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LONG-TERM MORTALITY OF WAR COHORTS: THE CASE OF FINLAND*

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Abstract. The system of full mobilisation and the modest effects of the World War II events on the civil population make Finland a highly useful case for exploring whether war veterans experience elevated long-term mortality risks. Using data from the Human Mortality Database and a detailed register-based sample containing main causes of death, we study mortality rates of the Finnish male cohorts who participated in the wars against the Soviet Union in 1939-1944. We find no indications of elevations in long-term mortality rates of people in the war cohorts. Recently after war-end, death rates in the war cohorts were substantially above the expected time trend, but they approached unity at the time antibiotics were introduced. The medical advances of later date have additionally helped in notably reducing mortality levels in the general population. This health beneficial development has evidently forced down any potential for a reduction of later-life survival in the war cohorts. Serving in a war zone for several years and under harsh conditions must consequently not reduce later-life survival.

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1. Introduction

Mortality follow-up studies of war veterans have been frequently used to exploit the issue of whether critical periods in adult persons' lives influence their subsequent mortality risks. The conclusions are mixed, however. Seltzer and Jablon (1974) found that, in the United States, the World War II veterans had lower mortality rates than non-veterans within the first few years after discharge, but thereafter gradually approached the parent population. Some other U.S. studies claim that, several decades after military service, veterans from World War II, the Korean War, and the Vietnam War had elevated mortality rates (Hearst, Newman & Hulley, 1986; Bedard & Deschênes, 2006; Boscarino, 2006). Findings from other countries, such as Germany, Poland, and the former Soviet Union, for instance, find no clear evidence that men who were of combatant age during World War II had higher long-term mortality rates (Anderson & Silver, 1989).

The equivocal evidence may be a result of different prerequisites. In the United States, veterans and non-veterans can be compared within the same birth cohorts, but selection into military service is most likely highly correlated with health. Pre-induction health screenings may select only the most physically fit for actual military service, but those who are initially motivated to apply for service or fail to evade conscription can also differ in important ways from the population at large (Conley & Heerwig, 2009). This makes the net effect of selection on post-war mortality rates largely indeterminate.

In most European countries that participated in World War II, veterans and non-veterans cannot be compared within the same cohorts. This is because a system of full mobilisation was practiced, resulting in a situation where practically all men of specific age at the time of the war were mobilised and participated in actions of war. In the European perspective, war veterans and non-veterans hereby inevitably belong to different cohorts. Since also the civilian population in most of these countries was severely affected by bombings and other warfare (Akbulut-Yuksel, 2009), it is difficult to find relevant reference points when exploiting any influence of military service on long-term mortality effects.

Finland provides an exception in this context. The country actively participated in the war and practiced a system of full mobilisation, but the civilian population was modestly affected by direct actions. One can hereby distinguish specific male cohorts in which practically all men served in the army within a war zone, and compare with non-serving cohorts. This country hereby serves as a quasi-experiment that can gain additional insight into the issue of whether war veterans have elevated long-term mortality rates.

Finland became involved in World War II in November 1939, when it was attacked by Soviet troops. This was the starting point for what is known as the Winter War, which lasted until March 1940. The conflict continued in June 1941, and the second stage, known as the Continuation War, ended in September 1944. During the period 1939-1944, there was full mobilisation of particular cohorts of young men. The only ones exempted from military service had severe physical handicaps. The battles against the Soviet Union, which was a superior enemy with four times as many troops, were intense and fought under harsh conditions. Direct effects of warfare on the country's civilian population were modest. The battles took place in the border regions from which the civilians had been evacuated, successful bombings of other parts of Finland were few, and the country never became occupied. There was rationing of food and daily-life supplies also in the home front, but obviously not of the magnitude that health deteriorated. During the wars, there was no evident increase in mortality rates in the civilian population.

Hence, most of the life-threatening and health detrimental events were concentrated to the specific male cohorts that served in the army. The most severely affected "war cohorts" were during the war period reduced by approximately 15 per cent. Among the survivors, more than a third received war injuries. The short-term negative health consequences were hereby considerable, and mortality rates in the war cohorts were substantially elevated within the first years after war-end (see the next section).

The central question in this paper is whether any mortality effects are visible in the war cohorts several decades after army service, during a post-war period of substantial mortality decline in the population at large. Available data that provide opportunities to explore this issue are of high quality. The population statistics in Finland are reliable, fully covering, and go several decades back in time. Since 1950, they are based on nationwide censuses.

We use two complementary sets of such register data. One is from the Finnish part of the Human Mortality Database (2009), and contains death risks and all deaths at the one-year level since 1878. These data make it possible to exploit the post-war development of all-cause mortality in each cohort for a period of more than fifty years. The other set constitutes a sample based on Statistics Finland's longitudinal population register (Statistics Finland, 2009), linked to mortality records with information about the main cause of death. The linkage is accomplishable because every newborn person in Finland is given a unique identification number that is used in all official documents. Micro data in various official registers can therefore be combined. These data allow us to see whether any long-term consequences of war experience manifest in specific causes. We can account for individual characteristics and undertake analyses for people in the same war and non-war cohorts from 1971 until 2004.

