Forced migration in childhood: are there long-term health effects?

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Abstract. Studies on the health of migrants have increased considerably in number during the past years, but little is still known about the long-term health effects associated with forced migration, and particularly of people who were forced to migrate as children. Data shortcomings together with the methodological challenges of studying migrant populations limit the ability to disentangle the roles of the various factors that influence migrant health outcomes. Finland provides an unusual opportunity to study long-term health effects associated with forced migration. During World War II, twelve per cent of the Finnish population was forced to leave the region nowadays referred to as Ceded Karelia. After the war, these Karelians could not return home because the area was relinquished to the Soviet Union. Using high quality, linked register-based data for the period 1988-2012, we investigate whether this forced migration had long-term health consequences for those who were forced to migrate as children. Comparison groups are non-displaced persons born on the adjacent side of the new border, and people born elsewhere in Finland. Health at ages 43-65 years is measured by receipt of sickness benefit, which is an indicator of short-term illness, and receipt of disability pension, which reflects long-term illness or permanent disability. All-cause and cause-specific mortality is analysed at ages 43-84 years. We find no strong support for the hypothesis that the traumatic event of being forced to migrate during childhood has long-term negative health consequences. The forced child migrants have lower odds for receipt of sickness benefit, and women also lower odds for receipt of disability pension. The mortality results are largely driven by patterns specific for eastern-born populations of Finland. A likely reason behind the absence of a health malicious influence of migration is that these migrants seem to have integrated well into post-war Finnish society.

Keywords: Finland; forced migration; migration in childhood; health; mortality; long-term effects

1. Introduction

Population mobility is one of the leading policy issues of the 21st century. An estimated one billion persons are on the move either internally or internationally (UNDP, 2009). Human migration is not a new phenomenon. Many people have migrated to look for better economic opportunities elsewhere, or to join family members who have previously migrated, but in the wake of globalization, political upheavals and armed conflict, mobility has changed in both nature and number (Zimmerman et al., 2011). About one fifth of the world's population today, or more than 1.5 billion people, live in countries affected by conflict. Political instability has a large human cost. By the end of 2012, about 45 million people were displaced due to conflict or persecution, and more than 15 million of them were refugees (UNDP, 2014). Since then the numbers have grown, and the OECD countries face an unprecedented refugee crisis. In 2014, more than 800,000 asylum applications were recorded, whereof more than 600,000 in Europe (OECD, 2015). In 2015, the number of irregular entries into the European Union was over one million (BBC, 2016). This is a substantially higher number than the one reached in 1992, during the Balkan war, when the EU countries registered 630,000 asylum requests (Financial Times, 2015).

Although studies of the health of migrants have increased in recent years, fairly little is known about the long-term health effects associated with forced migration, and particularly of people who were forced to migrate as children. They are the focal point of this paper. Data shortcomings, together with the methodological challenges of studying migrant populations, limit the ability to disentangle the roles of the various factors that influence migrant health outcomes (Andersson and Drefahl, 2015; Constant et al., 2015). Longitudinal data are needed to follow migrants over time and space, yet most studies of migrant health outcomes are based on cross-sectional data collected in only one geographical area or country. In addition, issues related to self-selection, screening made by authorities, visa policies, migrants' health and

behaviours at the time of migration, and various acculturation processes cannot be fully addressed with cross-sectional data.

Finland provides an unusual opportunity to overcome some of the problems associated with analyses of the interrelation between migration and later life health outcomes. During World War II, twelve per cent of the country's population was forced to leave the region that is nowadays referred to as Ceded Karelia when it was occupied by the Soviet Union. After the war, these Karelians could not return home because Finland relinquished this region to the Soviet Union. These forced migrants, who primarily were farmers, were relocated elsewhere in Finland and had to prepare for permanent existence in new surroundings. The Finnish population register makes it possible to undertake longitudinal analyses of the health of these migrants several decades after they were forced to move. These data are of high quality with no loss to follow-up and hence avoid methodological challenges present in many other data sources. In this paper, we focus on the children who were forced to migrate, which they did together with their parents at ages 0-17 years, and compare their health and mortality at ages 43-84 years to those of individuals who were born in other parts of Finland.

2. Previous research and theoretical considerations

There is an extensive body of research on the health of immigrants in a variety of countries, but a dearth of quantitative studies on the subject of the health of forced child migrants. Studies on the immediate effects of forced migration overwhelmingly demonstrate the mortality disadvantage of children of displaced populations compared to the children of the host population (Macassa et al., 2003, Van Herp et al., 2003; Guha-Sapir and Gijsbert, 2004; O'Hare and Southhall, 2007). Most of these studies are concerned with populations who originate in severe conflict zones in developing countries. The typical outcome studied is under-five mortality, or other aspects related to health below age five. Research concerned

with effects that are beyond the immediate are less conclusive (Singh et al., 2005; Khawaja, 2004; Verwimp and Van Bavel, 2005; Avogo and Agadjanian, 2010). This is probably because the influences are complex. On the one hand, migration itself may pose significant hazards to children with psycho-social impacts (Sluzki, 1979; Hicks et al., 1993; James, 1997). On the other hand, it may increase access to health care and improved environmental conditions (Popkin and Udry, 1998; McKenzie et al., 2009). Apart from child mortality, studies have also documented positive outcomes such as increases in child immunizations (Kristensen et al., 2000; Nielsen et al., 2005; Senessie et al., 2007). However, to the best of our knowledge, there are no follow-up studies that extend to adulthood in which forced child migrants are followed several decades after the move.

There are several potential pathways through which migration may affect the health of children. Drawing from Grossman's health production function (Grossman, 1972), migration may influence child health via changes in medical and nutritional inputs, parental time devoted to child care, and changes in parental health knowledge (Carballo et al., 1998, Unger et al., 2004; Hildebrandt and McKenzie, 2005). One of the main challenges in identifying the impact of migration on health, irrespective of the age when the move occurs, lies in the fact that the event of migration itself is likely to be correlated with unobserved characteristics of the migrants, such as biological endowments, personality traits, and random health shocks (Stillman et al., 2012). This identification challenge is present in the vast majority of studies of migrants' health outcomes.

Factors that can be considered more structural in nature are usually not to the migrants' advantage. As compared to natives, many adult migrants have lower socioeconomic status, limited access to health services, they experience discrimination that stem from xenophobia, racism and alienation, they may experience poorer working conditions, and they are often sorted into more dangerous and strenuous occupations (Grove and Zvi, 2006; Orrenius and

Zavodny, 2009). Health profiles and epidemiological regimes may additionally differ between origin and destination areas (Rivera et al., 2002; Cunningham et al., 2008). However, numerous studies, and particularly those conducted in the context of international migration to the United States, document what is known as an immigrant health paradox. In spite of the structural impediments, many immigrant groups have better health than natives as measured by various indicators such as mortality, morbidity, or self-rated health (Kibele et al., 2008; Markides and Eschbach, 2005; Elo et al., 2011; 2014). There are nevertheless exceptions: Finns in Sweden, the Irish in England, and Russians in the United States, for instance, tend to have poorer health than people in reasonable comparison groups of natives (Raftery et al., 1990; Weitoft et al., 1999; Mehta and Elo, 2012).

There are four main explanations for the immigrant health paradox, which are either directly or indirectly, related to the challenge of identifying the causal impact of migration on health (Palloni and Morenoff, 2001). These are (1) selective migration, (2) selective return migration, (3) sociocultural protection and acculturation, and (4) data artifacts. Selective migration refers to the fact that movement, and long-distance movement in particular, is dominated by people whose health is better than that of the origin country population (Wallace and Kulu, 2014). Individuals in poor health are not likely to undertake migration as it requires considerable physical stamina, disruption in one's life, and adaption to a new environment and lifestyle (Lu and Qin, 2014). This positive health selection can be reinforced by host country screening of prospective immigrants. Governments may choose healthier, wealthier and better educated immigrants over others, as these individuals will not pose a public health threat and can more easily cope with the physical and psychological challenges of immigration (Evans, 1987; Gushulak, 2007; Chiswick et al., 2008). Hence the selective migration hypothesis posits a set of processes whereby health itself, or other unobserved

characteristics related to it, are associated with the likelihood of migration (Riosmena et al., 2013).

