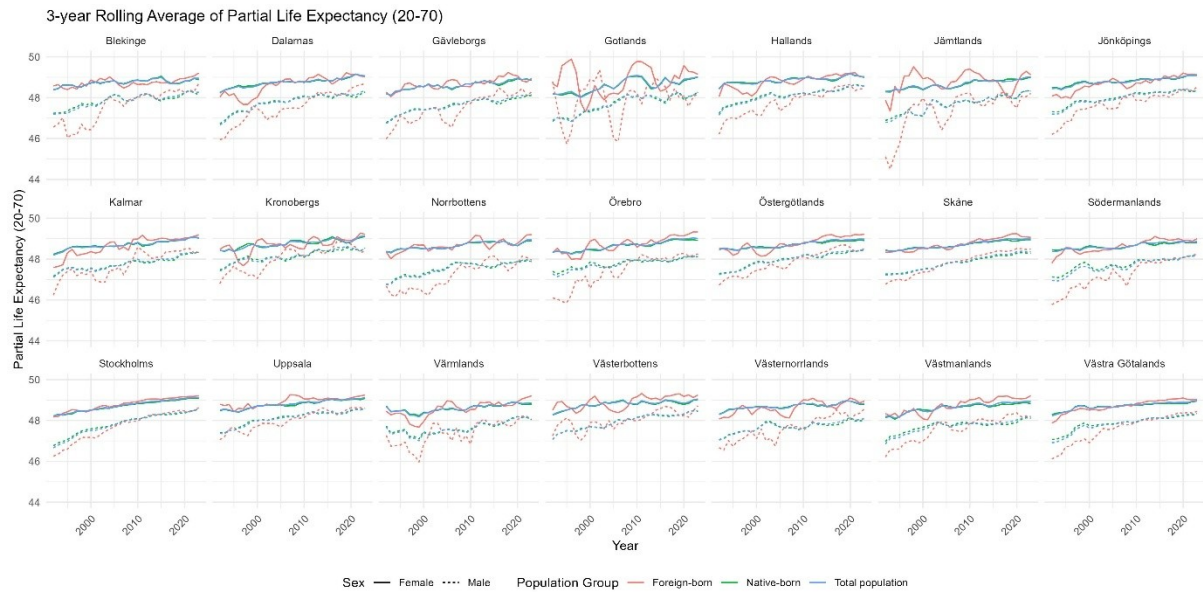


Figure 2. 3-Year rolling average of Partial Life Expectancy (PLE_{20_70}) between 1992 and 2023 by nativity, sex and region.

Figure 3 takes the start point (1992) and end point (2023) of the time series in an attempt to capture the overall magnitude of change (or ‘swing’) over the past three decades in differences in PLE_{20_70} among **(3A)** total population vs. native-born men; **(3B)** total population vs. native-born women; **(3C)** native-born vs. foreign-born men and **(3D)** native-born vs. foreign-born women. Across all subplots, there is clear evidence of shifting life expectancy dynamics between the total population and native-born populations, which reflect a positive and growing effect of foreign-born individuals on national life expectancy levels across counties in Sweden. Briefly, we acknowledge the fluctuations in PLE_{20_70} for certain smaller countries (such as Gotlands) from **Figure 2**. Resultantly, in our description of **Figure 3**, we only refer to counties with stable PLE_{20_70} estimates over time (and often larger counties), for which the overall magnitude of change tracks very coherently with the more detailed trends plotted in **Figure 2**.

Figure 3A and **3B** illustrate sizeable net change in the PLE gap between total population and native-born population from 1992 to 2023, for males and females respectively. In 1992, 20 of 21 counties had a negative difference in PLE_{20_70} for men, whereby the PLE_{20_70} among the total population was lower than the PLE_{20_70} for native-born populations, indicating a systematic negative effect on migrants PLE_{20_70}. By 2023, this relationship has reversed, in which most counties moved closer to a zero or positive differences in PLE_{20_70}, reflecting a reduced disadvantage or a positive contribution from migrants. For males, 13 of the 21 counties moved from a negative to positive difference in PLE_{20_70}. Counties such as Södermanland, Västra Götaland and Örebro witnessed the largest swing between 1992 and 2023, with the gap shifting by 0.22 years in favour of the total population, suggesting a growing positive influence of migrants on regional life expectancy. Similar results can be seen for females, however the magnitude of the changes are smaller. All counties illustrated a positive swing, with 6 counties moving from an already positive

difference to a greater positive difference in PLE_20_70. Södermanlands saw the largest swing between 1992 and 2023, shifting by to around 0.14 years.