The specific life course experiences of the Finnish war cohorts are next illustrated in light of their mortality development.

2. The Finnish war cohorts

As illustrated by the Lexis diagram in Figure 1, the cohorts called up for military service were born 1895-1925. In the Winter War 1939-1940, which was fought under very severe climate conditions, the youngest men mobilised were aged 20 years. The oldest cohort that was trained consisted of men born in 1894, but they never faced any battles. In the Continuation War 1941-1944, men born 1910 or earlier were released from army service in 1942, whereas younger cohorts were gradually mobilised. Before war-end, even the 1926 cohort was mobilised, but few of them reached the war zone. The hardest affected war cohorts consist of men born in the late 1910s, as they have the longest experience of warfare.

(Figure 1 here)

In these two wars, the Finnish troops amounted to 600,000 men, which constitute well over 80 per cent of the corresponding cohorts. The sacrifice was large. The total number of war deaths was 90,000 and 200,000 men were wounded (Institute of Military Science, 1991; 1994; Finnish National Archives, 2009). The large number of war deaths is reflected upon in Figure 2. Based on data from the Human Mortality Database, it gives age-specific mortality rates for selected years before, during, and after the war period. Particularly in 1941 and 1944, when there were great military offensives, the death rates skyrocketed.

(Figure 2 here)

Since so many were injured, mortality rates remained relatively high some years after the wars. The age-specific death rates reached the pre-war levels in 1946, but to account for the general mortality reduction over a longer period, one must compare with women. The curves in Figure 3 represent five-year death risks at ages 25 and 30 years during the period 1925-1970. For men, we have here excluded the extreme period of war. In women, there was a quite steady decline from 1930, which slowed down in the late 1930s and first part of the 1940s. Since the wars caused quite few civilian deaths, death rates in women did not increase during the war period. The same conclusion applies for non-mobilised male age groups (not shown). At ages 25 and 30 years, the trend in men was initially very similar to that in women, but in the post-war period, male death risks remained relatively high until about 1950.

Comparing the trends in men and in women, we can conclude that male mortality was elevated by approximately 30 per cent in the first few years after the wars. The succeeding dramatic decline apparently reflects the introduction of antibiotics in the late 1940s. The mortality reduction in these ages was greater in men than in women, which indicates that a considerable proportion of the men suffered from diseases related to war participation, such as tuberculosis and various infections, for which antibiotics treatment was very effective.

(Figure 3 here)

Another circumstance that distinguishes cohorts born before the 1920s from the younger ones needs some comments. In addition to the wars in 1939-1944, the cohorts born before 1920 experienced the hard conditions that prevailed during the Finnish Civil War in 1918 and the time of the Spanish influenza pandemic in 1918-1920.

During the civil war, approximately 37,000 persons died, which include casualties at the war fronts, deaths from political terror campaigns, and high prison mortality rates. The battles in 1918 were fought within the country, but women did not experience any substantial mortality increase. Figure 4 illustrates that only the oldest male war cohorts appear to have been directly affected by the events, as the death rates in 1918 increased primarily in men aged over 15 years. Male mortality was still more evenly distributed across age groups than in 1939-1944.

(Figure 4 here)

The Spanish flu pandemic also reached Finland, but in relation to many other countries, Finland was quite spared. The disease was not concentrated to a short period, like in the U.S., but spread across the country in three major waves. For the whole period 1918-1920, at most 33,000 deaths have been estimated as caused by the Spanish flu, and at least 2,500 of these were prisoners of war who died in camps from influenza and pneumonia (Linnanmäki, 2005). As compared to other potential factors, any long-term effects of the Spanish flu can therefore hardly be observed empirically in Finland. Findings from the U.S. (Almond, 2006; Almond & Mazumder, 2005), which provide a better framework for understanding the consequences, suggest that exposure to the virus may affect long-term health in a negative manner.

The above description illustrated that there is great variation in exposure to extreme events between cohorts born before and after 1925. Next, we study if these have resulted in different long-term mortality rates.

3. Long-term mortality rates

3.1. All-cause mortality

As illustrated by the age-specific death rates in Figure 5, the periods 1939-1944 and 1918 stand out with abnormal male mortality. The figure also shows that, similar to most other industrialised countries, overall mortality rates in Finland decreased markedly after World War II. The mortality improvement can be ascribed primarily to two main factors. First, there were pronounced gains at younger ages around 1950, as deaths caused by tuberculosis and many infections were abolished because of antibiotics (Kannisto, Nieminen & Turpeinen, 1999). Second, during recent decades, there has been a sharp decline in deaths at higher ages because of improved medication, prevention and surgical treatment for ischemic heart disease (Saarela & Finnäs, 2009a). In the period 1950-2000, the life expectancy for a newborn boy increased from 60.4 to 74.2 years, and for a newborn girl from 67.9 to 81.0 years.

(Figure 5 here)

The ultimate question is whether a "war-cohort effect" can be discerned in light of this overall post-war mortality improvement. If that is the case, there should be a notable level difference in mortality rates between the hardest affected war cohorts and the cohorts (closest in time) without war experience. In Figure 5, such an influence would take effect in terms of a diagonally stretching ridge (toward the Northeast corner) for the war cohorts, or as a notable downward shift (a reversed step-function) when comparing war cohorts to the younger cohorts. No such war-cohort effect is visible, however.

