Migration and health: a study of effects of early life experiences and current socio-economic situation on mortality of immigrants in Sweden.

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Abstract

Objectives: Previous research has demonstrated mortality differences between immigrants and natives living in Sweden. The aim of this study is to investigate the effects of early life conditions in the country of birth and current socioeconomic conditions in adult life in Sweden on cardiovascular, cancer, all other cause and total mortality among immigrants and natives in Sweden. *Design*: The cohort data concerning individual demographic characteristics and socioeconomic conditions stems from the Swedish Longitudinal Immigrant Database (SLI), a register-based representative data base, and consists of individuals from 11 countries of birth, born between 1921 and 1939, who were resident in Sweden between 1980 and 2001. The associations between current socioeconomic conditions as well as infant mortality rates (IMR) and GDP per capita in the year and country of birth, and total, cardiovascular, cancer and "all other" mortality in 1980-2001 were calculated by survival analysis using Cox proportional hazards regression to calculate hazard rate ratios. *Results*: The effects of current adult life socioeconomic conditions in Sweden on mortality are both stronger and more straightforward than the effects of early life conditions in the sense that higher socioeconomic status is significantly associated with lower mortality in all groups of diagnoses, however, we find associations between infant mortality rates (IMR) in the year and country of birth, and cancer mortality among men and women in the final model. *Conclusions*: Socioeconomic conditions in Sweden are more strongly associated with mortality than early life indicators IMR and GDP per capita in the year of birth in the country of origin. This finding has health policy and other policy implications.

Key words: early life conditions, infant mortality rate, GDP per capita, immigrant mortality, socioeconomic status, Sweden.

Introduction

Empirical evidence suggests that migration and health are two population processes that are related to each other. International as well as Swedish studies concerning migration and health have mostly compared the health among foreign born immigrants with the health of natives. Such studies sometimes find that immigrants are healthier than native-born people (Anson, 2004), sometimes they find that the health of immigrants is poorer compared to natives (Lindström, Sundquist, & Östergren, 2001). The causes behind these patterns are complex. A Mediterranean diet may for instance significantly decrease the risk of coronary heart disease (Walker, & Reamy, 2009). However, no studies have managed to demonstrate the association between early life experiences in the country of origin, migration, current socioeconomic position and health. The demonstration of such effects would require taking all these factors into consideration.

A wide variety of factors may explain ethnic differences in health and immigrant health. Factors such as culture, beliefs, racism, biology/hereditary factors and access to health care and amenities may contribute to ethnic differences in health (Davey Smith, Chaturvedi, Harding, Nazroo, & Williams 2003; Axén, & Lindström, 2002; Lindström, 2008). However, three principally different hypotheses concerning the importance of socioeconomic factors for the association between migration and health may be discerned. A first hypothesis attributes health differences today to both socioeconomic conditions and health conditions in the past. Socioeconomic circumstances in early life are important factors to take into account when explaining differences in health status later in life, e.g. migrants from less developed countries that have grown up in a risk environment regarding health also have a higher risk of health problems compared with the native population in developed immigration countries (Davey Smith, Chaturvedi, Harding, Nazroo, & Williams, 2003). According to a second hypothesis health is primarily affected by the existing socioeconomic situation, including civil status, income, degree of labour market attachment, occupation, education, etc. Such factors have important impact on the health situation of the individual. In cases where immigrants are poorly integrated into the host society they will also experience more health problems than natives (Davey Smith, Chaturvedi, Harding, Nazroo, & Williams 2003, Klinthäll 2007, 2008). A third plausible hypothesis states that there is a “healthy migrant effect”, i.e. migrants are healthier than natives because they are positively selected. Those who are healthy, young, ambitious, etc. are more likely to migrate than the rest of the population in the country of origin, and consequently immigrants will also have better health than the native population in the immigration country (Lu, 2008).

In recent decades there has been an immense increase in interest in the life course approach to chronic disease epidemiology (Kuh, & Ben-Schlomo, 2004; Bengtsson, & Mineau, 2009). The life course approach is sometimes discussed in terms of *cohort* effects on health and survival as opposed to diseases caused by health determinants with a short time period between exposure and health/ disease outcome. For example, many infectious diseases have period effects on health because they cause symptoms in the very short term (hours-days-weeks). In contrast, cohort effects are the results of the varying forms of stress or heavy disease load on the human body in early life, most importantly during pregnancy and the first (infant) year of life, on the susceptibility to various diseases much later in life (Lindström, & Davey Smith, 2008). Results suggesting cohort explanations were first put forward in 1934 in a study of age-specific mortality rates in England, Scotland, Wales, and Sweden which showed that mortality reductions attained at any particular point in time were primarily due to date of birth of the studied individuals and only indirectly depended on the year under consideration (Kermack, McKendrick, & McKinlay, 1934). In recent decades the notion (or cohort hypothesis) that early life conditions may affect the risk of disease and death later in life was first confined to cardiovascular diseases and the metabolic syndrome (Barker, 1995). One study demonstrated that Mexican Americans who migrated in early life experienced higher death rates in cardiovascular disease than migrants who immigrated later (Colón-López, Haan, Aiello, & Ghosh, 2009). A Swedish-Iranian study showed a strong association between migration status and the prevalence of hypertension and smoking when elderly people of Iranian origin living in Sweden were compared with elderly people of Iranian origin living in Iran (Koochek et al., 2008). However, more recently the cohort hypothesis has been applied also to other groups of diseases. Cancer tumours develop in stages, with great variation in growth velocity prior to clinical detection. Since the early 1990s a number of studies have evaluated factors in utero or very early in life after birth with results suggesting a causal link between early life conditions and different forms of cancer in later life (Potischman, Troisi, & Vatten, 2004).