Figures 3C and 3D illustrate a net change in the PLE_20_70 gap between the native-born population and foreign-born population from 1992 to 2023, for males and females respectively. These figures really highlight the positive transformation in life expectancies among migrants compared to the native-born population across counties in Sweden. The magnitude of the swing in the PLE_20_70 difference was markedly larger between foreign-born and native-born populations than between the total and native-born populations. For example, in males, the foreign-native PLE_20_70 difference in Södermanlands experienced a swing of 1.46 years, where the gap transitioned from -1.36 years to 0.10 years in favour of the foreign-born population between 1992 and 2023. 14 of the 21 counties experienced a positive swing from a negative difference in PLE_20_70 to a positive difference by 2023. As before, females showed similar results that were smaller in magnitude. For example, the gap shifted in Södermanlands by 0.85 years between 1992 and 2023. These results raise the question of how these differences in migrant effects might affect our ability to make comparisons of PLE between these counties.

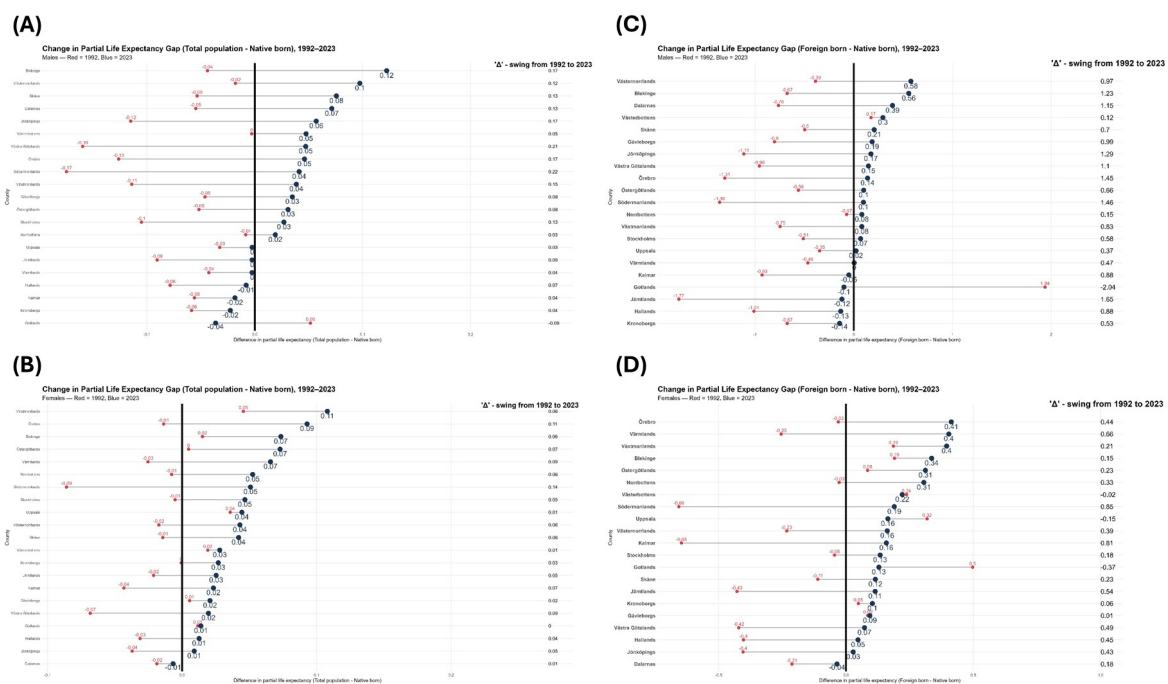


Figure 3. The temporal gap in 3-year rolling averages of Partial Life Expectancy (20-70 years) in 1992 and 2023 and swing (in years) for: (A) Total vs. Native-Born differences in men; (B) Total vs. Native-Born differences in women; (C) Native-Born vs. Foreign-Born differences in men; (D) Native-Born vs. Foreign-Born differences in women.