To achieve easier interpreted two-dimensional plots of the mortality trends, we calculated five-year death risks at various ages using standard life table techniques. These death risks are in Figure 6 plotted against each cohort's year of birth. The dotted parts of the curves refer to the war cohorts. For younger ages, the description is restricted to the period after 1950.

(Figure 6 here)

There are no shifts in the death risk between war cohorts and other (pre- or post-war) cohorts. This confirms the view that the war cohorts have not experienced any reduction in later-life survival. The overall development across cohorts appears somewhat ambiguous when comparing the profiles for each age group. However, if the same age-specific curves are outlined by calendar year instead of by birth year, it comes out that they are more or less parallel. This feature, which is illustrated in Figure 7, signals that period effects dominate any influence of cohort.

(Figure 7 here)

3.2. Cause-specific mortality

The analyses of cause-specific mortality utilise a random sample from the longitudinal population register, which has been linked to deaths for each year during the period 1971-2004. Mortality is categorised as being from ischemic heart disease, other cardiovascular diseases, lung cancer, other diseases, or external causes, which are mutually exclusive categories. The sample is stratified by ethnic group. It contains five per cent of all Finnish speakers and 50 per cent of all Swedish speakers (who constitute barely six per cent of the country's total population).

The data construction implies that we follow each person over successive five-year periods and estimate one-year death risks. To facilitate cohort comparisons, and to have a good age balance in the data, analyses are restricted to persons aged 50-69 years at the beginning of each five-year period, and to cohorts born 1911-1940 (see Figure 1). Thus, the death rates are estimated in the age interval 50-74 years, using the Cox regression module in SPSS. The total number of person-years in the unweighted data is 980,525. Deaths from ischemic heart disease are 7,030, from other cardiovascular diseases 2,552, from lung cancer 2,028, from other diseases 5,221, and from external causes 1,861.

Variables included in the estimations are each person's birth cohort, age, educational level, homeownership, marital status, birth region, and ethnic group. All are known to be important determinants of cause-specific mortality in Finland (Saarela & Finnäs, 2009b), and they have similar strong and expected effects on the main causes studied here. Most important still is that, including them into the models had practically no influence on the cohort trends.

These standardised mortality rates for each main cause of death are outlined by cohort in Figure 8. The death rates for all-cause mortality naturally correspond with those for the total population in Figures 6 and 7. Figure 8 highlights the great importance of cardiovascular mortality for all-cause mortality in these ages. Mortality from ischemic heart disease, in particular, initially lies at a very high level, but reduces steeply across cohorts. Death rates from lung cancer and other diseases have also decreased over cohorts, albeit clearly less, whereas those from external causes have slightly increased. A war-cohort effect cannot be discerned, however, which can be contrasted with results from the United States. Bedard and Deschênes (2006) find that the excess deaths in World War II veterans manifest primarily in mortality from ischemic heart disease and lung cancer, whereas those in Vietnam War veterans arise from suicides and motor-vehicle accidents (Hearst et al., 1986), but also from many other causes (Boscarino, 2006). At some instances in our data, the limited number of deaths causes a somewhat unstable pattern and wide variation around specific point estimates, but there are no indications of any shift in the death rates between war and non-war cohorts.

(Figure 8 here)

4. Conclusion

The system of full mobilisation and the modest effects of the World War II events on the civil population make Finland a highly useful case for exploring whether war veterans experience elevated long-term mortality rates. Within particular cohorts, practically all men served in the army, and since exposure to combat appears to have been idiosyncratically distributed, the survivors cannot either be regarded as selected on pre-war health status.

Using high-quality register data, we find no indications that long-term mortality rates in the war cohorts were elevated. Similar conclusions apply to detailed analyses of main causes of death, where we adjust for standard confounders. Hence, the extreme life events these people experienced appear not to have reduced their survival in later-life. In the first years after war-end, death rates in the war cohorts were substantially above the expected time trend, but they approached unity at the time antibiotics were introduced. The medical advances of later date have additionally helped in notably reducing mortality levels in the general population. This health beneficial development has evidently forced down any potential for a reduction of later-life survival in the war cohorts.

Within a particular subgroup of the Finnish population, events related to the wars had some mortality influence, however. People forced to migrate from the ceded areas, and particularly men, experienced an increased death risk, which manifested in cardiovascular mortality, more than 40 years after their evacuation (Saarela & Finnäs, 2009c). This was in the late 1980s, i.e., during the time of the collapse of the Soviet Union, and suggests that psychosocial stress might take effect with a long time lag if individuals must adjust to situations for which appropriate coping behaviour is unknown.

Unlike the case with the forced migrants, we believe that, for the war cohorts, coping behaviour was known, and that this might be an additional explanation to the absence of a war-cohort effect. As the country remained independent and non-occupied after the wars, the population was prepared to rebuild society. The cause for fighting was also considered legitimate, in spite of the large human sacrifice, the substantial war damages to be paid, and the loss of ten per cent of the country’s territory.

