

# Home and away: mortality among Finnish-born migrants in Sweden compared to native Swedes and Finns residing in Finland

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**Background:** Most first-generation migrants have lower mortality compared to the native population. Finnish-born migrants in Sweden instead have higher mortality; possibly because of health behaviours established before migration. To increase our understanding of this excess mortality, we compared the cause-specific mortality of Finnish migrants in Sweden to both the native population of Sweden and the native Finnish population residing in Finland. **Methods:** We used Swedish and Finnish register data, applying propensity score matching techniques to account for differences in sociodemographic characteristics between the migrants, Swedes and Finns. The index population were Finnish migrants aged 40–60, residing in Sweden in 1995. We compared patterns of all-cause, alcohol- and smoking-related, and cardiovascular disease mortality across the groups in the period 1996–2007. **Results:** Finnish migrant men in Sweden had lower all-cause mortality compared to Finnish men but higher mortality compared to the Swedish men. The same patterns were observed for alcohol-related, smoking-related and cardiovascular disease mortality. Among women, all three groups had similar levels of all-cause mortality. However, Finnish migrant women had higher alcohol-related mortality than Swedish women, similar to Finnish women. Conversely, migrant women had similar levels of smoking-related mortality to Swedish women, lower than Finnish women. **Conclusions:** Finnish-born migrants residing in Sweden have mortality patterns that are typically in between the mortality patterns of the native populations in their country of origin and destination. Both the country of origin and destination need to be considered in order to better understand migrant health.

## Introduction

First-generation migrants tend to experience lower mortality rates compared to the majority population in the country of destination.<sup>1–3</sup> The size of the mortality advantage varies across countries and migrant groups,<sup>4</sup> and a minority of studies have documented higher mortality among first-generation migrants.<sup>5–7</sup> The mortality advantage of migrants tends to decrease with duration of residence in the country of destination.<sup>8–10</sup> Migrants moving to Sweden from other Nordic countries, specifically Denmark and Finland, experience higher mortality rates compared to the native population.<sup>11</sup> Among Nordic migrants, the Finns are the largest group. The mortality disadvantage of Finnish-born migrants is only present among men and largely stems from causes of death associated with behavioural risk factors such as cardiovascular disease and alcohol-related causes of death.<sup>9,11</sup> Similar patterns have emerged in earlier studies comparing the national populations of Finland and Sweden; Finnish men have a shorter life expectancy than Swedish men, while Finnish women have a similar life expectancy to that of Swedish women.<sup>12–14</sup> Furthermore, a recent study found that about half of the difference in life expectancy between Finnish and Swedish men were attributable to alcohol-related mortality, and that smoking-related mortality also made a substantial contribution.<sup>14</sup>

The health of migrant groups may be shaped by both pre-migration and post-migration factors,<sup>10</sup> e.g. through self-selection

by health behaviours. Silventoinen et al.<sup>15</sup> examined migrant-discordant Finnish twin pairs and found higher pre-migration levels of smoking and alcohol use for the twin migrating to Sweden compared to the twin that remained in Finland. However, the behavioural patterns of Finnish migrants may converge to that of native Swedes after migration.<sup>16,17</sup> Other studies also based on the Finnish Twin Cohort<sup>18</sup> have observed health behaviours post-migration and have found tendencies towards lower alcohol consumption,<sup>19</sup> less heavy smoking and more quit attempts,<sup>20</sup> and higher levels of physical activity<sup>21</sup> among the twin residing in Sweden. Differences among women are generally smaller and less conclusive compared to those observed among men.<sup>19–21</sup> Overall, these findings indicate that the health behaviours of migrants are shaped by pre-migration factors in Finland, as well as post-migration factors in Sweden, leading to the gradual adaption of health behaviours that are more similar to those of the native Swedish population.