Infant mortality rate (IMR) as well as economic stress are early life indicators even for the survivors in the infant age group for exposure to increased stress and disease load during the first year of life, and thus increased risk of morbidity and mortality in later life (Bengtsson, & Lindström, 2000; Bengtsson, & Lindström, 2003). Gross Domestic Product per capita (GDP/capita) is used as a measure of the absolute level of material and economic development in a country (Lindström, & Lindström, 2006), and may be recorded for each birth year and country

of birth of immigrants in modern Sweden. Both the GDP per capita (van den Berg, Doblhammer, & Christensen, 2009) and the infant mortality rate (IMR) (Bengtsson, & Broström, 2009; Bruckner, & Catalano, 2009; Gagnon, & Mazan, 2009) measures are commonly used as indicators of early life material and economic development and stress for a particular birth cohort in a particular country. Studies investigating later life effects on health caused by earlier life conditions in the country of origin, stress during the process of migration, or earlier life experiences in the new country are very scarce. One important reason is that indicators of early life conditions at the micro-/individual level data are mostly simply not available. The use of aggregate country level data such as IMR and GDP per capita at birth, as in this study, is mostly the only option available, and even studies using this kind of aggregate data are still scarce.

The effects of current socioeconomic position, defined as occupational status, education and/or income, on ethnic differences in mortality have been analyzed and discussed for many years (Davey Smith, Neaton, Wentworth, Stamler, & Stamler, 1998), and are still considered necessary to take into consideration in studies on the effect of early life factors on health in later life (Palloni, Milesi, White, & Turner, 2009). Prevalent diseases such as ischaemic heart disease and stroke are distributed with higher manual than non-manual employee incidence and mortality rates *within* different UK ethnic minority groups. These minority groups also have higher proportions of both manual employees and unemployed than the UK majority population (Harding, & Maxwell, 1997), a pattern also observed in Sweden (National Public Health Report, 2005), which would be a compositional factor explaining the finding in some studies of poorer health and higher mortality in some immigrant groups in some countries. Still, this discussion concerning ethnic differences in health, disease and mortality remain largely unresolved. Other studies demonstrate that such ethnic differences remain even after adjustment for socioeconomic position. One Swedish study has for instance demonstrated that male and female immigrants from Finland and southern Europe as well as refugees from non-Western countries had high odds ratios of long term illness which could not be explained by material deprivation and a sedentary lifestyle (Sundquist, & Johansson, 1997).

Several studies have demonstrated that immigrants have better health and lower death rates than natives (see above). This may be due to methodological problems associated with the assessment of data such as under-registration of return migration, i.e. many immigrants return to their country of birth while still registered in their country of immigration as they get ill or die in their country of birth (National Public Health Report, 2005). However, such differences may also be due to

"healthy migrant" effects which may be explained by the fact that migrants represent a comparatively healthy group not representative of the entire population in the country from which they migrated (Palloni, & Morenoff, 2001). The healthy migrant pattern may be particularly strong for immigrant populations which migrated in order to get jobs or even better paid jobs in the new country (Lu, 2008). This may be the reason why the results of studies comparing immigrants' health with natives' health vary across countries. Patterns of immigrant health and mortality differ somewhat across immigration countries, across immigrant groups and across diagnoses, but there seems to be strong support for the healthy migrant effect. There are two exceptions that are particularly interesting; Irish immigrants in the UK and Finnish immigrants in Sweden, both being characterized by large-scale, unemployment-driven, short-distance labor immigration. This type of migration is less likely to be positively selected, and there are indications of this being one reason for the absence of a healthy migrant effect (Ringbäck-Weitoft, Gullberg, & Rosén, 1998). The healthy migrant effect will not be directly tested in the article for reasons of feasibility. Our focus is on the effect of conditions during early life in the country of origin, taking into account current socioeconomic position in Sweden.

The study population in this study consists of individuals from 11 countries of birth, born between 1921 and 1939, who were resident in Sweden between 1980 and 2001. In 1980 Sweden had 8,317,235 inhabitants of which 625,450 were born in other countries than Sweden. People born in the Nordic countries constituted 55% of the foreign born (Finland 40%, Denmark 7%, Norway 7% and Iceland 1%). Another 14.5% of the foreign born had their origins in Western Europe (Germany 6%), 9% in southeastern Europe (Yugoslavia 6%), and 4.4% in the Middle East (Turkey 2.3%) (Biterman, 2010). The 2009 Public Health Report reveals that the prevalence of poor self rated health increases with the distance of the country in which the immigrants were born: Sweden 4%, Sweden both parents born abroad 6%, born in the fifteen first EU membership countries 7% (adjusted for social conditions 6%), other parts of Europe 13% (adjusted for social conditions 9%) and countries other than Europe 17% (adjusted for social conditions 10%). In contrast, the death risk of immigrants born in the first fifteen EU membership countries is significantly higher than among people born in Sweden while the death risk of immigrants born in countries outside Europe is significantly lower. The death risk of immigrants born in European countries other than the fifteen first EU membership countries does not significantly differ from the death risk of people living in Sweden. The two dominant causes of death in Sweden have for decades been cardiovascular diseases and cancer. In the total population the mortality rate among men in CVD was 420/100,000 per year and among women 250/100,000 per year in 2004-2006.

The corresponding mortality rates for cancer in the same years were 300/100,000 per year among men and 210/100,000 per year among women. The total annual death rate among men in Sweden in 2006 was 1190/100,000 per year and among women 830/100,000 per year (Danielsson, 2009).

The main hypothesis of this study is that a significant association exists between early life conditions in the country of birth, i.e. infant mortality rate as well as GDP per capita at the year of birth in the country of birth, and later life mortality in cardiovascular diseases, cancer (all cancers), and all other causes. A complementary hypothesis is that this significant association is stronger for cardiovascular diseases and all cancers than for all other causes, both because of the support in the literature for associations between early life conditions and cardiovascular diseases and many forms of cancers is strong, and because the "all other causes" group is a less clear-cut aggregate of many different diagnoses. A second main hypothesis is that current socioeconomic conditions in Sweden are significantly associated with mortality in cardiovascular diseases, all cancers, and all other causes, i.e. that lower socioeconomic status groups have higher mortality in these three aggregate groups of diagnoses than higher socioeconomic status groups.

Objective

The aim of this study is to investigate the associations between, on the one hand, early life conditions, measured primarily as infant mortality rate (IMR) and GDP per capita in the year of birth in the country of birth as well as current socioeconomic conditions in adult life, and, on the other hand, mortality in cardiovascular diseases, all cancers, and all other causes of death, for women and men born in different countries, but living in Sweden in the period 1980-2001. The study was ethically approved by the Ethical Committee at Lund University, Sweden.