Selective return migration, or the salmon bias hypothesis, postulates that unhealthy migrants or migrants who experience deteriorating health have a greater tendency to return or to move closer to their origin communities than healthier migrants (Abraído-Lanza et al., 2006). Immigrants with poor health are less likely to achieve high productivity in the destination labour market, which may lead to decreasing earnings and a lowered standard of living. If combined with limited access to health care services, lack of support networks, and various sources of stress, return migration may become an attractive option (Lu and Qin, 2014). The empirical evidence on the importance of salmon bias is nevertheless mixed (Razum et al., 1998; Palloni and Arias, 2004; Turra and Elo 2008; Arias et al., 2010).

Sociocultural protective factors are thought to enable migrants to cope with stress and promote better health outcomes and behaviours, most often thought to be associated with health behaviours of the sending country (Landale et al., 2000). In many sending countries, diets and behaviours are healthier than at the destination, including better nutrition and dietary habits, more physical activities, close family and religious ties, and other socially protective factors that shield migrants and preserve good health (Constant et al., 2015). This immigrant health advantage declines with time spent in the host country, and converges or even falls below the health status of natives. The acculturation is consequently a temporal process by which individuals adopt the behaviours and attitudes of the host society. The adoption can be associated with both positive health behaviours, such as increased use of preventive health services, and negative health behaviours, such as uptake of drinking and smoking, and reduced physical activity (Anson, 2004; Lara et al., 2005). Over time, the importance of sociocultural protective factors on health differences between immigrants and natives remain important if the groups remain culturally distinct (Franzini et al., 2001).

Data artifacts refer to measurement errors that disproportionally affect immigrant health measures relative to how they bias measurement of health in native, or other, groups (Riosmena et al., 2013). They might therefore be artificially overstating migrant health. Return migrants are not captured in host country data sources (Wallace and Kulu, 2014). This omission can lead to overestimation of the at-risk population when estimating mortality, and result in underestimation of death rates among the foreign-born population relative to the native-born population (Abraido-Lanza et al., 1999; Andersson and Drefahl, 2015). Other immigrant health measures may also suffer from data artifacts, particularly if they are contingent on access to health care, such as, for instance, self-reported chronic conditions (Pagán et al., 2007; Derose et al., 2007). Whether the native-immigrant health difference persist irrespective of the data artifacts continues to be debated (Weitoft et al., 1999; Razum et al., 1998; Elo et al., 2004; Crimmins et al., 2007).

Observed health outcomes of migrants may therefore not be evidence of the consequences of migration itself, but may arise from the selective features of migration on health (Lu and Qin, 2014). The event of migration is associated with stress and processes that may influence health, such as increased stress levels, disrupted social ties, diminished social support and social isolation (Deri, 2005; Jasso et al., 2004). Conventional theory on migrants' adaption to stress suggests that moving imposes stress on the individual because it disturbs the equilibrium between the migrant and the environment (Ben-Sira, 1997). This compels the migrant to readjust, which may negatively affect health and raise subsequent mortality. Although these negative health consequences of migration are likely to become weaker over time (Cornia, 2000), a fundamental issue is whether they are discernible in the longer term.

3. The context

Longitudinal surveys that follow individuals in and out of the source and destination areas are needed to fully explore the role of migration for health, mortality and other population-related processes (Turra and Elo, 2008; Riosmena et al., 2013). They are rarely available, however, or large enough to detect reliable differences. Register-based data are more extensive, but are generally bound by space to one specific country context (Andersson and Drefahl, 2015). Such studies have shown that long-distance migrants and working-age migrants tend to be relatively healthy, while the opposite tends to hold for short-distance and elderly migrants (Boyle et al., 2002; Boyle, 2004). Health selective migration is of importance also in the case of internal migration, and results in distorted patterns, because differentials in domestic migration patterns by health status tend to produce some of the morbidity variation observed across regions and local areas (Brimblecombe et al., 2000; Connolly et al., 2007).

The case of the Finnish forced migration provides an excellent and unusual opportunity to examine the relationship between migration and long-term health outcomes, because it enables us to circumvent some of the standard confounding factors. We focus on children of parents who were forced to migrate from Karelia during World War II, when Finland waged war on the Soviet Union. Finland lost it south-eastern territory to the Soviet Union and all residents from this area were relocated to other parts of Finland. The role of migration on the long-term health of children who moved with their parents has not been previously studied from childhood to adulthood, which is the focus of our analyses.

The forced migration was an exogenously determined migration decision and thus avoids the problem that migrants might be inherently different from non-migrants simply because they had decided to migrate (Saarela and Finnäs, 2009a). Thus, this context provides a natural experiment in that all individuals had to leave the area and therefore none were selected on health or any other characteristics.

The forced migrants were relocated elsewhere in Finland with the assistance of the Finnish government and were distributed around the country in a manner that was, if not perfectly random, at least not dependent on the migrants' own decisions. The socioeconomic background of the forced migrants was similar to the rest of the Finnish population, and particularly to people living on the Finnish side of the new border (Sarvimäki et al., 2010). In terms of chronic health profiles and epidemiological regimes, the population in other parts of eastern Finland is similar to the forced migrants (Norio, 2003; Saarela and Finnäs, 2006). Cultural differences, which may affect health behaviours and diet, are much less pronounced across Finnish regions than is typically the case when individuals move across international borders (Saarela and Finnäs, 2010).

All evacuated families had the right to receive a new homestead and they were allocated land in proportion to their former property (Pihkala, 1952; Virtanen, 2006). This policy resulted in the migrants having similar socioeconomic profiles immediately before and after relocation. Previous research has documented only small variations between the forced migrants and non-migrants with respect to various observable characteristics, such as education, employment, sector of work, homeownership and marital status, regardless of whether observed only a few years after the evacuation or two or more decades later (Saarela and Finnäs, 2009a; Sarvimäki et al., 2010). However, a quarter of a century after displacement, the evacuees earned more than the comparison groups of non-migrant Finns (Sarvimäki et al., 2010). It has been hypothesized that these income gains were related to a faster transition from traditional to modern occupations and from rural to urban areas than was the case among other Finns.

Because it was not possible to move back to the ceded area after 1945, the forced migrants were encouraged to accustom themselves for permanent residence in their new surroundings, with the expectation that they would participate in all facets of economic, social and political

life (Ahonen, 2005). Consequently, there is no reason to expect that the migrants would have suffered from limited access to services, experienced discrimination or poor working conditions, or to have been sorted into more dangerous or strenuous occupations as compared to non-migrants.

There is only one previous large-scale study of the long-term health consequences of this forced migration (Saarela and Finnäs, 2009a). It analysed mortality at ages 55-79 years for people who were forced to migrate at any age between 0-50 years. Apart from a peak in male mortality around the collapse of the Soviet Union, interpreted as stress induced, no other mortality differences between migrants and non-migrants were found. There were no differences by migration status among women.

The impact of the forced migration on those who migrated as children might differ from that of their parents. First, the children have not been in combat or participated in war-related civilian activities. Second, the early life experiences of child migrants differ from those of their parents, because the children have been exposed to the environment in the new destination from a young age. Acculturation to the habits of new surroundings can therefore be assumed particularly strong for child migrants, although these experiences might differ depending of the age at which the children migrated. The ages of the children at the time of migration ranged from 0 to 17 years. Third, the child migrants grew up under similar environmental, economic and social circumstances as the non-displaced children.