Previous studies have shown that the mortality disadvantage of Finnish migrants can partly be attributed to socioeconomic conditions.<sup>22</sup> Although recent Finnish migrants have a higher average education than the general Finnish population,<sup>23</sup> the bulk of Finnish migration took place in the 1960s and 1970s and mainly consisted of blue-collar workers from the Finnish country side moving to Sweden to work in industries.<sup>24</sup> Compared to the native Swedish population, Finnish migrants are more likely to have less

favourable socioeconomic conditions, which are independent risk factors for mortality.<sup>25</sup>

The mortality patterns among Finnish migrants in Sweden may then be dependent on both socioeconomic conditions and behavioural patterns and established before migration as well as their socioeconomic conditions and behavioural changes post-migration. It is therefore meaningful to compare the Finnish migrants to both the Swedish and Finnish populations. A study by Westman et al.,<sup>26</sup> based on survey data, compared the self-rated health of Finns residing in Sweden to both Swedes residing in Sweden and Finns residing in Finland. They found that Finns had higher odds of reporting poor self-rated health regardless of their country of residence. Finnish men residing in Sweden had a tendency to report better health than those in Finland, while the opposite pattern was observed among Finnish women. These patterns remained after adjusting for sociodemographic characteristics.<sup>26</sup> Direct comparisons between migrants and the population in the country of origin are, however, often difficult due to limited access to comparable individual-level data on sociodemographic characteristics and mortality in both the country of origin and the country of destination.

In this study, we make use of population register data in both Sweden and Finland to compare mortality among Finnish-born migrants residing in Sweden to both the Swedish-born population and to the Finnish-born population residing in Finland. Sweden and Finland have a similar tradition of keeping administrative registers on, among other things, demographic characteristics, socioeconomic conditions and mortality. The similarities in data content enable us to compare mortality patterns across the three groups while adjusting for sociodemographic conditions.

## Methods

### Data sources

Data on demographic characteristics (including country of birth), socioeconomic conditions and cause of death were obtained from national total population registers in Sweden, and from an 11% random sample of the population registers in Finland, supplemented with an 80% oversample of individuals who died during the period. We identified all Finnish-born individuals residing in Sweden in 1995, which was the earliest year that comparable socioeconomic data were available for both countries. We used the same categories as Westman et al.<sup>26</sup> and constructed three cohorts: Finnish-born individuals residing in Sweden (hence 'Finnish migrants'), Swedish-born individuals residing in Sweden (Swedes) and Finnish-born individuals residing in Finland (Finns). The use of data was approved by the KI regional ethics committee (ref. 02–481) in Sweden and by Statistics Finland (TK-53-47-17, TK-53-339-13) in Finland.

### Measurements

We collected data on sex and age, in 5-year groups as well as data on baseline sociodemographic characteristics for the cohort members. Education was categorized into three levels based on highest achieved level of education; compulsory (ISCED 0–2), upper secondary (ISCED 3–4) and tertiary (ISCED 5–6). Income was defined as quintiles of disposable household income, measured after taxes and transfers and equalized across household compositions using the Oxford method.<sup>27</sup> Civil status was divided into married and not married and we also collected data on whether or not there was a child living in the household. We restricted the cohorts to members that were between 40 and 60 years old at baseline, an age span during which most individuals are active on the labour market. Mortality follow-up covered the years 1996–2007 (the last available year), when they were between 41 and 72 years old. If an individual left any of the cohorts during the follow-up without dying, they were

**Table 1** Number of observed individuals, person-years and deaths among Finnish migrants residing in Sweden, Finns residing in Finland and Swedes residing in Sweden, men and women 1996–2007

Cohort		<i>n</i>	Person-years	Deaths
Men	Finnish migrants	46 138	499 275	5073
	Finns	149 979	1 713 239	15 011
	Swedes	1 034 761	12 007 386	67 097
Women	Finnish migrants	57 988	660 946	2932
	Finns	149 054	1 749 526	6718
	Swedes	999 212	11 725 131	43 302

right censored. The final population comprised altogether 2.4 million individuals followed over 28.4 million person-years, experiencing 140 133 deaths (table 1).