Figure 4 and Figure 5 present time-series bar plots showing changes in the PLE_20_70 gap between the total population and the native-born population from 1992 to 2023, disaggregated by county for males and females, respectively. These plots provide further insight into the growing contribution of migrants to PLE_20_70 in each county and highlight the presence of any gender-based differences. Based on 3-year rolling averages, these figures provide a more detailed view of how the gap evolved year-by-year and offer further insight

into the growing contribution of migrants to overall PLE_20_70 in Sweden. They help to fill in the gaps between the broader summary measures and reveal county-specific trajectories over the analysis period.

Figure 4 shows that, in general, male migrants' contribution to PLE_20_70 gradually reversed from negative in the 1990s to positive by the 2020s. However, across the counties we can report differences in (a) the size of the effect and (b) when the migrant effect transitioned from positive to negative—two factors that have potential to impact comparisons of PLEs between counties. In the early 1990s, the largest negative and prolonged effects on PLE_20_70 are found among in Orebro (-0.17 years), Södermanlands (-0.21 years), Vastmanlands (-0.13 years), and Vastra Gotaland (-0.16 years). Additionally, while in the counties such as Skåne and Kronobergs the transition from a negative to positive effect on national PLE_20_70 emerged in the early 2000s, for most counties (including Stockholms) this reversal did not take place until over a decade later in the early 2010s. In Jonkoping, the influence essentially of migrants essentially remains negative until as late as 2020. This reveals a counteracting effect of migrants across different counties at specific time points (e.g., elevating county partial life expectancy in Skåne in 2010, while continuing to lower it in Stockholms). In counties including Gotlands, Hallands, Jamtlands, Gotlands, Norrbottens and Varmlands, we see a large degree of fluctuation and no identifiable trend, likely owing to their smaller population and migrant numbers in these particular counties.

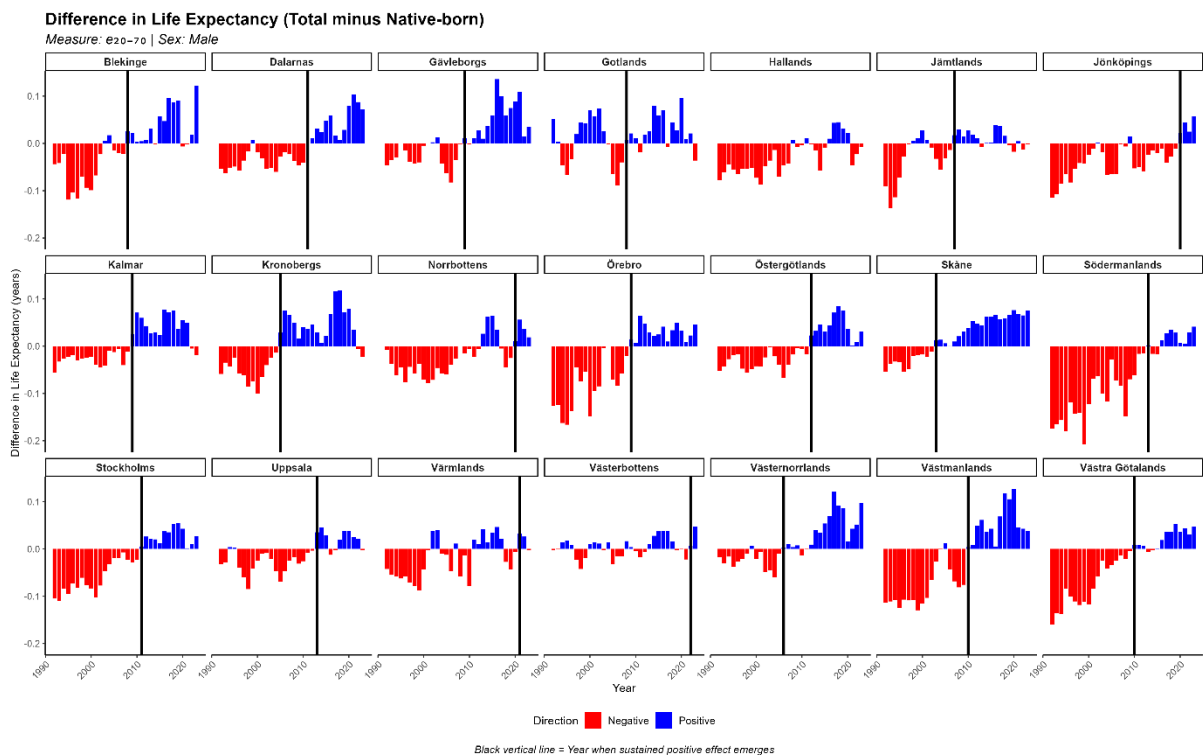


Figure 4. Annual differences in Partial Life Expectancy (20–70 years) between total and native-born populations (1992–2023), in males.