Study design and setting

Study population and study design

The data set used for this study is a sample from the Swedish Longitudinal Immigrant Database (SLI). The SLI is a register-based representative data base with demographic and socioeconomic information on a random sample of about 550,000 Swedish residents from 17 countries including a control group of native Swedes. The longitudinal structure of the data implies that each observation is sorted chronologically by individual, creating individual event histories ending with emigration, death or the end of the observation period 2001. Detailed information on income from work, unemployment benefits, social welfare payments,

housing subsidies, etc. is available from 1980 and hence, we analyse mortality for the period 1980-2001. The sample used for this study is a panel of male and female individuals from 11 countries of birth, born between 1921 and 1939 and resident in Sweden between 1980 and 2001. The included countries of origin (Chile, Czechoslovakia, Denmark, Finland, Germany, Greece, Italy, Norway, United States, former Yugoslavia and Sweden) were selected due to the availability of information on infant mortality rates and GDP per capita for the period 1921-1939. Before 1921 and 1939-45 this information is lacking for several countries. For the six remaining birth countries in the data base (Ethiopia, Iran, Iraq, Poland, Turkey and Vietnam), information on GDP and/or infant mortality rates is lacking for the whole or part of the period 1921-1939. Before 1945 there was little immigration to Sweden. Due to this fact very few individuals included in the sample grew up in Sweden. For those for which we have information on year of immigration, 97.5 percent of the sample used for this study immigrated after age 18 and only 0.4 percent immigrated before age 6. Hence, the individuals included in this study were exposed to the socioeconomic conditions of their country of birth during their first years of life. In order to minimize the problem of under-registration of return migration, individuals who have not received any form of income or welfare transfer whatsoever in a year are treated as having left the country and hence excluded from the sample.

Dependent variables

The dependent variable is death by cause of death, categorized into three broad groups; cardiovascular disease, all cancers, and all other death causes. Mortality information stems from The Causes of Death Register (dödsorsaksregistret), which is kept by the Swedish National Board of Health and Welfare, and covers all deaths of residents in Sweden, irrespective of citizenship. Causes of death in the register are determined from death certification and recorded according to ICD classification.

Independent variables

Infant mortality rates have been collected from a large-scale dataset on infant mortality rates, based on several sources, such as the UN Demographic Yearbooks, national statistics and specific IMR research sources; see Abouharb and Kimball (2007). Annual GDP per capita for the different origin countries stems from Angus Maddison's work on historical statistics (see Maddison 2007), and can be downloaded from www.ggdc.net/maddison. Socioeconomic information is measured annually and stems from official registers, such as taxation and education registers kept by Statistics Sweden.

Tables A and B (to be viewed on the web only) show number of individuals and number of deaths by birth country, for men and women respectively, as well as means and standard deviations of the independent variables included in the regressions. The total number of deaths in the data set is 4031 for men and 2020 for women. Cardiovascular disease mortality accounts for 43 percent of the male deaths, whereas cancer accounts for 31 percent. Regarding women, 42 percent of the deaths were caused by cancers, whereas cardiovascular disease caused 30 percent of the female deaths. For both men and women, "other causes" account for less than 30 percent of the deaths in our data. Independent variables are: *Age group*, in five-year categories; *Civil status* is included as a dummy variable indicating whether an individual is single (reference category), married, divorced or widowed. *Country of birth* is accounted for by dummy variables; *IMR at birth*, the infant mortality rate per 1000 live births in the year and country of birth of the individual; *GDP at birth* measures the de-trended variation in the level of production per capita in the country and year of birth of the individual, measured in 1990 International Geary-Khamis dollars (i.e. fixed prices adjusted for national differences in purchasing power). We detrended the GDP time-series using the Hodrick-Prescott filter with a lambda value of 100, as frequently recommended for annual data (e.g. Backus and Kehoe 1992) ; *Income level* measures the total disposable income after taxes, including income from employment, self-employment and capital, as well as social transfers such as pensions, sickness benefits, housing subsidies and income support. Disposable income was categorized into six dummy variables according to income level. *Higher education* is a dichotomous variable indicating that the individual has completed secondary education or higher; and *Welfare recipient* is a dichotomous variable indicating that the individual has received income support from the social services authorities in the year of observation.

Statistics

The outcome of interest is death or survival in a given year between 1980 and 2001 and hence, we choose to apply survival analysis using Cox proportional hazards regression. The STATA software statistical program was used.

Results

Table 1 shows the estimation results of three simple models, where the effect of early life conditions and birth cohort on the risk of death from any cause is estimated. The point estimates in the three models show that the relative risk of death in the period 1980-2001 was 150-165 percent higher for the cohort born in the 1920s, compared to those born in the 1930s. In model 1, infant mortality in the year of birth in the country of birth is included as the only indicator of early life conditions, and table 1 shows that higher infant mortality rates are associated with a higher risk of death for men, however, there is no significant effect of IMR at birth for women. In model 2, variation from the GDP trend is included as indicator of early life conditions, and being born in a year with unusually high rate of economic growth in the birth country is associated with around 50 percent lower risk of death, compared to those born in a "normal" year, the effect being slightly stronger for women compared to men. In model 3, both IMR and GDP at birth are included as indicators of early life conditions, but the effects of birth cohort, IMR and GDP at birth do not change much compared to the results in models 1 and 2. A high economic growth rate in the year of birth is associated with a lowered death risk for both men and women, and a high infant mortality rate at birth increases the risk of death for men but not for women.

Table 2 shows extended models. In model 4, demographic variables such as age category and civil status are included. The results show that age is positively associated with the risk of death; the higher the age, the higher the hazard ratio. Married individuals display a lower risk compared with singles (significant for men only) whereas divorced and widowed individuals display a higher risk. The effects of birth cohort and early life conditions become weaker when the demographic variables are introduced. The hazard ratio for birth cohort decreases from 2.56 to 1.23 for men and from 2.65 to 1.36 for women, compared to model 3, apparently because birth cohort captures the age effect in models 1-3. The effects of early life conditions become weaker and statistically insignificant, except regarding the effect of GDP at birth for women, which is significant at the 10 percent level.