The Finnish famine in 1866-1868 provides another Finnish quasi-experiment that has been used for exploiting the influence of critical events on later-life survival. Cohorts born during this period were subject to prolonged and extreme in-uterus nutritional deprivation. They suffered immediate rises in mortality during infancy and early childhood, but did not carry any after-effects that decreased their later-life survival (Kannisto, Christensen & Vaupel, 1997). Those findings contrast with analyses based on the Dutch Hunger Winter in 1944-1945 (Roseboom, van der Meulen, Ravelli, Osmond, Barker & Bleker, 2001), and might be due to variation in the duration of the events. Since the period of famine in Finland was very long, selection into fertility could have made the produced offspring relatively healthier. A similar explanation does of course not apply to the absence of war-cohort effect in the present study, and the latent factors at work are presumably also other.

We still think that the empirical evidence from Finland signals an essential aspect, namely that long-term health outcomes are highly dependent on post-exposure underpinnings. The substantial health improvement in the post-war population obviously masks any potential negative influence of war participation in the cohorts affected. The findings of this paper hereby pinpoint the empirical complexities of studying how critical events experienced at adult and young ages affect long-term mortality rates.

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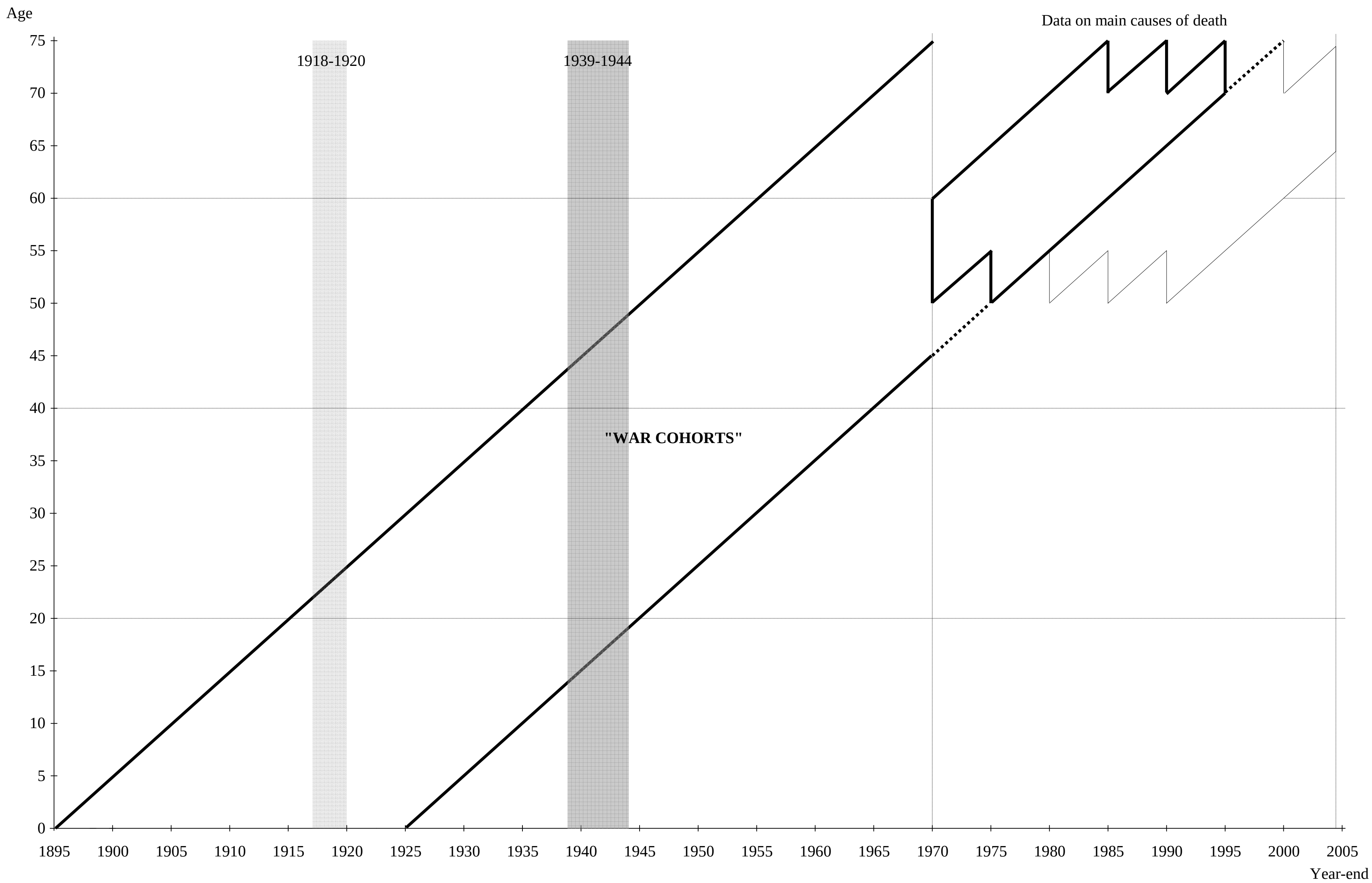