For migrant women, the patterns and trends are a little less definitive and smaller in magnitude (**Figure 5**). For Dalarnas, Jonkoping, Kalmar, Orebro, Ostergotlands, Skåne, Södermanlands, Vasterbotten, Vastmanlands, and Vastra Gotlands, we report the same reversal from a negative to positive effect of migrants on partial life expectancy in the county, again with variation in the timing of the reversal—as we do among migrant men. The

negative effects are largest and prolonged in the 1990s for Jonkopings (-0.06years), Kalmar (-0.04 years), Södermanlands (-0.09 years), Varmlands (-0.06 years), and Vastra Gotlands (-0.07 years). By the 2020s, we find the largest and prolonged positive effects in Dalarnas (+0.04 years), Gavleborgs(+0.07 years), Skåne (+0.10 years), and Vastmanlands (+0.11 years). Many counties show sizeable fluctuations between a positive and negative impact of migrant women, with no identifiable trend (e.g., Blekinge, Gotlands, Hallands, Jamtlands, Kronobergs, Norrbottens, Varmlands, Vasternorrlands). Interestingly, and in contrast with the patterns and trends among men, two counties—Stockholms and Uppsala—never document any prolonged negative effect. Migrant women in these two counties always have a positive —albeit fluctuating impact upon county-level partial life expectancy between 1990 and 2023. This is a salient gender-based difference.

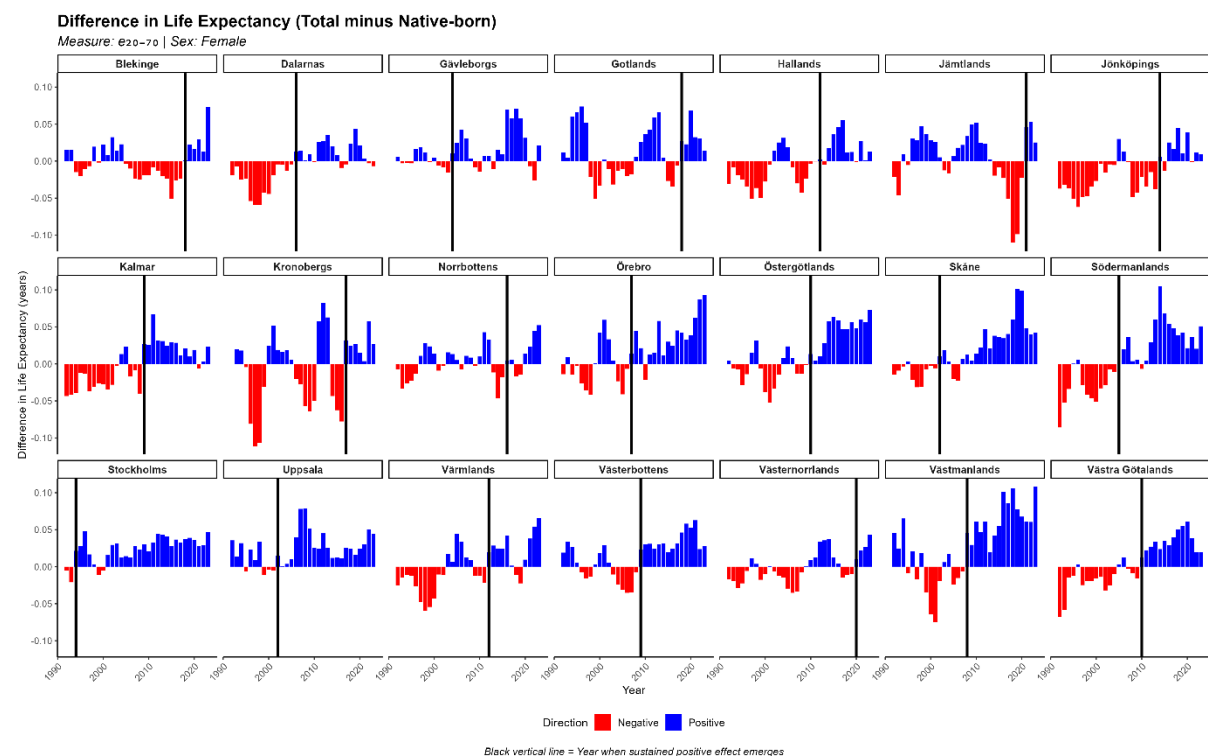


Figure 5. Annual differences in Partial Life Expectancy (20-70 years) between total and native-born populations (1992–2023), in females.