In model 5, indicators of the current socio-economic situation in Sweden are included in the estimations. Income is categorized into six income levels and the results show that individuals with higher incomes display lower death risks than individuals with low incomes. The relationship is however not completely linear; the second lowest income category displays

hazard ratios that are similar (for women) or higher (for men) compared to the lowest income category. The reason is partly that the poverty indicator "Welfare recipient" captures some of the income effect for the lowest income category. There may also be a problem of unregistered emigration; some of the individuals in the lowest income category may have some registered income although they have left Sweden and are consequently not in the population at risk. As discussed above, individuals with zero disposable income are omitted from the sample in order to minimize the problem of unregistered emigration. There is a significant negative relationship between educational level and death risk; individuals who have completed secondary education or higher display about 25 percent lower death risks compared to those who have lower education, significant for both men and women. Regarding recipients of social welfare payments, there are significantly increased risks of death for both men and women. Compared to non-recipients, the point estimates show that the risk is 63 percent higher for male recipients and 75 percent higher for female welfare recipients. Hence, model 5 shows that there are clear effects of current socio-economic conditions in Sweden, both for men and women. On the other hand, the results regarding early life conditions are less clear. The effects of IMR at birth are negative in model 5, which is not in the expected direction. A high rate of economic growth in the year of birth is associated with lower risk of death, which is in the expected direction, but this result is significant for women only.

In model 6, birth country indicators are included in the estimations. The introduction of birth country indicators affects the hazard ratios for IMR at birth, which become positive for both men and women, however statistically insignificant. Male immigrants from Denmark, Finland and Norway display higher risks of death compared to native Swedes, controlling for early life conditions, demographic factors, and current socio-economic situation, and immigrants from Greece display lower risk of death. Regarding female immigrants, only those born in Denmark and Norway display higher death risks, whereas Chileans and Greeks display significantly lower risks of death. The results show that the effect of current socio-economic conditions on all cause mortality is stronger and more straightforward compared to the effect of early life conditions.

Table 3 shows model 5 estimated by cause of death. Contrary to our expectations, cardiovascular mortality is negatively associated with infant mortality in the country of birth in the year of birth, both for men and women. The effect of GDP at birth is statistically

insignificant. The effects of age, civil status and socio-economic status are stronger for men than for women.

Table 3 shows that cancer mortality is positively associated with age, whereas other associations are rather weak. Welfare recipients display a 40-50 percent higher risk compared to non-recipients, significant for men and women. For women, higher income is weakly associated with lower risk of death from cancer, whereas men display the highest risk in the second-lowest income category. Higher education is associated with lower risk of death from cancer, but statistically significant for men only. The effects of early life conditions are insignificant, except for IMR at birth, which is negatively associated with cancer mortality for women.

The third column in table 3 shows that death from causes other than cardiovascular disease and cancers are strongly associated with income level, for men as well as for women. Welfare recipients display significantly higher risks than non-recipients and higher education is associated with lower risk, significant for men only. Both men and women display a cohort effect, where hazard ratios are higher for those born in the 1920s compared to those born in the 1930s. The effects of early life conditions are insignificant, except for IMR at birth, which, for women only, shows a negative association with death from causes other than cardiovascular disease and cancers.

Table 4 shows model 6 estimated by cause of death. Comparing model 5 and model 6, we can see that the inclusion of country of birth affects the hazard ratios for our measures of early life conditions, in particular for IMR at birth. The effect of IMR at birth on cancer mortality is significantly positive for both men and women. For cardiovascular disease and other causes of death, our measures of early life conditions are insignificant. Regarding current socio-economic conditions, however, hazard ratios are only marginally affected by the inclusion of birth country indicators.

In sum, our estimation results show that the effects of early life conditions on mortality disappear when we control for current socio-economic conditions. Our largest model shows that a high level of infant mortality in the year of birth is associated with higher risk of death from cancer, significant for both men and women. Otherwise, there are no significant effects of our measures of early life conditions. The effects of current socio-economic conditions, on

the other are clear and straight-forward. A higher education implies lower risk of death, individuals who receive social welfare payments display significantly higher risk of death and individuals with high incomes have lower risk of death compared to those with low incomes, with a few exceptions only, e.g. income level is not significantly associated with cancer mortality for men.

Discussion

Most effects of early life conditions on mortality disappear after adjustments for current socioeconomic conditions. The largest model including demographic factors, early life exposures, socioeconomic factors and country of birth show that a high infant mortality rate (IMR) in the year of birth in the country of birth is significantly associated with cancer mortality among men and (at 5.4% significance level) among women. Otherwise, we find no significant effects of the two early life variables IMR at birth and GDP at birth on total, CVD or all other diagnoses mortality. In contrast, the effects of current socioeconomic conditions in Sweden are significant and robust. Higher education and high income are associated with lower mortality, while being a welfare recipient is associated with higher mortality. A few exceptions may be observed, such as for instance the fact that income is not significantly associated with cancer mortality among men.

Men born in Denmark, Finland and Norway as well as women born in Denmark and Norway display significantly higher hazard rate ratios of total mortality than men and women born in Sweden, respectively, in the final models including both the early life factors and current socioeconomic position. Even more persistent results have been observed for Irish descent second and third generation men and women living in the United Kingdom who had higher total mortality rates than the UK population (Harding & Balarajan, 1996; Harding & Balarajan, 2001). These results were hard to explain (Haskey, 1996). In contrast, our study also shows that men born in Greece as well as women born in Greece and Chile display significantly lower hazard rate ratios of total mortality than men and women born in Sweden, respectively.

In the final models with all variables included, men born in Denmark, Finland and Norway have significantly higher (at the 5% significance level) CVD mortality than men born in Sweden. Women born in Finland also have significantly higher CVD mortality than women born in Sweden. In contrast, men born in Greece as well as women born in Greece have significantly lower CVD mortality. Men born in Chile as well as women born in Chile and Greece have

significantly lower cancer mortality than men and women born in Sweden, respectively. Men who were born in Czechoslovakia and Finland display higher all other cause mortality than men born in Sweden.