Thus, we might expect the children of migrants to have similar health profiles later in life as the rest of the Finnish population. On the other hand, if the move itself created a stressful early environment that had long-term negative health consequences, we would expect to observe worse health and higher mortality later in life of people who were forced to migrate as children as compared to their non-migrant counterparts. The overall aim with this paper is to investigate these hypotheses.

4. Data and methods

The data come from a five per cent random sample of all persons living in Finland in 1988-2012, drawn from the Finnish population register. These individuals can be observed longitudinally on an annual basis over this time period in various Finnish register data sources, and hence can be linked to employment statistics, death records and records of the Social Insurance Institute (KELA). The data sources are merged by Statistics Finland using personal identification numbers. Each person's socio-demographic characteristics and region of birth come from the population register, which makes it possible to distinguish forced migrants. We study people born in Ceded Karelia in 1927-1944, and compare them with non-displaced people born on the adjacent side of the new border in Eastern Finland, and with people born elsewhere in Finland (Figures 1 and 2). The regional categorisation is the same as that used by Saarela and Finnäs (2009a) who studied mortality at ages 55-79 years of those born in 1895-1944. The last male cohort that was mobilised for army service during the war period consists of people born in 1926 (Saarela and Finnäs, 2012). Thus none of our study subjects had participated in combat during the war. We exclude individuals who can be assumed culturally distinct in terms of having a mother tongue other than Finnish. This group accounted for only two percent of all individuals born in Ceded Karelia, who were mostly Swedish speakers and had lived in the city of Viipuri.

(Figure 1 here)

(Figure 2 here)

We examine health and mortality at ages 43-84 years, although the data structure places emphasis on ages 55-70. Health is proxied by three outcomes: whether a person (a) received a sickness benefit before age 65, (b) received disability pension before age 65, or (c) died. We study all-cause mortality as well as mortality from six main causes of death; ischemic heart

disease, other cardiovascular disease, lung cancer or respiratory diseases, other cancers, any other disease, and alcohol related or external causes.

The information on sickness benefit and disability pension comes from linkage to the records of KELA. After the tenth day of sickness, KELA pays sickness benefit as compensation for loss of earnings caused by illness. To qualify, a person must be of working age and unfit for work for medical reasons. Individuals eligible for sickness benefit include employees, self-employed persons, full-time students, unemployed jobseekers, and people on sabbatical, but not pensioners. The sickness benefit is approximately 70 percent of income received in the two previous calendar years.

KELA pays disability pension to disabled or chronically ill persons aged 16-64 years if their ability to function has remained diminished for at least a year, and if their illness or injury causes impairment, need of assistance and/or additional financial expenses. The allowance is payable at three fixed rate levels depending on the need for assistance, guidance and/or supervision. It can be paid during a specific period of time or without a time limit.

Hence if a person becomes unqualified for work, he or she first seeks sickness benefit. If the illness lasts for more than 300 days, the person can apply for disability pension. Sickness benefit is thus a proxy for temporary illness that makes one unfit for work, whereas disability pension refers to prolonged poor health or permanent illness, although it is possible for individuals on disability pension to return to work.

The data are split into calendar year observations. We estimate discrete-time logistic regression models to study receipt of sickness benefit and receipt of disability pension, and discrete-time hazard models to estimate the risk of all-cause and cause-specific mortality. In the mortality models, individuals are censored at the time of death or at the end of the follow-up period.

Our analytic sample consists of 7,791 individuals who were forced to migrate as children, and who contributed 87,953 person years of follow-up (Table 1). The comparison groups consist of 23,236 individuals born in Eastern Finland and 57,512 individuals born elsewhere in Finland, who contributed 269,005 and 669,382 years of follow-up, respectively.

(Table 1 here)

The socio-demographic time-varying control variables include age, period, educational attainment, homeownership, income quintile, region of residence, and family type. Family type combines information about marital status and whether or not a person lives alone. The distribution of the control variables by place of birth is shown in Table 2.

(Table 2 here)

5. Results

As seen from the unstandardised numbers in Table 1, people born in Ceded Karelia were less likely to receive a sickness benefit (6.2 percent of the men and 6.5 per cent of the women) than people born in Eastern Finland (7.2 percent of the men and 7.3 per cent of the women) or elsewhere in Finland (6.7 percent of the men and 7.0 per cent of the women). The percentage receiving disability pension was similar among the forced migrants and those born in eastern Finland (approximately 27 per cent of the men and 23 per cent of the women), but lower among those born in other parts of the country (approximately 23 percent of the men and 21 per cent of the women). The unstandardised death rate was highest for the group of people born in Ceded Karelia.

Many of the socio-demographic characteristics were similar among the three comparison groups. Given the similarity in the distribution of these characteristics by area of birth, we would expect that their inclusion explain only a modest part of small variation in health outcomes by area of birth. Some differences are nevertheless notable. People who were forced

to migrate as children were, naturally, less likely to live in Eastern Finland than those who were born there, but still more likely to live in Eastern Finland than those who were born elsewhere in the country. Also, the forced migrants were more likely to have some tertiary-level education compared to those born in Eastern Finland, and were more similar to those born elsewhere in Finland.

The results of the fully adjusted multivariate models for sickness benefit and disability pension are shown in Table 3. These results were very similar when estimated without adjustment for explanatory variables other than age and year of observation. Overall, they suggest no support for the argument that forced migration in childhood is associated with malicious long-term health consequences. In contrast, we find that the displaced persons were somewhat healthier than non-displaced persons born in Eastern Finland. The displaced men had approximately ten per cent lower standardised odds of receipt of sickness benefit as compared to men born in Eastern Finland (1/1.11-1 in Table 3). They were also slightly less like to have received sickness benefit compared to men born elsewhere in Finland. Differences for women were in the same direction. Women who were forced to migrate as children were 6-7 per cent less likely than other Finnish women to receive sickness benefit (1/1.08-1 and 1/1.06-1). In addition, they had 16 per cent lower odds of receiving disability pension as compared to women born in Eastern Finland (1/1.19-1), and approximately four per cent lower odds as compared to women born elsewhere in Finland (1/1.04-1). Displaced men, on the other hand, were equally likely to receive disability pension as men born in Eastern Finland (1/1.02-1), and twelve per cent more likely to receive this allowance as compared to men born elsewhere in Finland (1/0.89-1).

The results with respect to the other explanatory variables are consistent with previous findings regarding the association between health and socioeconomic variables (Saarela and Finnäs, 2002; Lahelma et al., 2004; Sumanen, 2016). People with higher levels of education

were significantly less likely to receive sickness benefit or disability pension than those with lower levels of education. Similarly, those with the highest levels of income were significantly less likely to receive disability pension, but more likely to take advantage of the sickness benefits.

(Table 3 here)

The results for all-cause and cause-specific mortality are shown in Table 4 for men and Table 5 for women. As was the case for sickness benefit and disability pension, these results were very similar when estimated without adjustment for explanatory variables other than age and year of observation. Among men, forced migrants had a similar all-cause mortality risk as men born in Eastern Finland, but somewhat higher mortality than men born in the rest of the country. This elevation related primarily to their higher mortality from cardiovascular diseases and from ischemic heart disease in particular. The results were similar for women. Cardiovascular mortality contributed to over 40 per cent of all male deaths in the age range studied, and to roughly 30 per cent of all female deaths (Table 1). We found no significant interaction between region of birth and region of current residence.

(Table 4 here)

(Table 5 here)

To examine the sensitivity of our findings to alternative specifications, we estimated several other models. The follow-up was set to start at the same age for all study participants. Receipt of sickness benefit and disability pension was set to be time-constant, meaning that once a person received the benefit, he or she was considered a recipient thereafter. We estimated the mortality models for age groups 43-64 and 65-84 years separately. We tested interaction terms between area of birth and area of current residence, and we ran also regressions with interaction terms between area of birth and birth cohort, to see if the specific age at migration (below age 18) was associated with benefit receipt or mortality. In all cases,

none of the estimates changed the main conclusions discussed above. Results of these additional analyses are available upon request.