We conducted some additional analysis to help contextualise and validate our results. **Online file S1** shows all the above analysis again for partial life expectancy at birth (PLE0). Due to small numbers and low death counts, we were unable to derive PLE0 for the foreign-born population, and therefore can only directly compare results between the total population and native-born population. Figures **S1d** and **S1f** present results comparable and consistent with those presented above. For men, counties such as Södermanlands, Västra Götaland and Örebro remained among those with the largest swing between 1992 and 2023, but these effects were slightly larger in magnitude due to the wider age range. For example, Örebro saw a swing of approximately 0.3 years in favour of the foreign-born population. However, the overall pattern differs slightly, further highlighted in figure **S1f**. Whilst nearly all counties showed a transition towards a less negative gap, far fewer achieved a positive difference by

2023. This partly reflects the fact that many migrants are not captured at younger ages because they had not yet arrived in Sweden, and therefore the migrant advantage may be more visible when focusing on adult and working-age survival, whereas comparisons at birth continue to highlight a structural disadvantage across most counties. Similar results were found among women (**S1e and S1g**).

Online file S2 compares our estimates of PLE0 to those of Statistics Sweden, documenting a small, but consistent underestimation of across counties that falls within 0.2 years. This likely results from difference in how our estimates are put together and calculated, including the fact that we do not implement any smoothing at older ages.

Online file S3 provides compositional information about migrants in each county in 1990 and 2023, including country/region of birth, refugee status, age, duration of residence, educational attainment, and income. In the 1990s, the largest negative effects on PLE_{20_70} were among migrant men in Örebro, Stockholm, Södermanlands, Västmanlands, and Västergötland (**Figure 4**). **Tables S3a and S3b** shows that these counties all exhibited similar shares of international migrants in 1990 (between 10% to 15%) which nearly all doubled by 2023 (between 20% and 27%). Importantly, the composition of these migrants also shifted, from predominantly born in Nordic countries (with historically higher mortality risks compared to native Swedes) in 1990, to a majority of migrants born in non-Western countries by 2023. At the same time, the percentage of migrants with post-secondary education rose from approximately 12-21% in 1990 to 33-67% in 2023. Other compositional factors also help explain the reversal: while the share of recently arrived migrants decreased, the proportion arriving as children increased, potentially improving long-term health outcomes through earlier integration. Counties converged in socioeconomic terms, with an increase in the share of migrants in the lowest income quintile and simultaneous decrease in the share in the highest quintile, indicating a shift toward greater concentration at the lower end of the income distribution. This may have limited health improvements for some migrant subgroups despite gains in education which likely contributed to the persistent negative PLE_{20_70} differences in counties where low-income concentrations rose (e.g. Södermanlands). These changes in compositional characteristics likely contribute to the systematic reversal from negative to neutral or positive impact of migrants over time (in conjunction with previous research showing higher mortality among Nordic migrants and lower mortality among non-Nordic migrants). However, they provide little insight into why county-level heterogeneity persist.

DISCUSSION

We examined the effect of the mortality of international migrants on regional (county-level) partial life expectancy in Sweden from 1990 to 2023. Our findings add to a small body of evidence from a select number of high-income countries that show migration status is playing an increasingly relevant role in shaping national mortality outcomes^{2-4,8,15}. We provide unique insight into how life expectancy trends differ within Sweden among the total population, native-born and foreign-born population and report how the effect of migrants has transformed.

Over the past several decades, migrant's share of the population has increased substantially in all counties, accompanied by widening differences in these shares, suggesting varying potential impacts on regional health outcome across counties. During this time, despite differences in the levels of partial life expectancy between populations, PLE_20_70 rose steadily for the total population, migrants, and native-born from 1990 to 2023. Over time, migrants in nearly every county experienced a remarkable reversal, from lower to higher life expectancy than the native-born population of each county. In 1990, migrants, and especially men, had lower partial life expectancy than native-born Swedes across all counties. By 2023, however, migrant partial life expectancy had, in just three decades, converged, caught up with, and in many counties actually exceeded the partial life expectancy levels of the native-born populations. Nevertheless, we saw that persistent and prolonged disadvantages remained in certain counties, notably Örebro, Västra Götaland, Södermanland, Norrbotten, and Blekinge. Conversely, other counties, such as Skåne showed particularly early reversals in the impact of migrants on life expectancy, and the positive impact of the life expectancy of migrants, on total life expectancy in their county.