As hypothesized, we find significant positive effects of infant mortality rate at birth in country of birth on cancer mortality; a higher infant mortality rate in the year and country of birth is associated with higher cancer mortality later in life. In contrast, no significant association is observed between GDP at birth in country of birth and cancer mortality. We find no significant effects of either IMR at birth or GDP at birth in country of birth on CVD mortality. Furthermore, we find no significant effects of either IMR at birth or GDP at birth in country of birth on all other causes mortality. However, although other diseases such as respiratory and allergic diseases (Strachan & Sheikh, 2004) and some neuropsychiatric outcomes (Factor-Litvak & Susser, 2004) are associated with early life conditions, the all other causes of death group is very heterogeneous.

Infant mortality rate in the year of birth in the country of birth seems to have an unclear association with CVD mortality in our study. This result is clearly discordant with findings in the previous literature (Barker, 1995; Lawlor, Ben-Schlomo, & Leon, 2004; Potischman, Troisi, & Vatten, 2004). CVD mortality and cancer mortality are well established in the literature as later life diseases with early life determinants and risk factors (Lawlor et al., 2004; Potischman et al., 2004). Furthermore, a previous study of immigrants from West Africa and the Caribbean has shown higher mortality rates from cerebrovascular diseases prior as well as persistently after migration to the United Kindom, which in that study was attributed to genetic factors (Wild & KcKeigue, 1997). The absence of an effect of IMR on cardiovascular mortality in our study may be due to a healthy migrant selection effect or, alternatively, to other selection effects, such as selective return migration. For instance, one US study showed that Mexican return migrants from the United States were shorter than those who stayed, height being associated with CVD as well as with early life conditions (Crimmins et al., 2005). However, such selection would probably also counteract the effect on cancer mortality. Actually, we find no evidence of an overall healthy migrant effect in Sweden. Greek and Chilean immigrants seem to be somewhat healthier than native Swedes, whereas most other groups seem to be similar to native Swedes, and in particular Nordic immigrants seem to be less healthy compared with Swedes.

Current socioeconomic conditions appear to have a clear effect on mortality in the expected direction, with the exception of cancer mortality in most income levels. In this study

socioeconomic status is measured using educational level and disposable income. Socioeconomic status is often also measured according to occupational status (Lynch & Kaplan, 2000). However, this third option was not possible to include in the analyses of this study. In addition, occupational status is highly correlated with levels of income and education.

The dataset analysed in this study did not include diet, smoking and other health related lifestyle factors. Mediterranean diet, which would be presumed to be more prevalent among participants born in Greece and Chile but also among participants born in Italy and Yugoslavia, would for instance be a lifestyle factor protecting against both CVD (Bendinelli et al., 2011) and cancer (Couto et al., 2011) mortality. Other studies have documented earlier migrants to be more obese, to have greater levels of cholesterol, to be less physically active and to smoke more cigarettes than those with a shorter duration of residence (Wilkinson et al., 2005; Goel et al., 2004; Gadd et al., 2005).

The most obvious health policy implication from this study is that health policy should focus on the reduction of the effects of current socioeconomic risk factors in the country of immigration, i.e. in our study Sweden. This may include measures to increase the level of education which would in the next step widen labour market opportunities for immigrants, but it also includes direct policy measures to increase immigrants' access to employment. Further epidemiological studies of early life risk factors are needed in order to infer any health policy recommendation, mostly because of the restrictions on interpretation imposed by the aggregate nature of IMR and GDP per capita. Still, some of the findings, particularly the significant hazard rate ratio 2.07 (1.06-4.04) for men and almost significant hazard rate ratio 2.19 (0.99-4.86) for women for the association between IMR at birth and cancer mortality suggest that policy makers should set goals for health policy that take into account early life experiences.

Strengths and limitations

Selection bias is less likely because the study population is a random sample from register data. In addition, we have reduced the problem of under-registration of return migration, i.e. fact that some immigrants in Sweden may have return migrated to their countries of birth without this event of migration being registered, through the elimination of individuals who have no registered income at all and who can be assumed to have left Sweden.

Indicators of early life conditions at the micro-/individual level are simply not available for data on large immigrant populations. The use of aggregate country level data such as IMR and GDP per capita at birth, as in this study, is mostly the only option available, and even studies using this kind of aggregate data are still scarce.

Misclassification according to country of birth is not likely. Misclassifications of diagnoses are also less likely due to the high aggregation level of diagnoses. GDP per capita and IMR, both at birth, may be very crude measures of early life conditions, mostly due to the variety of development and economic prosperity *within* countries, especially large countries, in the year of birth. However, they are the best internationally comparable measures we have. Many important confounders have been taken into account in the multiple Cox regression survival analyses, although other important confounders, most importantly lifestyle factors such as for instance smoking, exercise and diet, have not been taken into account due to lack of these variables in the data material.

The longitudinal study design using Cox regression survival analyses may be considered a strength of this study.

Conclusions

Socioeconomic conditions in Sweden are more strongly associated with mortality than early life indicators IMR and GDP per capita in the year of birth in the country of origin. This finding has health policy and other policy implications.

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Table 1. Estimation of mortality risk, Sweden 1980-2001, for immigrants and native Swedes, born 1921-1939. All cause mortality, men and women analysed separately.

	Model 1[a]		**Model 2**[b]			**Model 3**[c]
Men	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*
n = 18673						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	2.50**	2.35-2.66	2.57**	2.41-2.73	2.56**	2.40-2.72
IMR at birth	1.08**	1.01-1.15			1.07*	1.00-1.14
GDP at birth			0.50**	0.43-0.59	0.51**	0.43-0.59
Women						
n = 16022						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	2.58**	2.36-2.83	2.64**	2.41-2.88	2.65**	2.42-2.90
IMR at birth	0.96	0.87-1.06			0.95	0.86-1.05
GDP at birth			0.47**	0.38-0.59	0.47**	0.37-0.59

Cox proportional hazards regression, results displayed as hazard ratios.
** indicates statistical significance at 5% level, * indicates statistical significance at 10% level.
a. Model 1 adjusted for IMR at birth and birth cohort.
b. Model 2 adjusted for GDP at birth and birth cohort.
c.Model 3 adjusted for IMR at birth, GDP at birth and birth cohort.
Source: Swedish Longitudinal Immigrant Database (SLI).