6. Discussion and conclusion

In this paper, we have taken advantage of a unique historical event that forced 12 percent of the Finnish population to relocate from south-eastern Finland to other parts of the country following World War II. Finland lost this territory to the Soviet Union and none of the Finns could remain in the ceded area. Using high quality register-based data, we have studied the potential long-term health consequence for the children who were forced to relocate with their parents. We have compared with people in the same birth cohorts who originate on the adjacent side of the new border, and with people born elsewhere in Finland. Health outcomes were measured by whether or not the individual received a sickness benefit, which indicates a short-term illness, and disability pension, which reflects a long-term illness or disability, at ages 43-65 years. In addition, we examined all-cause and cause-specific mortality at ages 43-84 years.

We found no strong support for the hypothesis that the traumatic event of being forced to migrate during childhood would have long-term negative health consequences. At adult age, the forced child migrants were less likely than non-displaced persons to receive a sickness benefit. Male migrants were more likely to receive disability pension than men in the total population, but equally likely as compared with men born in the comparison group of people born in Eastern Finland. Similarly, men born in the ceded territory had the same mortality rates at ages 43-84 years as men born in Eastern Finland, with both groups having higher mortality than men born in other parts of the country. This elevation was due primarily to the higher mortality from ischemic heart disease and other cardiovascular diseases.

Women born in Ceded Karelia were less likely than other Finnish women to receive both sickness benefit and disability pension. The results with respect to mortality were similar as for men. Women had a similar all-cause mortality risk as women born in Eastern Finland, but higher mortality as compared to women born in other parts of the country, and this difference was primarily due elevated risk of deaths from ischemic heart disease or other cardiovascular diseases.

Since mortality from cardiovascular diseases has been historically higher in eastern parts of Finland than elsewhere (Saarela and Finnäs, 2009b; 2010), the mortality differences observed are most likely caused by chronic disease patterns related to health behaviours and diet, and exposure to pathogens that are specific to the eastern regions of Finland (including the ceded area). These are factors that remain relevant throughout one's life course, regardless of one's current region of residence (Koskinen, 1994; Norio, 2003; Saarela and Finnäs, 2009c). We found no significant interactions between region of birth and current region of residence, suggesting that the higher risk of death is established relatively early in life. Prior studies have also documented that the regional variation in all-cause mortality in Finland is largely driven by mortality from ischemic heart disease, and that people's birth region is a more decisive determinant of mortality from ischemic heart disease than their current region of residence (Valkonen, 1987; Saarela and Finnäs, 2009b; 2009c; 2010).

One reason for why the event of forced migration during childhood does not seem to have negative health consequences may be that, at least according to observable socioeconomic and demographic characteristics, this migrant group appear to have integrated well into post-war Finnish society. The Finns in other parts of the country were also generally supportive of the relocation assistance and the integration of the people who were forced to move into new surroundings. Thus, one should be somewhat cautious of generalizing these findings to other settings, such as current migration from war torn areas in the Middle East or Africa to Europe.

It may still be noted that the results are supportive of other studies based on Finnish register data, concerned with long-term mortality effects of critical life events. People born during the famine in the 1860s (Kannisto et al., 1997), male cohorts who fought in World War II (Saarela and Finnäs, 2010), and people who were evacuated as foster children to Sweden during the war period (Santavirta, 2014), have previously been found to have no increase in later-life mortality. A reason to why critical life events of this kind have no influence on mortality in the long term may be selective mortality, also known as cohort inversion. This would mean that the frailer individuals die at an early stage and the healthier parts of the cohorts survive to higher age.

However, for the forced migrants we have in the literature found no evidence which would suggest elevated mortality or poorer general health status immediately or recently after the evacuation (Saarela and Finnäs, 2009a; Sarvimäki et al., 2010). Cohort life tables for different age groups of the civilian population do not either reveal any increase in mortality during or recently after the war period (Kannisto et al., 1999; Saarela and Finnäs, 2012). It nevertheless needs to be stressed that the estimates in this paper were conditional on survival to the start of the follow-up, which was in 1988 for the cohorts born 1927-1944. Thus, we have been unable to address the question of whether health and/or mortality differed among individuals who were forced to migrate as children versus individuals born in Eastern Finland or elsewhere prior to this point in time. It is possible that weaker members of the cohorts had died prior to the mortality follow-up, but we do not expect these differences to substantially affect the results reported here. To scrutinize this issue, and/or the role of any other potential mechanism that may take effect before people enter the observation window as defined by the data used here, one would need register-based data that follow people from the moment when they were evacuated. That may be an assignment for future research in this field.

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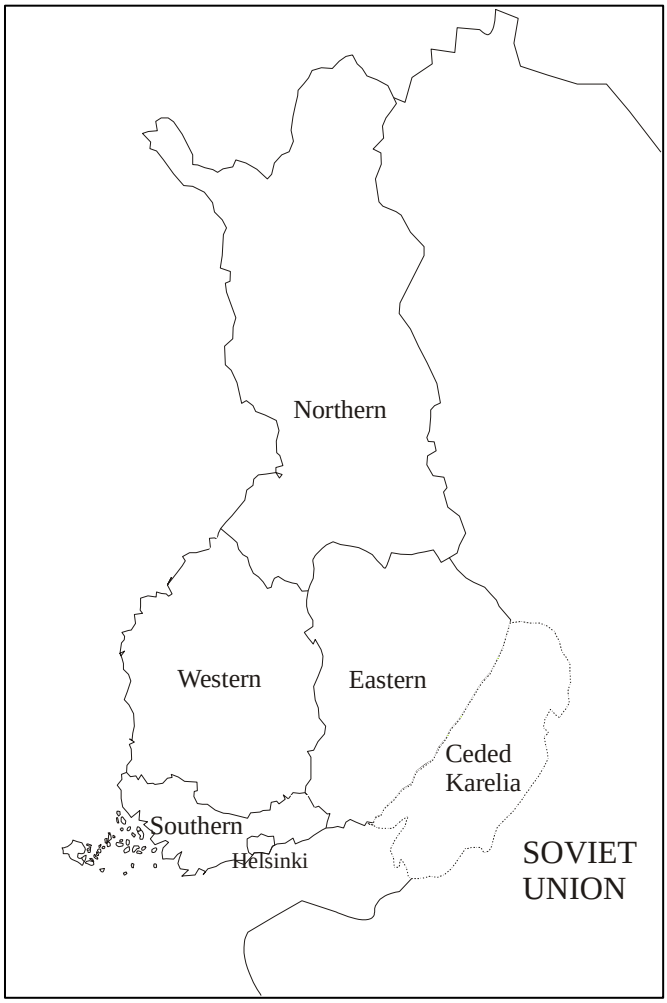

Figure 1. Map of Finland after World War II.