Figure 1. Lexis diagram of the observation plan

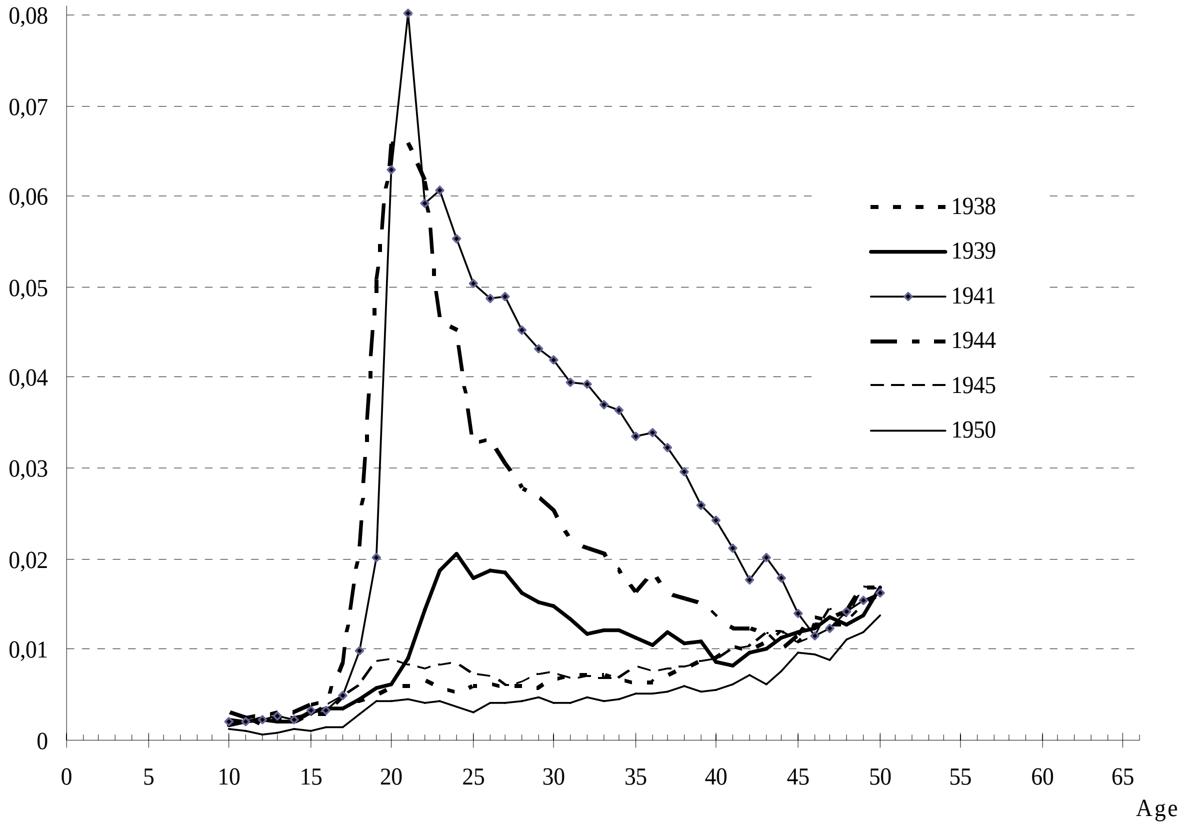

Figure 2. Age-specific death rates of men, before, during, and after the war period in 1939-1944