We calculated all-cause mortality, alcohol-related mortality, smoking-related mortality and mortality from cardiovascular diseases using data from the cause of death registers in Finland and Sweden. Alcohol-related mortality was defined by identifying the following causes using the ICD-10 standard: F10.0–9, G31.2, G40.5, G72.1, I42.6, K29.2, K70.0–4, K85.2, K86.0, X45, as either the underlying or a contributing cause. Smoking-related mortality was indicated by C30–C39, J40–J47, either as the underlying or a contributing cause. Mortality by cardiovascular diseases was indicated by I01–I41, I42.10–I42.16, I42.7–I42.9 or I50–I99 being the underlying cause of death. The estimates for cause-specific mortality partly overlap, and do not cover all deaths. We additionally decomposed all deaths by ICD-10 chapter based on the underlying cause (Supplementary table S1). Note that some of the chapters were combined due to small numbers of death.

### Using propensity scores to adjust for sociodemographic conditions across the cohorts

The study by Westman et al.<sup>26</sup> used pooled survey data from Finland and Sweden. Pooling the data were, however, not a viable option in this study. In order to access register data for research purposes, it is necessary to obtain ethical permits and establish user agreements with the responsible government agencies.<sup>28</sup> These agreements limit the use and sharing of register data, especially regarding data on health, which are considered sensitive. Therefore, we could not share individual-level data or data on health across national borders. We used propensity score weighting to overcome this obstacle.

Propensity score techniques were originally developed to mimic experimental designs in observational data.<sup>29,30</sup> We do not attempt to estimate causal effects. Instead, we apply this technique to adjust the mortality estimates for differences in the distribution of sociodemographic conditions across the groups using two separate data sets. Propensity score weighting consists of two steps: estimating a set of probabilities using a treatment model and weighting the treatment groups using these probabilities.

In the first step, we estimated propensity scores using a treatment model, where the different treatment groups were defined by country of birth and country of residence in 1995. We used aggregated data on the distribution of education, income, civil status and having children in the household in each group. Since these data sets were aggregated and did not contain any information on health, they could be shared between the countries. We fitted a logit model using the treatment group as the dependent variable and sociodemographic characteristics as independent variables. Finnish migrants were defined as the reference group. Propensity scores (the probabilities of belonging to a specific treatment group given the observed values of the sociodemographic characteristics) were obtained in post-estimation. The propensity scores were then applied as weights in the data on Finns and Swedes. Once applied, the distributions of the sociodemographic characteristics among the

native populations in Sweden and Finland are similar to those of the Finnish migrants. [Supplementary table S2](#) provides the observed and weighted distributions in the three cohorts.

In the second step, we appended the propensity score weights to data on mortality in Sweden and Finland, respectively. The propensity scores were used to weight number of person-years and number of deaths by age and sex, both for all-cause and for cause-specific mortality. We then used the weighted numbers to calculate age-standardized mortality rates and incidence rate ratios. All calculations were carried out in Stata 14.

## Results

[Table 2](#) presents age-standardized mortality rates among the Finnish migrants, the Finns and the Swedes. Among men, the Finnish migrants had the highest observed mortality rate followed by the Finns and the Swedes, who had the lowest. When comparing the weighted estimates, which are adjusted for differences in sociodemographic characteristics between the cohorts, a different pattern emerged. The migrants experienced lower all-cause mortality than the Finns but higher mortality than the Swedes, although the latter difference was reduced from 41.2 to 27.2 deaths per 10 000 person-years. Similar patterns emerged for alcohol-related and smoking-related mortality as well as mortality from cardiovascular diseases: Finnish migrants had a mortality advantage compared to the Finns and a mortality disadvantage compared to the Swedes.

Among women, the patterns were less consistent. No substantial differences in weighted all-cause mortality were observed between the Finns and Swedes. All-cause mortality among the Finnish migrants was somewhat higher but the differences were small, around two deaths per 10 000 person-years. Alcohol-related mortality was similar among migrants and native Finns, but lower among

**Table 2** Observed and weighted age-standardized mortality rates and 95% confidence intervals for all-cause mortality, alcohol-related mortality, smoking-related mortality and mortality from cardiovascular disease among Finnish migrants residing in Sweden, Finns residing in Finland and Swedes residing in Sweden, men and women 1996–2007