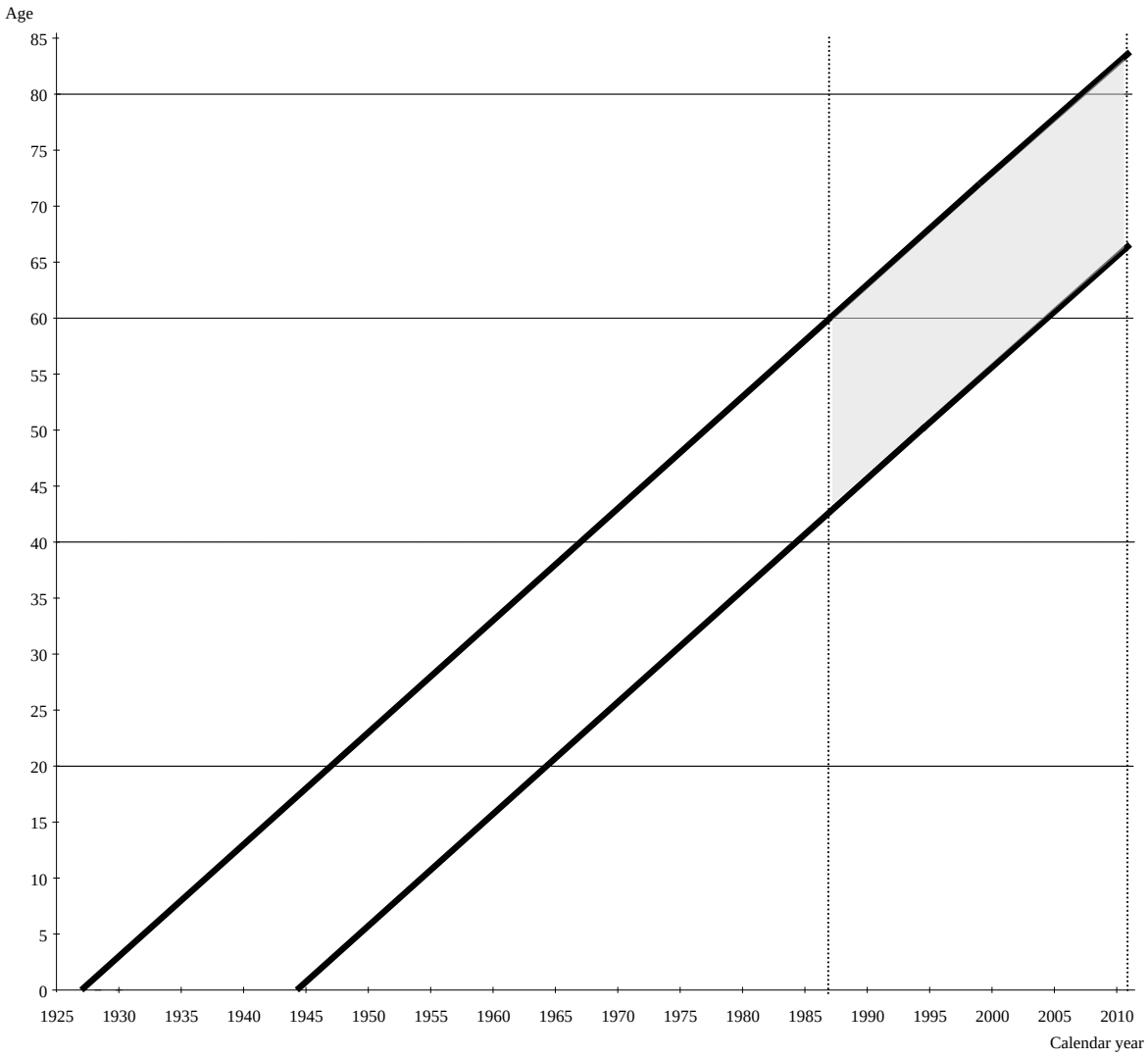

Figure 2. Lexis diagram of the observation plan (grey-shaded area is the observation window)

Table 1. Data description by age group, sex and birth area (%)

	Ages <65 years						Ages 65+ years					
	Men			Women			Men			Women		
	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
Number of individuals	2,039	6,076	15,166	2,096	6,292	15,218	1,697	4,998	12,873	1,959	5,870	14,255
Number of person years	23,064	77,960	200,415	23,611	84,099	205,746	17,660	46,050	118,197	23,618	60,896	145,024
Number of sickness benefit recipients	1,422	5,649	13,365	1,527	6,143	14,445						
unstandardised rate	6.2	7.2	6.7	6.5	7.3	7.0						
Number of disability pension recipients	6,295	21,091	46,575	5,486	19,273	43,531						
unstandardised rate	27.3	27.1	23.2	23.2	22.9	21.2						
Number of deaths	336	1,074	2,272	137	422	959	625	1,592	3,657	435	991	2,399
unstandardised rate	1.5	1.4	1.1	0.6	0.5	0.5	3.5	3.5	3.1	1.8	1.6	1.7
Deaths by main cause, %												
Ischemic heart disease	34.5	31.1	27.7	18.2	13.5	12.2	28.2	30.5	28.5	22.2	21.8	18.3
Other cardiovascular diseases	11.9	12.2	13.1	16.8	14.0	12.3	16.0	15.6	13.9	19.6	19.5	18.0
Lung cancer and respiratory diseases	11.9	11.4	13.0	5.1	7.3	8.0	13.9	14.4	15.1	8.8	8.1	8.9
Other cancer	15.2	15.9	17.1	31.4	38.4	41.4	19.3	18.5	22.7	24.0	26.7	30.9
Other diseases	9.5	7.6	7.2	13.1	10.4	11.2	13.7	11.8	11.9	21.4	18.2	19.2
Alcohol related and external causes	17.0	21.8	22.0	15.3	16.4	14.9	8.9	9.2	7.9	3.9	5.8	4.7

Notes: (A) Born in Ceded Karelia, (B) Born in Eastern Finland, (C) Born elsewhere in Finland.
Number of person years is the number of individuals multiplied with the number of calendar years they were observed.
All information refers to the period 1988-2012, except for numbers on main causes of death, which are for 1988-2011.

Table 2. Distributions of control variables by age group, sex and birth area (%)

	Ages <65 years						Ages 65+ years					
	Men			Women			Men			Women		
	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
Age in years												
43-49	7.9	13.1	13.8	6.5	12.6	12.9						
50-54	19.7	21.9	22.2	18.4	21.2	21.5						
55-59	33.2	30.9	30.3	33.0	30.6	30.3						
60-64	39.1	34.2	33.6	42.2	35.6	35.3						
65-69							44.5	49.7	50.0	39.8	45.5	46.3
70-74							32.9	31.3	31.1	33.1	31.5	31.4
75-84							22.6	19.0	18.8	27.1	23.0	22.3
Period												
1988-1992	42.9	37.9	36.9	43.7	37.0	36.5						
1993-1997	32.6	30.7	30.3	32.6	30.5	30.4	9.8	8.1	8.0	9.7	7.7	7.7
1998-2002	17.8	20.2	20.7	17.6	20.6	20.9	23.6	20.5	19.9	22.9	19.9	19.4
2003-2007	5.9	10.1	10.8	5.4	10.6	10.8	33.3	31.7	31.2	32.9	31.5	31.3
2008-2012	0.8	1.2	1.4	0.7	1.3	1.3	33.3	39.6	40.9	34.4	40.9	41.6
Level of education												
Primary	57.2	59.6	56.0	59.2	58.3	58.1	60.5	65.9	63.2	66.0	66.5	66.5
Secondary	20.6	22.7	22.6	23.9	26.2	24.1	17.7	18.7	18.5	20.3	22.2	20.1
Lowest tertiary	11.2	8.8	9.4	8.2	8.4	9.5	10.4	7.7	8.3	5.9	6.0	7.1
Lower-degree tertiary	5.4	4.5	5.5	5.8	4.1	4.9	6.0	3.8	4.7	5.1	3.3	3.9
Higher-degree tertiary	5.6	4.3	6.4	2.9	3.0	3.4	5.4	3.9	5.3	2.7	1.9	2.4
Homeownership												
No	20.2	19.3	17.5	18.0	18.3	16.6	18.1	17.7	16.8	21.8	22.1	20.5
Yes	79.8	80.7	82.5	82.0	81.7	83.4	81.9	82.3	83.2	78.2	77.9	79.5
Income quintile												
1st	13.7	15.5	14.2	26.0	24.8	23.1	10.9	14.3	13.0	26.4	28.8	26.6
2nd	12.9	13.3	12.5	18.1	17.1	17.2	21.8	22.5	22.5	32.4	30.9	31.6
3rd	17.8	18.1	16.2	18.9	19.1	19.1	25.9	25.7	24.5	21.9	22.0	21.5
4th	22.0	21.8	21.5	22.0	23.8	23.9	21.2	20.7	20.7	11.6	11.9	12.7
5th	33.5	31.4	35.7	14.9	15.2	16.7	20.3	16.9	19.4	7.7	6.4	7.6
Family situation												
With partner	75.5	75.0	76.5	64.3	68.4	68.2	74.1	73.1	73.6	45.8	49.6	50.6
Alone, never married	8.4	10.7	9.0	9.3	7.5	7.7	7.0	9.0	8.9	9.5	8.3	8.8
Alone, divorced	11.5	9.7	10.0	11.2	10.8	10.4	10.9	10.1	10.4	14.0	13.1	12.2
Alone, widow(er)	1.7	1.4	1.3	8.2	7.1	6.8	6.6	6.7	5.9	26.2	25.2	24.4
With parent or child	2.9	3.2	3.2	7.1	6.3	6.9	1.4	1.2	1.2	4.4	3.8	4.0
Region of residence												
Helsinki area	19.2	14.6	15.2	19.1	17.6	16.0	16.6	11.4	12.5	17.2	15.2	13.6
Southern Finland	19.3	7.3	17.7	19.1	8.5	17.5	19.8	6.6	17.9	19.7	7.4	17.1
Western Finland	35.4	11.5	44.5	35.7	12.6	44.7	36.9	10.9	46.1	36.1	12.3	47.6
Eastern Finland	20.3	64.4	4.1	20.9	58.7	4.4	21.9	69.2	3.7	22.3	62.6	4.0
Northern Finland	5.7	2.1	18.6	5.1	2.6	17.3	4.7	1.9	19.8	4.7	2.5	17.7