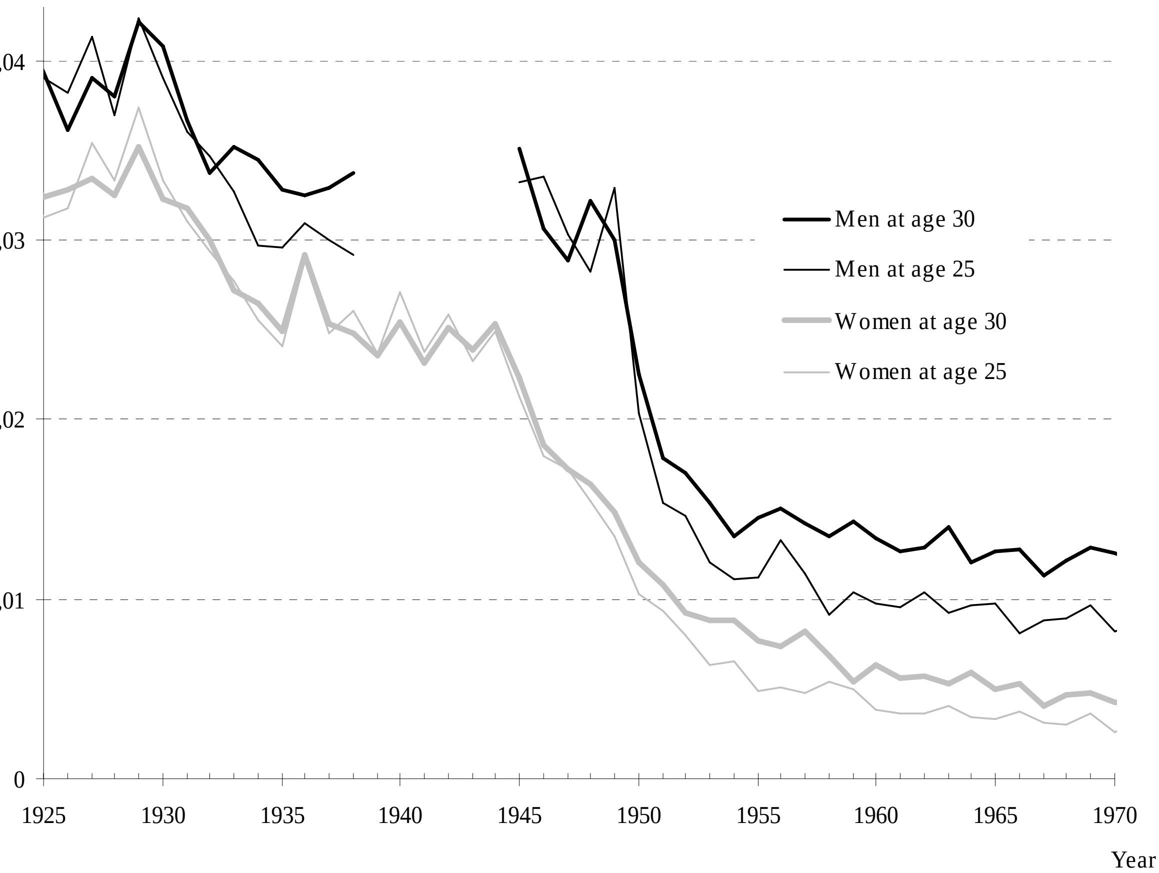

Figure 3. Five-year death risks at ages 25 and 30 years, men and women in 1925-1970

Figure 4. Age-specific death rates of men, before, during, and after the civil war in 1918