		Cohort	Observed	Weighted <sup>a</sup>
Men	All-cause	Finnish migrants	97.1 94.4–99.9	97.1 94.4–99.9
		Finns	91.7 90.2–93.2	104.1 100.7–107.6
		Swedes	55.9 55.4–56.3	69.9 67.6–72.3
	Alcohol-related	Finnish migrants	24.2 22.8–25.6	24.2 22.8–25.6
		Finns	24.9 24.2–25.7	29.7 27.9–31.6
		Swedes	7.1 6.9–7.2	10.7 9.8–11.7
	Smoking-related	Finnish migrants	11.2 10.4–12.2	11.2 10.4–12.2
		Finns	11.4 10.9–12.0	13.4 12.1–14.7
		Swedes	6.1 6.0–6.3	7.9 7.1–8.7
	CVD	Finnish migrants	24.3 23.0–25.7	24.3 23.0–25.7
		Finns	32.1 31.2–33.0	36.8 34.7–38.9
		Swedes	13.0 12.7–13.2	16.4 15.3–17.6
Women	All-cause	Finnish migrants	42.8 41.2–44.4	42.8 41.2–44.4
		Finns	39.5 38.6–40.5	40.2 38.3–42.2
		Swedes	36.6 36.3–36.9	41.1 39.6–42.7
	Alcohol-related	Finnish migrants	4.8 4.3–5.4	4.8 4.3–5.4
		Finns	5.0 4.4–5.4	5.2 4.5–5.9
		Swedes	1.9 1.8–2.0	2.4 2.0–2.8
	Smoking-related	Finnish migrants	6.6 6.0–7.2	6.6 6.0–7.2
		Finns	3.7 3.4–4.0	3.8 3.3–4.5
		Swedes	6.1 6.0–6.3	7.1 6.5–7.8
	CVD	Finnish migrants	5.5 5.0–6.1	5.5 5.0–6.1
		Finns	8.4 8.0–8.8	8.6 7.7–9.6
		Swedes	3.8 3.7–4.0	4.6 4.1–5.2

a: Finns and Swedes are weighted by propensity scores based on income, education, civil status and having a child in the household using the distributions of the Finnish migrants as the reference. The estimates for the Finnish migrants are not weighted.

the Swedes. By contrast, Finnish migrants and native Swedes experienced similar levels of smoking-related mortality, which was higher than the native Finns. The pattern observed for cardiovascular diseases was similar to that among men; the Finnish migrants had a mortality advantage compared to the native Finns and a disadvantage compared to native Swedes.

[Figure 1](#) displays incidence rate ratios by cohort, using the Finnish migrants as the reference. The estimates presented are weighted by sociodemographic characteristics. Overall, migrants had mortality patterns that were somewhere in between the two native populations. The highest, or lowest, mortality were consistently observed in one of the native populations. Similar patterns emerged when stratifying the population by age (results not shown). Similar patterns were also observed in all chapters of ICD-10, with the exception of Chapter V: mental and behavioural disorders, in which migrants had the highest mortality. The absolute number of deaths from causes in this chapter is, however, small ([Supplementary table S1](#)).