Note: (A) Born in Ceded Karelia, (B) Born in Eastern Finland, (C) Born elsewhere in Finland.

Table 3. Odds ratios for receipt of sickness benefit and disability pension, respectively, by sex

	Sickness allowance				Disability allowance			
	Men		Women		Men		Women	
Birth area								
Ceded Karelia	1		1		1		1	
Eastern Finland	1.11	(1.04-1.19)	1.08	(1.02-1.15)	1.02	(0.98-1.06)	1.19	(1.14-1.24)
Rest of Finland	1.09	(1.03-1.15)	1.06	(1.00-1.12)	0.89	(0.86-0.92)	1.04	(1.00-1.08)
Age group								
43-49	1		1		1		1	
50-54	1.20	(1.15-1.26)	1.26	(1.20-1.31)	1.78	(1.70-1.87)	1.95	(1.84-2.06)
55-59	1.15	(1.10-1.21)	1.12	(1.07-1.17)	3.79	(3.63-3.97)	4.21	(4.00-4.44)
60-64	0.51	(0.48-0.54)	0.42	(0.40-0.44)	6.44	(6.15-6.74)	6.39	(6.06-6.73)
Period								
1988-1992	1		1		1		1	
1993-1997	0.86	(0.83-0.89)	0.83	(0.81-0.86)	1.35	(1.31-1.38)	1.33	(1.30-1.37)
1998-2002	0.70	(0.66-0.73)	0.67	(0.64-0.70)	1.16	(1.13-1.19)	1.18	(1.15-1.22)
2003-2007	0.76	(0.71-0.81)	0.69	(0.64-0.74)	0.93	(0.90-0.96)	0.89	(0.86-0.92)
2008-2012	0.45	(0.36-0.57)	0.49	(0.39-0.62)	0.87	(0.80-0.94)	0.77	(0.71-0.84)
Level of education								
Primary	1		1		1		1	
Secondary	0.97	(0.93-1.00)	0.97	(0.93-1.00)	0.79	(0.78-0.81)	0.79	(0.77-0.81)
Lowest tertiary	0.47	(0.44-0.50)	0.56	(0.53-0.60)	0.74	(0.71-0.77)	0.79	(0.75-0.82)
Lower-degree tertiary	0.34	(0.31-0.37)	0.40	(0.36-0.44)	0.73	(0.69-0.77)	0.85	(0.79-0.90)
Higher-degree tertiary	0.25	(0.22-0.28)	0.45	(0.40-0.50)	0.62	(0.58-0.66)	1.01	(0.94-1.10)
Homeownership								
No	1		1		1		1	
Yes	0.96	(0.92-0.99)	0.99	(0.95-1.03)	0.75	(0.73-0.77)	0.75	(0.73-0.77)
Income quintile								
1st	1		1		1		1	
2nd	0.76	(0.71-0.80)	1.03	(0.98-1.08)	1.56	(1.52-1.61)	1.25	(1.22-1.28)
3rd	0.90	(0.85-0.95)	1.45	(1.39-1.52)	1.60	(1.55-1.65)	0.73	(0.71-0.75)
4th	1.27	(1.21-1.33)	1.29	(1.23-1.34)	0.78	(0.76-0.81)	0.25	(0.24-0.25)
5th	1.12	(1.06-1.17)	1.23	(1.16-1.30)	0.30	(0.29-0.32)	0.13	(0.13-0.14)
Family situation								
With partner	1		1		1		1	
Alone, never married	0.75	(0.71-0.80)	0.68	(0.64-0.73)	1.51	(1.47-1.56)	2.20	(2.13-2.27)
Alone, divorced	1.09	(1.04-1.15)	1.10	(1.05-1.15)	1.24	(1.20-1.28)	1.50	(1.46-1.55)
Alone, widow(er)	1.09	(0.96-1.24)	0.85	(0.80-0.91)	1.11	(1.04-1.20)	1.65	(1.60-1.71)
With parent or child	0.88	(0.81-0.95)	0.89	(0.85-0.94)	1.23	(1.17-1.30)	1.08	(1.03-1.12)
Region of residence								
Helsinki area	1		1		1		1	
Southern Finland	1.06	(1.00-1.12)	1.07	(1.01-1.12)	0.96	(0.93-1.00)	0.94	(0.91-0.97)
Western Finland	1.11	(1.06-1.17)	1.18	(1.12-1.23)	0.95	(0.92-0.98)	0.92	(0.90-0.95)
Eastern Finland	1.19	(1.13-1.26)	1.18	(1.12-1.24)	1.05	(1.01-1.09)	0.90	(0.87-0.93)
Northern Finland	1.11	(1.05-1.18)	1.13	(1.07-1.20)	1.30	(1.25-1.35)	1.15	(1.11-1.19)

Notes: All variables are time-varying. Numbers within parentheses are 95% confidence intervals.