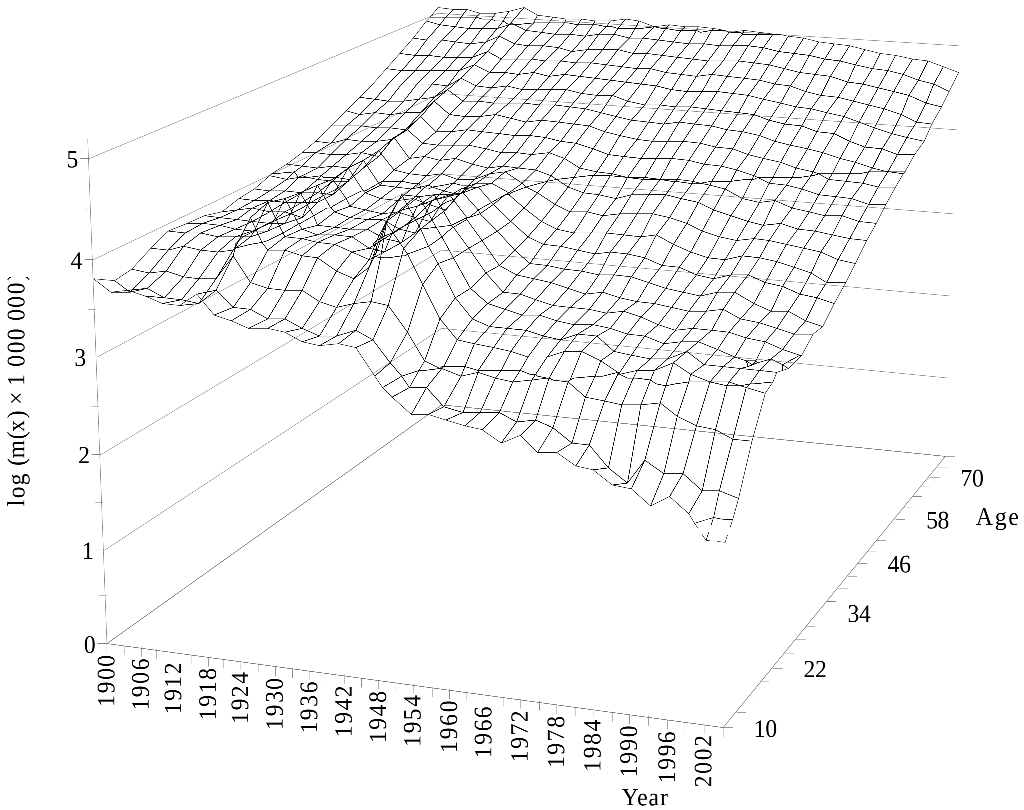

Figure 5. Age-specific death rates of men aged 10-75 years in 1900-2005

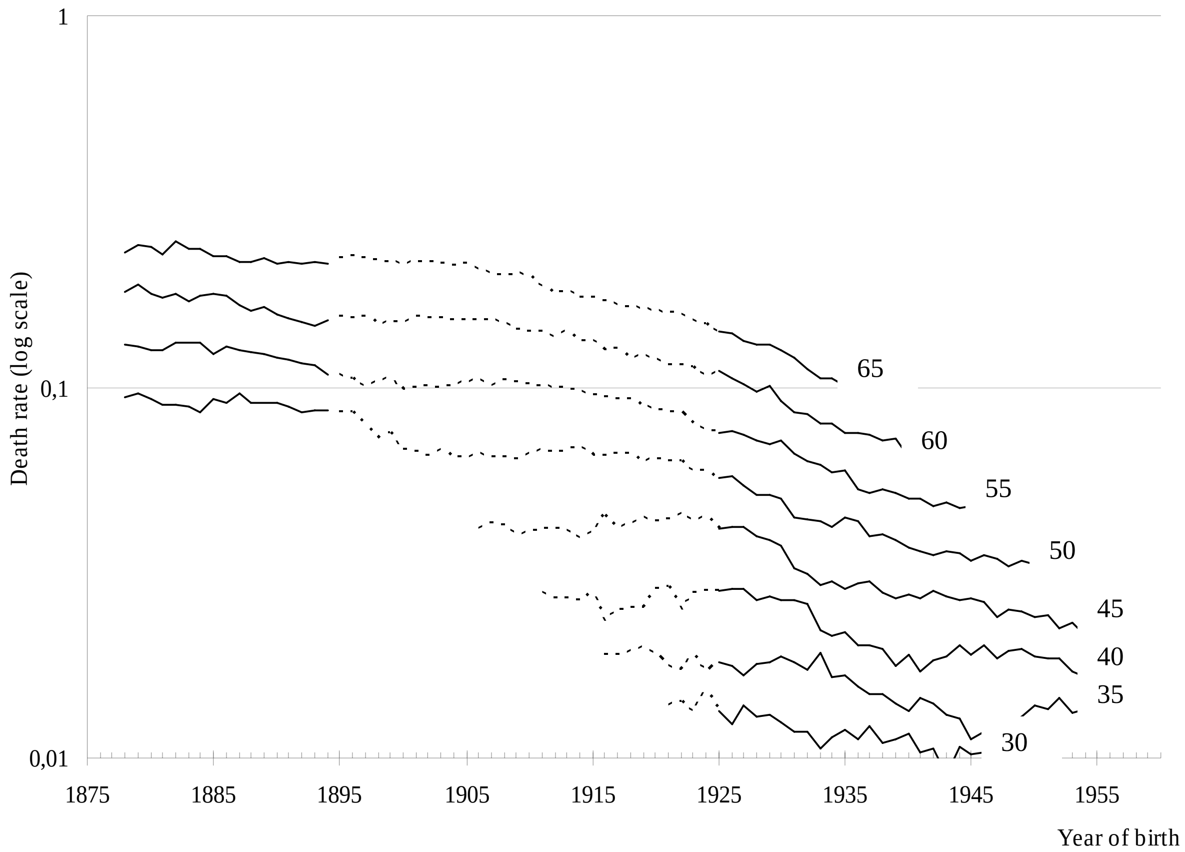

Figure 6. Five-year death risks at various ages in male cohorts born 1878-1955, plotted by year of birth (dotted parts refer to war cohorts)