## Discussion

### Summary of the main findings

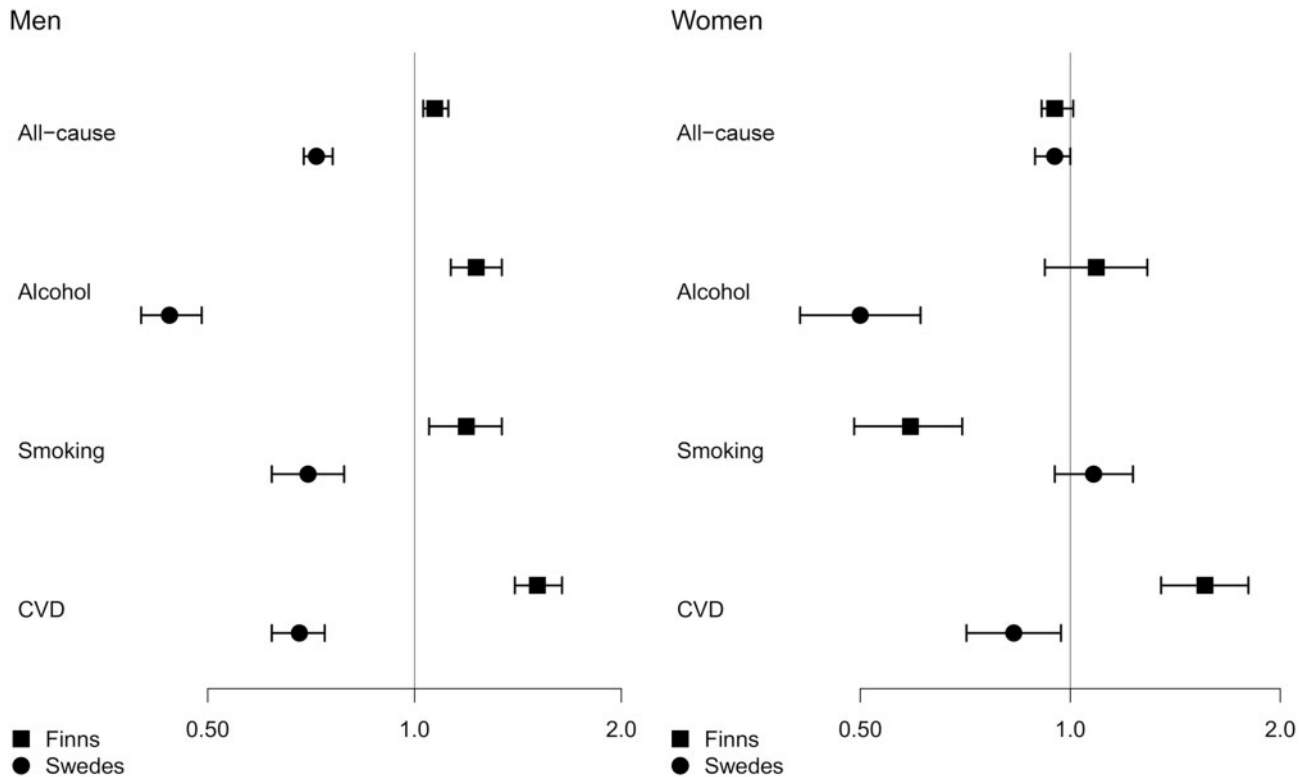
We compared mortality patterns between Finnish migrants residing in Sweden to those observed among native Swedes and Finns residing in Finland, adjusting for differences in sociodemographic characteristics between the groups using propensity score weighting. The results indicated that the mortality pattern among the migrants were somewhere in between those observed in the country of origin and the country of destination.

### Interpretation of the results

Migrant groups often experience lower mortality than native populations. Finnish migrants in Sweden are an exception, instead experiencing higher mortality than native Swedes. The mortality advantage often observed among migrants has been discussed in relation to selection processes in which obstacles related to the migration process ensure that only healthy and resourceful individuals are able to successfully complete migration.<sup>31,32</sup> Sweden and Finland are neighbouring countries and since the establishment of the common Nordic labour market in 1954, Finnish and Swedish citizens can freely move across the border.<sup>33</sup> It is therefore unlikely that such obstacles can explain the observed mortality differentials between Finnish migrants and native Swedes.

The free mobility also means that there are no restrictions for return migration. Return migration from Sweden to Finland is common and usually takes place shortly after the initial emigration.<sup>23</sup> The individuals that return are likely to have had a more difficult time adapting to the Swedish society compared to those who stay. Selection into return migration may then result in the remaining Finnish migrants being more similar to the Swedish population. Selective return migration can therefore be considered part of the processes that generate differences in mortality between migrant groups and native populations, and, given the open border between the two countries, may have contributed to the observed patterns. We were unable to link data across the border to observe the mortality of return migrants once they have returned. Individuals that left Sweden during the follow-up were instead right censored. It is therefore difficult to estimate the extent to which return migration contributed to the results.