Table 4. Risk ratios for all-cause and cause-specific mortality, men

	All causes		Ischemic heart disease		Other cardio-vascular diseases		Lung cancer and other respiratory		Other cancer		Other diseases		Alcohol and external causes	
Birth area														
Ceded Karelia	1		1		1		1		1		1		1	
Eastern Finland	0.99	(0.91-1.07)	0.99	(0.85-1.15)	0.99	(0.80-1.24)	0.97	(0.77-1.22)	0.99	(0.82-1.21)	0.88	(0.69-1.12)	1.07	(0.85-1.35)
Rest of Finland	0.90	(0.84-0.97)	0.83	(0.73-0.95)	0.85	(0.70-1.03)	0.99	(0.81-1.21)	1.01	(0.85-1.19)	0.77	(0.62-0.95)	0.96	(0.78-1.18)
Age group														
43-49	1		1		1		1		1		1		1	
50-54	1.30	(1.11-1.52)	2.09	(1.47-2.97)	1.10	(0.68-1.76)	1.53	(0.91-2.58)	1.46	(0.94-2.27)	1.01	(0.59-1.74)	0.97	(0.74-1.26)
55-59	2.01	(1.74-2.34)	3.92	(2.82-5.46)	2.15	(1.40-3.29)	2.26	(1.39-3.69)	2.45	(1.61-3.71)	1.64	(1.00-2.70)	1.00	(0.78-1.30)
60-64	2.88	(2.48-3.34)	6.00	(4.31-8.36)	3.30	(2.15-5.06)	4.53	(2.80-7.35)	3.15	(2.07-4.78)	2.59	(1.58-4.26)	1.00	(0.77-1.31)
65-69	3.93	(3.36-4.59)	8.52	(6.03-12.0)	4.67	(2.98-7.32)	6.86	(4.16-11.3)	4.86	(3.16-7.48)	4.24	(2.52-7.16)	0.83	(0.62-1.13)
70-74	5.64	(4.80-6.62)	13.6	(9.52-19.3)	7.50	(4.72-11.9)	9.60	(5.76-16.0)	6.37	(4.10-9.90)	7.10	(4.15-12.1)	0.78	(0.56-1.10)
75-84	9.94	(8.00-11.2)	21.5	(14.9-31.0)	13.8	(8.57-22.3)	13.2	(7.78-22.4)	10.2	(6.53-16.1)	16.4	(9.51-28.4)	0.77	(0.53-1.13)
Period														
1988-1992	1		1		1		1		1		1		1	
1993-1997	0.89	(0.82-0.96)	0.76	(0.66-0.88)	1.07	(0.85-1.34)	0.88	(0.70-1.11)	1.22	(0.98-1.52)	0.75	(0.55-1.01)	0.83	(0.69-0.99)
1998-2002	0.86	(0.79-0.94)	0.62	(0.53-0.73)	0.88	(0.69-1.12)	0.98	(0.78-1.25)	1.31	(1.05-1.64)	0.80	(0.59-1.09)	0.97	(0.79-1.18)
2003-2007	0.78	(0.71-0.86)	0.52	(0.44-0.61)	0.72	(0.56-0.94)	0.76	(0.58-0.98)	1.53	(1.21-1.93)	0.84	(0.60-1.16)	1.04	(0.83-1.31)
2008-2012	0.79	(0.72-0.88)	0.41	(0.34-0.50)	0.63	(0.47-0.84)	0.62	(0.46-0.82)	1.14	(0.89-1.47)	0.71	(0.50-1.01)	0.99	(0.75-1.30)
Level of education														
Primary	1		1		1		1		1		1		1	
Secondary	0.91	(0.87-0.96)	0.88	(0.79-0.97)	0.79	(0.68-0.93)	0.80	(0.68-0.93)	0.94	(0.83-1.07)	1.19	(1.01-1.40)	0.90	(0.78-1.04)
Lowest tertiary	0.96	(0.88-1.05)	1.01	(0.86-1.20)	1.07	(0.84-1.35)	0.66	(0.49-0.89)	0.99	(0.81-1.20)	1.02	(0.76-1.36)	0.86	(0.67-1.11)
Lower-degree tertiary	0.97	(0.86-1.10)	0.77	(0.59-1.01)	1.17	(0.85-1.62)	0.84	(0.56-1.24)	0.91	(0.70-1.20)	1.28	(0.87-1.87)	1.08	(0.78-1.48)
Higher-degree tertiary	0.85	(0.74-0.98)	0.63	(0.46-0.87)	1.09	(0.76-1.57)	0.69	(0.43-1.10)	1.00	(0.77-1.31)	0.98	(0.62-1.55)	0.71	(0.47-1.05)
Homeownership														
No	1		1		1		1		1		1		1	
Yes	0.56	(0.54-0.59)	0.63	(0.58-0.69)	0.62	(0.55-0.71)	0.43	(0.38-0.48)	0.65	(0.58-0.73)	0.38	(0.33-0.44)	0.60	(0.53-0.68)

continues...

... Table 4 continued

	All causes		Ischemic heart disease		Other cardio-vascular diseases		Lung cancer and other respiratory		Other cancer		Other diseases		Alcohol and external causes	
Income quintile														
1st	1		1		1		1		1		1		1	
2nd	0.90	(0.85-0.96)	1.00	(0.90-1.12)	0.91	(0.77-1.07)	0.83	(0.71-0.97)	1.01	(0.87-1.17)	0.75	(0.62-0.90)	0.85	(0.72-0.99)
3rd	0.80	(0.75-0.85)	0.87	(0.77-0.98)	0.80	(0.68-0.95)	0.69	(0.59-0.82)	0.86	(0.74-1.01)	0.70	(0.57-0.85)	0.71	(0.60-0.84)
4th	0.64	(0.59-0.68)	0.65	(0.57-0.75)	0.68	(0.56-0.82)	0.55	(0.45-0.66)	0.73	(0.62-0.86)	0.67	(0.54-0.83)	0.48	(0.40-0.58)
5th	0.47	(0.43-0.51)	0.48	(0.41-0.57)	0.45	(0.36-0.58)	0.29	(0.22-0.37)	0.69	(0.57-0.84)	0.41	(0.31-0.55)	0.38	(0.31-0.48)
Family situation														
With partner	1		1		1		1		1		1		1	
Alone, never married	1.63	(1.54-1.74)	1.81	(1.61-2.03)	1.78	(1.51-2.11)	1.49	(1.26-1.76)	1.12	(0.96-1.32)	1.96	(1.61-2.38)	2.10	(1.78-2.48)
Alone, divorced	1.75	(1.65-1.85)	1.82	(1.63-2.03)	1.81	(1.54-2.13)	1.58	(1.34-1.85)	0.98	(0.83-1.14)	2.27	(1.90-2.70)	2.94	(2.53-3.41)
Alone, widow(er)	1.51	(1.39-1.65)	1.67	(1.43-1.96)	1.51	(1.20-1.91)	1.37	(1.07-1.74)	1.04	(0.84-1.29)	1.45	(1.11-1.90)	2.78	(2.17-3.57)
With parent or child	1.34	(1.16-1.54)	1.38	(1.06-1.80)	1.77	(1.25-2.51)	1.30	(0.87-1.94)	0.89	(0.61-1.31)	1.63	(1.03-2.58)	1.56	(1.11-2.21)
Region of residence														
Helsinki area	1		1		1		1		1		1		1	
Southern Finland	0.96	(0.89-1.04)	1.01	(0.86-1.18)	1.03	(0.82-1.28)	0.80	(0.64-0.98)	1.12	(0.94-1.35)	0.88	(0.69-1.12)	0.84	(0.68-1.02)
Western Finland	0.94	(0.88-1.00)	1.01	(0.88-1.15)	1.12	(0.93-1.37)	0.74	(0.62-0.89)	1.07	(0.91-1.26)	0.93	(0.75-1.14)	0.71	(0.59-0.84)
Eastern Finland	0.97	(0.90-1.05)	1.08	(0.93-1.26)	1.09	(0.87-1.37)	0.82	(0.66-1.02)	1.02	(0.84-1.23)	0.85	(0.67-1.09)	0.83	(0.67-1.01)
Northern Finland	0.96	(0.89-1.05)	1.17	(1.00-1.37)	1.04	(0.82-1.32)	0.85	(0.69-1.05)	0.96	(0.79-1.17)	0.78	(0.60-1.01)	0.80	(0.64-0.99)

Notes: All control variables are time-varying. Numbers within parentheses are 95% confidence intervals.