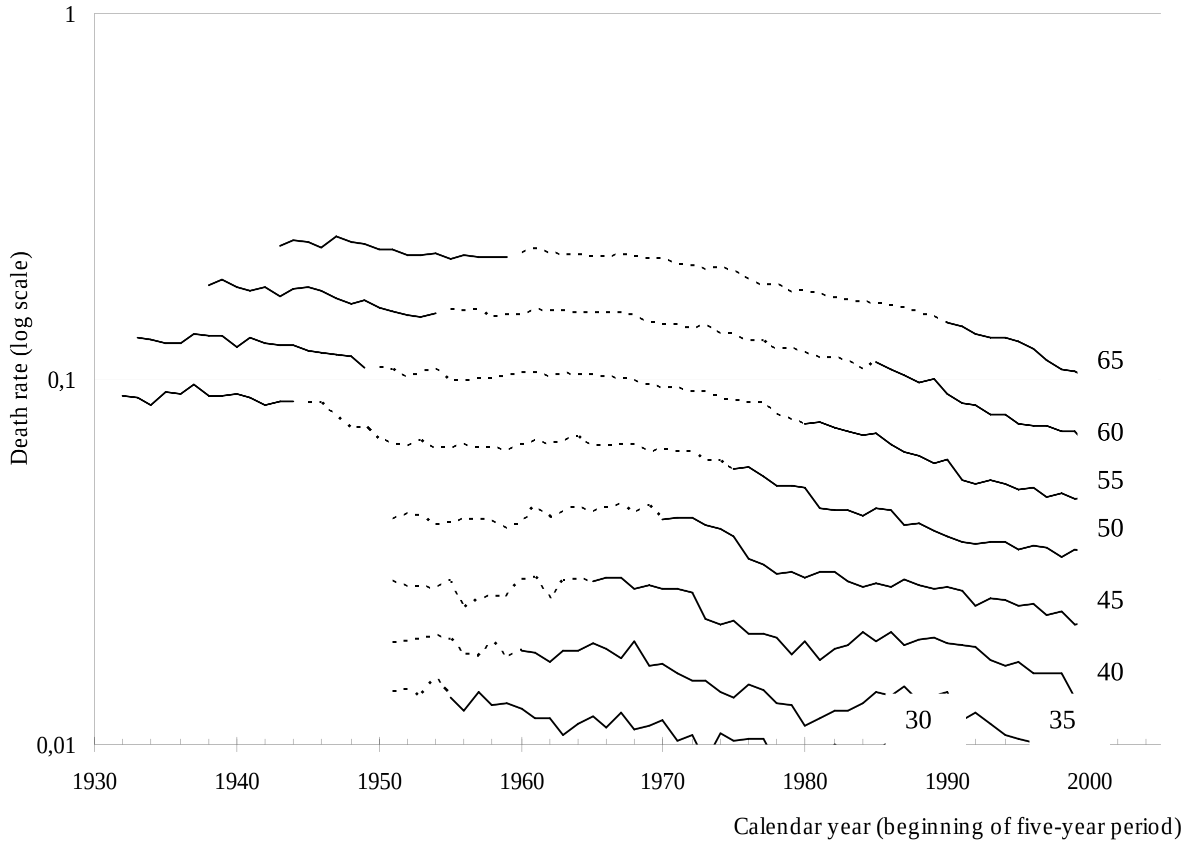

Figure 7. Five-year death risks at various ages in male cohorts born 1878-1955, plotted by calendar year (dotted parts refer to war cohorts)

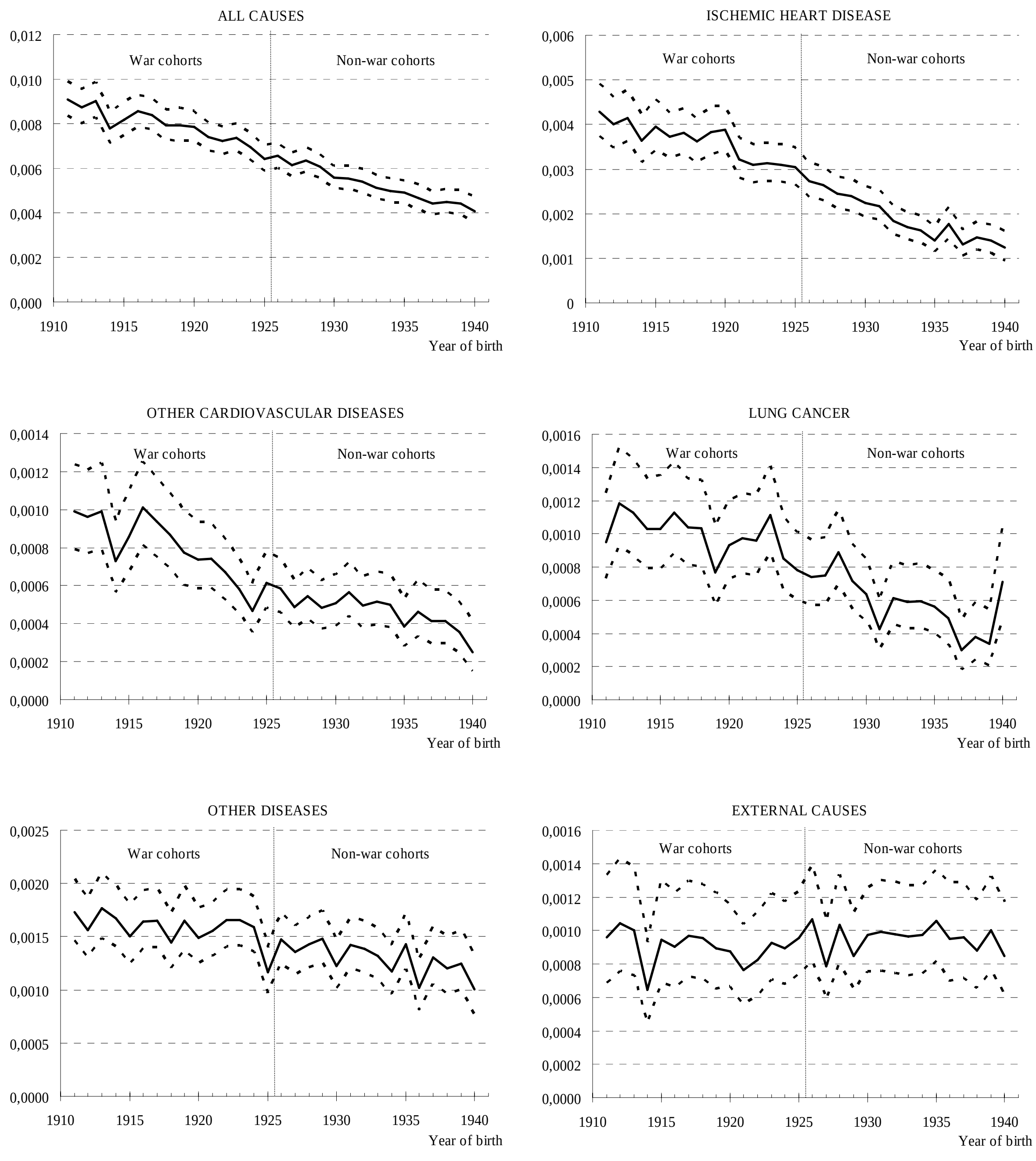

Figure 8. Death rates of men by cohort (with 95 per cent confidence intervals), for all causes and main causes of death in 1971-2004, adjusted for age, educational level, homeownership, marital status, birth region and ethnic group