It is important to note that while we estimate mortality from behavioural risk factors. We do not directly observe behaviour. Still, evidence from surveys and twin studies suggest that Finnish migrants are less likely than Finns residing in Finland to report smoking, low physical activity, poor diet and risky alcohol consumption.<sup>19–21,34</sup> These findings, together with those presented by Silventoinen et al.,<sup>15</sup> indicating higher levels of smoking and alcohol consumption before migration among twins that migrate compared



**Figure 1** Incidence rate ratios for all-cause mortality, alcohol-related mortality, smoking-related mortality and mortality from cardiovascular disease among Finns residing in Finland, Swedes residing in Sweden and among Finnish migrants residing in Sweden, men and women 1996–2007. Weighted for sociodemographic conditions. Note: Finnish migrants residing in Sweden are the reference group

to twins that remain, suggests that residing in Sweden may lead to the gradual adaption of health behaviours. Adapting to the health behaviours of the host country may imply either an increase or a decrease in mortality risk depending on the relationship between behavioural patterns in the country of origin and destination. In most cases, adapting to Swedish behavioural patterns results in lower mortality risks among Finnish-born migrants. However, Swedish women tend to smoke more than Finnish women.<sup>35</sup> We observed higher smoking-related mortality among Finnish migrant women compared to the Finnish women, on par with the level observed among the Swedish women. Furthermore, Juárez et al.<sup>36</sup> have found that the all-cause mortality among Finnish-born men tends to decrease over time in Sweden. In light of these findings, our results suggest that among both men and women, the gradual adoption of behavioural patterns of the Swedish population contributes to the mortality patterns of Finnish-born migrants in Sweden.

### Methodological considerations

Propensity score techniques were originally developed to mimic experimental designs and estimate causal effects in observational data.<sup>29,30</sup> It is important to note that we did not use the propensity scores to estimate causal effects. We calculated the propensity score to adjust for differences in the distribution of a specific set of socio-demographic characteristics in a setting where it was not possible to merge data. The treatment model was defined in line with this purpose, rather than to obtain the maximum explanatory power in terms of assignment of treatment. Furthermore, the sociodemographic conditions were observed in the post-treatment period making it difficult to assess if they are predictors or outcomes of migration. In order to properly estimate the causal effect of migration on mortality, detailed information on pre-migration characteristics is needed. This approach is not feasible using register data since the bulk of Finnish migration to Sweden occurred several decades before the establishment of many of the registers.

However, using propensity score weighting in this way enables a more sophisticated analysis than is typically possible in comparative research where data may not be merged.

We were unable to identify members of the ethnic minority of Finnish-born Swedish-speakers. Previous studies have shown that these have lower mortality<sup>37,38</sup> and are more likely to migrate to Sweden.<sup>23</sup> A recent survey from the Public Health Agency of Sweden indicated that the Swedish-speaking Finns residing in Sweden had higher levels of obesity and binge drinking compared to the native Swedes and somewhat lower levels compared to Finnish-speaking migrants.<sup>34</sup> The Swedish-speaking Finns are on average more affluent than Finnish-speakers, which substantially contributes to the observed differences in mortality between Finnish- and Swedish-speakers in Finland.<sup>37</sup> Since we adjust for sociodemographic characteristics, it is unlikely that the observed patterns are attributable to the inclusion of this group.

### Conclusions

Adjusted for sociodemographic characteristics, Finnish-born migrants residing in Sweden typically have mortality patterns that are in between the mortality patterns in the native populations in their country of origin and destination.

Causes of death that are subject to behavioural risk factors contribute to the observed patterns. Mortality patterns among migrants may converge to the mortality patterns of the country of destination as the migrants gradually adopt the behavioural patterns of the majority population.

Both pre- and post-migration factors are important for the health of migrants and for that reason, factors in both the country of origin and that of destination, need to be considered in order to better understand migrant health.



## Supplementary data

Supplementary data are available at *EURPUB* online.

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*Conflicts of interest:* None declared.

### Key points

- Male Finnish-born migrants in Sweden have a mortality disadvantage in relation to the native Swedish population and a mortality advantage in relation to the native Finnish population residing in Finland while only small differences were observed among women.
- Mortality attributable to alcohol, smoking and cardiovascular disease among Finish migrants in Sweden were typically in between the rates observed in Sweden and Finland, indicating that migrants modify their behavioural patterns in the country of destination.
- Factors in the country of origin and the country of destination need to be considered when designing interventions targeting migrant health.

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