Previous research at the national-level reports a positive and growing impact of international migrants on period life expectancy in Australia², Denmark³, Finland³, Norway³, and the United States⁴. In Sweden, in contrast, the initial impact of migrants at the national-level is negative and reverses over time^{3,8}, owing to the transformation of Sweden's migrant population from a majority of migrants born in Nordic countries (who have a higher mortality risk in Sweden) to a majority of (refugee) migrants born in non-Western countries (who have a lower mortality risk in Sweden compared to native-born Swedes)⁸. This is particularly true at working ages⁸—the ages that we focus in on here. We add nuance to this literature by examining whether these national level trends apply to regional period life expectancies in Sweden. Generally, our results support this transition from negative to positive effect of international migrants on regional life expectancy across all counties. Importantly, however, we find that there *is* considerable spatial variation in the timing of the reversal and magnitude of the negative effects in the 1990s and positive effects in the 2010s that have the potential to impact county-level comparisons of life expectancy within Sweden. Additionally, we reveal an important gender difference in the effect of migrants on life expectancy in both Stockholms and Uppsala in a literature that has so far only shown consistency between the effect of men and women on life expectancy at national-level. Our findings of lower life expectancy among migrants across counties in the 1990s are also consistent with prior work examining the mortality risks of foreign-born across counties between 1970 and 1999¹⁶, which showed higher mortality among migrants across all counties. Finally, the spatial variation in county life expectancy in Sweden that we report at the total population level for men and women is highly consistent with that reported in paper examining regional trajectories in life expectancy in Sweden that covered a similar period (1990-2014)¹⁷.

While we do not seek to explain this shift here as previous research has shown these trends can be attributed to the transforming origin composition of migration flows over time in Sweden, from negatively selected, low educated, and blue-collar intra-Nordic flows (and migrants with higher mortality risks than native-born in Sweden) to positively-selected non-European flows (and migrants with lower mortality risks than native-born) today, particularly

at working ages. Our contextual information in **Online File S3** supports this claim regionally, showing that the % of intra-Nordic migrants has fallen drastically between 1990 and 2023 in all counties (in the most extreme case from 80% to 31% of all migrants in Norrbottens), accompanied by substantial increases in the % of non-Western migrants (from 14% to 48% of all migrants in Norrbottens county—with much bigger shares across other counties in 2023). Alongside this, in **Online File S3** we report the following across all counties **(1)** increasing shares of refugee migrants, **(2)** large increases in the share of highly-educated migrants over time in all counties, **(3)** falls in shares of migrants who have arrived to live in Sweden in the past 5-years, and **(4)** increases in the shares of migrants across counties who belong to the lowest disposable income quintile. While these systematic and consistent changes over time in all counties are helpful to ground our findings, comparisons of variations in these background characteristics across the counties in truth reveal very little about any differences in the magnitude and timing of difference across counties. Future research should seek to try to understand why we uncover spatial variation in the magnitude of positive and negative impacts and the timing of reversal in effect in Sweden.

The absence of any major differences in migrant origins across counties are also unable to explain the notable gender-based difference in Stockholm and Uppsala, where migrant women show no prolonged negative effects, consistently contributing positively to county-level partial life expectancy between 1990 and 2023. Migrant women in these two counties also display higher disposable incomes and greater representation in the upper income quintiles than those elsewhere, a pattern not mirrored among men. Yet both men and women in these regions had the highest levels of upper secondary education in 1990. These differences could therefore reflect a positive self-selection of migrant women into these urban, education-focused centres for work or study rather than family reunification.