Table 5. Risk ratios for all-cause and cause-specific mortality, women

	All causes		Ischemic heart disease		Other cardio-vascular diseases		Lung cancer and other respiratory		Other cancer		Other diseases		Alcohol and external causes	
Birth area														
Ceded Karelia	1		1		1		1		1		1		1	
Eastern Finland	0.94	(0.85-1.04)	0.88	(0.69-1.12)	0.91	(0.71-1.18)	0.99	(0.67-1.45)	1.05	(0.86-1.30)	0.79	(0.61-1.02)	1.11	(0.75-1.64)
Rest of Finland	0.95	(0.86-1.04)	0.76	(0.61-0.93)	0.83	(0.66-1.03)	1.00	(0.71-1.40)	1.19	(0.99-1.43)	0.87	(0.69-1.08)	0.88	(0.62-1.26)
Age group														
43-49	1		1		1		1		1		1		1	
50-54	1.48	(1.16-1.88)	1.51	(0.58-3.91)	3.94	(1.66-9.35)	1.23	(0.38-3.95)	1.49	(1.02-2.18)	2.29	(0.93-5.64)	0.87	(0.55-1.39)
55-59	1.56	(1.24-1.98)	3.72	(1.58-8.76)	2.69	(1.13-6.42)	2.17	(0.74-6.42)	1.72	(1.20-2.49)	1.82	(0.75-4.46)	0.67	(0.42-1.07)
60-64	2.23	(1.76-2.81)	6.74	(2.89-15.7)	4.91	(2.08-11.6)	3.34	(1.14-9.83)	2.24	(1.55-3.23)	3.81	(1.59-9.13)	0.52	(0.32-0.85)
65-69	3.02	(2.37-3.86)	10.9	(4.54-26.0)	7.64	(3.81-18.4)	4.95	(1.64-14.9)	3.00	(2.04-4.42)	5.62	(2.30-13.7)	0.42	(0.24-0.73)
70-74	4.44	(3.46-5.71)	19.5	(8.07-47.1)	12.7	(5.21-30.7)	6.87	(2.24-21.0)	3.82	(2.56-5.70)	9.26	(3.75-22.9)	0.39	(0.21-0.71)
75-84	8.08	(6.26-10.4)	39.8	(16.3-97.2)	23.6	(9.63-58.0)	8.98	(2.87-28.0)	5.43	(3.59-8.23)	19.3	(7.74-48.0)	0.32	(0.16-0.62)
Period														
1988-1992	1		1		1		1		1		1		1	
1993-1997	1.00	(0.88-1.14)	0.76	(0.54-1.05)	0.82	(0.58-1.16)	1.61	(0.96-2.70)	1.02	(0.84-1.25)	1.18	(0.79-1.76)	0.97	(0.70-1.36)
1998-2002	1.03	(0.90-1.17)	0.66	(0.47-0.93)	0.99	(0.70-1.41)	1.71	(1.00-2.91)	0.97	(0.78-1.20)	1.30	(0.86-1.96)	1.09	(0.75-1.60)
2003-2007	1.00	(0.87-1.16)	0.59	(0.41-0.85)	0.85	(0.58-1.24)	1.72	(0.99-3.01)	1.05	(0.83-1.33)	1.25	(0.81-1.92)	1.65	(1.08-2.51)
2008-2012	1.11	(0.96-1.29)	0.45	(0.31-0.67)	0.82	(0.55-1.22)	1.34	(0.74-2.41)	0.83	(0.65-1.08)	1.19	(0.76-1.86)	1.56	(0.96-2.54)
Level of education														
Primary	1		1		1		1		1		1		1	
Secondary	0.92	(0.86-0.99)	0.89	(0.74-1.06)	0.86	(0.71-1.04)	0.58	(0.43-0.77)	1.02	(0.90-1.16)	0.85	(0.71-1.03)	0.93	(0.72-1.20)
Lowest tertiary	0.98	(0.87-1.12)	0.86	(0.59-1.24)	0.90	(0.64-1.28)	0.46	(0.26-0.79)	1.13	(0.91-1.39)	1.04	(0.75-1.44)	1.23	(0.82-1.84)
Lower-degree tertiary	0.99	(0.83-1.18)	0.48	(0.24-0.95)	0.90	(0.55-1.47)	0.29	(0.12-0.72)	1.31	(0.99-1.72)	0.99	(0.62-1.60)	1.57	(0.91-2.70)
Higher-degree tertiary	1.13	(0.90-1.41)	0.31	(0.10-1.00)	1.04	(0.57-1.91)	0.45	(0.18-1.17)	1.42	(1.00-2.01)	1.05	(0.57-1.92)	2.26	(1.23-4.15)
Homeownership														
No	1		1		1		1		1		1		1	
Yes	0.49	(0.47-0.52)	0.42	(0.36-0.49)	0.52	(0.44-0.60)	0.42	(0.34-0.52)	0.83	(0.74-0.94)	0.27	(0.23-0.32)	0.55	(0.44-0.69)

continues...

... Table 5 continued

	All causes		Ischemic heart disease		Other cardio-vascular diseases		Lung cancer and other respiratory		Other cancer		Other diseases		Alcohol and external causes	
Income quintile														
1st	1		1		1		1		1		1		1	
2nd	0.80	(0.75-0.86)	0.74	(0.63-0.87)	0.72	(0.61-0.85)	0.81	(0.63-1.04)	0.91	(0.80-1.04)	0.73	(0.61-0.86)	0.74	(0.57-0.96)
3rd	0.62	(0.57-0.67)	0.45	(0.37-0.56)	0.54	(0.44-0.67)	0.75	(0.56-1.01)	0.74	(0.63-0.86)	0.66	(0.54-0.81)	0.50	(0.37-0.68)
4th	0.54	(0.49-0.60)	0.41	(0.31-0.54)	0.38	(0.29-0.51)	0.72	(0.50-1.04)	0.67	(0.56-0.79)	0.48	(0.36-0.64)	0.44	(0.31-0.61)
5th	0.49	(0.43-0.57)	0.33	(0.21-0.51)	0.45	(0.31-0.66)	0.81	(0.49-1.33)	0.54	(0.43-0.69)	0.56	(0.38-0.81)	0.26	(0.16-0.41)
Family situation														
With partner	1		1		1		1		1		1		1	
Alone, never married	1.57	(1.43-1.72)	1.62	(1.29-2.04)	1.82	(1.45-2.28)	1.88	(1.36-2.60)	1.30	(1.09-1.54)	1.98	(1.58-2.48)	1.70	(1.22-2.35)
Alone, divorced	1.36	(1.25-1.48)	1.28	(1.03-1.58)	1.55	(1.26-1.92)	1.84	(1.39-2.44)	1.12	(0.95-1.31)	1.57	(1.27-1.94)	1.81	(1.36-2.39)
Alone, widow(er)	1.43	(1.33-1.54)	1.61	(1.34-1.94)	1.58	(1.31-1.91)	1.28	(0.96-1.70)	1.24	(1.07-1.43)	1.55	(1.28-1.88)	1.66	(1.21-2.27)
With parent or child	1.12	(0.98-1.28)	1.46	(1.08-1.98)	1.23	(0.88-1.73)	1.52	(0.97-2.36)	1.02	(0.81-1.30)	1.08	(0.74-1.58)	0.64	(0.36-1.16)
Region of residence														
Helsinki area	1		1		1		1		1		1		1	
Southern Finland	0.95	(0.86-1.04)	1.06	(0.81-1.37)	1.03	(0.79-1.35)	0.85	(0.60-1.19)	0.83	(0.69-1.00)	0.98	(0.76-1.26)	0.89	(0.63-1.26)
Western Finland	0.91	(0.84-0.99)	0.91	(0.72-1.15)	1.09	(0.86-1.37)	0.67	(0.50-0.90)	0.89	(0.76-1.03)	0.92	(0.74-1.14)	0.79	(0.58-1.06)
Eastern Finland	0.89	(0.81-0.99)	0.97	(0.75-1.26)	1.00	(0.77-1.30)	0.65	(0.45-0.93)	0.86	(0.72-1.04)	0.93	(0.72-1.20)	0.70	(0.49-0.99)
Northern Finland	0.94	(0.85-1.05)	1.28	(0.98-1.67)	0.99	(0.74-1.32)	1.06	(0.75-1.51)	0.76	(0.62-0.93)	0.93	(0.71-1.23)	0.82	(0.56-1.21)

Notes: All control variables are time-varying. Numbers within parentheses are 95% confidence intervals.