Table 2. Estimation of mortality risk, Sweden 1980-2001, for immigrants and native Swedes, born 1921-1939. All cause mortality, men and women analysed separately.

	Model 4[a]		**Model 5**[b]		**Model 6**[c]	
Men	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*
n = 18673						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	1.23**	1.10-1.36	1.21**	1.09-1.34	1.21**	1.08-1.35
IMR at birth	1.04	0.97-1.12	0.90**	0.84-0.97	1.10	0.75-1.62
GDP at birth	0.92	0.77-1.10	0.92	0.77-1.11	0.89	0.74-1.07
Age 41-45	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Age 46-50	2.05**	1.38-3.05	2.14**	1.44-3.18	2.08**	1.39-3.09
Age 51-55	2.67**	1.81-3.94	2.83**	1.91-4.18	2.68**	1.81-3.96
Age 56-60	3.70**	2.50-5.49	3.87**	2.61-5.75	3.58**	2.41-5.33
Age 61-65	6.00**	4.01-8.98	6.06**	4.03-9.10	5.48**	3.63-8.26
Age 66-70	8.73**	5.74-13.3	8.13**	5.33-12.4	7.23**	4.71-11.1
Age 71-75	12.4**	7.97-19.3	11.2**	7.15-17.5	9.81**	6.23-15.4
Age 76-79	20.7**	12.9-33.1	18.2**	11.3-29.4	15.8**	9.74-25.8
Single	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Married	0.90**	0.82-0.97	0.94	0.86-1.02	0.89**	0.82-0.97
Divorced	1.45**	1.32-1.59	1.40**	1.27-1.53	1.32**	1.20-1.45
Widowed	1.25**	1.08-1.45	1.25**	1.08-1.44	1.18**	1.02-1.37
Income level 1			*1.00*	*reference*	*1.00*	*reference*
Income level 2			1.18**	1.07-1.30	1.18**	1.08-1.30
Income level 3			0.89**	0.80-0.98	0.90**	0.82-1.00
Income level 4			0.77**	0.68-0.87	0.79**	0.70-0.89
Income level 5			0.60**	0.51-0.70	0.62**	0.53-0.72
Income level 6			0.59**	0.51-0.67	0.61**	0.53-0.70
Higher education			0.74**	0.66-0.83	0.75**	0.66-0.84
Welfare recipient			1.62**	1.44-1.83	1.62**	1.44-1.83
Sweden					*1.00*	*reference*
Chile					0.61	0.29-1.31
Czechoslovakia					1.17	0.80-1.70
Denmark					1.23**	1.07-1.41
Finland					1.46**	1.26-1.69
Germany					0.95	0.76-1.19
Greece					0.60**	0.45-0.81
Italy					0.97	0.72-1.31
Norway					1.26**	1.11-1.43
USA					1.03	0.78-1.38
f.Yugoslavia					0.98	0.67-1.44

Table 2, continued.

Women						
n = 16022						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	1.36**	1.17-1.59	1.35**	1.15-1.57	1.28**	1.09-1.50
IMR at birth	0.91	0.81-1.02	0.80**	0.72-0.89	1.42	0.85-2.37
GDP at birth	0.79*	0.61-1.01	0.79*	0.61-1.02	0.80*	0.61-1.04
Age 41-45	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Age 46-50	1.36	0.83-2.24	1.42	0.86-2.33	1.37	0.83-2.26
Age 51-55	1.72**	1.06-2.80	1.78**	1.09-2.90	1.68**	1.03-2.75
Age 56-60	2.18**	1.33-3.56	2.17**	1.32-3.57	2.03**	1.23-3.34
Age 61-65	3.27**	1.96-5.46	3.13**	1.87-5.25	2.87**	1.70-4.84
Age 66-70	4.78**	2.79-8.20	4.20**	2.43-7.25	3.79**	2.18-6.59
Age 71-75	6.51**	3.65-11.6	5.58**	3.11-10.0	5.02**	2.77-9.10
Age 76-79	9.68**	5.21-18.0	8.18**	4.36-15.3	7.26**	3.83-13.8
Single	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Married	0.96	0.85-1.09	0.98	0.86-1.11	0.93	0.81-1.06
Divorced	1.26**	1.10-1.44	1.28**	1.11-1.46	1.19**	1.04-1.37
Widowed	1.19**	1.04-1.38	1.25**	1.08-1.44	1.19**	1.03-1.39
Income level 1			*1.00*	*reference*	*1.00*	*reference*
Income level 2			1.05	0.95-1.17	1.06	0.95-1.18
Income level 3			0.81**	0.70-0.93	0.82**	0.71-0.94
Income level 4			0.70**	0.57-0.86	0.71**	0.58-0.88
Income level 5			0.63**	0.47-0.85	0.65**	0.48-0.87
Income level 6			0.61**	0.45-0.83	0.63**	0.46-0.85
Higher education			0.75**	0.63-0.90	0.75**	0.62-0.90
Welfare recipient			1.75**	1.46-2.10	1.82**	1.52-2.19
Sweden					*1.00*	*reference*
Chile					0.27**	0.10-0.75
Czechoslovakia					0.85	0.51-1.44
Denmark					1.19*	0.97-1.46
Finland					1.06	0.87-1.30
Germany					0.98	0.73-1.30
Greece					0.46**	0.31-0.70
Italy					0.95	0.61-1.49
Norway					1.19**	1.00-1.42
USA					0.83	0.52-1.31
f. Yugoslavia					0.69	0.42-1.14

Cox proportional hazards regression, results displayed as hazard ratios.

** indicates statistical significance at 5% level, * indicates statistical significance at 10% level.

a. Model 4 adjusted for IMR at birth, GDP at birth, birth cohort, age and civil status.

b. Model 5 adjusted for IMR at birth, GDP at birth, birth cohort, age, civil status, income, education and welfare.

c. Model 6 adjusted for IMR at birth, GDP at birth, birth cohort, age, civil status, income, education, welfare and birth country.

Source: Swedish Longitudinal Immigrant Database (SLI).

Table 3. Estimation of mortality risk, Sweden 1980-2001, for immigrants and native Swedes, born 1921-1939. Mortality by cause of death, men and women analysed separately.