This is the first study to capture subnational long-term trends in PLE (20–70 years) over three decades (1990-2023) in the context of migrants' influence on PLE developments in Sweden. We contribute a subnational, regional perspective that is rarely incorporated into migrant health studies that seldom stray beyond comparisons to the wider national population. We show that the same trends *broadly* apply across counties in Sweden. We make use of nationwide register data provides comprehensive coverage of both native-born and foreign-born populations. We lean upon one of the most widely used summary measures of population health and provide a unique exploration into the influence of the mortality of international migrants. Disaggregating this data by county additionally provides an underexplored investigation into important spatial heterogeneity in migrant population growth and its influence on life expectancy in Swedish demographic research. Another key strength of this study is our methodological approach to understanding how migration influences population health, capturing both long-term trends and year-to-year fluctuations. Our findings capture the underlying direction of change in the PLE gap while also revealing county-specific and gender differences that are often obscured in aggregated analyses. By focusing on rolling averages, our analysis provides robust evidence for understanding medium- and long-term trajectories, offering insights that support both strategic long-term planning and nuanced local policy responses to the ever-evolving role of migrants in shaping life expectancy. Our comparison between total populations and native-born populations as

well as between native-born and foreign-born populations further strengthen interpretations drawn, revealing disparities that would otherwise be masked using aggregate measures, clarifies the drivers of change in population life expectancy, and highlight the importance of disaggregated analyses when assessing population health trends in increasingly diverse societies. Further, comparisons across populations improves validity and prevents bias.

Some limitations should be considered. Swedish population registers minimise salmon bias, whereby some foreign-born individuals may return to their origin countries when seriously ill, through detailed tracking of emigration and population coverage. Due to data restrictions, we do not account for heterogeneity within migrant populations, such as considering region of origin, duration of residence or reason for migration. Further restrictions include the geographic scale of analysis, as county-level data may mask important within-county variation. There is also likely a complex causality attributed to the results found in this study, which are not disentangled here due to the observational nature of the study.

Future research should examine potential intersecting factors such as duration of residence, region of origin, and socioeconomic status to explain and mitigate some of this variability and identify the underlying causes of these disparities. Literature suggests differing results when investigating the health of migrants from different native countries[1]. Examining whether the trends found in this study occur across all migrant groups or are driven by certain nativity regions (e.g., EU vs. non-EU) would also be useful. Cause-specific mortality data in migrant populations would decompose any life expectancy differences. Further analysis using linked data could also explore any socioeconomic and structural determinants of regional gaps in PLE which were not directly assessed in this study. For example, data on migration policy implementation or area deprivation could help to understand the complexity of the relationship between migrant populations and their influence on regional PLE. Qualitative insight would provide nuanced context behind the trends found here.

With evidence of both an increasing migrant share and shifting health contributions over time, migrants are now a central demographic shaping regional health trends. Our study reflects the importance of investigating the influence of migration on life expectancy as regional disparities in life expectancy may increasingly reflect the demographic and health profiles of migrant populations. There was some heterogeneity in the migrant influence on life expectancy across counties, suggesting persistent unresolved structural or social barriers for migrants in these areas, such as access to primary care, health-seeking behaviours, and social isolation [2]. This highlights the importance of place-based policy that are responsive to migrant population dynamics and adaptable to regional contexts where policies may differentially impact migrant well-being.

Persistent differences remained; counties with large, diverse, and often better-educated migrant populations (e.g. Stockholms, Skåne, and Uppsala) contrast with counties where more limited labour-market opportunities and different demographic compositions may continue to constrain health improvements (e.g. Värmland, Norrbotten, and Blekinge). However, despite this variation, the story remains consistent, and we see a national pattern playing out differently in each county. These findings underscore the importance of accounting for both the size and composition of migrant populations when comparing

regional PLE, and point to broader implications for health equity and population projections in Sweden as migrant populations continue to grow and diversify. These results carry broader implications for health equity and population projections as migrants become an increasingly central driver of life expectancy trends. Sweden's improvements in access, integration, and public health over time have likely contributed to better long-term outcomes for migrants, especially in urban counties like Stockholms and Skåne. The acculturation experience by migrants may have elevated their PLE toward native levels over time. The lagged effects of improved inclusive welfare and integration may explain our observed narrowing and reversal of the gap in PLE between foreign and native-born populations in Sweden.

Overall, this study demonstrates that migrants are no longer a marginal demographic in Sweden's regional health landscape; their growing population and improving longevity mean they are now a key influential driver of change in population health indicators. We illustrated a remarkable shift in the impact of migrants on life expectancy, from disadvantage to parity, and to advantage in many places. We show that national numbers, the ones we're used to seeing, can hide some big regional differences. In some counties, migrants are now leading life expectancy gains; in others, they're still lagging behind. Yet despite this variation, the story remains consistent, thus raising the question – is it just **where** you live, or is it also **who** is living there? If we want to understand population health and design policies that work, we have to look at the regional level, where local demographics and settlement patterns shape these outcomes.