Model 5[a]	Cardiovascular		Cancer		Other causes	
Men	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*
n = 18673						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	1.30**	1.10-1.52	1.07	0.89-1.29	1.24**	1.00-1.54
IMR at birth	0.75**	0.66-0.85	0.97	0.85-1.10	1.08	0.94-1.23
GDP at birth	0.97	0.73-1.29	0.90	0.65-1.24	0.89	0.63-1.26
Age 41-45	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Age 46-50	2.90**	1.31-6.40	2.16*	0.97-4.85	1.69*	0.96-2.98
Age 51-55	5.48**	2.53-11.8	3.29**	1.50-7.24	1.37	0.77-2.44
Age 56-60	7.17**	3.29-15.6	5.73**	2.60-12.6	1.54	0.85-2.78
Age 61-65	12.0**	5.44-26.5	8.99**	4.01-20.1	2.16**	1.16-4.02
Age 66-70	16.7**	7.41-37.6	13.2**	5.73-30.3	2.47**	1.27-4.79
Age 71-75	22.7**	9.80-52.7	17.3**	7.24-41.5	3.71**	1.80-7.66
Age 76-79	43.7**	18.2-105.1	22.8**	8.99-58.0	5.70**	2.57-12.6
Single	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Married	0.94	0.83-1.07	1.06	0.92-1.23	0.79**	0.66-0.93
Divorced	1.41**	1.23-1.62	1.12	0.94-1.33	1.69**	1.42-2.00
Widowed	1.33**	1.07-1.65	1.25*	0.96-1.63	1.11	0.82-1.51
Income level 1	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Income level 2	1.29**	1.12-1.50	1.20*	1.00-1.43	1.03	0.87-1.22
Income level 3	1.01	0.87-1.18	1.01	0.84-1.22	0.63**	0.52-0.76
Income level 4	0.81**	0.68-0.98	1.01	0.82-1.25	0.52**	0.42-0.65
Income level 5	0.63**	0.50-0.80	0.92	0.71-1.19	0.31**	0.22-0.43
Income level 6	0.54**	0.43-0.68	0.93	0.73-1.17	0.36**	0.27-0.48
Higher education	0.72**	0.60-0.87	0.74**	0.61-0.90	0.76**	0.59-0.97
Welfare recipient	1.73**	1.44-2.08	1.41**	1.11-1.78	1.66**	1.33-2.07
Women						
n = 16022						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	1.76**	1.31-2.36	1.17	0.93-1.48	1.29*	0.96-1.75
IMR at birth	0.82**	0.68-0.98	0.85**	0.73-0.99	0.72**	0.59-0.88
GDP at birth	0.83	0.51-1.37	0.82	0.56-1.19	0.72	0.44-1.18
Age 41-45	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Age 46-50	0.99	0.31-3.15	1.37	0.68-2.78	1.79	0.73-4.39
Age 51-55	1.48	0.50-4.38	1.91*	0.96-3.81	1.84	0.75-4.50
Age 56-60	2.06	0.70-6.10	2.44**	1.21-4.94	1.94	0.78-4.86
Age 61-65	3.37**	1.10-10.3	3.35**	1.60-7.00	2.76**	1.06-7.18
Age 66-70	5.76**	1.80-18.4	3.58**	1.63-7.85	3.93**	1.43-10.8
Age 71-75	8.21**	2.42-27.9	4.38**	1.86-10.3	5.08**	1.70-15.2
Age 76-79	12.4**	3.42-44.6	4.83**	1.87-12.5	9.39**	2.92-30.2
Single	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Married	0.95	0.75-1.19	0.95	0.79-1.14	1.05	0.81-1.35
Divorced	1.23*	0.96-1.58	1.03	0.84-1.27	1.80**	1.39-2.34
Widowed	1.23*	0.96-1.58	1.12	0.89-1.40	1.50**	1.13-2.00
Income level 1	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Income level 2	1.22**	1.01-1.48	0.98	0.83-1.16	0.98	0.80-1.21
Income level 3	0.83	0.63-1.08	0.84	0.69-1.04	0.73**	0.56-0.95
Income level 4	0.63**	0.41-0.97	0.78*	0.59-1.04	0.62**	0.42-0.91
Income level 5	0.66	0.36-1.20	0.69*	0.45-1.05	0.52**	0.29-0.93
Income level 6	0.48**	0.24-0.96	0.80	0.53-1.19	0.42**	0.22-0.81
Higher education	0.62**	0.42-0.90	0.82	0.64-1.06	0.76	0.54-1.08
Welfare recipient	1.45**	1.01-2.08	1.51**	1.14-2.02	2.49**	1.83-3.39

Cox proportional hazards regression, results displayed as hazard ratios.

** indicates statistical significance at 5% level, * indicates statistical significance at 10% level..

a. Model 5 adjusted for IMR at birth, GDP at birth, birth cohort, age, civil status, income, education and welfare.

Source: Swedish Longitudinal Immigrant Database (SLI).

Table 4. Estimation of mortality risk, Sweden 1980-2001, for immigrants and native Swedes, born 1921-1939. Mortality by cause of death, men and women analysed separately.

Model 6[a]	**Cardiovascular**		**Cancer**		**Other causes**	
Men	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*	*Haz. R.*	*Conf. int.*
n = 18673						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	1.30**	1.10-1.54	1.01	0.84-1.23	1.31**	1.05-1.63
IMR at birth	0.98	0.54-1.80	2.07**	1.06-4.07	0.60	0.29-1.26
GDP at birth	0.90	0.67-1.22	0.90	0.65-1.25	0.87	0.60-1.25
Age 41-45	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Age 46-50	2.78**	1.26-6.15	2.07*	0.92-4.64	1.71*	0.97-3.03
Age 51-55	5.09**	2.35-11.0	3.02**	1.37-6.64	1.41	0.79-2.50
Age 56-60	6.47**	2.97-14.1	5.08**	2.30-11.2	1.58	0.87-2.86
Age 61-65	10.5**	4.76-23.4	7.65**	3.39-17.3	2.23**	1.19-4.18
Age 66-70	14.4**	6.34-32.6	10.8**	4.64-25.1	2.58**	1.32-5.07
Age 71-75	19.3**	8.25-45.2	13.8**	5.69-33.5	3.91**	1.88-8.15
Age 76-79	36.8**	15.1-89.3	17.5**	6.79-45.3	6.18**	2.75-13.9
Single	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Married	0.88*	0.77-1.00	1.05	0.90-1.22	0.74**	0.62-0.88
Divorced	1.32**	1.14-1.51	1.09	0.92-1.30	1.56**	1.31-1.86
Widowed	1.23*	0.99-1.53	1.22	0.93-1.59	1.04	0.77-1.42
Income level 1	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Income level 2	1.30**	1.13-1.51	1.19*	0.99-1.43	1.03	0.87-1.22
Income level 3	1.04	0.89-1.22	0.99	0.82-1.20	0.65**	0.54-0.79
Income level 4	0.85*	0.71-1.02	1.00	0.81-1.23	0.54**	0.43-0.68
Income level 5	0.66**	0.52-0.84	0.91	0.70-1.18	0.32**	0.23-0.46
Income level 6	0.58**	0.46-0.72	0.91	0.72-1.15	0.39**	0.29-0.52
Higher education	0.74**	0.61-0.90	0.73**	0.59-0.89	0.78**	0.61-0.99
Welfare recipient	1.74**	1.45-2.09	1.43**	1.13-1.80	1.64**	1.32-2.03
Sweden	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Chile	0.54	0.16-1.79	0.22**	0.06-0.86	2.40	0.57-10.2
Czechoslovakia	1.18	0.65-2.14	0.71	0.37-1.36	2.12**	1.03-4.34
Denmark	1.26**	1.02-1.56	1.12	0.87-1.43	1.30*	0.98-1.73
Finland	1.69**	1.35-2.12	0.93	0.71-1.22	1.88**	1.42-2.48
Germany	0.93	0.65-1.33	0.77	0.52-1.14	1.23	0.80-1.91
Greece	0.63**	0.41-0.99	0.43**	0.26-0.73	0.85	0.48-1.49
Italy	1.01	0.63-1.61	0.81	0.48-1.34	1.03	0.55-1.94
Norway	1.29**	1.06-1.56	1.24*	0.99-1.56	1.22	0.94-1.58
USA	0.85	0.52-1.39	0.93	0.57-1.51	1.53	0.90-2.58
f. Yugoslavia	0.84	0.46-1.54	0.47**	0.24-0.93	2.73**	1.33-5.63

Table 4, continued.

Women						
n = 16022						
Cohort 1930s	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Cohort 1920s	1.71**	1.26-2.33	1.05	0.83-1.34	1.29	0.95-1.74
IMR at birth	1.10	0.42-2.86	2.19*	0.99-4.86	0.95	0.36-2.54
GDP at birth	0.81	0.47-1.39	0.87	0.60-1.26	0.69	0.41-1.15
Age 41-45	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Age 46-50	0.97	0.30-3.07	1.32	0.65-2.68	1.73	0.70-4.25
Age 51-55	1.42	0.48-4.21	1.78	0.89-3.56	1.74	0.71-4.27
Age 56-60	1.96	0.66-5.82	2.23**	1.10-4.54	1.81	0.72-4.55
Age 61-65	3.17**	1.03-9.78	2.98**	1.41-6.30	2.52*	0.96-6.64
Age 66-70	5.40**	1.66-17.5	3.09**	1.39-6.88	3.55**	1.27-9.94
Age 71-75	7.74**	2.25-26.6	3.74**	1.56-8.95	4.56**	1.51-13.8
Age 76-79	11.67**	3.17-42.9	4.01**	1.52-10.6	8.36**	2.55-27.4
Single	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Married	0.86	0.68-1.09	0.96	0.79-1.16	0.95	0.73-1.24
Divorced	1.08	0.83-1.39	1.02	0.83-1.27	1.66**	1.27-2.16
Widowed	1.13	0.87-1.46	1.12	0.88-1.41	1.40**	1.04-1.87
Income level 1	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Income level 2	1.24**	1.03-1.50	0.98	0.83-1.16	0.99	0.81-1.21
Income level 3	0.85	0.65-1.12	0.85	0.69-1.04	0.75**	0.57-0.98
Income level 4	0.66*	0.43-1.02	0.78*	0.58-1.04	0.64**	0.43-0.95
Income level 5	0.69	0.38-1.26	0.69*	0.45-1.05	0.55**	0.30-0.98
Income level 6	0.52*	0.26-1.03	0.79	0.52-1.18	0.44**	0.23-0.85
Higher education	0.64**	0.44-0.93	0.77**	0.59-1.00	0.80	0.56-1.14
Welfare recipient	1.52**	1.06-2.18	1.58**	1.18-2.11	2.56**	1.88-3.48
Sweden	*1.00*	*reference*	*1.00*	*reference*	*1.00*	*reference*
Chile	0.39	0.06-2.59	0.16**	0.03-0.75	0.37	0.05-2.62
Czechoslovakia	1.08	0.40-2.92	0.68	0.31-1.49	0.89	0.32-2.48
Denmark	1.22	0.83-1.79	1.11	0.82-1.51	1.30	0.88-1.90
Finland	1.63**	1.12-2.37	0.73*	0.53-1.01	1.12	0.76-1.65
Germany	1.30	0.75-2.25	0.84	0.54-1.29	0.89	0.50-1.58
Greece	0.37**	0.16-0.86	0.27**	0.14-0.54	0.99	0.50-1.97
Italy	0.89	0.37-2.15	0.92	0.48-1.74	0.97	0.39-2.40
Norway	1.25	0.91-1.72	1.11	0.84-1.46	1.25	0.90-1.72
USA	0.17*	0.02-1.20	1.13	0.64-1.97	0.80	0.31-2.01
f. Yugoslavia	1.06	0.42-2.68	0.35**	0.16-0.78	1.14	0.44-2.96

Cox proportional hazards regression, results displayed as hazard ratios.

** indicates statistical significance at 5% level, * indicates statistical significance at 10% level.

a. Model 6 adjusted for IMR at birth, GDP at birth, birth cohort, age, civil status, income, education, welfare and birth country.

Source: Swedish Longitudinal Immigrant Database (SLI).